

Using focus groups and interviews to inform the design of a workplace exercise programme:

An example from a high-intensity interval training intervention

Naomi L. Burn PhD¹, Matthew Weston PhD¹, Greg Atkinson PhD¹ and Kathryn L. Weston
PhD²

¹School of Health and Life Sciences, Teesside University, Middlesbrough, United Kingdom

²School of Applied Sciences, Edinburgh Napier University, Edinburgh, United Kingdom

Corresponding author: Dr Naomi Burn, School of Health and Life Sciences, Teesside
University; Address: Teesside University, Middlesbrough, TS1 3BX.

email: n.burn@tees.ac.uk

Funding: No sources of funding were used to assist in the preparation of this article.

Conflicts of interest: Naomi Burn, Matthew Weston, Greg Atkinson and Kathryn Weston
declare that they have no conflicts of interest relevant to the content of this article.

Acknowledgements: The authors would like to thank Neil Maguire for his contribution to
the peer debriefing process undertaken during the analysis of the data presented in this article.

Short running title: Using focus groups and interviews to inform the design of a workplace
exercise programme

ORCID:

Naomi Burn: 0000-0001-6189-4210

Matthew Weston: 0000-0002-9531-3004

Greg Atkinson 0000-0002-5459-9042

Kathryn L Weston: 0000-0001-5918-6389

Abstract

Objective: Using a formative evaluation of a high-intensity interval training (HIIT) intervention, we illustrate how qualitative data can inform the development of workplace exercise interventions.

Method: Eight focus groups and four interviews were conducted with employees (n=38) and management (n=4) from six office-based organisations before intervention implementation.

Results: Some participants thought workplace-based HIIT would be practical, given the limited time required. Others perceived it may not be acceptable for all individuals, given the exercise intensity. With consideration of identified barriers (workload /family commitments effecting time availability) and facilitators (flexible working conditions) participants' perspectives were incorporated into the intervention protocol. A short-term group-based intervention was preferred, with a choice of exercise modes (based on stair climbing, stepping or boxing).

Conclusion: This study provides a framework to incorporate stakeholders' perspectives into the development of workplace exercise interventions.

Keywords: workplace; high-intensity interval training; formative evaluation; intervention development; qualitative.

1.0 Introduction

Workplaces provide access for researchers to a considerable proportion of the adult population (1) and have been identified as a priority setting for health promotion initiatives, such as exercise interventions (2, 3). While workplace-based exercise interventions have been shown to elicit meaningful adaptations in cardiorespiratory fitness (4), markers of cardiometabolic health (5), and wellbeing (6), participation rates vary widely (10 to 64% of eligible employees (7)) and loss to follow-up ranges from 4 to 40% (8). These factors may be explained by intervention developers focusing on study design, intervention content (frequency, intensity, time and type of exercise (9)) or statistical power and analysis (10), without giving due consideration to the needs of the target study population. Inadequate consideration of the views and requirements of key stakeholders can impact on the recruitment, implementation fidelity and participant retention of the resultant intervention (11). One way of minimising these potential issues is through formative evaluation conducted during the early development stage of an intervention (12).

Formative evaluation is a systematic set of research activities, undertaken before an intervention is implemented, to obtain detailed information about the people for whom, and the context in which, interventions will be implemented (13). Formative evaluation can also be used to enhance and refine preliminary intervention plans (14), which can facilitate an understanding of the circumstances, needs and resources (e.g. workplace facilities for exercise such as showers or space to exercise) of the target population, and assess the types of solutions to barriers the target population would support (11). Various qualitative methods have been used in previous formative evaluations of prospective health promotion programmes, including telephone interviews, semi-structured face-to-face interviews and focus group discussions (14). Although the use of quantitative methods (e.g., questionnaires) could permit the recruitment of

larger samples (15), this may be at the expense of the depth of information collected (11). Furthermore, as part of the rationale for conducting formative evaluation is to build relationships with key stakeholders and potential intervention participants, face-to-face focus groups or interviews are considered a more appropriate data collection technique for this purpose (11). Despite the documented usefulness of formative evaluation (11, 16), there are surprisingly few examples of how qualitative formative evaluation can be used to inform the design of exercise interventions. Of those available (e.g. 17, 18, 19), none have focused on workplace exercise programmes.

Outside of formative evaluation work, employees' perspectives of workplace exercise have been explored in various ways. In focus groups conducted with 42 hospital workers in the United States, participants expressed an interest in a range of workplace exercise options including walking groups, team-based competitions, exercise classes and access to personal trainers (20). Commonly reported barriers included personal safety while exercising and perceived lack of time (20). In a quantitative survey of 252 university employees in Australia, respondents expressed preferences for personal training and group exercise classes, with lack of time or motivation the most commonly cited barriers (21). While these studies are useful for documenting potentially acceptable exercise modes for workplace programmes, they were not conducted to inform the development of a specific workplace intervention *per se*. Rather, they were standalone studies and thus do not provide explicit guidance or examples of how their findings or the process undertaken could be used to tailor the design and implementation of a future workplace programme.

Workplace exercise interventions have traditionally used moderate intensity aerobic and resistance training exercise prescriptions (4) but recently the potential of conducting high-intensity interval training (HIIT) in the workplace has begun to be explored (22-26). High-intensity interval training is a form of exercise characterised by brief, intermittent bouts of intense exercise, alternated with periods of rest or low-intensity active recovery (27), which has shown promise for improving physical fitness and cardiometabolic health in both healthy and diseased populations (28-30). While favourable adaptations in cardiorespiratory fitness, cardiometabolic health and markers of mental wellbeing have been observed post-intervention in the workplace (22-26), research into participant perceptions of delivering HIIT in the workplace remains in its infancy.

To date only two workplace HIIT interventions have included a qualitative evaluation in their overall programme design (22, 31). Nevertheless, in both instances, participants' insights were sought solely after the intervention. How employees' perspectives could be incorporated into the development and design of a proposed workplace HIIT intervention, therefore, remains unknown. Accordingly, our aim was to demonstrate how qualitative data can inform the development and implementation of a workplace exercise intervention. To illustrate this, we have used focus group and one-to-one interview data from a formative evaluation of a proposed workplace HIIT intervention, named Brief Exercise at Work (BE@Work). Herein, we aim to provide a framework for the methods that can be undertaken to assist researchers and practitioners to design bespoke workplace exercise interventions informed by key stakeholders' perspectives.

2.0 Materials and methods

2.1 BE@Work overview and proposed intervention

The development and implementation of the BE@Work intervention was based on the Medical Research Council framework for the development and evaluation of complex interventions (16). The present study describes findings from the development stage; data from the implementation of the BE@Work intervention will be published elsewhere (ClinicalTrials.gov Identifier: NCT03467594). The MRC framework recommends formative research, involving consultation with key stakeholders during intervention development, which can be undertaken to explore perspectives of preliminary intervention plans (14).

The preliminary BE@Work intervention plan which we described to study participants, was designed following a review of the scientific literature on HIIT. Specifically, the proposed workplace intervention involved thrice-weekly, 20-30 minute supervised HIIT sessions, for a duration of 6 to 10 weeks, based on the duration and frequency of previous workplace HIIT interventions (23, 24). Proposed exercise modes (walking, jogging, running, skipping, non-contact boxing [boxing herein], stair stepping, stair climbing and dance) were based on activities used in previous HIIT or workplace exercise interventions which required minimal equipment and/or could be modified to account for different fitness levels and exercise experience (24, 32-35). However, the researchers explained to participants that the exercise modes were merely examples, and exercise modes in the intervention could be based on participant preference. They were also informed the proposed exercise programme would be supervised by a member of our research team.

