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DOI:

[10.3138/ptc-2020-0083](https://doi.org/10.3138/ptc-2020-0083)

[10.3138/ptc-2020-0083](https://doi.org/10.3138/ptc-2020-0083)

Document Version

Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Meade, L., Bearn, L., & Godfrey, E. (2022). Using Intervention Mapping in the Systematic Development of a Behavior Change Intervention to Enhance Exercise Adherence among People with Persistent Musculoskeletal Pain. *PHYSIOTHERAPY CANADA*, 74(2), 216-223. [10.3138/ptc-2020-0083]. <https://doi.org/10.3138/ptc-2020-0083>, <https://doi.org/10.3138/ptc-2020-0083>

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1 THE SYSTEMATIC DEVELOPMENT AND PRELIMINARY TESTING OF A BEHAVIOUR
2 CHANGE INTERVENTION TO ENHANCE EXERCISE ADHERENCE IN PEOPLE WITH
3 PERSISTENT MUSCULOSKELETAL PAIN

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21 *Purpose: To describe the design and testing of an empirically and theoretically informed*
22 *intervention aimed at increasing adherence to prescribed exercise in people with persistent*
23 *musculoskeletal pain.*

24 *Methods: To systematically design an intervention to target exercise adherence, the first four*
25 *stages of Intervention Mapping were applied and supported by the involvement of a patient*
26 *engagement group. A systematic review and qualitative study (step one) informed intervention*
27 *content and context. A theoretical framework supporting exercise adherence was described (step*
28 *two) to inform study methods (step three). How these methods could be utilised to support*
29 *behaviour change and enhance exercise adherence was discussed (step four). The resulting*
30 *intervention was assessed in a proof of concept feasibility and acceptability study.*

31 *Results: The Health Action Process Approach was identified as an appropriate theoretical*
32 *framework to underpin an intervention encompassing virtually delivered motivational*
33 *interviewing and an app-based exercise program to support adherence to exercise. The*
34 *intervention was shown to be feasible and acceptable.*

35 *Conclusions: An Intervention Mapping approach was successfully employed to develop an*
36 *intervention aimed at supporting the development of self-management behaviours and*
37 *addressing maladaptive beliefs as a means to enhance exercise adherence. Future evaluation*
38 *and implementation of the intervention should now be determined.*

39 *Keywords: Adherence, pain, exercise, intervention development*

40 *Acknowledgments*

41 *The authors would like to acknowledge the contributions of Retha Welding, Consultant*
42 *Physiotherapist, London UK. We also acknowledge the members of the Patient Engagement*
43 *group and all research participants for their time and dedication to this research.*

44 **INTRODUCTION**

45 Persistent musculoskeletal (PMSK) pain, such as low back pain, has substantial personal, social
46 and economic impacts.^{1,2} Evidence-based nonpharmacological strategies, including prescribed
47 exercise are a recommended treatment plan for patients with PMSK pain.³ Evidence supports the
48 effects of prescribed exercise in alleviating pain and improving function and quality of life.⁴
49 However, less than half of people with PMSK pain adhere to the exercises they have been
50 prescribed by a healthcare provider.⁵ In order to address this challenge, there is a need for
51 programs to identify and target the barriers to exercise adherence. Yet, there is a lack of
52 empirical evidence to guide the development of a targeted intervention to inform practice.⁶ The

53 systematic reporting of intervention development is essential to enhance understanding and
54 address this problem via informing future research and decision-making.

