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QUALITATIVE EVALUATION OF A HIIT PROGRAM

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In it together: A qualitative evaluation of participant experiences of a 10 week, group based, work place HIIT program for insufficiently active adults

Date submitted: 21st December 2017

QUALITATIVE EVALUATION OF A HIIT PROGRAM

1 **Abstract**

2 Using guidance from the RE-AIM evaluation framework, we aimed to qualitatively evaluate the
3 participant experiences of a high intensity interval training (HIIT) workplace intervention. Twelve
4 previously insufficiently active individuals (4 male, 8 females) were interviewed once as part of 3
5 focus groups. Perceptions of program satisfaction, barriers to and facilitators of adherence and
6 persistence to exercise were explored. HIIT initiates interest because of its novelty, provides a
7 sense of accomplishment and overcomes the barriers of perceived lack of time. The feeling of
8 relatedness between the participants can attenuate negative unpleasant responses during the HIIT
9 sessions. HIIT, in this workplace setting, is an acceptable intervention for physically inactive
10 adults. However, participants were reluctant to maintain the same mode of exercise, believing that
11 HIIT sessions were for the very fit.

12

13 **Key words:** High-intensity interval training, evaluation, qualitative, health promotion, physical
14 activity

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1 **Introduction**

2 The prevalence of physical inactivity worldwide and associated non-communicable diseases are a
3 growing concern (Lee et al., 2012). A regularly active lifestyle has consistently been shown to
4 contribute to improved physiological and psychological wellbeing (e.g., cardiovascular risk factors,
5 improved mood: Penedo & Dahn, 2005; Puetz, O'Connor, & Dishman, 2006). To ameliorate the
6 concern about inactive lifestyles, different intervention approaches have been **used in an attempt to**
7 increase physical activity levels in physically inactive and insufficiently active adults (Prince,
8 Saunders, Gresty, & Reid, 2014). However, a perceived lack of time and convenience, low levels of
9 energy, low perceived self-efficacy and unsuitable physical environments continue to be cited as
10 common barriers to exercise in working adults (Edmunds et al., 2014). Therefore, to increase their
11 efficacy, interventions should aim to overcome such barriers by incorporating time effective
12 components, in an acceptable context whilst aiming to facilitate perceptions of competence and
13 self-efficacy.

14 One intervention approach that has received recent debate on its suitability as a public
15 health intervention (Biddle & Batterham, 2015) is high-intensity interval training (HIIT). HIIT
16 typically involves repeated bouts of high intensity exercise interspersed with periods of low
17 intensity recovery or rest (Shepherd et al., 2015). HIIT, as an intervention approach for previously
18 inactive adults, has produced cardio-metabolic adaptations beneficial to physical health (Prince et
19 al., 2014) and psychological health (Gibala et al., 2012). These improvements are comparable to
20 more traditional moderate-intensity continuous training. Biddle and Batterham (2015), Gibala et
21 al. (2012) and Shepherd et al. (2015) collectively agree that HIIT is a time-efficient strategy to
22 illicit positive adaptations. This is associated with the fact that participants are required to engage in
23 high intensity exercise for shorter periods of time to achieve the benefits in comparison to
24 moderate-intensity continuous training (Gillen & Gibala, 2013). However, research examining
25 affective responses to exercise in physically inactive adults has identified, in line with dual mode
26 theory (Ekkekakis, 2003), a negative relationship between exercise intensity and affect, such that,
27 as the intensity of the exercise increases above the ventilatory, or lactate threshold, the affective

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1 response becomes increasingly negative and individuals experience a rapid decline of pleasurable
2 feelings (Ekkekakis, Parfitt, & Petruzzello, 2011). Given that affect experienced during exercise is
3 claimed to predict future exercise behaviour (i.e., Rhodes & Kates, 2015; Williams et al., 2016), a
4 possible explanation for high rates of physical inactivity is that individuals choose not to engage in
5 behaviours perceived to be unpleasant (Jung, Bourne, & Little, 2014). Healthy, insufficiently active
6 adults have reported greater enjoyment of HIIT compared to moderate-intensity continuous training
7 (MICT; Bartlett et al., 2011) and continuous vigorous exercise (Jung et al., 2014) despite higher
8 ratings of Rate of Perceived Exertion (RPE; Bartlett et al., 2011); which is more commonly
9 associated with negative affect (Ekkekakis et al., 2011). Bartlett et al. (2011) suggested that the
10 increased enjoyment experienced during HIIT could be due to participants perceiving a greater
11 sense of challenge, stimulation or accomplishment from more demanding training sessions rather
12 than enjoyment of the activity per se. A recent scoping review by Stork, Banfield, Gibala and
13 Martin, (2017) highlighted that post-exercise assessment of affect and enjoyment, overall
14 enjoyment and preferences of interval exercise are equal or greater than for continuous exercise.
15 However, methodological issues (e.g., varying protocol, measures and inconsistent terminology)
16 require further attention to support the viability of interval exercise as an appropriate mode of
17 exercise for the general population (Stork et al., 2017).

