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Sit Less and Move More - A multi-component intervention with and without height-adjustable workstations in contact centre call agents: a pilot randomised controlled trial

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Abstract

Objective: To pilot a multi-component intervention to sit less and move more, with (SLAMM+) and without (SLAMM) height-adjustable workstations, in contact centre call agents.

Methods: Agents were individually randomised to SLAMM or SLAMM+ in this 10-month, parallel, open-label, pilot trial. Mixed-methods assessed response, recruitment, retention, attrition and completion rates, adverse effects, trial feasibility and acceptability, preliminary effectiveness on worktime sitting, and described secondary outcomes.

Results: The participant recruitment rate, and randomisation, data collection and interventions were mostly acceptable. Refinements to organisation recruitment were identified. High staff turnover negatively impacted retention and completion rates. The multi-component intervention with height-adjustable workstations has potential to reduce sitting time at work.

Conclusions: The demonstrated findings will help prepare for a future randomised controlled trial designed to assess the effect of the interventions.

Key words: Intervention development, Feasibility, Adults, Occupational, Health, Sedentary behaviour, Physical activity.

Introduction

Contact centre call agents spend up to 90% of their time at work sitting, with high volumes accumulated in prolonged periods (>30 minutes) [1, 2]. This is worrying as high levels of total and prolonged sedentary behaviour (SB) are associated with increased risk factors for chronic diseases such as the metabolic syndrome and cardiovascular disease in addition to premature and all-cause mortality [3]. Call agency work is attributed to low autonomy over daily working practices, high productivity requirements, high call volumes and sitting-based workstations which connect agents to a computer via a headset [4-7]. Accordingly, the sedentary nature of call agents work exposes them to greater risks compared to other desk-based occupations, and tailored interventions which address these influential factors are needed to help this at-risk occupational group to sit less and move more at work [7].

There is a distinct lack of evidence on how to support call agent workers to sit less and move more. Consistent with evidence in other desk-based occupations [8], a nineteen -week multi-component intervention including height-adjustable workstations reduced sitting time and increased standing time at work in Australian call agents relative to controls, without reducing productivity [5]. Similarly, an 8-week multi-component intervention targeting SB and physical activity (PA) including height-adjustable workstations was perceived by UK call agents and team leaders to benefit behavioural, health and work outcomes in call agents [2]. Despite these encouraging findings, entrenched sitting habits, productivity demands and work stress reduced intervention acceptability among call agents in UK and Australian based contact centres [2, 5]. Further, costs associated with height-adjustable workstations may prevent contact centres from implementing them [7]. To date, to the best of our knowledge no trial has implemented a multi-component intervention including and excluding an environmental component (height-adjustable workstations) within the contact centre setting. Such research will inform future trials, occupational health guidance, and whether organisations invest in beneficial intervention strategies such as height-adjustable workstations. Thus, this original pilot trial evaluated the feasibility and acceptability of a multi-component intervention to sit less and move more, including and excluding height-adjustable workstations, in contact centre call agents. This study will help prepare for a future fully powered randomised controlled trial (RCT) designed to assess the effect of the interventions. The pilot trial objectives were:

1. To assess the response, recruitment, retention, attrition and outcome measure completion rates.
2. To assess the feasibility and acceptability of the interventions from call agent, team leader and senior team leader perspectives.
3. To monitor any adverse effects, such as injuries and disruption to working practices.

4. To derive estimates of the preliminary effect of the interventions on sitting time at work (proposed primary outcome for a full trial) and provide a description of the proposed secondary outcomes.

Methods

Trial design

We conducted a pilot RCT (January 2018-July 2019) in a single company. The multi-component intervention was delivered at the individual level, including (SLAMM+) or excluding (SLAMM) a height-adjustable workstation. The intervention was in place across a 10-month period with follow-up measures completed at 3 and 10-months post baseline. Allocation (1:1 ratio) was informed by a contact centre trial that identified recruiting at the team level was a barrier to recruitment [2]. Institutional ethical approval was granted (18/SPS/001). The trial is reported in line with the Template for Intervention Description and Replication checklist [9].

Participants

Organisation recruitment

In January 2018, contact centres with ≥100 call agents affiliated with a contact centre forum in the North West of England were emailed a tender describing the trial aims, objectives and anticipated timescales. Centres were given three weeks to email an expression of interest to the research team, specifying their suitability against criteria (see Table, Supplementary Digital Content 1, company eligibility criteria). Applications were reviewed by the research team who met applicants at their respective centres to discuss their suitability. The successful centre was notified by telephone and email.

Planning phase

In March 2018, the gatekeeper at the recruited centre provided written informed consent to conduct the trial. The company housed six independent contracts who operated in separate locations within the worksite. Each contract varied in their inbound call handling times (mean 6-15 min). The gatekeeper approved us to target one contract. The contract housed 215 call agents within one open plan office, with teams of 15-20 agents per team leader, and 70% of agents employed on non-permanent agency contracts. The company had a hot desk policy, which involved multiple workers using a single physical work desk during different time periods. Existing company policy meant that call agents could be eligible for a height-adjustable workstation based on the outcome of a Display Screen Equipment assessment. The gatekeeper identified a suitable middle manager to act as the 'centre contact'. The appointed centre contact agreed to undertake the role. The gatekeeper and

centre contact met with the research team to discuss the trial timeline, and identify the company structure and key stakeholders to involve, including two senior team leaders, two planning team members and an 'temporary centre contact' if the main contact was unavailable. Three subsequent meetings discussed logistics for recruitment, data collection, randomisation and intervention delivery, including the process for scheduling offline time to enable agents to participate in data collection and intervention sessions.

Team leader engagement and recruitment

In May 2018, a 30-minute researcher-led team leader briefing was held onsite during work hours. All team leaders were emailed an invitation to attend this optional session. The trial aims, objectives, protocol and team leaders' role to encourage and support agents to sit less and move more at work, were discussed. A small group task helped identify strategies team leaders could adopt to support agents, and discuss any concerns and barriers. At 3 and 10-months, stakeholders (senior team leaders, team leaders, planning team members, centre contacts) were invited via email to a focus group or interview to assess the feasibility and acceptability of the trial. Team leaders provided written informed consent prior to focus group participation.