55 Increasing exercise adherence is often challenging, as it requires people to change their
56 behaviour. Supporting behaviour change entails an understanding of internal and external
57 influences, such as access to resources or beliefs about the behaviour.⁷ Intervention Mapping
58 provides systematic guidance on developing complex behaviour change interventions to address
59 these influences, while acknowledging the importance of evidence, theory, process and
60 outcomes.⁸ It is compatible with any theory and can help identify appropriate theory-informed
61 methods and behaviour change techniques (BCTs; the smallest identifiable active ingredient of
62 behaviour change interventions, see Abraham & Michie,⁹ for more information). This method
63 could be useful in developing a complex behaviour change intervention in people with PMSK
64 pain. The approach guides users iteratively from problem identification to problem solving to
65 facilitate a comprehensive consideration of the influences enacting on the behaviour. The
66 completion of each of the six steps within Intervention Mapping informs the subsequent step.¹⁰
67 Reporting on the development of an intervention promotes transparency, improves interpretation
68 of results and allows researchers to learn from one another.¹¹ There is currently limited research
69 outlining the development and theoretical justification of an intervention to target exercise
70 adherence in a PMSK pain population.⁶ It is therefore imperative to clearly outline the steps
71 taken to gather and disseminate the data to support the development of further research in the
72 field.

73 The aim of this research was to design an intervention to enhance adherence to exercise
74 in people with PMSK pain following the Intervention Mapping approach. The objectives were to
75 (i) describe the initial development of an intervention using the first four stages of Intervention

76 Mapping; (ii) describe a small feasibility and acceptability study; and (iii) propose refinements to
77 the intervention to be tested in the next step of intervention development and testing.

78 **METHODS**

79 Following the Strategy for Patient Oriented Research (SPOR)¹² a patient engagement (PE) group
80 was consulted throughout each step of this research. Members were individuals with PMSK pain
81 identified from three outpatient physiotherapy clinics in London, United Kingdom (UK). Six
82 individuals met four times over two years to inform this research. The methods are presented
83 following the Intervention Mapping approach.¹⁰

84 **Step One: Needs assessment of the content and contextual factors influencing exercise** 85 **adherence**

86 In step one of the Intervention Mapping approach, the problem is assessed to determine risk
87 factors, existing supporting evidence and gaps in the literature. This step consisted of a
88 systematic review and a qualitative study.

89 *Systematic review of behaviour change techniques associated with exercise adherence*

90 The methods and comprehensive reporting of study findings are reported elsewhere.⁶ However,
91 in brief, this review identified five BCTs that were found to be the most influential on exercise
92 adherence:

- 93 (i) Social support (e.g., from family members or the physiotherapist).
- 94 (ii) Behaviour goal setting (e.g., completing prescribed exercises twice per week after
95 dinner).
- 96 (iii) Behaviour practice/rehearsal (e.g., practicing prescribed exercises during a clinical
97 appointment).

98 (iv) Demonstration of behaviour (e.g., the therapist thoroughly demonstrates how to
99 accurately perform the prescribed exercise).

100 (v) Instruction of the behaviour (e.g., providing written or verbal instruction on how to
101 accurately perform the prescribed exercise).

102 The review identified interventions that employed seven or less BCTs were most effective at
103 enhancing exercise adherence in this population, suggesting that overburdening patients
104 negatively impacts adherence. However, the review did not identify the context in which these
105 BCTs are most effectively delivered to people with PMSK pain. Understanding the context of an
106 intervention informs researchers and practitioners about the suitability and transferability of the
107 intervention to the context they are considering using for the intervention.¹¹ To build on these
108 findings, a qualitative study was conducted to further explore the contextual components that
109 influence exercise adherence in people with PMSK pain.

110 *Qualitative study exploring the barriers and facilitators to exercise adherence*

111 This step aimed to identify the contextual factors, such as environment and relationships that
112 influence exercise adherence. Semi-structured interviews were conducted with people with
113 PMSK pain (n=20) to explore their experience of adhering to prescribed exercise. Two focus
114 groups were conducted with physiotherapists (n=10) to explore their perceptions of exercise
115 adherence and prescribing exercise to people with PMSK pain. The methods and findings have
116 been published elsewhere.¹³ Four main themes were identified:

- 117 (i) The role of the physical and social environment to facilitate adherent behaviours.
- 118 (ii) The impact of a collaborative therapeutic relationship to develop a tailored
119 exercise prescription.

120 (iii) Facilitating self-management by providing support to overcome environmental
121 barriers and establishing realistic treatment expectations.

122 (iv) Understanding the influence and impact of pain and negative affect.

