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Ageing accounts for much of the association between decreasing grip strength and subsequent loneliness: the English Longitudinal Study of Ageing

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ABSTRACT

Background Loneliness at older ages has been associated with higher morbidity and mortality. One of the risk factors for loneliness may be age-related decline in skeletal muscle strength, which may limit the possibilities for engagement in usual social activities and maintaining relationships. We aimed to identify if decrease in grip strength is an independent determinant of subsequent change in loneliness.

Methods Prospective cohort study of participants aged 50 years or older living in private households and provided data in the English Longitudinal Study of Ageing waves 2 (2004/2005), 4 (2008/2009) and 6 (2012/2013) (n=6118). We used fixed effects linear models to estimate β coefficients and 95% confidence intervals.

Results The adjusted estimates for a 5-kilogramme decrease in grip strength and loneliness score (ranging from 3 to 9) are β 0.04 and 95% CI −0.003 to 0.08 among men and β 0.03 and 95% CI −0.02 to 0.09 among women. In age-stratified analysis, a statistically significant association was observed among men below the age of 80 years (0.04, 0.0001 to 0.08) but not among older men (0.04, −0.28 to 0.35), and among women below the age of 80 years (0.03, −0.002 to 0.09) or above (−0.02, −0.32 to 0.28).

Conclusion Muscle strength declines with age and may help explain the greater social isolation that occurs at older ages. Decline in strength was only independently associated with modestly increased loneliness among men younger than 80 years of age, indicating its limitation as a potential marker of loneliness risk.

INTRODUCTION

Loneliness at older ages is a concern as it may lead to systemic inflammation,[1 2] and has been associated with poorer cognitive function,[3] depression,[4] higher risk of developing coronary heart disease[5] and excess mortality risk.[6] The prevalence of loneliness at older ages varies between 20% and 34% in Europe, China, USA and Latin America[7] and with the number of persons over 65 years projected to increase from 9.3% in 2020 to 16% in 2050 globally,[8] this could affect the quality of life for many.

Decreasing skeletal muscle strength may contribute to loneliness through reduced capability to engage in usual social activities such as visiting relatives and friends, going out or travelling. Skeletal muscle strength can be measured using grip strength which is often chosen as a reliable and convenient measure to evaluate muscle strength for the assessment of geriatric conditions, including sarcopenia[9] and frailty.[10] Decline in grip strength, as a stand-alone measure, has been associated with various adverse outcomes, including decline in mobility,[11] increased physical limitations[12] and disability.[13] Therefore, it could be used to identify reduced ability to engage in social activities and thus risk of loneliness. While there could be a bidirectional association between grip strength and loneliness, we used the temporal sequence of the associations to help assess the possibility that loneliness follows decline in grip strength. However, there are very few studies that have investigated the association between grip strength and loneliness.[14] Several studies have explored associations between the more complex measure, frailty and loneliness, most of which are cross-sectional, reporting more loneliness among frail older people, compared with non-frail.[15 16] A few prospective studies reported that greater physical frailty at baseline was associated with more loneliness at follow-up.[15 17] While frailty requires a more complex measurement, including decline in multiple physiological systems, grip strength is a simple measure that can be used in homecare, clinical practice and other settings.

The study aims to examine whether declining muscle strength over time is associated with an increase in loneliness, using repeated measures of grip strength among participants aged 50 years or older living in private households.

METHODS

Study population

The data are drawn from the English Longitudinal Study of Ageing, an ongoing prospective cohort study of a general population, representative of private household residents living in England aged 50 years and older.[18] The study began in 2002 with respondents selected from the Health Survey of England[19] in 1998, 1999 and 2001, using a multistage random sampling strategy. Our research question was addressed using data from wave 2 (W2) (2004/2005), W4 (2008/2009) and W6 (2012/2013) with approximately 9000 core members who completed the main interview in each wave (N=8780; N=9886; N=9169, respectively).[20]

All cohort members were invited to participate in the data collection conducted by nurses during a home visit. The home visit included collection of

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biological samples, anthropometric measurements and physical performance measures, including grip strength. The response rate for the nurse visit was 87% in W2, 86% in W4 and 84% in W6. Participants provided written consent for the main interview and the nurse visit.

In this study, the baseline for each participant is the wave when their data were collected first, and we included only those who participated in all three waves or two consecutive waves. At baseline, 9084 participants attended the main interview. After excluding those who did not participate in the nurse visit (n=1672), had no grip strength measurement (n=235), did not answer questions about lo neliness (n=931) and had missing data on any covariates used in the analysis (n=128), 6118 (67%) participants remained for analysis (online supplemental table 1).

