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Original Article

Improving Prescription and Delivery of Resistance Exercise Training for Older People with Sarcopenia or Physical Frailty: Results from Wave Two of The Benchmarking Exercise Programme for Older People (BEPOP) Quality Improvement Initiative

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Abstract

Objectives: Resistance exercise training is often not prescribed or delivered effectively for sarcopenia or frailty. BEPOP aims to improve the effectiveness of resistance exercise training for people referred to community-based UK National Health Service (NHS) physiotherapy. **Methods**: Anonymous data collection for 20 consecutive patients by each participating physiotherapy service. Wave two data collection (2024-25) was compared with Wave one data (2021-22) against five key quality recommendations. Aggregate and service-specific data on performance against the recommendations were fed back to each participating site. **Results**: Twenty-eight services submitted Wave two data for 542 patients, mean age 82 (range 60-104) years. Two hundred and seventy-nine (52%) participants had initial objective strength-based assessments; sarcopenia was diagnosed in 316 (58%) participants, 496 (92%) undertook resistance exercise training but only 222 (41%) had exercise intensity progressed, 205 (38%) were reassessed using the same objective strength-based assessment as baseline and 238 (44%) were signposted or referred to follow-on exercise services. For services participating in both Waves, performance for objective strength assessment improved (64% vs 52%), as did intensity progression (33% vs 11%) and onward referral (40% vs 31%). **Conclusions**: BEPOP was effective at improving the quality of resistance exercise training delivery in participating NHS physiotherapy services.

Keywords: Sarcopenia, Frailty, Older, Exercise, Quality Improvement

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Introduction

Sarcopenia (the age-related loss of muscle mass and strength) and physical frailty are both common in older people and are associated with a range of adverse outcomes, including impaired ability to perform activities of daily living and consequent need for care, increased risk of hospital admission, worse quality of life and earlier death[1,2]. There is good evidence that resistance exercise training is an effective intervention to treat both sarcopenia and frailty[3]. However, this is only the case when exercise is appropriately prescribed at the correct dose[4]. To be effective, resistance exercise training should be individually tailored to induce progressive overload (i.e., gradually increase the stress on the body over time) throughout a training programme. Progressive overload is fundamental to achieving the desired adaptive response of increased muscle strength. Knowledge of an individuals' current strength, as well as regular monitoring of changes in strength, is necessary to enable exercise practitioners to prescribe exercise that progressively overloads an individual throughout the course of an exercise programme. Ongoing engagement in resistance exercise training is necessary to maintain strength gains over time. UK surveys have found that resistance exercise training is not routinely prescribed in exercise programmes targeted at older people living with sarcopenia or frailty[5,6]; where it is offered, resistance exercise training is often not prescribed at intensities required to deliver optimum benefits to patients[7].

These findings were confirmed by Wave one of the BEPOP national benchmarking and quality improvement programme[8]. BEPOP delivers individualised feedback to participating physiotherapy services to benchmark their performance in the prescription and delivery of resistance exercise training against other comparable services. BEPOP provides a forum for training, education, dissemination of good practice and peer support for NHS physiotherapists working with older people with sarcopenia or physical frailty. Similar iterative benchmarking and feedback approaches have been highly effective in improving the quality of care in other areas of clinical practice, most notably in the care of older people with hip fracture[9].

A series of best-practice recommendations were derived from the findings of BEPOP Wave one, focussing on making a diagnosis of sarcopenia, measuring strength objectively, retesting to measure progress, progressing exercise intensity, and signposting and referral to follow-on services. The aim of this report is to describe the quality improvement methods implemented following the BEPOP Wave one report. It also describes the findings from Wave two of BEPOP data collection, which measured the impact of this quality improvement activity against the key recommendations derived from Wave one.

Methods

Contextual elements

Exercise training for older people living with sarcopenia and physical frailty is delivered via multiple providers in the UK, including NHS, private and third-sector routes. The focus for BEPOP in both Wave one and Wave two is on community-based NHS physiotherapy services in the UK.

These services are heterogenous with differences across all aspects of their delivery models, e.g. clinic-based vs home-based, different referral criteria, different degrees of face-to-face contact, different types of therapy programmes and different skill-mix of staff. Participation in BEPOP is voluntary and free of charge, however time for participation is not reimbursed.

Nationally, key organisations that are championing effective exercise prescription and delivery for older people living with sarcopenia and physical frailty are the British Geriatrics Society (BGS) and the Chartered Society of Physiotherapy (CSP) via their Professional Network for Older People (AGILE), both of whom are partners in delivering the BEPOP programme. Frailty is increasingly

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Element	Details
Benchmarking and feedback	• Individualised reports with service-specific data benchmarked against national results emailed to all participating services in Wave one and two (and if returning service, comparison between their performance at Wave one and two included)
Dissemination of findings to national multiprofessional audience	• Chartered Society of Physiotherapy Complexity Summit (London, October 2022; 600+ attendees)
	• BGS national conference (Spring 2023)
	• ISTRC 2023 conference (Oct 2023)
	• CSP annual conference symposium (Manchester, Sept 2024)
	• Report on BEPOP website (www.bepop.org.uk)
	• Paper on Wave one findings in JFSF
	• Twitter promotion via AGE, BGS, AGILE
	• Article in AGILE newsletter (AGILITY)
Knowledge exchange and peer to peer learning	• AGILE Webinars x 2 (200+ attendees at each) – results, service reflections and knowledge exchange (2023).
Training in good practice	• Interactive, in-person training session covering: - the rationale for resistance exercise training - fundamental principles of resistance exercise prescription - exercise programming theory - evaluating exercise programmes
	• Workshop on prescribing and delivering resistance exercise training in practice

Table 1. Components of intervention to improve national practice in resistance exercise training for older people with sarcopenia or frailty.

visible as an area of UK healthcare policy interest[10] and is gaining in priority at organisational level because of financial incentives for identification. Sarcopenia does not yet have this visibility, nor is it a priority at policy or healthcare delivery level, however resistance exercise training has become a more important public health priority in recent years with increased focus in UK and US physical activity guidelines for adults[11,12].

