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STAND UP FOR HEALTH: A FEASIBILITY CLUSTER RANDOMISED CONTROLLED TRIAL (RCT) OF A THEORY BASED INTERVENTION TO REDUCE SEDENTARY BEHAVIOUR IN CONTACT CENTRES

Background and Scientific Rationale

Sedentary behaviour as a public health problem

Sedentary behaviour is a serious occupational health hazard, linked with an increased risk of type 2 diabetes, cardiovascular disease, musculoskeletal issues, and poor mental wellbeing [1-6]. These risks are independent of physical activity [7, 8]. Conceptually, sedentary behaviour and physical activity are different [9], with each thought to pose health risks independent of each other [5, 10-12]. A review of behaviour change strategies used for sedentary behaviour reduction among adults [13] reported that interventions which showed the most promise in reducing sitting time were those that aimed to change sedentary behaviour rather than increase physical activity. The reduction of sedentary behaviour is therefore not a consequence of effectively promoting physical activity and should be recognised independently when developing interventions, guidelines and legislation.

Workplace sedentary behaviour is placing a large burden on employers and the healthcare system. Many employees working in office-based environments become exposed to prolonged periods of inactivity in static seated postures, which are enforced by factors such as ergonomic set-up and workplace culture [14]. This sedentary behaviour can impact significantly on the daily lives and activities of workers. For example, musculoskeletal issues are one of the most prevalent occupational health problems for desk based workers and are a leading cause for disability worldwide [15-17]. Estimates of the prevalence of musculoskeletal symptoms in computer users are as high as 50 per cent [18]. Lower back pain in particular is associated with prolonged sitting [19, 20].

Factors contributing to sedentary behaviour in workplaces

In a traditional office setting, high levels of sedentary behaviour and low levels of physical activity are a result of multiple causal factors, which include workload and social norms surrounding workplace behaviours [21, 22]. Multi-level interventions have previously been successful in reducing total [23]

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and prolonged [24] sedentary behaviour within this setting, though few studies have been effective at promoting physical activity [25] in the workplace and only a limited number of trials have reported success in managing long-term positive behaviour change [24]. At present, only a very limited number of research studies have sought to explore the reduction of sedentary behaviour or promotion of physical activity in the contact centre setting.

Contact centres and organisational drivers

Many organisations representing the contact centre industry are highly constrained by profit-based drivers, cost minimization, and economic outcomes based on productivity and high quantity customer enquiry resolution [26]. This has resulted in standardised work methods, removing the need for specific skills and reducing costs associated with employee training. The work itself can be isolating, and employees may view themselves as replaceable. These factors can also often influence organisational investment into workplace health initiatives; fears of cost-ineffective programmes and reduced productivity rates are commonly presented by senior team leaders within private contact centres [27].

Whilst emergent technology and customer expectations are important for shaping the nature of the work contact centres (e.g. voice recognition, more use of social media) there is no anticipation that this will remove the necessity for contact centre agents to use a computer of some sort. There may be a trend to more remote working in the next few years, but it is likely that sedentary will still be an issue.

Contact centres as a setting for public health interventions

There are over 6,200 contact centres in the UK, employing 734,000 agents [28] which is roughly 1 in 25 of the UK workforce. Scotland and the North East of England are home to some of the largest contact centres in Europe. Workplaces are often considered as homogeneous, but there are wide variations in terms of the demographics of the worker, the amount of worker autonomy, salaries, the environment (e.g. rigid workstations) and culture.

The staff demographic profile is different from other non-manual workplaces, with a younger workforce, lower wages, and a higher proportion of women and part-time workers. The call handlers (the highest proportion of contact centre staff) earn an average salary of £16,319 per year compared with the national average of £26,500 which puts them in the bottom third of earners [29]. In terms of gender, they are more likely to be female (60:40) [28] and ONS [30] data shows a reasonably consistent picture of a 70:30 split of full and part time employment [31]. Career progression is limited and even the most experienced of contact centre staff earn only slightly more than those with least experience. Turnover rates are high in UK contact centres with average attrition rates of 21% reported in 2017. Short-term absence rates are also high with 6.8% of agent workdays being lost to short-term sickness and unauthorised absences [32].

Contact centres and health

Due to their occupational nature, contact centres are currently one of the most sedentary working environments, with some members of staff reporting up to 95% of their shift spent sitting. The

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technology in contact centres prevents staff from regularly leaving their desk and many call handlers often report stressful work environments due to low workplace autonomy, strict supervision of individual performance and commission-based salary systems [33]. One in four members of contact centre staff regularly experience musculoskeletal problems with 22.4% of sick days lost to such problems [30]. A recent study found that a common factor for sedentary behaviour shared by contact centre agents, team leaders and senior staff included a considerable lack of knowledge and awareness of sedentary behaviour as a risk factor for poor health in highly sedentary workplaces [27]. Additionally, there was also a low level knowledge among staff of guidelines and recommendations relating to sedentary behaviour and physical activity in the workplace and often there is no reflection of this in organisational policies [27, 34].

In 2012, a study found that working in a contact centre was associated with higher levels of sedentary behaviour than other office-based work [4]. Another study [35], hypothesised that the culture and policies of a contact centre may differ from other office-based work and thus present a unique setting.

As well as being a highly sedentary workplace, work in contact centres has been described as 'constrained' work, where opportunities for enrichment and intrinsic reward are apparently limited [26]. Contact centre agents have voiced concerns over job security, performance monitoring and a desire for increased autonomy over their working practices as influential factors for their motivation to participate in strategies to reduce sedentary in the workplace [27]. However, organisational pressures to maintain high levels of productivity and meet targets frequently work against organisational investment into health and physical activity programmes within some contact centres. This is often due to perceptions that these activities will reduce the agents' call making time and lead to productivity losses [36]. One study reported that leaders and senior staff had 'identified a conflict between promoting productivity and targets to call agents, while encouraging them to move more and sit less' [27].