Call agent recruitment and selection

In June 2018, the centre contact positioned researcher-designed recruitment posters around the centre. Call agents were emailed an invitation to a 15-minute researcher-led meeting to outline the trial aims, objectives, protocol and eligibility criteria. All briefings occurred during working hours. Agents were told they would be randomly assigned to an intervention arm (SLAMM or SLAMM+) following baseline data collection. Agents had two weeks to submit an expression of interest form directly to the centre contact via email or in person. At this stage agents could also volunteer as a Stand Up Champion. Interested agents were screened for the following inclusion criteria by the research team via telephone or in person: a) ≥0.6 full-time staff member (or part-time equivalent) in a call agent job role; b) aged ≥18 years; c) access to a work telephone and desktop computer with internet; d) can stand for 10 minutes; e) ambulatory; f) not assigned a height-adjustable workstation; g) no planned absence >3 weeks in intervention months 1-3; h) no planned relocation to another workplace/site in interventions months 1-3; i) not pregnant. Agents were notified of their acceptance via telephone or in person by a member of the research team. Baseline data collection was scheduled, in which written informed consent was obtained.

Interventions

Theoretical basis and intervention development

The 10-month intervention was delivered over two phases; firstly, a 3-month 'intensive' phase, followed by a 'maintenance' phase (see Table, Supplementary Digital Content 2, intervention timeline). The phased approach was based on a workplace trial demonstrating positive changes in occupational SB over time [10]. The interventions were underpinned by the socio ecological model [11] and targeted organisational, environmental, interpersonal and intrapersonal factors that impact call agents' sitting and PA behaviours during working hours. Intervention components were mapped to the COM-B model and the behaviour change wheel [12] to enable agents to reduce their total and prolonged sitting time and move more at work by enhancing their capabilities, opportunities and motivation.

Organisational strategies

During recruitment, team leaders and agents were informed that the senior management had given their approval to appoint centre contacts and Stand UP champions, install height-adjustable workstations and allow offline time for engagement in trial activity. Recruited agents were co-located in an open plan office that operated a hot desk policy, thus, Senior management agreed to assign SLAMM+ agents an individual physical work desk across the trial and therefore those agents did not have to comply with the company hot desk policy. This approach aimed to foster a supportive environment during the trial and demonstrate organisational buy-in.

Environmental strategy

After randomisation, a height-adjustable workstation (Posturite DeskRite 100 or VARIDESK ProPlus) was installed onto the assigned individual desk of SLAMM+ agents outside work hours. The centre contact and facilities team helped installation. An independent researcher randomly allocated workstation models, which were provided by the research team and the participating organisation, using an online random number generator. Workstations allowed work to be conducted in either a seated or a standing posture, and enabled frequent transitions between postures. An A5 laminated sheet adapted from Posturite [13] attached to each workstation provided written instructions on how to use the workstations safely and effectively. Agents were also briefed on how to operate the workstations during the first education and training session.

Interpersonal strategies

Stand Up Champions and team leaders were to encourage and support participants to sit less and move more at work. To allow participants to discuss their experiences, team leaders were asked to address the intervention during their weekly team or monthly 1:1 meetings. The role of the Stand Up Champions was to advocate the sit less and move more intervention message through conversations with their peers and modelling in their own working practice. Agents autonomy to participate in the intervention was emphasised to team leaders and Stand Up champions to avoid any pressure, manipulation or coercion. The centre contact was asked to disseminate researcher-designed support emails to participants and team leaders weekly (month 1-3) then monthly (month 4-10). Email content was informed by research [2, 7, 14, 15], and tailored to agents by incorporating their ideas from the first education and training session, with content encouraging frequent posture changes, active breaks and standing work (SLAMM+ only).

Intrapersonal strategies

Call agents were emailed an invitation to four 30-minute researcher-led education and training sessions. All education and training sessions occurred onsite during working hours. In week 1 the sessions outlined, and reinforced (weeks 3, 9, month 6) the intervention aims and benefits of sitting less and moving more, and, identified opportunities and strategies for this with emphasis on frequent posture changes, active breaks and standing work (SLAMM+ only). In week 1, agents worked collectively to identify practical ways to incorporate sitting less and moving more into their working practice. The sessions also introduced (week 1) and reinforced (week 3 and 9) a goal setting and self-monitoring strategy to gradually increase standing and light activity (walking) at work to 2-4 h/day [14]. Agents received a diary and timer and were encouraged to monitor (timer) and log (diary) their daily standing (weeks 1-12) and walking (weeks 4-12) time at work against incremental goals suggested in the diary. Agents received paper-based individual feedback, and group-level feedback via presentations, on anthropometric, cardiometabolic (both week 1, month 6) and behavioural outcomes (week 9, month 6). Normative and threshold values contextualised the data. The feedback was referred to as 'health check feedback' in the trial.

Trial measurements

In line with the Medical Research Council framework [16, 17], process and outcome measures were taken at baseline, 3 and 10-months unless stated (Table 1). A 1-h session included anthropometric and cardiometabolic assessments, survey completion and activPAL fitting. Agents were scheduled to arrive

between 08:00–11:30 and reminded via text message 24 h prior. Before arriving, participants were asked to avoid strenuous exercise for ≥24 h, alcohol, tea and coffee for ≥12 h and fast for ≥8 h. Due to the cardiovascular measures, participants were also asked to avoid smoking and active transport on the morning of the assessment. Participants were asked to complete a diary 24h prior to the baseline assessment detailing their food/fluid intake and PA and were instructed to replicate those behaviours at follow-up by referring to the diary. Trained researchers conducted all assessments on site during working hours and privacy screens were used to promote participant confidentiality and comfort.

