A very brief intervention with the muscle-strengthening guidelines to improve strength in adults aged 50-75 years: a mixed methods study

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Abstract

Background

Muscle strength is a robust predictor of healthy ageing and vital for independence in later life. Despite their potential reach, there is little evidence that healthcare practitioners are promoting the muscle-strengthening component of the United Kingdom's (UK) Chief Medical Officers' physical activity guidelines in practice. This study aimed to objectively measure strength following a very brief intervention (VBI) with the muscle-strengthening guidelines to determine if this could increase muscle strength in adults aged 50-75 years in the resource-constrained settings of primary care.

Methods

A VBI was delivered to 31 participants. Participants were instructed to follow the recommended guideline *'build strength on at least 2 days a week'* and asked to keep a diary of their behaviour throughout the six-month period. Grip and ankle strength were measured at baseline and six-months post-intervention. Quantitative strength and demographic data were analysed, alongside qualitative data from diary records.

Results

Pre-to-post intervention measures showed a significant improvement in grip strength from the VBI, however changes in ankle strength were non-significant. Age, employment, income, strength training history, and current self-reported strength level significantly predicted intervention effects. Qualitative data provided additional insight into findings and intervention acceptance, highlighting its perceived value alongside requests for further exercise guidance.

Conclusion

This study is the first to investigate the potential of a 5-minute intervention to increase muscle strength. Results identified a character profile of whom healthcare professionals may best target with this intervention and how to improve this intervention for future implementation in primary care settings.

Key words: handgrip, ankle, middle-age, older, behaviour change, VBI, intervention

Background

In addition to musculoskeletal problems, low muscle strength (dynapenia), is associated with an increased risk of at least 10 different non-communicable diseases (including type 2 diabetes, cardiovascular diseases, and some cancers), impaired mental health, cognitive dysfunction, functional disability, and is the third greatest risk factor for all-cause mortality (1). Low muscle strength has also been identified as a more powerful predictor of cardiovascular mortality than systolic blood pressure or total physical activity (2, 3). Low strength may also be a better explainer of bone mineral density and osteoporosis than muscle mass (4) and has been shown to be associated with greater hip fracture incidence (5). Typically, muscle strength peaks around the age of 30 to 40 years, followed by a slow decline and later, an accelerated decline (6, 7). Unfortunately, due to decreasing levels of physical activity, individuals with low levels of muscle strength are being seen earlier in the life course than ever before (8-10). In the United Kingdom (UK), muscle weakness has been conservatively estimated to cost an excess of £2.5 billion annually to the health and social care system (11). Furthermore, given the obesogenic environment we live in, low muscle strength is likely to accelerate, alongside its associated costs, if effective and feasible interventions are not implemented.

Assessing handgrip strength with a dynamometer is a quick and simple measurement that can be used to offer a glimpse into global levels of muscle strength, health, functional ability, and quality of life (1, 12). Normative values for handgrip strength stratified for age, sex, height, and measurement side are available from the UK Biobank data (13). In addition, a number of working groups have proposed thresholds for the definition of low muscle strength. According to the Foundation for the National Institutes of Health (FNIH) thresholds, in men, a low handgrip strength is classified as <26kg and in women, <16kg (14). For the European Working Group on Sarcopenia in Older People (EWGSOP2), a low handgrip strength is classified as <27kg in men, and <16kg in women (15). In the Sarcopenia Definitions and Outcomes Consortium (SDOC), a low handgrip strength in men is classified as <35.5kg and in women, <20kg (16).

Progressive strength training is the most effective tool we have for the prevention, treatment, and management of low muscle strength. As a result of the robust evidence in this area, both the World Health Organization (WHO) and the UK's Chief Medical Officers recommend that all adults *'build strength on at least 2 days a week'* (17, 18). However, often labelled the 'forgotten guideline,' it is estimated that only 22.8% of healthy adults worldwide participate and adhere to the muscle-strengthening guidelines (19). In a study looking specifically at English adults, that number fell to just 1.3% (20). Additionally, older adults and adults living with chronic conditions are even less likely to adhere to the physical activity guidelines (19, 21). Consequently, taking a primary prevention approach in mid-life may be an acute but influential teachable moment to successfully build a life-long exercise habit to help preserve health and health-span in later life (22).

Despite the importance to health, there is no international standardised questionnaire or device-based measurement for muscle-strengthening exercise participation or adherence. In the UK, the Sport England Active Lives Survey is the primary source for data on physical activity levels (23). Participation in muscle-strengthening exercise is self-reported for the last 28 days and example modalities provided include walking, dancing, cycling, sporting activities, and 'fitness activities' (23). Therefore, recall bias, misclassification bias, and social desirability bias are significant limitations for most survey-based findings (24). Nevertheless, of those 39% of adults aged 55+ that self-report to be 'meeting' the muscle-strengthening guidelines in the Active Lives Survey (23), it is unknown how many are objectively improving their levels of muscle strength in line with UK guidance that recommend all adults *'build strength.'*

General practice and primary care networks deliver approximately 30 million consultations each month (25). Patients visiting their general practice office are more likely to be physically inactive but at the same time, more likely to look to their healthcare practitioner (HCP) for help to increase their activity levels (22). Thus, HCP are in an ideal position to promote participation and adherence to the muscle-strengthening guidelines with their high levels of patient contact, reach, and influence. Promotion of physical activity by health professionals is one of the eight investments that work by the International Society for Physical Activity and Health (ISPAH) (26). In addition, the Hamburg Declaration (27), WHO, and the National Institute for Health and Care Excellence (NICE) all recommend that brief physical activity advice be provided in primary care. Brief advice is defined as '*verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up*' including the use of behaviour change principles (28). There is evidence that Brief Interventions (BIs) (up to 30 minutes) are cost-effective and just as effective as more intense interventions (29-31). In fact, simply measuring physical activity appears to increase behaviour (32). Therefore, it is plausible that primary care settings could take advantage of the well-established measurement reactivity phenomenon and Hawthorne effect to help improve population-level participation in muscle-strengthening exercise (32).

Unfortunately, due to increasing time pressures in primary care, BIs are no longer feasible. Lamming et al. (2017) recommended that future research focus on *very* brief interventions (VBIs), consisting of advice of no longer than 5 minutes (30). The authors are unaware of any VBI aligning to or targeting the muscle-strengthening component of the UK's Chief Medical Officers' physical activity guidelines. However, a VBI including measurement of muscle strength followed by very brief advice aligning to the muscle-strengthening guidelines, could overcome barriers to physical activity advice given in clinical settings by standardising a simple, time-efficient, low-cost, and highly predictable approach to assessing, promoting, and increasing muscle strength for health. The aim of this study, therefore, was to (1) explore whether a very brief intervention aligning to the muscle-strengthening component of the UK's Chief Medical Officers' physical activity guidelines would lead to objective strength gain in adults aged 50 to 75 years of age and (2) whether this intervention would be acceptable to those on the receiving end of the intervention.

Materials and methods

Design

This was a concurrent, mixed method, one-arm, six-month, pre-post study to explore the preliminary effectiveness of a very brief intervention (VBI). The VBI was designed to be feasible within the time typically allotted for primary care appointments, the current skillset of HCP, and aligned to the muscle-strengthening recommendations made in the latest edition of the UK's Chief Medical Officers' physical activity guidelines (17).

