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1 **Abstract**

2 **Introduction.** Exercise and physical activity may improve pain and function in people with
3 persistent musculoskeletal pain, but adherence is often low. Understanding the barriers and
4 facilitators of exercise adherence could aid in the development of an intervention to promote
5 exercise adherence. This study explored the factors influencing adherence to prescribed
6 exercise in people with persistent musculoskeletal pain.

7 **Methods.** Qualitative semi-structured interviews were conducted with patients with persistent
8 musculoskeletal pain. Registered physiotherapists specialising in the treatment of persistent
9 musculoskeletal pain were recruited to two focus groups. Data was analysed using framework
10 analysis informed by the Theoretical Domains Framework.

11 **Findings.** Twenty patient participants (mean age=44 years, standard deviation=14) and ten
12 physiotherapists (mean duration registered=11 years, standard deviation=5) were included.
13 Four themes were identified: the role of environment, the therapeutic relationship, facilitating
14 engagement with self-management and the influence of pain and negative affect. The Health
15 Action Process Approach was identified as an appropriate model to inform intervention
16 development.

17 **Conclusions.** Personal, social, and environmental factors as well as the relationship with the
18 physiotherapist influences exercise adherence. These findings may inform practice and the
19 development of theoretically-informed interventions to enhance exercise adherence in people
20 with persistent musculoskeletal pain.

21 **Keywords:** persistent pain, musculoskeletal, exercise adherence, behaviour change, qualitative

22 **Word count:** 7173

23

24

25 **Introduction**

26 Persistent musculoskeletal pain is experienced in the axial skeleton and peripheral joints
27 persisting over three months after initial onset [1]. Common diagnoses include low back pain,
28 osteoarthritis, and fibromyalgia [2]. Clinical practice guidelines suggest referral to a healthcare
29 professional and treatment often includes a prescription of exercise or regular physical activity
30 to maintain function and mobility [1]. Exercise is defined as planned, structured and repetitive
31 bodily movement, while physical activity is considered any bodily movement resulting in
32 energy expenditure [3]. In this study, the term *prescribed exercise* was used to encompass
33 either of these behaviours recommended by a healthcare professional. Prescribed exercise can
34 improve mobility while decreasing pain [4, 5]. However, the degree of improvement is still
35 relatively unknown, since 50-70% of patients are minimally or non-adherent to their prescribed
36 programme [6, 7]. Poor adherence means that patients often fail to achieve the optimum benefit
37 from prescribed exercise [8].

38 Treatment adherence has been defined by the World Health Organization as “the extent
39 to which a person’s behaviour corresponds with agreed recommendations from a healthcare
40 provider” [9]. However, this definition is not specific to exercise adherence [10] and few
41 studies have focused on adherence to prescribed exercise as a primary outcome [7, 11, 12].
42 Recent systematic reviews have identified intervention components that can enhance exercise
43 adherence [4, 13-15]. A review of 12 randomized controlled trials identified activity feedback
44 (e.g., via an activity monitor), written exercise instruction, and behavioural programmes
45 including goal planning as strategies that may enhance adherence to physiotherapy
46 appointments in the general population [4]. Specifically, for people with acute or persistent
47 musculoskeletal pain, three reviews of controlled trials identified that motivational and
48 behavioural programmes, such as cognitive behavioural therapy [14], goal setting, graded
49 tasks, self-monitoring, feedback, problem solving [15], individualised exercise programmes,

50 and self-management techniques (e.g., symptom management and relaxation techniques) [13]
51 may effectively enhance exercise adherence. However, moderate quality evidence, small
52 sample sizes and heterogeneous adherence measures used in the included studies limit the
53 conclusions of these reviews. These limitations are compounded by a lack of qualitative
54 research in people with persistent musculoskeletal pain, which impedes the development of
55 interventions aimed at improving exercise adherence. Qualitative research is recommended in
56 the early stages of developing complex interventions to explore the full experience of the
57 behaviour [16].

58 Barriers to exercise adherence have however been qualitatively investigated in a
59 population with rheumatoid arthritis. A number of factors have been identified including: a
60 lack of social connections, fatigue, fears relating to risks of infection, lack of professional input
61 or conflicting professional advice, a lack of disease specific programmes, inaccessible facilities
62 and psychological barriers [17-19]. Whilst these findings are specific to people with
63 rheumatoid arthritis [20], they inform the development of qualitative research in a broader
64 population with persistent musculoskeletal pain. This may support the development of an
65 appropriately tailored behaviour change intervention [21].

66 Behaviour change interventions are defined as “coordinated sets of activities designed
67 to change specified behaviour patterns” [22], and are most effective when tailored to a specific
68 behaviour and population group [16, 23]. Frameworks for intervention design suggest that the
69 identification of an appropriate theory is one of the first steps in intervention development [24]
70 and there is some evidence that interventions developed with a theoretical framework are more
71 effective than interventions without an explicit theoretical underpinning [25, 26].

72 There are a number of theories used to underpin behaviour change interventions, many
73 with overlapping constructs [16, 27]. The Health Action Process Approach is one model
74 describing the process of health behaviour change [28, 29] and has been used to explain

75 exercise and physical activity behaviours [30-34]. The model has two layers, a continuum layer
76 providing a distinction between a *motivational phase* that leads to behaviour intention and a
77 *volitional phase* that leads to the actual health behaviour. The second layer can be considered
78 a more explicit stage model and considers individuals as *preintenders*, *intenders* or *actors*.
79 Individuals within these phases or stages can be differentiated based on the constructs eliciting
80 the most influence on the behaviour [29].

