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EMPIRICAL STUDIES

"It depends on the boss" – a qualitative study of multi-level interventions aiming at office workers' movement behaviour and mental health

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ABSTRACT

Purpose: This embedded qualitative study explored the acceptability, feasibility, and fidelity of two multi-level RCT interventions among office workers, aiming at improving movement behaviour to enhance mental health and cognition. The interventions addressed the organizational, environmental, and individual level.

Methods: Semi-structured interviews and focus group discussions were conducted with 38 stakeholders after completion of the interventions. Data were analysed using reflexive thematic analysis.

Results: The interventions were well appreciated, and office workers attributed improvements in movement behaviour and wellbeing to the interventions. Especially the cognitive behavioural therapy (CBT) based counselling and free gym access were appreciated, feasible and delivered as planned. Participants described existing workplace norms as barriers to more activity, particularly for reducing sitting. Support from managers and team support were considered crucial components. However, delivering these components was difficult.

Conclusions: The findings support the design of the multi-level interventions for changing movement behaviour. Results highlight the potential of CBT for this target group and the importance of manager and team support. Desired effects of similar multi-level interventions, including CBT, might be achieved in future studies that carefully address the issues with feasibility and acceptability and the resulting low fidelity of some intervention components that were identified in this study.

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Introduction

Increasing physical activity and decreasing sedentary behaviour can improve mental health (Naczenski et al., 2017; Schuch et al., 2018; Stubbs et al., 2017; Teychenne et al., 2015; Zhai et al., 2015). This might be especially relevant for office workers, a large proportion of high-income societies who spend large amounts of work and leisure time sedentary (Clemes et al., 2014; Parry & Straker, 2013; Thorp et al., 2012). Impaired mental health imposes a tremendous burden on affected individuals (World Health Organization, 2022). It is a common reason for sickness absence (Swedish Social Security Agency, 2017, 2020; WHO Regional Office for Europe and, 2010) with negative effects on the productivity and competitiveness of businesses (LaMontagne et al., 2014; OECD, 2012; WHO Regional Office for Europe and, 2010). Therefore, it is important to investigate how the workplace can be used as an arena for health promotion, especially for reducing physical inactivity and improving mental health (World Health Organization, 2022).

Systematic reviews of previous workplace-delivered interventions focusing on movement behaviour and mental health among office workers found inconclusive results due to lack of randomized controlled trials (RCTs), heterogeneity of exercise type, frequency and duration, differences in baseline mental health, outcome measures and sample size (Abdin et al., 2018; Chu et al., 2014). To our knowledge, cognitive behavioural therapy (CBT) has not been part of previous movement behaviour change interventions among office workers, although it is an effective movement behaviour change approach for other target groups (Barrett et al., 2018). In addition, most previous interventions addressed only the individual level by asking participants to partake in pre-defined exercise sessions. It is however well established that movement behaviour is determined by factors not only at the individual level, but also at the organizational, environmental and social level, as suggested by Ecological models of health behaviour (Sallis et al., 2008). Interventions targeting multiple levels of influence are likely to be more successful in

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empowering participants to make meaningful and sustainable changes to their movement behaviour (Ojo et al., 2019).

Ideally, evaluations of such interventions should be both quantitative and qualitative to not only learn whether interventions achieve desired effects but also how and why or why not. Acceptability, feasibility and fidelity of interventions are considered key moderators of intervention efficacy (Bellg et al., 2004). Acceptability refers to determining how well an intervention was received by the target population and the extent to which an intervention or its components meet the needs of the target population and their organizational setting (Ayala & Elder, 2011). Feasibility studies assess practicability of the interventions, appropriateness of extent and duration and adequacy of the logistics required for delivering interventions (Sidani & Braden, 2021). They may further include investigating perceived benefits or harms of participating in an intervention as well as exploring how intervention components produce certain outcomes (O'Cathain et al., 2015). Fidelity is defined as the extent to which an intervention was delivered and received as intended (Bellg et al., 2004). Assessing these aspects can help to explain quantitative results and to distinguish between interventions that do not show desired effects due to faulty intervention concept or theory, or due to poor acceptability, feasibility or fidelity (O'Cathain, 2018). Such analyses also provide important information for future effective movement behaviour change interventions (O'Cathain, 2018).

Our research team designed a cluster RCT with two multi-level interventions for office workers that addressed the individual office workers, their physical work environment and organization (Nooijen et al., 2019). Multiple behaviour change techniques were used, including CBT-based counselling sessions (see Figure 1). During the 6-month intervention period, one intervention group focused on increasing physical activity (iPA) and the other on reducing sedentary behaviour (iSED) to improve mental health outcomes and cognitive functions. Quantitative effectiveness analyses found no intervention effects on accelerometer-measured moderate to vigorous PA (MVPA) and SED time (Nooijen et al., 2020) 24-hour movement behaviour (Larisch et al., 2021) work vs. non-work movement behaviour (Larisch et al., 2021) cardiorespiratory fitness (Larisch et al., 2021) and cognitive functions (Bojsen-Møller et al., 2022). However, preliminary analyses indicate an increase in self-reported PA in the iPA group and reduced self-reported sitting time in the iSED group. Preliminary analyses of intervention effects on mental health indicate positive effects on mental wellbeing, and on anxiety within the iPA group. The interventions also increased autonomous and controlled motivation among iPA participants and self-efficacy for regulating own movement behaviour in both intervention groups (Blom et al., 2021).

The aim of this embedded qualitative study was to investigate the acceptability, feasibility, and fidelity of intervention components that addressed the organizational, environmental, and individual level.

Methods

Study design and participants

This qualitative study was embedded in a large multilevel cluster RCT that enrolled 263 office workers from two companies. Thirty-eight stakeholders participated in this study, including persons who delivered (health coaches, team leaders, human resources (HR) staff) or received (office workers) the interventions and those who were involved in logistics around the RCT (HR staff).

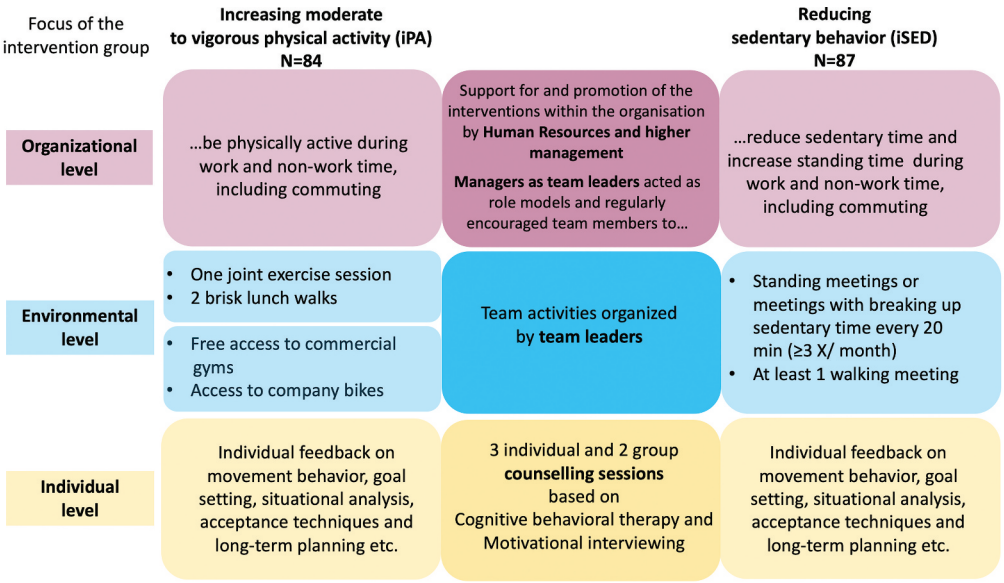

Figure 1. Overview of the multi-level interventions.

We aimed to individually interview a convenience sample of 2–3 *HR* or *higher management staff* who delivered part of the organizational component in addition to being involved in logistics around the RCT. Five HR and higher management staff members participated.

For *team leaders*, we planned to conduct individual interviews with all 22 of them, of whom eight participated.

All 263 *Office workers* who received the interventions were invited to participate through a question in the web-based questionnaire that they received at the end of the intervention period. Those who indicated willingness to participate received written information about this study via email and an invitation to a focus group discussion. We intended to conduct two focus group discussions per company, each with 4–6 participants. The final voluntary sample of office workers consisted of 22 persons.