Mixed-method integration was achieved through embedding at the methods level, linking data collection and analysis at multiple points to understand contextual factors that could influence study results and provide detailed information about the experience of participants (33). Embedding will also help to explain or offer insight to outliers and develop hypotheses about changes that might be necessary for further widespread implementation of this VBI (33). Integration with narration at the reporting level will occur to describe the quantitative and qualitative findings in this single article (33). The weaving approach will be taken to write both quantitative and qualitative findings together on a concept-by concept basis in the results section (33). The coherence or 'fit' of data integration is described as expansion (33).

The current study examined the preliminary effectiveness and acceptability of a VBI by assessing upper and lower body strength, providing participants with a printed handout of the UK's Chief Medical Officers' physical activity guidelines infographic (see Supplementary Materials 1), and discussing participation and adherence to the strength-component for the duration of the intervention period (six-months). The VBI was delivered in August 2022 by first author (AG), a clinical exercise physiologist, individually and in-person, in a clinic room resembling a primary care office on the

University campus. Author had no relationship to the participants prior to the study. The standardised intervention took approximately 5 minutes. Participants were also provided a one-day per page hard copy diary and asked to record their muscle-strengthening activities to provide further insight into their behaviour and experiences with this VBI.

Participants

Participants were community-dwelling individuals aged 50-75 years. Inclusion criteria were as follows: males and females aged 50-75 years old, no contraindication to strength training or testing, willing to attend both pre and post in-person appointments, and willing to adhere to the strength guidelines for six-months. Due to budget and time constraints, the study's size was limited and conveniently sampled, recruiting eligible university staff via staff e-mail announcement system, and snowballing.

Handgrip and ankle plantarflexion strength - quantitative data collection

Handgrip strength was assessed using the Jamar Hydraulic Dynamometer, both pre- and post-intervention (i.e. baseline and six-months). The NIHR procedure for measuring handgrip strength with the Jamar Dynamometer was used (34). In brief, participants were in a seated position with their feet flat on the floor and back supported. Participants kept their elbow on their dominant side at a 90-degree angle throughout the measurement. Participants held the dynamometer with their thumb facing upwards. One practice test was permitted. Needle was reset to the '0' position between tests. Two tests were recorded and averaged. All participants were encouraged to squeeze as fast and as hard as they could on the count of three until the assessor said ‘stop.’ Assessor used a standard encouragement phrase of ‘squeeze, squeeze, squeeze, squeeze, squeeze…and stop.’ Difference in grip strength was calculated by subtracting scores from pre-to-post-intervention. Handgrip strength is reported in kilograms.

Ankle plantarflexion strength was assessed using the Lafayette Manual Muscle Testing System Model-01165 (Lafayette Instrument Company, Lafayette IN, USA), both pre- and post-intervention (i.e. baseline and six-months). Ankle plantarflexion was measured while the participant was lying supine on a plinth with their ankle in plantargrade with hips and knees extended (35). The dynamometer was placed onto the metatarsal padding on the sole of the dominant foot (35). One practice test was permitted. Dynamometer was reset between tests. Two tests were recorded and averaged. All participants were encouraged to push as fast and as hard as they could on the count of three until the assessor said ‘stop.’ Assessor used a standard encouragement phrase ‘push, push, push, push, push…and stop.’ Participants were permitted to hold the plinth for stabilisation but not use it to push their leg or body down into the dynamometer. Similarly, difference in ankle strength was calculated by subtracting scores from pre-to-post-intervention and reported in kilograms.

Age was collected in years at the time of baseline measurement. Sex was scored 1 for male, and 2 for female. No participants opted for ‘non-binary’ or ‘other’ options. Ethnicity was scored 1 for white, and 2 for ‘other’ due to the lack of diversity in the population sample. Income was scored 0 for an annual salary of under £10,000, 1 for £10,000 to £19,999, 2 for £20,000 to £29,999, 3 for £30,000 to £39,999, 4 for £40,000 to

£49,999, and 5 for £50,000 and above. Employment was scored as 0 for individuals who were retired, 1 for those working part-time, and 2 for those in full-time employment. Living situation was scored as 0 for individuals living alone, and 1 for those living with a spouse or children. Strength training history was scored 0 if individuals had never engaged in strength training, 1 if they had engaged with strength training in the past, and 2 if they were currently engaging with strength training. Participants were asked to self-report on whether they were meeting the UK's Chief Medical Officers' physical activity guidelines for muscle-strengthening activity ('building strength at least 2 days a week'). Meeting guidelines was scored 0 if participants responded with 'no', 1 if participants responded 'maybe' or 'unsure', and 2 if participants reported they were currently meeting guidelines. Self-reported strength was assessed and scored 0 if individuals reported their strength as below average, 1 if they reported it as average, and 2 if they reported it as above average. Injuries were assessed as 0 if no injuries had been experienced, and 1 if injuries had occurred. Health conditions were scored as 0 if an individual reported having no current health conditions, 1 if they reported having a single health condition, and 2 if they reported having multiple health conditions.

Diary - qualitative data collection

Pre-dated (one-page per day) hard-copy diaries were provided to the participants at their baseline visit. Participants were provided with a coloured print out of the UK's Chief Medical Officers' physical activity guidelines infographic (see Supplementary Materials 1) and asked to participate and adhere to the strength component (which states, *'build strength on at least 2 days a week to keep muscles, bones, and joints strong'*) for six months, to begin immediately following the visit. Each time that participants believed that they were meeting the muscle-strengthening guidelines, they were asked to record their activity in detail on the appropriately dated page (including repetitions, sets, session duration, and type of resistance used), along with their rating of perceived exertion (on a 1-10 scale). Diaries were collected at the post-intervention (six month) appointment.

Very Brief Intervention

The VBI used in the current study was aligned to the UK's Chief Medical Officers' physical activity guidelines (17). Physical copies of the infographic were provided to participants and the available information verbally described (recommended frequency – *'at least 2 times a week'* and recommended modalities shown in icon image format – 'gym', 'carry heavy bags,' and 'yoga'). Of note, this infographic does not include intensity, time, volume, or progression strategies. Behaviour change techniques (BCTs) used by first author (AG) in this intervention were coded using the BCT Taxonomy v1 (36). Items were coded independently by both researchers and then agreed upon for accuracy. The VBI delivered to participants included the following BCTs; 1.1 goal setting (behaviour), 1.4 action planning, 2.3 self-monitoring of behaviour, 3.1 social support (unspecified), 4.1 instruction on how to perform the behaviour, 5.1 information about health consequences, 5.6 information about emotional consequences, and 9.1 credible source.

Analysis

Quantitative analysis of data was conducted by second author (GH) using JASP (version 0.19.3). The first stage of the quantitative analysis was to examine pre-to-post intervention effects via a paired samples t-test. This was completed through a comparison of scores in grip strength and ankle strength before the very brief intervention and then scores of grip and ankle strength six months later from the same sample. The second stage of analysis was to identify predictors of intervention effects. A correlation matrix was computed to examine the association between all variables in the current study. Following this, two multiple linear regression analyses were performed. Both regression analyses had the independent variables of; age, sex, employment, education, income, living situation, strength training history, self-reported current strength, injuries history, and self-reported health conditions. One regression had the dependent variable of change in grip strength, the other had the dependent variable of change in ankle strength. Multicollinearity and normality of residuals were checked, with an interpretation of findings following.