Grip strength

The isometric hand grip strength test was collected in W2, W4 and W6, every 4 years. For safety reasons, participants were excluded if both hands were affected by inflammation, were swollen, in severe pain, injured or underwent surgery in the preceding 6 months. The handgrip strength was measured using the 'Smedley's for Hand' Dynamometer, scale of 0–100 kg, with prespecified positioning and adjustment of the gripometer according to the protocol. The measurements were taken from both hands up to three times and recorded to the nearest whole value in kilogrammes by the nurse.[21] This study uses the highest measurement of the dominant hand.[22]

Loneliness

Perceived loneliness was assessed using the University of California Los Angeles (UCLA) 3-item Loneliness Scale, which is a shortened version of the validated 20-item UCLA Loneliness Scale Version 3.[23] The measure consists of three questions asked in a self-completion questionnaire: 'How often do you feel you lack companionship?', 'How often do you feel left out?' and 'How often do you feel isolated from others?'. The response options were 1=hardly ever or never, 2=some of the time and 3=often. The points were summed to produce a summary score between 3 and 9, with higher number indicating higher level of loneliness. A validation study reported a high correlation of 0.82 between the 3-item UCLA loneliness and a 20-item UCLA Loneliness Scale.[24] The convergent and discriminant validity has been confirmed by a high correlation of the 3-item UCLA Loneliness Scale with other measures of emotions and mood that are associated with loneliness such as depressive symptoms and perceived stress.[24] The reliability of the 3-item UCLA Loneliness Scale is indicated by a Cronbach's α of 0.72,[24] while higher α of 0.79 has also been reported.[25]

Covariates

Included potential confounding factors that vary over time were: living alone (yes and no), age (continuous variable), employment status (retired, employed, unemployed, permanently sick or disabled), National Statistics Socioeconomic Classification (NS-SEC) which aims to differentiate positions within labour markets, indicating source of income, economic security, employment relations and conditions (managerial and professional occupations, intermediate occupations, routine and manual occupations), self-reported diagnoses (yes and no) of arthritis, cancer, diabetes, cardiovascular diseases (congestive heart failure, heart attack, angina and other) and stroke. In the dataset, age was provided as a continuous variable for all participants up to the age of 89 years, whereas the age of 90 years and above was provided as '99' for confidentiality reasons. Instead of excluding participants above the age of 90 years, a midpoint of 95 years between ages 90 years and 100 years was derived, allowing us to include all participants with an age variable on a continuous scale, which is more appropriate to use in fixed-effects models. All covariates were measured at all three time points.

Statistical analysis

Means, SDs and percentages were computed for all participants at baseline, first and second follow-up. To examine the association between the change in grip strength and the change in loneliness score over time, we employed fixed-effects linear models to estimate β coefficients and 95% CIs. Fixed-effects models allow control for both measured and unmeasured within-individual time-invariant characteristics, such as sex, genetic, cultural or physical traits.[26] Since the association of increase and decrease in grip strength on the loneliness score may be asymmetrical, we modelled increases and decreases of grip strength at consecutive time points separately by generating two variables reflecting increase and decrease in grip strength. For example, when grip strength increased from 10 kg to 15 kg, the variable reflecting increment was assigned a value of 5 kg, while the variable for decline remained 0 kg. The two variables were included in all models simultaneously.[27] An unadjusted model did not include covariates, and an adjusted model included all covariates as characteristics that change over time. Both models were stratified by sex as there may be variation in risks for loneliness.[28 29] Age stratification was included to examine an association among those below 80 years of age (95.5%) and above (4.5%) as those with exceptional longevity tend to have healthier lifestyle, lower incidence of chronic diseases and better late-life physical function as well as mental well-being.[30] Since the decline in grip strength in ageing is estimated about less than 1 kg/year, the estimates are calculated for a 5-kilogramme change in grip strength to reflect change between data collection (every 4 years).[31]

We conducted several sensitivity analyses. First, to allow for potential measurement error, we recoded small changes in grip strength between −2 kg and + 2 kg to 0 kg (no change). Second, to examine whether the observed associations were influenced by extreme values of grip strength, we excluded the highest and the lowest 1% of values. Third, we excluded participants with the highest score of loneliness at baseline to minimise reverse causation. Fourth, to address the issue of missing data, we conducted a sensitivity analysis using multiple imputation with chained equations and generated five imputations. Estimates using imputed data were obtained using Rubin's rule.[32] The imputation model included all variables used in the analysis, auxiliary variables such as physical activity, and was weighted using the weight provided in data (see online supplemental material). Observations with imputed outcome were removed before analysis.[33]

All analyses were conducted using Stata (V.14.2, College Station, Texas, USA).