81 In the motivational phase individuals do not yet have an intention to act (e.g., the patient
82 does not intend to engage with their physiotherapy exercises). These individuals are referred
83 to in the model as *pre-intenders*. Three factors are theorised to be most influential in this phase
84 of the model. The first is risk perception, which is the interpretation of a health threat (such as
85 the experience of pain), the second is outcome expectations (such as expectations of the
86 prescribed exercise), and the third is self-efficacy (the belief in one's capabilities to
87 successfully engage in the behaviour [35]). The model differentiates between phase-specific
88 self-efficacy with task self-efficacy being most influential in this phase [31].

89 After an intention is formed the individual moves into the volitional phase. With this
90 transition, factors are theorised to change in importance, thereby reflecting a mindset that
91 differs from that of the motivational phase. Individuals are first in the intentional stage where
92 volitional factors such as maintenance self-efficacy and action and coping planning are most
93 influential. Once the behaviour has been adopted, the individual moves to the actional stage,
94 where maintenance of the behaviour is influenced by maintenance self-efficacy and external
95 barriers and facilitators. Stronger intentions and planning may contribute to maintenance of the
96 behaviour [30, 32]. This theory may provide an appropriate framework to explain exercise
97 adherence and underpin the development of an intervention.

98 There is, however, argument within the literature regarding the necessity of theory to
99 ensure intervention effectiveness [36, 37]. This may be due to the inappropriate selection of

100 theory, which subsequently fails to target the most pertinent behavioural constructs [38]. To
101 adequately evaluate and ensure a comprehensive consideration of theoretical models
102 explaining health behaviour, formative research should be undertaken to allow for an informed
103 decision on the appropriate factors to target [16]. Formative research is important to understand
104 factors contributing to health behaviour. It is often gathered through in depth qualitative
105 research such as interviews and focus groups, as this provide researchers and clinicians with a
106 deeper understanding of individual decision processes [16]. This may inform the development
107 of effective interventions to overcome identified barriers.

108 Thus, the aim of this study was to explore the key factors related to exercise adherence.
109 This was done by identifying the perceived barriers and facilitators from both the perspective
110 of patients with persistent musculoskeletal pain and physiotherapists, in order to identify the
111 theoretical constructs most pertinent to this population to establish the appropriateness of the
112 Health Action Process Approach to underpin intervention development.

113 **Methods**

114 This qualitative study included semi-structured interviews with patients with persistent
115 musculoskeletal pain and focus groups with specialist musculoskeletal physiotherapists.

116 *Participant information and recruitment*

117 Patients were purposefully recruited from outpatient physiotherapy clinics in three large public
118 hospitals in London, United Kingdom. Posters advertising the study were displayed in
119 physiotherapy clinic waiting rooms and interested patients contacted the study researcher for
120 eligibility screening. Patients were eligible if:

- 121 i. they had self-reported persistent musculoskeletal pain for three months or
122 longer

123 ii. received physiotherapy which included prescribed exercise for their persistent
124 musculoskeletal pain

125 iii. were able to understand and speak sufficient English to engage in an interview

126 Patients were not eligible if they experienced pain due to inflammatory diseases such
127 as rheumatoid arthritis, as these conditions receive different management and have been
128 previously explored [17-19]. Once eligibility was confirmed potential participants were
129 provided with the study information sheet and given 24 hours to consider their participation.

130 Physiotherapists for two focus groups were recruited from (i) a physiotherapy
131 department in a large public hospital in London and (ii) a Masters in Advanced Musculoskeletal
132 Physiotherapy programme at a London university. Physiotherapists were eligible for inclusion
133 if they were Health and Care Professions Council registered physiotherapists with at least three
134 months experience working with patients with persistent musculoskeletal pain.

135 *Topic guide development*

136 Interview and focus group topic guides were informed by the study aims and previous research
137 [17-19] (see supplementary material for sample topic guides). A Patient and Public
138 Involvement group which consisted of five individuals with persistent musculoskeletal pain
139 commented on the topic guides during development. The interview topic guide was piloted
140 with two participants. Following the pilot interviews, comprehension was checked, and the
141 participants provided feedback on length and phrasing of questions. The topic guide was
142 refined following the pilot interviews, which were not included in the analysis. The interviews
143 were iteratively refined as they were conducted, and new ideas or descriptions were generated
144 [39]. The focus group topic guide was refined iteratively following the first focus group.

145 *Researcher reflexivity and trustworthiness*

146 All interviews and focus groups were conducted by the first author (LM) who had no previous
147 relationship with the participants. LM has a master's degree in health and exercise psychology
148 and received training in conducting focus groups and semi-structured interviews from
149 experienced qualitative researchers.

150 Throughout data generation, reflective notes were recorded in a diary. A social
151 constructivist approach was maintained during this study. This asserts that reality is socially
152 constructed and subjective to the individual. Therefore, the reflective diary assisted in
153 providing congruence across the data and was used to identify and acknowledge any potential
154 interpretation bias [40].

155 *Ethical consideration*

156 Ethical approval was obtained from West Midlands-Edgbaston Research Ethics Committee and
157 the King's College London and Guy's & St Thomas' NHS Trust Foundation (17/WM/0249).

158 *Procedure*

159 Interviews

160 Following informed consent, individual interviews were conducted face to face in a private
161 room at a London university or via telephone, depending on participant preference. Descriptive
162 data (age, sex, occupation, pain location and duration) were collected. Recruitment continued
163 until data saturation of themes was reached. This was defined as no new information obtained
164 for three consecutive interviews [41].

165 Focus groups

166 Following informed consent, the two focus groups were conducted. One was held in a private
167 room in a public hospital physiotherapy department and the other at a London university. The
168 perceptions from the physiotherapists provided data contributing to understanding patient
169 behaviours in the clinic that may influence adherence levels [42]. Conducting two focus groups

170 allowed for the generation of insight from physiotherapists working in different settings and
171 clinics and at different stages in their careers. Participants provided data on their sex and years
172 registered as a physiotherapist. An independent researcher was present during both focus
173 groups to take field notes.