[Table 1 near here]

Process evaluation

Feasibility and acceptability

In line with Moore, Audrey [17], the present trial evaluated the process of implementation (i.e. what was implemented and how), the mechanisms of impact (i.e. how participants responded to and interacted with the intervention) and contextual factors (i.e. how the context of the intervention affected both implementation and outcomes). Researcher records logged the trial pathway to determine the response, recruitment, retention, attrition and outcome measure completion rates. Researchers logged the implementation process including education and training session attendance and the support emails received from the centre contact. Participants self-reported adverse effects at 3 and 10-months. A questionnaire adapted from a previous trial [18] assessed the feasibility and acceptability of the trial phases (recruitment, randomisation, data collection and intervention components), including participants perceived effectiveness, importance and willingness to continue receiving, each component. Questions were answered on a Likert scale (1=strongly agree/very effective, 5=strongly disagree/very ineffective). SLAMM+ agents self-reported perceived use of the height-adjustable workstation, and the twelve-item Self-Report Habit Index assessed the extent to which use was performed unconsciously and the relevance to self-identity [19]. Standardised habit scores were calculated (>50% indicates the presence of a habit) [19].

Focus groups and interviews assessed the feasibility and acceptability of recruitment, randomisation and data collection (3-months) and the intervention (3 and 10-months). At 3 and 10-months, two focus groups were conducted with SLAMM+ agents, and two with SLAMM agents. An independent researcher randomly selected the call agent sub-sample (by group) using an online random number generator and collected the data. At 3-months, two focus groups were conducted; one with team leaders, and one with the planning team members and centre contacts. One interview was

conducted with the new centre contact at 10-months (a new contact was appointed during the trial as the original and temporary contacts changed jobs/moved to a new worksite). Interviews were conducted with three senior team leaders at 3-months but none were conducted at 10-months due to their limited availability. To promote open discussions, focus groups were conducted in occupational groups, except the centre contact and planning team. This process aimed to provide a rich context to feasibility and acceptability questionnaire responses [20] and provoke in-depth insights into participants perspectives and experiences of the intervention. The semi-structured approach allowed for flexible delivery in the order of questions to promote open and honest discussions, while also maintaining a level of commonality across the groups [21]. Probing questions were used where necessary to elicit depth or clarification in participant responses [21]. Audio recordings from focus groups and interviews were anonymised during the process of verbatim transcription.

Outcome evaluation

Behavioural

The activPAL accelerometer (PAL Technologies, Glasgow, UK) was worn continuously for 7 days to assess worktime and wholeday sitting, standing stepping, prolonged (≥30 minutes) sitting time and steps taken. The standardised placement of the activPAL was the front midline of the upper right thigh, with the monitor placed in a flexible waterproof sleeve (PAL Technologies) and attached by the researcher to the thigh with a hypoallergenic waterproof adhesive strip (Tegaderm 3M, Bracknell, UK). Spare sleeves, strips and an instruction leaflet supported optional attachment replacement. A diary was given to capture the time agents' start and end time of work [22]. In addition, participants detailed the time they went to bed, sleep, woke up and got out of bed each day whilst wearing the activPAL [22]. Subjective sleep quality was measured using The Pittsburgh Sleep Quality Index using a one month recall [23] with a global sleep quality index calculated (higher scores indicate worse sleep quality) [24]. A questionnaire adapted from a previous trial [18] assessed baseline smoking status, diet and alcohol consumption.

Anthropometric

Agents wore light clothing and removed their shoes for all assessments. Stature was measured using a stadiometer (Leicester Height Measure) to the nearest 0.1cm, body mass using a calibrated mechanical flat scale (Seca Clara 803, both Seca Ltd, Birmingham, UK) to the nearest 0.1kg [25] and body mass index was calculated (kg/m^2). Waist and hip circumference were measured a minimum of two times to the nearest 0.1cm using an inelastic tape (Lufkin, Apex Tool Group Ltd, Maryland, USA).

If the difference between the two measures taken exceeded >1% for all outcomes, a third measure was taken and the mean calculated.

Cardiometabolic

After a 10-minute supine stabilisation period, systolic (SBP) and diastolic blood pressure (DBP) was measured at the brachial artery using a Dinamap (GE Healthcare, Buckinghamshire, UK). Thereafter, a reproducible [26] and non-invasive high-resolution B-mode ultrasound technique (flow-mediated dilation) measured endothelial function of the femoral artery utilising current best practice guidelines [27]. The femoral artery was measured as lower limb endothelial function, which is more susceptible to the haemodynamic changes induced by alterations in sitting behaviours than upper limb arteries [28]. An occlusion cuff was placed distal to the imaged artery. After a 1-minute baseline diameter measurement, the occlusion cuff was inflated to 250mmHg for 5 minutes. Following cuff release, the artery was imaged for 3 minutes. Images were analysed using a continuous edge detection and wall tracking software to remove observer bias described in detail elsewhere [29]. In line with common cardiometabolic biomarkers assessed in PA and SB interventions [30], fasting blood samples were then taken using a standard finger prick technique and analysed immediately for total cholesterol and glucose via an Accutrend analyser (Accutrend Plus, Roche, USA). Samples were not stored.

Musculoskeletal, psychosocial, sociodemographic & occupational

Agents self-reported musculoskeletal symptoms over the past week and year via the Nordic musculoskeletal questionnaire [31, 32]. Wellbeing was assessed via the SF12v2 survey and health-related quality of life via the EQ-5D [33]. A survey adapted from a previous trial [18] assessed baseline sociodemographic and occupational characteristics.

Work

Presenteeism and absenteeism were self-reported using the Work Limitations Questionnaire [34], job satisfaction via a general job satisfaction tool [35], work engagement via the Utrecht Work Engagement Scale [36] and the extent to which occupational fatigue can be improved or reversed via the Need for Recovery Scale [37].

