Use of the nominal group technique to identify UK stakeholder views of the measures and domains used in the assessment of therapeutic exercise adherence for patients with musculoskeletal disorders

MALLETT, Ross <http://orcid.org/0000-0001-8486-4452>, MCLEAN, Sionnadh <http://orcid.org/0000-0002-9307-8565>, HOLDEN, Melanie A., POTIA, Tanzila, GEE, Melanie <http://orcid.org/0000-0001-9149-4314> and HAYWOOD, Kirstie

Available from Sheffield Hallam University Research Archive (SHURA) at:
http://shura.shu.ac.uk/25861/

---

This document is the author deposited version. You are advised to consult the publisher's version if you wish to cite from it.

Published version


---

Copyright and re-use policy

See http://shura.shu.ac.uk/information.html
ABSTRACT

Objectives The objective was to undertake nominal group technique (NGT) to determine current exercise adherence measures and isolated domains to develop stakeholder consensus on the domains to include in the measurement of therapeutic exercise adherence for patients with musculoskeletal disorders.

Design A 1-day NGT workshop was convened. Six exercise adherence measures were presented to the group that were identified in our recent systematic review. Discussions considered these measures and isolated domains of exercise adherence. Following discussions, consensus voting identified stakeholder agreement on the suitability of the six offered adherence measures and the inclusion of isolated domains of exercise adherence in future measurement.

Setting One stakeholder NGT workshop held in Sheffield, UK.

Participants Key stakeholders from the UK were invited to participate from four identified populations. 14 participants represented patients, clinicians, researchers and service managers.

Results All six exercise adherence measures were deemed not appropriate for use in clinical research or routine practice with no measure reaching 70% group agreement for suitability, relevance, acceptability or appropriateness. Three measures were deemed feasible to use in clinical practice. 25 constructs of exercise adherence did reach consensus threshold and were supported to be included as domains in the future measurement of exercise adherence.

Conclusion A mixed UK-based stakeholder group felt these six measures of exercise adherence were unacceptable. Differences in opinion within the stakeholder group highlighted the lack of consensus as to what should be measured, the type of assessment that is required and whose perspective should be sought when assessing exercise adherence. Previously unused domains may be needed alongside current ones, from both a clinician’s and patient’s perspective, to gain understanding and to inform future measurement development. Further conceptualisation of exercise adherence is required from similar mixed stakeholder groups in various socioeconomic and cultural populations.

INTRODUCTION

Within the UK population, the prevalence of musculoskeletal disorders (MSDs) is estimated to be 38%. Prevalence increases markedly with age and is likely to continue to rise due to the ageing population and increasingly sedentary lifestyles. MSDs cause more functional limitations than any other group of disorders within the adult population and lead to vast healthcare expenditure and loss of work. Therapeutic exercise is commonly
recommended for the management of MSDs and may include strength and conditioning, aerobic exercise and functional activities. Adherence to therapeutic treatment, defined as ‘the extent to which a person’s behaviour corresponds with agreed recommendations from a healthcare provider’, has been shown to enhance the effectiveness of exercise programmes and to impede recurrent, persistent or disabling conditions. Conversely, non-adherence may be a missed opportunity for therapeutic benefit and may negatively affect treatment duration, the therapeutic relationship, waiting times, cost of care and may be responsible for non-significant research outcomes.

Systematic reviews consistently show the beneficial effects of different types of exercise on key clinical outcomes, such as pain, physical function and quality of life, leading to clinical guidelines that advocate the use of exercise programmes to manage MSDs. Despite its importance, adherence to clinic-based exercise protocols is approximately 50% and is often lower for unsupervised home exercise programmes. Interventions exist that may potentially improve exercise adherence for MSDs. Although supportive evidence exists for the use of therapeutic exercise across many MSD conditions, no gold standard measure of exercise adherence currently exists with many measures being un reproducible or exhibiting limited evidence of essential measurement and practical properties.