174 *Data management and analysis*

175 Interviews and focus groups were audio recorded, transcribed verbatim and
176 anonymised. Data was managed and analysed using the framework approach to analysis [43]
177 using NVivo 11.41 (QSR International Ltd). This method provided an in-depth analysis of
178 themes and allowed for a cohesive analysis of interview and focus group data [43]. This
179 approach encompasses seven steps that ensures a systematic, rigorous and transparent
180 qualitative data analysis [43, 44]. To ensure theoretical constructs were comprehensively
181 considered, the analysis was informed by the Theoretical Domains Framework [31].

182 The Theoretical Domains Framework assists in identifying and selecting the most
183 appropriate theoretical constructs. The framework consists of 14 domains of theoretical
184 constructs [31] that can aid in identifying factors (i.e., barriers and facilitators) that are provided
185 by the qualitative data analysis [30]. Responses can then be mapped onto the appropriate
186 domains, identifying key factors that may influence behaviour and could be targeted in
187 subsequent interventions [32]. It has been used extensively as preparation for the qualitative
188 analysis of patient experiences [33,34].

189 The Theoretical Domains Framework informed the development of the matrices
190 required for the completion of the framework analysis [44]. Data was charted into matrices
191 informed by the domains that comprise the framework (table 1). This process was also
192 inductive so that any data that was not captured by one of the 14 domains was open coded.
193 Conversely, if no data matched one of the 14 domains, the domain was not used. The data was
194 then summarized and synthesized and linked back to the original transcripts in NVivo to

195 maintain a data management audit trail. The summarised data was then analysed across all the
196 matrices for themes pertaining to exercise barriers and facilitators.

197 [Insert table 1 here]

198 *Data validation*

199 Validation of the focus group and interview data was ensured by checking initial codes with an
200 independent researcher (a health psychology doctoral student with experience of conducting
201 framework analysis). The final themes derived from the data were shared with participants and
202 the Patient and Public Involvement group for resonance and relevance.

203 **Findings**

204 Twenty persistent musculoskeletal pain patient participants (75% female, mean age=44 years,
205 $SD=14$) and ten physiotherapists (60% female, mean duration registered=11 years, $SD=5$) were
206 recruited to this study (table 2). Interviews had a mean duration of 64 minutes (range 48-72
207 minutes). Three patient participants (ID2, ID8, ID15) completed telephone interviews due to
208 poor mobility. The two focus groups had similar durations of 54 (public hospital
209 physiotherapists) and 56 minutes (master programme students). The findings between the two
210 focus groups were congruent and there was no apparent difference between years of clinical
211 experience and perceptions about patient adherence. Notes were made in the reflective diary
212 pertaining to the rapport developed between the interviewer and participants, and how this
213 impacted on data collection. These reflections assisted in data analysis and interpretation. The
214 excerpts in the diary aided in identifying congruence, and conversely, disparities between the
215 responses from the patient participants and physiotherapists. This provided a richness to the
216 interpretation of the results.

217 [Insert table 2 here]

218 The analysis identified four superordinate themes with two subordinate themes each:
219 the role of environment; the therapeutic relationship; facilitating engagement with self-
220 management and the influence of pain and negative affect (table 3).

221 ***Theme 1: the role of environment "it's just helpful to have that additional support"***

222 Patient participants reported that the availability of suitable physical space as well as social
223 influences impacted on their adherence to prescribed exercise. All physiotherapists agreed that
224 environmental factors were important for exercise adherence and discussed ways to ameliorate
225 these influences with their patients when prescribing exercise. The two subthemes will be
226 discussed separately below.

227 **Sub theme 1.1: physical environment**

228 The accessibility of adequate space or equipment was important to facilitate exercise adherence
229 and the majority of patient and physiotherapist participants commented on this aspect. This
230 barrier prevented some patients from completing their prescribed exercises:

231 *"...some of the exercises they give are like 'ok now do this' and it's like ok so where in*
232 *my flat am I going to attach an exercise band at that height and do it at home?"* **Male**
233 **patient ID21 (shoulder pain > 5 years, ≥ 40 years old, employed).**

234 The physiotherapists also recognized the impact of an appropriate environment on
235 exercise adoption and adherence and tried to support patients by suggesting alternative places
236 to complete their exercises, such as at work or in a dedicated exercise space. For example, one
237 physiotherapist reported:

238 *"Often we'll encourage patients to take exercise and extend it out into the local gym or*
239 *a pool."* **Physiotherapist ID3 (certified < 10 years).**

240 Some patient participants reported that completing exercises in a gym was helpful as
241 they viewed it as an enabling environment which facilitated their prescribed exercise and
242 encouraged additional physical activity.

243 *"I think going to the gym is a big help...I feel like I sort of want to make the most of my*
244 *time here so then I do the exercises...and I feel like I had a proper workout."* **Female**
245 **patient ID9 (hip pain < 5 years, < 40 years old, not employed).**

246 In contrast, other patient participants found that completing exercises in a gym could
247 be disconcerting due to the nature of the exercises.

248 *"I felt a bit silly, I mean the guy beside me is lifting these huge weights and I'm lying*
249 *there with my like exercise band moving my leg back and forth...I'm a little more aware*
250 *of people looking around at me."* **Male patient ID11 (hip pain < 5 years, < 40 years**
251 **old, employed).**

252 Therefore, completing the exercises at home was the most realistic option for some
253 patients, and they felt identifying physical prompts in their environment supported their
254 adherence.