No single “best-practice” HIIT protocol has been identified (36) and although this could be viewed as problematic when designing evidence based HIIT protocols; it could also be viewed

as an opportunity to design a range of HIIT programmes that could be tailored to a range of settings, provided the intensity of the exercise is uniform and quantified (37). With this in mind, the example HIIT protocol described to participants consisted of repeated 60-second high-intensity bouts interspersed with 60 seconds of rest, based on previous HIIT protocols shown to be effective for improving health and fitness in adults (38, 39).

2.2 Study design and research ethics

The reporting of our study adheres to the consolidated criteria for reporting qualitative research (COREQ) (40). The formative evaluation used qualitative methods where focus groups with employees and one-to-one interviews with management representatives were conducted prior to intervention implementation. Teesside University Research Governance and Ethics Subcommittee granted ethics approval (study number 053/17). Study participation was voluntary, and all participants provided informed consent prior to data collection.

Following guidance on the reporting of qualitative research (40), to provide insights into the perspectives they may bring to the work, brief details regarding the researchers involved in the data collection and analysis of this project are provided. The first author was a female postgraduate student with both positive and negative experiences of participating in group-based HIIT. She had two years of previous qualitative research methods experience, had received post-graduate level training in qualitative research methods and conducted all focus groups, interviews and data analysis. Another researcher acted as a critical friend during the analysis process. This researcher had experience delivering group-based exercise interventions in healthy and clinical populations and had previous positive and negative experiences of participating in high-intensity exercise.

2.2 Recruitment and participants

The first author contacted Local Authority Health Leads (Public Health Specialists employed by local government) in Northeast England with preliminary study information. Local Authority Health Leads acted as gatekeepers and distributed preliminary study information via email to office-based organisations using their pre-established networks. Six organisations expressed interest in participating via return email to the first author. The study was then advertised via email distribution lists by human resources or occupational health departments at each of the interested organisations. Participants were informed that the study purpose was to develop a workplace exercise intervention and had no prior contact with the first author prior to their involvement in the study.

Inclusion criteria were any employee of the participating organisations, aged over 18 years. Employees were defined as any paid member of staff from the participating organisations. To understand all working conditions in the organisations involved, no restrictions were placed on length of employment or employment status (e.g. part time/ full time/ casual employment). Exclusion criteria were inability to speak English and/or inability to provide informed consent. As it was necessary to explore organisational perspectives of the proposed intervention, management representatives were approached separately for recruitment. Management representatives were defined as any employee in a senior management position within the organisation. Using convenience sampling (41, 42 participants (38 employees, 4 management representatives) were recruited from six organisations. Organisation and participant characteristics are presented in Table 1. Participating organisations were urban medium (~100 employees in total) to large organisations (~2000 employees in total) with office-based employees.

TABLE 1 HERE

2.3 Procedures

Data collection was conducted between June and November 2017, 5 to 10 months before planned intervention implementation. Participant characteristics (age and sex) were collected prior to the focus group or interview. Eight focus groups were conducted with 3 to 7 participants per focus group (Table 1). The focus groups provided an opportunity to elicit opinions via group discussion rather than individual reflection (42). Each lasted between 34 to 64 minutes and were audio recorded and transcribed verbatim by the first author. This resulted in 140 pages of focus group transcriptions (Arial, font size 12, 1.5 line spacing).

A management representative from four organisations consented to a one-to-one interview. Management representatives from the remaining two organisations (study sites 2 and 4) did not respond to recruitment attempts. Management interviews lasted between 21 to 33 minutes and were audio-recorded and transcribed verbatim. This resulted in 35 pages of interview transcriptions (Arial, font size 12, 1.5 line spacing).

2.4 Focus groups and interview schedules

The focus group interviews were designed to explore participants' perceptions and experiences of workplace exercise, participants' perceptions of HIIT as an exercise modality conducted in the workplace and participants' perceptions of the logistics of the proposed BE@Work intervention. Interview schedules were developed based on our previous experience developing and implementing HIIT interventions in community settings (35) and on aspects of workplace exercise interventions described in extant literature (e.g. frequency, intensity, length of exercise sessions and intervention and mode of exercise) (4). Focus group and interview schedules were developed and piloted on a group of university employees prior to data collection. Following pilot work, we re-ordered questions to improve the flow of the focus group or interview. Due

to limited time availability with management representatives, questions pertaining to the managements' perspectives of HIIT were removed so that management interviews could focus on their perspectives of the logistics of the proposed workplace HIIT programme. The employee focus group and management interview schedules can be found in Supplemental digital file 1. Briefly, discussions opened with participants describing their thoughts and experiences of workplace exercise. Barriers and facilitators to workplace exercise were then explored. Following some initial questions relating to HIIT and what participants perceived to be HIIT, participants were provided with the following 'researcher definition':

"HIIT is a type of exercise where you do bursts of exercise, always followed by a rest break, repeatedly. During the bursts of exercise, you work as hard as you can, and you always get a break afterwards. In the bursts of exercise your heart rate would increase, you would feel out of breath and you wouldn't be able to speak in full sentences. By the end of each burst you would need a rest break to catch your breath and be able to speak in full sentences.

HIIT will look different in different people. For example, for some people 'working as hard as they can' is walking as fast as possible, and for others it is running as fast as possible. Both people would be working at high-intensity, it is just that the intensity 'looks' different depending on their fitness levels and ability."

This interpretation of HIIT is based on a widely-accepted definition within the scientific literature (27), the criterion for high-intensity exercise ($\geq 85\%HR_{max}$) (28) and the "talk test" which is a subjective assessment of exercise intensity commonly used as a surrogate marker of high-intensity exercise (43). After participants were provided with these items, discussion of the participants' perspectives of the planned workplace HIIT intervention continued. The final part of the focus groups and interviews focused on important aspects of workplace exercise

programme planning. Here, the preliminary BE@Work intervention plans were described to participants (as described in Section 2.1), and discussion ensued about the participants' perspectives of each intervention aspect (e.g., frequency, location, session and intervention length and exercise modality).

2.5 Analysis

Focus group and interview data were analysed using directed content analysis (44) using NVivo 10. Directed content analysis was chosen because it has been successfully used to facilitate intervention development in previous health promotion interventions (45, 46). In directed content analysis the structure of the analysis is informed by previous research or theory (47). As part of the purpose of this study was to develop an understanding of the participants' perspectives of specific BE@Work programme elements, a pre-defined categorisation matrix was developed based on standard exercise prescription nomenclature (frequency of exercise, intensity of exercise, time spent exercising and type of exercise (48)) and important intervention elements described in previous workplace HIIT literature (23) (Table 2).

Following familiarisation with the data, which involved transcription and re-reading of the data, transcripts were read line-by-line by the first author and coded based on the pre-determined categorisation matrix. After this initial coding, the data were examined within the pre-defined categories and inductively coded to further explore participants' perspectives of each intervention element. These codes were then grouped together according to their meaning, similarities and differences to produce sub-categories (47). During the inductive coding process within the predefined categories, as recommended in contemporary guidance for qualitative research (49), the first author undertook a process of peer-debriefing with another researcher. Here, the other researcher acted as a critical friend, asking the first author to justify the rationale, rigour and consistency of all coding decisions within each pre-defined category

of the categorisation matrix (49). Given recent critiques of the concept of data saturation (50, 51), we did not seek to assess data saturation.

TABLE 2 HERE

2.6 Criteria for Judging Research Quality

In line with contemporary guidance suggesting that the quality of qualitative research should be assessed using an open-ended set of criteria (e.g. the worthiness of the topic of research, rich rigor, meaningful coherence, sincerity, and significant contributions) (49), the following section is presented to allow the reader to make their own judgement on the quality of this research. From our perspective, the topic of this study could be considered *worthy* because this is the first study to incorporate stakeholders' perspectives into the design and implementation of a workplace HIIT intervention. This study demonstrated *rich rigor* by collecting data from six organisations across five months, as well as recruiting both employee and management representatives to explore organisational and employee perspectives of the proposed intervention. This process resulted in 175 pages of qualitative data. *Meaningful coherence* was achieved by using well-established qualitative research methods to achieve the stated aims (i.e. to incorporate stakeholders' perspectives into the development of a workplace HIIT intervention). *Sincerity* was demonstrated by declaring the researchers' previous experiences with HIIT. Lastly, the study represents a *significant contribution* to knowledge by providing a framework of methods to assist researchers and practitioners to design bespoke workplace exercise interventions informed by stakeholders' perspectives, which as yet does not exist.

