Development and evaluation of a multi-component intervention to help call agents to sit less and move more at work.

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Abstract

Sedentary behaviour (SB) and physical inactivity are risk factors for non-communicable diseases, morbidity and premature mortality. Conversely, reducing total and prolonged SB and increasing physical activity (PA) can improve cardiometabolic and musculoskeletal health, wellbeing, and improve work outcomes such as absenteeism and productivity. In the UK, ~766,000 adults are employed within call centres. Worryingly, contact centre call agents spend ~90% of their working day seated, which can negatively impact cardiovascular and metabolic health, presenteeism and productivity. Despite knowing the relationships between SB, PA and health, little research has been conducted within the contact centre setting to develop robust SB and PA interventions for call agents. The overarching aim of this thesis therefore was to develop and evaluate a multi-component intervention to help call agents to sit less and move more at work. Three empirical studies were undertaken to achieve this aim;

Study 1 explored factors influencing call agent's workplace PA and SB and strategies perceived to help agents move more and sit less at work. Fifteen focus groups and interviews were conducted across four contact centres in the North West of England and perspectives were captured from three key stakeholder groups including; call agents (*n*=20), team leaders (*n*=11) and senior team leaders (*n*=12). Thematic analysis revealed insights into the impact of high occupational sitting and low PA on call agents physical and mental health, and factors influencing their motivation to move more and sit less. Team leaders, although pivotal, identified their own workload, and agents' requirement to meet targets, as factors influencing their ability to promote agents to move more and sit less at work. Senior team leaders offered a broad organisational perspective into the business needs and importance of return on investment from PA and SB interventions. Unique factors including continuous monitoring of productivity and personal time, a physical connection to their workstation, and low autonomy over working practices, seemed to limit call agent's opportunity to move more and sit less at work. Proposed strategies were acknowledgement of PA and SB within policy and job roles, height-adjustable workstations, education and training sessions, and greater interpersonal support. Evaluating the impact of interventions was perceived key for developing a business case and enhancing organisational buy-in. Multi-level interventions embedded into current working practices appeared important for the multiple stakeholders, while addressing concerns regarding productivity.

Study 2 used a mixed-methods approach to explore the feasibility of an 8-week non-randomised pre-post SB and PA intervention in one contact centre. Six of 20 team leaders were recruited, with 17 of 84 call agents *(*78% female, 39.3±11.9 years) completing

baseline assessments and 13 completing follow-up. High workload influenced agent and team leader recruitment. Call agents perceived data collection as acceptable, with strategies needed to enhance fidelity. Education sessions, height-adjustable workstations and weekly emails were perceived as the most effective intervention components; however, height-adjustable hot-desks were not feasible. The intervention was largely perceived positively, with call agents and team leaders describing numerous perceived benefits on behavioural, health and work-related outcomes. This study identified unique, pragmatic considerations for conducting a multi-level, multi-component PA and SB intervention and associated evaluation in the challenging contact centre setting.

Study 3 evaluated a pilot randomised controlled trial of a multi-component intervention, with (SLAMM+) and without (SLAMM) height-adjustable workstations, in one contact centre. Process and outcome evaluations assessed the response, recruitment and attrition rates, outcome measure completion rates, acceptability of randomisation and the interventions, adverse effects, and derived estimates of preliminary effectiveness. Stakeholders perceived the recruitment, randomisation, data collection and intervention delivery as acceptable, though fluctuating call volumes impacted offline time for agents for data collection and education and training sessions. 59 of 213 eligible call agents (68% female, 30.9±11.6 years) completed baseline, with 39 completing 12-week assessments. There were no adverse events reported. Except height-adjustable workstations, call agents in both arms ranked the individual feedback, education sessions, and weekly emails as the most important intervention components for moving more and sitting less at work, with team leader support, Stand Up Champions and daily logs least important. Both interventions reduced total and prolonged sitting time at work, and a significant difference in mental health was found in SLAMM+ relative to SLAMM at 12 weeks, although more strategies to promote increased PA for both arms are warranted.

Overall, the thesis has indicated that following the MRC framework has produced two interventions that appear acceptable in the contact centre setting, and, appear to have positive effects on sitting time, but not PA. Numerous perceived benefits were highlighted across health and work-related outcomes, although unique challenges highlighted in particular, the ongoing challenge surrounding scheduling offline time for call agent in this setting. Interventions need to be embedded into working practices to minimise concerns regarding productivity. Future research should seek to refine the intervention based on the findings from this thesis and evaluate the short and longer-term effectiveness of a full scale multi-component intervention with and without a height-adjustable workstation on behavioural, cardiometabolic, psychosocial and objectively measured work outcomes. If the findings are replicated in larger trials, it could inform changes to policy and practice for the benefit of employees and employers.