255 *"I had to actually put the towel by my bed so when I got up I would do the exercise."*
256 **Female patient ID20 (osteoarthritis > 5 years, ≥ 40 years old, not employed).**

257 Sub theme 1.2: social environment

258 It was acknowledged by patients and physiotherapists that social support provided by family,
259 friends or peers assisted patients to adhere to their prescribed exercise. Some patient
260 participants discussed the isolation that occasionally accompanied their condition and
261 identified that meeting others to complete exercises facilitated adherence, as reflected below
262 by a patient participant who was referred to a group exercise class:

263 *"It gives me a purpose to get dressed. To make an effort to go. You meet likewise people,*
264 *the same as you. They may not necessarily have the same condition, but you know*
265 *you're all there to do an exercise class. You're having a reason to get out of bed without*
266 *thinking."* **Female ID15 (fibromyalgia < 5 years, < 40 years old, not employed).**

267 The role of social support was recognized by the physiotherapists as a useful strategy
268 to be discussed when prescribing exercise, particularly when adherence to exercise is low:

269 *"I think you need to look at more than following their exercise, is it they don't know*
270 *how to do them, is it they're unmotivated maybe they would benefit from joining a class*
271 *some patients respond better in a class environment than a one to one."*

272 **Physiotherapist ID4 (certified ≥ 10 years).**

273 ***Theme 2: the therapeutic relationship "someone who considers me personally"***

274 The therapeutic relationship appeared to influence exercise adherence. This relationship was
275 described as collaboratively developing a tailored exercise programme which aligned with the
276 patients' needs and lifestyle. The importance of building a strong, collaborative relationship
277 was recognized as influencing exercise adherence by both patient participants and the
278 physiotherapists.

279 Sub theme 2.1: collaborative partnership

280 Many patient participants remarked on the importance of the role of the physiotherapist and
281 acknowledged that their physiotherapist influenced their exercise adherence. Collaboratively
282 developing a plan to achieve their set goals, and regular monitoring of their exercise adherence
283 by the physiotherapists encouraged greater exercise adherence.

284 *"I think my take up of the exercises was really good...I was feeling positive about my*
285 *progress and obviously I had a physio kind of monitoring me and helping and wanting*
286 *me to progress."* **Female ID7 (low back > 5 years, < 40 years old, employed).**

287 The physiotherapists recognised that it is important to understand a patient's needs and
288 their readiness to complete exercises and if this was not considered they may be less able to
289 support exercise adherence:

290 *"You think oh how can I get it across, and I think you can take it quite personally that*
291 *you haven't managed to engage that patient or it's that I'm not explaining things*
292 *properly but actually sometimes it's just that it's not right for them there and then."*

293 **Physiotherapist ID5 (certified < 10 years).**

294 However, some patient participants reflected that they felt that the physiotherapist was
295 not listening to, or acknowledging, their concerns. One patient participant reported that this
296 affected her relationship with the physiotherapist and subsequently her engagement with her
297 prescribed exercises:

298 *"...and I'm telling her it hurts and she's like oh yeah you just have to blah blah blah*
299 *and it's like, she didn't listen to me at all... I feel like I've blocked out anything she said*
300 *to be honest."* **Female ID3 (fibromyalgia < 5 years, < 40 years old, not employed).**

301 Failure to develop this relationship and collaborative plan led some patient participants
302 to question if their treatment was useful:

303 *"I think one of the issues is that I don't feel like I have a plan right now. I am just kind*
304 *of doing the physio."* **Male, ID16 (ankle pain > 5 years, ≥ 40 years old, employed).**

305 The physiotherapists recognized the need to collaborate with patients and help them
306 integrate exercises into their lifestyle. However, external factors such as limited appointment
307 duration impacted on their ability to provide knowledge and support for patients. This could
308 affect the development of a collaborative partnership.

309 *"...in my opinion experience doesn't stop the fact that we have very little time often to*
310 *enact a lot of stuff...drawing on a lot of information, try to synthesize that, bring that*
311 *together in a meaningful way that's going to change the patient's behaviour."*

312 **Physiotherapist ID6 (certified \geq 10 years).**

313 Sub theme 2.2: tailored exercise prescription

314 Both the patient participants and physiotherapists reported that tailoring an exercise
315 prescription to an individuals' needs, interests or lifestyle influenced exercise adherence. A few
316 patient participants noted that they were able to adapt their exercises to fit into their daily lives.
317 Sometimes this was done independently, or for others, facilitated by the physiotherapist.
318 However, failing to identify ways in which exercise programmes could be realistically
319 undertaken led patient participants to stop exercising.

320 *"The whole plan takes about 45 minutes so I was like oh my god! I want to go for walks*
321 *and get some fresh air and I was like I can't balance all these things and then I was*
322 *trying to go swimming to strengthen my leg as well and I just like ah! So the physio*
323 *[exercises] just kept getting pushed to the side."* **Female ID12 (knee pain < 5 years, <**
324 **40 years old, employed).**

325 The physiotherapists recognised that prescribing an acceptable and manageable exercise
326 programme facilitated exercise adherence.

327 *"I think also the personalisation too, so people feel that you've really taken the time to*
328 *understand them and how it relates to them, you get a greater buy in than someone that*
329 *just perceives oh they've come in and they've been given a sheet of exercises and off*
330 *they've gone."* **Physiotherapist ID3 (certified < 10 years).**

331 **Theme 3: facilitating engagement with self-management "it's important to 'buy in' to the new lifestyle"**

332 Both patient participants and physiotherapists recognized the need for patients to believe in and
333 engage with the advice and exercise prescription being provided. Patient participants discussed
334 adapting their attitudes and beliefs and altering their daily activities to integrate prescribed
335 exercise into their lives. To facilitate self-management, additional support and realistic
336 treatment expectations were considered important by both physiotherapists and patient
337 participants. The physiotherapists discussed developing a self-management plan (i.e., an action
338 plan) with patients to assist in adhering to their exercises. The physiotherapists acknowledged
339 their role in collaborating with patients to develop this plan. However, they recognised that
340 implementation of the plan is the responsibility of the patient.