Intervention

The key intervention element in the BEPOP programme was the process of data collection with individualised feedback to services, enabling them to benchmark their performance against other services. For those sites that returned from Wave one, feedback was also included to show their performance in Wave two vs Wave one. Other elements were also introduced between Wave one and Wave two: a) publicising the overall results and key recommendations from Wave one to the UK physiotherapy community and the wider multiprofessional team caring for older people living with sarcopenia and physical frailty; b) knowledge exchange and peer-to-peer learning events where participating teams were able to share their learning and experience of taking part in Wave one of BEPOP; c) training events and resources to promote best practice in prescription and delivery of effective resistance exercise training for older people living with sarcopenia and physical frailty. Table 1 gives a summary of the intervention components.

Design of study of intervention

We included NHS physiotherapy services offering community-based exercise interventions (outpatient, home-based or other community setting) to older people living with sarcopenia and physical frailty within the UK. We included teams offering longer courses of therapy (typically ≥6 weeks) as these services tended to focus on developing participants' strength, rather than just assessing patients. As with Wave one NHS inpatient services, services outside the UK and services with a disease-specific focus (e.g. stroke rehabilitation, cardiac rehabilitation, which have different aims and associated processes and measures) were excluded. There were a few expressions of interest from private physiotherapy services for Wave two, which was not the case for Wave one. We did not enrol these private services in Wave two to enable consistency of comparison between Waves but plan to include private providers in future Waves of BEPOP.

We advertised BEPOP through a range of channels, including social media (AGILE, BGS, National Institute for

Baseline patient characteristics (age, presence of long-term conditions, baseline mobility, Clinical Frailty Score)
Initial assessment of physical performance and muscle strength
The planned intervention and how it was intended to be delivered
Frequency of physiotherapy sessions and duration of the course
Progression of exercise intensity and repetitions
Re-assessment and any onwards referrals or signposting to further exercise programmes after the end of a course of therapy

Table 2. Information uploaded for individual patients by each service participating in BEPOP.

Characteristic		Value
Mean age (years)		81.8 (range 60-104)
Female Sex		316 (58.3%)
Living in own home or relatives' home		505 (93.1%)
Clinical Frailty Score (CFS) ≥ 5		333 (64.7%) *
Intended purpose of intervention**	Improve sarcopenia/ frailty	180 (33.2%)
	Falls prevention	385 (71.2%)
	To improve mobility	436 (80.4%)
	Improve physical performance	219 (40.4%)
	Other	77 (14.2%)

**515 participants had CFS recorded. **Note that some patients had multiple intended purposes for their intervention thus percentages add up to more than 100%.*

Table 3. Baseline data for Wave two patients (n=542).

Health and Care Research (NIHR) Newcastle Biomedical Centre), email contact lists (AGILE, BGS), promotional fliers at conferences and cascade to other physiotherapy services through personal contacts of those who participated in Wave one.

For Wave two of BEPOP, we asked each service to prospectively collect and upload data for 20 consecutive, eligible patients. Eligible patients met the following criteria: aged 65 years or over; likely to have frailty or sarcopenia (for example, Rockwood Clinical Frailty Score[13] of four or more, or suspicion of sarcopenia / confirmed diagnosis of sarcopenia); receiving an exercise intervention delivered in an outpatient/community-based setting; not referred for a disease-specific intervention or for post-operative rehabilitation.

Measures

Physiotherapy staff from participating services entered data using REDCap electronic data capture tools hosted at Newcastle upon Tyne Hospitals NHS Foundation Trust[14]. Services provided information on the characteristics of their service as part of their initial expression of interest for participation. Each service uploaded the information as shown in Table 2. A description of the six key measures used to assess performance against the five recommendations from BEPOP Wave one is given in Supplementary Table 1.

Statistical Analyses

Data were exported from RedCAP, then cleaned and checked by the BEPOP analysis team and converted into Microsoft Excel format for descriptive analyses. Data were checked for completeness and data plausibility with incomplete data removed before analysis. Uploaded data were not independently checked against clinical records from participating services. The main analyses sought to identify the proportion of patients whose care met the five key recommendations from Wave one using the six measures previously described (Supplementary Table 1). Descriptive data on the types of resistance exercise training offered, type of strength measure conducted at baseline and follow-up, and the characteristics of the population were also generated. Data from Wave two were compared with

	All services		Services taking part in both Waves	
Recommendation	*Wave One (n=10)*	*Wave Two (n=28)*	*Wave One (n=7)*	*Wave Two (n=7)*
1. Assessment	61%	51%	52%	64%
2. Diagnosis:				
- on entering programme	17%	41%	13%	44%
- at discharge from programme	*NM*	58%	*NM*	60%
3. Exercise Prescription	98%	92%	97%	87%
4a. Progress	26%	41%	11%	33%
4b. Re-Assess	32%	38%	34%	54%
5. Take Forwards	41%	44%	31%	40%
NM: Not measured at Wave one.				