123 This study highlighted the need for personalised support to facilitate exercise adherence in
124 people with PMSK pain and to elucidate to patients the importance of identifying internal and
125 external barriers to behaviour in order to establish coping strategies to support self-management.

126 The PE group was consulted prior to, and following, the qualitative study to inform the
127 topic guide development and check the resonance of findings. Feedback on the topic guide
128 resulted in changes to language used when discussing exercise behaviours and ensuring the
129 questions elicited answers pertaining to prescribed exercise as opposed to general physical
130 activity (i.e., walking to work). Following data collection and generation of themes, a mind map
131 and description of the themes was shared, and members discussed the resonance of the themes.
132 The members understood the themes and could relate to them personally. The PE members
133 shared their preliminary ideas on how these finding might inform intervention progression. For
134 example, members discussed the importance of accessible instructions and reminders to do their
135 exercises throughout their day (for example, when waiting for a train).

136 *Summary of findings from step one*

137 The preliminary research identified the need for the intervention to be tailored and accessible to
138 the participants. Instruction, demonstration and practice of behaviour were identified as
139 important in the prescription of exercise as well as a component of goal setting and social
140 support. Personal and professional relationships influence adherent behaviours and there is a
141 recognised need to foster this to support patients in adhering to their prescribed exercises. The
142 influential content and context identified in the two studies were further explored in step two.

143 **Step Two: Develop theoretically informed performance objectives to form a matrix of**
144 **program objectives**

145 The second step in Intervention Mapping requires the specification of program objectives. First,
146 the findings identified in step one were matched to appropriate theoretical constructs to develop a
147 logic model (Figure 1). This allowed for a systematic conceptualisation of appropriate theoretical
148 models to underpin the intervention and target the behavioural factors.

149

150 **[Insert Figure 1 here]**

151 The logic model informed the development of a matrix of change objectives. This matrix
152 identified pathways to influence behaviour change by targeting program objectives and
153 identifying intervention methods and strategies. Each cell within the matrix contains one change
154 objective, identifying what the participant must change to accomplish the program objective
155 (Table 1). Intervention Mapping suggests referring to theory to inform this development.¹⁰
156 Considering multiple theoretical constructs is fruitful during initial steps of intervention
157 development to identify relevant constructs and begin to conceptualise how the constructs may
158 be modified.¹⁴ However, the predictive properties of the constructs cannot be tested if
159 determinants from multiple theories are employed. Therefore, one theory was selected to
160 underpin the intervention and inform the program objectives.

161 Participants in the empirical research and PE members spoke about the importance of
162 their exercises being tailored to support their physical and psychological needs, as well as their
163 current level of engagement with their program. An appropriate multi-staged theoretical
164 framework is the Health Action Process Approach (HAPA).¹⁵ This framework aims to move
165 individuals towards adherence by targeting planning and coping activities and factors identified

166 as having the strongest predictive power depending on their current stage of behaviour change.
167 HAPA theorises that risk perception, outcome expectations and task self-efficacy are most
168 influential for pre-intenders; intentions, planning and maintenance self-efficacy for intenders;
169 and recovery self-efficacy and action control for actors. These constructs align with the findings
170 identified in step one.

171 The authors of HAPA posit that self-regulatory and self-management processes are necessary
172 to achieve adherence to behaviour.¹⁵ Therefore, an intervention to enhance exercise adherence
173 may target these constructs with a tailored approach to support individuals' attempts at exercise
174 self-management. To target the behavioural and environmental factors as per the logic model, the
175 two key program objectives of this intervention were to:

- 176 i. Assist people with PMSK pain to enhance self-management techniques and skills
- 177 ii. Provide tailored, accessible instructions to aid adherence to a prescribed exercise program

178 **[Insert Table 1 here]**

179 **Step Three: Select methods and practical applications**

180 The third step comprised the operationalisation of the change objectives outlined in Table 1 into
181 theoretically informed methods. The PE members were consulted during this stage. Information
182 on the HAPA and how it informed the intervention development, as well as a draft of the logic
183 model informing the intervention development was shared. The members discussed how the
184 findings and their previous input shaped the intervention and confirmed that the two program
185 objectives aligned with their feedback. The members discussed the conceptualisation and
186 description of each point of contact of the intervention. Their input informed the methods
187 described below.