Sample size

There is no formal requirement to conduct a sample size calculation for pilot trials [38]. The number of height-adjustable workstations available (n=30) dictated the sample size per treatment arm, which is similar to pilot trials in this field [8].

Randomisation

An independent researcher randomly allocated participants to groups via an online random number generator after baseline. The research team notified participants via email. Participants and outcome assessors were not blind to group allocation. The trial statistician was blind to group allocation.

Analyses

Feasibility and acceptability

The response rate was the percentage of approached organisations/agents who expressed interest. The recruitment rate was the percentage of approached organisations/agents who expressed interest, were eligible and randomised [39]. The retention rate was the percentage of agents engaged in data collection per time point from those recruited. The attrition rate was the percentage of agents who withdrew during the trial from those recruited. The completion rate was the percentage of agents that provided valid data for an outcome measure from those engaged in data collection per time point. Reasons for attrition and missing data were logged. The frequency (%) of response distribution from questionnaire data was calculated [40]. Focus groups and interviews were used to build knowledge and understanding from participant and stakeholder experiences and to elicit detailed insights into stakeholder perceptions and experiences of the intervention. A thematic analysis approach was adopted in line with Clarke, Braun [41], which advocates a flexible approach to identifying patterns and themes across the whole data set, regarding participant perspectives of the feasibility and acceptability of recruitment, randomisation, data collection and the intervention [42, 43].

A reflective commentary containing the researchers initial thoughts and emerging patterns was kept alongside the data collection process [44, 45]. During familiarisation, raw transcripts were read and re-read and initial codes were generated through an inductive process which identified any text relating to participants perspectives of the feasibility and acceptability of the intervention [44]. During the deductive process, initial coded data were then grouped into emerging patterns according to trial phase to generate higher-order themes. At this stage of analysis, the coding frameworks were presented to a minimum of two members of the research team who have expertise in qualitative data analysis and intervention delivery. During this process of triangulation, emerging themes were reviewed and refined which enhances the trustworthiness of the data [45]. Findings are presented in line with the consolidated criteria for reporting qualitative research (COREQ) [46].

Behavioural outcomes

The activPAL data were transferred onto the ActivPAL software (PAL technologies). Data were cleaned and processed using the Processing PAL (V1.2, Leicester, UK) algorithm which has demonstrated strong consistency (k>0.8 for 88% of participants) with the traditional diary method [47]. Valid waking wear data was separated from time in bed, prolonged non-wear and invalid data [47] within the Processing PAL application. Heat maps to visualise the data were created and compared to participant diaries to check how well the algorithm had worked on the data [47]. Corrections were made if the algorithm output looked incorrect, for example an early wake time or late sleep time in comparison to other days of data. On these occasions the algorithm output was compared to the self-reported times and corrected if necessary [47]. Agents' workdays and worktimes were manually entered into a CSV template (a pre-formatted Excel file) and uploaded into the Processing PAL to extract worktime PA and SB. Worktime and daily outcomes were standardised to an 8-h working day and 16-h day, respectively [48, 49]. Agents were included in analyses if they provided the following at each time point [10]: a) worktime analyses: ≥1 valid worktime day; b) workday analyses: ≥1 valid workday; c) whole day analyses: ≥1 workday and ≥1 non-workday. Worktime data was valid if ≥80% of total worktime was consistent with participant's diary data [10]. Whole day data was valid if there was a minimum wear time of 10 h/day, ≥500 stepping events (≥100 steps/day) and suitable postural variation (i.e. data were invalid if ≥95% of wear time was spent in one activity) [47].

Quantitative analysis

In line with objective two to derive estimates of the preliminary effect of the interventions on worktime sitting, linear mixed modelling was conducted to compare intervention effects at 3 and 10 months from baseline [50]. Behavioural data were analysed statistically using STATA (Timberlake Consultants Limited, UK) with a $p \leq 0.05$ alpha level. The dependent variable was the variable change score (3 and 10 months minus baseline) and the independent variable was the treatment arm (SLAMM vs SLAMM+) [51]. To control for any imbalances at baseline, covariates included the baseline values for each variable [52]. Secondary measures were tested as potential confounders (anthropometric, sociodemographic and job characteristics). To provide a description of the proposed secondary outcomes, descriptive statistics were calculated to provide a summary of the mean changes in behavioural, cardiometabolic and survey outcomes measured at baseline, 3 and 10 months.

Results

Process and outcome evaluation results are presented chronologically according to trial phase. Survey and focus group/interview results are integrated with verbatim quotes which are coded according to job role, participant number (AG=agent P1-59, TL=team leader P1-5, CC=centre contact P1-3, PT=planning team P1-2, STL=senior team leader P1-3), focus group or interview (FG=focus group, I=interview) and time point (1=3 months, 2=10 months), e.g. TL3, FG1. Mean focus group/interview length was 43.4 ± 10.1 min at 3 months and 25.4 ± 9.9 min at 10 months. Agent focus group attendance at 3 (10 SLAMM; 10 SLAMM+) and 10 months (5 SLAMM; 6 SLAMM+) was similar between groups.

Recruitment and randomisation (with response and recruitment rates)

Of 16 companies approached, 3 expressed interest (response rate = 18%) and 1 private company in a highly deprived urban area in North West England was recruited [53] (Figure 1). The company housed six independent contracts who operated in separate locations within the worksite. Each contract varied in their inbound call handling times (mean 6-15 min). At recruitment, the gatekeeper approved a single contract for the trial. The centre housed 215 call agents with teams of 15-20 agents per team leader, and 70% of agents employed on non-permanent agency contracts. Agents had to complete a Display Screen Equipment assessment to be eligible for a height-adjustable workstation.