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PhD

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PhD+

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This thesis is dedicated to you Bruv.

Declaration

I declare that the work contained within this thesis is entirely my own.

Publications

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Communications

Conference	**Presentation title, authors, date and location**
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International Society of Behaviour Nutrition and Physical Activity *Poster*	**Factors influencing call agents physical activity and sedentary behaviour within contact centres.** Morris, A.S., Murphy, R.C., Shepherd, S., Graves, L.E.F. June 2017 Vancouver Canada
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RISES Seminar *Oral*	**An evidence-based workplace intervention for call agents:** **A 'real-world' project.** Morris, A.S., Murphy, R.C., Shepherd, S., Graves, L.E.F. November 2017

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Table of contents

List of tables

List of figures

Abbreviations

Sedentary behaviour	SB
Physical activity	PA
Light physical activity	LPA
Moderate physical activity	MPA
Moderate-vigorous physical activity	MVPA
Body mass index	BMI
Systolic blood pressure	SBP
Diastolic blood pressure	DBP
High-density lipoprotein	HDL
Low-density lipoprotein	LDL
Randomised controlled trial	RCT
Consolidated standards of reporting trials	CONSORT
Template for intervention description and replication	TIDieR
Socio-ecological model	SEM

Chapter 1.

Introduction

1.1 Background

Physical activity (PA) is defined as 'any bodily movement, produced by the skeletal muscles that results in energy expenditure' (Caspersen, Powell and Christenson, 1985 p. 126). Higher levels of PA throughout the life course is widely supported in the interest of public health promotion and disease prevention (Department of Health, 2011). Physical inactivity is the failure to meet the PA guidelines of 150 minutes of moderate PA (MPA) in bouts of ≥10 minutes, or 75 minutes of vigorous PA (VPA) each week (Department of Health, 2011). Reducing population levels of physical inactivity is crucial as it is the fourth leading cause of premature mortality (Kohl et al., 2012; Lee et al., 2012) and accountable for up to 80% of cardiovascular disease, type 2 diabetes, stroke and over a third of cancers (World Health Organization, 2014). Worryingly however, it is estimated that 40% of men and 28% of women in England are physically inactive (Department of Health, 2011), with 4 in 10 UK adults aged 40-60 years walking for less than 10 minutes at a brisk pace each month (Public Health England 2018). There are also concerns that the subjective measures used to calculate national PA statistics grossly overestimate PA for a large proportion of the UK adult population (Scarborough et al., 2011; Marteau, 2018).

In addition to the pandemic of physical inactivity (Kohl et al., 2012), sedentary behaviour (SB) has emerged in recent decades as a distinct risk behaviour. Sedentary behaviour (SB) is defined as "*any waking behaviour in a seated, lying or reclining posture with an energy expenditure ≤ 1.5 metabolic equivalents of task*" (Tremblay et al., 2017p.5). Higher levels of SB are associated with all-cause and premature mortality and the development of chronic diseases such as cardiovascular disease, diabetes and some cancers (Biddle et al., 2016), with negative effects present after accounting for levels of moderate-to-vigorous PA (MVPA) (Bankoski et al., 2011). Further, in today's largely inactive population, the automation of many daily activities, including in the workplace, means that there is a greater risk of individuals becoming more sedentary than less physically active

(Maddison et al., 2016). Thus, encouraging individuals to increase PA and reduce SB to delay or prevent the onset or deterioration of chronic conditions appears a pertinent public health message.

In addition to the public health benefits, the prevention of poor health through PA promotion and SB reduction will have significant economic benefits. For example, the cost of cardiovascular disease in the UK alone is at an estimated £30 billion per annum through associated costs to the National Health Service and sickness absenteeism in the workplace (Scarborough et al., 2011). Improving the physical and mental health of working adults appears especially important for employers, as poor mental health is the third leading cause of absenteeism in the UK, accounting for 11.5% (~15 million) of days lost per annum (Office for National Statistics 2016). Another leading cause of absenteeism is musculoskeletal symptoms, accounting for 22.4% (~31 million) of days lost per annum (Office for National Statistics 2016). Further, the extent to which physical or psychological symptoms such as musculoskeletal discomfort and mental health adversely affect the work productivity of individuals who choose to remain at work is anticipated to cost between 1.9 and 5.1 times more than sickness absenteeism due to losses in productivity, worker errors and reduced ability to maintain company standards (Brown et al., 2011). This is supported by the workplace being identified as a key target setting for PA promotion and SB reduction (Buckley et al., 2015; NICE, 2016).