341 *"We'll ask the patient...what their goals are and then how they think that they are going*
342 *to get there and they're like 'well you're gonna do it', I'm kind of trying to explain that*
343 *no you're gonna do it [the exercises] but I'm gonna help facilitate you to get there."*

344 **Physiotherapist ID7 (certified \geq 10 years).**

345 Sub theme 3.1: support to overcome environmental barriers

346 Both physiotherapists and the patient participants recognized the supportive role of the
347 physiotherapist during the appointment, but there is less support available when patients
348 exercise at home. Patient participants reflected on the need for additional resources between
349 their appointments to assist with their efforts to self-manage. Some patient participants reported
350 they would leave their physiotherapist appointment with an understanding of how to complete
351 their exercises, however a lack of accessible resources would impact on their efforts to adhere.
352 In the time between appointments, participants noted they would often forget the detailed
353 instructions about how to perform the exercise accurately and effectively, this subsequently
354 affected their adherence levels.

355 *“I left [the appointment] thinking, yeah I got this, they’re written here on the paper. But*
356 *actually there are subtle things...should this be tilted forward...there are specific things*
357 *to make sure the exercise is done correctly. So in the time between appointments it fades*
358 *so I just stop [doing the exercise].” Female ID3 (fibromyalgia < 5 years, < 40 years*
359 **old, not employed).**

360 A few patient participants noted that their engagement with exercises waned between
361 appointments and some stopped exercising all together until their next appointment. Both
362 patient participants and physiotherapists noted that there are limited resources available that
363 patients can access between appointments to support their exercise adherence and their efforts
364 to self-manage.

365 *“You send them away with some progressions, but you know nobody wants to do the*
366 *same exercises for a year to come. So do they know how to progress themselves...maybe*
367 *this is why they stop at some point.” Physiotherapist ID9 (certified < 10 years).*

368 A few patient participants recognized the value of leaving the appointments with
369 resources to refer to while exercising at home. Some patients discussed being videotaped while
370 completing the exercise in their appointment and how this facilitated their adherence at home.

371 *“What he did for me this time was much more helpful...he used my phone to film me*
372 *doing the exercises. So that was really helpful because then when I came home I could*
373 *watch the video back and remember what I am supposed to do. And then I got his voice*
374 *in the background giving me instructions as I go.” Female ID9 (hip pain < 5 years, <*
375 **40 years old, not employed).**

376 Sub theme 3.2: establishing realistic treatment expectations

377 Patient participants discussed their expectations of their treatment and how they felt their
378 exercises would impact on their pain and function. These expectations modified their ability or

379 willingness to engage in their treatment and manage their condition. Some patient participants
380 discussed their uncertainty about the effectiveness of their physiotherapy when they did not
381 experience improvements in their pain and function. This led them to question their treatment,
382 and consequently decreased adherence to their prescribed exercises.

383 *"...I just get really frustrated and angry...physio doesn't always give me the result that*
384 *I want so it's like what else could I have done. Did I push it too much or did I not do*
385 *enough...like what the heck!" Female ID5 (hip pain < 5 years, ≥ 40 years old,*
386 **employed).**

387 Physiotherapists underlined that patient expectations of treatment outcomes may be
388 altered if they misunderstand the purpose of physiotherapy. Some physiotherapists reflected
389 that a few patients expect passive treatment (such as massage) and do not anticipate that they
390 would be required to complete exercises at home. The physiotherapists reported that this may
391 affect a patient's exercise adherence.

392 *"I think also the biggest thing is patient expectation. That you've got to do the exercises.*
393 *Or the idea is that you do the exercises regularly. And it may take several weeks or*
394 *months and often it's when you talk about the longevity, they are often looking for the*
395 *quick fix."* **Physiotherapist ID3 (certified < 10 years).**

396 ***Theme 4: the influence of pain and negative affect "I was really feeling like pain was a huge barrier...so I***
397 ***had quite low mood"***

398 Numerous patient participants discussed the role that their emotions and mental health had on
399 their adherence to exercise. Some patient participants suggested that their exercise adherence
400 was greatly influenced by the presence of pain or the fear of experiencing pain. Other patient
401 participants reported that these experiences or negative emotions had a self-regulatory effect

402 and acted as a reminder to complete their exercises. Physiotherapists recognized the importance
403 that these factors may have on patient exercise adherence as well as engagement with treatment.

404 Sub theme 4.1: understanding pain

405 Some patient participants reported that they were uncertain what pain represented and this
406 influenced their adherence to exercise. Few patient participants revealed that pain would trigger
407 anxiety as they did not know what initiated the pain and it would cause them to avoid activity
408 or make them more hesitant to complete their daily activities. This was largely because they
409 were unsure how to manage an increase in pain.

410 *"My fear is that when, you know, you feel a twinge and you're like ah did I just hurt*
411 *myself again and you have to wait 6 weeks to see someone and ask that question so I*
412 *won't want to do anything until I see them again."* **Male ID21 (shoulder pain > 5**
413 **years, ≥ 40 years old, employed).**

414 The physiotherapists recognized that poor understanding of the meaning of pain was a
415 potential barrier to exercise adherence, and that some patients may require additional support
416 and education around understanding their pain.