Table 4. Summary of performance for the key BEPOP recommendations, Wave one vs Wave two.

the same analyses from Wave one, both for patients from all Wave one and Wave two services and, as a secondary analysis, using patient data only from those services taking part in both Wave one and Wave two. For the purposes of the analysis, objective measurement of strength was categorised as any one of the following: handgrip strength (using a dynamometer), one repetition maximum, 5x sit to stand or 30 second sit to stand.

Results

Intervention and modifications

The components of the BEPOP intervention are given in Table 1. No modifications were made to the intervention once Wave two data collection had started.

Measures and outcomes

Data were collected from services across the UK (listed in Supplementary Table 2) between 1st April 2024 and 31st January 2025. Of 39 services expressing interest who were eligible to participate in Wave two, six were not able to proceed as they were unable to obtain local Caldicott Guardian (or Personal Data Guardian if based in Northern Ireland) approval. Of the 33 who started data collection, 2 services withdrew due to time constraints and 3 services did not collect any data, leaving a total of 28 services who contributed data to Wave two. Complete data sets were available for 542 patients. Details of patient characteristics are given in Table 3. Characteristics of patients contributing data to Wave two were similar to those who contributed data to Wave one [8].

A summary of performance across services for the six metrics addressing the five key recommendations from Wave one is given in Table 4. When comparing performance across all Wave one services with Wave two services, three of the six measures showed improvement of at least 5% between Waves one and two (see Table 4). There were modest declines in performance for diagnosis and provision of resistance exercise training, and no change in onward referral or signposting. When the analysis was confined to those services participating in both Wave one and Wave two, performance improved by >5% in 5 out of 6 measures (see Table 4) with greater improvements seen than the overall comparison of Wave one and Wave two services. The only metric that did not improve on this analysis was provision of resistance exercise training. This showed a drop in performance of <5% between Waves one and two.

Waterfall plots demonstrating the range of performance across individual services for each measure are shown in Supplementary Figures 1 to 6. For all metrics, except the metric for recommendation 3 (use of resistance-based exercise), a wide range of performance across services was noted, ranging from <10% to >90%. A more detailed breakdown of the type of resistance exercise training offered is given in Supplementary Figure 7. The most common modality utilised was bodyweight-based resistance training, with 80% of participants being offered this; 26% were offered training with resistance bands. Other methods such as the use of free weights, ankle or wrist weights or resistance machines were less commonly used (11%, 18% and <1% respectively). Some, but not all services offered more than one method; 8% of services did not offer resistance training.

Discussion

BEPOP has shown that it is possible to engage services in a national quality improvement and benchmarking programme for sarcopenia and physical frailty. The package of measures that forms the BEPOP programme (some

individualised for each service, some deployed at national level) has been successful in improving performance against key recommendations resistance exercise training for older people living with sarcopenia and frailty. Importantly, BEPOP found evidence of an effect at a whole-system level when comparing all participating sites in Wave one and Wave two, but a greater improvement when confining our analysis to those services that took part in both Waves one and two, suggesting that the service-specific feedback had a benefit over and above the generic training, knowledge exchange and profile-raising activities of BEPOP. The merits of resistance exercise training for a wide range of populations, including older people living with sarcopenia and frailty, are increasingly recognised and discussed[15].

Not all metrics improved; metrics with very high performance at Wave one showed slight worsening at Wave two, which may be attributable to regression to the mean, or the incorporation of sites in Wave two that were not early adopters. Despite the overall improvement, performance in several metrics remained very variable between services in Wave two, with considerable room for further improvement. Of particular note is the lack of improvement in onward signposting and referral at the end of a programme of therapy, which has not changed between Wave one and Wave two. This may reflect a paucity of well-defined referral pathways, which will require action at organisational and supra-organisational levels to address. Previous work by AGILE with community service providers to facilitate falls service referrals provides a template that could be adapted for this purpose[16].

As noted in the results section, there was a decrease in the prescription of resistance exercise from Wave one to Wave two, which was also noted in sites that participated in both Waves. As we did not collect any qualitative data during Wave two, we are unable to explore the reasons underlying this reduction. The reduction could possibly represent regression to the mean (given the very good results from Wave one), or to a lack of resources to provide resistance-based equipment or a change in local pathways between Waves. Exploring this finding will be a focus for more in-depth work in future Waves. The finding that few patients used weights, bands or resistance machines suggests that services have limited equipment to offer to support resistance training, likely contributed to by no designated equipment budget. This is a potential barrier to effective progression of training intensity and again requires further in-depth exploration of service characteristics, processes and resources in future Waves of BEPOP.

To our knowledge, BEPOP is the first national quality improvement programme specifically focussing on resistance exercise training for people living with sarcopenia or physical frailty. The principle of benchmarking and feedback is well established within healthcare and has been found to be associated with positive effects on quality indicators, either when deployed alone or in combination with other interventions[17,18]. Within the field of UK geriatric medicine, quality improvement programmes for the care of inpatient falls (the National Audit for Inpatient Falls, NAIF)[19] and for hip fracture (the National Hip Fracture Database, NHFD)[9] have both used benchmarking techniques to successfully improve care, with major reductions in time to surgery and 30-day mortality from the latter example.