Employed adults in the UK typically spend up to two thirds of their waking hours at work (Black, 2008). While the modern workforce is increasingly reliant on technology and ergonomic aids to promote optimum productivity and profitability (Parry and Starker, 2013), a typical desk-based environment often negates PA and promotes SB in frequent and prolonged bouts (Thorp et al., 2012), which is considered a distinct ergonomic hazard for employee musculoskeletal health (Burton, 2010), as supported by up to 92% of office workers reporting some musculoskeletal symptoms (Widanarko et al., 2011). Furthermore, high levels of occupational SB (>6 h/workday) are associated with an

increased incidence of anxiety (Teychenne, Costigan and Parker, 2015; White et al., 2017) and depression (Rebar et al., 2014). Individuals who engage in the highest quartile of SB and lowest quartile of PA across all domains have shown an increased risk of experiencing psychological distress (namely anxiety and depression) than those who are less sedentary and more physically active (Hamer, Coombs and Stamatakis, 2014). Thus, the highly sedentary nature of many desk-based occupations appears a contributing factor for both poor physical and mental health.

In the UK, ~4% of the working age population (~766,000 adults) are employed in contact centres as call agents (Babel, 2015). The work of a call agent is typically monotonous in nature (Sprigg, Smith and Jackson, 2003) and characterised by a high volume of customer service interactions that rely on telephone and computer assistance (Toomingas, 2005). Compared to traditional desk-based workers, call agents have less perceived autonomy over their working tasks (Sprigg, Smith and Jackson, 2003) and spend more time at work sitting (90% vs. 77%), often in periods of ≥30minutes (Thorp et al., 2012; Toomingas et al., 2012; Straker et al., 2013). Call agents also report significantly lower job satisfaction and higher job-related anxiety and depression than traditional desk-based workers in clerical, secretarial, technical support and professional jobs (Sprigg, Smith and Jackson, 2003) and are more likely to be obese than customer service or retail workers (Thorp et al., 2012). This suggests that the distinct nature of contact centre work exposes call agents to a greater risk of the deleterious effects of high SB and low PA than traditional office workers who sit for comparably less time and experience greater autonomy over their working tasks. To date however, minimal research has explored the potential impact of reducing total and prolonged SB and increasing PA on cardiometabolic, wellbeing and work related outcomes within the contact centre setting.

The socio-ecological model (SEM: Figure 1.1) suggests that human behaviour, such as PA and SB, is multifaceted and influenced by a complex system of interrelated factors that simultaneously act upon an individual at any one time. These factors can be grouped

according to level, with levels in the SEM including intrapersonal, interpersonal, environmental and organisational (Sallis, Owen and Fisher, 2008). In line with the SEM, previous research has sought to identify the multiple factors influencing PA and SB at work. Across desk-based occupations, common barriers to sitting reduction and occupational PA include productivity concerns from increased breaks, the sedentary nature of desk-based jobs, and high workload (De Cocker et al., 2015; Hadgraft et al., 2018). Similarly, in an emergency contact centre setting, call agents reported that workload took precedence over strategies to sit less (Chau et al., 2016a). Sitting at work is typically recognised as a habitual behaviour, with desk-based workers often unsure of alternative strategies to break up sitting time throughout the day (De Cocker et al., 2015). Culturally, perceived social norms have been identified as a major barrier to reducing sitting time and increasing incidental PA at work (De Cocker et al., 2015; Such and Mutrie, 2017). A common perception surrounding PA strategies were that they have the potential to disrupt co-workers and could be perceived as 'strange' or unproductive among management and colleagues (Hadgraft et al., 2016b). The working environment appears to further compound these behaviours due to office furniture facilitating seated postures, and the layout of buildings minimising opportunities for incidental PA (Hadgraft et al., 2018). To help overcome these common barriers and foster a working culture that supports sitting less and moving more, increased management and co-worker support appears an integral workplace strategy (Chau et al., 2014; De Cocker et al., 2015; Hadgraft et al., 2018). For management, a key driver for enhancing organisational buy in, and implementing PA and SB strategies, is cost effectiveness (Mackenzie, Goyder and Eves, 2015), and justification of return on investment for implementing costly strategies such as height-adjustable workstations (Hadgraft et al., 2018). In summary therefore, evidence suggests that multiple factors influence PA and SB at work, however most research to date has been conducted in traditional desk-based workers, with less known about the contextual factors influencing high SB and low PA among contact centre workers prior to the development of formal intervention strategies.

