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The factors that influenced physical activity in insufficiently physically active hospital patients: a qualitative study informed by the theoretical domains framework and COM-B model

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3 **The factors that influenced physical activity in insufficiently physically**
4 **active hospital patients: a qualitative study informed by the theoretical**
5 **domains framework and COM-B model**
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For peer review only

ABSTRACT

Objective: Behaviour change interventions targeting changes in physical activity (PA) can benefit by examining the underlying mechanisms that promote change. This study explored the use of the capability, opportunity, motivation and behaviour (COM-B) model and the Theoretical Domains Framework (TDF) to code and contextualise the experiences of patients that participated in a PA coaching intervention underpinned by Motivational Interviewing (MI) and Cognitive Behaviour Therapy (CBT).

Design: Semi-structured interviews were conducted with a purposive sample of participants.

Setting: Interviews were conducted in a tertiary hospital in regional Victoria, Australia.

Participants: Eighteen patients that participated in a PA coaching intervention were interviewed.

Results: Four participant themes mapped directly onto five components of the COM-B model, and ten of the TDF domains. Increases in PA were influenced by changes in motivation and psychological capability. The autonomy-supportive PA coaching intervention helped to evoke participants own reasons (and motives) for change and influenced PA behaviours. Participants reflected on their own social and/or professional strengths, and utilised these skills to set appropriate PA goals and action plans. The structure of the PA coaching intervention provided clarity on session determinants and a framework from which to set an appropriate agenda. Relational components (e.g. non-judgemental listening, collaboration) were continually highlighted as influential for change, and should be considered in future behaviour change intervention design.

Conclusion: We demonstrate the beneficial effect of utilising theory-informed Behaviour Change Techniques (BCTs), and delivering them in a style that promotes autonomy and relatedness. The views of participants should be a key consideration in the design and implementation of PA coaching interventions.

Keywords: exercise motivation; self-determination; motivational interviewing; behaviour change

ARTICLE SUMMARY

Strengths and limitations of this study

- This is the first qualitative study to apply the COM-B model and the TDF to help understand the experiences of insufficiently physically active adults that participated in a PA coaching intervention underpinned by MI and CBT
- By utilising theoretical behaviour change models we provide a robust basis for understanding determinants of PA behaviour change, giving an indication of *what* is required to change behaviour and the BCT techniques that can influence this.
- Identifying relational components (e.g. non-judgemental listening style) provides specificity on *how* to deliver behaviour change interventions to support PA behaviour change.
- The findings of this study can be used to influence future intervention design, delivery as well as monitoring and evaluation.
- The sample was exclusively non-admitted hospital patients that participated in a PA coaching intervention, and additional perspectives may provide a broader overview to inform intervention development.

only

INTRODUCTION

Regular physical activity (PA) is positively associated with numerous health-related benefits and a marked reduction in risk for chronic disease.^{1,2} Although the importance of regular PA has been widely publicised, large numbers of adults do not undertake the recommended levels of PA.³ For example, only 50% of adults in the USA and 56% in Australia undertake the required amount of PA to be deemed sufficiently physically active.^{4,5} Behaviour change interventions have been increasingly used in an attempt to influence PA change, however numerous systematic reviews and meta-analyses demonstrate that high proportions of participants revert to insufficient PA levels once the behaviour change intervention is ceased.⁶⁻⁸ The marked reductions or cessation of PA can nullify the health improvements gained from temporary PA increases.⁹ Consequently, there is a need to develop behaviour change interventions that strengthen the maintenance of PA over time.¹⁰

Rothman suggested that theory-informed interventions can be effective for promoting maintenance of behaviour change.¹¹ Michie and colleagues expanded on this more recently, proposing that behaviour change interventions need to address specific determinants of change, namely capability, opportunity, and motivation (COM-B model).¹² These determinants of behaviour change differ substantially from initiation of change to maintenance.^{12,13} The techniques required to influence motivation to initiate change can be different to those required to influence motivation to maintain change.¹³ Most behaviour change interventions predominantly focus on behaviour change initiation, and strategies and determinants for behaviour change maintenance are often ignored.^{10,14} The majority of individuals people drop out of lifestyle behaviour change interventions up to 12 weeks, emphasising the need for action planning that emphasises strategies for maintenance.¹⁰ Using the same theoretical constructs for behaviour change initiation and maintenance might not account for variations in capability, opportunity, and motivation, many of which can be driven by intentions, past experience, and environment.¹² There is a need to explore the potential determinants of successful PA maintenance to assist in the development of interventions to produce lasting change.

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3 Motivational Interviewing (MI) was developed to elicit motivation for behaviour change from the
4 individual.¹⁴ Motivational interviewing is an autonomy supportive intervention and seeks to empower
5 clients to voice their own reasons and strategies for change.^{14,15} As MI strategies for behaviour change
6 maintenance are less specific, and are not emphasised as part of the four MI processes, the integration
7 of action-orientated interventions such as cognitive-behavioural therapy (CBT) has been
8 recommended.¹⁶ Cognitive-behavioural therapy involves assisting clients develop strategies and skills
9 to change behaviours.¹⁷ Instead of being passive recipients of CBT skills training, the integration of
10 MI and CBT (MI-CBT) can ensure that clients' have autonomy around the focus and direction of
11 change, which might support maintained change.¹⁰ Integrated MI-CBT has demonstrated effectiveness
12 for the maintenance of PA behaviour change across a number of studies,^{18,19} however participant
13 experiences of the intervention are absent from the literature.

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29 Qualitative approaches are beneficial to capture individuals in-depth perspectives of the phenomenon
30 studied, in this case, their experience of the PA coaching intervention.²⁰ This study examines the
31 views of insufficiently physically active individuals enrolled in a randomised controlled trial that
32 examined the effectiveness of a MI-CBT based PA coaching intervention for changes in PA and
33 health-related outcomes.¹⁹ Relative to control, the intervention group demonstrated significant
34 changes in PA that were maintained 9 months after the commencement of the PA coaching
35 intervention.¹⁹ At present, we do not understand what influence contextual factors (mode of delivery,
36 behaviour change techniques, therapeutic alliance) within the coaching intervention might have had
37 on these findings. Thus, the aim of this current study was to qualitatively explore the experiences and
38 perceptions of individuals who received the MI-CBT based PA coaching intervention to identify
39 determinants and facilitating factors that influenced PA behaviour change. These insights will provide
40 a deeper understanding of their experiences, and might offer valuable information to assist health
41 professionals to improve intervention effectiveness and uptake.

METHODS

This study employed a qualitative design using an interpretive description approach,²¹ and adopted the Consolidated Criteria for Reporting Qualitative Research.²² Semi-structured interviews were conducted with a purposeful sample of insufficiently physically active adults who participated in a PA coaching intervention. A detailed description of the PA coaching intervention (H4U-2) including the intervention schedule, theories and techniques is available in the published literature.¹⁹ Ethical approval was obtained from the research Ethics Committees of the study hospital and associated university.

Sampling and recruitment

All H4U-2 trial participants were asked to complete an evaluation form at the 9-month follow-up which included a question about whether they would be willing to participate in a semi-structured interview. Individuals who responded with “yes” (n = 72) were considered as the sample eligible to participate in this study. A purposive sampling procedure was used. We aimed for a variation in the participants’ (i) change in PA, measured using accelerometers; (ii) engagement with the behaviour change intervention, identified by the intervention provider; (iii) gender and age to reflect the sample in the population; (iv) geographic location (rural or regional); and, (v) socio-economic status, using postcodes as a proxy. A research assistant contacted the individuals to confirm their wish to participate. Permission was sought to give their contact details to the interviewers.

Twenty five people were invited to participate. Two individuals declined; one reported no longer wishing to participate and the other individual cited health issues. The participant recruitment ceased when we met our variation sampling requirements and reached data saturation. Data saturation was considered to be reached when the analysis indicated that additional interviews were not providing new concepts and the data provided were sufficient to address the research aims.²³ No new significant information was derived between the seventeenth and eighteenth interviews, indicating that data

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3 saturation was reached and interviewing was ceased.²³
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7 **Interview process**

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10 Written informed consent was obtained from all participants at the start of the interviews. Face-to-face
11 interviews were carried out in the Health Promotion department of the associated hospital between
12 June and September 2020. The interviews were carried out by the first author who was a PhD
13 candidate with experience in carrying out qualitative interviews. A semi-structured interview schedule
14 was developed based on existing literature^{24,25} and was used to facilitate the discussion
15 (Supplementary Material 1). The interview schedule and process were piloted by interviewing three
16 individuals that took part in a MI-CBT based PA coaching intervention delivered by the Health
17 Promotion department of the associated hospital. Following this pilot, additional questions, probes
18 and prompts were included to further explore individuals' experiences in terms of engaging in the
19 behaviour change intervention. The pilot interviews were not included in the final sample as the
20 individuals were not enrolled into the study.
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35 **Data analysis**

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38 Interviews were audio recorded, transcribed verbatim and rendered anonymous. Participants were
39 identified as participant 1, participant 2 and so forth. The transcripts were analysed using an
40 interpretive description method.²¹ NVivo 12 software (QSR International, Cambridge, MA, USA) was
41 used to facilitate data analysis. The interpretive description approach requires emersion into the data
42 to identify thematic patterns, and an inductive analysis to permit theorising about explanatory
43 factors.²¹ We developed a draft coding frame to capture codes and emerging categories. The coding
44 frame was trialled by authors (SB¹ and KR) who independently coded 20% of the transcripts. A
45 revised version of the framework was co-developed and tested; this version was used to code all
46 transcripts. The first author independently coded 18 transcripts, and two authors (KR and GB)
47 independently coded 9 transcripts each. The level of agreement between independent coders was
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3 substantial. Disagreements were resolved through discussion amongst all coders.
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8 Following this stage, the identified categories were mapped against the TDF²⁶ and COM-B model.¹²
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10 We mapped the broad categories onto the TDF domains, as well as directly onto the six components
11 of the COM-B model. Participants' responses were analysed for descriptions of BCTs and skills used
12 as part of the PA coaching intervention. The technical components of the interventions were mapped
13 against Michie's BCT taxonomy,²⁷ and MI processes, relational components and micro-skills.²⁸ The
14 mapping of draft themes and findings were discussed amongst all authors to investigate a broad
15 perspective on thematic interpretations. Disagreements between the team were resolved through
16 discussion. The vigour of the qualitative research was strengthened through the implementation of
17 independent coding; triangulation of data, and the critical appraisal of developing themes.²⁹
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29 **Patient and public involvement**

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31 The research was designed and conducted without patient or public involvement.
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36 **RESULTS**

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38 Eighteen people participated in semi-structured interviews, where 13 (72%) were women and 5 (28%)
39 were men. The average age of participants was 54 (\pm 5) years, with participants ranging in age from
40 42 to 66 years. Table 1 provides details of the participants' characteristics. All participants had
41 completed the PA coaching intervention when the interviews took place. The interviews ranged in
42 duration from 26 to 45 minutes, with an average duration of 34 minutes.
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50 Perceptions of the PA coaching intervention were positive, including those participants who did not
51 find the intervention beneficial for maintaining PA change. The structural components (i.e. defined
52 session times and parameters) of the PA coaching intervention provided the participants with a clear
53 indication of what was involved, while the relational components (i.e. MI spirit; collaboration,
54 empathy, evocation, autonomy) provided a platform for the participants to engage and focus on their
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reasons for change. The structural and relational components highlighted by participants are detailed in Table 2.

Table 1 Profile characteristics of participants (N = 18)

Marital Status	
Married/living together	15
Widowed	1
Single	2
Highest completed education	
Secondary/high school	4
Post-school vocational	8
University	6
Employment	
Working full-time	13
Working part-time	3
Retired	2
Geographic location	
Regional	12
Rural	6
Socioeconomic area ^a	
1	4
2	4
3	6
4	4
5	3
Physical activity level at end of intervention ^b	
Meets guidelines	13
Does not meet guidelines	5
Pattern of physical activity from baseline to final measurement ^a	
Increased	13
No change	4
Decreased	1

^a Index of Relative Socio-economic Disadvantage (IRSD) SEIFA scores. IRSD data is presented as quintiles where 1 represents most disadvantaged, and 5 represents least disadvantaged.

^b Physical activity measurements taken from accelerometer data

Four themes were identified that mapped across 5 of the COM-B components and 10 domains of the TDF framework (Table 3). The themes included strength based coaching, autonomy-supportive listening, reframing PA goals, and self-regulation. As evidenced in Table 3, the themes mapped to multiple COM-B components and TDF domains; as such the findings are presented below under the identified COM-B heading, and related TDF domain sub-heading. These findings are described in detail below and supported using illustrative quotes from participants. The categories that informed

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3 these themes are presented in Supplementary Material 2.
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8 **Capability – psychological** 9

10 *Knowledge* 11

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13 Increased knowledge was not described as a key component that participants needed in order to
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15 increase PA. The participants repeatedly stated that they did not need to be told they would benefit
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17 from increasing PA.
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22 Anyone who is unfit knows they need to get fit – simple. But just telling them won't make a
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24 difference. (Female, 51)
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29 The participants highlighted how the PA coaching intervention used their existing skills to facilitate
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31 changes in PA. This strength-based, person-centred, approach did not seek to impart knowledge,
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33 rather it sought to evoke personal capabilities from the individual, and to build their autonomy in
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35 applying this knowledge towards initiating and sustaining changes in PA.
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40 The coaching was good, and I think spent lots of time looking at things I was good at, and sort
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42 of, how to apply these to my exercise. But it forced me to have a good look at myself, and
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44 what I was good at and probably not too good at, and at the time it took me a while to be
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46 comfortable with both. (Male, 52)
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Table 2 Technical, relational and structural components of the physical activity coaching intervention

Component	Description	Illustrative quotes
<i>Technical/Relational</i>		
Being heard	Listening to the individuals' unique issues and needs.	<i>"And I liked being listened to – I think that was another big one. I find sometimes if you are talking to someone who works in health, or it could be any profession but you don't get the feeling that they aren't even listening. They sit there looking at you and the head is bobbing away, but they are just waiting for you to stop talking so they can get their opinion in. But to be listened to, and I mean really listened to is quite important. Not a token gesture"</i> (Female, 61)
Collaboration	Participants reported that they did not feel like they were being told what to do. The intervention helped support their decisions.	<i>"So you feel listened to, but there isn't a pressure to do what you don't want. You are driving the bus, and you know where you want to go. And the coaching is like a copilot, trying to navigate the best route. Both heading in the same route, but with freedom in how to get there".</i> (Female, 56)
Guiding style	Autonomy supportive style, directive towards physical activity changes that were chosen by the individual.	<i>"It was clear with what we wanted to do – get me fitter. But I really felt like I was in control, nothing was forced upon me, and I could do things at my own speed".</i> (Female, 53) <i>I think that it's not just a conversation, but the kind of conversation. . So its guidance towards what's right, not a push. Because you push me and I'll push right back".</i> (Male, 51)
Supporting self-efficacy	Recognising that the individuals had the self-knowledge to manage their health; support was to draw these strengths out from them.	<i>"How can I run, and forgive me for saying, a successful business, and I can't manage my own fitness. That wasn't the question, but the process made me think about it. How do I use my skills, skills I already have to make the change?"</i> (Male, 56)

Big picture perspectives	Participants mentioned the implementation of strategies to support maintained change from early in the intervention.	<i>“Questions like ‘how will you manage if you cannot attend your exercise group?’ seemed odd to me. But then you know, months later and the gym is shut and I had to change tact to be active elsewhere. So it was good to have considered the what-if type thing”. (Male, 49)</i>
Structural		
Defined parameters	The use of clear descriptions for intervention sessions help clarify the goals of the sessions.	<i>“I felt I was kind of allowed to map the route for myself, I wasn’t forced down an alleyway. I didn’t have free reign, because the sessions started and ended with a rough guide of what we would do, so there was some bit of boundaries on it from that”. (Female, 50)</i>
One to one	Provided an environment where participants felt comfortable to be open.	<i>“I just know I wouldn’t be comfortable expressing doubts about myself in a groups setting”. (Female, 60)</i>
Telephone delivery	Beneficial for practical reasons such as travel. Some individuals enjoyed the 1:1 relationship without the face-to-face requirement.	<i>For me it was great, I was able to schedule a session towards the end of the work day, did it from the office and then I was able to leave work and concentrate on me”. (Male, 53)</i>
		<i>“I found it comforting to not have to look face to face while we were doing it. So having that physical distance allowed me to, to pace the hallways when I spoke if I needed, to laugh at myself or, frown or whatever. And that I think would have made me more relaxed overall”. (Female, 52)</i>
Session timeframes	The number of session and their spread over time permitted relationship to grown, and allowed time to plans into action. Knowing sessions were coming up influenced accountability.	<i>I’ve been to session before, with the physio say, and 15 minutes in he is writing my goals for me. But they aren’t my goals at all.... It was nice to be able to decide for myself, at my own pace”. (Male, 55)</i>

Table 3 Mapping of themes to TDF domains and COM-B model with the associated BCTs

Theme	COM-B component	TDF Domain	BCT ^{a b}
	Capability – Psychological	Knowledge	Identification of self as role model ^a Evoked personal capabilities ^b
• Strength based coaching	Capability – Psychological	Skills	Goal setting (behaviour) ^a Goal setting (outcome) ^a Acceptance ^b Evoked reasons for goals ^b
	Capability – Psychological	Behaviour regulation	Self-monitoring of behaviour ^a Problem solving ^a Anticipated regret ^a Evoked (commitment) ^b Plan ^b
	Opportunity - Physical	Environmental context and resources	Reframing ^a Commitment ^a Salience of consequences ^a
• Autonomy-supportive listening	Opportunity - Social	Social influences	Comparison ^b Acceptance ^b

	Motivation - Automatic	Emotion	Monitoring of behaviour by others without feedback ^a Engagement ^b Reflective listening ^b Evoke reasons for change) ^b Compassion ^b
• Reframing physical activity goals	Motivation - Reflective	Intentions	Discrepancy between current behaviour and goal ^a Pros and cons ^a Reframing ^a Focus to clarify agenda ^b
	Motivation - Reflective	Goals	Discrepancy between current behaviour and goal ^a Identification of self as role model ^a Evoke reasons for goals ^b Acceptance ^b
• Self-regulation	Motivation - Reflective	Social/professional role and identity	Focus on past success ^a Identification of self as role model ^a Evoke personal capabilities) ^b
	Motivation - Reflective	Beliefs about capability	Comparative imagining of future outcomes ^a Review behaviour goal(s) ^a Acceptance ^b Evoke personal capabilities) ^b

^a BCT taxonomy (Michie, van Stralen, and West 2011) ^b Motivational Interviewing techniques (Hardcastle et al. 2017; Miller and Rollnick 2012)
 BCT: Behaviour change technique; COM-B: Capability, Opportunity, Motivation, Behaviour; TDF: Theoretical Domains Framework

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4 Emotion - (Complex reactions - fear, anxiety, affect, stress, depression, positive and negative effect, burn out)
5 Intentions (A conscious decision to perform a behaviour)
6 Social/professional role and identity (Set of behaviours and displayed personal qualities in a social or work setting)
7 Skills (An ability or proficiency acquired through practice)
8 Beliefs about capability (Acceptance of the truth, reality or validity about an ability, perceived behavioural control, self-esteem, confidence)
9 Environmental context and resources (Person's situation or environment)
10 Social influences (Process that can change thoughts feelings or behaviours – social pressure).
11 Knowledge (Awareness of the existence of something: knowledge of condition)
12 Behaviour regulation (Managing or changes action – self monitoring)
13 Goals (Mental representations of outcome or end states that an individual wants to achieve)
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Skills

Although the individuals were recruited from a secondary care hospital clinic, physical capability was not discussed as a barrier to increasing PA. The participants did not indicate that they needed to be provided education on what exercise to do, or the skills required to do it. Instead, participants noted how in the past they felt that they did not have the ability to increase or maintain PA from a psychological or emotional perspective.