3.0 Results

The following sub-sections present the findings from each of the pre-determined categories, with illustrative quotes from participants. While employees and management representatives were separated for the purposes of data collection and analysis, due to similarities in the views and opinions reported, the findings of the employee focus groups and management interviews are reported together.

3.1 General perceptions of workplace exercise

Generally, participants perceived workplace exercise programmes positively. Some participants reported that workplace exercise programmes may improve physical and mental health and could facilitate a feeling of belonging or camaraderie within an organisation:

“...to create an environment here where it’s an enjoyable environment. Where, yes work is being done, but equally that people feel valued, that their health and their wellbeing is important. And if they needed anything, it gives them the opportunity through sport and through activity to be able to have better relationships and better ties with managers and their colleagues”. Management representative, male, study site 3.

However, some participants noted that workplace exercise programmes may lead to injury which could lead to absenteeism (from work). Lastly, some participants thought that some individuals may be unable or not feel comfortable to participate in workplace exercise:

“I suppose at the end of the day it has got to be about personal choice as well...I think if you start imposing [exercise in the workplace] I think that is when you will see more resistance because people will be reluctant. Although they may want to, they may not want to do it with a bunch of other people at work”. Employee, male, study site 4.

3.2 Barriers and facilitators

Employees and management representatives discussed similar barriers and facilitators to workplace exercise participation. Both employees and management representatives agreed that work commitments would always be prioritised over exercise participation:

“There’s no way on earth that you could say to somebody [client] mind your own [workplace issue] for a minute while I just finish this work out off. You couldn’t... you couldn’t bring yourself to, you would stop what you were doing [and attend to workplace issue]”. Employee, female, study site 3.

Similarly, the most commonly reported barrier was ‘lack of time’ because workload commitments were perceived as high. Family or caring commitments were reported as barriers which would prohibit employees from participating in exercise before or after work:

“I was going to start rowing. But I can’t get child care to cover when the rowing classes are. So, I can’t do that”. Employee, female, study site 4.

A lack of workplace shower facilities was another commonly reported barrier, as shower facilities were only available in one of the participating organisations. Participants reported that a culture of long working hours within their workplace could make individuals feel unable to participate in exercise during work hours:

“...the culture of working such long hours as well. I know we have these arbitrary cut points but sometimes I have worked 70-100 hour weeks. And that at one point became kind of the norm. And when you are working those kind of hours, fitting anything else in that isn’t eat and sleep is actually really difficult”. Employee, female, study site 6.

The most commonly reported facilitator for workplace exercise participation was flexible working conditions and autonomous workload planning. All but one of the organisations operated flexible working policies where employees were permitted to arrange their own working schedule between core working hours:

“In this sector we are actually very autonomous in our time management and we all manage our diaries independently. We have some fixed commitments, where we have to be at certain places at certain times...I don’t have to go and ask if I can come to this [focus group]. So I think within this sector there is some flexibility built into it. In other sectors people have to ask to leave the workplace, ask to get permission if it’s something unusual to leave the workplace maybe for a lunch break”. Employee, male, study site 6.

Social support was reported as a facilitator for workplace exercise. Participants reported if they were familiar with other people in a group-based exercise session they would be more likely to attend. Social support was perceived as particularly important for inactive individuals:

“Sometimes like you become a really good friend with the colleagues and you know that they will never go for a run for whatever reason. But if you make it more fun and actually get them to... encourage them to come along and have a go. And if they try it and like it, they might continue”. Employee, female, study site 4.

Similarly, management representatives felt it was important that they participate in workplace health programmes with their employees, to promote employee participation. Lastly, participants reported that a workplace exercise programme should be enjoyable.

3.3 High-intensity interval training

. Before the ‘researcher definition’ of HIIT was provided, employees were asked about their knowledge of activities they perceived to be HIIT. Although beyond the scope of the study to ascertain the exact number of participants in each category, some participants were unaware of HIIT, some were aware but had not participated in HIIT, and others had previously or currently participated in HIIT, thus demonstrating a broad range of experiences within the sample. Those who had some knowledge or had participated in HIIT previously reported that they had initially

heard about HIIT via ‘celebrity’ exercise videos or group exercise classes involving repeated high-intensity bouts of exercise on treadmills or stationary bikes and circuit style exercise classes.

Employees perceived HIIT to be a physically demanding form of activity that would result in sweating, an increase in heart rate and feelings of breathlessness:

“I don’t know jogging on the spot with your arms going up and down getting your heart rate up, warming your muscles up, getting your heart rate going”. Employee, female, study site 1.

Examples of exercise modes that employees identified as HIIT were burpees, squat jumps or shuttle run sprinting. Although infrequently discussed, some employees recognised the intermittent nature of HIIT and that HIIT could be completed in a shorter amount of time compared with traditional exercise modes. Some employees reported that HIIT could elicit weight loss and ‘burnt calories’ more effectively other forms of exercise. Some employees perceived that HIIT was not suitable for all individuals and one employee thought HIIT conferred a risk of injury:

“...I would be very concerned about trying to push it too far too fast, I would have to really work up to any sort of high-intensity work very slowly now. Because of the physical risks”. Employee, male, study site 6.

One employee expressed the view that HIIT may not be appealing to all individuals based on his experience of attending HIIT-type group exercise classes at his local gym where there was a high turnover of participants:

“I’ve been doing my [industry branded HIIT] classes for donks [a long time]... And I know if you see anyone start new and they don’t come back. It’s the same people...”

same 12 who have been going there for a couple of years every week, interspersed with people who come and go, come and go. I don't think... it's definitely not for everyone".

Employee, male, study site 4.

Following this initial discussion, employees were provided with the 'researcher definition' of HIIT. The intermittent nature of HIIT was received positively by employees because the rest breaks were perceived as sufficient to permit recovery:

*"And then like you say you get a rest to get your breath back and your oxygen levels back up *laughs*. So that gets a tick".* Employee, female, study site 3.

Further, given the intermittent nature of HIIT, employees perceived the intensity to be more manageable than initially discussed. Employees reported that because the intensity of HIIT should be relative to each individual, HIIT could be manageable for less physically fit individuals, which contrasted with their opinion before the 'researcher definition' was provided:

"The good thing about it [HIIT] is that you can tailor it so that if you have limitations... presumably you can develop [high-intensity] bursts to be able to do something that you can manage. As long as it is something that you can do and you do it as hard as you can, doesn't it? That's the key to it isn't it?". Employee, male, study site 4.

Given the short duration of the example HIIT protocol provided, employees reported that HIIT would be a feasible form of exercise given the limited time frame available in the workplace. One participant discussed that HIIT has a 'time/intensity trade off', where although the exercise may be physically demanding, the lower time commitment required and positive feelings on completion of HIIT may negate discomfort felt during exercise:

“I think people would do that. Because the trade-off is, it’s not comfortable while you are doing it, but when you asked us why we didn’t exercise we all said time. And the benefit of this is that you do feel quite good after it and you can do it... give up 10 minutes maybe to do it”. Employee, male, study site 6.

However, of particular importance to workplace HIIT interventions, personal hygiene was reported as a barrier to participating in HIIT in the workplace. Employees felt that exercise at high-intensity would result in sweating, so a shower and change of clothes would be required before they could return to work, which would therefore increase the time requirements for a session:

“Assuming you break a sweat you will need to have a shower, get changed into and out of the clothes that you would exercise in”. Employee, male, study site 5.