417 *"With persistent pain we are looking to help them functionally rather than just reducing*
418 *their pain which isn't going to happen. As long as they understand why they're doing*
419 *it and what benefits it's going to give them...they're the ones that are probably going*
420 *to succeed with it."* **Physiotherapist ID4 (certified ≥ 10 years).**

421 Some patient participants recognized that increased pain may be expected following
422 exercise, however there was still uncertainty about what pain represented:

423 *I mean I know I can do it [the exercises], but I would definitely avoid putting too much*
424 *pressure on it just because of how it has been in the past I wouldn't want it to go back*
425 *or revert to the condition [it was before]. I would do moderate exercise. But I wouldn't*

426 *know if I was causing more detriment, so I would just keep it moderate."* **Female ID17**
427 **(shoulder pain < 5 years, < 40 years old, employed).**

428 Sub theme 4.2: impact of negative affect

429 Some patient participants reported that the antecedents or consequences of the experience of
430 negative affect influenced exercise adherence. For some patients, negative affect resulted in
431 lower adherence to exercise as well as their everyday activities. Many patients reported a lack
432 of support regarding the management of negative emotions.

433 *"One thing I have noticed...there doesn't seem to be joined up thinking and I think what*
434 *we [the physiotherapist] haven't really talked about is the mental health implications*
435 *of the injury. Sometimes I just feel so [bad] about it [the pain] and I don't want to do*
436 *anything."* **Male ID16 (ankle pain > 5 years, ≥ 40 years old, employed).**

437 Conversely, for some patients the experience, or the anticipation, of negative affect
438 motivated them to adhere to their exercises.

439 *"I enter them [the exercises] in a notebook and at the end of the day if I have to enter*
440 *in there that I didn't do them...I feel quite guilty because it's like a confessional...so I*
441 *think damn I should do them."* **Male ID1 (back pain > 5 years, ≥ 40 years old, not**
442 **employed).**

443 The physiotherapists recognized that persistent pain conditions are complex, and that
444 mental health influences patient adherence to exercise and treatment recommendations.
445 However, our physiotherapists realised that they were not trained to assist with serious mental
446 health issues and recognise referral to appropriate services was required.

447 *"If it is chronic pain and they've gone through many many different physios and they've*
448 *failed physio, sometimes our best role is to refer to a psychologist for some other*

449 *treatment. Obviously we know that exercise is important but if they’re not willing to do*
450 *that there may be other yellow flags.”* **Physiotherapist ID10 (certified ≥ 10 years).**

451 [Insert table 3 here]

452 **Discussion**

453 This qualitative interview and focus group study provided perspectives from both patient
454 participants with persistent musculoskeletal pain and physiotherapists. The Theoretical
455 Domains Framework provided a framework for organizing the data to underpin a
456 comprehensive analysis identifying four themes encompassing individual, environmental and
457 interpersonal levels: the role of environment, the therapeutic relationship, facilitating
458 engagement with self-management, and the influence of pain and negative affect.

459 The physical and social environment was reported to influence exercise adherence by
460 both physiotherapists and patient participants. Our findings suggest that the accessibility and
461 appropriateness of exercise facilities affect exercise adherence. This concurs with other
462 research in the general population [38,39]. More specifically, for those with mobility issues,
463 the home environment and nearby facilities are important factors in facilitating exercise [45].
464 Our study extends these findings and suggests that for a population with persistent
465 musculoskeletal pain, the topic of accessible and adequate space to complete exercise needs to
466 be addressed. Physiotherapists can support patients in developing effective coping strategies
467 and identifying how to overcome situations where lack of appropriate space to exercise may
468 be an issue. For instance, by adapting exercises to align with their available environment or
469 referral to appropriate community resources.

470 Our findings also support previous research indicating that social support increases
471 physical activity levels in physiotherapy interventions [4, 12]. A qualitative study exploring
472 rheumatoid arthritis patient perspectives of an educational, self-management exercise
473 programme identified the environment as being influential in the participants’ adherence to the

474 programme [46]. Particularly, the support from others in the group, the physiotherapist
475 facilitating the programme, as well as friends and family, enabled the uptake and maintenance
476 of exercise. Physiotherapists in our study recognized the importance of social support,
477 particularly in patients with low motivation. This was incorporated into treatment planning
478 with patients by referring them to group exercise classes. The current evidence may not support
479 group exercise classes over individualised treatment in improving pain and function. There was
480 no significant difference in outcomes between participants with osteoarthritis and low back
481 pain receiving group education and exercise classes and those receiving individual treatment
482 or usual care [47]. However, as group-based treatment is cost-effective it may be more feasible
483 to deliver than individualised treatment [48]. Additionally, patients completing group exercise
484 may also benefit from increased social support. It may be more appropriate to establish with
485 the patient the desired type of social support, who should deliver it and how it can best be
486 utilised.

487 Our findings suggest that the therapeutic relationship influenced exercise adherence in
488 people with persistent musculoskeletal pain, and while this was recognized by both the
489 physiotherapists and the patient participants, their views differed to some extent. The influence
490 of the patient-provider relationship on treatment adherence is well recognised [49, 50], and the
491 impact of the therapeutic alliance on rehabilitation outcomes has been explored [51, 52]. The
492 therapeutic alliance has been described as the positive social connection between the patient
493 and healthcare professional [53]. The therapeutic alliance model comprises three elements:
494 agreement of treatment goals, agreement on the tasks, and the development of a personal bond
495 between the patient and the healthcare professional [51]. This relationship is increasingly
496 regarded as an important determinant to engagement with physical rehabilitation [54] and has
497 been found to be associated with the perceived ability to control pain in a persistent
498 musculoskeletal pain population [55]. The findings from our study extend this evidence by