For *health coaches*, our aim was to conduct individual interviews with all six of them, and three of them participated. Team leaders, HR staff, and health coaches received information about and invitations for this study via email. Several team leaders and HR staff were also receiving the interventions themselves.

We aimed to gather a wide range of perspectives for a comprehensive understanding of the acceptability, feasibility, and fidelity of the RCT. To increase the sufficiency and saturation of the data, we invited team leaders and office workers who were initially in the wait-list control group and who received the interventions after the initial intervention period. Sufficiency refers to the number and range of participants needed to reflect the population, while saturation of information refers to the point where the data collection no longer reveals new information (Seidman, 2006).

To ensure anonymity, we refer to participants and companies by numbers. Square brackets indicate that quotations were shortened for clarity and readability. Information about the participants' company and intervention group affiliation can be found in Appendix 1.

Textbox 1 and Figure 1 provide an overview of the RCT and the interventions. Further details of the RCT and the interventions are described in the published study protocol (Nooijen et al., 2019).

Data collection

Data collection was scheduled to take place within eight weeks after the intervention period to minimize recall-bias and to ensure that participants could reflect upon the entire intervention period. Data for this study were collected between November 2018 and January 2020. We used semi-structured interview guides (see Appendix 2) with open questions that invited participants to share their views on aspects relating to feasibility, acceptability, and fidelity of intervention components addressing the organizational, environmental, and individual level. One pilot interview was conducted to identity any potentially necessary adaptations to the interview guide. At the start of each conversation, the aim of the study and the role of the interviewer in the research project were clearly stated to participants. We planned to collect data from office workers via focus group discussions because parts of the interventions were delivered to and intended to act on

Textbox 1 RCT and intervention design

The multi-level cluster RCT tested two interventions among office workers. 263 office workers from two Swedish companies (73% women, mean age 42 ± 9 years, education 15 ± 2 years) (O'Cathain et al., 2015) were grouped into 22 cluster teams. At both companies, teams were randomized to one of two intervention groups or a wait-list control group. During the 6-month intervention period, one intervention group (iPA) focused on increasing moderate to vigorous physical activity (MVPA) and the other on reducing SED (iSED) by breaking up prolonged bouts of sitting and replacing SED with light-intensity physical activity to improve mental health and cognitive functions. The primary outcomes were accelerometer-measured time spent in MVPA and SED, while mental health and cognitive functions were secondary outcomes. The trial was conducted from 2018 to 2020. Ethical approval was obtained from the Stockholm regional ethic review board (2018/587–32).

The intervention design was based on the Ecological model of health behaviour (Ojo et al., 2019,) which suggests that factors on the organizational, environmental, and individual level influence health behaviour. Multiple behaviour change techniques were included to address these different levels, see Figure 1. The design was also informed by a preceding study on perceived barriers and facilitators for reducing SED among office workers at the same companies (Nooijen et al., 2018). The three most reported barriers were sitting is a habit (67%), standing is uncomfortable (29%) and standing is tiring (24%). Standing (33%) or walking meetings (29%) and more possibilities or reminders for breaks (31%) were most frequent suggestions for facilitators. The interventions aimed at changing movement behaviour during work and non-work time.

Organizational level: To ensure organizational support, human resource and higher management staff promoted participation in the interventions within their companies. In addition, the RCT aimed at recruiting managers as team leaders to provide manager support by acting as role models and by encouraging respective behaviours throughout the intervention period. They were also asked to promote continued participation in the interventions.

Environmental level: Managers functioning as team leaders were expected to implement group activities and access to standing and walking meetings (see Figure 1). In addition, iPA participants received free gym access. Team leaders were invited to one individual and one group meeting prior to intervention start where they received information about their role as team leaders and the importance of PA or SED. Throughout the intervention period, team leaders could contact the responsible researcher for questions or support.

Individual level: Both intervention groups received five counselling sessions based on cognitive behavioural therapy (CBT) and motivational interview (MI). Trained health coaches received additional training in applying CBT and MI. A detailed manual was used to standardize each session. Following CBT-based techniques were used: (1) Goal setting tied to internal rewards and value, (2) Identification of the individual's resources and barriers for making behaviour changes, (3) Functional analysis including antecedents and consequences of undesired and desired behaviour, (4) Acceptance techniques for handling negative emotions, (5) Plan for long-term behaviour change. Between sessions, participants were asked to manually track their PA or SED using a logbook. Participants chose physical activities according to their individual needs and preferences.

Table I. Overview of identified themes for each level of intervention.

Level of intervention	Organizational	Team	Environmental	Individual
Identified themes	Health promoting company culture and leadership	Preconditions for team leaders Impact of peer support	Ambiguity of environmental support	"Life puzzle" Counseling as facilitator for a "mental journey"

the team level. We were interested in gaining "access to social interaction and the way meaning is 'negotiated' in context" (Braun et al., 2016). expecting that it would reflect how the intervention worked at the team level. Note that the team level was regarded as part of the organizational level in the theoretical model of the interventions. Focus group discussions took place in person at the participants' workplace during worktime. Fourteen office workers participated in focus group discussions, while eight were individually interviewed via phone.

Team leaders, HR and higher management staff and health coaches could choose between video or regular phone calls during worktime. Most were interviewed via phone except one in-person interview. The focus group discussions lasted between 38–58 minutes, and the interviews lasted between 21–58 minutes. All conversations were audio-recorded and transcribed verbatim. All participants were offered the opportunity to review the transcripts of interviews and discussions, but they all declined. All data, except for one focus group discussion (VB), were collected by a graduate student with some previous experience in conducting interviews (LML). Ethical approval for this embedded qualitative study was granted by the Stockholm region ethical review board (2018/587–32).

Data analysis

Rationale for choice of analysis approach

We considered that focusing on identifying, analysing and reporting patterns (themes) within data as suggested by thematic analysis (Braun & Clarke, 2021) would be most suited for the aim of this study. Moreover, we aimed to provide a qualitative, detailed, and nuanced account of data (Braun & Clarke, 2006) that goes beyond describing or summarizing the semantic content of the data to identify underlying ideas, assumptions, and conceptualizations (Braun & Clarke, 2006). We positioned ourselves in a qualitative, constructivist research paradigm. In addition, we needed a flexible approach that would allow us to find themes relating to acceptability, feasibility, and fidelity of components on the different intervention levels. We chose reflexive thematic analysis because it emphasizes the importance of the researcher's subjectivity as an analytic resource and their reflexive engagement with theory (ecological model of health behaviour (Sallis et al., 2008), data and interpretation (Braun & Clarke, 2020).

Analysis procedure

Data were collected and analysed by LML and transcribed verbatim by a professional company. The correctness of transcription was confirmed by LML. LVK (associate professor) was the principal investigator and responsible for the interventions as well as for team leaders. VB (associate professor) was responsible for the counselling sessions and health coaches. BTJ (PhD) was not involved in the RCT but had previous experience in conducting thematic analysis.

The analysis included six recursive phases as described by Braun&Clarke (Braun & Clarke, 2020): familiarization, coding, generating initial themes, reviewing and developing themes, refining, defining, and naming themes, and writing up. LML became familiar with a subset of transcripts by reading them. Then, at least one transcript from each stakeholder group, was open coded to create initial themes with contributing codes that related to organizational-, environmental-, and individual-level components of the interventions. While reading and coding the remaining transcripts, themes were further developed. The themes were regularly discussed and consolidated with all authors. Appendix 3 displays the final theme and code tree. Quotations were translated from Swedish to English by LML and proofread by a native English speaker fluent in both languages. The NVivo (QSR International) software was used to support the data analysis. Findings from this study are reported in accordance with the COREQ (COnsolidated criteria for REporting Qualitative research) Checklist (Booth et al., 2014) (see Appendix 4).

Results

This embedded qualitative study aimed to explore the acceptability, feasibility, and fidelity of two multi-level cluster RCT interventions among office workers to enhance mental health by improving movement behaviour. The interventions addressed the organizational, environmental, and individual level. The main themes identified in relation to the different intervention levels, i.e., organizational, team, environmental and individual level, are presented. The team level was regarded as part of the organizational level in the theoretical model of the interventions. However, several results related distinctively to how the interventions worked on the team level. Therefore, we present results for the team level separately from the organizational level. Table I provides an overview of identified themes per intervention level.