3.4 Intervention structure

Frequency

Although the majority of employees and management representatives agreed that thrice-weekly exercise sessions would be acceptable, employees from one study site reported that twice weekly would be more acceptable initially, with the possibility of increasing frequency to three sessions per week after a number of weeks. Management representatives reported that daily sessions would be too time consuming, yet once weekly sessions were unacceptable due to the risk of individuals losing interest or being unable to attend one session and then missing a whole week of the programme:

“I think if you make it every day I think it might be more difficult. If you only make it once per week people might lose enthusiasm”. Management representative, female, study site 1.

Timing of exercise sessions

As previously mentioned, many of the organisations operated flexible working policies. Although both employees and management representatives said this may facilitate individual workplace exercise capacity, they discussed that group-based exercise sessions at a single time point would likely be poorly attended. To overcome this barrier, employees and management representatives requested multiple exercise sessions across the day:

“I think you have to factor in your workplace commitments. And the nature that your day can change from what you come into and what it becomes. I think the danger is if you offer one session a week, say on a Wednesday at 1 o’clock. People can make it but then something might happen and they drop off and might make some weeks and not others. I think it has to be sessions that you have the opportunity to drop in. It needs to be three sessions per week and you’ve got the opportunity to drop into a number of sessions over the week”. Employee, male, study site 4.

Employees expressed a preference for exercise sessions before work, at lunch time and after work to avoid the intervention impeding on work commitments, which was supported by management representatives.

Length of exercise sessions and intervention

Employees and management representatives across all study sites were entitled to a 30-minute break in the middle of the day. Therefore, they requested that exercise sessions did not exceed this timeframe. Employees perceived that 60-minute exercise sessions would be too time consuming:

“I think an hour is a big commitment at the beginning or the end of the day”. Employee, female, study site 1.

Most employees reported that the proposed intervention length of 6 to 10 weeks was acceptable; but there was no consensus between participants in terms of an exact preferred duration. Management representatives were supportive of a 6 to 10 week intervention:

“I think if you make something so far into the future that it is something that they can’t see an end to, they will drop out”. Management representative, female, study site 1.

3.5 Exercise Modes

Management representatives were supportive of whichever exercise modes were preferred by their employees but expressed a preference for simple exercise modes that did not require extensive exercise knowledge or experience.

Employees thought that walking, jogging and running would be feasible exercise modes, for a range of fitness levels. This was due to most participants being aware of previous workplace walking or running initiatives either in their current or previous workplaces.

Based on the ‘researcher definition’ of HIIT, employees acknowledged that for some individuals, power walking would elicit a high-intensity response, whereas for others running would be required. It was, however also acknowledged that walking or running would require outdoor space and would therefore only be feasible during fine weather. Although this mode was perceived as simple to understand, one employee reported that not all individuals may enjoy running:

“Running and jogging would be easier to understand it [the exercise modality], but at the same time people may not like it because they don’t like to run.” Employee, female, study site 4.

Many employees reported that skipping was a novel and fun exercise they had frequently participated in as a child but had not tried for some time. Some employees noted that to elicit

a high-intensity response, a level of skill would be required to continuously skip without tripping on the rope:

“You would need to be quite a skilled skipper to be able to go at full intensity for a minute wouldn’t you? So a lot of people wouldn’t be able to be to complete it”.

Employee, male, study site 5.

Employees discussed that boxing was a novel and interesting form of exercise, which may relieve stress and would be fun because it required partner work:

“The fact that you have got away from your desk and you have gone and punched the living daylight out of a punch bag, you’ll probably feel a whole lot better in the afternoon.” Employee, male, study site 5.

It was noted that boxing would require a small space or room to be completed, which was perceived as an important consideration for workplace exercise. Employees felt that some individuals may not enjoy the technical or combative nature of boxing, especially with a partner they did not know or feel comfortable with:

“I’m not sure if it would be too technical. I just think some people might be a bit put off if they haven’t done that type of thing before. If you said you haven’t exercised for years you come here and we are going to do some non-contact boxing, get the pads on, get a partner. Some people wouldn’t want to do that. Employee, female, study site 4.

Another participant reported that boxing might be an activity that people would enjoy after trying it once:

“I think as well, it’s one of those things. I had never really done it before and my son goes to a kick boxing class. And one of the guys was there and he asked would I mind holding some pads for him, and then when you start hitting them you think ‘oh this is actually quite good you know’, and you work up a hell of a sweat doing it. Employee, male, study site 4.

Stair climbing or stair stepping were perceived as feasible exercise modes because they were simple, required no prior exercise knowledge, and could be completed using the facilities available within the workplace:

“I think everybody, even if they are not active at the moment, they would know what stair stepping is. You’re not being put off by ‘I can’t run’ or ‘I can’t box’ or anything like that. But everybody could do that one”. Employee, male, study site 5.

However, some employees expressed concerns in relation to the safety of fast paced stair climbing:

“The first thing I think of is the safety issues. Because stairs is fantastic totally, and even though we have the facilities, it’s not easy if you can run up. And the traffic of people as well. And also I don’t think that stairs is safe for me, anyway”. Employee, male, study site 4.

Perceptions regarding dance as an exercise modality were polarised. Some employees reported that dance would be particularly enjoyable and suitable for inactive individuals because it is a familiar exercise mode for many:

“I think though, if you are a beginner because that [dance] has been around for a while a lot of people, they know what it is... and they know what they are going to do. And I think they would be more inclined to go and do something like that than boxing. I’m just thinking about some of the ladies in my office that would probably go along to that because they know what to expect”. Employee, female, study site 4.

While others reported that if dance were included in an intervention they would decline to participate in the intervention at all, because they did not enjoy or feel comfortable dancing:

“That is my idea of hell. I would never go anywhere near it... I have never been able to dance I have my own weird sense of dance and I cannot put steps to music at all”. Employee, male, study site 5.

Most employees agreed that some level of dance knowledge or experience would be required to permit high-intensity dance exercise. Additionally, it was noted that dance would be difficult to facilitate in some workplaces due to the requirement for music which may disrupt the working environment:

“It might be more, I’ll use the word disruptive because our conference rooms... you wouldn’t be able to accommodate that and obviously booking any bigger rooms would be difficult I guess. So the location of that one may be a problem”. Employee, female, study site 4.

Yoga was discussed as a preferred exercise modality by some employees although it was explained to participants that the intention was for the exercise to substantially increase the heart rate which would not likely be possible with yoga. The participants did not express an interest in any other exercise modes.

Despite individual differences in opinions of each of the reported exercise modes, all employees agreed that a choice of modes should be available both between and within sessions:

“So you say you’ve got your four, minute intervals... you can fill the four minutes with the things you like doing. You might one day choose to do three boxing things or one of each on one day, so you get variety. So for somebody who can’t skip very well, yes they are not going to get much of a workout because you are forever faffing about [wasting time] with the rope. Whereas if you can skip proficiently you know, I still think a minute of skipping is hard work. Other people might disagree. Obviously running for a minute is hard work if you make it hard work, going up stairs, I’ve punched a punch bag for a minute that is crucifying. So it would all do the job. It’s just having the choice of which one you want to do”. Employee, male, study site 5.

Employees discussed that individual preferences should be taken into account to facilitate enjoyment for a range of individuals. A choice of a variety of exercise modes between sessions was perceived to be more engaging:

“If you sold it to me that we just did stair stepping 3 times a week for 8 weeks I would probably get bored. So I think it would be interesting to give different activities to do as part of a programme”. Employee, female, study site 4.