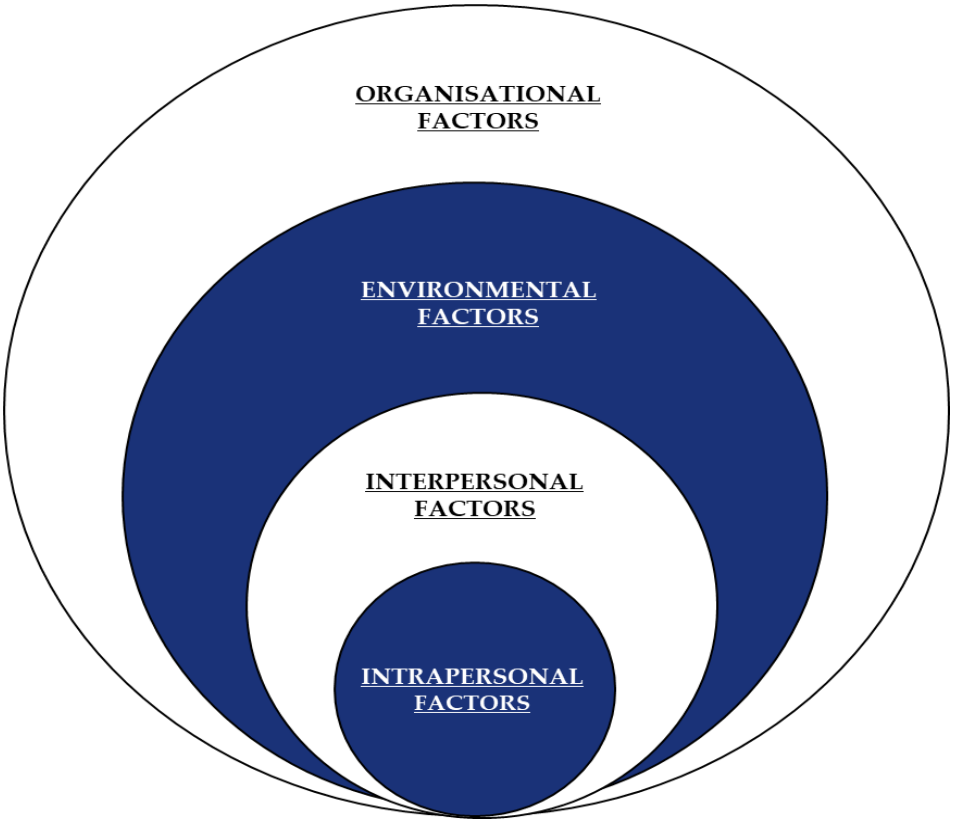

Figure 1.1 A schematic of the ecological levels of influence on human behaviour.

A review of workplace SB interventions identified that the greatest reductions in sitting time have been observed following the implementation of height-adjustable workstations compared to other strategies such as policy changes and counselling (Shrestha et al., 2018b). This is supported by evidence that environmental changes exert the strongest influence over PA and SB than other factors (Marteau, 2018). Height-adjustable workstations appear an effective short-term strategy among desk-based workers for reducing sitting time (mean reductions of -77 to -100 min per 8 h/workday) (Neuhaus et al., 2014a; Shrestha et al., 2018b), with recent longer-term trials reporting significant and sustained changes in occupational sitting in real world settings after 12-months (Healy et al., 2016b; Edwardson et al., 2018). Importantly, a reduction in occupational sitting has been observed alongside beneficial changes to fasting glucose (Healy et al., 2017), body fat percentage (Danquah et al., 2017), sickness absence (Neuhaus et al., 2014b), quality of life and work-related outcomes (Edwardson et al., 2018). Despite significant changes in

sitting, few trials have achieved the minimum recommendation of a 2h reduction in sitting time (Buckley et al., 2015) at either short (3-month) or longer term (12-month) follow up (Edwardson et al., 2018, Healy et al., 2016b), and fewer trials have succeeded in promoting PA at work (Malik, Blake and Suggs, 2014; Healy et al., 2016b; Edwardson et al., 2018). This suggests there may be significant contextual and pragmatic factors influencing the ability to translate the workplace PA and SB recommendations into real world practice. Further, to date, only two trials have attempted to reduce SB and increase PA levels in the contact centre setting, and they were deemed to be of low quality due to a lack of randomisation, and the use of self-reported measures to determine changes in sitting or PA (Chau et al., 2016c; Pickens et al., 2016). Given call agents' high exposure to occupational sitting, there is a pressing need to develop interventions to encourage PA and SB in line with the current workplace guidelines for mutual benefits to health, wellbeing, productivity and absenteeism (Buckley et al., 2015).