Our own recent systematic review identified 238 different measures of exercise adherence in musculoskeletal settings. Of these, only six measures (Sports Injury Rehabilitation Adherence Scale (SIRAS), Rehabilitation Adherence Questionnaire (modified), Adherence to Exercise Scale for Older Patients, Hopkins Rehabilitation Engagement Rating Scale (HRERS), Community Healthy Activities Model Programme for Seniors and Pittsburgh Rehabilitation Participation Scale (PRPS)) had been evaluated, by 11 studies, for the specific purpose of measuring exercise adherence. The review concluded that there was inadequate evidence of theoretical, measurement or practical properties for any of the measures. The absence of evidence does not preclude the use of these measures, and further evaluation may still indicate that they are suitable measures of exercise adherence. Consequently, the primary aim of this study was to use the NGT with a mixed stakeholder group to discuss and rank the six measures of exercise adherence to reach consensus on their suitability for use in a variety of settings. A secondary aim was to reach a similar consensus by discussing and ranking which domains of exercise adherence should be included in future measures.

METHODS

A 1-day workshop brought together key stakeholders to discuss how adherence to therapeutic exercise for MSD should be assessed, specifically, the suitability of six exercise measures for use in research and clinical practice settings (study protocol available). Therapeutic exercise was defined as ‘the systematic performance or execution of planned physical movements, postures, or activities intended to enable the patients to remediate or prevent impairments, enhance function, reduce risk, optimise overall health, and enhance fitness and well-being’.

Nominal group technique (NGT) has been used to derive consensus by collating and ranking stakeholder views through its structured anonymous approach within face-to-face group meetings. The flexible methodology provides predetermined stages to develop participants’ responses, therefore quickly representing a mixed group on complex issues by prioritising their perspectives. A modified NGT was employed to reach stakeholder consensus regarding two questions: 1. How suitable are the six candidate measures of exercise adherence with respect to Relevance (to their individual perspective)? Feasibility (for use in research and/or clinical practice settings)? Acceptability (to patients who are required to adhere to exercise regimes)? Appropriateness (to the musculoskeletal population)?

2. Which domains should be included in future measures of exercise adherence?

Using existing professional networks, the study targeted four key stakeholder groups (patients, clinicians, researchers and service managers) within the UK. A formal electronic invitation to participate in the NGT workshop was sent to potential participants with in all groups. The email included an information sheet detailing the study goals and research questions and offered the opportunity to ask questions about the study. Those who were willing and able to attend the workshop signed and returned a consent form. Prior to attending, participants received a further information pack summarising the results of our previous systematic review, a questionnaire, a copy of the six candidate measures and a list of the exercise adherence domains contained within these measures. The domains were extracted from the candidate measures by one author (RM) and peer reviewed by a second (SM). The questionnaire asked participants to rate each of the six candidate measures of exercise adherence for use in research/clinical practice and the relative importance of including each domain of exercise adherence contained. Respondents were also asked to add comments and to rate any additional domains that they felt were important but missing. Completed questionnaires were returned in advance of the workshop to inform the structure of the discussions (results not reported).

The 5-hour workshop was held in one room within a university environment in Sheffield, UK. First, an overview of the systematic review and a summary of the findings of the postal questionnaires were provided. Participants were assigned to two discussion groups: lay representatives (n=6) and all other participants (n=8). Members of the research team (SM, RM, MAH and KH) facilitated the group discussions. Two rounds of discussion focused
first on the candidate six measures then second on the iso
dated domains of exercise adherence. Throughout
this second round, an iterative process was employed
during discussions to reword suggested domains until
agreement from the wider group was reached that the
domain warranted consensus voting. Each round was
concluded by a group spokesperson summarising their
dialogue to all stakeholders, then finally a plenary semi-
structured session was held before undertaking the final
consensus voting.