The BEPOP programme has several strengths. The large and increasing number of participating services across the UK enhances the generalisability and robustness of the results and affords the opportunity to mitigate geographical variations in care. Use of individualised feedback and benchmarking to services provides a powerful incentive for change and also provides services with locally relevant data and comparisons to advocate for service redesign within their organisations. The national reach of knowledge exchange and training events, supported by key stakeholder organisations, enables BEPOP to influence practice even in services that are yet to take part in the programme. The continued growth in participation (42 services have signed up to Wave three of BEPOP) suggests a demand from the clinical community for this programme of work.

A few limitations should also be acknowledged. BEPOP is a voluntary programme, and those taking part are therefore likely to be enthusiasts for change and improvement. At present, BEPOP includes only NHS community-based physiotherapy services, although we are exploring the feasibility of extending participation to private and third-sector providers. Not all service types are included at present; in particular, services that see patients only for a very short period of time are not currently invited as it is unlikely that meaningful improvements in muscle strength can be achieved by very short duration exercise programmes[3]. The granularity of data collected in Wave two was limited by design to reduce burden on participating services, and we did not collect detailed data on contextual factors, for instance service inclusion criteria, staffing or standard operating processes. As the number of services participating in BEPOP continues to grow, these contextual factors will become more amenable to interrogation, both via collection of quantitative data but also via focussed qualitative enquiry. Further analyses of the existing datasets in BEPOP is likely to yield additional insights, particularly around the relationship between programme characteristics and the degree to which strength and physical performance improve. We did not attempt to capture data on unintended consequences in BEPOP Wave two and this should be a focus for future Waves. Burden on participating teams for data entry was found not to be high at Wave one, and we have reduced the number of data entry fields for Wave two. We did not capture information on whether improved delivery of exercise had potential adverse environmental consequences (e.g. more journeys to therapy; more equipment needing to be purchased) and given the current targets for carbon footprint reduction by

the UK NHS[20], this too should be a consideration for future work.

We have shown that the BEPOP programme is feasible to deliver and is sustainable at least in the medium term, with the third Wave of data collection underway. Longer-term sustainability and national impact will require longer-term investment, with further increases in the number of participating services to spread the benefit of participation as widely as possible. Ideally, participation would be seen as a standard part of good care, in the same way that participation in the NHFD is seen as a standard for UK hip fracture services. Continued engagement of key stakeholders, particularly the CSP and the BGS, will remain at the core of the programme. However, engagement of a wider range of stakeholders, including policymakers and health service commissioning bodies, will be essential to maximise the impact of the programme.

Other important steps that are underway are the development of a comprehensive communications strategy, spinoff work using the collected data to look at characteristics of individual exercise programmes that are associated with greater gains in strength, as well as exploration of contextual factors, drivers and barriers to successful service transformation. BEPOP has already highlighted the need for further educational and training resources for a wide range of staff around sarcopenia (now under development with the BGS), and the need for information on sarcopenia tailored for patients and families (under development through the NIHR Newcastle Biomedical Research Centre and AGILE). This growing package of initiatives, combined with regular cycles of service-tailored feedback and benchmarking, holds out the promise of driving further national-level improvements in the quality of resistance exercise training that older people living with sarcopenia and frailty can access. BEPOP also offers a platform for evaluating and spreading best practice for emerging therapies for these conditions and, through its communities of practice, can ensure these are effectively translated into clinical practice.

Ethics approval

BEPOP was designed as a service improvement project and does not require research ethics approval. Individual services obtain local Caldicott Guardian approval or devolved government equivalent to align with local data protection processes; data uploaded to the REDCap system are anonymised at the point of data entry by participating services.

Consent to participate

BEPOP is a service improvement programme using routinely collected anonymised data. Individual consent for use of these data was therefore not required under UK health data governance regulations.

Authors' Contributions

SH: Data collection, data analysis, first draft of paper. AC: Data collection, data analysis, first draft of paper. SA: Conception, oversight, interpretation of findings, critical revision of paper. CB: Conception, oversight, interpretation of findings, critical revision of paper. SDB: Conception, oversight, interpretation of findings, critical revision of paper. CH: Conception, oversight, interpretation of findings, critical revision of paper. RMC: Conception, oversight, interpretation of findings, critical revision of paper. AAS: Conception, oversight, interpretation of findings, critical revision of paper. DAS: Conception, oversight, interpretation of findings, critical revision of paper

MDW: Conception, oversight, interpretation of findings, critical revision of paper. All authors read and approved the final version of the manuscript.

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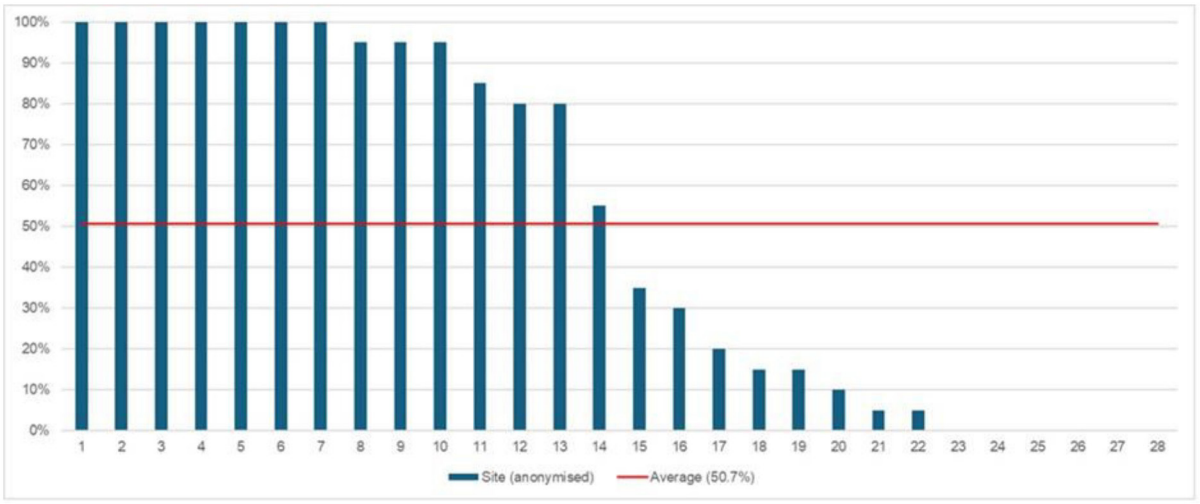
Supplementary Material