Lastly, many employees noted that some individuals may have physical limitations that prohibit participation in certain exercise modes:

“But classically someone who has got a bit of a dodgy knee or dodgy hip could come to this and they know their body better than anybody else. They could say well I will do that one or that one because I’ll be alright with it, but my knee won’t let me do that one so I will leave it out [and] I will do the others. Employee, male, study site 3.

3.6 Overall programme considerations

Overwhelmingly, group-based exercise was the preferred format for a workplace HIIT programme because both employees and management representatives perceived that it would increase motivation and compliance and provide an opportunity for networking and team building. It was acknowledged though that for some individuals it might be important to have the option to exercise individually:

“Personally I think it would be better in groups. But I suppose individual choice would come into it as well. So if somebody felt particularly uncomfortable doing some sort of exercise with other people, then I just think it’s their choice at that point. Management representative, male, study site 5.

It was important to employees that workplace exercise sessions were facilitated as close to their place of work as possible. Yet management representatives acknowledged that an indoor

location would be problematic for the facilitation of multiple exercise sessions across a day, as available space was limited in most of the participating organisations:

“It’s just finding that location. We do have a real problem with finding room availability.” Management representative, female, study site 6.

Outdoor sessions were perceived positively by employees because they would allow for a break from the indoor office environment, but only if the weather was fine:

“We went to go out for one (a walk) didn’t we once? We were going to go around here, and we got outside and it started pouring down with rain and everybody just did an about turn”. Employee, female, study site 1.

Employees from one study site discussed offering “taster sessions” as a method of programme promotion:

“Those who are familiar with exercise probably won’t mind turning up to a class blind. But when you are introducing something new, they [people unfamiliar with exercise] need that bit of reassurance.” Employee, female, study site 4.

They suggested that during taster sessions potential participants could try a HIIT session before they decided whether to participate in the intervention. This proposal was popular with both employees and management representatives in subsequent focus groups and interviews.

3.7 Modifications made to the planned intervention based on participant feedback

To fully illustrate how the focus group and one-to-one interview data informed the design of the planned BE@Work intervention, the following section describes the modifications that were made to the proposed HIIT intervention following data collection. The process demonstrated herein could be used as a framework to guide the incorporation of employees’ and key stakeholders’ perspectives into the development of future HIIT or workplace exercise interventions. A summary of the modifications is presented in Table 3.

The BE@Work intervention will be 8 weeks in duration. In our study, employees and management representatives agreed that a short term programme (6-10 weeks) was acceptable, and therefore we selected the mean intervention length used in previous workplace HIIT interventions shown to be effective for improving health and fitness (23, 24). The frequency and length of HIIT sessions (20 to 30 minutes, thrice weekly) were perceived as acceptable by the majority of participants, so no modifications were made. Due to competing work and family commitments, our participants stressed that flexibility in exercise session attendance was important and proposed that several sessions be made available throughout the week. Accordingly, the BE@Work programme will permit participants to self-select any three sessions per week from four exercise sessions delivered every day. The sessions will be conducted during the organisations “flexible hours” (i.e., early morning, lunch time and late afternoon), when work related events are not held. As participants explained that a lack of workplace shower facilities may be a barrier to participation during the work day, late afternoon sessions may be more popular. Accordingly, two sessions at 4:30pm and 5pm will be scheduled.

Participants requested a range of intervention activities - stair stepping, stair climbing and boxing were the most popular. These modes were perceived as practical and novel within a workplace environment. Lastly, a choice of three exercise modes will be provided within and between HIIT sessions as participants perceived this would be critical to increase the reach of the intervention and enhance adherence.

In line with preferences expressed by our participants, the scheduled HIIT sessions for BE@Work will be group-based, with the option of individual sessions if preferred. Our

participants expressed a preference for exercise sessions that are conducted within, or at least commence from and terminate at their workplace to limit travel requirements. As the planning of exercise session location will be largely dictated by workplace room availability, preparations will also be made for outdoor sessions where participants will meet within their workplace, then proceed to a nearby outdoor exercise location. The walk will be incorporated into the warm-up of the exercise session, to limit the time commitment required for the overall session.

Based on our employee feedback, one-off taster HIIT sessions will be scheduled in the month prior to BE@Work data collection commencement. Here, taster session participants will have the opportunity to try HIIT activities based on stair stepping, stair climbing and/or boxing before deciding whether they want to take part in the full intervention. An explanation of HIIT will be given, including a description of the relative intensity of HIIT, which was deemed important by our participants.

TABLE 3 HERE

4.0 Discussion

To date, the views of potential participants of health promotion programmes have been largely overlooked (11, 52), and there remains few examples of how qualitative formative evaluation can be used to tailor the design and implementation of exercise interventions, particularly those delivered in the workplace. We aimed to illustrate how employee focus groups and one-to-one interviews with management representatives can inform the development of a workplace exercise programme, via a formative evaluation of a proposed HIIT intervention called BE@Work.

In line with previous research (20, 53), our participants generally viewed workplace exercise positively but reported that work commitments would be prioritised over exercise participation. Indeed previous studies have highlighted employees concerns that workplace health promotion interventions may distract from work tasks (54, 55). We therefore recommend that potential participants' workloads are considered when planning workplace programmes and participant research burden (e.g., time commitment associated with data collection and exercise sessions) should also be minimised. Employees commonly cited barriers to workplace exercise were lack of time or competing work priorities, family or caring commitments and lack of shower or exercise facilities. Management representatives also suggested a lack of middle managers support could be a barrier for employees, despite the support of senior management. Employees' facilitators included flexible working conditions, senior management support, and social support from colleagues. Management representatives echoed this, adding it was important that management staff participate in workplace programmes to support employees. Similar barriers and facilitators have been reported in previous work from public and private sector organisations (e.g. 53, 56, 57), however as such factors are likely to be highly setting specific (16), it remains vital to explore them in the environment where an intervention is to be implemented.

In the specific context of HIIT, this is the first qualitative study to explore participants' perspectives before intervention implementation, or indeed before participants may have tried HIIT. Such an awareness is paramount due to the lack of literature on public perceptions of HIIT (58), and concerns about the adoption and maintenance of HIIT in the general population (59). Interestingly, some of the exercise modes our participants identified as HIIT (e.g., burpees, squat jumps or shuttle run sprinting), extended beyond those traditionally used in HIIT trials (e.g. stationary cycling or treadmill running or walking) (28). This could be because some participants had previously participated in what they perceived to be HIIT fitness classes,

which typically include similar exercises to those described (60). While more research is needed to explore wider public perspectives of HIIT, our findings highlight how HIIT appears to have transcended the scientific literature into the mainstream fitness industry. Though beyond the scope of our study, this transition and associated public perceptions represents an interesting avenue for future research.

When asked about workplace HIIT specifically, employee views varied. Some thought HIIT would be a novel and engaging activity, particularly given the intermittent nature of the activity and short duration. These findings are similar to those reported in a recent process evaluation of a workplace HIIT intervention, where participants reported that the novelty of HIIT initially attracted them to participate in the intervention (31). Additionally, the inbuilt rest breaks that are incorporated into HIIT protocols have been viewed favourably by participants of HIIT delivered in a number of settings including the workplace (22) gyms (60) and laboratories (61). In contrast, some participants in our study reported that because HIIT would induce sweating and breathlessness it may not be enjoyable or acceptable for all individuals in the workplace. While documented experiences of HIIT often note feelings of subjective fatigue such as breathlessness, increased heart rate or muscle fatigue which could lead to negative experiences (22), it has been reported that some individuals can have positive subjective experiences associated with HIIT (61, 62). One participant in our study perceived that participating in HIIT may lead to injury. To decrease injury risk, we recommend that current exercise prescription guidelines (e.g. pre-exercise screening, a thorough warm up and cool down and gradual progression of volume or intensity of exercise (9)) are strictly adhered to.