18 The current study included a sub-sample from a larger group-led workplace indoor program
19 where participants cycled using principles of HIIT. The workplace is a recognized key health
20 setting to increase physical activity due to the amount of time an individual spends there (Rongen,
21 Robroek, Van Lenthe, & Burdorf, 2013). A group based intervention approach has been successful
22 in a variety of populations, and in particular for physically inactive individuals (Kassavou, Turner,
23 & French, 2013) . However, the degree of efficacy depends on other (moderating) factors (Harden
24 et al., 2015). Specifically, group based interventions are thought to be more successful if the
25 members interact, identify as a unit and express a degree of cohesiveness towards accomplishing
26 goals (Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006).

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1 Participants in the current HIIT group were able to self-monitor their exercise intensity
2 throughout each session and were asked to attend a specified number of sessions per week
3 (Shepherd et al., 2015). Self-monitoring and goal setting (Piwek, Joinson, & Morvan, 2015), in
4 particular in a group setting, can facilitate adherence to exercise (Harden et al., 2015). Music has
5 been shown to enhance enjoyment during exercise sessions (Karageorghis & Priest, 2012) and
6 specifically during sprint intervals (Stork, Kwan, Gibala, & Martin Ginis, 2015). Therefore, music
7 of various genres (chosen by the instructor) was played throughout all sessions to facilitate
8 enjoyment.

9 Although the implications of HIIT for exercise adherence have been quantitatively
10 investigated (Bartlett et al., 2011), no study to date has qualitatively explored the participant
11 experiences of a workplace, group-based HIIT. In fact, qualitative research is missing from the
12 current literature on the psychological implications of interval exercise (Stork et al., 2017). A
13 qualitative approach can provide **an** in-depth understanding of **how an** individual experiences
14 **interval-style training**. It is increasingly acknowledged that acceptability should be considered when
15 evaluating interventions. The Medical Research Council has published guidance documents for
16 evaluating complex interventions and recommend qualitative methods to assess participant
17 acceptability (Moore, Audrey, Barker, & Bond, 2014). Although the amount of references to
18 acceptability within guidance documents has increased, published literature offers little direction on
19 how to define or assess acceptability. To address this lack of direction, Sekhon, Cartwright, and
20 Francis (2017) recently developed a definition of acceptability within healthcare interventions; “a
21 multi-faceted construct that reflects the extent to which people delivering *or* receiving a healthcare
22 intervention consider it to be appropriate, based on anticipated or experienced cognitive and
23 emotional responses to the intervention” (p 4). **Gaglio, Shoup, and Glasgow (2013) highlight the**
24 **merits of using qualitative measures to understand, provide detail and context to each dimension of**
25 **the evaluation framework RE-AIM (Reach, Efficacy, Adoption, Implementation and Maintenance;**
26 **Glasgow, Vogt, & Boles, 1999; www.RE-AIM.org).** In the published debate between Biddle and
27 Batterham (2015), Biddle points out that this information is not yet available for existing HIIT

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1 programs. The evaluation process is important for intervention efforts designed to encourage more
2 active lifestyles, and increases the likelihood that the intervention is appropriate, credible, relevant
3 and attractive to the target population; all of which are prerequisites for behaviour change (Deliens,
4 Deforche, De Bourdeaudhuij, & Clarys, 2015).

5 **Aims.**

6 Brief bouts of high intensity exercise sessions that are not perceived as aversive, that can save time
7 and achieve physiological and psychological benefits should be explored further. Using the
8 definition of acceptability by Sekhon et al. (2017) and guidance from the RE-AIM **framework to**
9 **frame topics of discussion**, the aim of this study was to qualitatively evaluate the participant
10 experience of a 10 week high-intensity interval training (HIIT) program which were group based,
11 and instructor led using stationary bikes in an indoor studio.

12 **Methods**

13 A University Research Ethics Committee granted ethical approval. A detailed overview of the
14 larger study (design, methods and findings) have been published in Shepherd et al. (2015). An
15 outline of the workplace program is provided below followed by methods used for the qualitative
16 evaluation.

17 **The intervention**

18 *Context:* Forty-six participants were recruited to the physical activity program at three separate time
19 points with three start dates 15 weeks apart (cohort 1 n= 19, cohort 2 n= 15, cohort 3 n= 16). The
20 start dates were spread over 10 months. Posters were displayed across a West Midlands University
21 Campus and University Hospital. Emails were sent to staff via the University intranet. All group
22 sessions were conducted to music and led by one of 4 qualified exercise instructors. Participants
23 were set individual heart rate target values, for each session (predetermined from results of a
24 baseline VO_{2max} test and measured using a heart rate monitor that transmitted the heart rate to a
25 central unit, the Polar Team 2, Polar Electro Ltd., Warwick, UK). Participants were asked to attend
26 3 out of 5 available sessions per week for a period of 10 weeks (Monday-Friday). Classes took

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1 place in close proximity of the participant's work place prior and after the normal working day.
2 Lunchtime sessions were also available.