What was stopping me from being fit before...it was the mind. Not the body. I could physically do it, but not mentally. (Male, 50)

Similar to the construct of knowledge, participants expressed how the intervention strategies sought to evoke from them examples of the skills that they possessed.

On paper being fit is easy right. You want to walk, get up and walk. And yet I sat at home on the couch feeling bad for myself for not exercising, even though I can walk. Me, a grown woman, house, kids, job. Can run them all and I wasn't able get off the couch. So I needed a shift in perspective. (Female, 55)

Behavioural regulation

Many of the participants described making numerous attempts at increasing PA in the past, only to lapse back to being insufficiently physically active. The inability to maintain regular PA over repeated attempts had diminished their self-efficacy to be physically active. The MI-CBT intervention used in the H4U-2 study employed specific BCTs to influence behaviour regulation as early as session 3 of the intervention. The process of exploring capability to maintain PA changes was new to many participants, as exemplified by the following quote.

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3 I think we weren't long into it, and I had started to do some exercise. And I was feeling good.
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5 He [intervention provider] started asking me about how I would manage to be fit if something
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7 happened, can't remember exactly, say, my strength training class finished up or something.
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9 And I was thinking, shouldn't he be telling me I was doing a good job. But you know, when
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11 you have to think about it, and explain yourself out loud it gets the wheels turning, and you
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13 have to think 'how would I do it?' Because I've slipped off the wagon before.
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18 **Opportunity – physical**

19 *Environmental context and resources*

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23 Physical opportunities were discussed alongside the shift in perspectives that many participants
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25 encountered, from PA being something that they had to do, to something that they wanted to do. The
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27 reframing of PA to something that was attainable and enjoyable resulted in individuals placing a
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29 higher value on PA; when PA was afforded a higher value, people made time for it irrespective of
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31 previously cited situational or environmental barriers.
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37 I used to drive to work every day. Its 2.2 KMs, which I know now because of walking. And of
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39 course you know how bad parking can be, so I'd probably spend ages looking for a park. Now
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41 I walk every day, to and from work. If it rains I can bring broolly, or drive if it's really bad. But
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43 I don't think of driving anymore, I enjoy the walk and it's a part of my day. (Female, 46)
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48 **Opportunity – social**

49 *Social influences*

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53 Some of the participants enrolled in community exercise programs, for example walking groups and
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55 strength training programs. The building of social links within groups was highlighted by some as an
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57 important factor for continuing attendance, though many others were not concerned with building
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3 social connections within PA groups.
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8 A large part of what kept me going back to the group was the friendship I made with other
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10 people. I was only there for a few sessions and a bunch of them invited me to come along for
11
12 coffee afterwards. That was always helpful in getting me along to sessions. (Female, 58)
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16
17 The social influence of partners and significant others was regularly discussed, primarily as it related
18
19 to the provision of unsolicited, didactic advice. The participants were aware that they were not
20
21 undertaking sufficient PA, they did not need this to be pointed out by their partners and significant
22
23 others. This didactic style of support contrasts with the relational components of the PA coaching
24
25 intervention such as autonomy-supportive listening and collaboration, components that participants
26
27 found beneficial in influencing PA change.
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32 There is always time for the right advice, and pointless advice is, well... pointless. (Female,
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34 62)
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39 My husband was with me on the appointment, and he thought it was great that the surgeon
40
41 discussed me getting fit. He's been on my back for a while about it. So, he is often asking
42
43 when I'll do more exercise, but I'll tell you what, that makes me want to do even less in spite
44
45 of him. Even though I knew I needed to do it. The fact that he was telling me to do more
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47 made me want to do less to show him. (Female, 48)
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51 **Motivation - automatic**

52 *Emotion*

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55 The repeated attempts to engage in regular PA resulted in a feeling of helplessness in many of the
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57 participants who enrolled in the PA coaching intervention. The sense of disappointment expressed by
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3 participants was compounded by the fact that the barriers to regular PA were not physical, but
4
5 psychological and specifically emotional. The inability to maintain regular PA likely influenced the
6
7 participants PA self-efficacy levels, and by extension their automatic motivation.
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12 When you have a few cracks at it, and you keep ending up in the same place, it doesn't feel
13
14 good. You tell yourself, and maybe a friend 'that's it, I'm going to get myself in shape'. Then
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16 two months later they ask you how that's going and you are ashamed that you haven't done a
17
18 thing. And that does nothing for the self-confidence. (Female, 46)
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23 I'm not afraid to say it, I needed the support. I mean, if I didn't I wouldn't have joined the
24
25 coaching. I just wasn't able to do it alone. My motivation was shot, I wasn't, maybe, thinking
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27 clearly about it. Probably fed up and disappointed trying the same thing over and over and not
28
29 going anywhere. (Male, 50)
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32 33 34 **Motivation - reflective**

35 36 37 *Intentions and goals*

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40 Many participants described how previous attempts at PA were driven from a desire to lose weight.
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42 When these attempts did not result in sustained PA levels or weight loss, they were sources of
43
44 frustration. It was commonly reported that the intervention looked to reframe PA from a weight loss
45
46 tool to something that might deliver general health benefits. This was followed with a change in goal
47
48 setting for outcomes. Shifting goal setting away from weight loss metrics changed the overall
49
50 intention of being active, and having flexible goals removed the notion of a binary outcome of
51
52 meeting or not meeting goals.
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57 For me, exercise was always about weight. Always. If I didn't reach the target I failed. And
58
59 generally, I didn't meet the target. So that was no good. But now I don't exercise for weight; I
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3 exercise for me. To make me feel good, and I am so much better for it. (Female, 55)
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8 *Social/professional role and identity*
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10 The concept of social or professional role was commonly described by participants as a tool used
11 within the PA coaching intervention to elicit from participants areas of their life that they felt they had
12 achieved or maintained success in, and formulated part of the strengths-based approach to making PA
13 changes. Many participants were in full time employment with partners and dependent children. They
14 commented how the PA intervention required them to reflect on the strengths they have and
15 commonly use in these social and/or professional roles. This approach evokes personal or professional
16 capabilities, and the participants were able to reflect on where a transference of skills to PA was
17 possible.
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30 So, they didn't use these words, but I needed to think on the lines of 'how can I run a team,
31 which I think is reasonably successful, and I can't get myself in shape'. Not those words, but
32 there was some, maybe, probing maybe. And you know, I thought, 'hey I am someone, and I
33 can do this'. It wasn't a kick in the bum, but it made me sit up a bit. (Female, 51)
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41 *Beliefs about capability*
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43 Participants beliefs about their capabilities were closely linked to the TDF domains of intentions and
44 goals. As an example, exercising for weight loss and failing to attain weight loss goals resulted in a
45 negative mindset and low self-efficacy. By reviewing and revising behavioural goals and learning
46 from previous attempts, the participants noted a shift in their perceptions on capability. When
47 discussing their attempts to be active before the PA coaching intervention some of the foremost
48 feelings that prevailed were those of frustration and disappointment. By reframing intentions and
49 altering their goals participants expressed a greater degree of confidence in their ability to maintain
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3 regular PA.
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8 Once I got going, then talking about reviewing the goals, and modifying, making harder, or
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10 easier as needed, [that] was all fine. The actual tasks right, the exercise itself, or the goal
11
12 setting – they aren't hard to do. It's not overly complicated. But... but you need to be smart
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14 about it and sometimes we get ourselves into a right spot that we can't see the timber from the
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16 forest. And the coaching can pull your head in a bit and give you perspective. (Female, 52)
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20 21 **DISCUSSION** 22

23
24 The aim of this study was to explore participants' perceptions of the factors that influenced their
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26 behaviour change throughout the course of a PA coaching intervention delivered using a MI-CBT
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28 framework. Inductive analyses resulted in the identification of several BCTs that participants found
29
30 influenced their PA, and the patients' experiences of the PA coaching intervention was systematically
31
32 mapped to the TDF and COM-B models. The interviews identified a wide range of barriers that
33
34 influenced participants' capability, opportunity, and motivation to undertake regular PA, as well as
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36 the key elements of the PA coaching intervention that addressed these barriers. These key elements
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38 identified by participants included the combination of relational factors, namely the MI spirit used to
39
40 underpin the intervention, and the technical factors which were the CBT skills that were utilised. The
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42 PA coaching intervention was designed to ensure that MI and CBT were integrated together in all
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44 sessions, and the fidelity of delivery was measured.¹⁹ The participants highlighted the synergistic
45
46 advantages of receiving both MI and CBT techniques to motivate and promote lasting PA change.
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52 Changes in reflective motivation was one of the dominant components that influenced participants'
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54 behaviour change throughout the course of the intervention. Participants attributed a major change in
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56 intentions towards PA because of the intervention, specifically the shifting of perspectives away from
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58 PA being something they had to do to something they valued.³⁰ By reframing their intentions, the
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3 participants set goals appropriate to their needs and importantly, their sense of capability.³⁰ Gaining a
4 sense of control and self-belief was consistently highlighted amongst those who were successful in
5 increasing PA. This relates closely with the need for self-efficacy for behaviour change.^{31,32}
6
7 Participants consistently noted that the strengths-orientated approach of the MI-CBT intervention
8 helped build this self-belief. The evocation of personal capabilities is encouraged within MI,^{14,15}
9 participants stated that reflecting on their capabilities within their social and/or professional role
10 highlighted their existing strengths. This demonstrated to individuals how to recognise the self-
11 regulatory skills they already had, and how these skills could be transferred to the attainment of
12 regular PA.³³ Instead of providing expert advice, the integration of MI-CBT permitted the individuals
13 to voice their intentions and goals, to understand what skills were needed to achieve these goals, and
14 recognise the need for specific action planning to attain those goals.^{10,34} Positive perceptions in
15 regards to one's own abilities has been shown to increase the likelihood of longer-term PA behaviour
16 change.³⁵
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33 In contrast to physical capability, which was rarely brought up in the interviews, the influence that
34 psychological capability had on PA behaviour change was widely discussed by most participants. The
35 participants did not seek exercise prescription from the intervention, indeed they largely claimed to
36 already know what to do. The prevailing issue was the interrelation between the lack of motivation
37 and a decreased sense of psychological capability. When discussing how the intervention helped
38 change behaviour, reflection on their personal capabilities and skills was a common technique
39 mentioned by the participants. Behaviour change techniques such as identification of self as role
40 model have been demonstrated to influence change;²⁷ the use of the more relational MI techniques to
41 evoke examples of personal capacity might have influenced their confidence in their own
42 capabilities.²⁸ Motivational interviewing has been shown to support psychological needs based on
43 self-determination theory³⁶ as well as enhance self-efficacy,³² and the integration of MI-CBT provides
44 an autonomy-supportive framework for the delivery of BCTs.¹⁰
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3 The interviews highlighted the importance of the relational components of the PA coaching
4 intervention, namely the MI style or spirit (i.e. collaboration, compassion, evocation and empathy)
5 used to underpin the intervention delivery. For most participants, the intervention was viewed as a
6 positive experience, with a strong emphasis on the value of being listened to.³⁷ This reinforces the
7 significance of person-centred interventions, and aligns with the importance of autonomy-supportive
8 influences described within self-determination theory.³⁶ Self-determination theory posits that the
9 quality of the support influences motivation and can help build self-efficacy.³⁶ The favourable
10 experience of the intervention contrasts to the participants' description of support offered by partners
11 or significant others. This support was didactic in nature, and they felt they were being informed of
12 what they should do, without being listened to. The provision of listening support is a fundamental MI
13 technique, and the spirit of MI communicates compassion, acceptance and partnership.^{14,38} Using MI
14 as the foundational platform provides a supportive environment in which to deliver non-judgemental
15 understanding and empathy.³⁸ These relational components are likely to result in an increased sense of
16 autonomy and build reflective motivation to increase and maintain PA changes.^{10,28,38,39}

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35 Increased beliefs about capability and use of self-regulation strategies characterised participants who
36 were successful in maintaining their PA, which included a 6-month non-intervention period from the
37 end of the intervention to the final measurement. Perceptions of capability and motivation are some of
38 the internal and external processes (cognitive, self-reflective and self-regulatory) that come into play
39 in human psychosocial functioning.¹² Indeed, behaviour- or self-regulation has been shown to mediate
40 PA behaviours.⁴⁰ Some of the self-regulation strategies highlighted by participants included "relaxed"
41 goal setting and planning. The MI framework of the intervention encouraged the individuals to set
42 goals appropriate for them, and work out and plan their own strategies to regulate their PA. This is
43 consistent with the autonomy-supportive approach of MI by offering choice over goals and
44 demonstrating to participants that there are different ways to achieve these goals.^{14,38} By empowering
45 participants to set appropriate goals and demonstrating that it is the participant who decides what
46 choices to make, the participants are likely to be more engaged in the process and the more
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3 demanding CBT elements of the intervention.⁴¹
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8 **Applied implications** 9

10 From a policy perspective, the delivery of the intervention 1:1 over the telephone was found to
11 support change for most participants. This permitted the development of an inter-personal relationship
12 which has been demonstrated to influence change,⁴² and at the same time the telephone delivery
13 provided participants with a sense of physical space which helped them relax. A systematic review
14 found that 50% of MI-CBT interventions used for PA change were delivered via telephone,¹⁸ though
15 participants' perspectives on telephone delivery have been absent from the literature.
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26 Participants commonly noted that the provision of defined parameters around the intervention
27 sessions was beneficial for instilling a degree of focus within the sessions. The participants enjoyed
28 the autonomy of goal setting and planning; goal setting is not always associated with autonomy, and
29 goals that are not self-endorsed are likely to inhibit motivation.⁴³ Using MI to underpin the delivery of
30 the PA coaching intervention likely contributed to the sense of empowerment the participants detailed
31 they had in setting their own goals and agendas.³⁰ Alongside this autonomy, the participants valued
32 being provided with clarity on the scope of each intervention session as this provided a scaffold from
33 which to establish their agenda. Providing clear descriptions for sessions, including scope, summaries
34 and in-between session plans are key components for intervention fidelity for MI-CBT.⁴⁴ Practitioners
35 and researchers can be encouraged that the structural parameters provided from the fidelity framework
36 were positively received by individuals, and potentially contributed to successful behaviour change.
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52 From a practice perspective, a large proportion of the techniques identified by participants as being
53 important for promoting PA change were classified as relational. The importance of relational
54 components within interventions needs to be considered when promoting behaviour change.⁴⁵ The
55 techniques classified in well-established BCT taxonomies have centred on the content of
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3 interventions, and have not examined the interpersonal components of interventions.⁴⁵ The PA
4 coaching intervention in the H4U-2 study used established BCTs, but delivered them using a MI
5 framework.¹⁹ The MI spirit is a style of interaction that promotes an interpersonal relationship; it
6 represents the way that the intervention content is delivered.³⁸ A number of authors have proposed
7 that relational components of interventions are likely to interact with technical components to
8 influence behaviour change.^{45,46} This is consistent with the argument put forward by Hilton and
9 Johnston that it is important *how* behaviour change interventions are delivered, rather than exactly
10 *what* is contained in the intervention.⁴⁷ Integrating MI with CBT permits the combination of content
11 and relational techniques to increase the effectiveness of the intervention.¹⁰ In this paper we have
12 examined participant's experiences of the intervention and attempted to make the distinction between
13 relational and content-based techniques found to influence behaviour change.
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29 **Strengths and limitations**

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31 By identifying BCT techniques and mapping successful intervention components to TDF domains,
32 COM-B components and central tenets of self-determination theory, we have distilled some of the
33 macro level *what* of behaviour change interventions down to the more micro level of *how*. Using the
34 TDF provides a deeper understanding of the barriers and enablers to PA for insufficiently physically
35 active ambulatory care patients.²⁶ Mapping the findings into the COM-B model and highlighting
36 specific BCTs is a significant strength of this study due to the integration of theoretically derived
37 domains and structural and relational BCTs. Together they demonstrate the theory-informed use of
38 MI-CBT as an evidence-based intervention to increase and maintain PA. The design of the PA
39 coaching intervention was based upon determinants of PA change;^{12,14,19} gaining perspectives from
40 individuals who participated in the intervention provides further evidence to assist in developing
41 effective interventions in the future.
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58 There were some potential limitations in this study. Some difficulty arose in the categorisation of TDF
59 themes and associated BCTs due to a degree of ambiguity in the definitions of the theoretical
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3 domains. Where this arose, the categorisation was determined through consensus via discussion
4 within the research team. The sampling frame for the study was another potential limitation as all
5 participants were recruited through an ambulatory hospital clinic in one hospital setting. The
6 recruitment from one setting only potentially restricted the diversity in participants, in particular
7 diversity in ethnicity, and limits the generalizability of the findings to broader populations. We made a
8 conscious effort to recruit male and female participants, to provide understanding into the experiences
9 of both genders.
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21 **CONCLUSIONS**

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23 This study provides an understanding of how insufficiently physically active adults perceived a PA
24 coaching intervention and identified some of the behavioural factors that enabled or inhibited PA and
25 the components that influenced their PA behaviour change. Using the TDF and COM-B model
26 provides a theoretical basis for understanding behaviour factors in specific contexts, providing an
27 indication of *what* is required to change. Identifying content and relational BCTs provides an
28 overview of *how* to deliver autonomy-supportive interventions to support self-regulation of PA
29 behaviour and build self-efficacy to maintain change. The findings from this study are valuable from
30 theoretical, applied, training and commissioning perspectives because the BCTs, and the structural
31 and relational components of the intervention that influenced behaviour change were identified
32 firsthand by patients involved in the study. Its findings can be used to influence future intervention
33 design, delivery and its monitoring and evaluation.
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Footnotes

Author Contributions: SB¹, MK, SB² and PO'H conceived the project and assisted with the protocol design. SB¹ collected and analysed the data with support from KR and GB. SB¹ wrote the first draft of the manuscript. SB¹, SB², PO'H, JB, KR, GB and MK critically reviewed the manuscript and provided detailed feedback. All authors read, edited and approved the final manuscript as submitted.

