1   **Comprehension and face validity of the Exercise Adherence Rating Scale in patients**

2   **with persistent musculoskeletal pain**

3   **Keywords:** persistent pain, exercise, adherence, musculoskeletal, physiotherapy,

4   questionnaire, measurement

5   **Introduction**

6   Active treatments, such as prescribed exercise, tend to be effective in reducing pain and

7   increasing function for common persistent musculoskeletal (PMSK) pain conditions, such as

8   low back pain or osteoarthritis (Geneen et al., 2017). However, the majority of people do not

9   adhere to their prescribed exercise, and therefore may not experience their intended benefits

10   (Jordan, Holden, Mason, & Foster, 2010). Research into exercise adherence is minimal,

11   largely due to the lack of standardised measurement methods (Beinart, Goodchild, Weinman,

12   Ayis, & Godfrey, 2013; Geneen et al., 2017). This results in a deficiency of homogeneous

13   data to allow for comparison and formulation of treatment standards. The Exercise

14   Adherence Rating Scale (EARS) was developed as the first standardised, validated measure

15   of exercise adherence to prescribed home exercise (Newman-Beinart et al., 2017) and is

16   currently being translated to nine other languages.

17   The EARS is a brief, self-report measure comprised of three sections; section A

18   requires participants to document their exercise prescription given by their healthcare

19   provider, section B is a 6-item measure of adherence and section C is a 10-item measure of

20   factors that influences (helps or hinders) exercise adherence. Construct validity was

21   confirmed through exploratory categorial data factor analysis on section B of the

22   questionnaire (Newman-Beinart et al., 2017). When explored in a population with persistent

23   low back pain, all items loaded strongly on one factor and the test-retest reliability was high.

24 However, the interpretation and comprehensibility of the EARS has not been measured in a

25 wider musculoskeletal pain population.

26   The aim of the current study was to assess the face validity and comprehensibility of

27 the EARS. To achieve this, the cognitive interviewing technique 'think aloud' was employed

28 as it provides a means of obtaining an empirical exploration of cognitive processes while

29 performing a task (Green & Gilhooly, 1996). This allows potential issues in the interpretation

30 and comprehension of the EARS to be explored. It has been used in a variety of contexts to

31 test questionnaire comprehension, such as the Theory of Planned Behaviour Questionnaire

32 (Darker & French, 2009), Brief Illness Perception Questionnaire (van Oort, Schröder, &

33 French, 2011) and habit measures (Gardner & Tang, 2014).

34 **Methods**

35 *Participants*

36 Following previous research employing the 'think aloud' protocol (Darker & French, 2009;

37 Gardner & Tang, 2014) a sample of 20 participants was deemed appropriate to capture rich,

38 heterogenous data for analysis. Participants were recruited via poster on a UK university

39 campus and an outpatient physiotherapy department. Screening questions were used to

40 determine eligibility and participants were invited to attend a face to face appointment with

41 the researcher. Individuals were eligible if they reported to have been diagnosed by a

42 registered healthcare professional with PMSK pain and had been prescribed exercise as

43 treatment. Individuals who could not fluently read or speak English were ineligible for the

44 study.

45   *Procedure*

46   Ethical approval was acquired through a local university Institutional Review Board, the

47   national research ethics committee and research governance approval from relevant National

48   Health Service Foundation Trusts.

49   Prior to completing the questionnaire, written informed consent was obtained, and the

50   participants were read instructions adapted by the original protocol by Green & Gilhooly

51   (1996). Participants were not asked to explain the reasons for their thoughts or responses, but

52   to simply vocalise all thoughts that are normally silent while completing a questionnaire (full

53   instructions available on request). Participants first practised the technique using a few

54   unrelated questions before being given section B and C of the EARS and the audio recording

55   commenced. Data was transcribed verbatim.

56   *Analysis*

57   A thematic analysis appraoch was applied (Braun & Clarke, 2008). This process focuses on

58   establishing themes in transcribed data, in this case, problems encountered with

59   understanding and interpreting the questionnaire. The initial validation study (Newman-

60   Beinart et al., 2017) analysed sections B and C of the scale separately, therefore the face

61   validity was assessed similarly. The first six items measuring adherence behaviours (section

62   B) were coded while the subsequent 10 questions pertaining to what influenced exercise

63   adherence (section C) were assessed and coded together. Each verbal response was identified

64   as a segment, generating 120 segments for the first questionnaire (6 items x 20 participants)

65   and 200 (10 items x 20 participants) for the second.

Results

Twenty participants (range 19-65 years, *M*=34.6, *SD*=13.9, 70% female) provided written

informed consent and were enrolled onto the study. Participants were diagnosed with

persistent low back pain (7), fibromyalgia, (4), knee pain (4), hip pain (3) and osteoarthritis

(2). The mean duration to complete section A and B was 5.97 minutes.

45% of the participants reported no issues with the 6-item adherence scale (section B)

and 80% of the participants did not experience any issues with the 10-item help or hinder

scale (section C). Issues were reported in 6% of responses; 20 issues out of a total of 320

segments, were identified. 16 issues in section B and four in section C. Two themes were

identified in the data: interpretation difficulties (1.1 confusion between physical activity (PA)

and prescribed exercise, 1.2 spontaneous inference) and comprehension difficulties.

Interpretation difficulty

This theme described issues in interpretation, including deviations from original intended

meaning of the question as well as the participant's uncertainty in their response. Two

subthemes were identified.