3 *High Intensity Interval Training (HIIT)*: Participants aimed for a HR equivalent to >90%
4 HR_{max} which were projected onto the wall in front of them. This allowed participants to track their
5 heart rates independently. Each session included repeated sprints of between 15-60 seconds
6 interspersed with periods of active recovery between 45-120 seconds. Sessions lasted 18-25
7 minutes and sprints got increasingly longer as the intervention progressed. **The main trial paper**
8 **highlighted that participants achieved an average maximum heart rate at the end of each interval**
9 **equivalent to 91% ($SD=6$) HR_{max} , with no significant difference seen between bouts lasting 15, 30, and**
10 **60 seconds (Shepherd et al., 2015).**

11 **The evaluation**

12 The evaluation was assessed using the definition of acceptability by Sekhon et al. (2017), **and**
13 **guidance from the RE-AIM framework (Glasgow et al., 1999). Specifically, we used five of the**
14 **seven qualitative evaluation criteria outlined by Gaglio et al. (2013) in their systematic review of**
15 **RE-AIM use from 1999-2000 to inform the topics discussed in the focus groups. The five key**
16 **qualitative evaluation criteria were explored from the participant perspective. They were; 1) The**
17 **intervention context (Participants experience of the external factors that influence the acceptability**
18 **of the program), 2) Reach (participant understanding of recruitment), 3) Effectiveness (participant**
19 **understanding of outcomes, participant satisfaction, individual barriers and facilitators to adopting**
20 **and adhering to the program; 4) Implementation (participant perceptions of barriers and facilitators**
21 **within the delivery), and 5) Maintenance (participant experience of persistence to exercise once the**
22 **program had ended).**

23 **Participants**

24 All 46 participants (adherers and non-adherers) from the intervention were invited, via email, to
25 participate in one of three focus groups between 2 and 3 weeks following the end of their 10 week
26 training program. **Four of the 46 participants did not adhere to the intervention because they were**
27 **relocated by their employer (n=2) or for personal reasons (n=2).** Three focus groups were

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1 conducted to include the experiences of participants from each of the three cohorts. Twelve of the
2 46 employees responded and volunteered to take part. All 12 volunteers were adherers to the HIIT
3 (n=12) program and had attended at least 80% of the sessions required. **This number is**
4 **representative of the wider programme where participants attended on average 83% (SD=14) of**
5 **sessions.** Table 1 details the mean demographic and other key characteristics for the participants.
6 Participants were physically healthy and insufficiently active at baseline according to the
7 recommended levels of physical activity (Department of Health, 2011).

8 [INSERT TABLE 1 HERE]

9 **Data collection**

10 Focus groups lasted between 65-75 minutes and consisted of a mix of age and gender (detailed in
11 table 1) to generate discussion and comparisons through participant discussion. We aimed to
12 provide a more ‘naturalistic’ setting whereby participants from the program could interact using a
13 range of communicative processes (i.e., storytelling, joking, challenging each other’s views).
14 Discussions could elicit individual understanding of the social context while they discussed and
15 compared their individual experiences (Wilkinson, 1998). Therefore participants could openly
16 discuss the nuances of their individual experiences within their classes and on the wider program.

17 The aim of each focus group was to evaluate the program at an individual level. Topics
18 explored the five evaluation criteria and included; 1) recruitment experience and participant
19 expectations, 2) facilitators and barriers to program participation and adherence, and 3) intentions
20 and factors impacting post-program persistence to physical activity. The focus group interview
21 schedule included broad, open ended questions, was guided by previous literature assessing the
22 feasibility of physical activity interventions (Thøgersen-Ntoumani, Loughren, Taylor, Duda & Fox,
23 2014) and treated as a template to provide flexibility. One researcher led the group while a second
24 documented body language and emotion within the group. These field notes acted as a means of
25 complementing and contextualizing the analysis.

26 **Analysis.**

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1 The audio recordings from the focus groups were transcribed verbatim and anonymised. We
2 analysed the data using thematic analysis by following the guidelines set out by Braun and Clarke
3 (2006). Within thematic analysis, the application of themes across datasets enables a systematic
4 overview of the scope of the data (Ritchie, Lewis, McNaughton Nicholls, & Ormston, 2014) and
5 facilitates comparisons within and between groups (i.e., within each focus group and between each
6 cohort). We analysed the data taking a contextualist approach (Willig, 2013), where we
7 acknowledged how individuals made meaning of their experiences, and how the broader social
8 context impacted on those meanings. This process was carried out in 3 steps. In the first instance,
9 raw data themes relating to each of the three topics were developed by the 1st author and
10 corroborated by the 2nd author, using both an inductive and deductive approach to the transcripts.
11 That is, we created themes **that aligned to the evaluation criteria outlined by Gaglio et al. (2013)**
12 **and guided by RE-AIM, and also from established theory (e.g., the higher order theme named**
13 ***quality of motivation* being a central tenet of self-determination theory; Deci & Ryan, 1985, 2000)**
14 followed by themes that did not fit established theoretical concepts (e.g., the lower order theme
15 **named *mid-point changes***). We identified both semantic and latent themes where individuals
16 explicitly communicated the meanings (e.g., convenience of session length) and themes where we,
17 as researchers, interpreted the meaning or framework that underpinned the semantic meanings (e.g.,
18 perceived competence). If new sub-themes appeared from the second or third focus group, we re-
19 read the first and/or second transcript to check for any additional data falling within this subtheme.
20 We were satisfied that data saturation had been achieved with the data from the 3 separate focus
21 groups. Coding was hierarchical, with variation in a given theme being coded under sub-themes.
22 For example, instructor-support was a sub-theme of social support which represented a higher order
23 theme in the assessment of barriers and facilitators to the program (implementation).