Qualitative analysis of data was completed by first author (AG) using NVivo (version 12.7.0) to manage the data. Hard copy diaries were professionally transcribed into Microsoft Word documents, uploaded to NVivo, and read in their entirety for each participant, to get a sense of the scope and quality of the data set gathered (37). An inductive approach with saliency analysis, the degree to which each code recurs, is highly important, or both, was used to determine units of meaning within the data (patterns across the dataset, but also differences, and divergences), relevant to the study question (37-40). Data in the form of quotations are used as a validation strategy to provide explanations of quantitative data, evaluate the effectiveness of the VBI in changing behaviour, and to understand what changes could be made to more effectively influence participation and adherence in future implementation (37). Quotes are presented followed by (pseudo-name, age range, handgrip strength (HGS), ankle plantar flexion strength (APS)). One arrow up (↑) or down (↓) indicates increase or decrease from baseline, respectively. Two arrows up (↑↑) or down (↓↓) indicates the increase or decrease was greater than 2kg from baseline, respectively.

Results

Very Brief Intervention impact

Handgrip strength

31 participants (11 males and 20 females) with a mean age of 67.52 years (SD = 6.64) were recruited in the current study. One revision was made to the analysis plan; ethnicity was collected but removed due a lack of variation between participants. Implications of this homogeneity are addressed in the discussion section.

Table 1. A paired samples t-test to examine changes in pre-to-post intervention grip strength and ankle strength.

Measure	Pre-intervention *M (SD)*	Post-intervention *M (SD)*	*t (df)*	*p*	*d*
Grip strength	32.26 (9.28)	33.40 (9.64)	-2.29 (30)	**.029**	-.41
Ankle strength	25.66 (7.06)	25.40 (5.76)	.28 (29)	.780	.05

Assumption checks were performed, with normality shows within the data (Shapiro-Wilk = .97, p = .466). A paired samples t-test was conducted to compare grip strength pre- and post-intervention (see Table 1). Results indicated a small yet statistically significant difference in scores, $t(30) = -2.29$, $p = .029$, $d = -.41$, with an increase in grip strength from pre-intervention ($M = 32.26$, $SD = 9.28$) to post-intervention ($M = 33.40$, $SD = 9.65$). Raincloud plots illustrated individual pre-post changes in grip strength, split into male (see Figure 1) and females (see Figure 2) for visual clarity.

Importantly, there was evidence of using handgrip tools to maximise post-intervention handgrip strength results in at least 3 participants' diaries (Sharon, Anne, Edward). Sharon, early 70's, ↑↑ HGS, ↑↑ APS (who showed a 4.5kg increase in grip strength; 20kg at baseline to 24.5kg at six-months,) showed evidence of performing hand grip exercise with progressive overload. She wrote, *'3 minutes squeezing rubber egg shaped balls.'* And later in the intervention wrote, *'5 minutes squeezing soft balls one in each hand.'* Anne, early 70's, ↑↑ HGS, ↑↑ APS (who showed a 4.25kg increase in grip strength; 24.25kg to 28.5kg,) *'invested in a gripper'* noting *'It's challenging…[but] I can do it watching TV!'*

Laura, early 70's, ↓↓HGS, ↓↓APS (who showed a 4.25kg loss in handgrip strength; 17.25kg to 13kg) had the lowest grip strength at baseline and post-intervention. She broke her wrist two years ago and explained that she expected a weak grip score. She was one of three people in the sample that reported to have seen the physical activity guidelines prior to the current intervention and is a chair-based exercise instructor. Her goal, as written at the beginning of her diary, was to *'aim for at least 150 minutes of moderately intense exercise a week, such as brisk walking, cycling, swimming, dancing or gardening…'*

Figure 1. A raincloud plot of pre-to-post intervention grip strength scores in males.

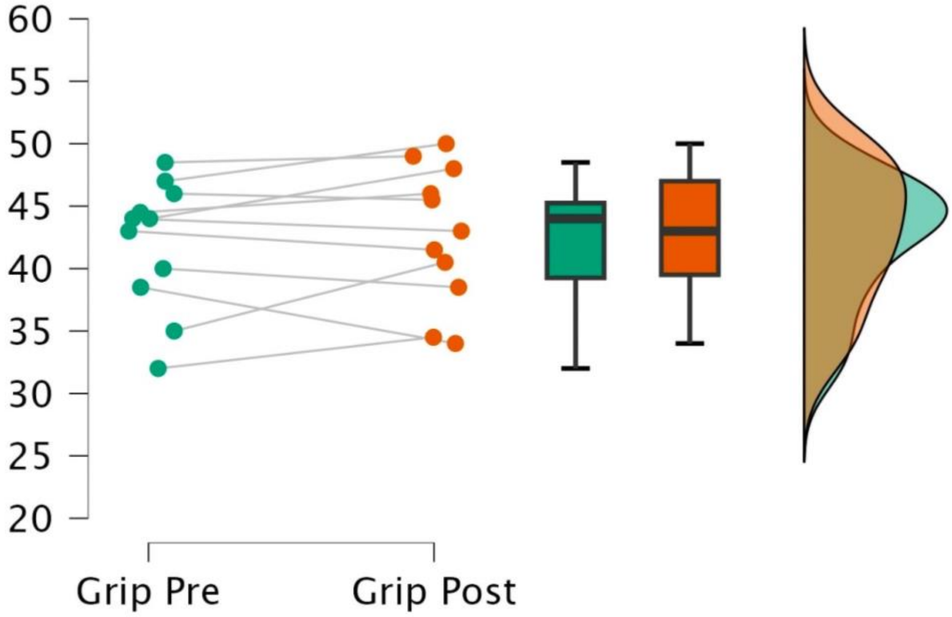
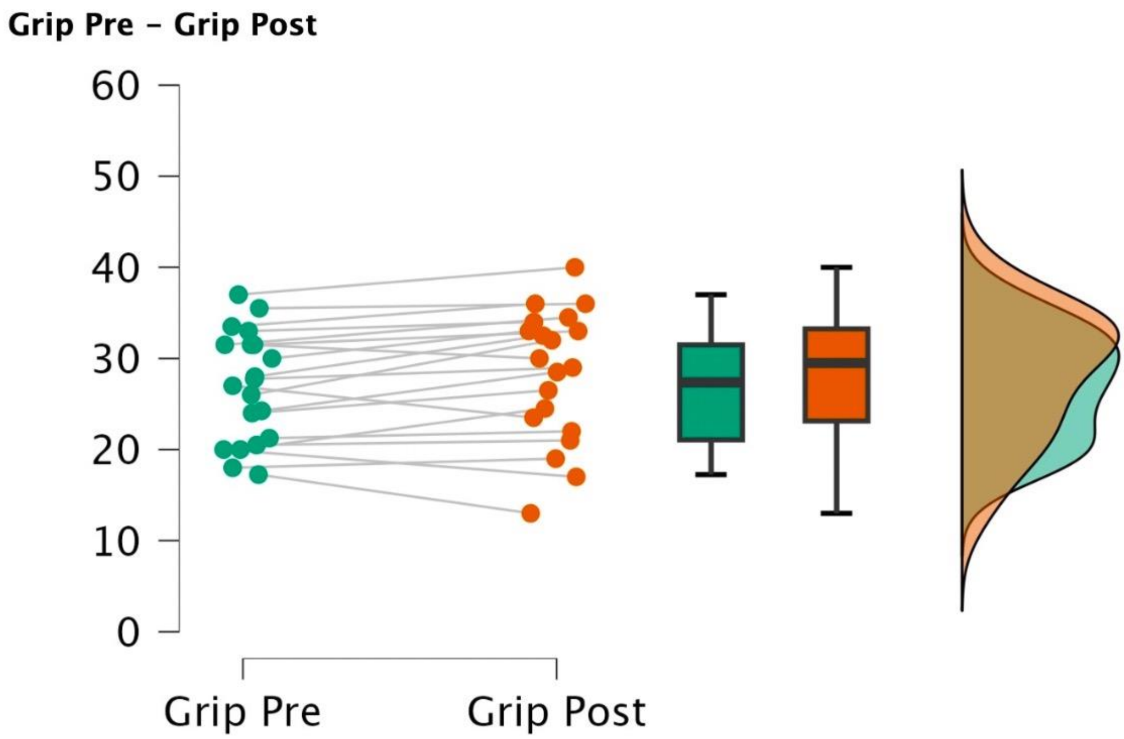


Figure 2. A raincloud plot of pre-to-post intervention grip strength scores in females.