Organizational level

Health promoting company culture and leadership

Office workers from both companies described how company culture influenced their movement behaviour. Specifically, they perceived social norms regarding appropriate workplace behaviour as barriers to reducing SED, particularly during meetings and within higher hierarchy levels.

> You are regarded as some kind of nerd, I think, if you stand up during meetings and such like. People think you are a bit silly, that you've gone too far. They think that you can … If you walk between meetings, isn't that enough? Now we'll sit here for two hours. Can't you just sit down? #40, office worker, company 1

> Well, there is the norm and deviation from the norm. And I would say that, breaking up sitting, that is not according to the norm here. To suddenly stand up and do squats in the middle of everything, that's strange. So we need to find a new norm. #1, HR, company 2

Office workers experienced that the company leadership and direct managers had a strong impact on this company culture and also on the individual employee's possibilities for being physically active. In company 1, for instance, office workers expressed their appreciation for the transition to an activity-based office. They interpreted it as a demonstration of the leadership's commitment to promoting a healthy workplace. However, being physically active in the workplace was difficult due to high workload, a culture driven by ambition and hard work, and resulting stress and lack of time.

> What also hindered them was that they had so much to do at work. Reducing their sedentary time at work, that was sort of not a priority for them because they didn't have time. #41, health coach

High workload was also mentioned as a barrier for engaging in the planned intervention activities during worktime and as a reason for dropping out of the interventions.

Many emphasized that the possibility of being active in the workplace and for breaking social norms around reducing and interrupting sitting ultimately depended on the support of the closest manager.

> It is individual. It depends on your boss. If you have a manager who exercises, it becomes easier […] Company 1 [author edit to ensure anonymity] is a big company […] it really depends on the department, I would say. #19, team leader company 1

Many participants experienced a lack of manager support. They described how not receiving support from managers led to feelings of guilt towards other colleagues who did not participate.

> But especially to get a little more commitment or a little more pep from the management. That the management was also involved in this and saw how much it actually required to reduce their sedentary behavior. Because it almost became like some people felt a little guilty if they went for a lunch walk or if they went to work out at lunchtime or if they took a break from sitting. It almost became a bit like "oh, now I'm skipping work just to do this". They felt strongly that if a manager had been involved and done the same thing, it would have been a little easier. Because many of them had a lot to do at work, this was not a high priority. So, more commitment from the management teams. #41, health coach

Many Swedish workplaces offer a so called "health promotion hour", an official policy allowing employees to use worktime for health promoting activities (Swedih Union of Civil Servants, 2022). The participating companies allowed participation in data collection, counselling sessions and the planned team activities during worktime. However, they rejected the suggestion to include a health promotion hour as part of the intervention. Nonetheless, some office workers at both companies misunderstood and thought they were officially allowed to use worktime for health promotion activities beyond the planned group activities. They highly appreciated this. Being allowed to exercise during worktime was interpreted as a sign of organizational support and legitimation, making them less dependent on the support of their closest manager and colleagues. It helped to resolve feelings of letting down colleagues, to handle signs of disapproval by colleagues when taking a break for exercising, and to solve the personal dilemma of having to unite work and family responsibilities with exercise. Many of those who correctly perceived that they were not allowed to use worktime for health promotion activities requested more top-level commitment in the form of a health promotion hour.

> We are also a group where you don't even go for coffee. We just sit and work. That is the culture we have in our department. So, it is quite difficult to suddenly go and exercise and sort of do it during working hours. So it is obvious that it takes a bit… […] It gives me support that I had the right to exercise during worktime. Which actually really made me go. #14, office worker, company 2

> Mm, I think that if company 1 [author annotation] had stepped in and subsidized hours so that one could do sports during working hours […], it would really have made a difference. Because many felt that "yes, but I have to do my 40 hours at work and then I'll go home and then I have a family and so on." […] I think everyone would have basically exercised for an hour each… Then nothing would have been in the way I think. #23, team leader, company 1

Team level

Preconditions for team leaders

Team leaders were tasked with enabling peer support within cluster teams and with organizing team activities. To ensure manager and team support, the RCT aimed to recruit managers as team leaders. However, few managers volunteered, and regular employees who had enrolled as participants were asked to act as team leaders. Those who volunteered were initially highly motivated, but perceived declining engagement and motivation over time since important preconditions and resources for fulfilling their role as team leader were not given. Intervention teams were supposed to be built based on the criteria of 1) having a team or line manager, 2) having regular group meetings, and 3) having limited regular meetings with other teams. These were difficult to fulfil because participating office workers belonged to different working units. In addition, the larger company moved from an office with fixed desks to an activity-based office building without fixed desks for most employees during the intervention period, which largely resolved the initial cluster structure. This led to team sizes that varied largely due to lack of team leaders, unfamiliarity among team members, lack of regular meetings with only team members, and lack of physical proximity to other team members in the office. Overall, few team leaders reported that they succeeded in fulfilling their role and delivering the planned team activities, especially at the larger company:

> It was not easy for me. I am a happy and motivating person but if people don't know me, I cannot have the same impact. #19, team leader, company 2

> The problem with our team was its constellation because nobody worked at the same unit and people did not know each other. It would have been easier to motivate them if people were familiar with one another. #22, team leader, company 2

> It felt like most team leaders had some difficulties with the team leader role. How to actually act. None of us are necessarily experienced team leaders, so we were kind of thrown into a role. So you felt like, "Yes, sure, I can go along with it, but what am I really supposed to do?" We would have needed a bit more support." #20, team leader, company 2

> There was an ambition to have a sort of group leader. But I can say that did not work at all at our company. It was very difficult to get people to act as some sort of unofficial health promoter for people they don't know and so on. #16, HR, company 1

Team leaders described high workload and resulting lack of time as barriers to fulfilling their role. They also expressed the wish for more support in their role, indicating that they were not well enough equipped to act as team leaders. They lacked more concrete information regarding what and how they could motivate and communicate with team members. They were demotivated by the moderate interest of team members to participate in activities. Additionally, they would have appreciated opportunities for exchange with other team leaders to learn from each other and to join forces. Due to the cluster-randomization this was not possible. Many team leaders had created online communication channels to facilitate communication with team members, which was useful and necessary especially for large teams where members were unfamiliar with each other and lacked physical proximity in the office. The task to lead by example, however, was well received and worked well for many team leaders, both to change their own behaviour and as a tool for motivating team members.

> Yes, I think I've been good at that [laughs]. I … especially to vary sitting and standing at work, and as I said, I always take the stairs instead of the elevator. […] If I go with some others, whether they participated in the study or not, I always say "but we'll take the stairs, right?", like that. Try to get people motivated. #20, team leader, company 1

> Well, that worked well, I think. I'm not more than human either, so I cycled a lot. But on days when it was pouring with rain, I didn't do it. But I was … I tried to inspire and share … well encourage everyone and … well I think I did what I could to be a good role model. #5, team leader, company 2

Impact of peer support

Participants perceived team support as a facilitator for changing movement behaviour, but few teams worked as intended. Many office workers did not experience but wished for more team support as a source of motivation. Some did not know that a team component was part of the interventions, and others reported that no team activities were offered in their team.

> But in general, I think there were very few of those teams that worked. #32–35, office workers, company 1

> We were only a few people at our company who participated in the study, and when I attend full-day meetings and I want to stand up every half hour, the whole meeting stops and everyone starts giggling. They find it really amusing, and then it becomes this strange thing, and eventually, you stop doing it. But if everyone in the company had gone through something similar and had the same information, especially the knowledge that I have gained, then everyone would want to stand up every half hour. And that would make it much easier. Now, you become this oddball, and it all becomes a bit silly." #40, participant, company 2

However, in the few teams that managed to support each other, participants provided detailed descriptions of the mechanisms by which peer support within the team helped to change behaviour. Participants in the iSED groups experienced how team support assisted in overcoming norms related to SED and iPA participants described team support as a facilitator for engaging in exercise.

> But then I had a meeting with someone who was also participating in the study and then we stood up. When I remembered it, then I stood up and then she joined me. Or vice versa. It became so natural. It wasn't like a big deal. #40, participant company 1

Office workers experienced team support directly by organizing joint activities, but also indirectly by observing and by being reminded of the desired behaviour by team members, by a feeling of belonging, and by experiencing a feeling of positive peer pressure. It motivated them to adopt the desired behaviour. Team support was also considered important for preventing dropout and for sustaining behaviour change.