24 We employed four criteria (credibility, transferability, dependability and confirmability)
25 proposed by Egon, Clark, Havlicek, Mclaughlin and Miskel, (1981), and reviewed by Shenton
26 (2004), to ensure trustworthiness. The first credibility, was met by; adopting research methods well-
27 established to research the phenomena (e.g., Finn & Sladeczek, 2001); using strategies to help

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1 ensure honesty in the participants (interviewer emphasised there were no right or wrong answers);
2 including iterative questioning we used probes to elicit detailed data, and questions were re-phrased
3 to ensure a clear understanding and a true account from the participants. Finally, we included field
4 notes to contextualize the data and allow for body language, expression and tone of voice to be
5 included in the analysis. Transferability and dependability was addressed by providing a detailed
6 account of the current study (i.e., detail of participants who contributed to the data, data collection
7 methods employed, number and length of sessions and the time period over which the data was
8 collected). To ensure that our interpretation was that of the participants rather than the
9 characteristics and preferences of the researcher (confirmability) we (1st and 2nd author) conferred
10 over the themes, and an interim account was discussed in a University Physical Activity and
11 Chronic Disease research group meeting including 3 academics in the field of psychology, and 2
12 academics with expertise of HIIT programs. Finally, the wider research team reviewed the themes
13 and supporting narrative and provided comments. These comments were considered in the final
14 write up of the manuscript.

15 **Findings**

16 The focus group discussions centred around the five qualitative evaluation criteria; 1) The
17 intervention context (Participants experience of the external factors that influence the acceptability
18 of the program), 2) Reach (participant understanding of recruitment), 3) Effectiveness (participant
19 understanding of outcomes, participant satisfaction, individual barriers and facilitators to adopting
20 and adhering to the program; 4) Implementation (participant perceptions of barriers and facilitators
21 to adopting and adhering to the program within the delivery), and 5) Maintenance (participant
22 experience of persistence to exercise once the program had ended). For ease of presentation,
23 themes developed within each criteria are presented separately and detailed in table 2.

24 [INSERT TABLE 2 HERE]

25 **Assessing Intervention Context.**

26 *Convenience:* Convenience of the program was expressed in terms of the location, time and
27 the length of the session. The close proximity to the place of work enabled participants to attend

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1 sessions without disruption to their day, “being close proximity to my workplace. It meant if you
2 missed something you could still come back and do it. Three a week was manageable and, kind of,
3 sustainable” (Focus group 1).

4 Participants were grateful for the amount of classes scheduled per week. It provided
5 flexibility for them to select sessions to their personal timetables, “Three a week was manageable
6 and, kind of, sustainable. It helped me to stay with it because there were options of when you could
7 come and do the classes. My weeks are such that I can’t predict them” (Focus group 3). However,
8 there were occasions where the scheduled classes did not suit life commitments that were a priority
9 for the participant,

10 I think that’s what I found difficult, fitting it in, especially the last couple of weeks, my
11 other half started to work away, so, and having three children, trying to fit it in with the
12 time schedules that were given, that was, that’s the only difficulty I found (Focus group 2).

13 The short length required for the HIIT session was appreciated for individuals with busy schedules.
14 The time-efficient nature of HIIT was a benefit for the group, “The time aspect is a big win. I’d pay
15 the same for 30 minutes of this as I would for an hour of something else” (Focus group 3).

16 **Assessing Reach**

17 *Visibility of recruitment:* Participants agreed that the recruitment posters could have been
18 more visible. Most participants responded to the email sent via the University intranet. Although it
19 was widely received, some individuals may have missed the opportunity,

20 Saw the email that was sent around, I responded to that but I could have easily have missed
21 it because we get quite a few of those things that I delete all the time and I hadn’t seen
22 anything else, but once we started I saw a couple of posters (Focus group 2).

23 **Assessing effectiveness**

24 *Meeting expectations:* Participants from all cohorts indicated that the program met and
25 exceeded their expectations because of the positive outcomes they experienced, “[I am] more aware
26 of my fitness level and my weight and things like that, so yeah it’s exceeded my expectations”

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1 (Focus group 1). Participants wanted the program to continue, “We wanted to sort of sign up again,
2 yeah, disappointed when it finished really” (Focus group 1).

3 *Novelty:* Participant attendance was facilitated by the novelty of HIIT training approach.
4 This interest in the perceived novelty of the training was increased by the positive information they
5 had received via the media, “I know there was a program on the television last week that reiterated
6 the good that this particular regime does” (Focus group 2), and “I’d seen the documentary and it
7 reminded me of that, thought that’s really interesting, I’d love to do that” (Focus group 3).

8 *Quality of motivation:* Quality of motivation could act as a barrier or facilitator to
9 adherence of the program. The mid-point of the program was a key time where participants
10 experienced a shift in their quality of motivation. Some participants perceived positive changes to
11 their physical and psychological wellbeing which in turn increased their autonomous reasons to
12 exercise,

13 I hit a wall at week four as I hadn’t noticed many gains at that stage. Then suddenly there
14 seemed to be like a tipping point, that’s also the time that I noticed the differences in fitness
15 and then motivation increased again and [I] just went for it (Focus group 1).

16 Other participants reported a negative shift in their quality of motivation at mid-point. This was
17 more prevalent for those participants who reported extrinsic or controlled forms of motivation to
18 exercise (e.g., to lose weight, to avoid perceived failure),

19 It might have been useful mid-way at like week 5 to do a weigh in or some kind of
20 assessment so you’ve got more of a, oh I know where I am and actually I’ll get better in the
21 next five weeks. In the past I’ve been weighed every two weeks so I always know where
22 I’m going, or if I’m failing (Focus group 1).

