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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 categorical 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 approach 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.

66 **Results**

67 Twenty participants (range 19-65 years, $M=34.6$, $SD=13.9$, 70% female) provided written
68 informed consent and were enrolled onto the study. Participants were diagnosed with
69 persistent low back pain (7), fibromyalgia, (4), knee pain (4), hip pain (3) and osteoarthritis
70 (2). The mean duration to complete section A and B was 5.97 minutes.

71 45% of the participants reported no issues with the 6-item adherence scale (section B)
72 and 80% of the participants did not experience any issues with the 10-item help or hinder
73 scale (section C). Issues were reported in 6% of responses; 20 issues out of a total of 320
74 segments, were identified. 16 issues in section B and four in section C. Two themes were
75 identified in the data: interpretation difficulties (1.1 confusion between physical activity (PA)
76 and prescribed exercise, 1.2 spontaneous inference) and comprehension difficulties.

77 ***Interpretation difficulty***

78 This theme described issues in interpretation, including deviations from original intended
79 meaning of the question as well as the participant's uncertainty in their response. Two
80 subthemes were identified.

81 *1.1 Confusion between PA and prescribed exercise.* Eight respondents reported 11 issues
82 (55% of all issues) due to confusion between general PA behaviour and specific prescribed
83 exercise (Table 1). Some participants recalled instances of engaging in general PA, such as
84 walking to work, instead of the exercises prescribed by their healthcare professional when
85 they responded to the question.

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

89 *1.2 Spontaneous inference.* This theme describes issues that participants experienced
90 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