Ankle plantarflexion strength

A paired samples t-test was also conducted to compare ankle strength pre- and post-intervention (see Table 1), following no violations in assumptions (Shapiro Wilk = .96, p = .327). Results indicated there was a non-significant difference between pre- and post-intervention scores, $t(29) = .28$, $p = .780$, $d = .05$. Here, a slight decrease was reported in ankle strength from pre-intervention ($M = 25.66$, $SD = 7.06$) to post-intervention ($M = 25.40$, $SD = 5.76$). Raincloud plots illustrated individual pre-post changes in ankle strength, split into male (see Figure 3) and females (see Figure 4) for visual clarity.

Interestingly, the two participants who lost the most ankle strength over the intervention were partners (Hazel and Neil). Hazel, mid-70's, ↑HGS, ↓↓APS was physically active with walking and long gardening sessions daily (up to 4 hours) but no evidence of structured exercise. Her goal, as written at the start of her diary was *'5,000 steps day min.'* She noted that both her and her partner, Neil *'both think that the results of our test may not be very different in 6 months time due to current fitness levels.'*

Neil, early 70's, ↓HGS, ↓↓APS also had evidence of high levels of walking and gardening activity. His personal reflection halfway through study noted that he *'would like to become more focused and exercise more than just what we do on the allotment'* but no addition to his walking and gardening activity was ever recorded.

Figure 3. A raincloud plot of pre-to-post intervention ankle strength scores in males.

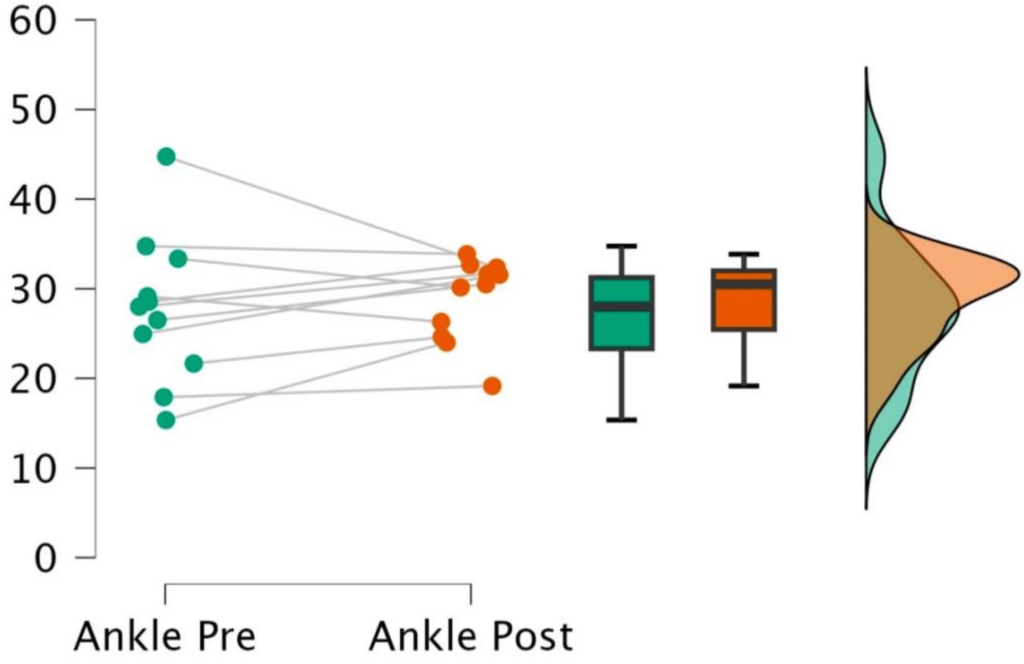
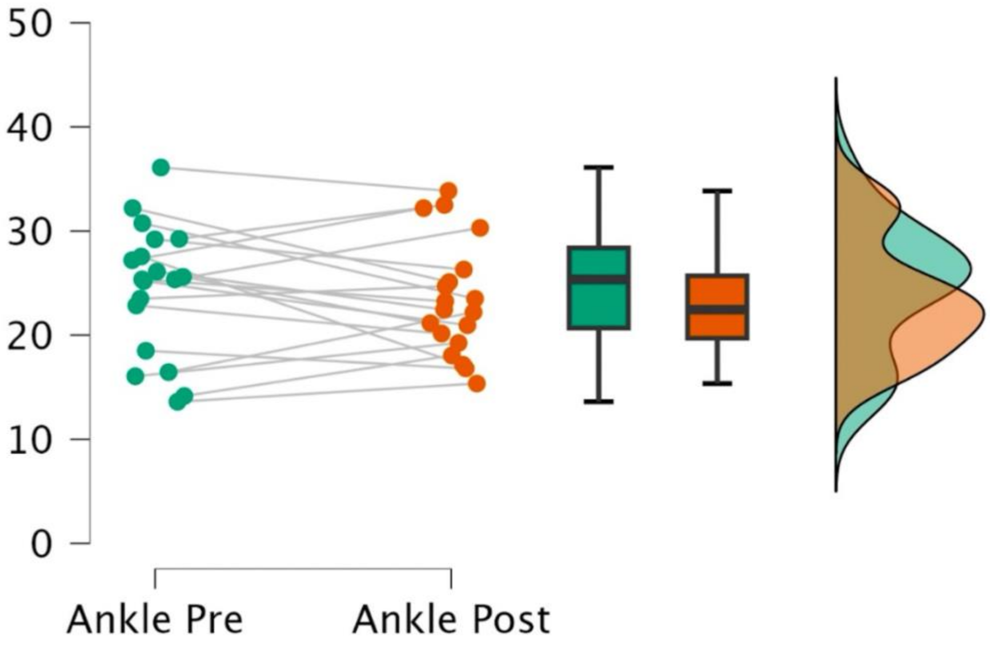


Figure 4. A raincloud plot of pre-to-post intervention ankle strength in females.



Predictors of intervention effects

A Pearson's correlation matrix was computed to examine the relationships between all variables in the current study (see Table 2).

Table 2. A correlation matrix of variables.

Variable	Age	Sex	Emplo-yment	Educati-on	Income	Living	Strength History	Strength	Injuries	Health	Grip diff	Ankle diff
Age	-											
Sex	-.261	-										
Employment	**-.527****	.328	-									
Education	-.288	.244	**.429***	-								
Income	**-.395***	-.015	.309	**.597*****	-							
Living	.019	-.254	**-.412***	-.131	.282	-						
Strength history	**.446***	.048	-.322	-.168	-.143	-.012	-					
Strength	.288	-.334	-.119	-.175	-.019	-.291	.128	-				
Injuries	.069	.172	-.062	-.140	-.079	-.067	-.032	-.028	-			
Health	.159	.066	.038	-.347	-.322	-.080	-.184	.204	.113	-		
Grip difference	-.187	.113	.064	.153	**.391***	-.131	**-.443***	.188	.289	.112	-	

Ankle difference	-.118	-.203	**-.439***	.010	.090	-.090	-.006	-.218	.123	-.004	.124	-

- * p<.05, ** p<.01, *** p<.001.