Workplace intervention research to reduce sedentary behaviour

Over the last 5-10 years there have been a number of systematic reviews of workplace interventions to increase physical activity and reduce sedentary behaviour [35, 37-39]. Most recently a systematic review of environmental interventions in workplaces (e.g. sit-to-stand desks) found evidence of significant reductions in sedentary behaviour in 14 out of 15 studies [38]. The most effective interventions were multi-component, targeting more than one level of the socio-ecological framework. In 2016, a systematic review assessed the effectiveness of white-collar workplace interventions to reduce sedentary time [39]. It similarly found that multi-component interventions had the greatest effect. Both reviews [38, 39] recommended a need to assess whether policy-based measures or organisational change could further increase effectiveness. One study assessed the effect of sit-stand desks and ergonomic awareness on reducing sedentary behaviour in 15 Swedish contact centres [40] and found that working at a sit-stand desk was associated with a slightly greater reduction in sitting time as opposed to sitting at a non sit-stand desk. Regular interruptions to sitting time during the work day have previously been found to significantly reduce discomfort in the lower

back and fatigue levels in overweight and obese office workers, without affecting productivity [41]. Another study found that the use of standing desks led to significant reductions in upper back and neck pain in office workers [42]. A recent study exploring barriers to participation suggested that, 'barriers occurred at multiple levels of influence, and support the use of ecological or multilevel models to help guide future programme design/delivery' [43].

Multi-component workplace interventions

Given the specified need to address cultural and organisational factors affecting workplace behaviour, we developed and piloted Stand Up for Health (SUH, the intervention in this current proposal). There are a limited number of other similar interventions but the evidence is still sparse and only one study, currently on-going, is UK based. This UK study is NIHR-PHR funded and is currently examining the effectiveness of the SMaRT Work & Life intervention aimed at reducing sitting time of office workers [44]. Whilst this intervention is similar to our intervention in some aspects, Stand Up for Health specifically considers aspects of organisational change, targets contact centres, and takes a systems-based approach [45]. This takes into account the complexity of the context, resources and assets of specific contact centres. The Stand Up Victoria study in Australia also had a multi-component intervention [46, 47]. However, height adjustable workstations were a main part of the intervention. Whilst we envisage some contact centres may take up this option, we recognise that not all contact centres have the resources, or desire, to implement them. A third study in Perth, Australia, used a similar participatory approach to SUH but had no theoretical basis, and was only assessed at a 12 week timepoint [48].

Contact centre research

Many existing practices in contact centres contribute to prolonged sedentary behaviour. Introducing smaller environmental changes to some of these practices can considerably encourage reduced sitting times. Recommendations emphasise the importance of regularly breaking up sedentary time, with desk-based workers being encouraged to accrue 2-4 hours of standing and light activity daily during working hours [49]. However, workplace cultures can often contribute to perceived judgements of behaviour, where staff may feel uncomfortable going against 'sitting-norms' [50]. These perceptions can often deter employees from engaging in less sedentary practices during the working day. Stand Up for Health is designed to have organisational change as a key component of the intervention.

Relevant policy and practice

Policy regarding sedentary behaviour lags behind the evidence. A recent study reviewed current national and international occupational safety and health policy documents (e.g. guidelines, legislation, codes of practice) for their relevance to occupational sedentary behaviour [34]. The review found that many workplace and jurisdictions had legal frameworks which established a duty of care for occupational health but discovered that no occupational health and safety authority had a policy specifically targeting occupational sedentary behaviour. Although some existing policies have aspects relevant to sedentary behaviour in the workplace, the authors identified a need to address the emergent hazard of excessive occupational sedentary behaviour by developing specific policies

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for this issue. They also highlight a need to support workplace-based initiatives which aim to minimise sedentary behaviour and associated risks.

A number of awards exist across the UK which are designed to recognise and encourage efforts made by organisations to improve health and wellbeing in the workplace. These include the North East Better Health at Work Award (BHAWA) [51] in England and the Healthy Working Lives award [52] in Scotland. Although these awards have a number of categories for health promotion that can help mitigate some of the negative outcomes of excessive sitting time, reducing sedentary behaviour as a specific outcome is not acknowledged.

Importance of this research

Current UK workplace legislation means that many members of staff in contact centres receive remedial ergonomic support as a mitigation measure to reduce existing musculoskeletal issues, *only after* a chronic or musculoskeletal condition has been diagnosed [53]. However, current practices, compounded by workplace culture, inhibit initiatives that encourage contact centre staff to reduce sitting time [54]. Combined with the lack of policies from authoritative bodies that are specific to sedentary behaviour it is important that workplaces take proactive steps to develop their own organisational policies which include, and promote, opportunities for reducing occupational sitting time [34]. Given that contact centres are amongst the most sedentary workplaces [55], and employees report higher levels of stress and depression compared with other desk-based work [56], it is key that preventative approaches are implemented.

This work is currently needed to ensure healthier working policies are distributed equitably across all workplaces, not just those which have more worker autonomy and better working conditions. Creating healthier contact centres may be more difficult to do than for other workplace settings, which is why such an intervention is necessary. Also, building the capacity to develop and measure workplace-based interventions for health in contact centres is vital for developing a stronger business cases to encourage and enhance organisational uptake and buy-in.

Study Aims and Research Questions

Study Aims:

Aim 1: To test the acceptability and feasibility of implementing the Stand Up for Health intervention in contact centres

Aim 2: To assess the feasibility of using a cluster randomised controlled trial study design

Aim 3: To scope the feasibility of a future health economic evaluation of Stand Up for Health

Research questions for Aim 1

1. What is the acceptability, feasibility, and utilisation of the various components of the intervention in a range of contact centres?
2. Does the programme theory and process of implementing the intervention work as intended?
3. Does the programme theory/intervention need adapting and in what ways?

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4. Are there differences in delivery of the intervention, between different contact centres? If so what are the reasons for these?

Research questions for Aim 2

5. Is the study design (cluster RCT) feasible for a confirmatory trial of an intervention to reduce sedentary behaviour in staff working in contact centres?
6. How many clusters and participants per cluster are required for a confirmatory trial?
7. What is the recruitment rate of participants in each cluster and how many are lost of follow-up (e.g. due to staff turnover)?
8. Are the range of study procedures (e.g. recruitment strategies and outcome measurement tools) feasible for a future confirmatory trial?
9. Are there differences in aspects of study procedures (e.g. uptake) between different contact centres? If so what are the reasons for these?
10. What are the preliminary estimates of the variability of primary (reduction of sedentary behaviour in the workplace) and secondary outcomes within and between contact centres?