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Competing interests: None declared.

Ethics approval: The study was approved by the Research Ethics Committees of Bendigo Health Care Group (approved November 1, 2018; reference number LNR/18/BHCG/44121) and La Trobe University College of Science Health and Engineering Human Ethics Sub-Committee (approved November 13, 2018). Participants provided informed written consent prior to starting the study.

Data sharing statement: Data are available upon reasonable request.

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3 Table 1. Profile characteristics of participants
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6 Table 2. Technical, relational and structural factors of intervention
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9 Table 3. Mapping of themes to TDF domains and COM-B model with the associated BCTs.
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For peer review only

H4U-2 Participants experiences - Interview guide

Topics	Questions
General	Standard opening question: What was the reason you agreed to participate in the Healthy 4U-2 study?
Expectations prior to the study	<p>What expectations did you have prior to the Healthy 4U-2 study?</p> <p>Can you tell me to what extent your expectations were met?</p> <p><i>Can you rate this 1-10?</i></p>
Perceived outcome	<p>Can you tell me whether you think you became more physically active due to your participation in the study?</p> <p><i>In what ways?</i></p> <p><i>How long did it take to have an impact?</i></p>
Experiences with MI-CBT intervention	<p>Can you tell me how you experienced the telephone support you received during the consultations?</p> <p>Can you tell me whether you think the consultations helped you increase your physical activity?</p> <p>If yes, what components helped with increasing physical activity?</p> <p><i>Which components were most helpful? (Prompt: in what ways?)</i></p> <p><i>Which components were not so helpful? (Prompt: why not)</i></p> <p><i>Would you recommend changing any components? In what ways? Why?</i></p>
Perceptions towards the MI-CBT consultation structure and most prevalent BCTs	<p>How did you experience setting personal goals and action plans?</p> <p>Did the facilitator help you to set your own goals and plan your actions? <i>[BCTs: goal setting and action planning]</i></p> <p>To what extent did this affect your progress?</p>

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	What is your opinion about reviewing the extent to which you attained your goals? [BCT: reviewing behavioural goal(s)] Did this affect your progress?
	Did the facilitator discuss how you can get any support from e.g., family or friends? [BCT: social support] To what extent did this affect your progress?
	Did you discuss strategies to maintain being physically active?
	Did you bring up the strategies yourself? [BCTs: habit formation, problem-solving and relapse prevention].
	Can you tell me how the facilitator supported you if you found it difficult to maintain your progress? What did you find helpful and unhelpful? [BCT: problem-solving]
	Can you tell me whether you think the study consultations differed compared to other consultations you have had around increasing physical activity?
Experiences with the study materials and equipment	Can you tell me how you found wearing the accelerometer and keeping the activity logbook? How did this affect your progress? Did you perceive any difficulties while wearing the accelerometer or keeping the activity log? How did you handle this?
Most and least effective components	Can you tell me what you found most helpful in becoming more physically active? Can you tell me what you found least helpful in becoming more physically active?
Duration of the intervention	What is your opinion about the number and length of the consultations?

1		Generally, how much time did you spend on keeping the activity
2		log? Was this helpful?
3		
4		Was this acceptable to you?
5		
6		
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8		
9		
10	Satisfaction with the intervention	Can you tell me how satisfied you are with your participation in
11		the Healthy 4U-2 study?
12		
13		Ask for scale rating 1-10 – <i>follow up with why this score.</i>
14		
15		
16		
17		
18		Would you recommend this intervention to other patients?
19		
20		Why/why not
21		
22		What time of people would you recommend this intervention
23		to?
24		
25		
26		
27	Prevention in hospitals	You entered the study after coming into hospital to see a
28		surgeon- how did that happen?
29		What are your thoughts on receiving this information from the
30		surgeon?
31		Did receiving a referral from a surgeon influence your decision
32		to take part?
33		
34		
35		Have you discussed increasing physical activity with other health
36		professionals in the past?
37		
38	Perceptions towards maintaining	Have you made any changes to your general daily routine as a
39	physical activity	result of your participation in the study?
40		
41		To what extend do you think you will maintain being physically
42		active?
43		Now you have finished the intervention, how motivated are you
44		to continue being more physically active?
45		
46		
47		
48		Now you have finished the intervention, how self-confident are
49		you to continue being more physically active?
50		
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53		How do you plan to maintain the changes you have made?
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Additional questions regarding Do you have anything to add to the questions I have asked
previous or not discussed topics

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Themes, categories and associated TDF domains and COM-B model components

Theme	Categories	COM-B component	TDF Domain
<ul style="list-style-type: none"> • Strength based coaching 	<ul style="list-style-type: none"> • Building on existing skills to address physical activity 	Capability – Psychological	Knowledge
	<ul style="list-style-type: none"> • Focus on individuals strengths and capabilities 	Capability – Psychological	Skills
	<ul style="list-style-type: none"> • Goal setting based on capabilities • Non-judgmental, autonomous decision making 		
	<ul style="list-style-type: none"> • Confidence in abilities • Non prescriptive / clients felt they not directed to make undesired change 	Capability – Psychological	Behaviour regulation
<ul style="list-style-type: none"> • Building maintenance skills 			
<ul style="list-style-type: none"> • Autonomy-supportive listening 	<ul style="list-style-type: none"> • When you value physical activity you can find time for it 	Opportunity - Physical	Environmental context and resources
	<ul style="list-style-type: none"> • Didactic support from significant others does not positively influence change 	Opportunity - Social	Social influences
	<ul style="list-style-type: none"> • Being told what to do does not lead to change 		
	<ul style="list-style-type: none"> • Being heard and having your opinion valued 		

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Theme	Categories	COM-B component	TDF Domain
	<ul style="list-style-type: none"> Feelings of helplessness based on previous failed attempts to be physically active 	Motivation - Automatic	Emotion
<ul style="list-style-type: none"> Reframing physical activity goals 	<ul style="list-style-type: none"> Gaining/shifting perspectives on being physically active Why do I really want to be active 	Motivation - Reflective	Intentions
	<ul style="list-style-type: none"> Utilisation/transference of existing skills 	Motivation - Reflective	Goals
<ul style="list-style-type: none"> Self-regulation 	<ul style="list-style-type: none"> Strengths orientated approach to maintain change 	Motivation - Reflective	Social/professional role and identity
	<ul style="list-style-type: none"> Challenging a negative mindset Learning from and forgetting past failures Non-judgmental listening support 	Motivation - Reflective	Beliefs about capability

Emotion - (Complex reactions - fear, anxiety, affect, stress, depression, positive and negative effect, burn out)

Intentions (A conscious decision to perform a behaviour)

Social/professional role and identity (Set of behaviours and displayed personal qualities in a social or work setting)

Skills (An ability or proficiency acquired through practice)

Beliefs about capability (Acceptance of the truth, reality or validity about an ability, perceived behavioural control, self-esteem, confidence)

Environmental context and resources (person's situation or environment)

Social influences (Process that can change thoughts feelings or behaviours – social pressure).

Knowledge (Awareness of the existence of something: knowledge of condition)

Behaviour regulation (Managing or changes action – self monitoring)

Goals (mental representations of outcome or end states that an individual wants to achieve)

COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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BMJ Open

Factors influencing adults who participate in a physical activity coaching intervention: a theoretically informed qualitative study

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4 **1 Factors influencing adults who participate in a physical activity coaching**
5 **2 intervention: a theoretically informed qualitative study**
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36 ABSTRACT

37 **Objective:** Behaviour change interventions targeting changes in physical activity (PA) can benefit by
38 examining the underlying mechanisms that promote change. This study explored the use of the
39 Capability, Opportunity, Motivation and Behaviour (COM-B) model and the Theoretical Domains
40 Framework (TDF) to code and contextualise the experiences of participants who completed a PA
41 coaching intervention underpinned by motivational interviewing and cognitive behaviour therapy
42 (MI-CBT).

43 **Design:** Semi-structured interviews were conducted with a purposive sample of participants.

44 **Setting:** Interviews were conducted in a tertiary hospital in regional Victoria, Australia.

45 **Participants:** Eighteen participants who completed a PA coaching intervention were interviewed.
46 The participants were recruited into the coaching intervention because they were insufficiently
47 physically active at time of recruitment.

48 **Results:** Thirteen (72%) participants were women and the average age of participants was 54 (\pm 5)
49 years. Four participant themes mapped directly onto five components of the COM-B model, and ten
50 of the TDF domains. Increases in PA were influenced by changes in motivation and psychological
51 capability. The autonomy-supportive PA coaching intervention helped to evoke participants own
52 reasons (and motives) for change and influenced PA behaviours. Participants reflected on their own
53 social and/or professional strengths, and utilised these skills to set appropriate PA goals and action
54 plans. The structure of the PA coaching intervention provided clarity on session determinants and a
55 framework from which to set an appropriate agenda. Relational components (e.g. non-judgemental
56 listening, collaboration) were continually highlighted as influential for change, and should be
57 considered in future behaviour change intervention design.

58 **Conclusions:** We demonstrate the beneficial effect of utilising theory-informed behaviour change
59 techniques, and delivering them in a style that promotes autonomy and relatedness. The views of
60 participants should be a key consideration in the design and implementation of PA coaching
61 interventions

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3 62 **ARTICLE SUMMARY**
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6 63 **Strengths and limitations of this study**
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- 9 64 • Semi-structured interviews enabled in-depth exploration of the experiences of individuals
10 who participated in a physical activity coaching intervention.
11 65
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13 66 • Including the perspectives of individuals who did not increase physical activity as well as
14 those who did increase physical activity as a result of the intervention can be considered a
15 67 strength of this study.
16 68
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18 69 • Another strength of this study is the application of the COM-B model and the TDF to explore
19 the experiences of individuals that participated in a physical activity coaching intervention
20 70 underpinned by motivational interviewing and cognitive behaviour therapy.
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23 72 • The sample was exclusively non-admitted hospital patients that participated in a physical
24 activity coaching intervention, and additional perspectives may provide a broader overview to
25 73 inform intervention development.
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75 INTRODUCTION

76 Regular physical activity (PA) is positively associated with numerous health-related benefits and a
77 marked reduction in risk for chronic disease.^{1,2} Although the importance of regular PA has been
78 widely publicised, large numbers of adults do not undertake the recommended levels of PA.³ For
79 example, only 50% of adults in the USA and 56% in Australia undertake the required amount of PA
80 to be deemed sufficiently physically active.^{4,5} Behaviour change interventions have been increasingly
81 used in an attempt to influence PA change, however numerous systematic reviews and meta-analyses
82 demonstrate that high proportions of participants revert to insufficient PA levels once the behaviour
83 change intervention is ceased.⁶⁻⁸ The marked reductions or cessation of PA can nullify the health
84 improvements gained from temporary PA increases.⁹ Consequently, there is a need to develop
85 behaviour change interventions that strengthen the maintenance of PA over time.¹⁰

87 Rothman suggested that theory-informed (e.g social-cognitive theory) interventions can be effective
88 for promoting maintenance of behaviour change.¹¹ Michie and colleagues expanded on this more
89 recently, proposing that behaviour change interventions need to address specific components of
90 change, namely an individual's capability, opportunity, and motivation to change.¹² The factors that
91 influence initiation of behaviour change differ substantially to those that influence maintenance.^{12,13}
92 Using the same theoretical constructs for behaviour change initiation and maintenance might not
93 account for variations in capability, opportunity, and motivation, many of which can be driven by
94 intentions, past experience, and environment.¹² There is a need to explore the potential determinants
95 of successful PA maintenance to assist in the development of interventions to produce lasting change.

97 Motivational Interviewing (MI) was developed to elicit motivation for behaviour change from the
98 individual.¹⁴ MI is an autonomy supportive intervention and seeks to empower clients to voice their
99 own reasons and strategies for change.^{14,15} MI strategies for behaviour change maintenance are less
100 specific, and are not emphasised as part of the four processes of MI (engaging, focusing, evoking, and
101 planning).¹⁴ As a result, the integration of action-orientated interventions such as cognitive-

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3 102 behavioural therapy (CBT) has been recommended.¹⁶ Cognitive-behavioural therapy involves
4
5 103 assisting clients develop strategies and skills (e.g. activity scheduling, successive approximation) to
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7 104 change behaviours.¹⁷ Instead of being passive recipients of CBT skills training, the integration of MI
8
9 105 and CBT (MI-CBT) can ensure that clients' have autonomy around the focus and direction of change,
10
11 106 which might support maintained change.¹⁰ Integrated MI-CBT has demonstrated effectiveness for the
12
13 107 maintenance of PA behaviour change across a number of studies,^{18,19} however participant experiences
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15 108 of the intervention are absent from the literature.
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21 110 Qualitative approaches are beneficial to capture individuals' in-depth perspectives of the phenomenon
22
23 111 studied, in this case, their experience of the PA coaching intervention.²⁰ This study examines the
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25 112 views of individuals who participated in a MI-CBT based PA coaching intervention as part of a
26
27 113 randomised controlled trial (RCT).¹⁹ Relative to control, the intervention group demonstrated
28
29 114 significant changes in PA at post-intervention (3-months) and these changes were maintained 9
30
31 115 months after the commencement of the intervention.¹⁹ At present, we do not understand what
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33 116 influence contextual factors (mode of delivery, behaviour change techniques, therapeutic alliance)
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35 117 within the coaching intervention might have had on these findings. Thus, the aim of this current study
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37 118 was to qualitatively explore the experiences and perceptions of individuals who received the MI-CBT
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39 119 based PA coaching intervention to identify determinants and facilitating factors that influenced PA
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41 120 behaviour change. These insights will provide a deeper understanding of their experiences, and might
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43 121 offer valuable information to assist health professionals to improve intervention effectiveness and
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45 122 uptake.
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51 124 **METHODS**

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55 125 This study employed a qualitative design using an interpretive description approach,²¹ and adopted the
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57 126 Consolidated Criteria for Reporting Qualitative Research (Supplementary Material 1).²² Semi-
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59 127 structured interviews were conducted with a purposeful sample of adults who participated in a PA
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3 128 coaching intervention in the H4U-2 RCT to explore their experiences and perceptions of the
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5 129 intervention to identify factors that influenced PA behaviour change.
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11 131 A detailed description of the PA coaching intervention (H4U-2) including the intervention schedule,
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13 132 theories and techniques is available in the published literature.¹⁹ In brief, in the H4U-2 study, 120
14
15 133 insufficiently active adults (aged 18-69) were recruited from an ambulatory hospital clinic and
16
17 134 randomised to an intervention group that received an education session and PA coaching, or to a
18
19 135 control group that received the education session only. The PA coaching intervention comprised
20
21 136 integrated MI-CBT and was delivered in five 20-min sessions over 12 weeks via the telephone. The
22
23 137 intervention used an MI framework and microskills (open-ended questions, affirmations, reflections
24
25 138 and summaries) to underpin all sessions. The CBT skills training (e.g. goal setting, problem solving
26
27 139 and coping strategies) was delivered using the MI framework. The intervention was delivered by a
28
29 140 physiotherapist trained in MI-CBT through workshop attendances, and individual coaching from an
30
31 141 experienced practicing psychologist.
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38 143 The H4U-2 participants completed outcome measures at baseline, post-intervention (3 months) and
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40 144 follow-up (9 months). This provided a 6-month non-intervention time to assess maintenance of
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42 145 behaviour change. At baseline, the mean age of the H4U-2 participants was 53 ± 8 years and
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44 146 accelerometer-measured PA for was 15 ± 5 mins/day of moderate-to-vigorous PA (MVPA). The
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46 147 intervention group increased MVPA at post-intervention (23 ± 10 mins/day) and maintained this at 9-
47
48 148 month follow-up (22 ± 10 mins/day). In contrast, the control group decreased MVPA at post-
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50 149 intervention (13 ± 6 mins/day) and at follow-up (10 ± 6 mins/day). Ethical approval was obtained
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52 150 from the research Ethics Committees of the study hospital and associated university. All participants
53
54 151 provided written consent prior to starting the study.
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152 **Sampling and recruitment**

153 All H4U-2 trial participants were asked to complete an evaluation form at the 9-month follow-up
154 which included a question about whether they would be willing to participate in a semi-structured
155 interview. Individuals who responded with “yes” (n = 72) were considered as the sample eligible to
156 participate in this study. A purposive sampling procedure was used. We aimed for a variation in the
157 participants’ (i) change in PA, measured using accelerometers; (ii) engagement with the behaviour
158 change intervention, identified by the intervention provider; (iii) gender and age to reflect the sample
159 in the population; (iv) geographic location (rural or regional); and, (v) socio-economic status, using
160 postcodes as a proxy. A research assistant contacted the individuals to confirm their wish to
161 participate. Permission was sought to give their contact details to the interviewers.