RESULTS

At baseline, the median age was around 62 years for both men and women, and 55% were women (table 1).

At baseline, approximately half of all participants were retired, 46% of men and 30% of women belonged to the highest NS-SEC group, while the majority of both men (85%) and women (74%) were not living alone. The proportion of participants with diagnoses of the individual chronic diseases varied between 1% and 12% and was similar between men and women

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Table 1 Characteristics of study participants (N=6118) at baseline, first and second follow-up, by sex

	Men			Women		
	Baseline	First follow-up	Second follow-up	Baseline	First follow-up	Second follow-up
	n=2769 (45%)	n=2769 (45%)	n=1363 (45%)	n=3349 (55%)	n=3349 (55%)	n=1692 (55%)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Grip strength (kg) (mean (SD))	41.6 (9.4)	39.1 (9.8)	37.3 (9.1)	24.9 (6.4)	23.4 (6.7)	22.4 (6.2)
Change in grip strength between the measurements (kg) (mean (SD))*	–	−2.5 (7.2)	−2.9 (6.6)	–	−1.5 (5.1)	−1.4 (4.9)
UCLA Loneliness Scale score 3–9 (median (IQR))	3 (3–5)	3 (3–5)	3 (3–4)	4 (3–5)	4 (3–5)	4 (3–5)
Change in UCLA loneliness score between the measurements (mean (SD))*	–	0.08 (1.3)	0.05 (1.2)	–	0.09 (1.4)	0.02 (1.4)
Age category (years)						
50–60	1190 (43)	722 (26)	23 (2)	1484 (44)	882 (26)	30 (2)
61–70	980 (35)	1086 (39)	699 (51)	1127 (34)	1316 (39)	850 (50)
≥71	599 (22)	961 (35)	641 (47)	738 (22)	1151 (34)	812 (48)
Employment status						
Retired	1349 (49)	1688 (61)	1068 (78)	1558 (47)	2080 (62)	1363 (81)
Employed	1210 (44)	907 (33)	248 (18)	1153 (34)	799 (24)	184 (11)
Unemployed	70 (3)	63 (2)	22 (2)	520 (16)	378 (11)	124 (7)
Permanently sick or disabled	140 (5)	111 (4)	25 (2)	118 (4)	92 (3)	21 (1)
NS-SEC by occupation						
Managerial and professional occupations	1262 (46)	1202 (43)	589 (43)	1020 (30)	993 (30)	466 (28)
Intermediate occupations	541 (20)	577 (21)	288 (21)	988 (30)	1016 (30)	552 (33)
Routine and manual occupations	966 (35)	990 (36)	486 (36)	1341 (40)	1340 (40)	674 (40)
Living alone						
No	2364 (85)	2303 (83)	1142 (84)	2480 (74)	2370 (71)	1134 (67)
Yes	405 (15)	466 (17)	221 (16)	869 (26)	979 (29)	558 (33)
Arthritis						
No	2549 (92)	2640 (95)	1312 (96)	2963 (88)	3160 (94)	1624 (96)
Yes	220 (8)	129 (5)	51 (4)	386 (12)	189 (6)	68 (4)
Cancer						
No	2709 (98)	2703 (98)	1320 (97)	3263 (97)	3284 (98)	1661 (98)
Yes	60 (2)	66 (2)	43 (3)	86 (3)	65 (2)	31 (2)
Diabetes						
No	2647 (96)	2706 (98)	1344 (99)	3249 (97)	3286 (98)	1677 (99)
Yes	122 (4)	63 (2)	19 (1)	100 (3)	63 (2)	15 (1)
Cardiovascular diseases						
No	2607 (94)	2672 (96)	1323 (97)	3211 (96)	3251 (97)	1645 (97)
Yes	162 (6)	97 (4)	40 (3)	138 (4)	98 (3)	47 (3)
Stroke						
No	2742 (99)	2733 (99)	1347 (99)	3322 (99)	3322 (99)	1682 (99)
Yes	27 (1)	36 (1)	16 (1)	27 (1)	27 (1)	10 (1)

The baseline comprises initial measurements at the entry of the study of each participant; the first and second follow-up were conducted 4 and 8 years thereafter.
*The third measure is in comparison to the second.
NS-SEC, National Statistics Socioeconomic Classification; UCLA, University of California Los Angeles.

apart from a higher proportion of arthritis diagnoses among women (12%) than men (8%). At baseline, 58% of men and 49% of women were not lonely. The average grip strength was 41.6 kg among men and 24.9 kg among women. Participants on average decreased their grip strength during the follow-up, which affected 61%, whereas 31% increased their grip strength and 7.5% experienced no change.