Research questions for Aim 3

Is it feasible to provide estimates of the cost-efficiency of Stand Up for Health from a) an NHS and personal social services (PSS) perspective and b) and employers perspective.

Design and methods

Feasibility study with a cluster RCT design (to address Aim 2) combined with a process and qualitative study (to address Aim 1), and an economic component (to address Aim 3). As the intervention is implemented in a workplace, it is not possible to randomise at the individual level; therefore a cluster RCT is the only option. We have explored the relative advantages and disadvantages of the stepped wedge and the cluster parallel group designs as the two most appropriate options. After much discussion we have decided that the design will be an **incomplete cross-forward cluster randomised trial** (see **Figure 1**). Our study design is unusual because it is not a standard stepped wedge design (it has lots of incomplete sections), but it is also not a standard wait-list control design because there are many cross-sectional comparisons which may not always be present in a wait list control design. Similar designs are increasingly being used in evaluation research and involve random and sequential crossover of clusters from control to intervention until all clusters are exposed [57]. It can be considered as an extension of the parallel cluster trial with a baseline period. Such a design makes it possible to achieve a phased introduction of the intervention. It combines pragmatism with a robust design, and the way the study is conducted has much in common with the parallel cluster trial. Such designs are considered to be appropriate when: 1) there is a belief that the intervention will be of benefit and unlikely to do any harm; 2) evaluating an intervention that will be implemented irrespective of evidence for effectiveness; or 3) when it will be logistically implausible to roll out the intervention simultaneously to all clusters [58]. This is an important consideration, since it would be very expensive to have enough equipment to loan out; we also wouldn't be able to collect activpal data on half of the anticipated sample at one time-point. This design allows us to have a smaller number of individuals at

each baseline assessment point thus smaller number of activpals and equipment and other resources required.

Whilst there continues to be debate over the design and its limitations (e.g. [59]), some of which are valid, evaluations of public health interventions often have to be pragmatic and take into account the stakeholders and context of the intervention involved (in this instance the contact centres). We argue that we need a pragmatic option for a number of reasons. First, it could potentially cause delays in the evaluation process if we waited until all contact centres were at the same stage of readiness for implementation. A structural/location/organisation change in one contact centre could delay the process. Second, it would be more costly and resource intensive to implement the intervention and collect baseline data in all the contact centres at a single time point. We have hired two researchers, but due to the spread of locations in Scotland and North East England, this would make implementation and data collection difficult and increase the potential for failure. Third, contact centres are already wanting to implement the intervention when they hear about it. It is unlikely to cause any harm. It has been implemented in one contact centre for over a year and only positive benefits have been reported. Journals such as The Lancet Global Health and Trials are publishing the results of such designs [e.g. 60, 61].

Setting

Ten contact centres with more than 100 employees in Scotland and/or the North East of England. These two areas have the highest rates of contact centres in the UK, employing up to 6% of the workforce in these regions [62]. We will consider other areas of England if there is interest and to ensure we have 10 contact centres taking part.

Study population

As this is a cluster RCT, contact centres rather than the staff employed in the contact centres (including managers, supervisors and call handlers) will be recruited. All staff will have the opportunity to participate in the intervention. For the evaluation components, staff will have the option of taking part on an opt-in basis.

Recruitment

Ten contact centres will be recruited and we aim to have them recruited by month three of the project. All staff in the contact centres who have been working in the contact centre will be invited (via email through their contact centre) to be involved in the evaluation of the intervention, with the aim of recruiting 27 individuals per contact centre per data collection period for the outcome data (270 in total), and 6-8 individuals per contact centre for the qualitative data collection (60-80 in total). Staff who are interested in participating will be sent an information sheet and consent form. It will be made clear that participation, or non-participation will not affect terms of their employment.

Retention

The average annual turnover (attrition) of contact centre staff is around 24% vs 15% for other industries. This high rate of attrition has implications for the retention and follow up of participants. The high turnover is partly due to the number of students and people looking for short term work.

Whilst this is a problem for the evaluation, it maybe more positive for the success of the intervention; it has the potential to impact on a range of people, enabling them to engage with health promoting activities that may encourage the development of lifelong habits.

One of the aims of this study is to determine the retention rates for a future study. We have a number of strategies:

1. Staff will be incentivised (£5-10 gift voucher) to complete baseline and outcome data assessments
2. If staff leave the contact centre we will explore what methods it may be possible to use to follow them up (e.g., post, email, telephone) and evaluate the most effective
3. We will record data on length of time employed in the contact centres. This data will help us determine whether turnover is higher at the beginning of the employment period (which could impact on retention rates)

Randomisation

Randomisation will occur in month three. The unit of randomisation is contact centres. A computer-generated block randomisation algorithm will be used to randomly allocate each contact centre to start the intervention at one of five time points, three months apart. Randomisation in this way allows us to introduce the intervention to each site in an unbiased way unrelated to time or the particular circumstances of each site. It also helps ensure there is approximate balance on average across all the intervention start times in terms of participant or contact centre characteristics.

Steps to minimise bias

Allocation

Allocation to trial arms will be performed after recruitment, consent and baseline data collection by the statistician who will be blind to the contact centre identity.

Contamination

Whilst it is possible that staff may move between contact centres allocated to different trial arms, we anticipate that this will have little impact. We will, however, attempt to measure/evaluate the extent to which this occurs by our follow-up attempts of contact.

Sampling and sample size

All employees at a site are likely to take part in some or all of the intervention activities. However, employees will have the option of taking part in the research evaluation component. When we discuss the sample size, we are referring to the number of people taking part in the research evaluation (not those only taking part in intervention activities). The sample size and target difference are the same as another similar study that proposed a sample size of 160 per arm to detect a reduction in workplace sedentary behaviour of 45 minutes per day [49]. Since we will have 6 control and post-intervention cross-sectional comparisons (see **Figure 1**), the target sample size is $160/6=27$ per contact centre per data collection period. There are 10 contact centres so we aim to recruit at least 270 employees in total taking part in the research evaluation. An aim of this feasibility study is to test sample size assumptions and produce a more accurate sample size calculation for a future study.