Each round of voting asked one question that required
a dichotomous yes/no response for the measure or
domain being considered. All questions were manda-
tory. The voting was conducted anonymously and digi-
tally on hand-held tablet devices using Google Forms
to request and record responses in real time. Following
the first round of discussion regarding the candidate
six measures participants were asked, ‘Are the follow-
ing measures (1) relevant, (2) feasible, (3) acceptable, (4)
appropriate or (5) overall suitable when assessing adher-
ence to therapeutic exercise programmes?’ Following
the second round of domain discussion, the question
posed was ‘Should the following adherence domain be
included in future measures of exercise adherence?’ For
all, voting a response was required for using the measure
domain in clinical trials and routine clinical practice.
A final summary session was convened and the results of
voting were fed-back to participants. The Standards for
Reporting Qualitative Research checklist was used when
writing this report.37

Patient and public involvement
This research was developed and conducted in line with
the INVOLVE framework.38 The proposed aims, design
and methods of this research proposal were informed by
discussion with the Barnsley Consumer Research Advi-
sory Group (CRAG) and the Allied Health Professionals
special interest groups of the South Yorkshire Collabora-
tive Local Research Network. Both groups agreed that the
project would be valuable considering the scale of non-
adherence to exercise for MSDs within physiotherapy
practice. Several recommendations from the Barnsley
CRAG group shaped the development and conduct of
the project to facilitate the involvement of patient
participants.

Data analysis
Voting responses were captured by Google Forms and
automatically populated into electronic spreadsheets.
Data were analysed separately for each required response
using Microsoft Excel V.16. The data were ranked in
percentage agreement of ‘yes’ responses for all partici-
pants for each required response regarding the measure
or domain. Consensus was defined as 70% participant
agreement level in keeping with criterion for consensus
recommendations.39 40

RESULTS
Fourteen participants consented to participate in the
workshop, including lay representatives with experience
of receiving exercise for an MSDr (n=6), clinicians
who use therapeutic exercise for treating MSDs (n=3),
researchers with expertise of exercise adherence or
measurement (n=2) and service managers with account-
ability for musculoskeletal outpatient departments (n=3).
All participants completed and returned the postal
questionnaire, attended the consensus workshop and
completed electronic consensus voting.

NGT: candidate exercise adherence measures
Three measures were deemed feasible to use with a
consensus of greater than 70% being reached for
completion of the SIRAS, HRERS and PRPS in routine
clinical practice but not clinical trials. No other measure
reached the consensus threshold for any other prop-
erty of suitability (table 1). The results demonstrate that
stakeholders almost unanimously agree that all measures
lack the essential qualities of relevance, acceptability and
appropriateness for application in all settings, and conse-
quently, no measure is suitable for use in routine practice
or clinical trials.

NGT: domains of exercise adherence
Nineteen exercise adherence domains were recognised
and extracted from the six candidate measures and
presented to the group alongside a further six proposed
domains from the questionnaire. Following group discus-
sion and domain development, four additional domains
of exercise adherence that had not previously been used
in existing measures were included alongside the existing
19 for consensus voting. Interpretation of the 23 domains
highlighted two distinct categories of adherence domain:
those which quantify the amount of exercise adherence
and those which explored factors that influence exer-
cise adherence and allowed some understanding of
the patient experience. The second consensus vote was
conducted using the distinguishing terms ‘quantifying’
and ‘influencing’ domains as judged by the research team
for clarity.

Twelve of the 16 quantifying domains reached 70% or
more consensus agreement (table 2), suggesting they
should be included in the assessment of exercise adher-
ence. Two were unanimously voted as important by all
participants: the patient’s perspective of both the amount
and frequency of exercise completed and the accuracy of
exercise completion. Stakeholders agreed that seeking
perspective of calorie expenditure of a given exercise
should not be included in the future measurement of
exercise adherence. Thirteen of 30 influencing domains
reached 70% or more consensus agreement (table 2),
suggesting they should be included in the assessment
of exercise adherence. Three were unanimously agreed
as important: the patient’s perception of their ability
to complete exercise despite other commitments, their
**Table 1** Vote 1: result of nominal group technique stakeholder group consensus of six candidate measures’ suitability for the assessment of exercise adherence