Exploring key factors of influence on occupational SB and PA through formative developmental work is considered to be an important prerequisite to the implementation of formal intervention strategies (Craig et al., 2008). The Medical Research Council (MRC) framework for designing and evaluating complex interventions provides a systematic and phased approach to tailor interventions to the specific needs of populations within specific contexts (Craig et al., 2008) (Figure 1.2). The framework holds behaviour change theory as a central tenant and aims to enhance the effectiveness and sustainability of health behaviour change interventions at the evaluation and implementation phases (Michie et al., 2009). In the contact centre context, no previous research has used the MRC framework to guide the development and subsequent evaluation of a PA and SB intervention for contact centre call agents. The body of work presented in this thesis therefore offers a novel approach to developing tailored intervention strategies and contributes original knowledge to the development and feasibility/piloting phases of the MRC framework within this workplace setting. Findings may be important for informing the

development of larger scale trials and may have important implications for shaping future policy and practice for the mutual benefit of both employees and employers. While, the evaluation and implementation phases of the MRC framework are beyond the scope of this thesis, the concluding chapter sets out to provide recommendations for future research in this setting in light of the original research.

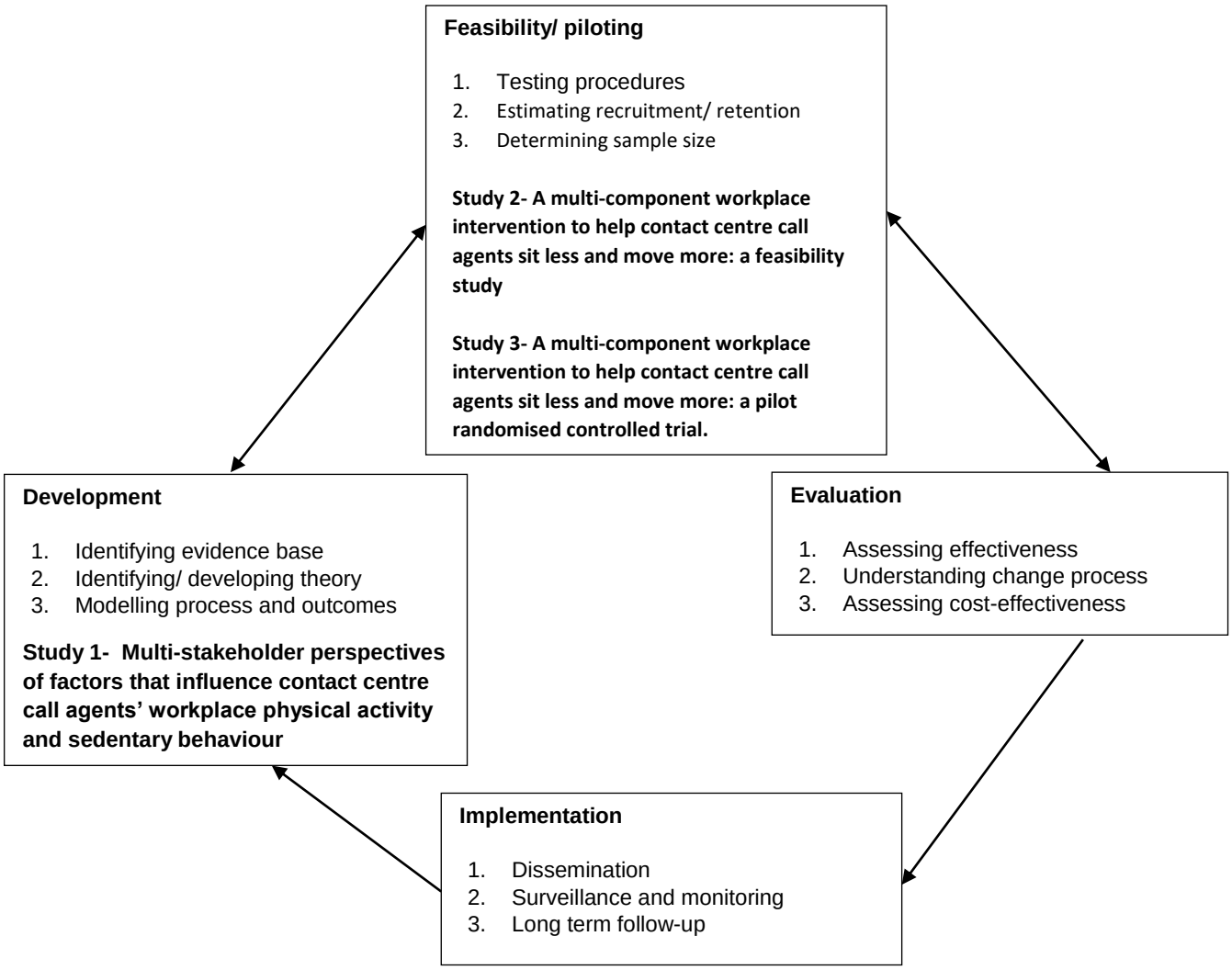

Figure 1.2. Key phases of the Medical Research Council framework mapped to the three empirical studies presented within this thesis. Evaluation and implementation phases are beyond the scope of the body of work presented.