The Intervention

Theoretical basis

The intervention is in part based on two main theories: Social Cognitive Theory [63] and the Social Ecological Model (SEM) [64]. The intervention also aims to create a sense of ownership to increase the likelihood of longer-term sustainability [65]. While the SCT addresses many personal determinants and socio-environmental factors, the SEM takes the proposed multifaceted approach one step further to consider not only the individual and interpersonal levels, but to also consider the intervention at the organisational, environmental, and group level and takes into account the interactions between each of these [66]. By targeting multiple levels of the workplace, Stand Up for Health will aim to foster an atmosphere that will create a social norm within the office community to be able to sit and stand within the workplace. The SEM justifies and predicts that Stand Up for Health's multifaceted approach will be effective, acceptable, feasible and sustainable. We also take a systems based approach, by recognising that the implementation and sustainability of the intervention is dependent on how adaptive the control centre system is to change.

The causal factors of sedentary behaviour in the workplace are complex and numerous, therefore no single activity (e.g. standing desks, goal setting) is likely to create significant change on its own. This complex, theory-based, public health intervention has been developed using the 6SQuID framework [65] and addresses theories of change at the individual; social/cultural; environmental; and organisational levels. The intervention addresses the complex causal factors of sedentary behaviour by exploring the theories of change through a range of evidence-based activities (see **Table 1**). Whilst activities will vary depending on local context (e.g. office and work space set-up) there must be at least one activity from each theory of change included in the intervention.

As an adaptive intervention, the fidelity of the intervention is to the theories of change rather than being prescriptive about activities that catalyse change. To ensure transferability, it takes into account the specific system (the contact centre, how it organises its work and how SUH will fit into the system) and context (e.g. layout of the centre, work-time flexibility, budget and resources available). Additionally, it includes all employees from the start of development, with the aim of creating a social norm to be able to stand more at work. By gaining insight from contact centre staff about their specific needs, this approach is more likely to lead to a sustainable and effective intervention [65].

Development of the intervention

The programme theory was developed through a comprehensive literature review and qualitative work in a pilot contact centre. The intervention was developed using the six steps in quality intervention development (6SQuID) framework [65].

6SQuID Step 1: Defining and understanding the problem and its causes

Evidence on the causes of sedentary behaviour in the workplace, and existing sedentary behaviour interventions in contact centres and other workplace were identified through comprehensive literature reviews and surveys in the pilot contact centre.

6SQuID Step 2: Identifying which factors can be modified

Based on reviews of the evidence-base and qualitative data collection, all factors leading to sedentary behaviour in the contact centre were identified to ascertain which of these were potentially modifiable. Modifiable factors with the greatest scope for change were considered in order to identify which specific factors should be targeted through intervention activities. These are described in the Fishbone Diagram (**Figure 2**).

6SQuID Step 3: Deciding on the mechanism of change (theory of change)

These factors were used to develop the programme theory (**Figure 3**) and underlying theories of change below (**Table 1**).

6SQuID Step 4: Clarifying how the mechanisms of change will be delivered (theory of action)

During this phase a workshop was held at the test contact centre to introduce staff to examples of intervention activities and equipment for the workplace. The workshop activities were developed based on feedback from staff in the focus groups. Staff were asked to add to the list with their own ideas, and also prioritise the ones which they wanted to try out. The research team fed back the results to the SUH implementation group that then decided the final intervention activities to be implemented. There was at least one activity from each theory of change and they took account the resources, the assets (e.g. local spaces, existing equipment, spare spaces) and budget available. Once the specific intervention activities were chosen the team worked with the contact centres to decide on an action plan for delivery and implementation of the activities (who, what, when, where).

6SQuID Step 5: Testing and adapting the intervention

Contact centre staff will be assisted and guided by the researchers during two wellness committee meeting to establish and set goals for the programme. Continuous feedback was gathered from staff throughout the duration of the intervention so that the delivery of activities can be adapted as necessary.

Results of the pilot

The pilot intervention is still being implemented and developed 18 months after it started. The contact centre has reported that 25% of staff now use standing desks (an increase from almost none). There are a number of different activities going on at any one time and the call centre staff are constantly thinking of new activities to implement. The contact centre also asked to 'bolt on' a mental health component - the research team worked with them to implement mindful activities which were either standing up interventions (e.g. jigsaw puzzles on a stand-up desk) or activities that encouraged them to leave their desk and be mindful (e.g. LEGO, knitting). This additional component is currently being implemented and has not yet been evaluated.

The intervention to be delivered to contact centre staff

6SQuID Stages 4 and 5 will form the basis of the tailored intervention for each contact centre. The hypothesised theories of change (Stage 3) remain constant but the theories of action are specific to each contact centre. The initial stage of the intervention includes a 'workshop' that takes place at a contact centre, where staff have a chance to try out, suggest and vote for the activities they want to

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try out. They also describe the environment, location, existing equipment and other assets which are then used to plan the activities. Some small pieces of equipment will be available to loan and try out through the SUH research team. Whilst the number of activities is not limited, there must be at least one activity from each theory of change. These activities are then converted into an action plan to be implemented over a number of weeks. A key intervention component is the creation of a SUH implementation group made up of all levels of contact centre staff who ensure that activities are implemented. At the end of the intervention period a second workshop is held to check in as to which activities have worked and which haven't. Further prioritisation and choosing of future activities is undertaken. All equipment and activities will be risk assessed, and details of how to use the equipment/undertake the activities provided. A website will be developed with useful resources, and opportunities for the contact centres to blog/share their experiences and create a community of SUH contact centres.