499 suggesting that targeting each component of the therapeutic alliance model in physiotherapy
500 treatment may support exercise adherence. Developing a personal bond was identified as
501 facilitating exercise adherence by both the patient and physiotherapist participants in our study.
502 Patient participants recognized that collaboratively developing a tailored and individualised
503 exercise prescription supported their adherence. However, it was noted by the physiotherapists
504 in our study that this partnership takes time to develop and may not always be feasible in the
505 current clinical setting. Whilst allied health professionals, such as physiotherapists, are
506 increasingly developing advanced communication skills to motivate and support behaviour
507 change [56], it is ultimately the patient’s responsibility to adhere to their prescribed exercise .
508 Self-efficacy, motivation and intentions have been identified as predictors of adherence to
509 physical therapy programmes [57], and better supporting patients in developing these skills,
510 and ultimately self-managing their conditions, may be required.

511 The World Health Organization published an action plan for the prevention and control
512 of non-communicable diseases, recognizing a need for the promotion of self-management to
513 support musculoskeletal health [58, 59], and in 2018 published the global action plan to
514 promote physical activity [60]. Patients are required to engage in self-management strategies
515 that include exercise in order to adequately benefit from treatment. However, their ability and
516 willingness to do so will greatly impact on this. Our participants reported that employing
517 techniques such as reminders assisted in the recollection of accurate exercise movements.
518 However, both patients and physiotherapists noted that there was often a lack of resources for
519 patients to access between appointments to help with continued exercise. While patients noted
520 feeling competent in performing the exercises initially, this feeling of competence declined
521 between appointments. This was reported to be influenced by patients forgetting the subtle
522 nuances of the movements, a lack of motivation, and the impact of negative affect. These
523 experiences and feelings of uncertainty contributed to lower adherence to exercise. A recent

524 qualitative study exploring adherence beliefs in a population with low back pain identified
525 increased knowledge and confidence regarding exercise performance greatly impacted long
526 term adherence [61]. This suggests that adherence to exercise between appointments and after
527 discharge from healthcare professional care, may require easily accessible, low cost support to
528 aid in developing self-management strategies.

529 The role of physiotherapy and expected treatment outcomes elicited perhaps the most
530 discordant views between the patient participants and the physiotherapists. Patient participants
531 expressed their concern and frustration when their exercises did not produce results as quickly
532 as hoped or expected. Many physiotherapists also reported that some patients expected more
533 passive treatment and immediate changes to their symptoms. This misalignment between
534 patient’s treatment and outcome expectations may impact the patient’s ability and willingness
535 to engage in their prescribed exercises. Pre-treatment expectations are known to influence
536 outcomes and, if these expectations are not met, they may contribute to greater pain perceptions
537 and disability [62]. Reframing of patient treatment and outcome expectations may be needed
538 to facilitate exercise adherence.

539 The fourth theme identified that the influence of pain and negative affect may also impact
540 the engagement in self-management strategies and particularly exercise adherence. Increased
541 pain following exercise, or perceived lack of improvement following the exercise programme
542 influenced exercise adherence in some of our patient participants. Patients reported a lack of
543 support for these issues in their current treatment. Pain is considered an experience that is
544 tempered by social, environmental, and cognitive factors. Therefore targeting these secondary,
545 biopsychosocial consequences of pain conditions may be important [63]. These may include
546 fear of moment, pain catastrophizing, and anxiety [64]. Accounting for these secondary
547 consequences during treatment may be the most effective approach [65], particularly when
548 considered alongside the prescription of exercise [64]

549 *Theoretical implications*

550 There is a paucity of research exploring exercise adherence in a population with persistent
551 musculoskeletal pain. Understanding the barriers and facilitators to exercise adherence assists
552 in the identification of salient theoretical constructs which can be targeted in interventions to
553 improve exercise adherence [66]. Pain perception, the expectations of physiotherapy treatment,
554 engagement with self-management and the ability to plan and cope with barriers to exercise
555 were evidenced in the results of this study. These findings align with the constructs proposed
556 by the Health Action Process Approach to be influential in behaviour change and maintenance:
557 risk perception, outcome expectations, action and coping planning and self-efficacy [29].

558 The two phases of the Health Action Process Approach (motivational phase and volitional
559 phase) can be used to assess causality in behaviour change. It is suggested that the phase
560 conceptualisation of the model provides a better way to predict behaviour [29]. However, it is
561 proposed that the explicit stage model of the Health Action Process Approach is best utilised
562 to inform intervention design by further identifying individuals who reside in the two phases
563 as pre-intenders, intenders and actors (figure 1). The intervention then targets treatment efforts
564 based on the stage that the individual resides in. The patient participants and physiotherapists
565 in the current study recognized the importance of tailoring exercise to facilitate exercise
566 adherence. The Health Action Process Approach thus enables the targeting of stage-specific
567 constructs to direct efforts appropriately to support individuals to adhere to exercise
568 (behavioural maintenance). Therefore, the Health Action Process Approach would support the
569 tailoring of an intervention to the individual by targeting the appropriate constructs to support
570 their exercise adherence.

571 The Health Action Process Approach also proposes that barriers and facilitators impact on
572 all phases of the model. While broadly defined in the model, the findings from the current study
573 may provide detail crucial to the development of an intervention. The physical and social

574 environment, the influence of pain and negative affect may act as barriers to exercise
575 adherence, while fostering a collaborative therapeutic relationship and facilitating self-
576 management may facilitate the behaviour. The barriers and facilitators identified in the current
577 study could extend the model to include more specificity when applying the model to support
578 adherence in a population with persistent musculoskeletal pain.