23 Participants expressed controlled forms of motivation to adhere. They described a sense of
24 obligation to the program because of the commitment they had made to take part and felt guilty at
25 the thought of missing a session. “if I was to do it on my own, I’d last two weeks and I’d forget
26 about it, I’ll do it a bit later, so it’s a nice structured thing to get on with really” (Focus group 2).
27 The obligation however, was viewed positively by the majority of the participants and suggests that

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1 controlled forms of motivation can be instrumental to engagement and short-term adherence,
2 “When I had to miss a couple of sessions because I wasn’t feeling well, I really thought, oh gosh,
3 I’m letting the side down here. I was very concentrated then on making up the sessions I’d lost”
4 (Focus group 3).

5 As the program progressed past the mid-point, participants reported more autonomous
6 reasons (i.e., increased enjoyment and energy) for exercising which appeared to be due to an
7 increased sense of competence, “Originally it was the motivation of committing to it and then I was
8 actually enjoying the way I felt, more energy and near the end, beginning to see results. That was
9 really good” (Focus group 1).

10 *Psychological processes involved in the adoption and adherence of the program:*

11 Participants experienced increases in their perception of competence and general positive affect,
12 particularly feelings of satisfaction, vitality and increased energy. The sense of competence
13 appeared to be facilitated through learning a new technique they could transfer to other modes of
14 exercise. This led to improved levels of self-efficacy,

15 I know it sounds silly just pedalling but getting your proper technique to do it. If I was to do
16 it myself, [I] wouldn’t have a clue about half the things they kept saying. We’ve learnt the
17 techniques. I do it in the gym on the bike, when I’m running (Focus group 3).

18 Satisfaction and energy were the dominant adjectives used by the groups, to describe the feeling
19 following each session, and for the remainder of that day,

20 I felt I’d captured some of me [sic] youthfulness again. When I was going home I was
21 tending not to do anything in the evenings at all, but if I’d had a morning session, I was
22 going home and I’d got energy to get on and do something. I just felt younger. It gave me a
23 feeling of, what’s the word? Self-satisfaction (Focus group 3).

24 The sense of satisfaction as a result of their achievement in the class appeared to override the
25 aversive effects during an unpleasant session, although only once the session had finished. This was
26 a key process for facilitating positive engagement to the program,

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1 On a Monday morning I did want to die, because I'd just got into my rhythm and then we
2 moved onto something else more difficult. The best part was when it was finished every
3 day. That's because then I felt really good for the rest of the day. I felt like I'd achieved
4 quite a lot with my day. That was the best bit for me (Focus group 3).

5 **Assessing implementation**

6 *Social support:* Social support was perceived via various sources from within the delivery
7 of the program and beyond. All sessions were led by one of four instructors. The instructor was
8 portrayed as a key influence of how each session was experienced. Participants explained that their
9 feelings of competence were supported by the instructors of the program,

10 I felt I wanted to carry on with [instructor] being the one that was, encouraging us. She did
11 keep us amused, and she was very good as delivering the course, the kind of guidance she
12 gave you, for example in terms of using the resistance (Focus group 3).

13 Controlling forms of instruction were met with resistance and resulted in negative experiences. **The**
14 **negative experiences were strongest during rest phases, warm-up and cool-down when interaction**
15 **with others was more easily achievable**, "I didn't like one instructor if I'm honest. They'd make me
16 sing, I didn't want to sing. For some people, maybe they felt uncomfortable" (Focus group 1).

17 Being part of a group with similar abilities brought a sense of comfort to all participants and
18 appeared to facilitate feelings of competence and the confidence of adopting and continuing with
19 the program, "Comfort in not going it alone: I did feel unfit, I didn't feel like going it alone, I didn't
20 know if I was healthy enough to go it alone" (Focus group 3). The social environment created by
21 the peers influenced the cohesion and fun. Participants did not have the opportunity to talk much
22 during their sessions because of the effort needed during the sprints. However, this did not detract
23 from the group cohesion,

24 It was literally five before and five minutes at the end you can chat, we were half way
25 through a conversation a few times then, 'talk to you in 20 minutes'. You go through it and
26 carry on the conversation when you're in the warm down. There was quite a nice
27 camaraderie, possibly similar to soldiers under fire or something (Focus group 2).

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1 Participants referred to their experience of exercise-induced affect during the training sessions,
2 “They’re not actually long, to start with I looked at my watch and thought, I thought if I’ve got
3 more of this, I’m going to die.” (Focus group 3). Importantly, it was the sense of relatedness
4 experienced that appeared to be a contributing factor to a more positive experience, over and above
5 any negative affect that was attributed to the early mornings and the exertion needed during the
6 classes, “It was good and it was nice, a bit of camaraderie in the mornings. You see all the same
7 faces and everyone, you know everyone’s miserable, but you’re all there doing it together” (Focus
8 group 3). In large, the participants who perceived support from a ‘significant other’ (e.g., partner,
9 family member) beyond the program appeared to engage in more physical activity outside of the
10 program.