Table 1. Theories of change underpinning the intervention, and examples of activities

Theory of Change	Example of Activities*
<i>Organisational</i>	SUH implementation group (made up of all levels of staff; this is the only obligatory activity); management led action plans; inclusion of non-sedentary behaviour as part of organisational strategies and goals; inclusion of non-sedentary behaviour activities for staff into roles and responsibilities (e.g. for supervisors); inclusion of 'standing' time into the working day.
<i>Environmental</i>	Equipment: Standing desks or a standing desk team area, bicycle desks, other equipment in communal places. Repurposing or changing the environment: standing communal areas with mindful/enjoyable activities such as jigsaws or knitting, or a darts board; moving printers further away; exercise spaces; boards on walls to draw on.
<i>Social/cultural</i>	Group activities in work time such as five minutes of stretching per hour; group goal setting; exercise classes before or after shifts; competitions between workspaces or teams; workplace challenges; rewards for standing more/being more physically active; educational prompts.
<i>Individual behaviour</i>	Individual goal setting, active travel to and from work, lunchtime walks; apps; links to local groups and activities.

*These are not exhaustive and the contact centre staff are encouraged to develop and think of their own activities.

Duration of the intervention:

Duration of the intervention is defined as the period in which the centres take to develop their preferred activities for each theory of change, prepare an action plan for sustained engagement and test out some of the activities. This process is expected to take around three months, but may be dependent on the contact centre.

Outcome measures

As this is a feasibility study we will be testing out the methods of collecting data on outcomes, as well as preliminary estimates of effectiveness. Table 2 outlines the methods/instruments used

Table 2. Methods for Quantitative Data Collection

Outcomes	Measurement
<i>Primary</i>	
Sedentary time in workplace (objectively measured)	The activPAL™ is a small, thigh-worn device for assessing posture and is the preferred measurement instrument for assessing changes in occupational sitting [67, 68]. Participants wear the device continuously for seven days (during waking/sleeping hours and water-based activity) to provide adequate reliability [68, 69]. Following recommended procedures [69], we will isolate and determine changes in accumulated sedentary time whilst at work as our primary outcome.
<i>Secondary</i>	
Sedentary time in workplace (subjectively measured)	The Occupational Sitting and Physical Activity Questionnaire (OSPAQ) will be used as a secondary measure given the favourable validity and reliability properties of this instrument [67, 68].
Sedentary behaviour (overall)	The activPAL™ device to assess changes in: Prolonged sitting time in the workplace (bouts of \geq 30 minutes) Total sedentary time (i.e. including time outside the workplace such as at home and leisure time); workplace & total standing time; workplace & total sit-to-stand transitions
Physical activity	Physical activity will be assessed using both objective and subjective instruments. Objective: activPAL™ device to assess changes over time in workplace and total stepping (utilising the stepping variable derived from the activPAL™ monitor) Subjective: The International Physical Activity Questionnaire (long), last 7 days self-administered [68] will be used to quantify time spent in different domains of physical activity. This validated and reliable instrument assesses occupational, transportation, housework and recreation/leisure-time physical activity.
Productivity	Objective measures of productivity may include: absenteeism, presenteeism, call handling time, time spent talking, time spent on hold, time spent wrapping up a call, attendance, or sick leave. Subjective measures will be assessed using the Utrecht Work Engagement Scale and other measures in similar studies [69-70].
Mental wellbeing	Warwick-Edinburgh Mental Well-being scale (WEMWBS) [71]
Musculoskeletal health	Roland-Morris Disability Questionnaire: validated 24 item tool to measure back pain [72]
Activities	Questionnaires developed by the researchers to measure use and preference.
Staff turnover	Number of people leaving and number of new joiners over the study period (both in the contact centre as a whole and in the people taking part in the research)

We will also collect data on demographics (age, gender, medical conditions which may impact on sedentary behaviour), activities use and preference; staff turnover.

Data collection timepoints

In order to minimise cost and participant burden for this trial, and since the main purpose of the trial is to test study processes and procedures, data will only be collected at a maximum of three occasions per site: at the end of the control period, and at 3 and 6 months after the end of the intervention in each site. Sites 1 and 6 will not have a control period, and sites 5 and 10 will not have a post-intervention period, in order to minimise the duration of the study for which there is no concurrent vertical comparison between control and post-intervention periods. To increase the response rate, participants will be paid a small amount (£5 end of control period and £10 for 3 months data) for taking part in data collection.

Assessment of unanticipated outcomes

We will provide each contact centre with a sheet to record harms such as injuries as a result of using the equipment. The contact centre staff will be made aware of this and be asked to record any harms they think are a result of the intervention. We will ask them to detail the type of activity where the harm occurred, the type of harm (e.g. injury) and the date and time. We will collate this data from all contact centre every three months. We will also use the focus groups as a way of eliciting any unintended consequences. Adverse events will also be a standing item on all Study Management and Study Steering Committee meetings.

Control/comparator group

Waiting list control – all 10 sites will receive no intervention for between 3 and 12 months after study set-up is complete; then they will receive the intervention.

Statistical analysis

The statistician will be blind to the allocation of the contact centres. The analysis and presentation of results will adhere to CONSORT guidance [73], and a statistical analysis plan. The analyses will be exploratory to investigate if it's feasible to fit such a model in a future trial. We will not interpret the results as confirmatory and it is not the primary analysis of the trial.

Sedentary time in the workplace and all continuous secondary outcomes will be analysed using linear mixed effects regression analysis; including site and participant as random effects; and adjusting for calendar time since start of study, season (spring, summer, autumn, winter), and an indicator variable for whether the intervention has been implemented or not as fixed effects. Using observed data from all participants, 95% CI of the intervention effect sizes will provide a guide to indicate the likely effect sizes that we will observe in a future study. Sensitivity analyses will be incorporated to explore the effects of missing data and staff turnover to aid the design of a definitive trial. The assumptions underlying the sample size calculation performed by a similar study [49] will be tested and compared to the estimates we calculate using real data from the feasibility trial (e.g. standard deviation, within-site correlation, intra-cluster correlation coefficient) to inform the power calculation for a future trial. The heterogeneity of quantitative outcomes across sites (e.g. estimated via intra-cluster correlation coefficients) and variability in intervention delivery and processes across sites is of particular interest.

Information gathered from this feasibility study will help determine the feasibility of conducting a future multi-site study with a larger number of contact centres.