Supplementary Table 1. List of key recommendations derived after Wave one metrics and method of measurement for each metric.

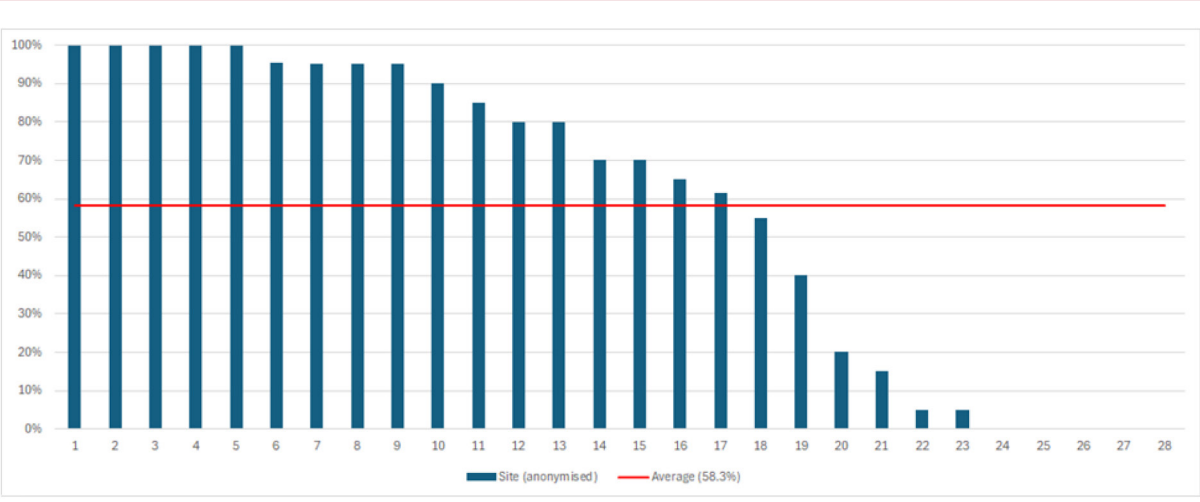
	Recommendation	Metric	Method of measurement
1	All older people referred for exercise programmes should be assessed using an **objective strength-based assessment method**, such as five times sit-to-stand test, before starting an exercise programme.	Proportion of patients from each service with complete data who were offered at least one baseline assessment	Mandatory question with pre-entered tick box option on REDCap. Handgrip, 1-rep max, 5x sit to stand or 30s sit to stand counted as objective strength-based assessments.
2	**Probable sarcopenia can be diagnosed**, as per EWGSOP guidelines and diagnostic cut-offs, using objective strength-based assessment methods (by measuring grip strength AND five times sit-to stand test). This should be clearly documented and shared with the patient's GP.	Proportion of patients from each service with complete data who had some form of sarcopenia diagnosis including exclusion of sarcopenia	Non-mandatory question with pre-set single selection options on REDCap. Data for diagnosis at point of referral and at point of discharge collected; sarcopenia or absence of sarcopenia recorded at either timepoint counted as diagnosis present.
3	**Exercise prescription: Progressive resistance exercise training** should be included in exercise prescriptions for older people living with sarcopenia (probable or confirmed) or frailty.	Proportion of patients from each service with complete data who were offered at least one form of progressive resistance exercise training	Mandatory question with pre-entered tick box option on REDCap – sites could select more than one assessment tool. Free text option for any not listed assessments. Resistance exercise training counted as offered if any of the following were offered: bodyweight, free weights, resistance bands, resistance machines, ankle/wrist weights or other resistance method where stated
4a	**Progress and Re-assess:** Resistance exercises should be **progressed by increasing intensity of exercises** (e.g. greater weight, stronger resistance bands, not just by increasing the volume of exercises.	Proportion of patients from each service with complete data who were offered at least one form of progression of their exercise intensity	Non-mandatory question with pre-entered tick box option on REDCap – sites could select more than one modality of progression. Free text option for any not listed methods of progression Intensity progression counted as: progression of 1-repetition maximum, increase in weight used or increase in resistance band strength
4b	At the end of an exercise programme, all older people should **be re-assessed using the same objective strength-based assessment** method that was used at baseline (paired outcome assessment), to assess progress and guide ongoing prescription.	Proportion of patients from each service with complete data who were re-assessed with the same objective strength-based assessment as used in recommendation 1	Mandatory question with pre-entered tick box option on REDCap – sites could select more than one assessment tool. This data was then manually reviewed by team to see if assessment used post intervention matched pre intervention assessment
5	**Take forwards**: All older people completing an exercise programme should be **offered signposting, or referral onwards to ongoing exercise services** where possible.	Proportion of patients from each service with complete data who referred onwards or signposted to other services	Non-mandatory question on REDCap with tick box to select one or both of these options. Additional free text, non-mandatory option to say why not if no answered to both

Supplementary Table 2. List of participating services.