> And then you got a little team feeling with them like "Now we're doing this together." We created a group on Workplace where we cheered each other on. People posted pictures like "last night I ran eight kilometers" and then someone had like taken a selfie or something ridiculous like that. That sparked like "Yes, but God, damn it, she trains a lot. Then I also have to run tonight." You pep each other up. So I experienced that this became like a group affiliation that made you spur each other on. I also thought that was positive. #10–11, participants, company 1

> And you can link arms with a buddy who you know is also participating in the study and say, "Now let's go." I heard that just the other day, there was this guy who was on his way to the gym and he got teased a bit for going to the gym during lunch. And then I said, "I can't back out now because three more are coming." It's like a bit of peer pressure, you know. #36–39, participants, company 2

Environmental level

Ambiguity of environmental support

There was strong awareness among participants that the physical office environment impacted their movement behaviour. Participants were aware of and appreciated components such as height-adjustable desks, showers and changing rooms. The larger company moved to an activity-based office building during the intervention period with an in-house gym and a bike garage. Some participants perceived that the new office building had a positive impact on their movement behaviour:

> This whole house has supported a bit that you move more too, that you don't sit so much. #32–35 participants, company 1

On the other hand, the absence of a health promoting culture and leadership was perceived as ambiguous, posing limitations to the effectiveness of environmental components in promoting health.

> I don't think I've ever worked at a company that is as permissive to this [activity in the workplace, author annotation] as this company. There is a lot… Then the question is whether you have time […]. It's one thing that all the possibilities are there, but then there is also […] quite a high workload. So there are many who feel that they never have time to go and exercise anyway. But in terms of what is offered, there is a lot. And these walking tracks on the sixth floor, you can walk and cycle and work and all sorts of things. Play ping pong and … well. #27, office worker, company 1

> Also, when you sit in a large landscape and have a desk that can be raised and lowered. Sometimes I just feel like: everyone is sitting, it's such a quiet environment. No one is allowed to talk, and it must be very quiet, and you are not allowed to talk on the phone. You can hardly whisper in some rooms. Then, to stand and raise the desk and everyone in the room is looking at you when you do that, then you realize that I've interrupted everyone in their thoughts just by raising the desk. But if everyone had the same approach and people had been used to others standing up and sitting down, then it would have worked better. […] But it really is the case that the closest twelve people look up when I raise my desk. Then you think like: "uh, I'ill just be sitting here for another hour, so don't do it." […] I think it's awkward when you stand up and everyone looks at you. #40 participant, company 1

Throughout the intervention period, iPA participants had free access to two commercial gyms with facilities across the cities, also located near their offices. The availability of free gym access in close proximity successfully motivated many iPA participants to engage in exercise

> What I especially remember from counseling session five, what people expressed in relation to "this has helped me", is partly that they got a chance for a gym card, they got that opportunity. #42, health coach

> There were many people who actively used these free gym cards. #43, health coach

> And then also that aspect of the gym card. To get going for real. There were no excuses for not exercising. #24–26, participants, company 1

However, office workers who were not accustomed to using gyms were demotivated by an initial delay in accessing the gym cards at company 2. Furthermore, they expressed a desire for more assistance in becoming familiar with the gym facilities.

> I think people became a bit frustrated. I think it is very important to use that initial high motivation. If you

> don't get to start when you are most motivated people back of and lose motivation, #19, team leader, company 2

> Well you go to that gym, you look around, well I can pull a bit here and there. But what am I supposed to do with these things? #32–35 participant ICA

Due to the challenges with the team leader component, the planned joint exercise session and lunch walks (iPA), as well as the walking and standing meetings (iSED) as changes to the work environment, were not delivered as planned.

Individual level

"Life puzzle"

> Especially because this physical activity is not something you do while working. It's something you have to do in addition. Put that puzzle together and make it work. #32-35, participants, company 1

Cultural norms surrounding sitting were consistently reported as significant contextual barriers to reducing SED in the workplace. Participants who aimed to incorporate more physical activity into their lives expressed the challenge of finding time as the strongest barrier. They frequently used the terms "Life puzzle" and "Everyday life puzzle" to illustrate the difficulty of incorporating physical activity into their already demanding balance of work and family responsibilities. On the one hand, striving to be physically active resonated with their life goals and personal values. On the other hand, they experienced fear and guilt about neglecting their family when dedicating time to exercise, creating a profound emotional dilemma. This was expressed particularly by female participants with children.

> What really stopped them? Well, a feeling of lack of time, absolutely. Stress that comes partly from taking care of one's family, to be present there, a feeling that "if I go away and have time for myself, am I leaving my family then?" A bit like that. #42, health coach

It appeared that many participants had prior experience with exercise that they wanted to resume but felt unable to do due to a perceived lack of time. Participants described a vicious cycle in which demanding workdays left them with little energy or opportunity to engage in PA outside of work. Family responsibilities and fatigue resulting from work further aggravated this challenge of pursuing PA.

Counseling as facilitator for a "mental journey"

The counselling sessions were very well appreciated and the most prominent component of the interventions for most participants. Participants referred to the individual CBT-techniques and described in detail how they impacted on their understanding, thinking, and behaviour. One of the health coaches described how participants went through a "big mental journey" (#42). Part of this journey was increased awareness of one's own movement behaviour and the importance thereof.

> It has been positive that people have opened their eyes to this issue about sitting still, how it affects the body and that it is positive to try to move throughout the day and not just during training and such. But to remember this all the time. […] It's also very much about awareness, and I think people got this from the counseling sessions. #6, team leader, company 2

During the first session, participants were asked to map values and goals that were later tied analysed in relation to the individual's resources and barriers for making behaviour changes. Participants recalled this exercise in detail, proving that they had internalized its content. It provided them with cornerstones and a direction towards which they adjusted their behaviour. Throughout the intervention they would often refer to these values and goals.

> These exercises when we did the four fields and the first analysis [Author annotation: referring to the ACT matrix. Participants tie goals to internal rewards and values, and identify individual resources and barriers for making behavior changes], I think they were great, because they really were … you got it down on paper what you are facing and how you act and how you think, what you value and what you really want. I thought that was great. #40, participant, company 1

For some, part of the mental journey was to rethink goal setting to align with goals and values and find long term solutions for integrating more activity in their lives. The counselling helped to find sustainable goals and strategies for more being more physically active that were in line with individual goals and values, as this quote exemplifies.

> So, for me at least, it was important to make changes where I feel this can work in the long run. I started to have a goal, for example, that I would stand up every half hour after seven o'clock in the evening. That I wouldn't just lie on the sofa like a coach potato, so to speak. And I noticed after a while that it wasn't sustainable. When I had been up the whole day and finally sat down on the sofa, I felt this pressure of "ah, right, I have to stand up", just for the sake of this study. I realized that I won't stick with this when the study is done, so I changed that goal about halfway through. I removed it and then I added 10,000 steps per day. And for me it's like being able to walk to and from work or maybe you can walk to the next subway station instead of the first or remember to take the stairs instead of the elevator. Things that can be integrated into everyday life in a way that feels like "yes, well that I can continue with". […] It is important to have that mindset. #20, team leader, company 1

Participants commonly described that they had intellectually understood the health benefits of PA and less SED, they also felt motivated and had a clear understanding of their goals and values. Nonetheless they had not been able to become more active. For these persons, exploring and changing their view of their barriers vs. opportunities, based on the situational analysis, was critical for changing their behaviour.

> Because I knew all the arguments, I could write why it is good to exercise, and why I want to exercise, I had everything. And then we looked at what was stopping me then. And I hadn't really thought of those questions, but she helped me with that. Well, I thought it was silly, I can't exercise at home because the floor reverberates so the neighbors below might complain. Would they really do that? And it was so … it was so very good, and it helped me a lot. #36–39, participants, company 1

> Well, I thought this coaching that I got was fantastic. It was very … there was nothing new to hear. But at the same time, when you sat there and had to sort of listen and had to… when she asked, "but what are your obstacles? Why don't you do it?" It meant so incredibly much actually. Because it helped me to get going. #14, participant, company 2

iSED participants identified less emotionally loaded barriers to interrupting sitting, but rather mentioned that they needed more reminders. To solve this, many iSED participants purchased activity watches for continuous and instant feedback on their activity. In addition, many had set goals for achieving a certain number of steps per day, and the watches helped to track goals. Receiving instant "black on white" (#40, participant, company 1) "proof" (#12, participant, company 2) of the positive effects of their changed behaviour helped them to overcome the common challenge of having to invest in something now that might give them positive results only in the far future. Health coaches were supposed to suggest the use of a free activity mobile phone application that included a reminder function and activity tracking. However, this app was not mentioned in any of the conversations.