Of 215 agents sent the recruitment email and 213 engaged in a recruitment meeting, 107 expressed interest (response rate = 50%), 87 were screened, and 59 eligible agents completed baseline and were randomised (recruitment rate = 27%: Figure 1). Twenty-two agents signed up to be a Stand Up Champion (37%; SLAMM n=9, SLAMM+ n=13). Participants were aware of the recruitment posters (*"I was aware of the SLAMM recruitment posters":* 87% agreed or strongly agreed) and found randomisation acceptable (*"I had no problem with being randomly selected to either SLAMM or SLAMM+":* 97% agreed or strongly agreed). To increase agent recruitment, team leaders suggested recruiting from other in-house contracts and providing more visual recruitment prompts or taster sessions (Table 2). Clearer communication of eligibility criteria or pre-screening of agents was recommended to prevent productivity losses from ineligible agents attending recruitment meetings (Table 2).

[Figure 1 near here]

[Table 2 near here]

Planning phase and trial delivery

The planning meetings and team leader briefing (13 of 20 team leaders attended) helped stakeholders understand the trial and their role, though supporting the trial was more of a burden than anticipated due to time commitments, particularly for centre contacts (Table 3). Trial delivery was influenced by three main factors. First, despite forecasts, changeable and unpredictable call volumes were a persistent challenge for scheduling offline time for agents' engagement with trial activities. Secondly, in intervention month two, several SLAMM+ agents moved office and had short periods (≤2.5 weeks) without their height-adjustable workstation. Thirdly, during the trial the original centre contact, temporary centre contact, two planning team members and one senior team leader changed jobs or moved to a new worksite. While the replacement centre contact was appointed following a detailed handover and timely notification to the research team, senior team leaders acknowledged that improved handovers and communication with the researchers would help to manage these ongoing organisational changes (Table 3).

[Table 3 near here]

Data collection

Most agents found data collection feasible and comfortable, the text message reminder prior to their data collection appointment useful, and felt supported by the company to attend (see Table, Supplementary Digital Content 3, data collection acceptability and feasibility results). During focus groups, some agents reported that they felt pressured by their team leader to return to work due to high call volumes. This was reflected by team leader, centre contact and senior team leader comments during data collection which emphasised that meeting and maintaining service levels was a company priority (Table 4). Agents dismissed the centre contacts suggestion for them to participate in trial activity in their own time. Centre contacts wanted to know more about what the data collection entailed, to help them better support this trial phase. The completion rate (calculated as the percentage of agents that provided valid data from those engaged in data collection per time point) for worktime sitting (proposed primary outcome) was 81% at baseline (SLAMM 86%, *n*=25, SLAMM+ 77%, *n*=23), 78% at 3 months (SLAMM 86%, *n*=18; SLAMM+ 68%, *n*=13), and 74% at 10 months (SLAMM 67%, *n*=8; SLAMM+ 81%, *n*=9). Completion rates for other outcome measures ranged from 52-100% (see Table, Supplementary Digital Content 4, completion rates for outcome measures).

Baseline characteristics

Participants were typically female, White British, single and employed full-time under agency contracts with tenure <1 year (Table 5). Participants were typically overweight with normal SBP and DBP levels and 'healthy' fasting glucose and total cholesterol levels [54]. Sitting occupied 80% (385.9 ± 75.8 min/8-h workday) of worktime, with 45% (218.5 ± 123.2 min/8-h workday) of sitting time accumulated in prolonged periods (≥30 minutes). Standing occupied 14% of worktime (68.7 ± 72.8 min/8-h workday) and sitting 5% (25.4 ± 10.9 min/8-h workday).

[Table 5 near here]

Intervention feasibility and acceptability

Of the common intervention components, SLAMM and SLAMM+ agents rated the health check feedback, education and training sessions and support emails as most important and effective at both follow ups (see Table, Supplementary Digital Content 5, ranked intervention components). Most agents indicated that their primary motivation to join the trial was the offline time for the data collection and education and training sessions. Many agents indicated that the health check feedback and education and training sessions motivated them to engage with the intervention due to increasing their knowledge and awareness of their behaviour and health (Table 6). Attendance at the education and training sessions was 58 in week 1 (SLAMM 28, SLAMM+ 30), 44 in week 3 (SLAMM 19, SLAMM+ 25), 32 in week 9 (SLAMM 15, SLAMM+ 17) and 27 in month 6 (SLAMM 13, SLAMM+ 14). Fifteen randomised agents (25%) attended all four sessions.

Each support email was sent to all participating agents in the trial with team leaders (*n*=20) copied in for information. Several agents found workload and time pressures negatively impacted their ability to read the intervention emails at work despite finding them informative. Some agents thought the suggested desk-based exercises were useful and completed them, but others felt it was not acceptable to do them at work. Call agents preferred receiving emails weekly (intensive intervention phase) rather than monthly (maintenance phase). Agents commonly reported the emails as a useful prompt to sit less and move more (Table 6).

SLAMM and SLAMM+ agents perceived the daily goals and self-monitoring, team leaders and Stand Up Champions as the least effective and important components at both follow ups (see Table, Supplementary Digital Content 5, ranked intervention components). Timers were deemed unacceptable due to their disruptive noise improper use among agents. Agents described limited interaction with team leaders in relation to the intervention. Team leaders described the conflict with

maintaining service levels which impacted their willingness to actively promote the sit less and move more message to agents, instead they simply only honoured requests for offline time for trial activity. Most team leaders felt that receiving trial feedback, including changes in agent's behaviour and health status would enhance their engagement in the trial. Agents saw the centre contacts as the prominent intervention drivers and were often unsure who the Stand Up Champions were (Table 6). Agents' perceived effectiveness and importance rankings were consistent with their willingness to receive each intervention component. Agents agreed or strongly agreed that they would be happy to continue to receive the daily goals (SLAMM 91%, SLAMM+ 72%), Stand Up Champions (SLAMM 52.4%, SLAMM+ 61%) and team leader support (SLAMM 86%, SLAMM+ 89%) despite ranking them as least important intervention components. If offered, most SLAMM and SLAMM+ agents would accept a height-adjustable workstation from their employer (76% and 75% of SLAMM and 100% and 91% SLAMM+ agreed or strongly agreed at 3 and 10 months respectively).