The polarised views of HIIT described by our participants mirror debates seen in the academic literature (59) , where the suitability of HIIT for the general population has been questioned.

Nonetheless employees in our study did note that if the relative intensity of HIIT and intermittent nature were explained to potential participants (i.e., that HIIT can be enacted differently depending on individual fitness levels and rest breaks are included in the protocol), this may alleviate concerns about inactive individuals' ability to participate. This finding highlights the importance of providing a detailed explanation of novel exercise strategies, such as HIIT, to potential participants during recruitment as well as demonstrating the language that could be used to describe HIIT in future interventions.

In our study, participant feedback informed the logistics of the resultant BE@Work intervention protocol, wherever possible. Most importantly, the participants requested a flexible schedule of group-based workplace exercise sessions, with a choice of different exercise modes. Based on participant feedback, the BE@Work programme will offer multiple HIIT sessions across the working week, with participants asked to attend any three sessions each week. While this flexible schedule of exercise sessions may enhance attendance in the BE@Work intervention, as reported in previous HIIT interventions (63) we acknowledge that providing such a high volume of exercise sessions may not be pragmatically or financially viable for some organisations outside of the context of a research study. In this case, a balance would need to be sought between employee requests and the cost of an exercise facilitator. Alternatively, as demonstrated in a recent workplace HIIT intervention (22) computer software can facilitate the delivery of HIIT. This would allow employees to participate in workplace HIIT at their convenience. However, given that participants in our study requested group-based exercise and previous research has indicated that group exercise can enhance motivation and reduce anxiety related to exercising alone in the workplace (20, 64); the suitability of computer-assisted individual exercise in this particular setting may be limited.

In our study, while specific views regarding the use of different exercise modes in the workplace were contrasting; boxing, stair climbing and stair stepping were the most commonly preferred modes. These modes have been successfully used in community-based exercise interventions previously, with heart rates indicating a high-intensity exercise response (24, 33, 35). Although this indicates that these modes could be incorporated into a HIIT protocol in isolation, whether a HIIT protocol which incorporates different exercise modes can elicit a high-intensity response is unknown and requires further investigation prior to intervention implementation. This is particularly important in the context of HIIT, because it is the intensity of exercise that is likely the driver for the physiological adaptations promoted by chronic training (65).

Regardless of specific views surrounding individual exercise modes, our participants agreed that the BE@Work intervention should provide a choice in a variety of exercise modes, both within and between exercise sessions. This finding is encouraging, as variety in exercise modes has been identified as a key facilitator to exercise intervention adherence (66), and a choice in exercise mode has been shown to effect both motivation and psychological responses to exercise (67). It is therefore surprising that most workplace HIIT interventions conducted to date utilise a single exercise mode across the intervention (either cycling or stair climbing only) (22-25). Our findings demonstrate that the use of a single exercise mode across a workplace HIIT intervention may not facilitate adherence or compliance in some individuals.

Despite the novelty of our study in terms of findings and knowledge application, it is not without limitations. As our participants were from organisations where employees were predominantly office based, our data will likely not extend to other organisational environments such as healthcare or manual labour settings. Further, we recruited a convenience

sample of participants, which could increase the likelihood of selection bias (41). Convenience sampling assumes that the members of the target population are homogeneous (41), that is, that there would be no difference in the research results obtained from a random sample. Given that recruitment material for our study stated that the purpose was to plan a workplace exercise intervention, it is possible that individuals uninterested in exercise would not feel willing or able to participate, resulting in respondents who are already active or at least willing to participate in exercise. Lastly, we are aware that some of the strategies applied to our proposed HIIT intervention model would not be possible in other workplaces. For example, in organisations without a flexible working structure, multiple exercise sessions spaced throughout the day may not be feasible or scalable.

Nonetheless, we have shown how qualitative formative evaluation can generate important considerations for the general planning of exercise interventions, using an example of a proposed workplace HIIT intervention. By illustrating the specific way in which qualitative data can inform the design of an exercise programme, we hope to provide a useful guide for the methods that can be used for the co-production of future exercise training studies between intervention developers, potential participants and key stakeholders. In the specific context of workplace HIIT, our study is the first to explore adults' perspectives on HIIT prior to intervention implementation and provides many novel and practical considerations into how HIIT could be operationalised in the workplace. Given the recent inclusion of HIIT in the US and UK public health physical activity guidelines (68, 69), and increasing interest in workplace HIIT (22) the implementation of workplace HIIT initiatives could soon become commonplace. The insights provided in our study therefore, could be particularly timely in aiding the development of future HIIT interventions.

5.0 Conclusion

Using qualitative focus group and interview data from a formative evaluation of a workplace HIIT intervention, we have demonstrated a process which will allow researchers and practitioners to use employees' and managements' perspectives, to enhance the development of future workplace exercise or HIIT interventions. Our data indicated that while the provision of exercise opportunities within the workplace was generally viewed favourably, there are a range of competing barriers (e.g., work demands or family and caring commitments) and facilitators (e.g., flexible working conditions and management support) to workplace exercise participation. In the specific context of our proposed workplace HIIT intervention, our findings invaluablely informed the logistics and content of the planned BE@Work intervention, including the format of the intervention (i.e., group-based exercise sessions), exercise modes (i.e. a choice between stair climbing, stepping and boxing within and between sessions) and timing of the exercise sessions (i.e. flexible schedule of sessions across the week). Collectively, our study demonstrates the vital role that formative evaluation plays in the development of exercise trials.

6.0 References

1. Dishman RK, Oldenburg B, O'Neal H, Shephard RJ. Worksite physical activity interventions. *American Journal of Preventive Medicine*. 1998;15(4):344-61.
2. National Institute for Health and Care Excellence. *Physical Activity in the Workplace*. London: National Centre for Health and Care Excellence; 2008.
3. World Health Organization. *The workplace as a setting for interventions to improve diet and promote physical activity*. Geneva: World Health Organization; 2007.
4. Burn NL, Weston M, Maguire N, Atkinson G, Weston KL. Effects of workplace-based physical activity interventions on cardiorespiratory fitness: a systematic review and meta-analysis of controlled trials. *Sports Medicine*. 2019;48(8):1255–74.
5. Reed JL, Prince SA, Elliott CG, Mullen KA, Tulloch HE, Hiremath S, et al. Impact of workplace physical activity interventions on physical activity and cardiometabolic health among working-age women: a systematic review and meta-analysis. *Circulation Cardiovascular Quality and Outcomes*. 2017;10(2).
6. Abdin S, Welch RK, Byron-Daniel J, Meyrick J. The effectiveness of physical activity interventions in improving well-being across office-based workplace settings: a systematic review. *Public health*. 2018;160:70-6.
7. Robroek SJ, van Lenthe FJ, van Empelen P, Burdorf A. Determinants of participation in worksite health promotion programmes: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*. 2009;6:26.

8. Rongen A, Robroek SJ, van Lenthe FJ, Burdorf A. Workplace health promotion: a meta-analysis of effectiveness. *American Journal of Preventative Medicine*. 2013;44(4):406-15.
9. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc*. 2011;43(7):1334-59.
10. Hecksteden A, Faude O, Meyer T, Donath L. How to Construct, Conduct and Analyze an Exercise Training Study? *Front Physiol*. 2018;9:1007.
11. Bauman A, Nutbeam D. Evaluation in a nutshell: a practical guide to the evaluation of health promotion programs. Sydney: McGraw-Hill; 2013.
12. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. *British Medical Journal*. 2008;337:a1655-a.
13. Gittelsohn J, Evans M, Helitzer D, Anliker J, Story M, Metcalfe L, et al. Formative research in a school-based obesity prevention program for Native American school children. *Health Education Research*. 1998;13(2):251-65.
14. Gittelsohn J, Steckler A, Johnson CC, Pratt C, Grieser M, Pickrel J, et al. Formative research in school and community-based health programs and studies: "state of the art" and the TAAG approach. *Health Education and Behavior*. 2006;33(1):25-39.