As part of the counselling, office workers received written feedback on their movement behaviour. They appreciated this feedback since achieving goals and seeing the results of changed behaviour was an important source of motivation for participants.

Another prominent strategy that participants identified as part of the focus on barriers and opportunities was to attribute a higher value to shorter bouts of exercise and lighter intensity PA in the form of everyday activity such as commuting. They had received information about the benefits of physical activity from the health coaches, including the benefits of short exercise bouts. This "better little than nothing" attitude presented a new alternative that helped them to integrate PA into their life puzzle. It also helped them to readjust their goals and make them more achievable. It was the "solution" (#10–11, participants, company 2) for many.

> My attitude before the counseling was "No, but I don't need this", I have the motivation to exercise. I just need more time. But as I have mentioned, I was very pleasantly surprised that when you do those exercises during this coaching, you get different perspectives. And you really see: is there really no time or why are certain things not enough for me? In my case, I used to consider all training shorter than an hour as no training – but it certainly is. That insight probably helped me more than I thought it would. #10–11, participants, company 2

> I like to exercise, but in my case the issue was to find the time for it. I thought this was great. Through the coaching, I have found alternative solutions that I might not have seen. And I feel that now that the project is finished, I exercise a little less because we don't get that worktime for exercise any longer which we got during the intervention. But I still exercise every week and I'm satisfied that I do it, rather than having, I don't know, desires to do maximal load training. There are other alternatives. I think it was quite an eye opener. #10–11, participants, company 2

Accepting negative feelings around PA and SED and understanding that fighting barriers cost more than embracing alternatives was also useful for participants, according to one health coach:

> It was one of the absolute coolest experiences. For example, during one of the last conversations, group conversation, many of the women who had high performance demands on themselves, and who from the beginning had this feeling of, "this is not going to work. I do not have time. How should I do this?" They happened to end up in the same group conversation. And to share their energy, when basically everyone there suddenly said: "But I want this, it makes me feel good and I accept that it's stressful when it's stressful. I can anyway … Yes, I'm satisfied with going once per week on Saturdays, with the family, and that has become the highlight of the week." And that… well, that's cool. #42, health coach

When talking about the sustainability of behaviour change, fear of falling back into old patterns due to injury or sickness was mentioned. Regular health checks and follow-up counselling were suggested as measures for sustaining changed behaviour. Some mentioned that they had learned to accept fluctuations in exercise patterns, in line with having accepted alternative ways of exercising.

Several factors were mentioned as crucial for successful counselling. Mutual trust between coaches and intervention participants and having the same coach throughout all sessions were considered important.

Participants described how coaches provided them with external motivation to become more active. Some appreciated feeling forced to perform well, while others appreciated being seen, praised, and reminded of their goals by their coach. Health coaches and participants mentioned that the combination and diversity of CBT techniques met participants' needs but were easier to use for iPA than iSED participants. Health coaches reported that they were well prepared for their task. Having a protocol for each session and the possibility of contacting the responsible psychologist in the research group were considered as very useful.

In general, the content and duration of the interventions were considered appropriate. Continuity and regularity of counselling sessions for not losing track of the goal of changing movement behaviour were important for participants. For some participants, the intervention period stretched over the summer months when many take several weeks long leaves from work, as is common in Sweden. Participants highly criticized this since they felt that they had to start all over again after the summer break and did not manage to do so.

> But I think the timing was very important, because there was a long, long summer break. I never got into it afterwards. [. . .] If I had gotten into it, if I would have started at a different time. . . maybe start in January after all the Christmas holidays . . . if I had been motivated and got into it, then I think the result would have been different. #13, participant, company 2

While the individualized approach was appreciated by many, one participant requested more external pressure to perform certain activities. Some participants experienced that the support did not suffice for changing behaviour and that it even presented a source of tension and anxiety. Prior level of PA was mentioned as a potential moderator for this.

There was widespread disappointment among iSED participants due to not having been randomized to the iPA group who knew that the iPA group would receive free gym access. It was considered a main reason for iSED participants dropping out

Ultimately, the mental journey, facilitated not only, but to a large extent, by the counselling sessions, resulted in perceived improvements in movement behaviour at work and beyond.

> Yes, and I can say that for me personally, it has really worked. Because I think completely differently. The fact that I walk to and from work. That I started walking instead, using the steps and such. After a while I realized that I stand up at work and that I appreciate these extra steps in everyday life rather than finding them annoying. I have a different mindset. So yes, for me the study has made a big impact. #20, team leader, company 1

> I have started to exercise a lot more, and I know that several in my group have started to move a lot more and exercise more. [. . .] Some who hardly ever exercised found that doing so made them feel much better. #4, team leader, company 2

Changed behaviour was accompanied by a stronger belief in their own capability for regulating their own behaviour, illustrated by this quote:

> In the beginning, we had to answer that question "How likely is it that you will complete this?" and then you thought "Well, I am highly motivated to do it", but then how likely it is that I will really change my. . . it didn't feel so likely. But after going through all this it feels like that question got a much higher score. Yes, so it still feels like this I think. . . And when you have changed your behavior for a longer time and can look back, it feels like. . . yes, it's not impossible to maintain a certain behavior, as it felt from the beginning. #6, team leader, company 2

Participants described how more PA and less SED led to improved mental and physical wellbeing, better performance at work and more stress resilience. They named positive spill-over effects on other health behaviours.

> It's like becoming a . . . behaving like a healthy person in many aspects. If you don't exercise, then you are an unhealthy person. Then I take the car and eat chips. #24–26, participants, company 1

Discussion

The aim of this embedded qualitative study was to investigate the acceptability, feasibility, and fidelity of multi-level RCT interventions among office workers that aimed to increase MVPA or reduce SED to improve mental health and cognitive functions. Intervention components addressed the individual, environmental and organizational level. We expected that the results would help to understand how the interventions worked on those different levels and help to understand the quantitative efficacy results.

Main findings

According to the different types of participants in this study, the interventions were generally well accepted and appreciated. Many participants experienced improvements in their movement behaviour and wellbeing and ascribed these to the intervention. The degree of acceptability, feasibility, and fidelity varied for different intervention components. Participants expressed appreciation particularly for the counselling sessions and free gym access. These components reached a high level of fidelity as they were largely delivered as planned. Participants clearly described how the free gym access facilitated exercise, and how the counselling had an impact on their understanding, thinking and behaviour, showing that these

components were feasible and worked as intended. In addition, the counselling helped to overcome perceived barriers and to identify opportunities for being more active and less sedentary. For instance, participants attributed a higher value to everyday activity and integrated shorter bouts of exercise that were easier to integrate into their busy lives with competing responsibilities. Others purchased activity watches to ensure regular reminders for interrupting sitting and for tracking their own movement behaviour. The content and duration of the interventions were considered appropriate for most participants. However, a delay in obtaining access to the gyms and summer breaks negatively impacted on the progress of some participants.

Several aspects negatively impacted on the feasibility, acceptability and resulting low fidelity of components related to the team leaders. The team leaders lacked crucial preconditions necessary to fulfil their role effectively. The criteria for creating clusters proved to be not feasible. As a result, many participating office workers belonged to different working units with different managers and no regular group meetings. This was especially challenging at the larger company that moved during the intervention period, which was not known at the start of the interventions. This caused unfamiliarity among team members, lack of regular meetings, lack of physical proximity to other team members in the office, and differences in team sizes. In addition, team leaders described how high workload and a perceived lack of proficiency in their role hindered them from executing their role. Since it was difficult to recruit managers as team leaders, they lacked manager authority and experience of leading teams. As a result, most participants did not receive support from their closest managers. Furthermore, the fidelity of intervention components depending on the team leaders, i.e., group activities and peer support and role modelling, was low. Especially iSED participants were not exposed to the planned environmental components, i.e., standing and walking meetings. Workplace culture and norms presented a major contextual barrier especially for breaking up sitting but also for engaging in exercise. Those barriers were difficult to overcome without team and manager support and role modelling by managers. Many participants highlighted the crucial impact of organizational leadership on the companies' culture and the individual office workers' movement behaviour in the workplace.