According to SLAMM+ participants the most important and effective intervention component at 3 and 10 months was the height-adjustable workstation (see Table, Supplementary Digital Content 5, ranked intervention components). Agents' habit strength for height-adjustable workstation use was medium-strong at 3 months (mean 68%, range 31-100%) and medium at 10 months (59%, 31-92%) [19]. The most common response for workstation use frequency was daily (39%) at 3 months and 2-4 times per week (46%) at 10 months. 30-60 minutes was the most common self-reported duration of standing work with the workstation at 3 (44%) and 10 (46%) months. Most agents agreed or strongly agreed that the workstation was easy to use (100%, 91%) and that they felt comfortable using the workstation among their colleagues (94%, 91%) at 3 and 10 months, respectively. In contrast, qualitative findings suggest many agents felt they disrupted colleagues when standing to work (Table 6). The majority of agents disagreed or strongly disagreed that use of the height-adjustable workstation had a negative influence on their work productivity (56%, 64%), work quality (72%, 82%), musculoskeletal symptoms (72%, 82%) or fatigue (67%, 64%) at 3 and 10 months, respectively. Most agents wanted further advice and guidance on workstation use at 3 (78%) and 10 (73%) months. Call agents not recruited to the trial sometimes used the desk of a SLAMM+ agent, which led to negative interactions. Qualitative findings suggested that grouping together agents with a workstation could help enhance interpersonal support, develop a positive culture around sitting less and moving more and minimise disruption to colleagues (Table 6).

[Table 6 near here]

Trial retention, attrition and completion rates

At 3 months, retention (68%, n=40; SLAMM 72%, n=21; SLAMM+ 63%, n=19) and attrition (32%, n=19; SLAMM 28%, n=8; SLAMM+ 37%, n=11) were similar between groups. At 10 months, retention (39%, n=23; SLAMM 41%, *n*=12; SLAMM+ 37%, *n*=11) and attrition (61%, n=36; SLAMM 59%, *n*=17; SLAMM+ 63%, n=19) were similar between groups. Withdrawals occurred regularly with no known withdrawals due to trial-related adverse effects. Half (50%, n=18) of all withdrawals were due to the participant leaving the company (Table 4). At 3 months, 10% of the withdrawals due to leaving the company had a tenure of 90 days or below in their current role at baseline and 78% were employed on a part-time contract. A high number of agents who were on a part-time contract at baseline withdrew at 3 (SLAMM 100% *n*=7, SLAMM+ 50% *n*=5) and 10 months (SLAMM 89% *n*=8, SLAMM+ 100% *n*=8).

Perceived benefits of interventions

At both follow ups, SLAMM and SLAMM+ agents reported perceived benefits of sitting less at work (Table 7). Perceived benefits were feeling more awake and alert, especially after eating, less stress and musculoskeletal pain, and greater awareness about their behaviour and health. Despite these benefits, workload pressure and low motivation to stand were perceived barriers to sitting less.

[Table 7 near here]

Estimates of the preliminary effects of the interventions

Objective two of the pilot trial was to derive estimates of the preliminary effect of the interventions on sitting time at work (proposed primary outcome for a full trial) and provide a description of the proposed secondary outcomes. Descriptive statistics for the activPAL-assessed behavioural outcomes (see Table, Supplementary Digital Content 6, descriptive statistics of behavioural outcomes) and anthropometric, cardiometabolic, musculoskeletal, psychosocial and work outcomes (see Table, Supplementary Digital Content 7, descriptive statistics for anthropometric, cardiometabolic, musculoskeletal, psychosocial and work outcomes) are presented by intervention group. Linear mixed modelling indicated a decrease in worktime sitting in SLAMM+ relative to SLAMM at 3 months (-21.0 (-61.2 to 19.2) min/8-h) and 10 (-28.8 (-79.2 to 21.6) min/8-h) months follow-up. For SLAMM+ agents who provided valid data at baseline and 10 months, there was a noticeable decrease in prolonged sitting time at work, and a noticeable increase in standing time at work. There were no such noticeable changes in these outcomes at 10 months in SLAMM agents.

Discussion

This pilot trial was the first to evaluate the feasibility and acceptability of a multi-component intervention to sit less and move more, including and excluding height-adjustable workstations, in contact centre call agents. The trial failed to recruit an organisation with multiple branches/worksites though the agent recruitment rate and group randomisation procedure were acceptable. The data collection procedures were acceptable however a high number of company leavers contributed to attrition and completion rates that need considering ahead of future trials. The interventions were mostly acceptable and preliminary estimates indicate the multi-component intervention including a height-adjustable workstation has potential to reduce sitting time at work. Findings are discussed by trial phase to address the objectives.

A tender process aimed to increase transparency and recruit an organisation with enhanced buy-in for the intervention. The process however elicited a low response rate and failed to recruit an organisation with multiple branches/worksites or clear areas of segregation within a centre, therefore preventing us from conducting a cluster pilot trial. This may be due to the 3-week application window being too short, and large contact centres typically having non-segregated large open plan offices. This offers important contextual information for the design of trials in open plan or shared offices, where the risk of contamination between groups is high and randomising to interventions or a non-treatment control may not be feasible [55]. Organisational and environmental steps were taken to minimise the potential risk of contamination across treatment arms in the present trial, however this risk could not be eradicated due to the open plan office. Future trials are recommended to use longer application windows and use a cluster design, with organisation, building or segregated areas as the cluster to enhance a trial's external validity [56]. Importantly, clustered RCT's are typically more complex to design than individual-level RCT's due to design characteristics which require a higher volume of participants to achieve statistical power, and are therefore more costly to conduct, the recruitment process in future trials should attempt to account for high levels of staff turnover in contact centres [57].