<table>
<thead>
<tr>
<th>Measure of exercise adherence</th>
<th>Relevance Yes (%)</th>
<th>Feasibility Yes (%)</th>
<th>Acceptability Yes (%)</th>
<th>Appropriateness Yes (%)</th>
<th>Overall suitability Yes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRERS in routine practice</td>
<td>7.1</td>
<td>85.7</td>
<td>7.1</td>
<td>7.1</td>
<td>14.3</td>
</tr>
<tr>
<td>HRERS in clinical trials</td>
<td>7.1</td>
<td>64.3</td>
<td>7.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>PRPS in routine practice</td>
<td>14.3</td>
<td>85.7</td>
<td>0.0</td>
<td>14.3</td>
<td>14.3</td>
</tr>
<tr>
<td>PRPS in clinical trials</td>
<td>7.1</td>
<td>50.0</td>
<td>7.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>RAQIS in clinical trials</td>
<td>14.3</td>
<td>21.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>SIRAS in routine practice</td>
<td>14.3</td>
<td>85.7</td>
<td>7.1</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td>SIRAS in clinical trials</td>
<td>7.1</td>
<td>64.3</td>
<td>14.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>AESOP in routine practice</td>
<td>0.0</td>
<td>7.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>AESOP in clinical trials</td>
<td>0.0</td>
<td>14.3</td>
<td>7.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>CHAMPS in routine practice</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>CHAMPS in clinical trials</td>
<td>0.0</td>
<td>21.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>RAQ in routine practice</td>
<td>7.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>RAQ in clinical trials</td>
<td>14.3</td>
<td>21.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

AESOP, Adherence to Exercise Scale for Older Patients; CHAMPS, Community Healthy Activities Model Programme for Seniors; HRERS, Hopkins Rehabilitation Engagement Rating Scale; PRPS, Pittsburgh Rehabilitation Participation Scale; RAQ, Rehabilitation Adherence Questionnaire (modified); SIRAS, Sports Injury Rehabilitation Adherence Scale.

understanding of the benefits of exercise and self-motivation of the patient during exercise.

**DISCUSSION**

As far as we are aware, this study describes the first consensus-based stakeholder evaluation of exercise adherence measurement for patients with musculoskeletal conditions. In the current study, multiple stakeholders, including patients, health professionals, researchers and service managers agreed that the six identified measures of exercise adherence were not suitable for use in routine practice or clinical trials due to their lack of relevance, acceptability and appropriateness. This is consistent with the findings of poor conceptual underpinnings in our and other earlier systematic reviews, which concluded that the evaluated exercise adherence measures in these reviews are of poor quality and are not fit for purpose. These reviews investigated exercise adherence measures for different purposes or environments and, coupled with our work, highlight the overall poor quality of these exercise adherence measures for all contexts and provide critical insight into the many failings of published measures of exercise adherence. However, we are aware that since this study was conducted, the Exercise Adherence Rating Scale (EARS) has been developed and preliminary testing of face and construct validity, internal consistency and reliability suggest that it is a promising new measure of exercise adherence in patients with MSK disorders. There remains a pressing need to prioritise further development of good quality measures that capture adherence to therapeutic exercise. Stakeholders agreed that 25 of the 46 domains considered could make an important contribution to the measurement of exercise adherence. These domains sought to both quantify adherence to exercise (eg, the amount, frequency and accuracy of completed exercise) and to gain insight into the factors that influence adherence (eg, the patient’s ability to complete exercise despite other commitments). This perspective is also supported by the recent research related to the development of the EARS.