188 *Methods to address program objective one: assist people with PMSK pain to enhance self-*
189 *management techniques and skills*

190 To address the first program objective, the preliminary research identified the need for a patient-
191 centred intervention that is tailored and accessible. An approach that is often employed to
192 facilitate health behaviour change is motivational interviewing (MI).¹⁶ MI is a patient-centred
193 counselling style that has been found to be an appropriate method for use by healthcare providers
194 dealing with musculoskeletal issues.¹⁷ It has the flexibility to be employed by a variety of
195 healthcare professionals. This could enable the intervention to be readily implemented and was
196 therefore selected to target self-management and facilitate exercise adherence.

197 *Methods to address program objective two: provide tailored and accessible instructions to aid*
198 *adherence to a prescribed exercise program*

199 Virtual health programming (including digital, mobile and telehealth systems) has been shown to
200 produce positive return on investments¹⁸ and increase patient access and clinician productivity.¹⁹
201 It is not surprising that its use has grown rapidly worldwide.^{10,20,21} Virtual health offers greater
202 flexibility than clinic based healthcare and is a promising approach to deliver a theoretically and
203 empirically supported tailored program.²² It has been recognised as an advantageous option for
204 influencing exercise adherence.^{20,23} Due to its accessibility it was therefore selected as an
205 appropriate platform to deliver the intervention. The second intervention objective was met by
206 using online and app-based technologies to provide tailored and accessible exercise instruction.

207 **Step Four: Describe the program plan**

208 The fourth step of Intervention Mapping encompasses the comprehensive reporting of
209 intervention components. The Template for Intervention Description and Replication (TIDiER)²⁴

210 and the GUIDance for the rEporting of intervention Development (GUIDED)¹¹ were followed to
211 provide the description of the behaviour change intervention.

212 *Intervention content and mode of delivery*

213 The intervention was underpinned by the HAPA model. This model was used to identify the
214 constructs most salient to each individual and these constructs were mapped onto BCTs and
215 delivered using MI. The intervention was delivered virtually; MI was delivered over the video
216 conferencing platform Zoom (Version 2.0) and complimented by an app-based tailored exercise
217 program.

218 Training in MI is required by the healthcare practitioner to ensure consistent delivery.
219 The sessions were delivered by the first author, a PhD candidate in health psychology who
220 underwent training in MI supplied by the British Psychological Society. The delivery of each MI
221 session was guided by a structured session format to support consistency and fidelity to MI
222 practices. The intervention comprised four MI sessions, delivered online over seven weeks.

223 The primary purpose of the first session was to develop a rapport and relationship with
224 the participant. A goal for them to strive towards over the coming week was set in collaboration
225 with the participant. The subsequent sessions explored their experience with the goal and any
226 successes and challenges they encountered. Focus started to shift towards long-term planning
227 and to identifying barriers and solutions to overcome them. The last session explored
228 maintaining exercise behaviours by identifying support needs beyond the program; and how they
229 could find support for long-term adherence (Table 2).

230 Following the initial in-person physiotherapy assessment, the personalised exercise
231 prescription was provided by a physiotherapist through the app Physitrack. This app was chosen

232 for its access to an extensive library of exercises complete with video demonstration and
233 instruction of the exercises.²⁵ Once the physiotherapist created a prescribed exercise program the
234 participant received their personal link. The participant could then access the program and
235 indicate when they completed their exercises.