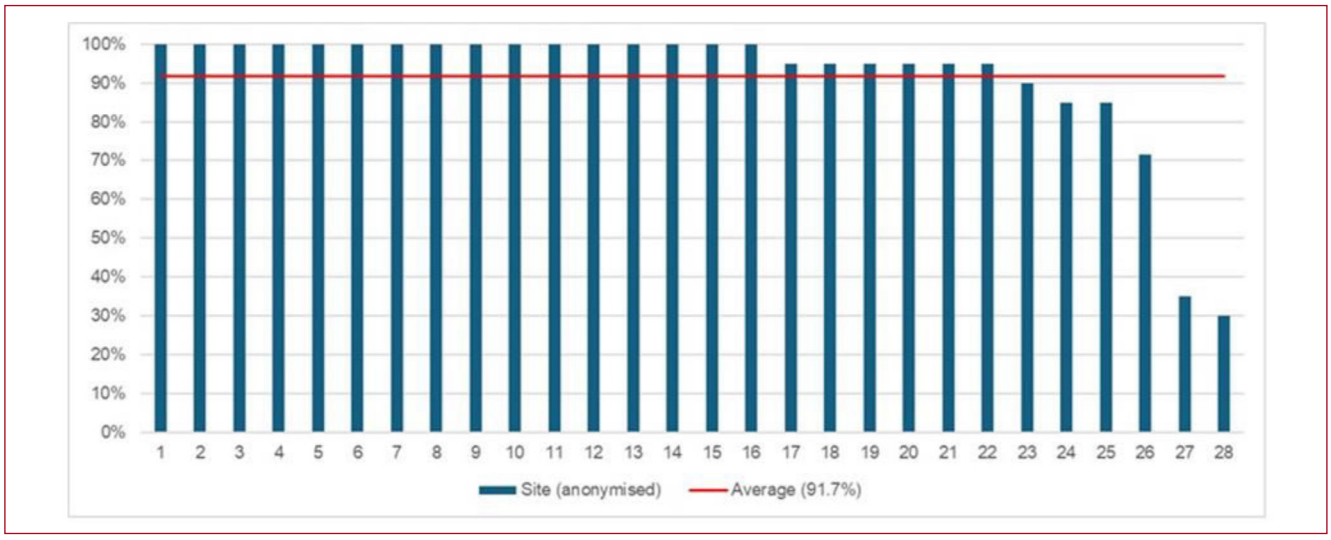
Armour Complex, Northern Health and Social Care Trust
Assessment and Rehabilitation Centre (ARC), Western General Hospital, NHS Lothian
Ballymena Health and Care Centre, Northern Health and Social Care Trust
Belsay Day Unit, Newcastle Upon Tyne Hospitals NHS Foundation Trust.
Community Therapy Team, Dorset Healthcare NHS Foundation Trust
Chandler's Ford and Eastleigh Therapy team, Hampshire and IOW Healthcare NHS Foundation Trust
Community Adult Therapy Service, Manx Care, Isle of Man
Community Physiotherapy, Moyle Hospital, Northern Health and Social Care Trust
Community Rehab and Falls Service, Guy's and St Thomas' NHS Foundation Trust
Domiciliary Physiotherapy, Newcastle Upon Tyne Hospitals NHS Foundation Trust
Community Rehabilitation Team: 1:1 Home based Sessions, East Lancashire Hospitals Trust
Community Rehabilitation Team: Strength and Balance Classes, East Lancashire Hospitals Trust
East Renfrewshire Community Rehabilitation Team, NHS Greater Glasgow and Clyde
Frailty Force, Newcastle upon Tyne Hospitals NHS Foundation Trust
Community Rehab Team, Great Western Hospital NHS Foundation trust
Intermediate Care Lambeth, Guy's and St Thomas' NHS Foundation Trust
Integrated Independence Team, Homerton Healthcare NHS Foundation Trust
Sherwood Rehabilitation Team, Sherwood Forest Hospitals NHS Trust
Whitefield Assessment and Rehabilitation Centre, NHS Fife
Community rehabilitation team, Newcastle upon Tyne Hospitals NHS Foundation Trust
Older Peoples Services - Outpatients, New Victoria Hospital, NHS Greater Glasgow and Clyde
Older Person's Assessment Unit, Guy's and St. Thomas' NHS Foundation Trust
Community Rehabilitation Team, Royal Devon University Healthcare NHS Foundation Trust
Mid and North Community Therapy, Hampshire and Isle of Wight Healthcare NHS Foundation Trust
Comprehensive Assessment Service for Older People (CASOP), University Hospitals of Derby and Burton NHS Foundation Trust
Urgent Community Response (UCR), East Lancashire Hospitals NHS Trust
Weymouth and Portland Frailty Service, Weymouth and Portland PCN
Allen Day Unit Therapy, Mersey and West Lancashire Teaching Hospitals
***Bold**: participated in wave one and wave two.*