Earlier qualitative work has highlighted differences in outcomes considered important by patients/carers versus health professionals, and therefore a strength of this study was the inclusion of multiple stakeholders to provide different perspectives on adherence measures, the constituents of exercise adherence and how they should be assessed. The involvement of patients in the research process as research partners is increasingly viewed as enhancing the development and evaluation of relevant and acceptable patient-centred outcome assessment. The variation in perspectives found in this study indicates the requirement for multiple stakeholder involvement in the future development of adherence measures which are suitable for use in research and clinical practice. An additional strength of the study was that measures and measurement domains considered by the stakeholder group were derived from a large rigorous systematic review ensuring that at the time the most contemporary material has been presented for evaluation. It is recognised omissions exist as recently published work could not be included, although stakeholder proposed domains were added. The number of consensus...
### Table 2: Vote 2: ranked results of nominal group technique stakeholder group consensus of the inclusion of ‘quantifying’ and ‘influencing’ domains in the assessment of exercise adherence

#### Should the following quantifying domain be included in the future measurement of exercise adherence?

<table>
<thead>
<tr>
<th>Domain</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The amount and frequency of completed exercise (patient's perspective)</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Accuracy of exercise completion (patient's perspective)*</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>The extent to which the patient follows a clinician's instructions (patient's perspective)</td>
<td>92.9</td>
<td>7.1</td>
</tr>
<tr>
<td>Attendance at rehabilitation sessions (clinician's perspective):</td>
<td>92.9</td>
<td>7.1</td>
</tr>
<tr>
<td>The extent to which the exercise works towards an agreed goal (patient's perspective)*</td>
<td>92.9</td>
<td>7.1</td>
</tr>
<tr>
<td>Accuracy of exercise completion (clinician's perspective)*</td>
<td>92.9</td>
<td>7.1</td>
</tr>
<tr>
<td>The amount and frequency of completed exercise (clinician's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The extent to which the patient follows a clinician's instructions (clinician's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Attendance at rehabilitation sessions (patient's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The extent to which the patient actively participates in exercise (patient's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The extent to which the exercise works towards an agreed goal (clinician's perspective)*</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The signs of physical or mental demands during exercise (patient's perspective)</td>
<td>57.1</td>
<td>42.9</td>
</tr>
<tr>
<td>The signs of physical or mental demands during exercise (clinician's perspective)</td>
<td>42.9</td>
<td>57.1</td>
</tr>
<tr>
<td>Calorie expenditure of a given exercise (patient's perspective)</td>
<td>14.3</td>
<td>85.7</td>
</tr>
<tr>
<td>Calorie expenditure of a given exercise (clinician's perspective)</td>
<td>0.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

#### Should the following influencing domain be included in the future measurement of exercise adherence?

<table>
<thead>
<tr>
<th>Domain</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The patient's ability to complete exercise despite other commitments (patient's perspective)*</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>The patient's understanding of the benefits of exercise (patient's perspective)</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Patient/clinician agreement of exercise recommendations (patient's perspective)</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Self-motivation of the patient during exercise (patient's perspective)</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>The patient's ability to complete exercise, although it is challenging (patient's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The patient's understanding of the benefits of exercise (clinician's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The patient's attitude toward exercise (patient's perspective)</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Patient/clinician agreement of exercise recommendations (clinician's perspective)*</td>
<td>85.7</td>
<td>14.3</td>
</tr>
<tr>
<td>The level of patient support received from family and friends (patient's perspective)</td>
<td>78.6</td>
<td>21.4</td>
</tr>
<tr>
<td>The patient's ability to complete exercise despite other commitments (clinician's perspective)</td>
<td>78.6</td>
<td>21.4</td>
</tr>
<tr>
<td>The patient's ability to complete exercise although it is challenging (clinician's perspective)</td>
<td>78.6</td>
<td>21.4</td>
</tr>
<tr>
<td>The patient's attitude toward exercise (clinician's perspective)</td>
<td>71.4</td>
<td>28.6</td>
</tr>
<tr>
<td>The relationship between clinician and patient (patient's perspective)*</td>
<td>71.4</td>
<td>28.6</td>
</tr>
<tr>
<td>The patient's pain tolerance during exercise (patient's perspective)</td>
<td>64.3</td>
<td>35.7</td>
</tr>
<tr>
<td>Self-motivation of the patient during exercise (clinician's perspective)</td>
<td>64.3</td>
<td>35.7</td>
</tr>
<tr>
<td>The relationship between clinician and patient (clinician's perspective)*</td>
<td>64.3</td>
<td>35.7</td>
</tr>
<tr>
<td>The patient's pain tolerance during exercise (clinician's Perspective)</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>The patient’s receptiveness to change in a therapeutic exercise programme (patient's perspective)</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>The extent to which the patient completes exercise without encouragement (clinician's perspective)</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>The patient’s ability to resume exercise following a forced break (patient's perspective)</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>The patient’s receptiveness to change in a therapeutic exercise programme (clinician's p)</td>
<td>42.9</td>
<td>57.1</td>
</tr>
<tr>
<td>The patient’s enjoyment of exercise (patient's perspective)</td>
<td>42.9</td>
<td>57.1</td>
</tr>
<tr>
<td>The patient’s ability to resume exercise following a forced break (clinician’s perspective)</td>
<td>42.9</td>
<td>57.1</td>
</tr>
<tr>
<td>The level of patient support received from family and friends (clinician's perspective)</td>
<td>35.7</td>
<td>64.3</td>
</tr>
<tr>
<td>The extent to which the patient completes exercise without encouragement (patient’s perspective)</td>
<td>35.7</td>
<td>64.3</td>
</tr>
<tr>
<td>The amount of prompting required to complete an exercise correctly (clinician's perspective)</td>
<td>21.4</td>
<td>78.6</td>
</tr>
</tbody>
</table>