Few teams worked as intended and reported that they had established routines for joint activities. They experienced and appreciated manager and team support as a source of motivation to engage in exercise and for overcoming workplace norms regarding breaking up sitting.

Overall, the potential of the interventions to support movement behaviour change was likely diminished due to reduced feasibility, acceptability and resulting low fidelity of some intervention components, especially manager and team support, lunch walks, standing and walking meetings. However, despite these challenges, the interventions still facilitated meaningful changes in participants' movement behaviour and contributed to improvements in wellbeing, as indicated by the findings of this study. Intervention components seemed to work as intended whenever they were delivered as intended, supporting the theory-based design of the interventions.

Main findings in relation to quantitative results of the RCT

The results from this study are in partial agreement with the quantitative RCT results. No intervention effects were found on accelerometer-measured MVPA and SED (Nooijen et al., 2020) 24-hour movement behaviour (Larisch et al., 2021) work vs. non-work movement behaviour (Larisch et al., 2021) cardiorespiratory fitness (Larisch et al., 2021) or cognitive functions (Bojsen-Møller et al., 2022). However, positive effects on motivation (iPA) and self-efficacy in relation to movement behaviour (iPA and iSED) (Blom et al., 2021) were found, as well as on self-reported movement behaviour (unpublished results).

Many participants in the present study reported that they had not been physically active before the intervention but started to exercise or to reduce SED because of the interventions. This is in disagreement with the quantitative results showing that office workers were on average highly active at baseline (103 min MVPA per day on average (Larisch et al., 2021) and that they had not changed accelerometer-measured movement behaviour (Larisch et al., 2021; Nooijen et al., 2020). One potential explanation for the discrepancy might be that participants with positive experiences are overrepresented in this qualitative study. Thus, it might be that the interventions influenced movement behaviour only for a subgroup of office workers, but not enough to lead to an overall effect. The hypothesis of intervention effects for a subgroup of participants is further supported by another analysis of this RCT. Among participants with high executive function and perceived high demands and control in relation to work, iPA participants substantially increased light-intensity PA and iSED participants showed a tendency of reduced SED compared to the control group (Wang et al., 2022). Executive function refers to the higher-level cognitive skills used to control and coordinate other cognitive abilities and behaviour. This suggests that corporate leadership has a pivotal role in creating working conditions that optimize the balance between work demand and control and that participants with high executive function might benefit most. This is in line with the findings of this study showing that office workers experienced

varying degrees of permission and support for being physically active, largely depending on their closest manager.

The intervention had positive effects on motivation and self-efficacy in relation to changing movement behaviour (Blom et al., 2021) i.e., the individual's belief in their own capacity to initiate and maintain healthy movement behaviour. These quantitative results are in line with the results found in this study. Participants reported that the CBT-techniques used in the counselling sessions increased their ability to find internal motivation, to overcome perceived barriers and to create their own incentives for becoming physically active or reducing SED. Moreover, unpublished results show that the intervention changed self-reported movement behaviour which is also in line with the present study results. An effect on movement behaviour might have occurred but was not detected due to reduced statistical power and/or the inability of accelerometers to register certain types of activities, such as biking, swimming and strength training. This is further supported by small increases in cardiorespiratory fitness in all groups and within the iPA group, but there was no difference between the intervention and control group (Larisch et al., 2021). High dropout rates in the iSED group contributed to reduced statistical power. Being randomized to the iSED intervention group instead of the iPA group was less appealing and seemed to have caused the higher dropout rates among the iSED group.

Findings in relation to previous studies

Multi-level interventions targeting movement behaviour in the workplace are complex and unique endeavours considering differences in content and context. However, certain features seem to be important for all of them. A pilot feasibility study of a multi-component intervention to reduce SED among male office workers also found social influence to be a powerful factor in promoting and motivating change in movement behaviour and norms around it (Nicolson et al., 2021). Other studies have shown that organizational social norms can negatively influence the feasibility of breaking up or reducing sitting (Hadgraft et al., 2016). The importance of social influences for the spread and adoption of health behaviour has also been highlighted by social network studies. Structuring social interactions within a group by adding a social comparison component provided a strong incentive for adopting and maintaining health behaviours (Zhang et al., 2016). Another study demonstrated that people are more likely to change behaviour when a certain number of people in one's social network do the same (Centola, 2010). Thus, emphasis should be placed on ensuring high acceptability, feasibility, and fidelity of team-level components in health promotion interventions to ensure effectiveness.

The importance of manager support for reducing sitting and more activity has been demonstrated by others (De Cocker et al., 2015; Gilson et al., 2011; Safi et al., 2022; Taylor et al., 2013). In line with our study, a recent qualitative study on workplace physical activity barriers and facilitators found that 75% of participants reported a lack of management support and 58% perceived workplace culture as a barrier to engaging in PA at work (Safi et al., 2022). In a preceding study on perceived barriers and facilitators for reducing SED among the same population, we found that only 2% of participants perceived that *Standing makes me shy* or *Does not fit in work culture* as barriers for standing up (Nooijen et al., 2018). This contrasts with the results of this study where overcoming workplace norms around sitting was described as a major barrier. It is likely that such norms are perceived as a barrier only when the attempt is made to diverge from them. Open access to a gym was identified as the main facilitator for more PA in previous research, alongside flexibility during working days (Safi et al., 2022). Other studies have shown that integrating more activity into the "Life puzzle" is especially challenging for women (Ha et al., 2020; Safi et al., 2022). This highlights the potential of using workplaces as an arena for more activity, especially for employees with childcare responsibilities. This might be achieved by allowing employees to use worktime for exercise or flexibility in taking breaks, a suggestion found in our and other studies (Safi et al., 2022).

One recent large RCT among office workers aimed at reducing sitting with multi-level interventions that also addressed the organizational, environmental, individual and group level (Edwardson et al., 2022). Senior management was involved, and workplace champions received training to gain knowledge and skills for facilitating behaviour change as well as protected time for this role. Office workers participated in online education sessions that included various behaviour change techniques. Stakeholders were involved during early stages and adaptations were made to increase the feasibility, acceptability, and fidelity of certain intervention components. At the 12-month follow-up, intervention effects on daily sitting time and small but non-clinically meaningful improvements in stress and wellbeing were found in contrast to our population, office workers received height adjustable tables as part of the interventions.

While the number of multi-level interventions is increasing, more high-quality RCTs are needed to identify the potential of workplace-delivered interventions for improving movement behaviour and mental health among office workers. Qualitative

investigations of such interventions are necessary to understand why or why not interventions achieve desired effects.

Implications

The findings from this study have implications for occupational health professionals, researchers, and employers. Although need for adaptations of intervention components was identified, this study supports the potential of using the office workplace as an arena for movement behaviour interventions that may improve employee mental health. Our study indicates that office workers master to make meaningful changes to their movement behaviour if they are provided with a combination of individual, environmental, team and organizational support. In line with the ecological model of health behaviours (Sallis et al., 2008) our study confirms the importance of supporting movement behaviour change on various levels of influence. For instance, without a supportive company culture, the potential of activity-promoting physical environments remains untapped.

Our study identified manager support as a crucial component. To enhance manager engagement, future interventions could explore options such as providing monetary or time compensation, along with offering more comprehensive support to team leaders in their role of promoting healthy movement behaviour among colleagues. At each workplace, organizational social norms around what is considered appropriate moving behaviour exist and influence employees. Our and other studies showed that whether these norms will be supportive of interrupting sitting or being active in the long run depends on the commitment and leadership from the companies. Creating awareness of the importance of organizational culture on health behaviour is important.

More research is needed to understand which combination of components addressing different levels of influence produces the most meaningful results for employees and organizations. Moreover, future studies may want to consider a clear distinction between multicomponent and multi-level interventions. Multicomponent interventions can include multiple components that all address the same level of influence, whereas multi-level interventions include several components that address at multiple levels of influence (Sallis, 2018).