236 **[Insert Table 2 here]**

237 *Intervention delivery schedule*

238 Participant burden was taken into consideration in regard to session frequency and duration.
239 Consultations with the PE group verified the decision to reduce session frequency throughout the
240 intervention to facilitate self-management behaviours. Duration between MI sessions therefore
241 increased by a week each time until intervention completion. Following MI guidelines, session
242 duration was 30 to 50 minutes.¹⁶

243 **RESULTS**

244 **Initial program implementation and proof of concept testing**

245 The intervention was initially investigated in a small single arm proof of concept study with a
246 pre-post study design incorporating qualitative acceptability interviews. The aim was to
247 determine feasibility of delivery (recruitment, retention and adherence to study protocol) and
248 acceptability (to provide insight on what participants and study personnel liked or did not like
249 about the intervention) to inform intervention refinement. The study was approved by the King's
250 College London BDM Research Ethics Panel (Biomedical & Health Sciences, Dentistry,
251 Medicine and Natural & Mathematical Sciences), and informed consent was obtained by all
252 participants. Participants were identified by the physiotherapist during their routine
253 physiotherapy assessment at a private physiotherapy clinic in central London, UK. Inclusion
254 criteria included adults aged 18 and above, with musculoskeletal pain for three months or longer
255 and receiving physiotherapy and prescribed exercise for PMSK pain from the study
256 physiotherapist.

257 Thirteen eligible patients were approached over two months by the researchers and ten
258 people enrolled in the study (76.9% recruitment rate). Eight (80% adherence rate) participants
259 completed all measures before and after the intervention. Eight participants completed all

260 intervention sessions (80% retention rate) and the eight participants who completed the study
261 participated in the qualitative acceptability interview. Data was analysed thematically and three
262 themes regarding intervention acceptability were identified:

263 (i) A holistic approach to treatment

264 Many participants reported that the intervention provided a holistic approach to support
265 exercise adherence. The multimodal delivery of the intervention assisted them in
266 integrating their prescribed exercises into their lives by providing additional support and
267 personalised care.

268 (ii) The pros and cons of using virtual health to support exercise adherence

269 Virtual health was discussed both in terms of using the Physitrack app as well as the online
270 delivery of the MI sessions. Participants were favourable to the convenience and
271 accessibility of virtual health programs and felt it supported their efforts to exercise.
272 However, there was some rigidity and some of the participants expressed a desire for more
273 tailoring in the appointment schedule or more personal contact. While the online sessions
274 may have been convenient, some participants felt they needed more personal interaction
275 than what was offered.

276 (iii) The impact of the intervention on supporting self-management of exercise

277 Many participants discussed the aspects of structure and accountability that the intervention
278 had on their broader attempts to self-manage and adhere to exercise. Participants reflected
279 that MI facilitated a sense of control of their care and that their program could be tailored
280 to their lifestyle. Some noted they felt accountable to the MI practitioner, while recognising
281 that reliance on the practitioner may not support independent skill development to learn to
282 manage and self-monitor their own behaviours for long term adherence.

283 The physiotherapist who administered the exercise prescription also provided feedback
284 during an informal interview regarding the experience of using the app. The physiotherapist felt
285 that the app was time-intensive when searching for exercises within the library. It also did not
286 allow for small adjustments to be made to the exercises to highlight the effective execution (i.e.,
287 accurate range of motion or angle of joint) tailored to the need of the participant. The
288 physiotherapist suggested that it would be more appropriate to record the participant accurately
289 executing their exercises while recording them to upload onto Physitrack to accompany the written
290 instruction. The physiotherapist noted, however, that Physitrack encouraged patients to engage
291 with the exercises and this was seen as a benefit.

292 ***Refinements and modifications to the intervention following the proof of concept study***

293 The feasibility results and insight from the acceptability interviews informed study refinement
294 and progression. Refinement to the two components of the intervention were made (i) adapted
295 utilisation of the exercise app (ii) revision to the MI schedule to be more flexible and tailored.

296 Participants responded positively to using the app to access their exercises, however an
297 improved utilisation of its capabilities would have minimised the need for more physiotherapist
298 contact. Participants may be positively influenced by the knowledge that their physiotherapist
299 can provide feedback remotely, and regular remote engagement by the physiotherapist has been
300 found to support adherence.²⁶ Messaging through the app may support engagement with exercise
301 and ensure participants are reliably and consistently documenting exercise completion.
302 Furthermore, uploading videos of the participant accurately demonstrating the proper execution
303 of the exercise would provide additional individualisation for the participant while ensuring the
304 exercises provided are in line with the physiotherapist’s prescription.