15. Langdridge D, Hagger-Johnson G. Introduction to research methods and data analysis in psychology. 2nd ed. Harrow: Pearson Education; 2009.
16. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *Int J Nurs Stud*. 2013;50(5):587-92.
17. Mackintosh KA, Knowles ZR, Ridgers ND, Fairclough SJ. Using formative research to develop CHANGE!: a curriculum-based physical activity promoting intervention. *BMC Public Health*. 2011;11:831.
18. Fjeldsoe BS, Miller YD, O'Brien JL, Marshall AL. Iterative development of MobileMums: a physical activity intervention for women with young children. *The international journal of behavioral nutrition and physical activity*. 2012;9:151.
19. Young DR, Johnson CC, Steckler A, Gittelsohn J, Saunders RP, Saksvig BI, et al. Data to action: using formative research to develop intervention programs to increase physical activity in adolescent girls. *Health Educ Behav*. 2006;33(1):97-111.
20. Phipps E, Madison N, Pomerantz SC, Klein MG. Identifying and assessing interests and concerns of priority populations for work-site programs to promote physical activity. *Health Promotion and Practice*. 2010;11(1):71-8.
21. Hunter JR, Gordon BA, Bird SR, Benson AC. Perceived barriers and facilitators to workplace exercise participation. *International Journal of Workplace Health Management*. 2018;11(5):349-63.
22. Metcalfe RS, Atef H, Mackintosh K, McNarry M, Ryde G, Hill DM, et al. Time-efficient and computer-guided sprint interval exercise training for improving health in the

workplace: a randomised mixed-methods feasibility study in office-based employees. *BMC Public Health*. 2020;20(1):313.

23. Shepherd SO, Wilson OJ, Taylor AS, Thogersen-Ntoumani C, Adlan AM, Wagenmakers AJM, et al. Low-volume high-intensity interval training in a gym setting improves cardio-metabolic and psychological health. *PloS One*. 2015;10(9):e0139056.
24. Allison MK, Baglole JH, Martin BJ, Macinnis MJ, Gurd BJ, Gibala MJ. Brief intense stair climbing improves cardiorespiratory fitness. *Medicine and Science in Sports and Exercise*. 2017;49(2):298-307.
25. Cuddy TF, Ramos JS, Dalleck LC. Reduced Exertion High-Intensity Interval Training is More Effective at Improving Cardiorespiratory Fitness and Cardiometabolic Health than Traditional Moderate-Intensity Continuous Training. *Int J Environ Res Public Health*. 2019;16(3).
26. Eather N, Babic M, Riley N, Harris N, Jung M, Jeffs M, et al. Integrating high-intensity interval training into the workplace: The Work-HIIT pilot RCT. *Scandinavian Journal of Medicine & Science in Sports*. 2020:1-11.
27. Gibala MJ, Little JP, Macdonald MJ, Hawley JA. Physiological adaptations to low-volume, high-intensity interval training in health and disease. *Journal of Physiology*. 2012;590(5):1077-84.
28. Weston KS, Wisløff U, Coombes JS. High-intensity interval training in patients with lifestyle-induced cardiometabolic disease: a systematic review and meta-analysis. *British Journal of Sports Medicine*. 2014;48(16):1227-34.

29. Weston M, Taylor KL, Batterham AM, Hopkins WG. Effects of low-volume high-intensity interval training (HIT) on fitness in adults: a meta-analysis of controlled and non-controlled trials. *Sports Medicine*. 2014;44(7):1005-17.
30. Su L, Fu J, Sun S, Zhao G, Cheng W, Dou C, et al. Effects of HIIT and MICT on cardiovascular risk factors in adults with overweight and/or obesity: A meta-analysis. *PLoS One*. 2019;14(1):e0210644.
31. Kinnafick FE, Thøgersen-Ntoumani C, Shepherd SO, Wilson OJ, Wagenmakers AJM, Shaw CS. In It Together: A Qualitative Evaluation of Participant Experiences of a 10-Week, Group-Based, Workplace HIIT Program for Insufficiently Active Adults. *J Sport Exerc Psychol*. 2018;40(1):10-9.
32. Brown DK, Barton JL, Pretty J, Gladwell VF. Walks4Work: assessing the role of the natural environment in a workplace physical activity intervention. *Scandinavian Journal of Work Environment and Health*. 2014;40(4):390-9.
33. Mair JL, Nevill AM, De Vito G, Boreham CA. Personalised prescription of scalable high intensity interval training to inactive female adults of different ages. *PLoS One*. 2016;11(2):e0148702.
34. Sertel M, Üçsular FD, Uğurlu Ü. The effects of worksite exercises on physical capabilities of workers in an industry of a developing country: A randomized controlled study. *Isokinetics & Exercise Science*. 2016;24(3):247-55.
35. Weston KL, Azevedo LB, Bock S, Weston M, George KP, Batterham AM. Effect of novel, school-based high-intensity interval training (HIT) on cardiometabolic health in adolescents: Project FFAB (Fun Fast Activity Blasts) - an exploratory controlled before-and-after trial. *PLoS One*. 2016;11(8):e0159116.

36. Gibala MJ. Interval training for cardiometabolic health: why such a HIIT? *Current Sports Medicine Reports*. 2018;17(5):148-50.
37. Taylor KL, Weston M, Batterham AM. Evaluating intervention fidelity: an example from a high-intensity interval training study. *PLoS One*. 2015;10(4):e0125166.
38. Phillips BE, Kelly BM, Lilja M, Ponce-González JG, Brogan RJ, Morris DL, et al. A practical and time-efficient high-intensity interval training program modifies cardio-metabolic risk factors in adults with risk factors for Type II Diabetes. *Frontiers in Endocrinology*. 2017;8:229.
39. Little JP, Safdar A, Wilkin GP, Tarnopolsky MA, Gibala MJ. A practical model of low-volume high-intensity interval training induces mitochondrial biogenesis in human skeletal muscle: potential mechanisms. *J Physiol*. 2010;588(Pt 6):1011-22.
40. 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;19(6):349-57.
41. Robinson OC. Sampling in interview-based qualitative research: a theoretical and practical guide. *Qualitative Research in Psychology*. 2014;11(1):25-41.
42. Sparkes A, Smith B. *Qualitative research methods in sport, exercise and health: From process to product*. London: Routledge; 2014.
43. Goode RC, Mertens R, Shaiman S, Mertens J. Voice, breathing, and the control of exercise intensity. *Advanced Experimental Medical Biology*. 1998;450:223-9.
44. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res*. 2005;15(9):1277-88.

45. De Cocker K, Veldeman C, De Bacquer D, Braeckman L, Owen N, Cardon G, et al. Acceptability and feasibility of potential intervention strategies for influencing sedentary time at work: focus group interviews in executives and employees. *The international journal of behavioral nutrition and physical activity*. 2015;12:22.
46. Jay M, Mateo KF, Squires AP, Kalet AL, Sherman SE. Military service and other socioecological factors influencing weight and health behavior change in overweight and obese Veterans: a qualitative study to inform intervention development within primary care at the United States Veterans Health Administration. *BMC Obes*. 2015;3:5.
47. Elo S, Kyngäs H. The qualitative content analysis process. *J Adv Nurs*. 2008;62(1):107-15.
48. Heyward VH. *Advanced fitness assessment and exercise prescription*. 6th ed. ed. Leeds: Human Kinetics; 2010.
49. Smith B, McGannon KR. Developing rigor in qualitative research: problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology*. 2018;11(1):101-21.
50. Braun V, Clarke V. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qualitative Research in Sport, Exercise and Health*. 2019:1-16.
51. Low J. A pragmatic definition of the concept of theoretical saturation. *Sociological Focus*. 2019;52(2):131-9.