162
163 Twenty five people were invited to participate. Two individuals declined; one reported no longer
164 wishing to participate and the other individual cited health issues. The participant recruitment ceased
165 when we met our variation sampling requirements and reached data saturation. Data saturation was
166 considered to be reached when the analysis indicated that additional interviews were not providing
167 new concepts and the data provided were sufficient to address the research aims.²³ No new significant
168 information was derived between the seventeenth and eighteenth interviews, indicating that data
169 saturation was reached and interviewing was ceased.²³

171 **Interview process**

172 Written informed consent was obtained from all participants at the start of the interviews. Face-to-face
173 interviews were carried out in the Health Promotion department of the associated hospital between
174 June and September 2020. The interviews were carried out by the first author. A semi-structured
175 interview guide was developed based on existing literature^{24,25} and was used to facilitate the
176 discussion (Supplementary Material 2). The interview guide was piloted by interviewing three
177 individuals that took part in a MI-CBT based PA coaching intervention delivered by the Health
178 Promotion department of the associated hospital; these three individuals did not participate in the

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3 179 H4U-2 study, but did receive the same 5 x 20 min session of PA coaching as the H4U-2 study
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5 180 participants which was offered as part of standard health promotion practice in the associated hospital.
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7 181 Following this pilot, additional questions, probes and prompts were included to further explore
8
9 182 individuals' experiences in terms of engaging in the behaviour change intervention. The pilot
10
11 183 interviews were not included in the final sample as the individuals were not enrolled into the study.
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15 184 **Data analysis**

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18 185 Interviews were audio recorded, transcribed verbatim and rendered anonymous. Participants were
19
20 186 identified as participant 1, participant 2 and so forth. The transcripts were analysed using an
21
22 187 interpretive description method.²¹ NVivo 12 software (QSR International, Cambridge, MA, USA) was
23
24 188 used to facilitate data analysis. The interpretive description approach requires emersion into the data
25
26 189 to identify thematic patterns, and an inductive analysis to permit theorising about explanatory
27
28 190 factors.²¹ We developed a draft coding frame to capture codes and emerging categories. The coding
29
30 191 frame was trialled by authors (SB¹ and KR) who independently coded 20% of the transcripts. A
31
32 192 revised version of the framework was developed and tested by the research team; this version was
33
34 193 used to code all transcripts. The first author independently coded 18 transcripts, and two authors (KR
35
36 194 and GB) independently coded 9 transcripts each. The level of agreement between independent coders
37
38 195 was substantial. Disagreements were resolved through discussion amongst all coders.
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43
44 197 Following this stage, the identified categories were mapped against the Theoretical Domains
45
46 198 Framework (TDF)²⁶ and COM-B model.¹² The TDF and COM-B model provide the theoretical basis
47
48 199 for understanding behaviour change. The TDF integrates 33 theories and 128 psychological constructs
49
50 200 into 14 domains underpinned by psychological theory.²⁶ The TDF domains include individual-level
51
52 201 factors (knowledge, skills), social factors (social influences, social support), environment and resource
53
54 202 factors (cost of resources to facilitate change).²⁶ Taken together the 14 domains prompt the
55
56 203 consideration of a wide range of influences on behaviour change. The 14 validated domains are
57
58 204 included in Supplementary Material 3.
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2
3 205 Michie and colleagues identified three components that need to be present to influence behaviour (B):
4
5 206 capability (C), opportunity (O) and motivation (M); together these components make up the COM-B
6
7 207 model.¹² Capability refers to having the knowledge and skills required to engage in a behaviour; it can
8
9 208 be broken down into two components, psychological capability and physical capability. Opportunity
10
11 209 refers to the external factors which make undertaking a behaviour possible. Its two components are
12
13 210 physical opportunity and social opportunity. Motivation refers to the internal processes which
14
15 211 influence decision making and behaviours. Its two components are reflective motivation and
16
17 212 automatic motivation. The COM-B model is widely used to contextualise individual-level change and
18
19 213 determine what needs to change for behaviour change interventions to be effective.¹²
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23
24 215 We mapped the broad categories onto the TDF domains, as well as directly onto the six components
25
26 216 of the COM-B model to identify factors that are likely to influence PA behaviour change and could be
27
28 217 targeted in future interventions. Participants' responses were analysed for descriptions of BCTs and
29
30 218 skills used as part of the PA coaching intervention. The technical components of the interventions
31
32 219 were mapped against Michie's taxonomy of behaviour change techniques (BCT),²⁷ and MI processes,
33
34 220 relational components and micro-skills.²⁸ The mapping of draft themes and findings were discussed
35
36 221 amongst all authors to investigate a broad perspective on thematic interpretations. Disagreements
37
38 222 between the team were resolved through discussion. The vigour of the qualitative research was
39
40 223 strengthened through the implementation of independent coding; triangulation of data, and the critical
41
42 224 appraisal of developing themes.²⁹
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46 47 226 **Patient and public involvement**

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49
50 227 The research was designed and conducted without patient or public involvement.
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3 **229 RESULTS**
4

5 230 Eighteen people participated in semi-structured interviews, where 13 (72%) were women and 5 (28%)
6
7 231 were men. The average age of participants was 54 (\pm 5) years, with participants ranging in age from
8
9 232 42 to 66 years. Table 1 provides details of the participants' characteristics. The interviews ranged in
10
11 233 duration from 26 to 45 minutes, with an average duration of 34 minutes.
12
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14 234

15
16
17 235 Table 1 Profile characteristics of participants (N = 18)
18

19 236

Marital Status	
20 237 Married/living together	15
21 Widowed	1
22 Single	2
Highest completed education	
23 Secondary/high school	4
24 Post-school vocational	8
25 University	6
Employment	
26 Working full-time	13
27 Working part-time	3
28 Retired	2
Geographic location ^a	
29 Regional	12
30 Rural	6
Socioeconomic area ^b	
31 1	4
32 2	4
33 3	6
34 4	4
35 5	3
Physical activity level at end of intervention ^c	
36 Meets guidelines	13
37 Does not meet guidelines	5
Pattern of physical activity from baseline to final measurement ^c	
38 Increased	13
39 No change	4
40 Decreased	1

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50 239 ^a The term 'regional and rural' encompasses all areas outside Australia's major cities. Regional
51 240 indicates living in a regional city. Rural indicates living in an area outside of a regional city.

52
53 241 ^b Index of Relative Socio-economic Disadvantage (IRSD) Socio-Economic Indexes for Areas
54 242 (SEIFA) scores. IRSD data is presented as quintiles where 1 represents most disadvantaged, and 5
55 243 represents least disadvantaged.

56
57 244 ^c Physical activity measurements taken from accelerometer data
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3 247 Perceptions of the PA coaching intervention were positive, including those participants who did not
4
5 248 find the intervention beneficial for maintaining PA change. The structural components (i.e. defined
6
7 249 session times and parameters) of the PA coaching intervention provided the participants with a clear
8
9 250 indication of what was involved, while the relational components (i.e. MI spirit: collaboration,
10
11 251 empathy, evocation, autonomy) provided a platform for the participants to engage and focus on their
12
13 252 reasons for change. The structural and relational components highlighted by participants are detailed
14
15 253 in Table 2. The delivery of the intervention via phone was reported as favourable by the majority of
16
17 254 the participants. The telephone delivery provided flexibility around participation in the intervention
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19
20 255 with 16 participants in gainful employment during the intervention period.

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22
23 256 Four themes were identified that mapped across 5 of the COM-B components and 10 domains of the
24
25 257 TDF framework (Table 3). The themes included strength based coaching, autonomy-supportive
26
27 258 listening, reframing PA goals, and self-regulation. As evidenced in Table 3, the themes mapped to
28
29 259 multiple COM-B components and TDF domains; as such the findings are presented below under the
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31 260 identified COM-B heading, and related TDF domain sub-heading. These findings are described in
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33 261 detail below and supported using illustrative quotes from participants. The participant's gender, age
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35 262 and change in PA as a result of the PA coaching intervention are provided alongside each quote. The
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37 263 categories that informed these themes are presented in Supplementary Material 4.

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265 Table 2 Technical, relational and structural components of the physical activity coaching intervention

Component	Description	Illustrative quotes
<i>Technical/Relational</i>		
Being heard	Listening to the individuals' unique issues and needs.	<i>"And I liked being listened to – I think that was another big one. I find sometimes if you are talking to someone who works in health, or it could be any profession but you get the feeling that they aren't even listening. They sit there looking at you and the head is bobbing away, but they are just waiting for you to stop talking so they can get their opinion in. But to be listened to, and I mean really listened to is quite important. Not a token gesture"</i> (Female, 61)
Collaboration	Participants reported that they did not feel like they were being told what to do. The intervention helped support their decisions.	<i>"So you feel listened to, but there isn't a pressure to do what you don't want. You are driving the bus, and you know where you want to go. And the coaching is like a co-pilot, trying to navigate the best route. Both heading in the same route, but with freedom in how to get there".</i> (Female, 56)
Guiding style	Autonomy supportive style, directive towards physical activity changes that were chosen by the individual.	<i>"It was clear with what we wanted to do – get me fitter. But I really felt like I was in control, nothing was forced upon me, and I could do things at my own speed".</i> (Female, 53) <i>I think that it's not just a conversation, but the kind of conversation. . So its guidance towards what's right, not a push. Because you push me and I'll push right back".</i> (Male, 51)
Supporting self-efficacy	Recognising that the individuals had the self-knowledge to manage their health; support was to draw these strengths out from them.	<i>"How can I run, and forgive me for saying, a successful business, and I can't manage my own fitness. That wasn't the question, but the process made me think about it. How do I use my skills, skills I already have to make the change?"</i> (Male, 56)

Big picture perspectives	Participants mentioned the implementation of strategies to support maintained change from early in the intervention.	<i>“Questions like ‘how will you manage if you cannot attend your exercise group?’ seemed odd to me. But then you know, months later and the gym is shut and I had to change tact to be active elsewhere. So it was good to have considered the what-if type thing”. (Male, 49)</i>
Structural		
Defined parameters	The use of clear descriptions for intervention sessions help clarify the goals of the sessions.	<i>“I felt I was kind of allowed to map the route for myself, I wasn’t forced down an alleyway. I didn’t have free reign, because the sessions started and ended with a rough guide of what we would do, so there was some bit of boundaries on it from that”. (Female, 50)</i>
One to one	Provided an environment where participants felt comfortable to be open.	<i>“I just know I wouldn’t be comfortable expressing doubts about myself in a groups setting”. (Female, 60)</i>
Telephone delivery	Beneficial for practical reasons such as travel. Some individuals enjoyed the 1:1 relationship without the face-to-face requirement.	<i>For me it was great, I was able to schedule a session towards the end of the work day, did it from the office and then I was able to leave work and concentrate on me”. (Male, 53)</i>
		<i>“I found it comforting to not have to look face to face while we were doing it. So having that physical distance allowed me to, to pace the hallways when I spoke if I needed, to laugh at myself or, frown or whatever. And that I think would have made me more relaxed overall”. (Female, 52)</i>
Session timeframes	The number of session and their spread over time permitted relationship to grown, and allowed time to plans into action. Knowing sessions were coming up influenced accountability.	<i>I’ve been to session before, with the physio say, and 15 minutes in he is writing my goals for me. But they aren’t my goals at all.... It was nice to be able to decide for myself, at my own pace”. (Male, 55)</i>

267 Table 3 Mapping of themes to TDF domains and COM-B model with the associated BCTs

Theme	COM-B component	TDF Domain	BCT ^{a,b}
	Capability – Psychological	Knowledge	Identification of self as role model ^a Evoked personal capabilities ^b
• Strength based coaching	Capability – Psychological	Skills	Goal setting (behaviour) ^a Goal setting (outcome) ^a Acceptance ^b Evoked reasons for goals ^b
	Capability – Psychological	Behaviour regulation	Self-monitoring of behaviour ^a Problem solving ^a Anticipated regret ^a Evoked (commitment) ^b Plan ^b
	Opportunity - Physical	Environmental context and resources	Reframing ^a Commitment ^a Salience of consequences ^a
• Autonomy-supportive listening	Opportunity - Social	Social influences	Compersion ^b Acceptance ^b

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	Motivation - Automatic	Emotion	Monitoring of behaviour by others without feedback ^a Engagement ^b Reflective listening ^b Evoke reasons for change) ^b Compassion ^b
• Reframing physical activity goals	Motivation - Reflective	Intentions	Discrepancy between current behaviour and goal ^a Pros and cons ^a Reframing ^a Focus to clarify agenda ^b
	Motivation - Reflective	Goals	Discrepancy between current behaviour and goal ^a Identification of self as role model ^a Evoke reasons for goals ^b Acceptance ^b
• Self-regulation	Motivation - Reflective	Social/professional role and identity	Focus on past success ^a Identification of self as role model ^a Evoke personal capabilities) ^b
	Motivation - Reflective	Beliefs about capability	Comparative imagining of future outcomes ^a Review behaviour goal(s) ^a Acceptance ^b Evoke personal capabilities) ^b

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270 ^a BCT taxonomy (Michie, van Stralen, and West 2011) ^b Motivational Interviewing techniques (Hardcastle et al. 2017; Miller and Rollnick 2012)

271 BCT: Behaviour change technique; COM-B: Capability, Opportunity, Motivation, Behaviour; TDF: Theoretical Domains Framework

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4 275 Emotion - (Complex reactions - fear, anxiety, affect, stress, depression, positive and negative effect, burn out)
5 276 Intentions (A conscious decision to perform a behaviour)
6 277 Social/professional role and identity (Set of behaviours and displayed personal qualities in a social or work setting)
7 278 Skills (An ability or proficiency acquired through practice)
8 279 Beliefs about capability (Acceptance of the truth, reality or validity about an ability, perceived behavioural control, self-esteem, confidence)
9 280 Environmental context and resources (Person's situation or environment)
10 281 Social influences (Process that can change thoughts feelings or behaviours – social pressure).
11 282 Knowledge (Awareness of the existence of something: knowledge of condition)
12 283 Behaviour regulation (Managing or changes action – self monitoring)
13 284 Goals (Mental representations of outcome or end states that an individual wants to achieve)
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3 287 **Capability – psychological**
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6 288 *Knowledge*
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8 289 Increased knowledge was not described as a key component that participants needed in order to
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10 290 increase PA. The participants repeatedly stated that they did not need to be told they would benefit
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12 291 from increasing PA.
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17 293 Anyone who is unfit knows they need to get fit – simple. But just telling them won't make a
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19 294 difference. (Female, 51, no change in PA)
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24 296 The participants highlighted how the PA coaching intervention used their existing skills to facilitate
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26 297 changes in PA. This strength-based, person-centred, approach did not seek to impart knowledge,
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28 298 rather it sought to evoke personal capabilities from the individual, and to build their autonomy in
29
30 299 applying this knowledge towards initiating and sustaining changes in PA.
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34
35 301 The coaching was good, and I think spent lots of time looking at things I was good at, and sort
36
37 302 of, how to apply these to my exercise. But it forced me to have a good look at myself, and
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39 303 what I was good at and probably not too good at, and at the time it took me a while to be
40
41 304 comfortable with both. (Male, 52, increased PA)
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46 306 *Skills*
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49 307 Although the individuals were recruited from a secondary care hospital clinic, physical capability was
50
51 308 not discussed as a barrier to increasing PA. The participants did not indicate that they needed to be
52
53 309 provided education on what exercise to do, or the skills required to do it. Instead, participants noted
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55 310 how in the past they felt that they did not have the ability to increase or maintain PA from a
56
57 311 psychological or emotional perspective.
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3 313 What was stopping me from being fit before...it was the mind. Not the body. I could
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5 314 physically do it, but not mentally. (Male, 50, increased PA)
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10 316 Similar to the construct of knowledge, participants expressed how the intervention strategies sought to
11
12 317 evoke from them examples of the skills that they possessed.
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16 319 On paper being fit is easy right. You want to walk, get up and walk. And yet I sat at home on
17
18 320 the couch feeling bad for myself for not exercising, even though I can walk. Me, a grown
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20 321 woman, house, kids, job. Can run them all and I wasn't able get off the couch. So I needed a
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22 322 shift in perspective. (Female, 55, no change in PA)
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28 324 *Behavioural regulation*

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30 325 Many of the participants described making numerous attempts at increasing PA in the past, only to
31
32 326 lapse back to being insufficiently physically active. The inability to maintain regular PA over repeated
33
34 327 attempts had diminished their self-efficacy to be physically active. The MI-CBT intervention used in
35
36 328 the H4U-2 study employed specific BCTs to influence behaviour regulation as early as session 3
37
38 329 (week 4 of 12) of the intervention. The process of exploring capability to maintain PA changes was
39
40 330 new to many participants, as exemplified by the following quote:
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45 332 I think we weren't long into it, and I had started to do some exercise. And I was feeling good.
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47 333 He [intervention provider] started asking me about how I would manage to be fit if something
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49 334 happened, can't remember exactly, say, my strength training class finished up or something.
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51 335 And I was thinking, shouldn't he be telling me I was doing a good job. But you know, when
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53 336 you have to think about it, and explain yourself out loud it gets the wheels turning, and you
54
55 337 have to think 'how would I do it?' Because I've slipped off the wagon before. (Female, 49,
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3 338 increased PA)
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8 340 **Opportunity – physical**
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10 341 *Environmental context and resources*
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12

13 342 Physical opportunities were discussed alongside the shift in perspectives that many participants
14
15 343 encountered, from PA being something that they had to do, to something that they wanted to do. The
16
17 344 reframing of PA to something that was attainable and enjoyable resulted in individuals placing a
18
19 345 higher value on PA; when PA was afforded a higher value, people made time for it irrespective of
20
21 346 previously cited situational or environmental barriers.
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26 348 I used to drive to work every day. Its 2.2 KMs, which I know now because of walking. And of
27
28 349 course you know how bad parking can be, so I'd probably spend ages looking for a park. Now
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30 350 I walk every day, to and from work. If it rains I can bring broolly, or drive if it's really bad. But
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32 351 I don't think of driving anymore, I enjoy the walk and it's a part of my day. (Female, 46,
33
34 352 increased PA)
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37 353
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39 354 **Opportunity – social**
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42 355 *Social influences*
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45 356 Some of the participants enrolled in community exercise programs, for example walking groups and
46
47 357 strength training programs. The building of social links within groups was highlighted by some as an
48
49 358 important factor for continuing attendance, though many others were not concerned with building
50
51 359 social connections within PA groups.
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56 361 A large part of what kept me going back to the group was the friendship I made with other
57
58 362 people. I was only there for a few sessions and a bunch of them invited me to come along for
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3 363 coffee afterwards. That was always helpful in getting me along to sessions. (Female, 58,
4
5 364 increased PA)
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10 366 *I did wonder if sometimes there was a bit too much chat about exercise groups and exercising*
11
12 367 *with other people. If I'm going to exercise I'll do it for myself, I don't need to be going with*
13
14 368 *someone for company. That's not important for me. (Male, 54; decreased PA)*
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16 369
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19 370 The social influence of partners and significant others was regularly discussed, primarily as it related
20
21 371 to the provision of unsolicited, didactic advice. The participants were aware that they were not
22
23 372 undertaking sufficient PA, they did not need this to be pointed out by their partners and significant
24
25 373 others. This didactic style of support contrasts with the relational components of the PA coaching
26
27 374 intervention such as autonomy-supportive listening and collaboration, components that participants
28
29 375 found beneficial in influencing PA change.
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34 377 There is always time for the right advice, and pointless advice is, well... pointless. (Female,
35
36 378 62, no change in PA)
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41 380 My husband was with me on the appointment, and he thought it was great that the surgeon
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43 381 discussed me getting fit. He's been on my back for a while about it. So, he is often asking
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45 382 when I'll do more exercise, but I'll tell you what, that makes me want to do even less in spite
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47 383 of him. Even though I knew I needed to do it. The fact that he was telling me to do more
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49 384 made me want to do less to show him. (Female, 48, increased PA)
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54 386 **Motivation - automatic**

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57 387 *Emotion*
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3 388 The repeated attempts to engage in regular PA resulted in a feeling of helplessness in many of the
4
5 389 participants who enrolled in the PA coaching intervention. The sense of disappointment expressed by
6
7 390 participants was compounded by the fact that the barriers to regular PA were not physical, but
8
9 391 psychological and specifically emotional. The inability to maintain regular PA likely influenced the
10
11 392 participants PA self-efficacy levels, and by extension their automatic motivation.
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16 394 When you have a few cracks at it, and you keep ending up in the same place, it doesn't feel
17
18 395 good. You tell yourself, and maybe a friend 'that's it, I'm going to get myself in shape'. Then
19
20 396 two months later they ask you how that's going and you are ashamed that you haven't done a
21
22 397 thing. And that does nothing for the self-confidence. (Female, 46, increased PA)
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27 399 I'm not afraid to say it, I needed the support. I mean, if I didn't I wouldn't have joined the
28
29 400 coaching. I just wasn't able to do it alone. My motivation was shot, I wasn't, maybe, thinking
30
31 401 clearly about it. Probably fed up and disappointed trying the same thing over and over and not
32
33 402 going anywhere. (Male, 50, no change in PA)
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35 403

38 404 **Motivation - reflective**

40 405 *Intentions and goals*

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42 406 Many participants described how previous attempts at PA were driven from a desire to lose weight.
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44 407 When these attempts did not result in sustained PA levels or weight loss, they were sources of
45
46 408 frustration. It was commonly reported that the intervention looked to reframe PA from a weight loss
47
48 409 tool to something that might deliver general health benefits. This was followed with a change in goal
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50 410 setting for outcomes. Shifting goal setting away from weight loss metrics changed the overall
51
52 411 intention of being active, and having flexible goals removed the notion of a binary outcome of
53
54 412 meeting or not meeting goals.
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3 414 For me, exercise was always about weight. Always. If I didn't reach the target I failed. And
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5 415 generally, I didn't meet the target. So that was no good. But now I don't exercise for weight; I
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7 416 exercise for me. To make me feel good, and I am so much better for it. (Female, 55, increased
8
9 417 PA)

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14 419 *Social/professional role and identity*

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16 420 The concept of social or professional role was commonly described by participants as a tool used
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18 421 within the PA coaching intervention to elicit from participants areas of their life that they felt they had
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20 422 achieved or maintained success in, and formulated part of the strengths-based approach to making PA
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22 423 changes. Many participants were in full time employment with partners and dependent children. They
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24 424 commented how the PA intervention required them to reflect on the strengths they have and
25
26 425 commonly use in these social and/or professional roles. This approach evokes personal or professional
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28 426 capabilities, and the participants were able to reflect on where a transference of skills to PA was
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30 427 possible.