Continued
group participants is a possible limitation, although agreement about what constitutes an optimum group size could not be found. Guidance on the appropriate mix of participants in a consensus workshop also does not exist; therefore, in line with advice received from our patient and public involvement group, the target sample was weighted to reflect the experiences and perspectives of patients. The group was UK based, which may limit the generalisability of our findings to other settings. Understanding an international stakeholder’s perspective of the components of exercise adherence is imperative if future measures are to be developed with global and cultural validity. It is also possible that the patient stakeholders who participated in this study might be considered adherent and therefore may not fully represent the views of non-adherent populations. Seeking the views of a non-adherent population would be ideal, although difficult to capture.

Further analysis of isolated voting patterns show simple quantification of exercise completion was viewed as important by all stakeholders but as insufficient by both physiotherapists and patient stakeholders. However, this view was not shared by researchers who indicated that simple quantification of adherence was the priority. The modified NGT was robust with workshop discussions not only reflecting domain development and voting patterns but also adding understanding throughout. Patient representatives alone would have reached consensus on 15 influencing domains as opposed to 10 by healthcare professionals indicating their belief of importance in understanding factors affecting adherence. This variance in perspectives points towards potential differences in the way that adherence instruments may be used within research and clinical practice. In clinical practice, understanding patient non-adherence and exploration of factors related to that non-adherence may inform a physiotherapist’s reasoning and future management strategy to optimise therapeutic outcomes.

This study has identified that these six measures of adherence with therapeutic exercise lack validity, reliability and acceptability to clinicians, managers, patients and researchers and have to date been poorly conceptualised. There is a need for valid and reliable exercise adherence measures which are suitable and acceptable for use with musculoskeletal populations in both clinical and research settings. These findings do not provide definitive domains for a new measure of exercise adherence, but they can form a foundation that may be evaluated alongside recent work by multiple stakeholders in international and varied socioeconomic settings in the future. It is evident that stakeholders were in unanimous agreement that to be acceptable, any measure should look at psychological and social determinants of adherence, not simple quantification of adherence. These contextual factors included cognitive factors (eg, the patient’s understanding of the benefits of exercise and patient/clinician agreement of exercise recommendation), psychological factors (eg, self-motivation of the patient during exercise) and social factors (eg, the patient’s ability to complete exercise despite other commitments and the level of patient support received from friends and family). This raises the prospect of an adherence profile which might consist of scales that (1) quantify adherence with therapeutic exercise and (2) measure important determinants of exercise adherence.