Future similar RCTs may consider feasibility testing of interventions prior to a full RCT to identify potential culprits for delivering them. Involving stakeholders in the design stage is likely to improve interventions.

Using the criteria of 1) having a team or line manager, 2) having regular group meetings, and 3) having limited regular meetings with other teams for creating cluster teams proved challenging since teams had to be created across working units. To overcome this, future RCTs may consider exposing entire working units to these environmental and team components, i.e., walking and standing meetings, lunch walks and manager support, as part of occupational health promotion, and to offer additional individual-level components only to those employees who also decide to participate in the RCT. This would not only guarantee that all participants are exposed to these components but also help address the challenges associated with the absence of regular group meetings, unfamiliarity among team members, and limited physical proximity in the office. Scheduling such activities as weekly reoccurring events instead of planning only a few occasions might further help to leverage their potential. Since people are more likely to adopt behaviours if others do as well (Centola, 2010) ensuring social support is crucial for changing movement behaviour.

Including continuous and instant feedback on movement behaviour and more reminders were frequently suggested and should be considered by future interventions. Using worktime for exercise or flexibility in taking breaks appeared to be a powerful facilitator for more activity during the workday Cost-effectiveness analyses of such measures are needed and might provide powerful arguments for promoting them.

Standing meetings might be feasible and acceptable for shorter meetings and in meeting rooms with standing office furniture (Hadgraft et al., 2016). Walking meetings might be feasible for less formal meetings (Hadgraft et al., 2016).

Disappointment of iSED participants about not having been randomized to the iPA group with free gym access was described as a common reason for drop out. This could be limited by conducting RCTs with one intervention arm per company instead of two.

While RCT interventions under real-world circumstances are necessary, the conduct can be complicated and challenging, such as the unforeseen move of one of the companies during the intervention period. This emphasizes the importance of qualitative analyses for understanding and evaluating such complex interventions.

Strengths and limitations

The qualitative methodology employed in this study constitutes a notable strength as it facilitated a comprehensive understanding of the contextual factors, operational mechanisms, and challenges associated with the interventions. This detailed insight can serve as valuable guidance for informing and refining future intervention strategies.

Another strength is the inclusion of various stakeholders, including recipients and deliverers of intervention components. They provided detailed and multi-facetted insight into the lived experience of participants and enabled an in-depth evaluation of this complex RCT.

Several limitations should be considered. Interviewing managers who chose not to act as team leaders would have yielded valuable insights into the underlying reasons and potential solutions for enhancing manager engagement.

Conducting qualitative investigations prior to the full RCT might have helped to improve intervention efficacy by increasing feasibility, accessibility, and fidelity. In this case, it was not possible due to time and budget constraints. However, the results of this study were critical for understanding why and how the interventions did or did not work. A potential disadvantage of collecting data after the intervention period is the difficulty of recalling early stages of the intervention (O'Cathain, 2018). However, an advantage is that participants can reflect upon the entire intervention period (O'Cathain, 2018). Additionally, participants recounted detailed content of the first counselling sessions, demonstrating their ability to recall.

Some authors of this study were both involved in designing the RCT and conducting its qualitative evaluation. This overlap may introduce bias into the qualitative evaluation because of a desire to view the interventions and RCT in a positive light (O'Cathain, 2018). However, this is also a strength since they have profound understanding of the RCT. We were aware of this potential bias and demonstrated our capability of critical evaluation by presenting both positive and negative results.

Since office workers volunteered to take part, participants in this qualitative study might not be representative of all office workers who received the interventions. Furthermore, office workers with a positive experience of taking part or team leaders with negative experiences might be overrepresented. Nonetheless, we still encountered a range of perspectives, including positive and negative ones. Including more participants with negative experiences might not have changed the central finding that most intervention components worked as intended when implemented as intended. They might, however, help to understand for whom it worked and for whom it did not. Furthermore, we did not investigate differences between companies, clusters, gender, or other factors, all of which might have generated important information. However, exploring such differences was beyond the scope of this study.

The findings from this study might not be generalizable for other workplaces and office workers. However, we attempted to provide information that can help other researchers to transfer insights from this study to their specific context.

Conclusions

The findings of this study suggest that the interventions were generally well accepted and led to improvements in perceived movement behaviour and wellbeing. The results especially support the use of CBT-based counselling sessions and free gym access among this population. Intervention components seemed to work as intended whenever they were delivered as intended, supporting the theory-based design of the interventions. However, several aspects reduced the feasibility, acceptability, and fidelity of components related to the team leaders. This might have reduced the potential of the interventions to improve movement behaviour since team and manager support were considered of utmost importance for breaking norms around sitting as well as for supporting healthy movement behaviour in the workplace.

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Geolocation information

This research has been performed in Sweden.

Author contributions

LML, VB and LVK designed the study. LML was responsible for the recruitment process and collected all data except one focus group discussion which was conducted by VB. LML was main responsible for data analysis, interpretation, and manuscript writing, supported by BJT, VB and LVK. All authors have agreed on the final version of the manuscript.

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Appendices

Appendix 1: Information about participants' company and intervention group affiliation

Type of participant	Company 1	Company 2	Other
Office workers	17	5	
iSED group	6	1	
iPA group	11	4	
Office workers that were first in the waitlist control group	9	0	
Team leaders	4 (out of 13)	4 (out of 8)	
iSED group	1	1	
iPA group	3	3	
Team leaders that were first in the waitlist control group	1	2	
Office workers Human Resource (HR) and higher management staff	3 (out of 5 who were contacted)	2 (out of 3 who were contacted)	
Health Coaches			3 (out of 6)
TOTAL		38	

Appendix 2: Semi-structured interview guides

Translated from Swedish to English by the first author

Questions for office workers (focus group discussions)

Motivation

1. What motivated you to participate in the study?

General impressions

2. What are your general impressions of the interventions?
3. In your opinion, which parts of the interventions did you experience as especially good or not good?

Barriers and facilitators for behaviour change

4. Which aspects of the intervention did you experience as supportive in reaching the goal of reducing sedentary time/increasing physical activity?
   (Did you think it was a facilitating factor that your colleagues also participated in the intervention?
5. Which aspects of the intervention made it difficult for you to reach the goal of reducing sedentary time/increasing physical activity?
6. Was there something else (life, etc.) that prevented you from sitting less/exercising more?
7. Was there anything else (life etc.) that made it easier to sit less/exercise more?
8. Is there anything else that you think would help you to reduce sedentary time and increase physical activity at work, during transport time or the rest of the day?
9. What would you need for maintaining reduced sedentary time/physical activity? (Sustainability)
10. Did you think that there was support from the company's side (manager/team leader/group leader, HR etc.) for behaviour change at individual and group level? Why yes/no?

Company/organizational culture

11. How did the culture at the company affect your ability to make behavioural changes?
12. Did the intervention affect the culture around physical activity or sedentary behaviour in your group?

Feasibility and acceptability of the interventions

13. How was the experience of standing or walking meetings?
14. How was the experience of access to the gyms and group training at work?
15. How was the experience of the individual counselling sessions? Group counselling sessions?
16. During the counselling, different tools were used. Which of them were helpful? In what way?
17. What aspects of the intervention could be improved? Why and how?
18. Did you think the scope and length of the intervention and the measurements were reasonable? If yes/no, why?
19. Would you recommend the measures for reduced sedentary time/increased physical activity to other departments/companies? Why yes/no?

Other

20. Is there anything else you would like to say about the intervention or about the experience of wearing the accelerometers, completing the measurements or completing the online questionnaire?

Questions for HR and higher management (interviews)

Motivation

1. Why did [company name] choose to carry out the research project and especially the intervention study at your company?

General impressions

2. What are your general impressions of the interventions?
3. In your opinion, which parts of the interventions did you experience as especially good or not good?

Barriers and facilitators for behaviour change

4. Which factors of the intervention do you think made it easier for the employees to make a behaviour change to sit less and be more physically active during working hours, on the way to and from work and during leisure time?
5. Which factors of the intervention do you think prevented the employees from making a behaviour change to sit less and be more physically active during working hours, on the way to and from work and during leisure time?
6. In how far can HR influence on employees' behaviour around sedentary behaviour and physical activity?
7. Is there anything (else) that you think would help employees to reduce sedentary time and increase physical activity at work, during transport time or the rest of the day?
8. What do you think is needed to maintain less sedentary life and more physical activity in the long term?