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36 429 So, they didn't use these words, but I needed to think on the lines of 'how can I run a team,
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38 430 which I think is reasonably successful, and I can't get myself in shape'. Not those words, but
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40 431 there was some, maybe, probing maybe. And you know, I thought, 'hey I am someone, and I
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42 432 can do this'. It wasn't a kick in the bum, but it made me sit up a bit. (Female, 51, increased
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44 433 PA)

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49 435 *Beliefs about capability*

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52 436 Participants beliefs about their capabilities were closely linked to the TDF domains of intentions and
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54 437 goals. As an example, exercising to lose weight and failing to attain weight loss goals resulted in a
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56 438 negative mindset and low self-efficacy. By reviewing and revising behavioural goals and learning
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58 439 from previous attempts, the participants noted a shift in their perceptions on capability. When
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3 440 discussing their attempts to be active before the PA coaching intervention some of the foremost
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5 441 feelings that prevailed were those of frustration and disappointment. By reframing intentions and
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7 442 altering their goals participants expressed a greater degree of confidence in their ability to maintain
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9 443 regular PA.
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14 445 Once I got going, then talking about reviewing the goals, and modifying, making harder, or
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16 446 easier as needed, [that] was all fine. The actual tasks right, the exercise itself, or the goal
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18 447 setting – they aren't hard to do. It's not overly complicated. But... but you need to be smart
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20 448 about it and sometimes we get ourselves into a right spot that we can't see the timber from the
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22 449 forest. And the coaching can pull your head in a bit and give you perspective. (Female, 52,
23
24 450 increased PA)
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28 29 452 **DISCUSSION**

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33 453 The aim of this study was to explore participants' perceptions of the factors that influenced their
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35 454 behaviour change throughout the course of a PA coaching intervention delivered using a MI-CBT
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37 455 framework. The interviews identified a wide range of barriers that influenced participants' capability,
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39 456 opportunity, and motivation to undertake regular PA, as well as the key elements of the PA coaching
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41 457 intervention that addressed these barriers. These key elements identified by participants included the
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43 458 combination of relational factors, namely the MI spirit used to underpin the intervention, and the
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45 459 technical factors which were the CBT skills that were utilised. The PA coaching intervention was
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47 460 designed to ensure that MI and CBT were integrated together in all sessions, and the fidelity of
48
49 461 delivery was measured.¹⁹ The participants highlighted the synergistic advantages of receiving both MI
50
51 462 and CBT techniques to motivate and promote lasting PA change.
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57 464 Changes in reflective motivation was one of the dominant components that influenced participants'
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59 465 behaviour change throughout the course of the intervention. Participants attributed a major change in
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3 466 intentions towards PA because of the intervention, specifically the shifting of perspectives away from
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5 467 PA being something they had to do to something they valued.³⁰ By reframing their intentions, the
6
7 468 participants set goals appropriate to their needs and importantly, their sense of capability.³⁰ This
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9 469 relates closely with the need for self-efficacy for behaviour change.^{31,32} Participants consistently noted
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11 470 that the strengths-orientated approach of the MI-CBT intervention helped build this self-belief. The
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13 471 evocation of personal capabilities is encouraged within MI;^{14,15} participants stated that reflecting on
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15 472 their capabilities within their social and/or professional role highlighted their existing strengths. This
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17 473 demonstrated to individuals how to recognise the self-regulatory skills they already had, and how
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19 474 these skills could be transferred to the attainment of regular PA.³³ Instead of providing expert advice,
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21 475 the integration of MI-CBT permitted the individuals to voice their intentions and goals, and to
22
23 476 understand what skills were needed to achieve these goals.^{10,34} Positive perceptions in regards to one's
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25 477 own abilities has been shown to increase the likelihood of longer-term PA behaviour change.³⁵
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31 479 In contrast to physical capability, which was rarely brought up in the interviews, the influence that
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33 480 psychological capability had on PA behaviour change was widely discussed by most participants. The
34
35 481 participants in this study did not seek exercise prescription from the intervention, indeed they largely
36
37 482 claimed to already know how to exercise. The prevailing issue was the interrelation between the lack
38
39 483 of motivation and a decreased sense of psychological capability, resulting in them not exercising.
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41 484 When discussing how the intervention helped change behaviour, reflection on their personal
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43 485 capabilities and skills was a common technique mentioned by the participants. Behaviour change
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45 486 techniques such as identification of self as role model have been demonstrated to influence change;²⁷
46
47 487 the use of MI techniques to evoke examples of personal capacity might have influenced their
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49 488 confidence in their own capabilities.²⁸ MI has been shown to support psychological needs based on
50
51 489 self-determination theory³⁶ as well as enhance self-efficacy,³² and the integration of MI-CBT provides
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53 490 an autonomy-supportive framework for the delivery of BCTs.¹⁰
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3 492 The interviews highlighted the importance of the relational components of the PA coaching
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5 493 intervention, namely the MI style or spirit (i.e. collaboration, compassion, evocation and empathy)
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7 494 used to underpin the intervention delivery. For most participants, the intervention was viewed as a
8
9 495 positive experience, with a strong emphasis on the value of being listened to.³⁷ This reinforces the
10
11 496 significance of person-centred interventions, and aligns with the importance of autonomy-supportive
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13 497 influences described within self-determination theory.³⁶ Self-determination theory posits that the
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15 498 quality of the support influences motivation and can help build self-efficacy.³⁶ The favourable
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17 499 experience of the intervention contrasts to the participants' description of support offered by partners
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19 500 or significant others. This support was didactic in nature, and they felt they were being informed of
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21 501 what they should do, without being listened to. The provision of listening support is a fundamental MI
22
23 502 technique, and the spirit of MI communicates compassion, acceptance and partnership.^{14,38} Using MI
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25 503 as the foundational platform provides a supportive environment in which to deliver non-judgemental
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27 504 understanding and empathy.³⁸ These relational components are likely to result in an increased sense of
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29 505 autonomy and build reflective motivation to increase and maintain PA changes.^{10,28,38,39}
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35 507 Increased beliefs about capability and use of self-regulation strategies characterised participants who
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37 508 were successful in maintaining their PA, which included a 6-month non-intervention period from the
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39 509 end of the intervention to the final measurement. Perceptions of capability and motivation are some of
40
41 510 the internal and external processes (cognitive, self-reflective and self-regulatory) that come into play
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43 511 in human psychosocial functioning.¹² Indeed, behaviour- or self-regulation has been shown to mediate
44
45 512 PA behaviours.⁴⁰ Some of the self-regulation strategies highlighted by participants included "relaxed"
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47 513 goal setting and planning. The MI framework of the intervention encouraged the individuals to set
48
49 514 goals appropriate for them, and work out and plan their own strategies to regulate their PA. This is
50
51 515 consistent with the autonomy-supportive approach of MI by offering choice over goals and
52
53 516 demonstrating to participants that there are different ways to achieve these goals.^{14,38} By empowering
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55 517 participants to set appropriate goals and demonstrating that it is the participant who decides what
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57 518 choices to make, the participants are likely to be more engaged in the process and the more
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3 519 demanding CBT elements of the intervention.⁴¹
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8 521 **Applied implications**

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10 522 From a policy perspective, the delivery of the intervention 1:1 over the telephone was found to be
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12 523 favourable for most participants. This permitted the development of an inter-personal relationship
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14 524 which has been demonstrated to influence change,⁴² and at the same time the telephone delivery
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16 525 provided participants with a sense of physical space which helped them relax. For health-service
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18 526 delivery is it encouraging that many participants found the coaching via telephone effective as
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20 527 telephone delivery permits offering services to wide geographic regions and can be delivered at
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22 528 participants' convenience.
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28 530 Participants commonly noted that the provision of defined parameters around the intervention
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30 531 sessions was beneficial for instilling a degree of focus within the sessions. The participants enjoyed
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32 532 the autonomy of goal setting and planning; goal setting is not always associated with autonomy, and
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34 533 goals that are not self-endorsed are likely to inhibit motivation.⁴³ Using MI to underpin the delivery of
35
36 534 the PA coaching intervention likely contributed to the sense of empowerment the participants detailed
37
38 535 they had in setting their own goals and agendas.³⁰ Alongside this autonomy, the participants valued
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40 536 being provided with clarity on the scope of each intervention session as this provided a scaffold from
41
42 537 which to establish their agenda. Providing clear descriptions for sessions, including scope, summaries
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44 538 and in-between session plans are key components for intervention fidelity for MI-CBT.⁴⁴ Practitioners
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46 539 and researchers can be encouraged that the structural parameters provided from the fidelity framework
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48 540 were positively received by individuals, and potentially contributed to successful behaviour change.
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54 542 From a practice perspective, a large proportion of the techniques identified by participants as being
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56 543 important for promoting PA change were classified as relational. The importance of relational
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58 544 components within interventions needs to be considered when promoting behaviour change.⁴⁵ The
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3 545 techniques classified in well-established BCT taxonomies have centred on the content of
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5 546 interventions, and have not examined the interpersonal components of interventions.⁴⁵ The PA
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7 547 coaching intervention in the H4U-2 study used established BCTs, but delivered them using a MI
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9 548 framework.¹⁹ The MI spirit is a style of interaction that promotes an interpersonal relationship; it
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11 549 represents the way that the intervention content is delivered.³⁸ A number of authors have proposed
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13 550 that relational components of interventions are likely to interact with technical components to
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15 551 influence behaviour change.^{45,46} This is consistent with the argument put forward by Hilton and
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17 552 Johnston that it is important *how* behaviour change interventions are delivered, rather than exactly
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19 553 *what* is contained in the intervention.⁴⁷ Integrating MI with CBT permits the combination of content
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21 554 and relational techniques to increase the effectiveness of the intervention.¹⁰ In this paper we have
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23 555 examined participant's experiences of the intervention and attempted to make the distinction between
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25 556 relational and content-based techniques found to influence behaviour change.
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31 558 **Strengths and limitations**

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34 559 By identifying BCT techniques and mapping successful intervention components to TDF domains,
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36 560 COM-B components and central tenets of self-determination theory, we have distilled some of the
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38 561 macro level *what* of behaviour change interventions down to the more micro level of *how*. Using the
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40 562 TDF provides a deeper understanding of the barriers and enablers to PA for insufficiently physically
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42 563 active ambulatory care patients.²⁶ Mapping the findings into the COM-B model and highlighting
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44 564 specific BCTs is a significant strength of this study due to the integration of theoretically derived
45
46 565 domains and structural and relational BCTs. Together they demonstrate the theory-informed use of
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48 566 MI-CBT as an evidence-based intervention to increase and maintain PA. The design of the PA
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50 567 coaching intervention was based upon determinants of PA change;^{12,14,19} gaining perspectives from
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52 568 individuals who participated in the intervention provides further evidence to assist in developing
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54 569 effective interventions in the future.
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3 571 There were some potential limitations in this study. Some difficulty arose in the categorisation of TDF
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5 572 themes and associated BCTs due to a degree of ambiguity in the definitions of the theoretical
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7 573 domains. Where this arose, the categorisation was determined through consensus via discussion
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9 574 within the research team. The sampling frame for the study was another potential limitation as all
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11 575 participants were recruited through an ambulatory hospital clinic in one hospital setting. The
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13 576 recruitment from one setting only potentially restricted the diversity in participants, in particular
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15 577 diversity in ethnicity, and limits the generalizability of the findings to broader populations. The
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17 578 participants who agreed to take part in this qualitative study may have been motivated and willing to
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19 579 talk about PA. The H4U-2 trial participants were asked if they were willing to participate in this study
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22 580 and we purposely recruited participants who did not increase PA as a result of the intervention to
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24 581 provide a broad sample. We made a conscious effort to recruit male and female participants, to
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26 582 provide understanding into the experiences of both genders.
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34 585 **CONCLUSIONS**

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37 586 This study provides an understanding of how participants perceived a PA coaching intervention and
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39 587 identified some of the behavioural factors that enabled or inhibited PA and the components that
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41 588 influenced their PA behaviour change. Using the TDF and COM-B model provides a theoretical basis
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43 589 for understanding behaviour factors in specific contexts, providing an indication of *what* is required to
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45 590 change. Identifying content and relational BCTs provides an overview of *how* to deliver autonomy-
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47 591 supportive interventions to support self-regulation of PA behaviour and build self-efficacy to maintain
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49 592 change. The findings from this study are valuable from theoretical, applied, training and
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51 593 commissioning perspectives because the BCTs, and the structural and relational components of the
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53 594 intervention that influenced behaviour change were identified firsthand by participants involved in the
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55 595 study. Its findings can be used to influence future intervention design, delivery and its monitoring and
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57 596 evaluation.
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3 597 **Footnotes**
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6 598 **Author Contributions:** SB¹, MK, SB² and PO'H conceived the project and assisted with the protocol
7
8 599 design. SB¹ collected and analysed the data with support from KR and GB. SB¹ wrote the first draft of
9
10 600 the manuscript. SB¹, SB², PO'H, JB, KR, GB and MK critically reviewed the manuscript and
11
12 601 provided detailed feedback. All authors read, edited and approved the final manuscript as submitted.
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17
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19
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21
22 605 conflicts of interests to declare.
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26 606 **Competing interests:** None declared.
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29 607 **Ethics approval:** The study was approved by the Research Ethics Committees of Bendigo Health
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31 608 Care Group (approved November 1, 2018; reference number LNR/18/BHCG/44121) and La Trobe
32
33 609 University College of Science Health and Engineering Human Ethics Sub-Committee (approved
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35 610 November 13, 2018). Participants provided informed written consent prior to starting the study.
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39 611 **Data sharing statement:** Data are available upon reasonable request.
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726 Table 1. Profile characteristics of participants

727 Table 2. Technical, relational and structural factors of intervention

728 Table 3. Mapping of themes to TDF domains and COM-B model with the associated BCTs.

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For peer review only

COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

H4U-2 Participants experiences - Interview guide

Topics	Questions
General	Standard opening question: What was the reason you agreed to participate in the Healthy 4U-2 study?
Expectations prior to the study	<p>What expectations did you have prior to the Healthy 4U-2 study?</p> <p>Can you tell me to what extent your expectations were met?</p> <p><i>Can you rate this 1-10?</i></p>
Perceived outcome	<p>Can you tell me whether you think you became more physically active due to your participation in the study?</p> <p><i>In what ways?</i></p> <p><i>How long did it take to have an impact?</i></p>
Experiences with MI-CBT intervention	<p>Can you tell me how you experienced the telephone support you received during the consultations?</p> <p>Can you tell me whether you think the consultations helped you increase your physical activity?</p> <p>If yes, what components helped with increasing physical activity?</p> <p><i>Which components were most helpful? (Prompt: in what ways?)</i></p> <p><i>Which components were not so helpful? (Prompt: why not)</i></p> <p><i>Would you recommend changing any components? In what ways? Why?</i></p>
Perceptions towards the MI-CBT consultation structure and most prevalent BCTs	<p>How did you experience setting personal goals and action plans?</p> <p>Did the facilitator help you to set your own goals and plan your actions? <i>[BCTs: goal setting and action planning]</i></p> <p>To what extent did this affect your progress?</p>

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	What is your opinion about reviewing the extent to which you attained your goals? [BCT: reviewing behavioural goal(s)] Did this affect your progress?
	Did the facilitator discuss how you can get any support from e.g., family or friends? [BCT: social support] To what extent did this affect your progress?
	Did you discuss strategies to maintain being physically active?
	Did you bring up the strategies yourself? [BCTs: habit formation, problem-solving and relapse prevention].
	Can you tell me how the facilitator supported you if you found it difficult to maintain your progress? What did you find helpful and unhelpful? [BCT: problem-solving]
	Can you tell me whether you think the study consultations differed compared to other consultations you have had around increasing physical activity?
Experiences with the study materials and equipment	Can you tell me how you found wearing the accelerometer and keeping the activity logbook? How did this affect your progress? Did you perceive any difficulties while wearing the accelerometer or keeping the activity log? How did you handle this?
Most and least effective components	Can you tell me what you found most helpful in becoming more physically active? Can you tell me what you found least helpful in becoming more physically active?
Duration of the intervention	What is your opinion about the number and length of the consultations?