Process evaluation and qualitative study: (Aim 1)

We will use the **RE-AIM** framework (Reach, Effectiveness, Adoption, Implementation, Maintenance) as a framework to guide the process evaluation. RE-AIM was developed to translate research into practice [74]. We will use both quantitative and qualitative methods to explore the elements of RE-AIM:

Reach: the number of people (and %) in the contact centres who a) take part in one or more activities in the various components of the intervention; and b) take part in the research.

Effectiveness: this is not the primary outcome but we will be measuring whether there are indicators of effectiveness using the outcome measures described earlier

Adoption: we will explore through focus groups and talking with key stakeholders the degree to which the intervention was adopted. We will also measure engagement in the two workshops, and use of the website and other resources.

Implementation: we will be in regular contact with the SUH implementation group in the contact centres to assess which activities were implemented by the contact centres and why; whether all the theories of change had a corresponding activity which was implemented.

Maintenance: maintenance is a key feature of the intervention, so we will speak to contact centre staff (particularly the SUH implementation group) after 9 months (in contact centres that received the intervention early on) to assess the degree to which the activities have been maintained or dropped.

Qualitative study

We will conduct an in-depth qualitative programme of research comprising of focus group discussions with a representative sample of the contact centre workforce and individual interviews with key stakeholders (i.e., members of the SUH Implementation group). Primarily, the qualitative component of our evaluation seeks to gather views and experiences of the SUH intervention activities, and implementation processes with a view to refining the Theories of Change (see Table 1) and the overall Programme Theory for SUH (see Logic Model upload). With contact centre workers, we will look to elucidate the specific mechanisms of change describing potential causal mechanisms for how SUH activities could impact on the specified short- and medium-term outcomes such as a reduction in sedentary behavior at work. We will also seek insight into why the SUH activities may not have worked as intended and any unintended consequences of the intervention. With key stakeholder interviews we will look to explore whether the process of implementation worked as intended across the different levels of the intervention activities.

The proposed study methodology will also be used for triangulation of quantitative evidence and stakeholder perceptions across multiple organisational structures, sectors and job roles. This component of our evaluation will contribute to enhancing the acceptability, reliability and replicability of future interventions in this setting. Given that there is considerable variation across the implementation of current workplace-based health policies and initiatives, this research will look to explore the generalisability of findings and identify any alternative factors influencing sedentary

behaviour and physical activity in the contact centre setting. We will also explore whether and why there are differences in aspects of study procedures (e.g. uptake, retention) between different contact centres and the reasons for these. A key outcome of this study will be to develop and refine the programme theory which would be used to help guide the evaluation of any subsequent effectiveness trial.

Sampling

Sampling will be purposive to ensure broad representation based on amount of involvement in the activities, as well as gender, age and staff member (e.g. manager, supervisor or call handler).

Data collection

One focus group will be conducted at each intervention site (10 groups in total; approx. n = 60 individuals) with contact centre staff that took part in the activities and the research. Additionally, one individual interview will take place in each site with key stakeholders involved in implementation. These will take place after 5 months. This will give contact centres time to implement the intervention fully, and participants time to try out the activities. The topic guide (focus groups with participants) and interview schedules (stakeholders) will be based around the programme theory exploring where appropriate; views and experiences of the intervention activities (and implementation of these) and impact on short- and medium-term outcomes. Additionally, we will collect qualitative data on key components of the RE-AIM framework; adoption, implementation and maintenance.

Data analysis

Data will be transcribed verbatim, anonymised, and coding will be performed by at least two members of the research team. Codes will be developed based on RE-AIM and the programme theory. Analysis will be based on the elements of RE-AIM and the programme theory and will be coded for both inductive (emergent themes) and deductive (data driven themes). We will examine divergence and similarities across the contact centres to develop a comprehensive understanding of how the theories of change operate across a range of contact centres and also assess the mechanisms of change, implementation, sustainability and potential for a larger effectiveness study.

Development of a health economic study (aim 3)

The health economic component of the study (Research question 8) will aim to lay the ground work for a health economic component of any future definitive trial, from a) an NHS and PSS perspective (Following the NICE reference case [75], and b) an employer's perspective (which may be important at an implementation stage to leverage commercial support). With regards to a), while it is possible that fitness level improvement may be observable within a trial, it is not anticipated that such fitness would be likely to translate into changes in "hard" health outcomes or patterns of healthcare utilisation (ie primary or secondary care utilisation) within an observable trial period, hence standard within trial analysis is not appropriate. Instead the health economic component of the study will focus on scoping the possibility for future economic modelling of longer term outcomes through consultations with managers and clinicians regarding possible model structures and associated data sources, with targeted literature searches for potential parameter sources where identified. If appropriate this may be extended to include employer perspective outcomes. Within trial

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observations will be limited to estimates of the cost of direct implementation costs (such as workstation adjustments, information sessions or similar) presented alongside descriptive statistics regarding the utilisation of each, and measures of workplace productivity reported. The latter will be determined through consultation with local management to identify measures most useful to the participating sites, though it is anticipated that these will include most of those outlined in Table 3.

Outcome	Measure
Absenteeism	WHO HPQ absenteeism and presenteeism questions
Presenteeism	WHO HPQ absenteeism and presenteeism questions
Productivity	Could include (depending on the contact centre): call handling time, time spent talking, time spent on hold, time spent wrapping up a call .
Quality of Life	EQ-5D

Progression criteria

We will proceed to a future larger study if all of the following are satisfied:

1. 95% confidence intervals for the primary outcome includes a clinically relevant reduction in sedentary time of 45 minutes per day or greater in favour of the intervention. This would reflect substantial progression towards accumulating recommended quantity of 2h/day standing/light activity during working hours [54] for employees in predominantly desk-based occupations.
2. Intervention successfully delivered in at least five of the sites within the study period, if at least one person in each site was able to use/experience at least one activity.
3. At least 10% of employees at a site were able to use/experience at least one of the intervention activities in the sites at which the intervention was successfully delivered.
4. Out of all the participants using/experiencing at least one of the intervention activities, primary and secondary outcome data was collected in at least 75% of participants overall.
5. Contamination between sites is low or else it is envisaged that contamination can be addressed in the study design of a future study.
6. It is envisaged that any practical difficulties in delivering the intervention across multiple sites or in measuring effectiveness can be overcome when conducting a future large-scale study.