305 Refinements to the MI schedule may increase flexibility and alignment with the needs of
306 the participant. Based on the HAPA model, individual needs differ depending on their current
307 exercise engagement.¹⁵ While the intervention aimed to target the constructs identified by the
308 HAPA, the predetermined session timetable may have hindered this. For example, a patient
309 actively engaged in their exercises (*actor*) may not require the same MI schedule as someone
310 still struggling to overcome barriers and initiate their exercise (*intender*). Once a behaviour has
311 been initiated, other constructs begin to influence maintenance of the behaviour.²⁷ A more
312 flexible, step-down approach may be more effective in eliciting self-management and supporting
313 exercise adherence.

314 **DISCUSSION**

315 The Intervention Mapping approach was successfully used to develop a behaviour change
316 intervention aimed at enhancing adherence to prescribed exercise in people with PMSK pain.
317 The approach guided the identification of program objectives, methods and theoretical
318 underpinning. The developed intervention was found to be feasible and acceptable to people with
319 PMSK pain.

320 This research described the explicit links between the existing evidence, underpinning
321 theory, and content to support future intervention implementation and evaluation. Consultation
322 and collaboration with PE members and stakeholders enhanced the likelihood of acceptability
323 and implementation in future clinical practice. The feasibility now needs to be determined by
324 further investigation of implementation and practicality of the intervention.

325 Following an implementation model such as the ORBIT model²⁸ would provide a
326 structured framework for further progression. The model proposes four phases (i) design, (ii)

327 proof of concept and pilot, (iii) efficacy trial and (iv) effectiveness trial. This paper described the
328 methods aligned to phase one and the beginning of phase two. To complete phase two, a full
329 feasibility study will be conducted to inform study parameters, such as sample size for a
330 randomised controlled trial to investigate intervention effectiveness, an assessment of who is best
331 suited to deliver the intervention, the feasibility of training other health professionals to deliver
332 the intervention, as well as the development and testing of a training package for the healthcare
333 professionals delivering the intervention.

334 Phase three will encompass an efficacy trial to ascertain clinical efficacy and provide
335 empirical insight. This will allow for an exploration of clinical significance and provide
336 empirical insight into the delivery of the intervention by different healthcare providers and
337 clinical settings.²⁸ Finally, if deemed appropriate, phase four will complete a full trial of the
338 revised intervention to determine effectiveness, cost-effectiveness, and provide a complete
339 process evaluation reporting implementation (e.g., treatment fidelity, dose, and reach).²⁹

340 **Strengths and limitations**

341 A strength of this study was the systematic development of an intervention using an Intervention
342 Mapping approach. The design was based on evidence from a robustly conducted systematic
343 review and qualitative research including patients and clinicians. A further strength was the
344 assessment of feasibility and independent qualitative assessment of acceptability of the resulting
345 intervention to inform modifications.

346 The intervention utilises virtual health technology, which is a strength, particularly
347 following the outbreak of the COVID-19 pandemic. The extent of the effects of COVID-19 are
348 still unknown, however adaptability of program delivery, particularly for individuals already

349 experiencing barriers to adherence, offers flexibility to withstand additional service delivery
350 barriers. It may also offer further opportunity for accessible, cost effective delivery to promote
351 service integration.

352 Assessing the intervention within current clinical practice was not determined. While
353 physiotherapists could be well positioned to deliver MI, this was not assessed and is a limitation
354 in terms of intervention implementation. Another important limitation is that the intervention
355 comprised both MI and an app-based exercise prescription that were delivered together and it is
356 not possible to identify the effects of the two in isolation. While this was a pragmatic approach
357 often used in intervention development; the separate assessment of these intervention
358 components should be investigated.

359 The intervention was developed and tested in a UK context. Participant recruitment in
360 London, UK may not be representative of a wider population base. However, the findings are
361 applicable to a Canadian healthcare system to inform practice.