1		Generally, how much time did you spend on keeping the activity
2		log? Was this helpful?
3		
4		Was this acceptable to you?
5		
6		
7		
8		
9		
10	Satisfaction with the intervention	Can you tell me how satisfied you are with your participation in
11		the Healthy 4U-2 study?
12		
13		Ask for scale rating 1-10 – <i>follow up with why this score.</i>
14		
15		
16		
17		
18		Would you recommend this intervention to other patients?
19		
20		Why/why not
21		
22		What time of people would you recommend this intervention
23		to?
24		
25		
26		
27	Prevention in hospitals	You entered the study after coming into hospital to see a
28		surgeon- how did that happen?
29		What are your thoughts on receiving this information from the
30		surgeon?
31		Did receiving a referral from a surgeon influence your decision
32		to take part?
33		
34		
35		Have you discussed increasing physical activity with other health
36		professionals in the past?
37		
38	Perceptions towards maintaining	Have you made any changes to your general daily routine as a
39	physical activity	result of your participation in the study?
40		
41		
42		To what extend do you think you will maintain being physically
43		active?
44		Now you have finished the intervention, how motivated are you
45		to continue being more physically active?
46		
47		
48		
49		Now you have finished the intervention, how self-confident are
50		you to continue being more physically active?
51		
52		
53		How do you plan to maintain the changes you have made?
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Additional questions regarding previous or not discussed topics	Do you have anything to add to the questions I have asked
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The Theoretical Domains Framework (TDF)

TDF domain	Description
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 representation 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 an individual to change their thoughts, feelings or behaviours.
Emotion	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.

Themes, categories and associated TDF domains and COM-B model components

Theme	Categories	COM-B component	TDF Domain
<ul style="list-style-type: none"> • Strength based coaching 	<ul style="list-style-type: none"> • Building on existing skills to address physical activity 	Capability – Psychological	Knowledge
	<ul style="list-style-type: none"> • Focus on individuals strengths and capabilities 	Capability – Psychological	Skills
	<ul style="list-style-type: none"> • Goal setting based on capabilities • Non-judgmental, autonomous decision making • Confidence in abilities • Non prescriptive / clients felt they not directed to make undesired change 	Capability – Psychological	Behaviour regulation
	<ul style="list-style-type: none"> • Building maintenance skills 	Capability – Psychological	Behaviour regulation
<ul style="list-style-type: none"> • Autonomy-supportive listening 	<ul style="list-style-type: none"> • When you value physical activity you can find time for it 	Opportunity - Physical	Environmental context and resources
	<ul style="list-style-type: none"> • Didactic support from significant others does not positively influence change 	Opportunity - Social	Social influences
	<ul style="list-style-type: none"> • Being told what to do does not lead to change • Being heard and having your opinion valued 	Opportunity - Social	Social influences

Theme	Categories	COM-B components	TDF Domain
	<ul style="list-style-type: none"> Feelings of helplessness based on previous failed attempts to be physically active 	Motivation - Automatic	Emotion
<ul style="list-style-type: none"> Reframing physical activity goals 	<ul style="list-style-type: none"> Gaining/shifting perspectives on being physically active Why do I really want to be active 	Motivation - Reflective	Intentions
	<ul style="list-style-type: none"> Utilisation/transference of existing skills 	Motivation - Reflective	Goals
<ul style="list-style-type: none"> Self-regulation 	<ul style="list-style-type: none"> Strengths orientated approach to maintain change 	Motivation - Reflective	Social/professional role and identity
	<ul style="list-style-type: none"> Challenging a negative mindset Learning from and forgetting past failures Non-judgmental listening support 	Motivation - Reflective	Beliefs about capability

Emotion - (Complex reactions - fear, anxiety, affect, stress, depression, positive and negative effect, burn out)

Intentions (A conscious decision to perform a behaviour)

Social/professional role and identity (Set of behaviours and displayed personal qualities in a social or work setting)

Skills (An ability or proficiency acquired through practice)

Beliefs about capability (Acceptance of the truth, reality or validity about an ability, perceived behavioural control, self-esteem, confidence)

Environmental context and resources (person's situation or environment)

Social influences (Process that can change thoughts feelings or behaviours – social pressure).

Knowledge (Awareness of the existence of something: knowledge of condition)

Behaviour regulation (Managing or changes action – self monitoring)

Goals (mental representations of outcome or end states that an individual wants to achieve)

BMJ Open

Factors influencing adults who participate in a physical activity coaching intervention: a theoretically informed qualitative study

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4 **1 Factors influencing adults who participate in a physical activity coaching**
5 **2 intervention: a theoretically informed qualitative study**
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36 ABSTRACT

37 **Objective:** Behaviour change interventions targeting changes in physical activity (PA) can benefit by
38 examining the underlying mechanisms that promote change. This study explored the use of the
39 Capability, Opportunity, Motivation and Behaviour (COM-B) model and the Theoretical Domains
40 Framework (TDF) to code and contextualise the experiences of participants who completed a PA
41 coaching intervention underpinned by motivational interviewing and cognitive behaviour therapy
42 (MI-CBT).

43 **Design:** Semi-structured interviews were conducted with a purposive sample of participants.

44 **Setting:** Interviews were conducted in a tertiary hospital in regional Victoria, Australia.

45 **Participants:** Eighteen participants who completed a PA coaching intervention were interviewed.
46 The participants were recruited into the coaching intervention because they were insufficiently
47 physically active at time of recruitment.

48 **Results:** Thirteen (72%) participants were women and the average age of participants was 54 (\pm 5)
49 years. Four participant themes mapped directly onto five components of the COM-B model, and ten
50 of the TDF domains. Increases in PA were influenced by changes in motivation and psychological
51 capability. The autonomy-supportive PA coaching intervention helped to evoke participants own
52 reasons (and motives) for change and influenced PA behaviours. Participants reflected on their own
53 social and/or professional strengths, and utilised these skills to set appropriate PA goals and action
54 plans. The structure of the PA coaching intervention provided clarity on session determinants and a
55 framework from which to set an appropriate agenda. Relational components (e.g. non-judgemental
56 listening, collaboration) were continually highlighted as influential for change, and should be
57 considered in future behaviour change intervention design.

58 **Conclusions:** We demonstrate the beneficial effect of utilising theory-informed behaviour change
59 techniques, and delivering them in a style that promotes autonomy and relatedness. The views of
60 participants should be a key consideration in the design and implementation of PA coaching
61 interventions

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3 62 **ARTICLE SUMMARY**
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6 63 **Strengths and limitations of this study**
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8

- 9 64 • Semi-structured interviews enabled in-depth exploration of the experiences of individuals
10 who participated in a physical activity coaching intervention.
11 65
12
13 66 • Including the perspectives of individuals who did not increase physical activity as well as
14 those who did increase physical activity as a result of the intervention can be considered a
15 67 strength of this study.
16 68
17
18 69 • Another strength of this study is the application of the COM-B model and the TDF to explore
19 the experiences of individuals that participated in a physical activity coaching intervention
20 70 underpinned by motivational interviewing and cognitive behaviour therapy.
21 71
22
23 72 • The sample was exclusively non-admitted hospital patients that participated in a physical
24 activity coaching intervention, and additional perspectives may provide a broader overview to
25 73 inform intervention development.
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75 INTRODUCTION

76 Regular physical activity (PA) is positively associated with numerous health-related benefits and a
77 marked reduction in risk for chronic disease.^{1,2} Although the importance of regular PA has been
78 widely publicised, large numbers of adults do not undertake the recommended levels of PA.³ For
79 example, only 50% of adults in the USA and 56% in Australia undertake the required amount of PA
80 to be deemed sufficiently physically active.^{4,5} Behaviour change interventions have been increasingly
81 used in an attempt to influence PA change, however numerous systematic reviews and meta-analyses
82 demonstrate that high proportions of participants revert to insufficient PA levels once the behaviour
83 change intervention is ceased.⁶⁻⁸ The marked reductions or cessation of PA can nullify the health
84 improvements gained from temporary PA increases.⁹ Consequently, there is a need to develop
85 behaviour change interventions that strengthen the maintenance of PA over time.¹⁰

86
87 Rothman suggested that theory-informed (e.g social-cognitive theory) interventions can be effective
88 for promoting maintenance of behaviour change.¹¹ Michie and colleagues expanded on this more
89 recently, proposing that behaviour change interventions need to address specific components of
90 change, namely an individual's capability, opportunity, and motivation to change.¹² The factors that
91 influence initiation of behaviour change differ substantially to those that influence maintenance.^{12,13}
92 Using the same theoretical constructs for behaviour change initiation and maintenance might not
93 account for variations in capability, opportunity, and motivation, many of which can be driven by
94 intentions, past experience, and environment.¹² There is a need to explore the potential determinants
95 of successful PA maintenance to assist in the development of interventions to produce lasting change.

96
97 Motivational Interviewing (MI) was developed to elicit motivation for behaviour change from the
98 individual.¹⁴ MI is an autonomy supportive intervention and seeks to empower clients to voice their
99 own reasons and strategies for change.^{14,15} MI strategies for behaviour change maintenance are less
100 specific, and are not emphasised as part of the four processes of MI (engaging, focusing, evoking, and
101 planning).¹⁴ As a result, the integration of action-orientated interventions such as cognitive-

1
2
3 102 behavioural therapy (CBT) has been recommended.¹⁶ Cognitive-behavioural therapy involves
4
5 103 assisting clients develop strategies and skills (e.g. activity scheduling, successive approximation) to
6
7 104 change behaviours.¹⁷ Instead of being passive recipients of CBT skills training, the integration of MI
8
9 105 and CBT (MI-CBT) can ensure that clients' have autonomy around the focus and direction of change,
10
11 106 which might support maintained change.¹⁰ Integrated MI-CBT has demonstrated effectiveness for the
12
13 107 maintenance of PA behaviour change across a number of studies,^{18,19} however participant experiences
14
15 108 of the intervention are absent from the literature.
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21 110 Qualitative approaches are beneficial to capture individuals' in-depth perspectives of the phenomenon
22
23 111 studied, in this case, their experience of the PA coaching intervention.²⁰ This study examines the
24
25 112 views of individuals who participated in a MI-CBT based PA coaching intervention as part of a
26
27 113 randomised controlled trial (RCT).¹⁹ Relative to control, the intervention group demonstrated
28
29 114 significant changes in PA at post-intervention (3-months) and these changes were maintained 9
30
31 115 months after the commencement of the intervention.¹⁹ At present, we do not understand what
32
33 116 influence contextual factors (mode of delivery, behaviour change techniques, therapeutic alliance)
34
35 117 within the coaching intervention might have had on these findings. Thus, the aim of this current study
36
37 118 was to qualitatively explore the experiences and perceptions of individuals who received the MI-CBT
38
39 119 based PA coaching intervention to identify determinants and facilitating factors that influenced PA
40
41 120 behaviour change. These insights will provide a deeper understanding of their experiences, and might
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43 121 offer valuable information to assist health professionals to improve intervention effectiveness and
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45 122 uptake.
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50 51 124 **METHODS** 52

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55 125 This study employed a qualitative design using an interpretive description approach,²¹ and adopted the
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57 126 Consolidated Criteria for Reporting Qualitative Research (Supplementary Material 1).²² Semi-
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59 127 structured interviews were conducted with a purposeful sample of adults who participated in a PA
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3 128 coaching intervention in the H4U-2 RCT to explore their experiences and perceptions of the
4
5 129 intervention to identify factors that influenced PA behaviour change.
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11 131 A detailed description of the PA coaching intervention (H4U-2) including the intervention schedule,
12
13 132 theories and techniques is available in the published literature.¹⁹ In brief, in the H4U-2 study, 120
14
15 133 insufficiently active adults (aged 18-69) were recruited from an ambulatory hospital clinic and
16
17 134 randomised to an intervention group that received an education session and PA coaching, or to a
18
19 135 control group that received the education session only. The PA coaching intervention comprised
20
21 136 integrated MI-CBT and was delivered in five 20-min sessions over 12 weeks via the telephone. The
22
23 137 intervention used an MI framework and microskills (open-ended questions, affirmations, reflections
24
25 138 and summaries) to underpin all sessions. The CBT skills training (e.g. goal setting, problem solving
26
27 139 and coping strategies) was delivered using the MI framework. The intervention was delivered by a
28
29 140 physiotherapist trained in MI-CBT through workshop attendances, and individual coaching from an
30
31 141 experienced practicing psychologist.
32

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38 143 The H4U-2 participants completed outcome measures at baseline, post-intervention (3 months) and
39
40 144 follow-up (9 months). This provided a 6-month non-intervention time to assess maintenance of
41
42 145 behaviour change. At baseline, the mean age of the H4U-2 participants was 53 ± 8 years and
43
44 146 accelerometer-measured PA was 15 ± 5 mins/day of moderate-to-vigorous PA (MVPA). The
45
46 147 intervention group increased MVPA at post-intervention (23 ± 10 mins/day) and maintained this at 9-
47
48 148 month follow-up (22 ± 10 mins/day). In contrast, the control group decreased MVPA at post-
49
50 149 intervention (13 ± 6 mins/day) and at follow-up (10 ± 6 mins/day). Ethical approval was obtained
51
52 150 from the research Ethics Committees of the study hospital and associated university. All participants
53
54 151 provided written consent prior to starting the study.
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152 **Sampling and recruitment**

153 All H4U-2 trial participants were asked to complete an evaluation form at the 9-month follow-up
154 which included a question about whether they would be willing to participate in a semi-structured
155 interview. Individuals who were in the intervention arm of the study and responded with “yes”
156 (n = 46) were considered as the sample eligible to participate in this study. A purposive sampling
157 procedure was used. We aimed for a variation in the participants’ (i) change in PA (an increase,
158 decrease or no change in PA between baseline and follow-up measured using accelerometers); (ii)
159 engagement with the behaviour change intervention, identified by the intervention provider; (iii)
160 gender and age to reflect the sample in the population; (iv) geographic location (rural or regional);
161 and, (v) socio-economic status, using postcodes as a proxy. A research assistant contacted the
162 individuals to confirm their wish to participate. Permission was sought to give their contact details to
163 the interviewers.

164
165 Twenty five people were invited to participate. Two individuals declined; one reported no longer
166 wishing to participate and the other individual cited health issues. The participant recruitment ceased
167 when we met our variation sampling requirements and reached data saturation. Data saturation was
168 considered to be reached when the analysis indicated that additional interviews were not providing
169 new concepts and the data provided were sufficient to address the research aims.²³ No new significant
170 information was derived between the seventeenth and eighteenth interviews, indicating that data
171 saturation was reached and interviewing was ceased.²³

172

173 **Interview process**

174 Written informed consent was obtained from all participants at the start of the interviews. Face-to-face
175 interviews were carried out in the Health Promotion department of the associated hospital between
176 June and September 2020. The interviews were carried out by the first author. A semi-structured
177 interview guide was developed based on existing literature^{24,25} and was used to facilitate the
178 discussion (Supplementary Material 2). The interview guide was piloted by interviewing three

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3 179 individuals who took part in a MI-CBT based PA coaching intervention delivered by the Health
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5 180 Promotion department of the associated hospital; these three individuals did not participate in the
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7 181 H4U-2 study, but did receive the same 5 x 20 min session of PA coaching as the H4U-2 study
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9 182 participants which was offered as part of standard health promotion practice in the associated hospital.
10
11 183 Following this pilot, additional questions, probes and prompts were included to further explore
12
13 184 individuals' experiences in terms of engaging in the behaviour change intervention. The pilot
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15 185 interviews were not included in the final sample as the individuals were not enrolled into the study.
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19 186 **Data analysis**

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22 187 Interviews were audio recorded, transcribed verbatim and rendered anonymous. Participants were
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24 188 identified as participant 1, participant 2 and so forth. The transcripts were analysed using an
25
26 189 interpretive description method.²¹ NVivo 12 software (QSR International, Cambridge, MA, USA) was
27
28 190 used to facilitate data analysis. The interpretive description approach requires emersion into the data
29
30 191 to identify thematic patterns, and an inductive analysis to permit theorising about explanatory
31
32 192 factors.²¹ We developed a draft coding frame to capture codes and emerging categories. The coding
33
34 193 frame was trialled by authors (SB¹ and KR) who independently coded 20% of the transcripts. A
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36 194 revised version of the framework was developed and tested by the research team; this version was
37
38 195 used to code all transcripts. The first author independently coded 18 transcripts, and two authors (KR
39
40 196 and GB) independently coded 9 transcripts each. The level of agreement between independent coders
41
42 197 was substantial. Disagreements were resolved through discussion amongst all coders.
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46 198
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48 199 Following this stage, the identified categories were mapped against the Theoretical Domains
49
50 200 Framework (TDF)²⁶ and COM-B model.¹² The TDF and COM-B model provide the theoretical basis
51
52 201 for understanding behaviour change. The TDF integrates 33 theories and 128 psychological constructs
53
54 202 into 14 domains underpinned by psychological theory.²⁶ The TDF domains include individual-level
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56 203 factors (knowledge, skills), social factors (social influences, social support), environment and resource
57
58 204 factors (cost of resources to facilitate change).²⁶ Taken together the 14 domains prompt the
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3 205 consideration of a wide range of influences on behaviour change. The 14 validated domains are
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5 206 included in Supplementary Material 3.
6
7 207 Michie and colleagues identified three components that need to be present to influence behaviour (B):
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9 208 capability (C), opportunity (O) and motivation (M); together these components make up the COM-B
10
11 209 model.¹² Capability refers to having the knowledge and skills required to engage in a behaviour; it can
12
13 210 be broken down into two components, psychological capability and physical capability. Opportunity
14
15 211 refers to the external factors which make undertaking a behaviour possible. Its two components are
16
17 212 physical opportunity and social opportunity. Motivation refers to the internal processes which
18
19 213 influence decision making and behaviours. Its two components are reflective motivation and
20
21 214 automatic motivation. The COM-B model is widely used to contextualise individual-level change and
22
23 215 determine what needs to change for behaviour change interventions to be effective.¹²
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27
28 217 We mapped the broad categories onto the TDF domains, as well as directly onto the six components
29
30 218 of the COM-B model to identify factors that are likely to influence PA behaviour change and could be
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32 219 targeted in future interventions. Participants' responses were analysed for descriptions of BCTs and
33
34 220 skills used as part of the PA coaching intervention. The technical components of the interventions
35
36 221 were mapped against Michie's taxonomy of behaviour change techniques (BCT),²⁷ and MI processes,
37
38 222 relational components and micro-skills.²⁸ The mapping of draft themes and findings were discussed
39
40 223 amongst all authors to investigate a broad perspective on thematic interpretations. Disagreements
41
42 224 between the team were resolved through discussion. The vigour of the qualitative research was
43
44 225 strengthened through the implementation of independent coding; triangulation of data, and the critical
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46 226 appraisal of developing themes.²⁹
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50 51 228 **Patient and public involvement**

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54 229 The research was designed and conducted without patient or public involvement.
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1
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3 231 **RESULTS**
4

5 232 Eighteen people participated in semi-structured interviews, where 13 (72%) were women and 5 (28%)
6
7 233 were men. The average age of participants was 54 (\pm 5) years, with participants ranging in age from
8
9 234 42 to 66 years. Table 1 provides details of the participants' characteristics. The interviews ranged in
10
11 235 duration from 26 to 45 minutes, with an average duration of 34 minutes.
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15
16
17 237 Table 1 Profile characteristics of participants (N = 18)
18

19 238

Marital Status	
20 239 Married/living together	15
21 Widowed	1
22 Single	2
Highest completed education	
23 Secondary/high school	4
24 Post-school vocational	8
25 University	6
Employment	
26 Working full-time	13
27 Working part-time	3
28 Retired	2
Geographic location ^a	
29 Regional	12
30 Rural	6
Socioeconomic area ^b	
31 1	4
32 2	4
33 3	6
34 4	4
35 5	3
Physical activity level at end of intervention ^c	
36 Meets guidelines	13
37 Does not meet guidelines	5
Pattern of physical activity from baseline to final measurement ^c	
38 Increased	13
39 No change	4
40 Decreased	1

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50 241 ^a The term 'regional and rural' encompasses all areas outside Australia's major cities. Regional
51 242 indicates living in a regional city. Rural indicates living in an area outside of a regional city.