52. Hesketh K, Waters E, Green J, Salmon L, Williams J. Healthy eating, activity and obesity prevention: a qualitative study of parent and child perceptions in Australia. *Health Promot Int.* 2005;20(1):19-26.
53. Ryde GC, Atkinson P, Stead M, Gorely T, Evans JMM. Physical activity in paid work time for desk-based employees: a qualitative study of employers' and employees' perspectives. *BMC Public Health.* 2020;20(1):460.
54. Stephenson A, McDonough SM, Murphy MH, Nugent CD, Wilson IM, Mair JL. Exploring the Views of Desk-Based Office Workers and Their Employers' Beliefs Regarding Strategies to Reduce Occupational Sitting Time, With an Emphasis on Technology-Supported Approaches. *J Occup Environ Med.* 2020;62(2):149-55.
55. Cole JA, Tully MA, Cupples ME. "They should stay at their desk until the work's done": a qualitative study examining perceptions of sedentary behaviour in a desk-based occupational setting. *BMC Res Notes.* 2015;8:683.
56. Brinkley A, McDermott H, Munir F. Team sport in the workplace? A RE-AIM process evaluation of 'Changing the Game'. *AIMS Public Health.* 2017;4(5):466-89.
57. Planchard JH, Corrion K, Lehmann L, d'Arripe-Longueville F. Worksite physical activity barriers and facilitators: a qualitative study based on the transtheoretical model of change. *Frontiers in Public Health.* 2018;6:326.
58. Stork MJ, Gibala MJ, Martin Ginis KA. Psychological and Behavioral Responses to Interval and Continuous Exercise. *Medicine and Science in Sports and Exercise.* 2018;50(10):2110-21.

59. Biddle SJ, Batterham AM. High-intensity interval exercise training for public health: a big HIT or shall we HIT it on the head? *International Journal of Behavioural Nutrition and Physical Activity*. 2015;12:95.
60. Burn N, Niven A. Why do they do (h)it? Using self-determination theory to understand why people start and continue to do high-intensity interval training group exercise classes. *International Journal of Sport and Exercise Psychology*. 2018:1-15.
61. Stork MJ, Williams TL, Martin Ginis KA. Unpacking the debate: A qualitative investigation of first-time experiences with interval exercise. *Psychology of Sport and Exercise*. 2020;51:101788.
62. Stork MJ, Banfield LE, Gibala MJ, Martin Ginis KA. A scoping review of the psychological responses to interval exercise: is interval exercise a viable alternative to traditional exercise? *Health Psychology Review*. 2017;11(4):324-44.
63. Hurst C, Weston KL, Weston M. The effect of 12 weeks of combined upper- and lower-body high-intensity interval training on muscular and cardiorespiratory fitness in older adults. *Aging Clinical and Experimental Research*. 2018;31(5):661-71.
64. Fletcher GM, Behrens TK, Domina L. Barriers and enabling factors for work-site physical activity programs: a qualitative examination. *Journal of Physical Activity and Health*. 2008;5(3):418-29.
65. MacInnis MJ, Gibala MJ. Physiological adaptations to interval training and the role of exercise intensity. *The Journal of Physiology*. 2017;595(9):2915-30.
66. Morgan F, Battersby A, Weightman AL, Searchfield L, Turley R, Morgan H, et al. Adherence to exercise referral schemes by participants - what do providers and

commissioners need to know? A systematic review of barriers and facilitators. *BMC Public Health*. 2016;16:227.

67. Parfitt G, Gledhill C. The effect of choice of exercise mode on psychological responses. *Psychology of sport and exercise*. 2004;5(2):111-7.

68. Department of Health and Social Care. *Physical activity guidelines*. London: Department of Health and Social Care; 2019.

69. 2018 Physical Activity Guidelines Advisory Committee. *2018 Physical Activity Guidelines Advisory Committee Scientific Report*. Washington (DC): U.S. Department of Health and Human Services; 2018.

Table 1 Organisation and participant characteristics

Study Site Number	Type of organisation	Number of focus groups (n=participants)	Management interview	Mean age, years (\pm SD)	Percentage female
1	Charitable organisation	1 (n=3)	n=1	48 (\pm 7)	100
2	Charitable organisation	1 (n=5)	No response	43 (\pm 9)	80
3	Charitable organisation	1 (n=4)	n=1	32 (\pm 10)	100
4	Local authority	3 (n=12)	No response	40 (\pm 5)	50
5	Tertiary institution (support staff)	1 (n=7)	n=1	52 (\pm 5)	100
6	Tertiary institution (academic staff)	1 (n=7)	n=1	44 (\pm 14)	30

Table 2 Categorisation Matrix

Category	Description
General perceptions of workplace exercise	General perceptions of the acceptability and feasibility of workplace exercise or physical activity interventions
Barriers	Elements of participants working environment that are a barrier to an employee's ability to participate in exercise in the workplace
Facilitators	Elements of participants working environment that facilitate an employee's ability to participate in exercise in the workplace
Intervention structure: Frequency	Views and opinions on frequency of exercise sessions in the workplace
Intervention structure: Time	Views and opinions of timing of exercise sessions in the workplace
Intervention structure: Length of exercise sessions	Views and opinions on length of exercise sessions in the workplace
Intervention structure: Length of the intervention	Views and opinions on intervention length
High-intensity interval training: before definition	Views and opinions of HIIT before definition of HIIT was provided
High-intensity interval training: after definition	Views and opinions of HIIT after definition of HIIT provided
Exercise modes	Views and opinions of different modes of HIIT in the workplace
Overall programme considerations: Group based vs. individual exercise	Views and opinions of group based exercise or individual exercise sessions in the workplace
Overall programme considerations: Location of exercise	Views and opinions on exercise locations within/nearby to the workplace
Overall programme considerations: Programme promotion	Views and opinions on how to promote a workplace exercise programme within the workplace

Table 3 Modifications made to the planned intervention protocol based on participant feedback

Intervention component	Initial BE@Work plan	Modifications made	Rationale
Frequency	Three sessions per week	No modifications made	Employees and management perceived this frequency as acceptable.
Time of day	Guided by participant and organisation requirements	Multiple exercise sessions facilitated across the working week	No single time point would suit all availability, flexibility needed
Length of exercise sessions	20-30 minutes	No modifications made	Session fit within 30-minute lunch break, perceived as acceptable by employees and management
Length of intervention	6-10 weeks	8 weeks	Short term programme perceived as acceptable to employees and management teams alike. Length based on mean length of previous workplace HIIT trials.
Intensity	HIIT	No modifications made to intensity of planned exercise Relative intensity of HIIT explained to potential participants in BE@Work promotional material	Explanation important for potential participant understanding of HIIT
Modality	Guided by participant choice. Examples given to participants: walking/ jogging/ running, stair stepping, stair	A range of activities within an intervention Stair stepping, stair climbing, boxing	Participants reported a preference for these modes Choice in a variety of modes most important

Using focus groups and interviews to inform the design of a workplace exercise programme:
 an example from a high-intensity interval training intervention

	climbing, boxing, skipping, dance		
Individual/ Group based	Guided by participant choice	Group based with option for individual sessions if requested	Group preferred but choice of group/ individual exercise important
Location of exercise	Guided by participant requirements and availability of space in the participating organisation	Meeting room booked in advance where possible However, 70% of sessions conducted outdoors but commencing from the main foyer of the organisation	Outdoor exercise sessions acceptable for participants however location largely based on room availability
Promotion of a programme	Guided by organisational facilities and participant suggestions	“Taster” exercise sessions facilitated in the fortnight before baseline data collection Emails sent via all staff email distribution lists Advertisements placed in organisational newsletters and on notice boards in prominent places around the workplace	Participants requested one-off taster sessions of HIIT before they decided to participate in the full programme.