The baseline grip strength among participants who were excluded due to missing data was lower, compared with those included in the complete-case analysis (mean (and 95% CI) among men: 38.9 kg (38.2 to 39.7) vs 41.6 kg (41.3 to 42.0), p<0.001; and among women: 22.4 kg (22.0 to 22.8) vs 24.9 kg (24.7 to 25.1.0), p<0.001). The median loneliness score was similar among excluded and included men and women at baseline, although the difference is statistically significant (p<0.001). The median age was higher by 1 year and 3 years among excluded men (p=0.01) and women (p<0.001), respectively. A larger proportion of those excluded due to missing data was living

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Table 2 Change in loneliness score estimated from the UCLA loneliness scale for each 5-kilogramme change in grip strength, a complete-case analysis

	Change in loneliness score			
	Men (n=2769)		Women (n=3349)	
	β (95% CI)	P value	β (95% CI)	P value
Decrease in grip strength				
Unadjusted	0.05 (0.03 to 0.08)	<0.001	0.08 (0.04 to 0.12)	<0.001
Adjusted*	0.04 (–0.003 to 0.08)	0.069	0.03 (–0.02 to 0.09)	0.277
Increase in grip strength				
Unadjusted	0.02 (–0.03 to 0.08)	0.426	0.01 (–0.06 to 0.09)	0.684
Adjusted*	0.01 (–0.05 to 0.07)	0.692	–0.02 (–0.10 to 0.06)	0.582

*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases and stroke.
NS-SEC, National Statistics Socioeconomic Classification; UCLA, University of California Los Angeles.

alone (24.3% (22.0 to 26.7) vs 14.6% (13.3 to 15.9), p<0.001 among men; and 35.6% (33.3 to 37.9) vs 25.9% (24.5 to 27.4) among women, p<0.001), was permanently sick or disabled (8.9% (7.4 to 10.5) vs 5.1% (4.2 to 5.9), p<0.001 among men; and 7.4% (6.1 to 8.7) vs 3.5% (2.9 to 4.1), p<0.001 among women) and had routine and manual occupations (43.9% (41.1 to 46.7) vs 34.9% (33.1 to 36.7), p<0.001; and 51.0% (48.5 to 53.5) vs 40.0% (38.4 to 41.7), p<0.001), compared with included participants. Chronic diseases were more common among excluded participants; however, the differences were statistically significant only for diabetes (6.4% (5.0 to 7.7) vs 4.4% (3.6 to 5.2), p=0.01) and stroke (2.4% (1.6 to 3.3) vs 1.0% (0.6 to 1.3), p<0.001) in men, and for diabetes (4.6% (3.6 to 5.6) vs 3.0% (2.4 to 3.6), p=0.004), stroke (1.8% (1.2 to 2.5) vs 0.8% (0.5 to 1.1), p=0.001) and arthritis (14.0% (12.2 to 15.6) vs 11.5% (10.4 to 12.6), p=0.01) in women.

Decrease in grip strength

A 5-kilogramme decrease in grip strength was statistically significantly associated with increase in loneliness score in men (0.05 (0.03 to 0.08), p<0.001) and women (0.08 (0.04 to 0.12), p<0.001) (table 2). After adjustment, the associations were attenuated, especially in women. In the multivariable analyses, age was the factor with the most marked influence on the estimates.

In age-stratified analyses, a 5-kilogramme decrease in grip strength among men <80 years was statistically significantly associated with an increase in the loneliness score in unadjusted (0.05 (0.02 to 0.08), p<0.001) and adjusted (0.04 (0.0001 to 0.08), p=0.049) analysis (table 3).

No association was observed in men ≥80 years of age or women of any age (table 3).

Sensitivity analyses

First, after recoding small changes in grip strength between −2 kg and +2 kg to 0 kg (no change), the adjusted estimates for decrease in grip were 0.04 (−0.001 to 0.07), p=0.057, and 0.03 (−0.02 to 0.08), p=0.265, among men and women, respectively (online supplemental table 2). After further stratifying by age, the statistically significant association among men <80 years of age and no association among men ≥80 years of age or women of any age remained (data not shown).