Grip strength difference, calculated from grip strength scores post-intervention minus scores pre-intervention, was significantly positively correlated with income, r = .391, p = .040, indicating that higher levels of income were associated with greater increase in grip strength. Grip difference was also significantly negatively correlated with strength training history, r = -.443, p = .014, indicating that lower levels of strength training history were associated with greater increase in grip strength from pre-to-post intervention.

Ankle strength difference, calculated in the same manner as above, was significantly positively associated with employment, r = -.439, p = .017, indicating that those with a lower level of employment showed greater increase in ankle strength from pre-to-post intervention.

Age was significantly negatively correlated with level of employment, r = -.527, p = .003, indicating as age increases employment level decreases. Age was also significantly negatively correlated with income, r = -.395, p = .037, indicating that income also decreased as age increased. Finally, age was significantly positively associated with strength training history, r = .446, p = .014, indicating that higher age was associated with greater likelihood of strength training history.

Employment was significantly negatively correlated with living situation, r = -.412, p = .024, indicating those with a lower level of employment were more likely to live with others. Employment was significantly positively correlated with education level, r = .429, p = .018, indicating those with a higher level of education also had a higher level of current employment. Finally, employment was also significantly positively correlated with income, r = .597, p<.001, indicating those with a greater level of employment also had a higher level of income.

Table 3. A multiple linear regression to identify predictors of grip difference from pre-to-post-intervention.

Variable	*B*	*SE*	*β*	*t*	*p*	*95% CI*
Age	.03	.09	.08	.37	.716	-.16, .23
Sex	2.13	1.38	.39	1.54	.145	-.82, 5.08
Employment	-1.74	.75	-.56	-2.33	**.034**	-3.34, -.15
Education	-.36	.56	-.15	-.65	.529	-1.54, .83
Income	1.42	.43	.86	3.28	**.005**	.50, 2.35
Living situation	-4.29	2.07	-.51	-2.08	.056	-8.69, .12
Strength training history	-1.51	.64	-.53	-2.37	**.032**	-2.87, -.15
Current self-reported strength	.15	.94	.03	.16	.874	-1.84, 2.14
Injuries history	.42	.99	.08	.43	.674	-1.68, 2.53
Health conditions	.32	.58	.10	.55	.572	-.92, 1.56
Meeting guidelines	.27	1.05	.07	.26	.801	-1,97, 2.51

Predictors of change in strength were then examined. A multiple linear regression was conducted to examine if variables predicted changes in pre-to-post-intervention grip strength. Independent variables in the regression model were age, sex, employment, education, income, living situation, strength training history, self-reported current strength, injuries history, self-reported health conditions, and meeting guidelines. Multicollinearity was not a concern as tolerance values and VIF values all fell between .2 and 5.0. Normality of residuals was checked for data with Q-Q plots, with no concerns seen. The overall regression model was statistically significant, $F(11,15) = 2.52$, $p = .049$, explaining 39% of the variance (*Adjusted* $R^2 = .39$).

Specifically, employment (B = -1.74, *SE* = .75, *β* = -.56, *t* = -2.33, *p* = .034, *95% CI* [-3.34, -.15]), and strength training history (*B* = -1.51, *SE* = .64, *β* = -.53, *t* = -2.37, *p* = .032, *95% CI* [-2.87, -.15]) significantly negatively predicted change in grip strength from pre-to-post intervention. Income (*B* = 1.42, *SE* = .43, *β* = .86, *t* = 3.28, *p* = .005, *95% CI* [.50, 2.35]), significantly positively predicted a change in grip strength pre-to-post-intervention. This data showed that those engaging in higher levels of employment had lower levels of change in grip strength, those who reported greater levels of strength training history showed smaller improvement in grip strength, and finally, those with a higher level of income experienced greater improvements in grip strength over time.

For example, the highest baseline handgrip strength and second highest post-intervention score (48.5kg, increases to 49kg) was found in Dean. Dean is a male, mid-70's, retired, reported a high income, currently strength training, meeting the muscle-strengthening guidelines, believed to have above average strength, no reported injuries, and 2 medical conditions (arthritis and controlled hypertension). He had evidence of a very structured gym routine, participating Monday, Wednesday, Friday *'throughout my life',* with *'resistance sets with an increasing weight each day matched with reducing number of reps.'*

The highest post-intervention handgrip strength (47kg, increased to 50kg) was seen in Ian. Ian is a male, mid-50's, retired but freelancing, reported a high income, noted that he had participated previously in '*small amounts'* of strength training but not sure if he is currently meeting the muscle-strengthening guidelines, believed himself to have average strength, no reported lower body injuries, and no medical conditions. While Ian is a long-time consistent runner who *'doesn't have very strong arms,'* there was evidence the intervention may have *'focused [his] mind on the importance of specific strength work to help avoid running injuries' and 'improved [his] weedy arm muscles.'* As an indication to the study's influence, he added free weights (*'dumbbells + a kettlebell'*) to his routine. Furthermore, an addition to his home during the intervention meant that he, *'...could have a small room dedicated to weights... [which] made it so* *much easier to add strength training to my routine. Having to get weights out and create space each time was a real barrier. Now I feel there's no excuse…'*

All other variables were non-significant; age (*B* = .03, *SE* = .09, *β* = .08, *t* = .37, *p* = .716, *95% CI* [-.16, .23]), sex (*B* = 2.13, *SE* = 1.38, *β* = .39, *t* = 1.54, *p* = .145, 95% CI [-.82, 5.08]), education (*B* = -.36, *SE* = .56, *β* = -.15, *t* = -.65, *p* = .529, *95% CI* [-1.54, .83]), living situation (*B* = -4.29, *SE* = 2.07, *β* = -.51, *t* = -2.08, *p* = .056, *95% CI* [-8.69, .12]), injuries history (*B* = .42, *SE* = .99, *β* = .08, *t* = .43, *p* = .674, *95% CI* [-1.68, 2.53]), self-reported strength level (*B* = .15, *SE* = .94, *β* = .03, *t* = .16, *p* = .874, *95% CI* [-1.84, 2.14]), self-reported health conditions (*B* = .32, *SE* = .58, *β* = .10, *t* = .55, *p* = .594, *95% CI* [-.92, 1.56]) and following of guidelines (*B* = .27, *SE* = 1.05, *β* = .07, *t* = .26, *p* = .801, *95% CI* [-1.84, 2.14]).

Table 4. A multiple linear regression to identify predictors of a change in ankle difference from pre-to-post-intervention.

Variable	*B*	*SE*	*β*	*t*	*p*	*95% CI*
Age	-.55	.16	-.74	-3.46	**.004**	-.88, -.21
Sex	-1.99	2.43	-.19	-.82	.428	-7.21, 3.46
Employment	1.62	1.28	-1.05	-4.84	**<.001**	-8.97, -.65
Education	1.62	.99	.36	1.63	.125	-.51, 3.75
Income	.13	.75	.04	.18	.861	-.1.47, 1.74
Living situation	-6.83	3.69	-.43	-1.85	.085	-14.74, 1.08
Strength training history	.15	1.12	.03	.13	.898	-2.26, 2.56
Injuries history	-.30	1.70	-.03	-.18	.864	-3.94, 3.35
Current self-reported strength	-4.49	1.63	-.53	-2.76	**.015**	-7.98, -1.00
Health conditions	1.93	1.02	.32	1.90	.079	-.25, 4.12
Meeting guidelines	3.58	1.82	.47	1.97	.069	-.31, 7.47

A multiple linear regression was conducted to examine if variables predicted changes in pre-to-post-intervention ankle strength. Independent variables in the regression model were age, sex, employment, education, income, living situation, strength training history, self-reported current strength, injuries history, self-reported health conditions, and meeting guidelines. Multicollinearity was not a concern as tolerance values and VIF values all fell between .2 and 5.0. Normality of residuals was checked for data with Q-Q plots, with no concerns seen. The overall regression model was statistically significant, $F(11,14) = 3.52$, $p = .015$, explaining 53% of the variance (*Adjusted* $R^2 = .53$).