There is a significant shortfall between the way exercise adherence is currently assessed when compared against the emerging biopsychosocial conceptual framework described here. This study has confirmed the complex nature of exercise adherence; it is a construct with both observable and non-observable components. Consensus suggests that it can, and should, be understood from the perspective of several key stakeholders; the clinician, the researcher and the patient. However, adherence to exercise has not been clearly defined from the perspective of any of these stakeholders, and hence the conceptual underpinning which provides an essential framework for measurement is not available. The first step in the development of any future measure of adherence must be to establish or adapt recognised conceptual models and theoretical frameworks to the related domains within the concept of exercise adherence for MSDs. Development of the conceptual model and framework will be required to address a wide range of issues, including the multifaceted nature of adherence, the focus of the measure (eg, evaluation, categorisation and prognostication) and issues of cross-cultural validity if the measure were to be applied across international settings. A patient-centred collaborative approach towards developing a measure of exercise adherence is essential to enable the true burden of exercise adherence to be described and the relative success of healthcare which seeks to prescribe exercise to be comprehensively understood.

### Table 2

<table>
<thead>
<tr>
<th>Should the following influencing domain be included in the future measurement of exercise adherence?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The suitability of the exercise environment for the patient’s needs (patient’s perspective)</td>
</tr>
<tr>
<td>21.4 78.6</td>
</tr>
<tr>
<td>The patient’s enjoyment of exercise (clinician’s perspective)</td>
</tr>
<tr>
<td>21.4 78.6</td>
</tr>
<tr>
<td>The amount of prompting required to complete an exercise correctly (patient’s perspective)</td>
</tr>
<tr>
<td>14.3 85.7</td>
</tr>
<tr>
<td>The suitability of the exercise environment for the patient’s needs (clinician’s perspective)</td>
</tr>
<tr>
<td>14.3 85.7</td>
</tr>
</tbody>
</table>

Domains achieving the consensus threshold level of 70%+ are denoted in bold.

*Group developed domains.*
CONCLUSION
At the time of undertaking, six measures of exercise adherence were available for incorporation within this study. Participants in the first UK-based patient-centred and NGT workshop unanimously rejected all six measures due to a perceived lack of suitability for routine practice or clinical trials. Exercise adherence must be clearly conceptualised to facilitate appropriate and robust assessment. Stakeholders in this study agreed on 25 domains of exercise adherence as a possible foundation for further research to develop a measure of adherence with therapeutic exercise. These domains indicate the possible requirement of an adherence profile which (1) quantifies adherence with therapeutic exercise and (2) measures important determinants of exercise adherence. Multiple stakeholders will need to take a patient-centred collaborative approach to develop any measure of exercise adherence that is of high quality, relevant and appropriate for universal use in routine clinical practice and/or clinical trials.

Author affiliations
1 College of Health, Wellbeing and Life Sciences, Sheffield Hallam University, Sheffield, UK
2 Primary Care Centre Versus Arthritis, Keele University, Keele, UK
3 Centre for Health and Social Care Research, Sheffield Hallam University, Sheffield, UK
4 Warwick Research in Nursing, University of Warwick, Coventry, UK

Contributors MAH, KH, TP, MG and SM were responsible for the study conception and protocol manuscript. Study logistics and recruitment were completed by RM and RM. Data collection was facilitated by RM SM, MAH and KH with analysis by RM SM. All authors contributed to data interpretation. Drafting of the manuscript was undertaken by RM with all authors providing contributions and critical revisions to reach a final version.

Funding This work was supported by a grant from the Chartered Society of Physiotherapy Charitable Trust (grant number PRF 12/13).

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethics approval was gained from the Sheffield Hallam Health and Wellbeing Faculty Research Ethics Committee.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data are available upon reasonable request for identified participant data from https://orcid.org/0000-0001-8486-4452. No additional information available.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is permitted others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is not non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iD
Ross Mallett http://orcid.org/0000-0001-8486-4452

REFERENCES
29 Bollen JC, Dean SG, Siegert RJ, et al. A systematic review of measures of self-reported adherence to unsupervised home-


38 INVOLVE N. Public involvement in research: values and principles framework 2015.