362 **Implications for practice**

363 The intervention is well aligned with recommendations calling for further development
364 informing the treatment and management of PMSK pain.³⁰ Complementing physiotherapy with
365 virtual interventions has drastically and rapidly increased and there is evidence to support its role
366 in enhancing adherence to treatment recommendations.^{20,31} While the intervention supports the
367 current clinical directions in the treatment and management of PMSK pain,³¹ it is still not clear
368 who is best to deliver it. Canada is leading the way in biomedical pain research, however there is
369 a need to provide insight into cost effective therapies while ensuring knowledge translation
370 activities to provide further integration into practice.³⁰ It is believed that the transparent and

371 systematic approach of this research will aid in further development of effective programs to
372 support exercise adherence in a PMSK pain population.

373 In summary, the intervention is promising and may provide a strategy to promote enhanced
374 engagement with prescribed exercise in people with PMSK pain. Reinforcing physiotherapy
375 treatment guidelines with the skill sets of other health professionals would enable the
376 comprehensive, multidisciplinary care this population needs. Future research could explore the
377 delivery of this intervention by allied health or non-clinical staff, such as fitness professionals,
378 healthcare assistants or technical instructors.³¹

379 **CONCLUSIONS**

380 The Intervention Mapping approach was useful to guide the development and initial testing of an
381 intervention to enhance exercise adherence in people with PMSK pain. There are many avenues
382 to pursue in the next steps of this research agenda, however the intervention aligns well with
383 current clinical directions in the treatment and management of PMSK pain.

384

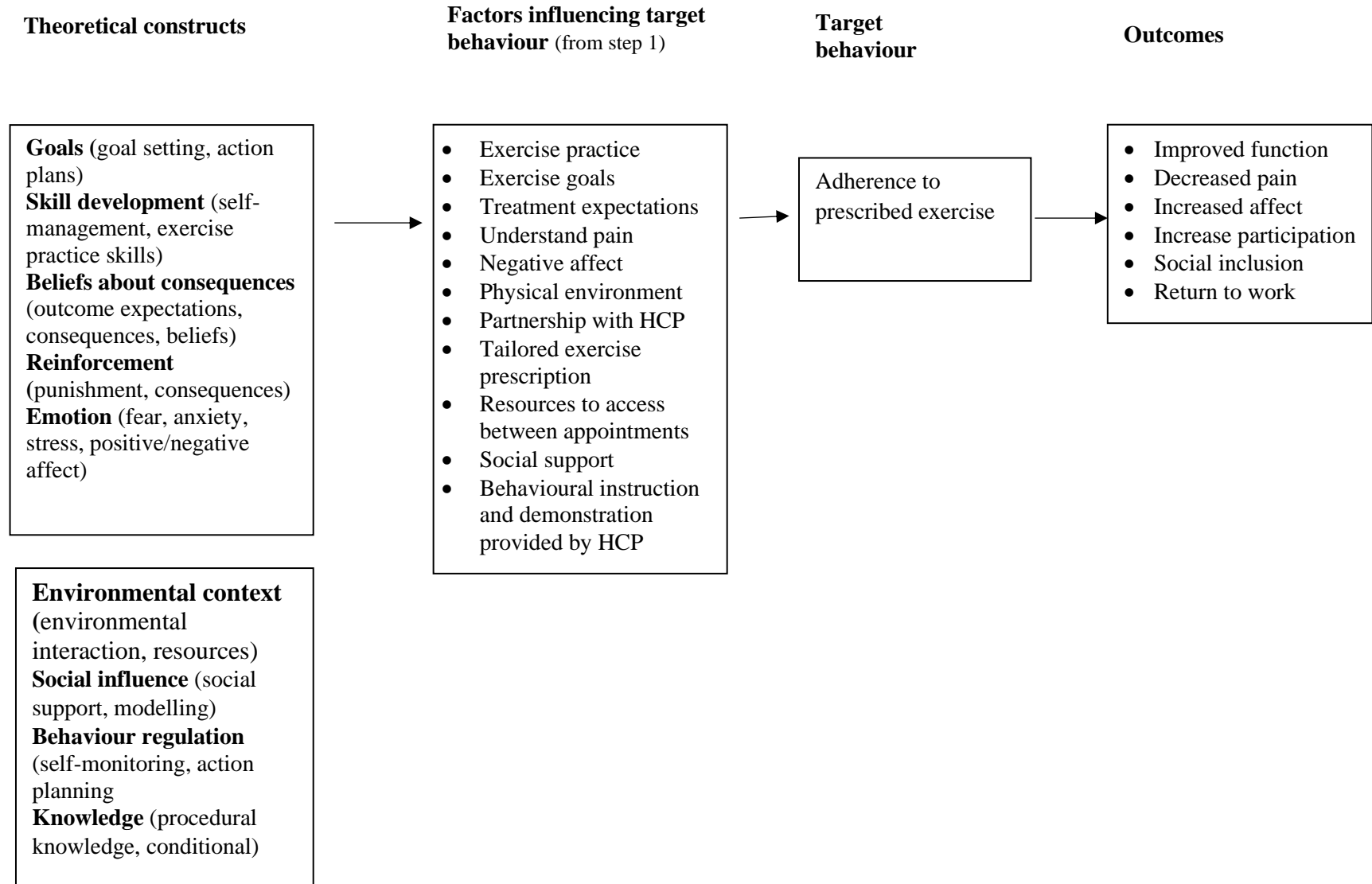
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474 **Figure 1 Intervention Logic Model**