In the second sensitivity analysis, the coefficients did not change notably after excluding either the highest 1% (n=77) or the lowest 1% (n=48) of the grip strength observations (online supplemental tables 3 and 4). Among men <80 years of age, excluding those with the lowest 1%, the evidence for an association between decrease in grip strength and higher loneliness score became weaker (0.04, 0.002 to 0.08, p=0.061), whereas similar estimates to the main findings were observed in all other strata (data not shown).

Third, after excluding 81 participants with the highest loneliness score at baseline, the adjusted estimates were similar to those in the main analysis among all participants (online supplemental table 5) and in age-stratified analysis (data not shown).

Table 3 Change in loneliness score estimated from the UCLA loneliness scale for each 5-kilogramme change in grip strength, a complete-case age-stratified analysis

	Change in loneliness score							
	Men				Women			
	<80 years		≥80 years		<80 years		≥80 years	
	n=2651		n=118		n=3190		n=159	
	β (95% CI)	P value	β (95% CI)	P value	β (95% CI)	P value	β (95% CI)	P value
Decrease in grip strength								
Unadjusted	0.05 (0.02 to 0.08)	<0.001	0.17 (–0.03 to 0.36)	0.094	0.08 (0.03 to 0.12)	<0.001	0.13 (–0.06 to 0.32)	0.167
Adjusted*	0.04 (0.0001 to 0.08)	0.049	0.04 (–0.28 to 0.35)	0.824	0.03 (–0.02 to 0.09)	0.223	–0.02 (–0.32 to 0.28)	0.894
Increase in grip strength								
Unadjusted	0.02 (–0.03 to 0.08)	0.446	0.20 (–0.29 to 0.68)	0.424	0.01 (–0.06 to 0.09)	0.706	0.09 (–0.49 to 0.68)	0.756
Adjusted*	0.02 (–0.05 to 0.08)	0.598	0.27 (–0.33 to 0.87)	0.369	–0.02 (–0.10 to 0.07)	0.677	–0.11 (–0.61 to 0.39)	0.658

*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases and stroke.
NS-SEC, National Statistics Socioeconomic Classification; UCLA, University of California Los Angeles.

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Fourth, after multiple imputation, the sample sizes increased by 14.8% for men and 17.6% for women. In adjusted analyses, the associations between decline in grip and increase in loneliness were consistent with the complete case analysis in both men (0.04 (−0.002 to 0.07), p=0.066) and women (0.04 (−0.02 to 0.09), p=0.181) (online supplemental table 6).

Increase in grip strength

There was no association between increase in grip strength and changes in loneliness in both men and women (tables 2 and 3) with consistent findings of no association in all sensitivity analyses (online supplemental tables 2–6).

DISCUSSION

The aim of this study was to examine if change in grip strength is associated with changes in loneliness across a 4–12-year follow-up period among adults aged 50 years and older. We hypothesised that decreasing muscle strength may prevent or reduce the usual participation in social activities, eventually resulting in increased loneliness. Our results indicate that decrease in grip strength over time may be independently associated with a modest increase in loneliness score, but only among men below the age of 80 years, after taking potential confounding factors, particularly age, into account. We did not find an association between decreasing grip strength and loneliness among women, indicating that risk factors for loneliness vary between men and women.

The evidence for an association of decreasing grip strength with loneliness is sparse. The Leiden 85-plus, a community-based prospective study, corroborates our findings of no association between grip strength and loneliness in older participants above the age of 80 years.[14] Our study, however, included an age range starting at 50 years. An indication of a statistically significant but modest magnitude association between decreasing grip strength and increase in loneliness score among men below the age of 80 years and the lack of association among women of any age is supported by studies examining an association between grip strength and impaired mobility. Among men, decline in grip strength has been associated with impaired mobility[12] and clinically significant functional decline over time,[11] whereas among women, grip strength did not predict mobility disability.[11] Women's Health and Aging Study concluded that grip strength was not associated with incident mobility disability.[34] The evidence indicate that decline in muscle strength may have a greater impact on mobility among men than women; hence, the isolating role of functional decline may be more evident among men.