1.2 Aims and objectives

The overarching aim of this thesis was to develop and evaluate a multi-component intervention to help call agents to sit less and move more at work. Three empirical studies were undertaken to achieve this aim;

Study 1 aim: To explore the factors influencing call agent's workplace PA and SB and to identify strategies that may help agents to move more and sit less at work.

- **Objective:** To use focus groups and interviews to explore the perspectives of call agents, team leaders and senior staff from multiple contact centres.

Study 2 aim: To explore the acceptability and feasibility of delivering and evaluating a multi-component SB and PA workplace intervention in the contact centre setting.

- **Objective**: To assess the response, recruitment and attrition rates, and completion rates for outcome measures. To explore the acceptability and feasibility of the intervention from participant and organisational perspectives.

Study 3 aim: To conduct a pilot randomised controlled trial (RCT) of a multi-component intervention with and without height-adjustable workstations in contact centres.

- **Objective:** To assess the response, recruitment and attrition rates, and completion rates for outcome measures. To assess the participant's acceptability of randomisation to an intervention with and without a height-adjustable workstation. To assess the acceptability of an intervention with and without a height-adjustable workstation from participant and organisational perspectives. To monitor any adverse effects, such as injuries and disruption to working practices. To derive estimates of the preliminary

effect of the interventions on sitting time at work, and other behavioural, health and work outcomes.

1.3 Organisation of the thesis

Chapter 1 has introduced the research problem, and target setting (workplace) and population (contact centre call agents) of this thesis. Chapter 2 builds upon the introduction and provides a literature review of key topics including the relationships between PA, SB and health, health promotion in the workplace, factors influencing PA and SB at work, and workplace PA and SB interventions. Chapter 3 describes the overarching process of intervention development including an overview of the underpinning pragmatic epistemology and behaviour change theory adopted throughout the thesis. Chapter 4 (study 1) is aligned to the developmental phase of the MRC framework and qualitatively explores the factors influencing call agents workplace PA and SB and identifies strategies that may help agents to move more and sit less at work. Study 2 (chapter 5) is aligned to the feasibility/piloting phase of the MRC framework and was informed by findings from study 1 and previous literature. Study 2 presents the acceptability and feasibility of delivering and evaluating an 8-week multi-component intervention in the contact centre setting. Chapter 6 (study 3) is aligned to the feasibility/piloting phase of the MRC framework and presents the acceptability, feasibility and estimates of preliminary effectiveness from a 12-week pilot RCT within a single contact centre. The intervention design and delivery in chapter 6 (study 3) were refined by the feasibility trial (study 2). Chapter 7 synthesises the results from each study in relation to the development and evaluation of a multi-component SB and PA intervention within the contact centre setting and discusses implications for future research, policy and practice.

Chapter 2.

Literature Review

2.1 Relationships between PA, SB and health

Engaging in regular PA has consistently been associated with a lower risk of all-cause mortality and premature mortality (Ekelund et al., 2016). Leading a physically active lifestyle can delay or prevent the onset of chronic conditions such as cardiovascular disease, type 2 diabetes, some cancers, and osteoporosis (Department of Health, 2011). Furthermore, there is a growing consensus that PA has a protective and attenuating impact on mental health, particularly in relation to the development of depression, stress and anxiety (Department of Health, 2011). Thus, the benefits of PA for the majority of the national and global population far outweigh any potential risks (Department of Health, 2011). In contrast, physical inactivity is positively associated with premature mortality and morbidity and is estimated to be responsible for between 6-10% of the global burden of disease (Lee et al., 2012; Forouzanfar et al., 2016). The greatest reduction in risk factors is observed when an inactive individual changes their activity and/or fitness level to low-to-moderate (Department of Health, 2011; Ekelund et al., 2016). Indeed, for an increasingly inactive population (Ng and Popkin, 2012), the growing health and economic costs are vast (Scarborough et al., 2011), with interventions urgently needed to address this public health pandemic (Kohl et al., 2012).