475 **Table 1 Matrix of Change Objectives for the Two Program Objectives**

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Program Objective One: Assist People with PMSK Pain to Enhance Self-management Techniques and Skills								
Behavioural constructs (from logic model)								
Performance objective	Goal setting	Skill development	Emotional regulation	Outcome expectations	Self-monitoring	Action planning	Self-efficacy	Knowledge
Formulate individualised strategies to overcome barriers to exercise	Set goals of when, where and how to complete exercises	Teach how to do exercises in space available	Awareness of fear around reinjury or increased pain	Awareness and understanding of treatment and exercise outcomes	Monitor behaviours and lapse in adherence	Detailed plan about how goals will be achieved	Express ability/confidence to complete exercises	Understand how to do exercises and where to access additional support
	External/environmental constructs (from logic model)							
	Physical prompts		Restructure physical environment		Tailoring		Social support	
Add objects to the environment to facilitate exercise		Develop an accessible space to facilitate exercise		Tailor program to lifestyle and needs		Identify sources of support necessary to facilitate behaviour		
Program Objective Two: Provide Tailored and Accessible Instructions to Aid Adherence to a Prescribed Exercise Program								
Behavioural constructs (from logic model)								
Performance objective	Knowledge		Skill development		Emotional regulation		Self-efficacy	
Have access to tailored prescription of exercise	Provide demonstration of proper exercise technique		Provide instruction and motivation on how to complete exercise correctly		Develop skills to manage emotions		Expresses confidence in completing exercises correctly	
	External/environmental determinants (from logic model)							
	Physical prompts/reminders		Social support/influence		Consequences		Tailoring	
Initiate practice of exercises		Provide therapeutic support for patient		Provide expected outcomes of exercise		Provide opportunity to select more suitable exercises		

477 **Table 2 Intervention Components**

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Motivational interviewing sessions					
	Session one	Session two	Session three	Session four	
Aim	Assess expectations and level of understanding	Taking constructive steps towards behaviour change	Tackling unhelpful thoughts	Looking long term	
Content	Building collaborative therapeutic relationships; establishing realistic treatment expectations; goal setting	Exploring current physical and social environment; goal setting	Exploring the relationship with pain and negative affect; goal setting	Barrier identification and long-term planning; planning for relapse; goal setting	
Physitrack app					
Aim	Provide a tailored and personalised exercise prescription and additional social support				
Content	Written instruction	Video demonstration	Behavioural practice	Exercise reminders	Adherence tracker

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