Specifically, age ($B = -.55$, $SE = .16$, $\beta = -.74$, $t = -3.46$, $p = .004$, *95% CI* [-.88, -.21]), employment ($B = -6.21$, $SE = .99$, $\beta = -1.05$, $t = -4.84$, $p < .001$, *95% CI* [-8.97, -.65]), and self-reported strength level ($B = -4.49$, $SE = .1.63$, $\beta = -.53$, $t = -2.76$, $p = .015$, *95% CI* [-7.98, -1.00]) significantly negatively predicted a change in ankle strength from pre-to-post-intervention. This data showed that a younger age predicted greater improvements in ankle strength, those engaging in higher levels of employment had lower levels of improvement in ankle strength, and that those who rated their self-reported strength level as lower showed greater levels of improvement in ankle strength.

Stewart, a male, early 70's, retired, and reported his strength to be below average had the third weakest ankles at baseline and showed the largest improvement in ankle strength post-intervention (8.65kg; 15.35kg to 24kg). He participated in a variety of physical activities (yoga, cycling, football, swimming, running, ruck sacking with extra load in backpack, 'KettFusion' class, a class combining Kettlebells and Martial Arts) and a 'Body Pump' class with inclusion of *'lunges, squats, clean + press'* with some evidence of load progression.

Paul, a male, mid-60's, retired, who reported his strength as average for his lower body had the second largest improvement (6.6kg; 24.95kg to 31.55kg). He also participated in a variety of physical activities ('*walking football, badminton, walking, cycling, gardening*'). He was a participant in a free Nuffield Health joint pain programme before the current study and he incorporated the exercises he learned there into his own routine, evident by his consistent *'up on toes'* calf raise exercise he reported to learn, for 1 set of 25 repetitions (41).

All other variables were non-significant; sex (*B* = -1.99, *SE* = 2.43, *β* = -.19, *t* = -.82, *p* = .428, *95% CI* [-7.21, 3.46]), education (*B* = 1.62, *SE* = .99, *β* = .36, *t* = 1.63, *p* = .125, *95% CI* [-.51, 3.75]), income (*B* = .13, *SE* = .75, *β* = .04, *t* = .18, *p* = .861, *95% CI* [-1.47, 1.74]), living situation (*B* = -6.83, *SE* = 3.69, *β* = -.43, *t* = -1.85, *p* = .085, *95% CI* [-14.74, 1.08]), strength training history (*B* = .15, *SE* = 1.12, *β* = .03, *t* = .13, *p* = .898, *95% CI* [-2.26, 2.56]), injuries history (*B* = -.30, *SE* = 1.70, *β* = -.03, *t* = -.18, *p* = .864, *95% CI* [-3.94, 3.35), health conditions (*B* = 1.93, *SE* = 1.02, *β* = .32, *t* = 1.90, *p* = .079, *95% CI* [-.25, 4.12) and meeting guidelines (*B* = 3.58, *SE* = 1.82, *β* = .47, *t* = 1.97, *p* = .069, *95% CI* [-.31, 7.47).

Acceptability of intervention

Participants, especially those at the higher end of the study's age range, were seeing significant declines to their strength and function. Participants, especially those at the lower end of the study's age range, noted intentions to start building muscle strength. Regrettably, final nudges into action previously either had not been present or had not been effective. Coupled with younger age being a predictive factor (for increases in ankle strength), mid-life may be an opportune time to deliver a VBI aligning to the muscle-strengthening guidelines, with increasing likelihood of physical and psychological capability, reflective motivation, and receptivity.

> *I am noticing negative changes to my ability to move e.g. difficulty getting up + down from the floor, difficulty pulling on support stockings (*Sharon, early 70's, ↑↑HGS, ↑↑APS)
>
> *The thought and intention to get stronger was always present but finding motivation to act on it never happened until signing up to the study. Made me feel accountable not to anyone in particular but myself mainly* (Margaret, late 50's, ↑↑HGS, ↑↑APS)

The Chief Medical Officers' physical activity guidelines infographic was too vague to enable clear understanding for most. Participants were disappointed by the lack of specific exercises and noted there is *'no guidance'* either in the infographic or intervention. Future VBIs should be much more detailed in their prescription and provide specific exercise examples with *'numeric examples'* of exercise variables to further increase understanding and self-efficacy, minimise time spent with ineffective modalities, and to optimise improvements in muscle strength and motivation.

> *Build strength guidelines. Should be clearer. What do we do at the gym? Weights??* (Angela, late 60's, ↑↑HGS, ↓↓APS)

> *Bit disappointed there were no [strength specific] exercises to be done over the period of the trial* (Tim, early 70's, ↓HGS, ↑APS)

On the other hand, there was some motivation in simply knowing that guidelines in this area exist and have been recommended by a credible source for all adults and older adults.

As noted at the start, I found the published guidelines so vague as to be meaningless. However, their existence and my involvement has sharpened my commitment to following through with my exercise routine and on those days when I woke up uncertain whether I could be bothered to go to the gym they have acted to sway my decision to go – and I'm always glad when I've been (Dean, mid-70's, ↑HGS, ↓APS)

Despite the VBI emphasising the muscle-strengthening component of the guidelines, there continued to be a misunderstanding and misclassification of what counted towards the muscle-strengthening guidelines. Walking, running, cycling, swimming, and sport were all counted towards muscle-strengthening participation, as participants were sure that they could feel these activities building their strength, even though these are all clearly placed (that is, pictured as examples) in the *aerobic* section of the infographic (see Supplementary Materials 1).

I always walk there, at a good steady pace. I take ~45 mins to get there – so good exercise and strength I suppose (Alexandra, mid-50's, ↑↑HGS, ↓↓APS)

Swimming is always listed as cardio, but I can't see how it isn't also resistance training (Nancy, early 70's, ↓↓HGS, ↑APS)

Interestingly, participants who focused on recording their walking (reported in duration, miles, or steps per day) in their muscle-strengthening journal showed a decrease in both their handgrip and ankle strength scores at post-intervention (Charles, Neil, Carolyn).

Community-dwelling participants also counted lighter intensity modalities (rated 2 or 3 out of 10 on the RPE scale) like yoga (i.e. stretching) and carrying shopping from the car to the kitchen as part of their participation in muscle-strengthening activities. This was unsurprising, as the UK's Chief Medical Officers' physical activity guidelines provides these specific examples in the muscle-strengthening section of the infographic. Importantly, the WHO's infographic indicates that muscle-strengthening activities should be performed at a *'moderate or greater intensity,'* however, the UK's guidelines do not indicate this intensity threshold on their infographic.