11 Those participants who perceived the structured form of exercise (i.e., set at a particular
12 time, led by an instructor and carried out in a group) to be facilitative also displayed a reliance on
13 the support from within the program to adhere,

14 I am no good at focusing myself. I’ve got no motivation. I need somebody there telling me
15 what to do, I have to admit that. I know it’s a poor excuse but if I’m left to my own devices
16 I won’t do it. That’s really sad but it’s me (Focus group 2).

17 *The wider context of the class:* The context in which the classes were conducted also played
18 an important role as a barrier or facilitator of adherence. Discussions focused on the temperature of
19 the exercise studio, and the music that was played during the sessions. The room temperature made
20 some sessions uncomfortable. “When the room’s 40 odd degrees [Celsius], no one felt like it. The
21 room got really hot at times, like a furnace. It just got hotter. As we got hotter and worked harder
22 and made it more humid, so, that got pretty unpleasant at times” (Focus group 2).

23 The music played during the sessions did not appear to be a major influence in the
24 participant’s experience. For example, one HIIT participant claimed, “I didn’t really notice the
25 music” (Focus group 1). Elements of personal preference were used to explain the fact that music
26 did not play a large role in the participant experience, “Is that because they were contemporary, it
27 was contemporary songs that us old timers probably weren’t really into” (Focus group 1).

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1 *Progress monitoring:* The physiological tests carried out with each cohort pre and post
2 program were perceived as facilitative to their adherence, “Then you having the tests at the end was
3 kind of like an incentive to really stick to it” (Focus group 1). However, focusing on the post results
4 was detrimental for those who did not perceive a sufficient improvement. Disappointing results led
5 to thoughts of dis-engagement, “When I got my results it encouraged me to be inactive. My before
6 and after weren’t that great, I was like, well I may as well just not do anything then really” (Focus
7 group 2). Participants particularly focused on the instant feedback they received from the heart rate
8 display during each session rather than the physiological tests at the end of the program.
9 Participants were able to self-monitor throughout each session. The self-monitoring enabled a sense
10 of autonomy where the individual could feel in control over their own efforts.

11 I liked the fact we were getting feedback from the graphs daily. That was positive; it’s
12 good to be able to measure. You’re not comparing yourself with other people. That’s not
13 the aim of it. It is good to compare yourself with yourself really (Focus group 3).
14 The instant feedback appeared to keep participants engaged even when the intensity, and length of
15 sprint interval, was challenging, “I didn’t like the minute. I really didn’t like the minute part of it. It
16 was very challenging, but you know, my motivation was looking at how long I stayed in the green
17 was it, zone” (Focus group 2).

18 **Assessing maintenance**

19 *Levels of physical activity (intensity and frequency):* Participants were asked if the program
20 had helped them to become more physically active. Responses varied between individuals across
21 the three cohorts. Some had become more active, although only one had continued with the same
22 mode of structured high intensity group exercise, albeit irregularly,

23 I felt more confident that I’m fitter, although I haven’t taken on a huge amount of extra
24 exercise, but I feel more confident too without being embarrassed. I could always turn
25 around and say to somebody, ‘Well I’ve been working out three times a week’. Not
26 wishing to show off, but you know what I mean? (Focus group 3).

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1 Generally, increased levels of physical activity were of a low to moderate intensity and less
2 frequent, “Over the holidays [we] went away and walked every day. I seemed to be walking ahead
3 of everybody and my stamina was good” (Focus group 1). The more strenuous classes that were
4 available in the centre did not suit the participants,

5 I tried a number of classes and haven’t really found any that I’ve clicked with. They’ve got
6 a lot on offer so it’s just like a whole buffet of things. They all just make me hurt in
7 different ways. I’m sure that one day I’ll find one that really works (Focus group 2).

8 Although all participants had intentions to continue with increased physical activity, many
9 intentions were not realised, “falling into temptation. I do try and go out a bit more on my bike, but
10 the thing is, I’ve got to make a big conscious effort to go out on the bike so it’s a problem” (Focus
11 group 2).

12 Participants who had discontinued activity discussed how their intentions to be active were
13 met with various perceived barriers,

14 I’m trying to find a way to do the intensity training at home. Investment is the only
15 problem. It’s either a turbo trainer which could be fun but I’ll fall off a lot, or buy a spin
16 bike. The cheaper bikes don’t hold my weight when I go at speed (Focus group 1).

17 **From those** who had persisted with exercise, **four participants specifically mentioned** attempting to
18 incorporate the principles of HIIT into their regime, “[I] have incorporated HIIT into jogging which
19 has been good. I have continued, maybe not three times a week, but I am doing it” (Focus group 2).

20 *Perceived competence for high intensity:* Similar classes to the HIIT program were
21 available at the same facilities. However, HIIT participants were reluctant to sign up suggesting that
22 they did not feel **competent** enough to engage in HIIT classes outside of the program but did within
23 their training groups. They wanted to avoid high intensity training that was perceived to be too
24 difficult,

25 I wanted to carry on with [program instructor] being there. One or two had made a
26 comment that the guy who did the spin class really made you work hard, and I was
27 thinking, [sharp intake of breath] ‘I don’t want that then’ (Focus group 3).

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1 Participants believed the classes for the general public were for more capable individuals with
2 higher fitness levels than themselves and preferred to be in a group with individuals who they
3 perceived to have similar fitness levels, even if it meant they would exercise for longer,
4 Being conscious that other people are fitter, like the normal spin classes. Something that
5 you know is full of other people like you, even if it was the full hour. It's, 'is it going to be
6 too much for me?' (Focus group 3).