The call agent recruitment process was refined from a previous study [2] by the removal of a team leader recruitment phase, and inclusion of participants with existing cardiometabolic conditions. This increased the response rate (50% vs 37%) and the rate of call agents recruited and engaged in baseline assessments (27% vs 20%) compared to our previous trial [2]. The target number of participants was recruited and the recruitment rate was above a 25% criteria suggested for progression from a pilot to definitive trial [58]. These findings suggest that recruiting healthy and 'at risk' call agents in future trials may be important for enhancing the overall reach, representativeness and generalisability of the findings [59]. Furthermore, including populations identified as high risk has the potential to elicit greater benefits to cardiometabolic health compared to healthy individuals, which is of importance in

551 the wider interests of public health [60]. To note, future trials are recommended to more strongly
552 emphasise the eligibility criteria in recruitment materials to minimise the number of ineligible agents
553 attending recruitment meetings and the associated impact on call centre service levels.
554 The planning phase in the present trial engaged stakeholders who could identify feasibility
555 considerations across each trial phase. Consistent with previous research [2, 7], and despite
556 anticipated forecasting, high and fluctuating call volumes, was an ongoing barrier for scheduling and
557 honouring offline time for agents. Maintaining service levels often took precedence and led to
558 cancelled and rearranged offline time impacting agents participation in trial activities. The pressure of
559 maintaining service levels also made some agents feel pressurised to return to work from trial
560 activities, prevented some agents from reading support emails, and, prevented some team leaders
561 from encouraging their agents to sit less and move more. Similarly, emergency contact centre workers
562 identified high service levels as a significant barrier to sitting less at work, despite being situated at a
563 height-adjustable workstation [61]. Importantly, non-attendance, cancelled or postponed
564 intervention sessions can affect the overall dose and fidelity of an intervention [62]. Accordingly,
565 future trials must develop flexible strategies and contingency plans to limit the impact of high and
566 fluctuating call volumes and the associated workload pressures on trial delivery, and enable agents to
567 engage with and team leaders to promote the target behaviours.
568 To enhance buy- in and to raise awareness of the intervention team leaders were invited to an optional
569 intervention briefing during the planning phase. Team leaders were told that office workers in
570 previous trials positively changed their sitting and/or PA behaviour at work when they were supported
571 by team leaders/managers [63-65]. Despite this, some team leaders indicated that they rarely
572 promoted the target behaviours and only honoured agents' offline time for trial activities, often due
573 to the perceived conflict with maintaining service levels. Accordingly, call agents perceived the team
574 leader component as ineffective for promoting the target behaviours at 10 months follow-up. Other
575 factors that may have limited the support team leaders gave to agents during the trial are the team
576 leaders receiving little training, not all team leaders attending the briefing session, some agents
577 changing offices and hence team leaders, and changes at the team leader and senior team leader
578 level. In addition to providing more comprehensive training to enhance trial awareness among middle
579 management, particularly around SB and PA at work, and the relationship with health, wellbeing and
580 work outcomes, recommendations to improve the effectiveness of the team leader component
581 included informing team leaders about the trial's progress and results, and engaging them in data
582 collection and education sessions. Similar management support strategies helped office workers
583 significantly reduce their SB in the 12 month Stand Up Lend Lease trial where participants reported
584 that management support was a key motivator [65]. Notably, significant changes in sitting time were

not observed until 12 months. These findings therefore suggest that effective management support strategies may be required in order to influence every day working practice and positively impact employee SB over time [66].

Call agents found the randomisation and data collection procedures acceptable. The compliance rates for the worktime and workday behavioural analyses were higher than the whole day analyses, due to the need for a valid non-work day in the latter. Of the other secondary outcomes, compliance rates were noticeably low at each time point for endothelial function assessment. For this measurement, a 10-12 MHz multi-frequency linear array probe is used as standard in our laboratory [67, 68]. However, our previous studies undertaking this procedure have typically been in participants with a healthy BMI. In the present trial though a high proportion of participants were overweight and had large amounts of fat mass in the leg, through which sonographers were sometimes unable to obtain sufficient distinction between lumen and artery wall for data to be included in analysis. Coupled with regular withdrawals across the trial, few participants provided complete data for endothelial function at every time point, which resulted in the large mean changes observed. For future studies aiming to measure femoral FMD in overweight or obese participants, a lower frequency probe with higher penetration depth may improve data quality.

The trial had a high attrition rate and the aforementioned regular withdrawals across the trial led to few participants providing complete data for outcome measures at every time point. No withdrawals were due to adverse events and 50% of withdrawals were due to company leavers. The attrition rate is higher than previous workplace [69, 70] and contact centre [71] studies. Average annual attrition is higher in contact centres (21% per annum) compared to other sectors and occurs frequently during the first 90 days of employment [72]. This somewhat supports the finding that 6 out of 19 withdrawals after 3 months had ≤90 days tenure at baseline. Further, 37% (*n*=13) of agents who withdrew during the trial because of leaving the company were on a part-time or agency contract. Accordingly, these findings suggest future trials may reduce attrition by recruiting agents with >90 day tenure and on a permanent contract. These eligibility criteria however would minimise the recruitment pool, and limit the external validity of a trial. Indeed, high staff turnover is a significant challenge for long-term trials in contact centres. In addition to conducting sample size calculations to inform sufficiently powered long-term evaluation [73], future trials should consider how intervention components can limit the impact of high staff turnover. This could involve embedding employee wellbeing and organisational strategies into the recruitment, induction and personal development planning and review processes to aid improved staff retention, and to establish a culture around sitting less and moving more.