Company/organizational culture

9. How do you think did the culture of the company affected the employees' ability to make behavioural changes?
10. Do you think the intervention affected the culture around physical activity and sedentary behaviour at the company? Why yes/no?

Feasibility and acceptability of the interventions

11. Did you think the scope and length of the intervention and the measurements were reasonable? If yes/no, why?
12. What aspects of the intervention could be improved? Why and how?
13. Would you recommend the measures for reduced sedentary time/increased physical activity to other departments/companies? Why yes/no?

Other

14. Is there anything else you would like to say?

Questions for team leaders and health coaches (interviews)

Motivation

1. What motivated you to support a behavioural change among your employees?

General impressions

2. What are your general impressions of the interventions?
3. In your opinion, which parts of the interventions did you experience as especially good or not good?
4. How do you feel that the intervention affected your/the employees? (well-being, performance, sickness absence/absence etc.)

Barriers and facilitators for behaviour change

5. Did you feel that you—in your role as manager/team leader/health coach—could influence how much your colleagues sit still or are physically active? Why yes/no?
6. Which factors made it easier for you as manager/team leader/health coach to encourage reduced sedentary time/increased physical activity?
7. What factors prevented you as manager/team leader/health coach from encouraging reduced sedentary time/increased physical activity?
8. Is there anything (else) that you think would help you maintain/strengthen yourself in promoting reduced sedentary time and increased physical activity among your employees?
9. Is there anything else that you think would help employees reduce sedentary time and increase physical activity?
10. Did you think that there was support from the company's side (manager/team leader/group leader, HR etc.) for behaviour change at individual and group level? Why yes/no?
11. What do you think is needed to maintain less sedentary life and more physical activity in the long term?

Company/organizational culture

1. How do you think did the culture of the company affected the employees' ability to make behavioural changes?
2. Do you think the intervention affected the culture around physical activity and sedentary behaviour at the company? Why yes/no?

Feasibility and acceptability of the interventions

1. Did you think the scope and length of the intervention and the measurements were reasonable? If yes/no, why?
2. What aspects of the intervention could be improved? Why and how?

3. Would you recommend the measures for reduced sedentary time/increased physical activity to other departments/companies? Why yes/no?

For team leaders only:

Evaluation of activities for reduced sedentary time or increased physical activity that team leaders were asked to deliver

During the first week of the intervention, we met with the other cluster team leaders to discuss how you can support your employees in reducing sedentary time/increasing physical activity. Did you experience this as helpful for you?

During that meeting we recommended various activities. I would like to go through these with you and evaluate how you felt their feasibility and how often you could use them in your group.

For team leaders of iSED groups, focusing on reduced sitting

How did it work with …		How often could you integrate this?
Interruption of prolonged sitting in meetings	• Book meetings where you motivate and facilitate standing meetings/interruptions in sitting • Breaks every 20 minutes in all meetings (suggestions for break activities can be found in video XY) • At least 3 times/month during the intervention period	
Walking meetings	• Encourage employees to have at least 1 walking meeting • At least 1 time during the first 2 months	
Standing while working, including standing meetings	• Encourage interruptions of sitting during the working day (going to the printer often, talking to colleagues, taking breaks, standing at the desk, etc.). • During the entire intervention period	
Lead by example	Being a good example by taking regular breaks in prolonged sitting, working while standing parts of the working time	

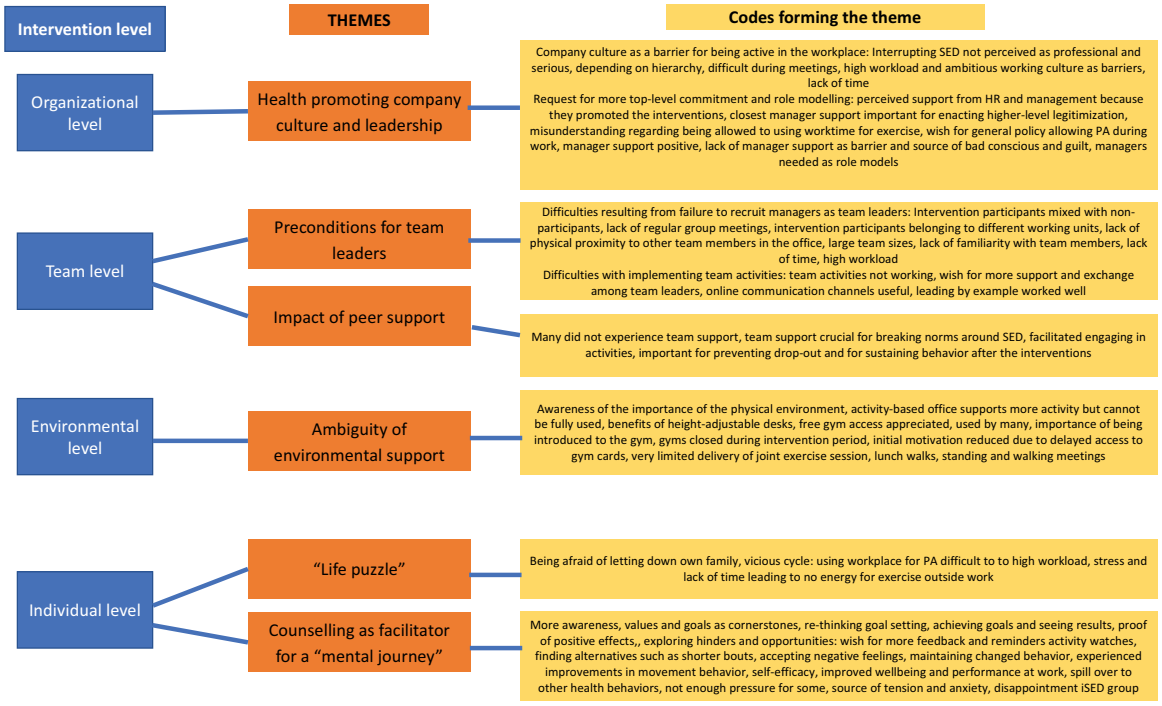
For team leaders of iPA groups, focusing on increased physical activity

How did it work with …		How often could you integrate this?
Exercise during the workday	• Organize 1 joint training session (lead by the gym) during working hours, for example during lunch for the entire work group including team leader • Around week 3	
Exercise during the workday	• Organize 1 joint brisk lunch walk (entire work group including team leader) • 2 times around week 5 and 15	
Exercise during the workday and outside working hours, including active commuting	• Encourage exercise during work and non-work time, including commuting (walking/cycling/jogging) to and from work • During the entire intervention period	
Lead by example	Being a good example by exercising during the workday and by actively commuting	

Other

Is there anything else you would like to say?

Appendix 3: For team leaders of iPA groups, focusing on increased physical activity



Appendix 4: COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

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

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	6
Credentials	2	What were the researcher's credentials? e.g., PhD, MD	6
Occupation	3	What was their occupation at the time of the study?	6
Gender	4	Was the researcher male or female?	1
Experience and training	5	What experience or training did the researcher have?	6
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	5
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	5 6
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory content analysis	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology,	6
Participant selection			
Sampling	10	How were participants selected? e.g., purposive, convenience, consecutive, snowball	5
Method of approach	11	How were participants approached? e.g., face-to-face, telephone, mail,	5
Sample size	12	email How many participants were in the study?	5
Non-participation	13	How many people refused to participate or dropped out? Reasons?	5
Setting			
Setting of data collection	14	Where was the data collected? e.g., home, clinic, workplace	5
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	5
Description of sample data, date	16	What are the important characteristics of the sample? e.g., demographic	Appendix 1
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6, Appendix 2
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	No
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	6
Field notes	20	Were field notes made during and/or after the inter view or focus group?	6
Duration	21	What was the duration of the inter views or focus group?	4
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or correction?	6
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	6
Description of the coding tree	25	Did authors provide a description of the coding tree?	Appendix 3
Derivation of themes	26	Were themes identified in advance or derived from the data?	6
Software	27	What software, if applicable, was used to manage the data?	6
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	8–16
Data and findings consistent	30	Was there consistency between the data presented and the findings?	17, 18
Clarity of major themes	31	Were major themes clearly presented in the findings?	7
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	8–16

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

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOTinclude this checklist as part of the main manuscript document. It must be uploaded as a separate file.