We speculate that the mechanisms linking grip strength and loneliness involve reduced physical capacity, which limits the ability to leave home, engage in various activities and fulfil socio-emotional needs. Over time, this reduced contact may result in loneliness. After the age of 50 years, losses in muscular strength occur at an approximate rate of 10%–15% per decade, accelerating to 25%–40% after the age of 70 years.[35] Furthermore, as part of the ageing process, muscle mass, strength, agility, flexibility, balance and endurance tend to decline, all contributing to reduced mobility. Individuals with a combination of low muscle mass and low physical performance or low muscle strength, that can be indicated by low grip strength, can be diagnosed with age-related sarcopenia.[9] Individuals who have a low grip strength may be additionally affected by frailty syndrome encompassing a simultaneous decline in several other physiological systems, which may include brain, endocrine, immune, cardiovascular and respiratory systems.[10] All of which may further reinforce skeletal muscle weakness and impaired mobility. In this study, adjustment for age attenuated the association the most. This could be due to falling muscle strength and function with age, as well as increasing loneliness with age, possibly influenced by extraneous reasons such as death or infirmity of friends and relatives. Hence, the observed modest increase in loneliness may be resulting from a decrease in grip strength beyond age-related effects on muscle strength decline.

An increase in grip strength accounted for 31% of all observations with a majority experiencing a small increase between 1 kg and 5 kg, which was not associated with changes in loneliness score. Some of the increase in grip strength may have been a recovery from a medical condition or an injury and regaining grip strength may be a part of a recovery with other aspects of, for example, mental health hindering the process of connecting with others and willingness to socialise.

Unlike our study, other studies on grip strength and closely related exposures such as motor function or frailty investigated loneliness as an exposure. Prospective studies indicate that loneliness is a risk factor for decreasing grip strength,[36] frailty[37] or motor decline.[38] The mechanisms through which loneliness may be affecting skeletal muscle strength and increasing risk of frailty include worsening health behaviours such as inactivity and lower quality diet, as well as impaired sleep and lower stress resilience.[15 37] Our evidence indicates that the relationship may be bidirectional, whereby impaired mobility due to skeletal muscle weakness is associated with subsequent increases in loneliness, which, in turn, may further affect grip strength and increase the risk of frailty.

The strengths of the study include a large sample size and longitudinal data, which allowed examination of an association between within-individual changes in grip strength and subsequent loneliness score. We used a simple measure of muscle strength that can be used as an indicator of physical decline and may indicate a variety of functional limitations, including worsening mobility, with a possible application in primary care and social care, although the modest magnitude of the association after adjustment for age suggests that it may not be useful for general clinical assessment of loneliness risk. The use of the asymmetric method enabled estimation of different associations of decreasing or increasing grip strength with loneliness. The fixed-effects adjusted model accounted for both within person measured and unmeasured time-invariant characteristics, and large sample size provided sufficient statistical power often needed for fixed-effects models. Since the fixed-effects models produce larger standard errors, resulting in wider CIs and higher p values, when an effect is found, it is more likely to be robust.[26] While there were some differences in characteristics of those who were excluded due to missing data and the cohort members with complete data, the results in the sensitivity analysis using imputed datasets and weighted by provided non-response weights were consistent with the main findings, suggesting that the results from the main complete-case analysis may be generalised to a population aged 50 years and over, living in private households in England.

This study has potential limitations. Although the measurement of grip strength is used as a stand-alone measure for relevant outcomes, it is only one measure, with repetitions over time in this study. Decline in neurological and sensory function, including eyesight and hearing, are also likely to contribute to difficulties in maintaining close relationships and participating in social activities.

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CONCLUSION

A decline in grip strength over time is associated with a modest increase in subsequent loneliness, consistent with the isolating role of functional decline. The association was only observed in men below the age of 80 years, possibly signalling fewer social interactions due to functional limitation and limiting its use as a marker for loneliness.

What is already known on this subject

- Decline in grip strength has been associated with various adverse health outcomes and the associated physical limitations may limit social activities and thus increase the risk of loneliness. However, the evidence between decline in grip strength and risk of loneliness is sparse.

What this study adds

- Decline in muscle strength is associated with subsequent loneliness, consistent with the isolating role of functional decline. Much of the association is explained by the ageing process, and the association remains statistically significant only among men below the age of 80 years.

How this study might affect research, practice or policy

- In the general population aged over 50 years, decrease in grip strength is of limited value in identifying loneliness risk, beyond what is expected for a person's age. There may be some subsets of the population below age 80 years, where change in grip strength is an indicator of increased risk of social isolation, but this remains to be confirmed.

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Data availability statement Data are available in a public, open access repository. The English Longitudinal Study of Ageing dataset is available in a public, open access repository and can be accessed through the UK Data Service at: https://ukdataservice.ac.uk/. The data can be used after registration and acceptance of end user licence.

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