> *1 hour mobility & flexibility group session – an element of strengthening, 3/10 [RPE]* (Nigel, late 60's, ↑HGS, ↑↑APS)

> *Carried 2 bags of shopping from car to kitchen, RPE 2. Weekly shop. I pack my bags at the car so didn't load into car, just back out and indoors* (Claire, early 70's, ↑HGS, ↓↓APS)

Participants would have benefitted from further discussion with an exercise professional or signposting to credible information around effective variables to build muscle strength, including appropriate modalities, intensities, loads, and progression principles. Some participants managed to find credible sources or correctly guessed best next steps on their own, but others did not.

> *Not sure when supposed to increase weights. Get confused about how much weight to use for how long and whether I should be switching to much heavier weights or longer classes. Online resources feels confusing and frustrating at times. I tried to increase my strength training again today. I decided to increase the dumbbell from 7kg to 8.5 kg.* (Margaret, late 50's, ↑↑HGS, ↑↑APS)

> *Yes [I do muscle strengthening] 6 days a week but especially on Tuesday with [group class] added in. I do think my strength has changed, I can now go into a full COBRA [yoga pose].* (Carolyn, early 70's, ↓↓HGS, ↓APS)

The appetite for more information was palpable and will need to be considered in any future interventions or implementation efforts. Providing more information upfront for those who display motivation to improve their muscle strength may help to avoid frustration with online searches, which may eventually lead to disengagement and apathy.

> *…do I only focus on upper body or whole body? Hard to find online and so little practical meaning + description* (Sally, late 50's, ↑HGS, ↑↑APS)

> *There have been quite a few articles on BBC News and in the papers about how important strength training is as you get older but there was no guidance on what to do or what counts as strength training* (Margaret, late 50's, ↑↑HGS, ↑↑APS)

For participants who indicated they had access to and used a personal trainer, group classes, or gym during the intervention, their accelerated self-reported strength improvements during the study appeared to foster adherence and the development of a strong exercise identity. Providing access and opportunity should be used early to develop strong habits that may last beyond the duration of VBIs.

> *Hardest kettlecise session have done to date. I've not used 2 kettlebells at the same time before + really felt a difference. I feel more toned as well…I have made strength training part of my weekly routine + will continue to do so.* (Suzanne, late 50's, ↑HGS, ↑↑APS)

The speed of change doing personal training really stands out to me compared with before…At the end of the study [I will be] carrying on with personal trainer twice a week. (Margaret, late 50's, ↑↑HGS, ↑↑APS)

For those who may not have had access to a personal trainer, group classes, or a gym, this intervention still appeared to have increased conversations and information seeking. Self-directed learning and experimentation may be more salient and lead to different realisations and more personalised action plans (i.e. home-based exercise is more convenient for one participant, while another (discussed above) realised that a personal trainer was needed). Again, providing resources up-front may ensure that the information read, discussed, and acted upon is evidence-based.

My highlight [of the intervention] was discussing with [my friend] our different fitness issues and how we might improve, how we manage that part of our lives. (Edward, early 70's, ↑↑HGS, ↑↑APS)

Before I started on this trial, I had not understood strength training as a separate goal. I purchased some dumbbells for use at home. This was quite successful as I saw my strength improve quite rapidly…I don't think I could have trained so effectively if I was relying on the gym (Brett, late 60's, ↑↑HGS, ↓↓APS)

The VBI, as delivered for the first time in this study, had key enablers that should be considered in future research and implementation efforts within primary care settings. Simply discussing the importance of muscle strength to health, measuring strength, encouraging self-monitoring of the target behaviour, and scheduling following-up appointments improved participants' awareness and understanding of the topic and of oneself.

> *Even after the study I will continue to write down so I can see what I'm achieving each week. I have bought a new diary so I can record my own progress.* (Suzanne, late 50's, ↑HGS, ↑↑APS)

> *Going though the process/journey helped identify what works for me* (Margaret, late 50's, ↑↑HGS, ↑↑APS)

There were also barriers to the VBI as delivered. These included the challenge of keeping a diary, requiring extra or ongoing support for those with current health conditions, injuries, and/or psychological stress, and possibly for those starting exercise for the first time later in life. Barriers should be carefully considered before being applied in the future. For example, the diary burden can be alleviated by explaining that all aerobic activities do not need to be recorded while worries about exercise exacerbating a current or chronic health condition can be addressed by referring to ongoing support with a clinical exercise physiologist.

> *Getting harder to do this diary. Days are so busy that I am struggling to find time to record exercise (*Sharon, early 70's, ↑↑ HGS, ↑↑ APS)
>
> *I have an ongoing neck problem, not serious, but worry about exacerbating it by using weights.* (Margaret, late 50's, ↑↑HGS, ↑↑APS)

Discussion

This is the first study to explore a very brief intervention (VBI) to increase levels of muscle strength in adults for future implementation in primary care settings. We have therefore extended the physical activity advice continuum tool (a guide for physical activity promotion in healthcare) proposed by Freene et al (2024) to explicitly include muscle-strengthening advice in primary care (42). Our findings suggest that providing five-minutes of very brief advice has the potential to improve muscle strength with evidence pointing to lasting behaviour change in patients aged 50-75 years of age. Specifically, 22 of 31 participants improved their handgrip strength and this change was significant. Fifteen of 30 participants improved their ankle plantar flexor strength, although, the change was not significant. 42% of participants increase their handgrip strength by more than 2kg while 40% of participants increased their ankle strength by more than 2kg. Six participants were able to gain more than 2kg in both upper and lower body strength and only 1 participant lost more than 2kg in both. Due to the number of patients seen in primary care settings each year, small changes to the number of people participating in muscle-strengthening activities could have the potential for significant population-level impact.

Comparison to literature

While the authors are unaware of any brief or very brief interventions aligning to the strength component of the UK's Chief Medical Officers' physical activity guidelines, overall, the literature indicates that Brief Interventions (BIs) are effective at increasing physical activity levels (29, 30, 43). However, a systematic review on the delivery of brief physical activity interventions in primary care found that physical activity screening and advice varied widely (0.6%-100%) (44). Barriers to delivery included a lack of time, knowledge and training, clear intervention protocols and guidelines, and HCP not being physically active themselves (44-46). Our findings may be used to overcome some these commonly reported barriers and may serve as the foundation to strengthen the current VBI protocol for future research and implementation.

There is evidence that simply measuring physical activity may lead to increased physical activity levels (32) and this appears to translate when measuring muscle strength. Even a low frequency of measurement (0- and 18-weeks) was effective in improving fitness, yet higher frequency (0, 6,12, and 18-weeks) showed promise for additional health outcomes (47). Participants in the current study reported that they were motivated by knowing that their strength would be measured again, corroborating findings in previous strength training research (48). Due to the simplicity and quickness of the handgrip strength test (which could be measured at check-in by administrative assistants to save more time), increasing the frequency of measurement appears to be a feasible strategy to maintain motivation and accountability in adults within primary care settings. Future research could look to confirm increased motivation and objective strength gain with more frequent or ongoing strength measurements.

Future VBIs could include a patient leaflet (or other means of signposting) to further emphasise all the social, physical, physiological, psychological, and mental health improvements that have been associated with higher levels of muscle strength through the participation of evidence-based strength training (1, 49, 50). For example, of the 466,788 participants in the UK Biobank database, individuals who fell into the lowest quintile of handgrip strength (mean 21.12kg) had a 72% higher incident dementia risk and 87% higher risk of dementia mortality compared to those in the highest quintile (40.82kg) (51). Based off these findings, several participants in the current study appeared to be at high risk of dementia. Being aware of the robust association between muscle strength and cognitive impairment may inspire participants to increase their strength training participation and may be worth further investigation. In fact, every 1-point higher on the handgrip dynamometer was associated with a 13% lower dementia incidence and 43% lower risk of Alzheimer's disease, indicating that our results are not only statistically significant, but may be clinically relevant (52, 53).