7 **Discussion**

8 The aim of this study was to qualitatively evaluate the participant experience of a 10 week work
9 place **program**. Overall, the data suggested that HIIT, as an intervention strategy, was an acceptable
10 mode of exercise and participants were satisfied with the workplace program. However, only one
11 out of the 12 who engaged in the focus groups maintained their engagement in a structured form of
12 exercise involving HIIT, and thus we can agree with Biddle in the Biddle & Batterham (2015)
13 debate on the appropriateness of HIIT, that this HIIT program has resulted in low maintenance as
14 per the RE-AIM framework. HIIT was acceptable in terms of participant level effectiveness and
15 implementation. Participants did report a persistence to exercise albeit at a lower intensity and less
16 frequently.

17 HIIT was perceived favourably due to the shorter time needed to complete each sessions
18 supporting the proposal that HIIT is a time-efficient strategy and overcomes the commonly cited
19 barrier to exercise; lack of time (Jung et al., 2014; Shepherd et al., 2015). It would be interesting to
20 investigate whether more traditional moderate intensity continuous training programs **of similar**
21 **session length** could achieve maintenance to exercise compared to the current HIIT program.
22 Although physiological adaptation **may** not reach the same levels (Gaesser & Angadi, 2011),
23 participants may find shorter sessions convenient.

24 The nature of the barriers and facilitators of adherence to the program suggest that the
25 determinants of exercise behaviour are multi-factorial (Bauman et al., 2012). For example, feeling
26 an obligation to others was a prominent motive to adhere. This supports the work of Thøgersen-
27 Ntoumani and Ntoumanis, (2006) in that less autonomous motivation can be associated with both

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1 adaptive and maladaptive outcomes, providing that controlled forms of motivation are accompanied
2 by more self-determined motivation. According to self-determination theory (Deci & Ryan, 1985),
3 acting out of feelings of external contingencies and guilt is considered controlled motivation and a
4 type of motivation unlikely to lead to sustained changes (Teixeira, Carraça, Markland, Silva, &
5 Ryan, 2012). Therefore, it is important to develop more self-determined motivations which are
6 more likely to lead to sustained behaviour changes (Ng et al., 2012). Our findings indicate that the
7 mid-point of the program was a key time where participants experienced changes in the quality of
8 their motivation. It was at this point where some individuals developed a stronger sense of
9 autonomy whereas others saw a dip in their motivation. Findings contribute to the work by
10 Kinnafick, Thogersen-Ntoumani, and Duda, (2014), who found that satisfaction of the needs for
11 competence and relatedness were central for participation during exercise at the adoption stages,
12 and autonomy was pertinent in facilitating adherence. This qualitative study has provided insight
13 into the psychological processes involved in the adherence of a work-place HIIT intervention.
14 Further experimental work is needed to fully understand the relationship between psychological
15 processes associated with need satisfaction and adherence to similar HIIT programs.

16 In support of previous research investigating the exercise class instructor's role in
17 facilitating an autonomy/need supportive environment (Edmunds, Ntoumanis, & Duda, 2008), our
18 findings indicate that the group instructor was central to enabling a cohesive and motivational
19 climate. Those participants who relied on the social-contextual support within the program (i.e.,
20 instructor and peers) tended to cease their physical activity following the end of the program.
21 Similar to the findings of Kinnafick et al. (2014), the individuals who perceived support from
22 beyond the program engaged in physical activity outside and following the end of the 10 week
23 intervention. Future programs could look to involve a 'significant other' into a program to optimise
24 maintenance.

25 HIIT was viewed as a novel form of training which facilitated adherence to the program
26 itself. Previous research has reported that novel activities are opportunities for fun, particularly
27 relating to physical activity in the workplace (Edmunds et al., 2014). However, there is a paucity of

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1 research that investigates the long-term impact of novel approaches to physical activity promotion,
2 such as HIIT, on persistence to this mode of exercise. Although the length of the intervention was
3 sufficient to elucidate positive physiological and psychological outcomes, it may not be long
4 enough to achieve stable autonomous motivations needed for exercise maintenance (Rodgers, Hall,
5 Duncan, Pearson, & Milne, 2010). Monitoring progression was a key driver of motivation during
6 the sessions. The participants used self-monitoring of their heart rates during the sessions which
7 increased levels of self-efficacy and did not discuss the final outcome in as much detail.

8 The high intensity nature of HIIT has caused academics to question the appropriateness of
9 HIIT as a public health intervention (Biddle & Batterham, 2015). In support of Ekkekakis's work
10 and the propositions of the dual-mode theory (Ekkekakis, 2003), participants from the HIIT group
11 found the intensity of HIIT acutely unpleasant during the sessions. Zenko, Ekkekakis, and Ariely,
12 (2016) suggested that reducing intensity after a bout of high intensity improved post exercise
13 pleasure, enjoyment and remembered pleasure. HIIT participants had a 5 minute cool down after
14 each session where they were able to chat to their peers. This could partly explain why participants
15 remembered the sessions in a positive way and highlights the importance of including a period of
16 lower intensity after any HIIT session.