Support emails, education and training sessions, and individual and group-level feedback were acceptable to agents and perceived as effective. Time and workload pressures often prevented agents

from reading the emails, though the emails commonly prompted a change in posture. The suggested desk-based exercises were not an acceptable behaviour at work for some agents. Similarly, cultural factors which influenced employee perceptions around acceptable working behaviours and a lack of physical or social opportunities to accumulate incidental PA at work have been identified as barriers to increasing PA at work [7, 76]. As such, implementing strategies to reduce sitting time across contact centre and desk-based occupations appears more acceptable and feasible than strategies promoting PA, with few trials successful in increasing ambulation or PA at work [11, 43, 64, 75]. Enhanced management support for PA breaks [59] and policy changes to increase task variation and provide longer or more frequent breaks [78] may overcome the limited opportunities for structured or incidental PA at work in contact centres [77] and warrant investigation. Similar to the support emails, the education and training sessions and feedback appeared to enhance call agent's motivation and self-efficacy to sit less at work. A previous office-based intervention provided with or without a height-adjustable workstation similarly educated participants and observed reductions in workday sitting in both groups [73]. Low-cost interventions including behavioural and educational strategies may therefore have potential to reduce workday sitting time in contact centres. Taken together, these collective findings support the use of concise weekly support emails, face-to-face education and training sessions, and the provision of health and behaviour feedback, in future contact centre trials.

Daily goal setting and self-monitoring with timers was not an acceptable intervention component and constant workload pressures made it unrealistic for agents to engage with this component. Similar to the team leader component, interpersonal support from Stand Up Champions appeared ineffective, which contrasts previous trials [65, 74]. More comprehensive training for team leaders and champions may promote positive social interaction and reinforcement, and increase individual and group motivation and self-efficacy for the target behaviours by enhancing individuals capability, opportunities and motivation to sit less and move more [12]. Future trials are recommended to extend this training to the centre contact who was viewed by agents as the prominent intervention driver.

Consistent with previous trials in office workers [18] and call agents [2], the height-adjustable workstation was acceptable to SLAMM+ agents and perceived as the most effective and important intervention component. This is supported by a medium strength habit for workstation use, and preliminary, objectively-assessed estimates that total and prolonged occupational sitting time decreased and occupational standing time increased in agents with a workstation compared to those without, at 10 months follow-up. The mean changes in worktime sitting in SLAMM+ at 10 months follow-up are lower than previous trials [10, 75]. This suggests that contextual factors associated with the contact centre setting such as low autonomy and sedentary job tasks may negate the impact of workplace sitting reduction strategies over time [7]. Nonetheless, the >30 min/8h reduction observed

in worktime sitting in the SLAMM+ intervention is potentially meaningful for cardiometabolic health [70, 72]. Further, the demonstrated potential of the SLAMM+ intervention to reduce prolonged sitting time is especially pertinent as frequent postural transitions appears more important than longer or less frequent breaks for reducing cardiometabolic risk [76, 77]. Future trials are advised to locate agents with a height-adjustable workstation in close proximity and away from agents without a workstation, in order to promote individual and group motivation and self-efficacy to stand when working, avoid negative interactions with colleagues, and make standing to work a social norm.

Strengths and limitations

In accordance with the Medical Research Council framework, key strength of this mixed-methods pilot trial was the rigorous process and outcome evaluation used to explore the feasibility and acceptability of each trial phase from multiple stakeholder perspectives and derive estimates of the preliminary effect of the interventions to help prepare for a future RCT [17]. The present trial builds on our previous, phased approach [2, 7] to intervention development in contact centres and provides original and significant knowledge on workplace interventions targeting SB in this high risk setting [5, 71]. Behavioural outcomes were objectively measured which minimises the risk of reporting or recall bias. Participants were also recruited from both healthy and 'at risk' individuals which is more reflective of the call agent population who have a higher exposure to occupational SB compared to other desk-based occupations and have demonstrated greater risk factors for cardiometabolic health. This indicates that the sample in the present trial was more representative of call agents within the contact centre sector [59]. The interventions were underpinned by the socio ecological model [11] and the COM-B model of behaviour change [12]. Detailed trial methods were reported in line with COREQ and TIDER frameworks to enhance replicability and transparency [9, 46]. Participants identified the most effective intervention components for encouraging them to sit less and move more at work, although further research is warranted to explore which intervention components mediate the observed changes.

Strategies were adopted to mitigate the risk of selection and detection bias, however an open-label trial was unavoidable due to the provision of height-adjustable workstations within an open plan office. It is believed however that the potential risk of contamination between intervention arms was low due to the environmental component (height-adjustable workstations), which could not be transferred and could be difficult to swap between agents [18]. Nonetheless, the presence of SLAMM+ participants may have motivated SLAMM participants to reduce their SB, and future trials may benefit from a cluster randomised approach. Researchers conducting assessments were not blind to group allocation, though the outcome assessments were not likely to be influenced by lack of blinding. The

complete case analysis may have introduced a potential risk of attrition bias [78]. Analyses of the proposed primary outcome is preliminary and should be interpreted with caution due to the lack of statistical power [71]. Further, due to the pilot nature of the trial, mean change scores are presented for all other outcome variables. Results should be interpreted with caution as they are unadjusted for any potential confounding variables. The intervention was delivered in a real-world setting which strengthens the ecological validity although a single contact centre approach may impact the external validity of the findings. Overall the findings are consistent to a previous contact centre trial [2], which indicates that the findings may be generalisable to the UK contact centre context. Furthermore, it is unknown whether greater behavioural changes may have been observed if SLAMM+ intervention was compared to a usual practice control arm.

Conclusion

The present pilot trial indicated that the participant recruitment rate and randomisation, data collection, and intervention components were mostly acceptable to call agents, team leaders and senior team leaders. Refinements are needed to the organisation recruitment process, and the impact of the observed high staff turnover, typical to contact centres, on attrition and outcome measure completion rates is a critical challenge for future trials. Estimates indicate the multi-component intervention including a height-adjustable workstation has potential to reduce sitting time at work though further studies with sufficiently powered samples are needed to support or refute this preliminary finding. The iterative findings of the present trial and our earlier work will help prepare for a future RCT designed to assess the effect of the interventions.

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Figure caption list

Figure 1. Consort flow diagram of enrolment, allocation, follow-up and analyses.

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Supplemental Digital 6. Descriptive statistics for behavioural outcomes.docx

Supplemental Digital Content 7**.** Descriptive statistics for anthropometric, cardiometabolic, musculoskeletal, psychosocial and work outcomes.docx