Strengths and Limitations

This is the first study to explore a VBI aligned to muscle-strengthening guidelines in a simulated primary care setting, therefore a valuable first step towards integrating these 'forgotten' guidelines into physical activity advice in primary care settings.

The pre-post study design did not have a control group and cannot show causal certainty. However, given that a decline in muscle strength with ageing is well established (54, 55) and participating in heavy load strength training has been shown to reverse this decline (56, 57), this intervention has shown promise and has built upon and further developed our understanding of the benefits of incorporating very brief physical activity interventions within primary care settings. Future research with a larger and more heterogenous sample is now warranted. However, if this research continues to prove effective, it will also be important to investigate the feasibility, acceptability, and sustainability of this intervention from the healthcare providers' perspective.

As with any research or real-world physical activity programme, those with a particular interest in or motivation for improving their fitness may have been more likely to participate. However, as we have seen, even those who may be interested and have been measured and monitored may still see a decline in muscle strength over six-months. It is important to identify individuals with a lower understanding of what activities are likely to build full-body levels of muscle strength and engage in ongoing monitoring and communication before levels drop below the disability threshold. Participation in muscle-strengthening activities is a life-long endeavour and needs to be followed up throughout the life course. While there were promising passages on the intention to adhere to muscle-strengthening exercise following the intervention, this six-month study is unable to comment on actual longer-term habit trajectory (58). However, a meta-analysis by Singh et al. (2024) concluded a median duration of 59 to 66 days and mean duration of 106 to 154 days for habit formation to occur in health behaviour, meaning the current study does examine some behaviour post-habit formation (59).

Next steps

There is an urgent need to identify effective ways to support ongoing participation in muscle-strengthening activity. Thus far, our participation estimates are limited by self-report. By objectively measuring muscle strength during general practice consultations, we can more conclusively assess and monitor effective participation. From this and previous research, we see a misunderstanding and misclassification of what counts toward the strength component of the guidelines (along with the potential of recall and social desirability bias), we argue that monitoring objective levels of strength would be easier and more effective than subjectively monitoring adherence via self-reported questionnaire (24).

We suggest using a clear, five-step protocol in practice settings of (1) Target, (2) Examine, (3) Educate, (4) Plan, and (5) Deliver (or TEE-P-D; see Supplementary Materials 2).

To help during the Target phase, predictors of increased muscle strength from pre-to-post intervention were identified in the current study, providing healthcare practitioners with ideal user profiles in the delivery of this intervention when time prohibits reaching all patients. If the clinician does not have time to discuss muscle-strengthening activity during every clinical contact, characteristics that practitioners could look for include patients younger in age, lower levels of strength training history, and lower self-reported levels of strength. People as early as age 30 may notice or be aware that they are losing strength and functional capacity. It is also important to build an exercise habit before significant pain, disability, or disease sets in from sedentary lifestyles, as after which such participation may become harder to promote (60). Conversely, there is some evidence to suggest motivation is present in individuals with impaired self-reported health (22). Thus, while middle-aged may be an opportune time to intervene, those with impaired health or those later in life may simply require more resource-intensive interventions. Our study has highlighted the lack of opportunity and health inequalities that people with lower levels of income may experience, and future implementation of brief or very brief physical activity advice must work to not widen these inequalities.

In the Examine phase, measure and keep an ongoing record of handgrip strength for all patients. Then, identify patients that are ready to progress to the educate phase of the intervention. This could include those in teachable moments and/or in key life stages such as those who have seen their handgrip strength is low for their age or even approaching clinical frailty. As a reminder for the clinician, posters could be placed in the waiting room asking patients to ‘ask their healthcare practitioner’ to check their handgrip strength. This examination can then inform the depth and focus of the education phase.

In the Educate phase, clear and consistent messaging from healthcare practitioners is crucial. Messaging needs to emphasise that everyone can and does benefit from building muscle strength. Furthermore, muscle strength is not just for body composition or athletes. Describe the wide array of benefits to social, mental, and physical health. As mentioned, further information about health consequences, and the salience of consequences could be beneficial due to participants reporting surprise over the sheer impact of strength on health outcomes.

A common request in diary entries was for further detail to be provided. This centred around the three choices indicated in the strength section of the infographic (including 'gym') but with no details of exercises or exercise variables to accompany this guidance. Educate on 'how' to effectively participate in muscle-strengthening activities using the FITT-VP acronym (recommended frequency, intensity, time, type, volume, and progression strategies). Participants in the current study noted that they would benefit from the demonstration of possible exercises (for example, the squat or sit-to-stand). Previous research has shown that this cohort seems to prefer the American College of Sports Medicine Resistance Training for Health infographic due to the increased detail of the resistance training prescription (61). Remind patients that bio-hacking handgrip strength is not the goal but rather, to build strength in *all* major muscle groups.

In the Plan phase, set goals and action and coping plans. Plan how often you would like to maintain follow-up. Increased frequency of handgrip strength measurement and accountability may increase long-term adherence (62).

In the Deliver phase, have printed resources or hard-copy prescriptions (with a starting rep range, intensity level, and progression strategy) to hand (30, 62). Refer patients to an exercise class, gym, or personal trainer or clinical exercise physiologist, if appropriate. At the very least, signposting to evidence-based information for beginners, intermediate, and advanced exercisers is important for self-efficacy and confidence and may help to keep sufficient levels of strength throughout the ageing journey.

Finally, we urge trusted clinical resources, like Moving Medicine, to include specific advice pertaining explicitly to the muscle-strengthening guidelines, including how to assess handgrip strength, and encouraging referral for the prevention or treatment of low muscle strength. In addition, integrating these steps into electronic health records would allow for more accurate capture and understanding of relationships between strength and disease outcomes, referral effectiveness, and research opportunities.

Conclusion

The current study explored the impact and acceptability of a very brief muscle-strengthening intervention by examining objective changes in handgrip and ankle strength accompanied by qualitative data using the diary method over a six-month period. Changes in handgrip strength were significant, promising findings for the potential use of this five-minute intervention within resource-limited settings such as primary healthcare. Future improvements for the intervention were identified, with participants requesting further details of effective exercise prescription including exercise examples and progressive overload strategies. The current study is the first to incorporate the muscle-strengthening guidelines into a brief or very brief intervention intended to be delivered by healthcare practitioners, as recommended by the National Institute for Health and Care Excellence (NICE) and the Academy of Medical Royal Colleges. Overall, the very brief intervention appears to be a feasible and effective method to encourage behaviour change while also meeting the increasing workload demands of primary healthcare staff, holding valuable implications for the future of primary healthcare.

Abbreviations

BI Brief intervention

HCP Healthcare practitioner

UK United Kingdom

VBI Very brief intervention

WHO World Health Organization

Ethics approval and consent to participate

This study was reviewed and approved by the University of Manchester's Research Ethics Board (2022-13876-22436). Participants were sent the information sheet and consent form via email and written informed consent was obtained prior to data collection. The study was conducted in accordance with the Declaraion of Helsinki.

Consent for publication

All participants consented to the publication of this data.

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Data availability statement

Metadata underpinning this publication are openly available from the University of Salford's Figshare at https://10.17866/rd.salford.28927655

Contributions

AG developed the study. AG conducted data collection. AG and GH conducted data analysis. AG and GH prepared and edited the manuscript. Both authors read and approved the final manuscript.

Disclosure statement

The authors report there are no competing interests to declare.

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