PA can be sub-divided by intensity as light PA (LPA; >1.5-2.99 metabolic equivalents of task (METs)), moderate PA (MPA; ≥3-5.99 METs) and vigorous PA (VPA; ≥6.0 MET) dependant on the amount of energy required for a task (Caspersen, Powell and Christenson, 1985). MVPA has consistently been associated with lower adiposity (Henson et al., 2017), lower BMI (Bakrania et al., 2017), improved BP (Miyashita, Burns and Stensel, 2008) and psycho-social health (Harvey et al., 2017), providing greater benefits to health per unit of time compared with PA performed at lower intensities. MVPA however typically accounts for <5% of daily living activities (<30 min/day), with sleep (40%), SB (40%) and LPA (15%) accounting for the other 95% of behaviour across a 24h cycle

(Chaput et al., 2014). The majority of daily energy expenditure therefore occurs during non-exercise or LPA (Hamilton, Hamilton and Zderic, 2007; Maddison et al., 2016). Despite this, LPA is not acknowledged within UK PA or workplace guidelines (Department of Health, 2011; Buckley et al., 2015).

Compared to MVPA, the extent to which LPA contributes to health is less understood. A recent systematic review and meta-analysis pooling data from 72 experimental and observational studies indicated that LPA has significant acute and long term benefits for adults cardiometabolic health and mortality risk, with the strongest effects among individuals with impaired metabolic profiles and high BMI (Chastin et al., 2018). Furthermore, a systematic review of 25 prospective studies found that self-reported PA, including both light and moderate PA, was negatively associated with onset of depressive symptoms over a 1-27 year follow-up (Mammen and Faulkner, 2013). Considering that one in four UK adults is affected by mental health issues (*Health survey for England*, 2014), and the prevalent lifestyle factor of physical inactivity is positively associated with poor physical and mental health (*Health survey for England*, 2014), a pertinent public health message for inactive individuals may be to increase LPA across daily volitional activities. This may be particularly appropriate in contexts such as the workplace where participation in formal PA programmes is typically low (Robroek et al., 2009) and perceived social norms and high productivity demands negate MVPA (De Cocker et al., 2015; Hadgraft et al., 2018).

In addition to PA, a proliferation of research over the past decade has identified SB as a distinct health behaviour that occurs across all lifestyle domains. In particular, recreational TV viewing and occupational sedentary time has been associated with the development of type II diabetes, cardiovascular disease, morbidity and premature mortality (Bankoski et al., 2011; Biswas et al., 2015). Prospective and cross-sectional data from 18 studies (n=794,577) found that total self-reported sitting and TV viewing time, an inherently sedentary activity, was associated with a significantly increased risk ratio for diabetes

(112%), cardiovascular disease (147%), cardiovascular mortality (90%) and all-cause mortality (49%) (Wilmot et al., 2012). Findings from the Australian Diabetes, Obesity and Lifestyle study, also indicated that prolonged periods of TV viewing (≥4 h per day) were positively associated with an increased risk of all-cause and cardiovascular disease mortality, with an incremental risk of 11% and 18% for each additional hour of viewing time per day respectively (Dunstan et al., 2010a). Though self-reported TV viewing time may not be fully representative of total daily sedentary time, there has since been reasonable epidemiological evidence to demonstrate a causal link between self-reported SB and all-cause mortality (Biddle et al., 2016). Furthermore, cardiometabolic health risks associated with high TV viewing and self-reported sedentary time are apparent even after controlling for LPA, MPA or VPA (Dunstan et al., 2010a; Wilmot et al., 2012).

Objective measures of PA and SB estimate that the average adult spends between 50-60% of their waking time sedentary (Wilmot et al., 2012), which is a major risk to public health. A recent systematic review and meta-analysis pooling objective and self-reported SB data across 34 prospective studies (n=1,331,468) identified a dose-response relationship where total daily sitting (≥6 h per day) was associated with an increased risk for all-cause and cardiovascular disease mortality after controlling for PA (Patterson et al., 2018). To that end, adults should minimise the amount of time spent being sedentary (sitting) for extended periods in addition to the PA guidelines (Department of Health, 2011).

2.2 Interrelationship between PA, SB and health.

MVPA has traditionally been considered the cornerstone for lifestyle disease prevention (Dunstan et al., 2010b). Individuals who engage in the highest quartile of PA (≥35.5 MET. h/week) and highest quartile of SB (≥8 h/day) appear to mitigate the risk of all-cause mortality (Ekelund et al., 2016) and cardiovascular disease (Maddison et al., 2016). These

findings suggest that MVPA can have both a protective and attenuating impact on the deleterious effects of SB. Accruing high (60-70 minutes) levels of MVPA per day however does not appear to be a feasible public health message for the UK population, as 25% of adults fail to achieve even 30 minutes of PA per week (British Heart Foundation, 2015). Moreover, the 'active couch potato' phenomenon highlights that highly sedentary individuals (>8h per day) are unable to mitigate the deleterious effects of high SB by simply meeting the PA guidelines (Owen et al., 2010). Accordingly, there is a growing consensus supporting the need to explore the interrelationship between PA, SB and health, particularly as uptake of one behaviour, results in the displacement of another across a 24h cycle (Chastin et al., 2015).