579 [Insert figure 1 here]

580 *Clinical and research implications*

581 This study provides insight into the factors that influence exercise adherence in people with
582 persistent musculoskeletal pain. Healthcare professionals, specifically physiotherapists, should
583 be aware of the factors which influence adherence when prescribing exercise, so strategies can
584 be incorporated into their practice to target these factors.

585 This study included perspectives from both patients and physiotherapists. The
586 similarities and disparate views may inform clinical care and the development of future
587 interventions to facilitate exercise adherence. Both patient participants and physiotherapists
588 recognized the importance of the physiotherapist in supporting exercise adherence. However,
589 the patient participants largely reported that they were ill equipped to continue their exercises
590 between appointments. Therefore, physiotherapists’ may need to recognize the barriers and
591 facilitators to exercise and collaborate with their patients to identify appropriate coping
592 strategies and provide further resources.

593 Future research should explore the development of a clinically applicable, theoretically
594 informed behaviour change intervention to support exercise adherence. The Health Action
595 Process Approach may provide an appropriate theoretical underpinning to inform an
596 intervention to enhance exercise adherence in a population with persistent musculoskeletal
597 pain. A phase specific intervention may target the constructs identified in the current study.

598 ***Strengths and limitations***

599 Both patients and physiotherapists working with people with persistent musculoskeletal pain
600 were enrolled to explore a broad range of views. The framework analysis informed by the
601 Theoretical Domains Framework ensured a rigorous and systematic method of data analysis.
602 The use of this framework may inform clinical reasoning and practice by enabling clinicians
603 to consider the multiple constructs that may impact on exercise adherence. Recruitment of
604 participants continued until no new ideas emerged. These strengths allowed for a
605 comprehensive analysis of the data.

606 There were several limitations to this study. Only physiotherapists were recruited to
607 provide professional insight. Future research should explore the experiences of other
608 professional groups, such as fitness trainers or general practitioners, who may prescribe
609 exercise to this population. In addition, the patients and physiotherapy participants were
610 recruited from central London institutions. Including participants with different cultural,
611 socioeconomic status and lifestyles may generate new information.

612 The Theoretical Domains Framework was chosen to provide a framework for the data
613 analysis. However, systematic frameworks such as these have been criticised for being too rigid
614 to encompass the variability within health behaviours [67]. Developing analytical matrices
615 structured around the 14 domains may have limited the ability for other ideas to emerge from
616 the data. However, attempts were made to ameliorate this by allowing ideas to generate
617 inductively.

618 ***Conclusion***

619 The findings of this study identified four key themes which influence exercise adherence in
620 people with persistent musculoskeletal pain; the environment, therapeutic relationship,
621 facilitating engagement with self-management and the influence of pain and negative affect.
622 This may inform the use and refinement of the Health Action Process Approach which can be

RUNNING HEADER: "It's important to buy in to the new lifestyle"

623 used in intervention development. Clinicians may wish to facilitate self-management strategies
624 in their patients that emphasise coping strategies to overcome personal, social and
625 environmental barriers.

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789

790

791 List of figure captions:

792 Figure 1: Themes mapped onto the Health Action Process Approach

793 Schwarzer R. Modeling Health Behavior Change: *How to Predict and Modify the Adoption*
794 *and Maintenance of Health Behaviors*. Appl Psychol 2008;57(1):1-29.
795 *Permission to reproduce licence number: 4541840840843*

796

797 **TABLE 1**

798 *THEORETICAL DOMAINS FRAMEWORK*

Domain	Description^a
Knowledge	An awareness of the existence of something
Skills	An ability or proficiency acquired through practice
Social/professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use
Optimism	The confidence that things will happen for the best or that desired goals will be attained
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way
Goals	Mental representations of outcomes or end states that an individual wants to achieve
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
Environmental context and resources	Any circumstance of a person’s situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours
Emotions	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions

799 ^aDefinitions as stated in Cane, J., D. O'Connor, and S. Michie, *Validation of the theoretical*
 800 *domains framework for use in behaviour change and implementation research.*
 801 *Implementation Science*, 2012. **7**: p. 37.

802

803 **TABLE 2**

804 *PARTICIPANT DEMOGRAPHICS*

Patients		
	Frequency	%
Age		
20-30	5	25
31-40	3	15
41-50	5	25
51-60	2	10
61-65	5	25
Sex		
M	5	25
F	15	75
Ethnicity		
Caucasian	14	70
African	3	15
Asian	1	5
Caribbean	1	5
Bangladeshi	1	5
Occupational status		
Employed full time	8	40
Employed part time	2	10
Student	2	10
Retired	4	20
Long term disability	4	20
Pain location		
Low back	6	30
Fibromyalgia	4	20
Hip	3	15
Shoulder	3	15
Osteoarthritis	2	10
Knee	1	5
Ankle	1	5
Pain duration		
<1 year	1	5
1-5 years	12	60
6-10 years	2	10
20-30 years	4	20
>30 years	1	5
Physiotherapists		
	Frequency	%
Years certified		
5-10	5	50
11-15	2	20
16-20	3	30
Sex		
M	4	40
F	6	60

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806 **TABLE 3**

807 *ANALYTICAL THEMES*

Themes	The role of environment	The therapeutic relationship	Facilitating engagement with self-management	The influence of pain and negative affect
	<i>It’s just helpful to have that additional support”</i>	<i>“Someone who considers me personally”</i>	<i>“It’s important to ‘buy in’ to the new lifestyle”</i>	<i>“I was really feeling like pain was a huge barrier...so I had quite low mood”</i>
Subthemes	Physical environment	Collaborative partnership	Support to overcome environmental barriers	Understanding pain
	Social environment	Tailored exercise prescription	Establishing realistic treatment expectations	Impact of negative affect