1.1 Confusion between PA and prescribed exercise. Eight respondents reported 11 issues

(55% of all issues) due to confusion between general PA behaviour and specific prescribed

exercise (Table 1). Some participants recalled instances of engaging in general PA, such as

walking to work, instead of the exercises prescribed by their healthcare professional when

they responded to the question.

> *P1 (female, back pain) "Completely disagree because I am still trying to stay healthy*
>
> *and still trying to go to the gym and stay active even if I forget to do the exercises or*
>
> *one of them I'm still going and working out*

1.2 Spontaneous inference. This theme describes issues that participants experienced

responding to questions because they had not received or understood a specific prescription

91   of exercise, and therefore developed a hypothetical scenario on which to base their response.

92   This accounted for four concerns (20%) generated by three respondents.

93   *P5 (female, knee pain) "Well my recommendations haven't been very specific, but as*

94   *often as recommended by myself so far…I said how many* (repetitions) *I want to do*

95   *and I do that."*

96   ***Comprehension difficulty***

97   This theme accounted for instances where the participant did not comprehend the question

98   itself, which led them to seek clarification from the researcher. Four participants did not

99   understand the meaning of a question or the scoring system, for example they queried where

100   a middle rating on the Likert scale would be. This accounted for five problems (25%).

101   *P8 (male, back pain) is this question saying that I feel confident of the fact that I*

102   *actually do do them, or is it asking that I feel confident when I do them* (the

103   exercises).

104   **Discussion**

105   Our findings indicate that the EARS was comprehensible to the majority of our participants

106   with PMSK pain and has good face validity. Two themes describing a small number of issues

107   pertaining to the comprehension of the EARS were identified. The EARS is currently the

108   only exercise adherence questionnaire to have undergone face validity testing (McLean et

109   al., 2016). However, refinements to the instructions of the EARS are suggested to negate

110   some of the issues encountered by our participants.

111   Participants reported more issues with Section B, which measures the levels of

112   exercise adherence, than section C, which asks questions about what influences adherence.

113   Most issues were encountered when participants responded to questions and referenced their

114   general PA behaviour (rather than the exercise or PA recommendations from their healthcare

115   provider). This may be due to several factors. While participants did not have difficulties

116   interpreting the individual questions, the instructions on the questionnaire may have caused

117   confusion. This may require rewording to ensure participants understand which activity or

118   behaviour to base their responses on. The initial questionnaire instructions may not be

119   specific enough to prompt respondents to consider their prescribed exercises or PA only

120   when answering the questions.

121   Confusion may also be due to an unclear exercise prescription from a healthcare

122   provider. Some participants stated that they were not given specific recommendations about

123   exercise dosage and so had difficulty responding to the questionnaire. In this situation,

124   participants referred to hypothetical scenarios; as they did not have precise recommendations

125   to comment on and therefore were unable to answer the questions posed. This was

126   particularly evident in participants with wide spread pain conditions, such as fibromyalgia.

127   The four participants with fibromyalgia (50% of those with problems answering the

128   questionnaire) reported that they had received nonspecific exercise or PA advice. This may

129   indicate that more specific prescription of exercise and PA and checks that a patient

130   understands these needs to be included in a healthcare consultation, as well as more general

131   discussions around the collaboratively agreed treatment goals and action plans, including

132   exercise dosage or PA recommendations.

133   PA is a multifaceted construct defined as "any bodily movement produced by skeletal

134   muscles that results in energy expenditure"(Caspersen, Powell, & Christenson, 1985, p.129).

135   However, PA recommendations can also be measured by the EARS if the parameters are well

136   defined and measurable, for example walking for 30 minutes a day at a pace that makes you

137   slightly out of breath. Our participants may not have been aware of the differences between

138   PA and exercise, making our questionnaires difficult to interpret. The scale may need to

139   provide better definitions of these behaviours, in line with other scales measuring similar

140 constructs, such as the International Physical Activity Questionnaire (Godin & Shephard,

141 1985).

142   Five comments referred to issues with comprehension of the rating scale, only minor

143 clarification was required prior to the participants successfully completing these questions.

144 Amendments to the instructions may alleviate these issues with comprehension.

145 **Conclusion**

146 This study demonstrates that there is good comprehension and face validity of the EARS

147 questionnaire, adding to the evidence that it is a robust measure of adherence. Healthcare

148 professionals should be aware that there is potential for people with PMSK pain to

149 misunderstand the questionnaire if exercise or PA specifications are unclear or not

150 understood. Instructions to the scale could be refined to specify that questions refer to

151 prescribed exercise or specific PA recommendations. The development of this scale will aid

152 in providing a better understanding of exercise adherence behaviours.

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Table 1: Breakdown of issues per question

	Interpretation Difficulty		Comprehension difficulty
	Confusion between PA and prescribed exercise	Spontaneous inference	
Exercise Adherence			
1. I do my exercises as often as recommended	x	xx	x
2. I forget to do my exercises			
3. I do less exercise than recommended by my healthcare professional	xxxxx	x	x
4.I fit my exercises into my regular routine	x		
5. I don't get around to doing my exercises			xx
6. I do most, or all, of my exercises	x	x	
Helps or Hinders			
1. I don't have time to do my exercises			
2. Other commitments prevent me from doing my exercises			
3. I don't do my exercises when I am tired			
4. I feel confident about doing my exercises			x
5. My family and friends encourage me to do my exercises			
6. I do my exercises to improve my health	x		
7. I do my exercises because I enjoy them	xx		
8. I adjust the way I do my exercises to suit myself			
9. I stop exercising when my pain is worse			
10. I'm not sure how to do my exercises			

x indicates one participant experiencing theme identified