17 A progressive increase in feelings of competence experienced during the training sessions
18 (e.g., achieving target heart rates or completing all sprints) also mitigated the aversive nature of
19 high intensity exercise, albeit after each session had finished. This suggests that the perceived
20 achievement and satisfaction experienced by the HIIT group could be as a result of the difficulty
21 and intensity of the session. Our findings can add to the suggestion made by Bartlett et al. (2011) by
22 explaining the processes that can lead to feelings of achievement and accomplishment when an
23 individual pushes their physical efforts beyond the ventilatory threshold.

24 Feelings of relatedness and cohesion within the group also appeared to somewhat attenuate
25 the negative affective responses to the high intensity. In support, and adding to the work by Harden
26 et al. (2015) and Burke et al. (2006), this information suggests that a positive group experience
27 where individuals experience the same challenging situation can contribute to adherence of a HIIT

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1 program, despite a lack of pleasure felt during the exercise. It is important to note that the increased
2 sense of competence of the group was relevant within the program, where participants felt
3 comfortable with their perceived 'fitness' within the group. All but one participant were reluctant to
4 join existing HIIT based classes open to the general public and thus disengaged in this mode of
5 exercise. They would rather be amongst those who they considered to be at a similar fitness level to
6 them. Existing literature demonstrates, in-line with self-categorization theory (Turner, 1985), that
7 individuals define themselves within a group and may feel uncertainty in another group where they
8 do not feel like they belong (Haslam, 2004). Future efforts should focus on matching fitness levels
9 within classes and progressively integrating individuals who were insufficiently active with regular
10 exercisers in a need supportive and progressive manner to encourage long term behaviour change.

11 **Limitations.**

12 Participants who volunteered for the focus groups were healthy and had adhered to over 80% of the
13 program sessions indicating that they were more likely to be satisfied with the program. Although
14 efforts were made in the current study, future research should include the perspective of non-
15 adherers to explore their experiences of similar HIIT programs. **Eight of the 12 participants were**
16 **female. Although this makes the focus group predominantly female, it was representative of the**
17 **larger study (HIIT group=15 male, 31 female).**

18 The maintenance dimension in the RE-AIM framework classes maintenance as 6 months
19 after the end of the intervention. The current evaluation was conducted within three weeks of the
20 end of the program. Our intention was to assess whether participants had continued with HIIT as a
21 mode of exercise. However, future research should conduct an evaluation of maintenance to HIIT at
22 a 6 months follow up. Finally, discussions within the focus groups would lead participants to
23 further reflect on their experiences of the program. Although this may have altered their
24 perceptions, the continued reflection, and discussions between participants is important to
25 understand how perceptions to exercise are formed within a social context.

26 **Conclusions**

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1 In summary, group led HIIT was seen as an acceptable and effective on-site workplace intervention
2 for insufficiently active adults to increase physical activity. However, participants were reluctant to
3 maintain the same mode of exercise, believing that HIIT sessions were for the very fit. HIIT
4 initiates interest because of its novelty, can provide a sense of accomplishment and overcomes the
5 barriers of perceived lack of time. Social factors facilitated adherence. Specifically, the feeling of
6 belonging (relatedness) between the participants can attenuate negative unpleasant responses during
7 the HIIT sessions. Those designing HIIT based interventions should select a supportive
8 environment for groups of peers within their perceived individual fitness capabilities. Multiple
9 levels of influence to adherence were present including individual quality of motivation, social
10 cohesion, support within and beyond the program, and the quality of the physical environment in
11 which individuals exercised. Those responsible for designing and implementing interventions
12 should consider all intervention components, layers of influence and how each develops over time.

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1 Table 1: Demographic and other key characteristics of participants attending each of the three focus groups.

Cohort	Age (years)	Gender	Sample	Pre		Post	
				BMI (kg/m ²)	Vo2max (ml.kg.min ⁻¹)	BMI (kg/m ²)	Vo2max (ml.kg.min ⁻¹)
	M (SD)	male, female	<i>n</i>	M (SD)	M (SD)	M (SD)	M (SD)
1	41.7 (8.45)	1/2	3	27.83 (4.45)	31.4 (6.7)	25.44 (3.65)	34.65 (5.97)
2	35.6 (7.76)	2/3	5	29.40 (5.93)	32.32 (7.85)	29.03 (6.62)	36.42 (5.18)
3	43.3(11.23)	1/3	4	29.2 (5.54)	26.24 (8.92)	27.9 (5.79)	29.85 (7.02)

2 **Note:** *M*=mean, *SD*=Standard deviation, HIIT=high intensity interval training,

QUALITATIVE EVALUATION OF A HIIT PROGRAM

1 Table 2: Higher order and lower order themes developed according to evaluation criteria

Evaluation Criteria	Higher Order Themes	Lower Order Themes		
Intervention Context	Convenience	Location	Session schedule	Session length
Reach	Visibility of recruitment			
Perceived Effectiveness	Meeting expectations	Outcomes	Novelty	Time efficiency
	Quality of motivation	Mid-point changes	Obligation	Autonomous motivation to exercise
	Psychological Processes	Perceived competence	Affect	Satisfaction
Implementation	Social Support	Instructor support	Group cohesion	Support from important others
	Context of Sessions Progress Monitoring	Room Program monitoring	Self-monitoring	
Maintenance	Levels of PA (intensity, frequency)	Perceived competence for high intensity		

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