Scalability and translation

This intervention is designed to be scalable and transferrable into other contact centre settings in the UK and internationally. It is also transferable into other workplace settings. The reason why we have not specified activities (or fidelity to particular activities) is to allow for flexibility, scalability and transferability to different contexts. We recognise that some contact centres will have more resources and assets than others which is why we have suggested a range on activities which can all activate the theory of change. As it is the theories of change which are the most important aspect of the intervention, it is adaptive to all contact centres. It is designed so that the contact centre can implement the intervention at little or no cost.

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Socioeconomic position and inequalities

Many contact centres are located in areas such as the North East of England and part of Scotland which have been traditionally industrial. Since the late 1970s, many towns and cities across the UK have faced processes of deindustrialisation and now rely on new forms of insecure, flexible service sector employment, such as contact centres [76]. The workforce is primarily unskilled, has lower than average wages, and a higher proportion of women and part-time workers. The job involves rigid practices and a focus on productivity and customer satisfaction. As such this is an intervention targeted at a workforce, which has less than optimal working conditions, and live in areas with higher levels of disadvantage.

Dissemination, Outputs and Anticipated Impact

The study outputs relate to the feasibility of the study design and methods, as well as testing and refining the intervention. At the end of the study we anticipate having a fully tested intervention which has the best chance of success. We also expect to have enough evidence on the feasibility of the study design to proceed to a larger outcomes evaluation. Study outputs will be maximised through a dissemination strategy that will be finalised following further discussions but will involve the following elements:

- i) the Study Steering Committee (SSC) will provide infrastructure for partners to interact and create a forum for sharing research findings and offering the opportunity for immediate feedback on implementation and implications of the findings;
- ii) we will develop press releases and send to local and national media outlets to update them on study findings; we will make findings publicly available on the SCPhRP website
- iv) lay summaries of academic outputs will be made publicly available on the SCPhRP website and in relevant industry publications (e.g. newsletters and magazines);
- v) short evidence summary for politicians/policy makers;
- vi) social media including twitter to disseminate the findings; explore the potential of creating materials such as YouTube videos and infographics.

vi) We will have two forms of academic outputs: 1) presentation at international and national conferences (e.g. ISPAH 2020 <http://www.ispah.org/vancouver-2020/>; Health and Wellbeing at Work <http://www.healthwellbeingwork.co.uk>; Work Disability Prevention and Integration Conference <http://www.wdpi2019.dk> and 3-4 peer reviewed publications.

Publication strategy

We will intend to publish papers on the methods and findings in journals such as Occupational Medicine, BMC Public Health and PLOS one. As this is a feasibility study we are not anticipating any major impact. However, we anticipate that we can increase awareness of the intervention in the contact centre industry which will mean that any effectiveness study has a better chance of recruiting a large number of contact centres. We will work with the SSC if we are successful to develop a publication strategy

Products of the research

We intend to produce a well theorised, acceptable and sustainable intervention to decrease sedentary behaviour in contact centres which has well-recognised branding. We hope to have a

website that has all the information and resources needed for contact centres to implement the intervention and promote the intervention to others. We also intend to develop a variety of resources to supplement the intervention such as short reports, blogs and vlogs.

Engagement with the wider population

We will inform contact centres and the wider workplace through industry events - either by talking at the events or having a stall at the events. We will also use our social media platforms to communicate with industry. We will work with our industry stakeholders on the SSC to develop an engagement plan. The intervention is designed so that all the costs of the intervention are borne by industry, so it is important that they see the benefits to their organisation as well as the benefits to staff. So we will not only focus on the health benefits, but also the impact on outcomes such as productivity, absenteeism and customer satisfaction.

How the outputs will enter our health and care system or society as a whole

The output will enter our system through the dissemination of findings, the branding we have produced, and through social media and our website.

Further funding or support required if this research is successful

The next stage would be to undertake a larger effectiveness study and for this we would have to have support from a funding body such as NIHR. We would also want the support of the contact centre industry.

Possible barriers for further research, development, adoption and implementation

This is a feasibility study and we anticipate that the next stage will be an outcomes evaluation. The barriers to further research would be primarily that contact centres do not see the value of the intervention and do not want to take part in the study. In terms of future development, adoption and implementation, we have created an adaptive low cost intervention which is designed to be implemented in any contact centre setting. We have already had interest from researchers in New Zealand and Australia who would like to evaluate the intervention. Because it is an intervention built upon theories of change rather than specific activities, there are no specific IP issues. However, we would expect that people using the branding would adhere to the theories of change and some of the specific design features (e.g. the workshops to create ownership and prioritise activities; and the SUH implementation team). SUH is an easily scaled up intervention that could also be applied in other workplace settings. The health costs of sedentary behaviour include absence due to musculoskeletal issues, and the long term contribution it makes to chronic conditions such as diabetes. The non-health care costs relate to the economy, and costs such as low productivity/low presentism due to sitting for extensive periods.

Project / research timetable

Project Gantt chart

Months	Tasks	Key milestones
1-2	University ethical approval and preparation of study materials. Recruitment of contact centres begins	Ethics approval obtained
3	Recruitment and randomisation of contact centres. Recruitment of study participants	
4-6	Intervention and control period start. Data collection	Intervention starts Quantitative data collection starts
8 - 12	Focus groups begin and run for several months in the different sites	Qualitative data collection starts
13-17	Intervention and data collection continues Analysis of data begins	
18-21	Analysis and write up	Intervention period ends Quantitative data collection period ends. Analysis completed. Report and papers written

Project management and governance

The project is sponsored by the University of Edinburgh and funded by the National Institute for Health Research (NIHR). We will register the trial with the International Standard Randomised Controlled Trial Number Register prior to starting and will submit the trial protocol for publication. Ruth Jepson (PI) will be responsible for ensuring that the study is carried out with strict adherence to the principles of good governance. We will establish a study steering committee (SCC), which will meet twice a year (once face to face) for the duration of the project. The SCC will comprise researchers, experts on workplace health, and staff (at different levels) from contact centres.