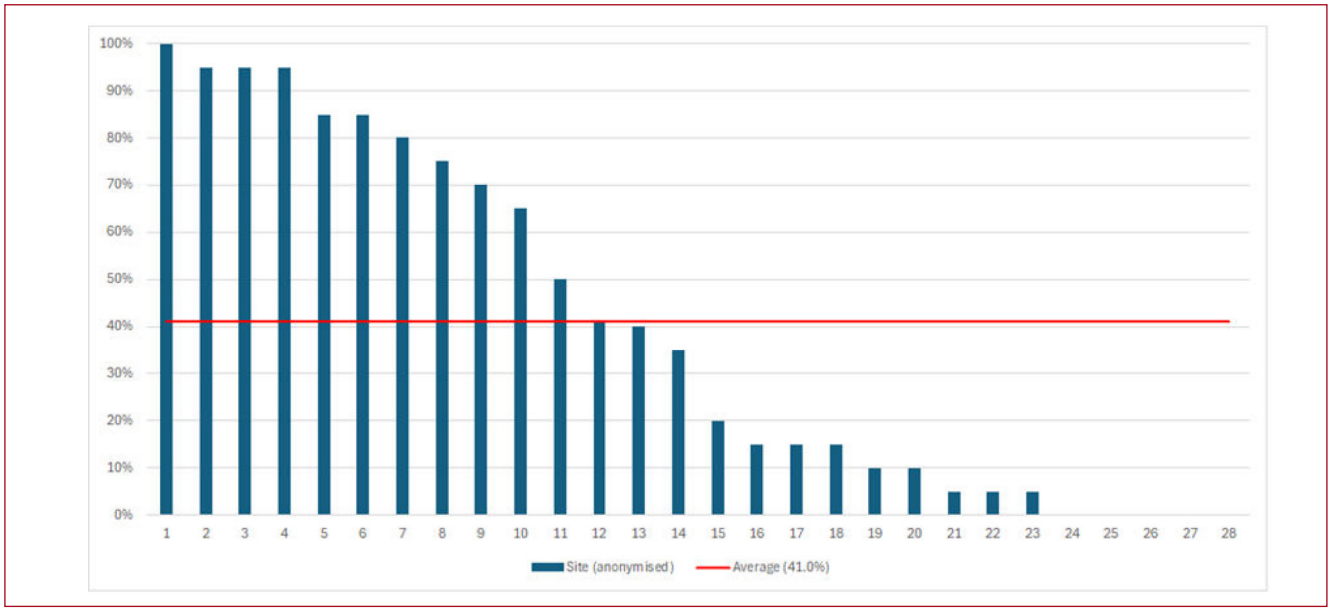
Supplementary Figure 1. Waterfall plot for recommendation 1 (assessment using an objective strength-based measure before starting the exercise programme). *Each bar represents a service; services are ordered from highest performers (left hand side) to lowest performers (right hand side).*



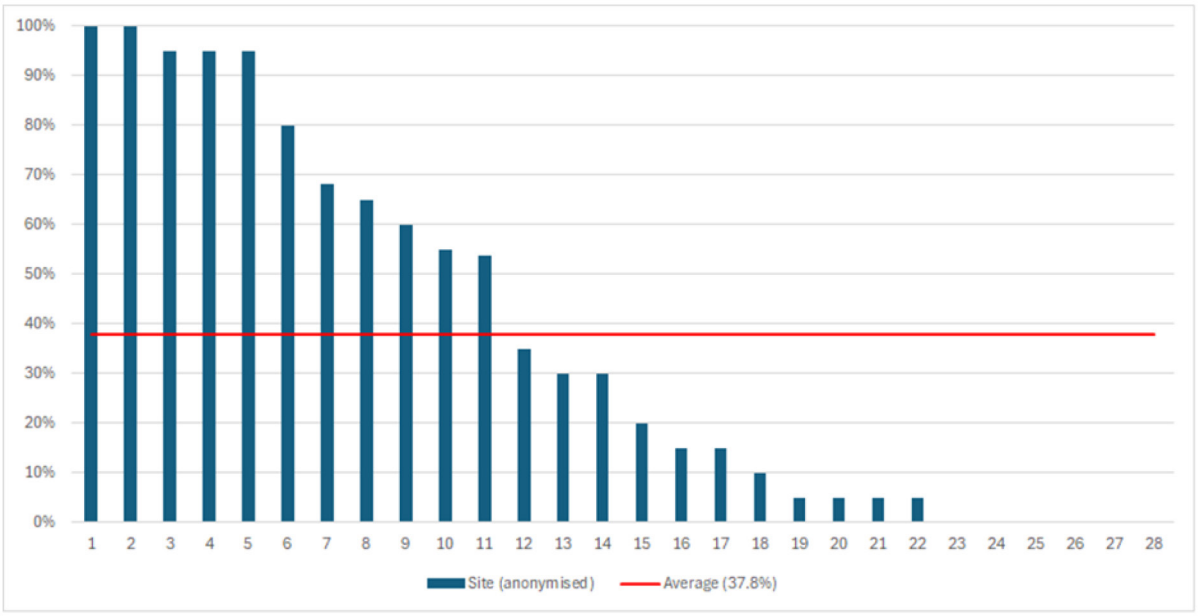
Supplementary Figure 2. Waterfall plot for recommendation 2 (to make/ exclude a diagnosis of probable sarcopenia). *Each bar represents a service; services are ordered from highest performers (left hand side) to lowest performers (right hand side).*