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53 243 ^b Index of Relative Socio-economic Disadvantage (IRSD) Socio-Economic Indexes for Areas
54 244 (SEIFA) scores. IRSD data is presented as quintiles where 1 represents most disadvantaged, and 5
55 245 represents least disadvantaged.

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57 246 ^c Physical activity measurements taken from accelerometer data
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3 249 Perceptions of the PA coaching intervention were positive, including those participants who did not
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5 250 find the intervention beneficial for maintaining PA change. The structural components (i.e. defined
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7 251 session times and parameters) of the PA coaching intervention provided the participants with a clear
8
9 252 indication of what was involved, while the relational components (i.e. MI spirit: collaboration,
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11 253 empathy, evocation, autonomy) provided a platform for the participants to engage and focus on their
12
13 254 reasons for change. The structural and relational components highlighted by participants are detailed
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15 255 in Table 2. The delivery of the intervention via phone was reported as favourable by the majority of
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17 256 the participants. The telephone delivery provided flexibility around participation in the intervention
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20 257 with 16 participants in gainful employment during the intervention period.

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23 258 Four themes were identified that mapped across 5 of the COM-B components and 10 domains of the
24
25 259 TDF framework (Table 3). The themes included strength based coaching, autonomy-supportive
26
27 260 listening, reframing PA goals, and self-regulation. As evidenced in Table 3, the themes mapped to
28
29 261 multiple COM-B components and TDF domains; as such the findings are presented below under the
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31 262 identified COM-B heading, and related TDF domain sub-heading. These findings are described in
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33 263 detail below and supported using illustrative quotes from participants. The participant's gender, age
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35 264 and change in PA as a result of the PA coaching intervention are provided alongside each quote. The
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37 265 categories that informed these themes are presented in Supplementary Material 4.

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267 Table 2 Technical, relational and structural components of the physical activity coaching intervention

Component	Description	Illustrative quotes
<i>Technical/Relational</i>		
Being heard	Listening to the individuals’ unique issues and needs.	<i>“And I liked being listened to – I think that was another big one. I find sometimes if you are talking to someone who works in health, or it could be any profession but you get the feeling that they aren’t even listening. They sit there looking at you and the head is bobbing away, but they are just waiting for you to stop talking so they can get their opinion in. But to be listened to, and I mean really listened to is quite important. Not a token gesture” (Female, 61, increased PA)</i>
Collaboration	Participants reported that they did not feel like they were being told what to do. The intervention helped support their decisions.	<i>“So you feel listened to, but there isn’t a pressure to do what you don’t want. You are driving the bus, and you know where you want to go. And the coaching is like a co-pilot, trying to navigate the best route. Both heading in the same route, but with freedom in how to get there”. (Female, 55, no change in PA)</i>
Guiding style	Autonomy supportive style, directive towards physical activity changes that were chosen by the individual.	<i>“It was clear with what we wanted to do – get me fitter. But I really felt like I was in control, nothing was forced upon me, and I could do things at my own speed”. (Female, 52, increased PA)</i> <i>I think that it’s not just a conversation, but the kind of conversation. . So its guidance towards what’s right, not a push. Because you push me and I’ll push right back”. (Male, 51, no change in PA)</i>
Supporting self-efficacy	Recognising that the individuals had the self-knowledge to manage their health; support was to draw these strengths out from them.	<i>“How can I run, and forgive me for saying, a successful business, and I can’t manage my own fitness. That wasn’t the question, but the process made me think about it. How do I use my skills, skills I already have to make the change”? (Male, 52, increased PA)</i>

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Big picture perspectives	Participants mentioned the implementation of strategies to support maintained change from early in the intervention.	<i>“Questions like ‘how will you manage if you cannot attend your exercise group?’ seemed odd to me. But then you know, months later and the gym is shut and I had to change tact to be active elsewhere. So it was good to have considered the what-if type thing”. (Male, 50, increased PA)</i>
Structural		
Defined parameters	The use of clear descriptions for intervention sessions help clarify the goals of the sessions.	<i>“I felt I was kind of allowed to map the route for myself, I wasn’t forced down an alleyway. I didn’t have free reign, because the sessions started and ended with a rough guide of what we would do, so there was some bit of boundaries on it from that”. (Female, 51, increased PA)</i>
One to one	Provided an environment where participants felt comfortable to be open.	<i>“I just know I wouldn’t be comfortable expressing doubts about myself in a groups setting”. (Female, 62, no change in PA)</i>
Telephone delivery	Beneficial for practical reasons such as travel. Some individuals enjoyed the 1:1 relationship without the face-to-face requirement.	<i>For me it was great, I was able to schedule a session towards the end of the work day, did it from the office and then I was able to leave work and concentrate on me”. (Male, 52, increased PA)</i> <i>“I found it comforting to not have to look face to face while we were doing it. So having that physical distance allowed me to, to pace the hallways when I spoke if I needed, to laugh at myself or, frown or whatever. And that I think would have made me more relaxed overall”. (Female, 52, increased PA)</i>
Session timeframes	The number of session and their spread over time permitted relationship to grown, and allowed time to plans into action. Knowing sessions were coming up influenced accountability.	<i>I’ve been to session before, with the physio say, and 15 minutes in he is writing my goals for me. But they aren’t my goals at all.... It was nice to be able to decide for myself, at my own pace”. (Male, 54, decreased PA)</i>

269 Table 3 Mapping of themes to TDF domains and COM-B model with the associated BCTs

Theme	COM-B component	TDF Domain	BCT ^{a b}
	Capability – Psychological	Knowledge	Identification of self as role model ^a Evoked personal capabilities ^b
• Strength based coaching	Capability – Psychological	Skills	Goal setting (behaviour) ^a Goal setting (outcome) ^a Acceptance ^b Evoked reasons for goals ^b
	Capability – Psychological	Behaviour regulation	Self-monitoring of behaviour ^a Problem solving ^a Anticipated regret ^a Evoked (commitment) ^b Plan ^b
	Opportunity - Physical	Environmental context and resources	Reframing ^a Commitment ^a Salience of consequences ^a
• Autonomy-supportive listening	Opportunity - Social	Social influences	Compassion ^b Acceptance ^b

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	Motivation - Automatic	Emotion	Monitoring of behaviour by others without feedback ^a Engagement ^b Reflective listening ^b Evoke reasons for change) ^b Compassion ^b
• Reframing physical activity goals	Motivation - Reflective	Intentions	Discrepancy between current behaviour and goal ^a Pros and cons ^a Reframing ^a Focus to clarify agenda ^b
	Motivation - Reflective	Goals	Discrepancy between current behaviour and goal ^a Identification of self as role model ^a Evoke reasons for goals ^b Acceptance ^b
• Self-regulation	Motivation - Reflective	Social/professional role and identity	Focus on past success ^a Identification of self as role model ^a Evoke personal capabilities) ^b
	Motivation - Reflective	Beliefs about capability	Comparative imagining of future outcomes ^a Review behaviour goal(s) ^a Acceptance ^b Evoke personal capabilities) ^b

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272 ^a BCT taxonomy (Michie, van Stralen, and West 2011) ^b Motivational Interviewing techniques (Hardcastle et al. 2017; Miller and Rollnick 2012)

273 BCT: Behaviour change technique; COM-B: Capability, Opportunity, Motivation, Behaviour; TDF: Theoretical Domains Framework

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3 276
4 277 Emotion - (Complex reactions - fear, anxiety, affect, stress, depression, positive and negative effect, burn out)
5 278 Intentions (A conscious decision to perform a behaviour)
6 279 Social/professional role and identity (Set of behaviours and displayed personal qualities in a social or work setting)
7 280 Skills (An ability or proficiency acquired through practice)
8 281 Beliefs about capability (Acceptance of the truth, reality or validity about an ability, perceived behavioural control, self-esteem, confidence)
9 282 Environmental context and resources (Person's situation or environment)
10 283 Social influences (Process that can change thoughts feelings or behaviours – social pressure).
11 284 Knowledge (Awareness of the existence of something: knowledge of condition)
12 285 Behaviour regulation (Managing or changes action – self monitoring)
13 286 Goals (Mental representations of outcome or end states that an individual wants to achieve)
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3 289 **Capability – psychological**

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6 290 *Knowledge*

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8 291 Increased knowledge was not described as a key component that participants needed in order to
9
10 292 increase PA. The participants repeatedly stated that they did not need to be told they would benefit
11
12 293 from increasing PA.

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17 295 Anyone who is unfit knows they need to get fit – simple. But just telling them won't make a
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19 296 difference. (Female, 51, no change in PA)

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24 298 The participants highlighted how the PA coaching intervention used their existing skills to facilitate
25
26 299 changes in PA. This strength-based, person-centred, approach did not seek to impart knowledge,
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28 300 rather it sought to evoke personal capabilities from the individual, and to build their autonomy in
29
30 301 applying this knowledge towards initiating and sustaining changes in PA.

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35 303 The coaching was good, and I think spent lots of time looking at things I was good at, and sort
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37 304 of, how to apply these to my exercise. But it forced me to have a good look at myself, and
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39 305 what I was good at and probably not too good at, and at the time it took me a while to be
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41 306 comfortable with both. (Male, 52, increased PA)

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46 308 *Skills*

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48
49 309 Although the individuals were recruited from a secondary care hospital clinic, physical capability was
50
51 310 not discussed as a barrier to increasing PA. The participants did not indicate that they needed to be
52
53 311 provided education on what exercise to do, or the skills required to do it. Instead, participants noted
54
55 312 how in the past they felt that they did not have the ability to increase or maintain PA from a
56
57 313 psychological or emotional perspective.

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3 315 What was stopping me from being fit before...it was the mind. Not the body. I could
4
5 316 physically do it, but not mentally. (Male, 50, increased PA)
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10 318 Similar to the construct of knowledge, participants expressed how the intervention strategies sought to
11
12 319 evoke from them examples of the skills that they possessed.
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16 321 On paper being fit is easy right. You want to walk, get up and walk. And yet I sat at home on
17
18 322 the couch feeling bad for myself for not exercising, even though I can walk. Me, a grown
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20 323 woman, house, kids, job. Can run them all and I wasn't able get off the couch. So I needed a
21
22 324 shift in perspective. (Female, 55, no change in PA)
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28 326 *Behavioural regulation*

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30 327 Many of the participants described making numerous attempts at increasing PA in the past, only to
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32 328 lapse back to being insufficiently physically active. The inability to maintain regular PA over repeated
33
34 329 attempts had diminished their self-efficacy to be physically active. The MI-CBT intervention used in
35
36 330 the H4U-2 study employed specific BCTs to influence behaviour regulation as early as session 3
37
38 331 (week 4 of 12) of the intervention. The process of exploring capability to maintain PA changes was
39
40 332 new to many participants, as exemplified by the following quote:
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46 334 I think we weren't long into it, and I had started to do some exercise. And I was feeling good.
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48 335 He [intervention provider] started asking me about how I would manage to be fit if something
49
50 336 happened, can't remember exactly, say, my strength training class finished up or something.
51
52 337 And I was thinking, shouldn't he be telling me I was doing a good job. But you know, when
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54 338 you have to think about it, and explain yourself out loud it gets the wheels turning, and you
55
56 339 have to think 'how would I do it?' Because I've slipped off the wagon before. (Female, 49,
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3 340 increased PA)
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8 342 **Opportunity – physical**
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10 343 *Environmental context and resources*
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13 344 Physical opportunities were discussed alongside the shift in perspectives that many participants
14
15 345 encountered, from PA being something that they had to do, to something that they wanted to do. The
16
17 346 reframing of PA to something that was attainable and enjoyable resulted in individuals placing a
18
19 347 higher value on PA; when PA was afforded a higher value, people made time for it irrespective of
20
21 348 previously cited situational or environmental barriers.
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26 350 I used to drive to work every day. Its 2.2 KMs, which I know now because of walking. And of
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28 351 course you know how bad parking can be, so I'd probably spend ages looking for a park. Now
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30 352 I walk every day, to and from work. If it rains I can bring broolly, or drive if it's really bad. But
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32 353 I don't think of driving anymore, I enjoy the walk and it's a part of my day. (Female, 46,
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34 354 increased PA)
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39 356 **Opportunity – social**
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42 357 *Social influences*
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45 358 Some of the participants enrolled in community exercise programs, for example walking groups and
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47 359 strength training programs. The building of social links within groups was highlighted by some as an
48
49 360 important factor for continuing attendance, though many others were not concerned with building
50
51 361 social connections within PA groups.
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56 363 A large part of what kept me going back to the group was the friendship I made with other
57
58 364 people. I was only there for a few sessions and a bunch of them invited me to come along for
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3 365 coffee afterwards. That was always helpful in getting me along to sessions. (Female, 58,
4
5 366 increased PA)
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10 368 I did wonder if sometimes there was a bit too much chat about exercise groups and exercising
11
12 369 with other people. If I'm going to exercise I'll do it for myself, I don't need to be going with
13
14 370 someone for company. That's not important for me. (Male, 54; decreased PA)
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19 372 The social influence of partners and significant others was regularly discussed, primarily as it related
20
21 373 to the provision of unsolicited, didactic advice. The participants were aware that they were not
22
23 374 undertaking sufficient PA, they did not need this to be pointed out by their partners and significant
24
25 375 others. This didactic style of support contrasts with the relational components of the PA coaching
26
27 376 intervention such as autonomy-supportive listening and collaboration, components that participants
28
29 377 found beneficial in influencing PA change.
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34 379 There is always time for the right advice, and pointless advice is, well... pointless. (Female,
35
36 380 62, no change in PA)
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41 382 My husband was with me on the appointment, and he thought it was great that the surgeon
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43 383 discussed me getting fit. He's been on my back for a while about it. So, he is often asking
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45 384 when I'll do more exercise, but I'll tell you what, that makes me want to do even less in spite
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47 385 of him. Even though I knew I needed to do it. The fact that he was telling me to do more
48
49 386 made me want to do less to show him. (Female, 48, increased PA)
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54 388 **Motivation - automatic**

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57 389 *Emotion*
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3 390 The repeated attempts to engage in regular PA resulted in a feeling of helplessness in many of the
4
5 391 participants who enrolled in the PA coaching intervention. The sense of disappointment expressed by
6
7 392 participants was compounded by the fact that the barriers to regular PA were not physical, but
8
9 393 psychological and specifically emotional. The inability to maintain regular PA likely influenced the
10
11 394 participants' PA self-efficacy levels, and by extension their automatic motivation.
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16 396 When you have a few cracks at it, and you keep ending up in the same place, it doesn't feel
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18 397 good. You tell yourself, and maybe a friend 'that's it, I'm going to get myself in shape'. Then
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20 398 two months later they ask you how that's going and you are ashamed that you haven't done a
21
22 399 thing. And that does nothing for the self-confidence. (Female, 46, increased PA)
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27 401 I'm not afraid to say it, I needed the support. I mean, if I didn't I wouldn't have joined the
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29 402 coaching. I just wasn't able to do it alone. My motivation was shot, I wasn't, maybe, thinking
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31 403 clearly about it. Probably fed up and disappointed trying the same thing over and over and not
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33 404 going anywhere. (Male, 50, no change in PA)
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406 **Motivation - reflective**

407 *Intentions and goals*

408 Many participants described how previous attempts at PA were driven by a desire to lose weight.
409 When these attempts did not result in sustained PA levels or weight loss, they were sources of
410 frustration. It was commonly reported that the intervention looked to reframe PA from a weight loss
411 tool to something that might deliver general health benefits. This was followed with a change in goal
412 setting for outcomes. Shifting goal setting away from weight loss metrics changed the overall
413 intention of being active, and having flexible goals removed the notion of a binary outcome of
414 meeting or not meeting goals.
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3 416 For me, exercise was always about weight. Always. If I didn't reach the target I failed. And
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5 417 generally, I didn't meet the target. So that was no good. But now I don't exercise for weight; I
6
7 418 exercise for me. To make me feel good, and I am so much better for it. (Female, 55, increased
8
9 419 PA)

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14 421 *Social/professional role and identity*

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16 422 The concept of social or professional role was commonly described by participants as a tool used
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18 423 within the PA coaching intervention to elicit from participants areas of their life that they felt they had
19
20 424 achieved or maintained success in, and formulated part of the strengths-based approach to making PA
21
22 425 changes. Many participants were in full time employment with partners and dependent children. They
23
24 426 commented how the PA intervention required them to reflect on the strengths they have and
25
26 427 commonly use in these social and/or professional roles. This approach evokes personal or professional
27
28 428 capabilities, and the participants were able to reflect on where a transference of skills to PA was
29
30 429 possible.