Ethics / Regulatory Approvals

The study will be conducted in line with MRC guidelines and the ESRC ethical framework. Ethical approval will be sought from the Health in Social Science ethics committee, University of Edinburgh. **Informed consent:** Whilst the employees do not have to provide informed consent to take part in the intervention activities, they will have to provide informed consent to take part in the research (the quantitative and qualitative data). We will provide them with information sheets and consent forms. It will be made clear that participation or not in the research will not affect their work contracts or roles.

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Data storage: Questionnaire data will be stored anonymously using numerical identification codes in a locked cabinet. Interviews and focus groups will be recorded using encrypted digital devices. Audio files will be sent to an authorised transcription service using a secure file transfer link, transcribed and then anonymised by the study team. All data will be stored on password protected university networked computers. A separate database of participant names and unique identification numbers will be stored securely and in a separate location to the study data. In reporting the results of the qualitative data and process evaluation, care will be taken to avoid the identification of participants through quotations.

Patient and Public Involvement

Public involvement (in this case, contact centre staff) is at the heart of this intervention, and we hypothesis that this is the only way to make it an acceptable, sustainable and successful intervention. Contact staff (at all levels) are encourage to work with us to develop activities that will work for them, and encouraged to take ownership of both the problem and the solution. We have successfully tested the intervention in a single contact centre, and staff from that contact centre will be invited to be on the Study Steering Committee and also to work with us to develop content for the website and social media.

Project / Research Expertise

The team brings together expertise in intervention development and evaluation, physical activity and sedentary measurement, statistics, workplace health promotion and health economics.

Ruth Jepson is Director of the Scottish Collaboration for Public Health Research and Policy. She will be the PI on the grant. She is PI on a NIHR PHR funded project (Is 20mph plenty for health?; PhR 15/82/12). Ruth was part of the team that developed the 6SQuID framework and has expertise in intervention development and evaluation. Ruth Jepson will be the PI and will be responsible for project management, and ensuring all milestones are completed in a timely and robust manner. She will be the line manager for the research assistants.

Graham Baker is a Lecturer in Physical Activity for Health and has expertise in the measurement of sedentary and physical activity behaviours. Graham also has expertise in qualitative methods and currently leads a qualitative work-package as part of an NIHR PHR funded project (Is 20mph plenty for health?; PhR 15/82/12) evaluating the programme theory and effects of a complex public health intervention on health inequalities.

Richard Parker is a Senior Statistician based in the Edinburgh Clinical Trials Unit. He has statistical expertise and expertise in designing and running cluster randomised controlled studies and stepped wedge evaluations;

Andrew Stoddart is a senior health economist working with 7 years experience in clinical trials. He has an active interest in costing methodology and the application of routine data linkage in health technology assessment, particularly in the estimation of service costs and/or remote patient follow up

Scott Lloyd is Advanced Public Health Practitioner for Obesity, Physical Activity and Settings at Public Health South Tees, a shared service for both Middlesbrough Borough Council and Redcar & Cleveland Borough Council. He has held lead roles in workplace health programmes since 2005 including supporting at least eight call centres to improve the health of staff with demonstrable results. His role in the study will be to assist with the recruitment of call centres via the North East

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Better Health at Work award (engages over 400 employers in North East England including a number of large call centres) and to provide expert advice and guidance, including making links with trade unions

Resources

We have received a total of £343,387.79 from NIHR to cover the following costs:

Website and online resources (£8,000): £8000 will be used to cover the costs of developing and maintaining a website/webpage over the duration of the study. The website will mainly serve as a resource for the contact centres involved in SUH, but will also help to promote SUH to other contact centres. We will work with a group of contact centre employees to develop the content of the site, but expect it to contain information about the study, resources and links to other similar interventions, blog posts, links to the SUH social media (instagram, Facebook, twitter). We hope that the website will help develop a sense of community amongst the contact centres and may will provide the opportunity for share learning and even competitions between the contact centres.

Equipment (£3200): in the pilot study we had a small amount of equipment that we would take to the workshops to enable the employees to try out before the contact centre committed to purchasing it. We loaned some of the equipment our during the intervention period, whilst encouraging the staff to bring in unwanted items from home, and making them aware of deals in local shops. By the end of the intervention period and in the subsequent months, the pilot site invested in the equipment that the staff liked and used, whilst not spending money of equipment that lay idle. We need some additional equipment to take with us to the contact centres as we will be implementing the intervention in several sites simultaneously.

Payment to staff for completing surveys (£4800): one of the difficulties in any studies is obtaining complete data. To minimize the risks we intend to pay each research participant £5 for the first round of data collection and £10 for the second round of data collection.

Focus groups (1700): We estimate that £1700 will cover the costs of room hire, refreshments, payments for participation (£15) and transcription costs.

Travel and Subsistence (£5,200): the call centres will be located in various regions of Scotland and the North East of England and potentially other areas of England. The researchers will be expected to make at least 5 site visits to each site to set up the project, deliver the workshops and collect data (both qualitative and quantitative) at an estimated cost of £2800. We estimate that £2400 will cover the costs and subsistence for members of the Study Steering Committee and the Project Team to travel to Edinburgh up to four times during the study period.

Dissemination Costs (£8000):

Conferences (£3000) we will attend one international conference relevant to the project (£3000 total)

Open Access (£3000) publish two papers in open access journals

Other (£2000): design and print out reports to be sent to every contact centre in the UK

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Patient and Public Involvement Costs (£1,600.00): We anticipate having four members of the public on the Study Steering Committee and will pay them £110 per meeting.

Success criteria and barriers to proposed work

We will measure success by whether we are able to implement the intervention successfully, engage contact centres and staff in the research and reach a decision as to whether to proceed to a full trial. There are four main risks which is why we are undertaking a feasibility study:

1. Contact centres will not want to take part
2. Individuals will not want to take part in either the intervention or the research component
3. Individuals will not take part the data collection or complete all parts of the data collection
4. Injuries: Any injuries are likely to be similar to those gained in a gym or by taking part in any other intervention to reduce sedentary behaviour. As such, the benefits outweigh the risks associated with the study. We will undertake a risk assessment of all equipment.