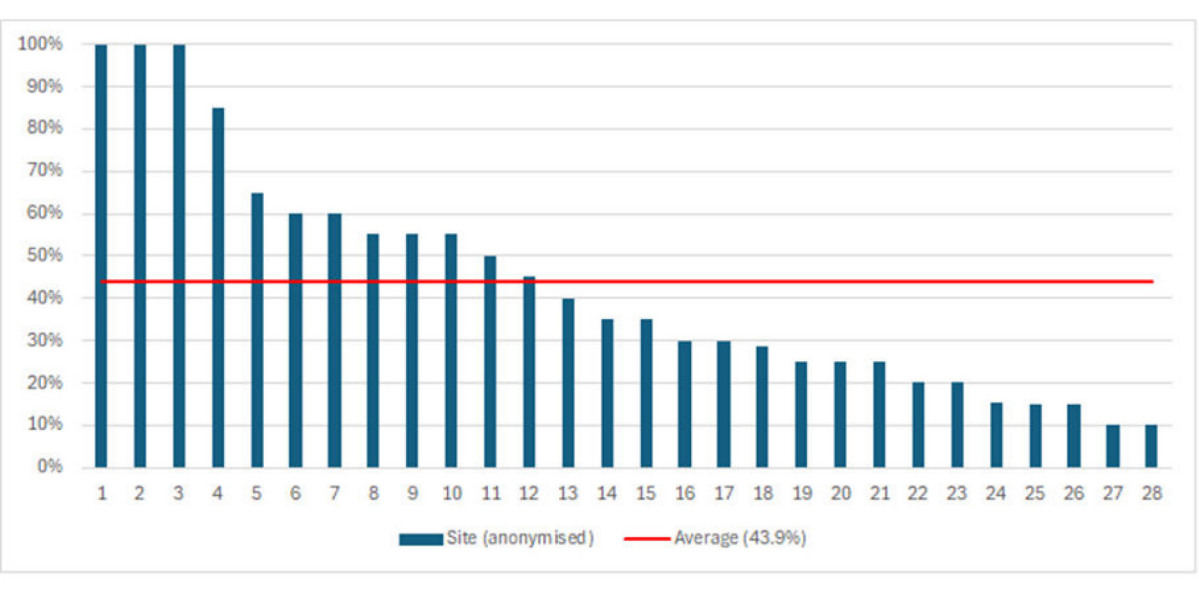
Supplementary Figure 3. Waterfall plot for recommendation 3 (exercise prescription containing progressive resistance exercise training). *Each bar represents a service; services are ordered from highest performers (left hand side) to lowest performers (right hand side).*



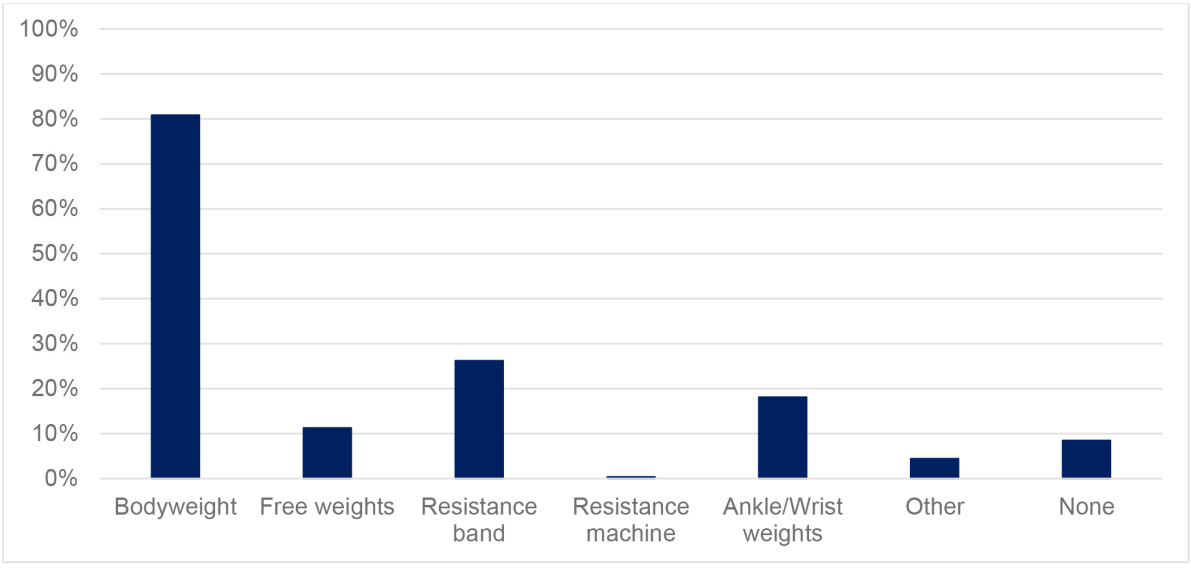
Supplementary Figure 4. Waterfall plots for recommendation 4a (progression of exercises by intensity). *Each bar represents a service; services are ordered from highest performers (left hand side) to lowest performers (right hand side).*



Supplementary Figure 5. Waterfall plot for recommendation 4b (re-assessment at the end of the programme using the same objective strength-based assessment). *Each bar represents a service; services are ordered from highest performers (left hand side) to lowest performers (right hand side).*



Supplementary Figure 6. Waterfall plot for recommendation 5 (at the end of the programme there should be signposting or onwards referral to another exercise service). *Each bar represents a service; services are ordered from highest performers (left hand side) to lowest performers (right hand side).*



Note that some sites used more than one modality so totals are greater than 100%

Supplementary Figure 7. Type of resistance exercise training offered in wave 2.