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36 431 So, they didn't use these words, but I needed to think on the lines of 'how can I run a team,
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38 432 which I think is reasonably successful, and I can't get myself in shape'. Not those words, but
39
40 433 there was some, maybe, probing maybe. And you know, I thought, 'hey I am someone, and I
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42 434 can do this'. It wasn't a kick in the bum, but it made me sit up a bit. (Female, 51, increased
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44 435 PA)

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49 437 *Beliefs about capability*

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52 438 Participants beliefs about their capabilities were closely linked to the TDF domains of intentions and
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54 439 goals. As an example, exercising to lose weight and failing to attain weight loss goals resulted in a
55
56 440 negative mindset and low self-efficacy. By reviewing and revising behavioural goals and learning
57
58 441 from previous attempts, the participants noted a shift in their perceptions on capability. When
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3 442 discussing their attempts to be active before the PA coaching intervention some of the foremost
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5 443 feelings that prevailed were those of frustration and disappointment. By reframing intentions and
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7 444 altering their goals participants expressed a greater degree of confidence in their ability to maintain
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9 445 regular PA.
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14 447 Once I got going, then talking about reviewing the goals, and modifying, making harder, or
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16 448 easier as needed, [that] was all fine. The actual tasks right, the exercise itself, or the goal
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18 449 setting – they aren't hard to do. It's not overly complicated. But... but you need to be smart
19
20 450 about it and sometimes we get ourselves into a right spot that we can't see the timber from the
21
22 451 forest. And the coaching can pull your head in a bit and give you perspective. (Female, 52,
23
24 452 increased PA)
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28 29 454 **DISCUSSION**

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33 455 The aim of this study was to explore participants' perceptions of the factors that influenced their
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35 456 behaviour change throughout the course of a PA coaching intervention delivered using a MI-CBT
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37 457 framework. The interviews identified a wide range of barriers that influenced participants' capability,
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39 458 opportunity, and motivation to undertake regular PA, as well as the key elements of the PA coaching
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41 459 intervention that addressed these barriers. These key elements identified by participants included the
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43 460 combination of relational factors, namely the MI spirit used to underpin the intervention, and the
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45 461 technical factors which were the CBT skills that were utilised. The PA coaching intervention was
46
47 462 designed to ensure that MI and CBT were integrated together in all sessions, and the fidelity of
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49 463 delivery was measured.¹⁹ The participants highlighted the synergistic advantages of receiving both MI
50
51 464 and CBT techniques to motivate and promote lasting PA change.
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57 466 Changes in reflective motivation was one of the dominant components that influenced participants'
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59 467 behaviour change throughout the course of the intervention. Participants attributed a major change in
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3 468 intentions towards PA because of the intervention, specifically the shifting of perspectives away from
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5 469 PA being something they had to do (e.g. participants highlighted the erroneous assumption that PA
6
7 470 was necessary to lose weight) to PA being something they valued.³⁰ By reframing their intentions, the
8
9 471 participants set goals appropriate to their needs and importantly, their sense of capability.³⁰ This
10
11 472 relates closely with the need for self-efficacy for behaviour change.^{31,32} Participants consistently noted
12
13 473 that the strengths-orientated approach of the MI-CBT intervention helped build this self-belief. The
14
15 474 evocation of personal capabilities is encouraged within MI;^{14,15} participants stated that reflecting on
16
17 475 their capabilities within their social and/or professional role highlighted their existing strengths. This
18
19 476 demonstrated to individuals how to recognise the self-regulatory skills they already had, and how
20
21 477 these skills could be transferred to the attainment of regular PA.³³ Instead of providing expert advice,
22
23 478 the integration of MI-CBT permitted the individuals to voice their intentions and goals, and to
24
25 479 understand what skills were needed to achieve these goals.^{10,34} Positive perceptions in regards to one's
26
27 480 own abilities have been shown to increase the likelihood of longer-term PA behaviour change.³⁵
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33 482 In contrast to physical capability, which was rarely brought up in the interviews, the influence that
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35 483 psychological capability had on PA behaviour change was widely discussed by most participants. The
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37 484 participants in this study did not seek exercise prescription from the intervention, indeed they largely
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39 485 claimed to already know how to undertake their preferred exercise. The prevailing issue was the
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41 486 interrelation between the lack of motivation and a decreased sense of psychological capability,
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43 487 resulting in them not exercising. When discussing how the intervention helped change behaviour,
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45 488 reflection on their personal capabilities and skills was a common technique mentioned by the
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47 489 participants. Behaviour change techniques such as identification of self as role model have been
48
49 490 demonstrated to influence change;²⁷ the use of MI techniques to evoke examples of personal capacity
50
51 491 might have influenced their confidence in their own capabilities.²⁸ MI has been shown to support
52
53 492 psychological needs based on self-determination theory³⁶ as well as enhance self-efficacy,³² and the
54
55 493 integration of MI-CBT provides an autonomy-supportive framework for the delivery of BCTs.¹⁰
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3 495 The interviews highlighted the importance of the relational components of the PA coaching
4
5 496 intervention, namely the MI style or spirit (i.e. collaboration, compassion, evocation and empathy)
6
7 497 used to underpin the intervention delivery. For most participants, the intervention was viewed as a
8
9 498 positive experience, with a strong emphasis on the value of being listened to.³⁷ This reinforces the
10
11 499 significance of person-centred interventions, and aligns with the importance of autonomy-supportive
12
13 500 influences described within self-determination theory.³⁶ Self-determination theory posits that the
14
15 501 quality of the support influences motivation and can help build self-efficacy.³⁶ The favourable
16
17 502 experience of the intervention contrasts to the participants' description of support offered by partners
18
19 503 or significant others. This support was didactic in nature, and they felt they were being informed of
20
21 504 what they should do, without being listened to. The provision of listening support is a fundamental MI
22
23 505 technique, and the spirit of MI communicates compassion, acceptance and partnership.^{14,38} Using MI
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25 506 as the foundational platform provides a supportive environment in which to deliver non-judgemental
26
27 507 understanding and empathy.³⁸ These relational components are likely to result in an increased sense of
28
29 508 autonomy and build reflective motivation to increase and maintain PA changes.^{10,28,38,39}
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35 510 Increased beliefs about capability and use of self-regulation strategies characterised participants who
36
37 511 were successful in maintaining their PA, which included a 6-month non-intervention period from the
38
39 512 end of the intervention to the final measurement. Perceptions of capability and motivation are some of
40
41 513 the internal and external processes (cognitive, self-reflective and self-regulatory) that come into play
42
43 514 in human psychosocial functioning.¹² Indeed, behaviour- or self-regulation has been shown to mediate
44
45 515 PA behaviours.⁴⁰ Some of the self-regulation strategies highlighted by participants included "relaxed"
46
47 516 goal setting and planning. The MI framework of the intervention encouraged the individuals to set
48
49 517 goals appropriate for them, and work out and plan their own strategies to regulate their PA. This is
50
51 518 consistent with the autonomy-supportive approach of MI by offering choice over goals and
52
53 519 demonstrating to participants that there are different ways to achieve these goals.^{14,38} By empowering
54
55 520 participants to set appropriate goals and demonstrating that it is the participant who decides what
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57 521 choices to make, the participants are likely to be more engaged in the process and the more
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3 522 demanding CBT elements of the intervention.⁴¹
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8 524 **Applied implications**
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10 525 From a policy perspective, the delivery of the intervention 1:1 over the telephone was found to be
11
12 526 favourable for most participants. This permitted the development of an inter-personal relationship
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14 527 which has been demonstrated to influence change,⁴² and at the same time the telephone delivery
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16 528 provided participants with a sense of physical space which helped them relax. For health-service
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18 529 delivery is it encouraging that many participants found the coaching via telephone effective as
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20 530 telephone delivery permits offering services to wide geographic regions and can be delivered at
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22 531 participants' convenience.
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28 533 Participants commonly noted that the provision of defined parameters around the intervention
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30 534 sessions was beneficial for instilling a degree of focus within the sessions. The participants enjoyed
31
32 535 the autonomy of goal setting and planning; goal setting is not always associated with autonomy, and
33
34 536 goals that are not self-endorsed are likely to inhibit motivation.⁴³ Using MI to underpin the delivery of
35
36 537 the PA coaching intervention likely contributed to the sense of empowerment the participants detailed
37
38 538 they had in setting their own goals and agendas.³⁰ Alongside this autonomy, the participants valued
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40 539 being provided with clarity on the scope of each intervention session as this provided a scaffold from
41
42 540 which to establish their agenda. Providing clear descriptions for sessions, including scope, summaries
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44 541 and between session plans are key components for intervention fidelity for MI-CBT.⁴⁴ Practitioners
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46 542 and researchers can be encouraged that the structural parameters provided from the fidelity framework
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48 543 were positively received by individuals, and potentially contributed to successful behaviour change.
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54 545 From a practice perspective, a large proportion of the techniques identified by participants as being
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56 546 important for promoting PA change were classified as relational. The importance of relational
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58 547 components within interventions needs to be considered when promoting behaviour change.⁴⁵ The
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3 548 techniques classified in well-established BCT taxonomies have centred on the content of
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5 549 interventions, and have not examined the interpersonal components of interventions.⁴⁵ The PA
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7 550 coaching intervention in the H4U-2 study used established BCTs, but delivered them using a MI
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9 551 framework.¹⁹ The MI spirit is a style of interaction that promotes an interpersonal relationship; it
10
11 552 represents the way that the intervention content is delivered.³⁸ A number of authors have proposed
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13 553 that relational components of interventions are likely to interact with technical components to
14
15 554 influence behaviour change.^{45,46} This is consistent with the argument put forward by Hilton and
16
17 555 Johnston that it is important *how* behaviour change interventions are delivered, rather than exactly
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19 556 *what* is contained in the intervention.⁴⁷ Integrating MI with CBT permits the combination of content
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21 557 and relational techniques to increase the effectiveness of the intervention.¹⁰ In this paper we have
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23 558 examined participants' experiences of the intervention and attempted to make the distinction between
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25 559 relational and content-based techniques found to influence behaviour change.
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31 **Strengths and limitations**

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34 562 By identifying BCT techniques and mapping successful intervention components to TDF domains,
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36 563 COM-B components and central tenets of self-determination theory, we have distilled some of the
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38 564 macro level *what* of behaviour change interventions down to the more micro level of *how*. Using the
39
40 565 TDF provides a deeper understanding of the barriers and enablers to PA for insufficiently physically
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42 566 active ambulatory care patients.²⁶ Mapping the findings into the COM-B model and highlighting
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44 567 specific BCTs is a significant strength of this study due to the integration of theoretically derived
45
46 568 domains and structural and relational BCTs. Together they demonstrate the theory-informed use of
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48 569 MI-CBT as an evidence-based intervention to increase and maintain PA. The design of the PA
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50 570 coaching intervention was based upon determinants of PA change;^{12,14,19} gaining perspectives from
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52 571 individuals who participated in the intervention provides further evidence to assist in developing
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54 572 effective interventions in the future.
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3 574 There were some potential limitations in this study. Some difficulty arose in the categorisation of TDF
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5 575 themes and associated BCTs due to a degree of ambiguity in the definitions of the theoretical
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7 576 domains. Where this arose, the categorisation was determined through consensus via discussion
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9 577 within the research team. The sampling frame for the study was another potential limitation as all
10
11 578 participants were recruited through an ambulatory hospital clinic in one hospital setting. The
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13 579 recruitment from one setting only potentially restricted the diversity in participants, in particular
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15 580 diversity in ethnicity, and limits the generalizability of the findings to broader populations. The
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17 581 participants who agreed to take part in this qualitative study may have been motivated and willing to
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19 582 talk about PA. The H4U-2 trial participants were asked if they were willing to participate in this study
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21 583 and we purposely recruited participants who did not increase PA as a result of the intervention to
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23 584 provide a broad sample. We made a conscious effort to recruit male and female participants, to
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25 585 provide understanding into the experiences of both genders.
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34 588 **CONCLUSIONS**

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37 589 This study provides an understanding of how participants perceived a PA coaching intervention and
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39 590 identified some of the behavioural factors that enabled or inhibited PA and the components that
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41 591 influenced their PA behaviour change. Using the TDF and COM-B model provides a theoretical basis
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43 592 for understanding behaviour factors in specific contexts, providing an indication of *what* is required to
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45 593 change. Identifying content and relational BCTs provides an overview of *how* to deliver autonomy-
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47 594 supportive interventions to support self-regulation of PA behaviour and build self-efficacy to maintain
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49 595 change. The findings from this study are valuable from theoretical, applied, training and
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51 596 commissioning perspectives because the BCTs, and the structural and relational components of the
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53 597 intervention that influenced behaviour change were identified firsthand by participants involved in the
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55 598 study. Its findings can be used to influence future intervention design, delivery and its monitoring and
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57 599 evaluation.
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3 **600 Footnotes**
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6 **601 Author Contributions:** SB¹, MK, SB² and PO'H conceived the project and assisted with the protocol
7
8 **602** design. SB¹ collected and analysed the data with support from KR and GB. SB¹ wrote the first draft of
9
10 **603** the manuscript. SB¹, SB², PO'H, JB, KR, GB and MK critically reviewed the manuscript and
11
12 **604** provided detailed feedback. All authors read, edited and approved the final manuscript as submitted.
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15
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19
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21
22 **608** conflicts of interests to declare.
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25
26 **609 Competing interests:** None declared.
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29 **610 Ethics approval:** The study was approved by the Research Ethics Committees of Bendigo Health
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31 **611** Care Group (approved November 1, 2018; reference number LNR/18/BHCG/44121) and La Trobe
32
33 **612** University College of Science Health and Engineering Human Ethics Sub-Committee (approved
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35 **613** November 13, 2018). Participants provided informed written consent prior to starting the study.
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39 **614 Data sharing statement:** Data are available upon reasonable request.
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729 Table 1. Profile characteristics of participants

730 Table 2. Technical, relational and structural factors of intervention

731 Table 3. Mapping of themes to TDF domains and COM-B model with the associated BCTs.

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COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

H4U-2 Participants experiences - Interview guide

Topics	Questions
General	Standard opening question: What was the reason you agreed to participate in the Healthy 4U-2 study?
Expectations prior to the study	<p>What expectations did you have prior to the Healthy 4U-2 study?</p> <p>Can you tell me to what extent your expectations were met?</p> <p><i>Can you rate this 1-10?</i></p>
Perceived outcome	<p>Can you tell me whether you think you became more physically active due to your participation in the study?</p> <p><i>In what ways?</i></p> <p><i>How long did it take to have an impact?</i></p>
Experiences with MI-CBT intervention	<p>Can you tell me how you experienced the telephone support you received during the consultations?</p> <p>Can you tell me whether you think the consultations helped you increase your physical activity?</p> <p>If yes, what components helped with increasing physical activity?</p> <p><i>Which components were most helpful? (Prompt: in what ways?)</i></p> <p><i>Which components were not so helpful? (Prompt: why not)</i></p> <p><i>Would you recommend changing any components? In what ways? Why?</i></p>
Perceptions towards the MI-CBT consultation structure and most prevalent BCTs	<p>How did you experience setting personal goals and action plans?</p> <p>Did the facilitator help you to set your own goals and plan your actions? <i>[BCTs: goal setting and action planning]</i></p> <p>To what extent did this affect your progress?</p>

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	What is your opinion about reviewing the extent to which you attained your goals? [BCT: reviewing behavioural goal(s)] Did this affect your progress?
	Did the facilitator discuss how you can get any support from e.g., family or friends? [BCT: social support] To what extent did this affect your progress?
	Did you discuss strategies to maintain being physically active?
	Did you bring up the strategies yourself? [BCTs: habit formation, problem-solving and relapse prevention].
	Can you tell me how the facilitator supported you if you found it difficult to maintain your progress? What did you find helpful and unhelpful? [BCT: problem-solving]
	Can you tell me whether you think the study consultations differed compared to other consultations you have had around increasing physical activity?
Experiences with the study materials and equipment	Can you tell me how you found wearing the accelerometer and keeping the activity logbook? How did this affect your progress? Did you perceive any difficulties while wearing the accelerometer or keeping the activity log? How did you handle this?
Most and least effective components	Can you tell me what you found most helpful in becoming more physically active? Can you tell me what you found least helpful in becoming more physically active?
Duration of the intervention	What is your opinion about the number and length of the consultations?

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3		Generally, how much time did you spend on keeping the activity
4		log? Was this helpful?
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6		Was this acceptable to you?
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10	Satisfaction with the intervention	Can you tell me how satisfied you are with your participation in
11		the Healthy 4U-2 study?
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13		Ask for scale rating 1-10 – <i>follow up with why this score.</i>
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18		Would you recommend this intervention to other patients?
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20		Why/why not
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22		What time of people would you recommend this intervention
23		to?
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27	Prevention in hospitals	You entered the study after coming into hospital to see a
28		surgeon- how did that happen?
29		What are your thoughts on receiving this information from the
30		surgeon?
31		Did receiving a referral from a surgeon influence your decision
32		to take part?
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35		Have you discussed increasing physical activity with other health
36		professionals in the past?
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38	Perceptions towards maintaining	Have you made any changes to your general daily routine as a
39	physical activity	result of your participation in the study?
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42		To what extend do you think you will maintain being physically
43		active?
44		Now you have finished the intervention, how motivated are you
45		to continue being more physically active?
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49		Now you have finished the intervention, how self-confident are
50		you to continue being more physically active?
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53		How do you plan to maintain the changes you have made?
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Additional questions regarding previous or not discussed topics	Do you have anything to add to the questions I have asked
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The Theoretical Domains Framework (TDF)

TDF domain	Description
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 representation 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 an individual to change their thoughts, feelings or behaviours.
Emotion	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.

Themes, categories and associated TDF domains and COM-B model components

Theme	Categories	COM-B component	TDF Domain
<ul style="list-style-type: none"> • Strength based coaching 	<ul style="list-style-type: none"> • Building on existing skills to address physical activity 	Capability – Psychological	Knowledge
	<ul style="list-style-type: none"> • Focus on individuals strengths and capabilities 	Capability – Psychological	Skills
	<ul style="list-style-type: none"> • Goal setting based on capabilities • Non-judgmental, autonomous decision making • Confidence in abilities • Non prescriptive / clients felt they not directed to make undesired change 	Capability – Psychological	Behaviour regulation
	<ul style="list-style-type: none"> • Building maintenance skills 	Capability – Psychological	Behaviour regulation
<ul style="list-style-type: none"> • Autonomy-supportive listening 	<ul style="list-style-type: none"> • When you value physical activity you can find time for it 	Opportunity - Physical	Environmental context and resources
	<ul style="list-style-type: none"> • Didactic support from significant others does not positively influence change 	Opportunity - Social	Social influences
	<ul style="list-style-type: none"> • Being told what to do does not lead to change • Being heard and having your opinion valued 	Opportunity - Social	Social influences

Theme	Categories	COM-B components	TDF Domain
	<ul style="list-style-type: none"> Feelings of helplessness based on previous failed attempts to be physically active 	Motivation - Automatic	Emotion
<ul style="list-style-type: none"> Reframing physical activity goals 	<ul style="list-style-type: none"> Gaining/shifting perspectives on being physically active Why do I really want to be active 	Motivation - Reflective	Intentions
	<ul style="list-style-type: none"> Utilisation/transference of existing skills 	Motivation - Reflective	Goals
<ul style="list-style-type: none"> Self-regulation 	<ul style="list-style-type: none"> Strengths orientated approach to maintain change 	Motivation - Reflective	Social/professional role and identity
	<ul style="list-style-type: none"> Challenging a negative mindset Learning from and forgetting past failures Non-judgmental listening support 	Motivation - Reflective	Beliefs about capability

Emotion - (Complex reactions - fear, anxiety, affect, stress, depression, positive and negative effect, burn out)

Intentions (A conscious decision to perform a behaviour)

Social/professional role and identity (Set of behaviours and displayed personal qualities in a social or work setting)

Skills (An ability or proficiency acquired through practice)

Beliefs about capability (Acceptance of the truth, reality or validity about an ability, perceived behavioural control, self-esteem, confidence)

Environmental context and resources (person's situation or environment)

Social influences (Process that can change thoughts feelings or behaviours – social pressure).

Knowledge (Awareness of the existence of something: knowledge of condition)

Behaviour regulation (Managing or changes action – self monitoring)

Goals (mental representations of outcome or end states that an individual wants to achieve)