Compositional analysis of the 2005-2006 National Health and Nutrition Examination Survey (NHANES) investigated the association between objective and cross-sectional time allocated to, and displacement of, PA, SB and sleep (Chastin et al., 2015). Cardiometabolic health markers measured included BMI, waist circumference, BP, non-fasted high-density lipoprotein (HDL) cholesterol, fasted low-density lipoprotein (LDL) cholesterol, triglycerides, plasma glucose and insulin (Chastin et al., 2015). Time spent in SB and LPA was detrimentally associated with obesity, HDL cholesterol and BP, while relative time spent in MVPA had a beneficial impact on health markers (Chastin et al., 2015). In contrast, a prospective cohort study explored the effects of replacing SB with other types of non-sedentary activities using isotemporal substitution (Van der Berg et al., 2017). Theoretical replacement of sitting (30 min/day^{-1}) with standing or stepping (30 min/day^{-1}) was associated with a lower risk of the metabolic syndrome (7% and 28% respectively) and type 2 diabetes (6% and 21% respectively). In addition, reallocating SB with standing or stepping (LPA) was positively associated with more favourable waist circumference, BMI and blood profile (cholesterol, insulin and glucose). Although weaker associations are apparent during reallocation of sitting with standing compared to LPA, metabolic benefits to postprandial glucose and insulin are still present (Chastin et al.,

2018) and appear clinically significant, particularly in populations at high risk of glycaemic impairments (Yates et al., 2015). Importantly, replacing SB with MVPA is associated with greatest benefits to health, however an important public health message should also consider the benefits of replacing SB with standing or LPA, when it is not possible to achieve MVPA. This may be more feasible through incidental activities, especially in workplace settings.

2.3 PA and SB patterns

A bout of SB is defined as the '*minimum period of uninterrupted sedentary time'* and total sedentary time is the *'total time accumulated in sedentary bouts per day (or per week)'* (Tremblay et al., 2017 p. 1). The pattern of SB is therefore defined as '*the manner in which SB is accumulated throughout the day or week while awake (e.g., the timing, duration and frequency of sedentary bouts and breaks)*' (Tremblay et al., 2017p.10). Increasingly, since the seminal work of Morris and Crawford (1958), experimental evidence suggests that in addition to total time spent sitting, the frequency in postural changes between extended and continuous sitting bouts and standing is important for health (Tremblay et al., 2017). Large cross sectional data from the Australian Diabetes, Obesity and Lifestyle study observed that frequent LPA breaks to prolonged sitting bouts were beneficially associated with cardiometabolic biomarkers such as 2h plasma glucose, triglycerides, BMI and waist circumference (Healy et al., 2008a). This pivotal work incited further exploration into the specific time allocation and activity related impacts of breaks to SB.

Experimental studies have demonstrated that frequent breaks to prolonged sitting are more effective at enhancing cerebral health, cardiometabolic risk factors and perceived psychological benefits than a single bout of continuous exercise. In an acute 3 arm cross-over trial among 15 desk-based workers, 2 minutes of light intensity treadmill walking

dispersed at 30 minute intervals across 4h offset the decline in cerebral blood flow experienced during 4 h of uninterrupted sitting (Carter et al., 2018). A novel finding was that the same dose of breaks, delivered at 8-minute walking intervals every 2 h did not negate the reductions in cerebral blood flow. Similarly, 5-minute moderate walking breaks improved mood and decreased feelings of fatigue and appetite across 6 h compared to prolonged sitting or a single 30 minute bout of walking (Bergouignan et al., 2016). This is consistent with reductions in self-reported fatigue following 3-minute light intensity walking breaks every 30 minutes (Wennberg et al., 2016). In healthy males however, similar reductions in triglycerides and blood pressure were found between 30 min continuous walking and an accumulation of 30 minutes in bouts of 3 minutes (Miyashita, Burns and Stensel, 2008). This indicates that healthy males may require a greater intensity of PA, or a longer duration of break to induce similar metabolic benefits.

Importantly, significant metabolic improvements have been observed following light and moderate PA breaks to sitting, with benefits apparent across both healthy and at risk populations. Among individuals with type 2 diabetes, three minutes of light walking and simple resistance exercises (calf raises, gluteal contractions, half squats and knee raises) were beneficially associated with cardiometabolic risk markers (Dempsey et al., 2016a). Simple resistance exercises also significantly improved blood triglycerides compared to a prolonged sitting condition but not LPA, therefore the type of activity modality appears important for metabolically impaired populations (Dempsey et al., 2016a; Dempsey et al., 2016b). Among overweight and obese participants, two minutes of light and moderate intensity treadmill walking breaks following 20 minutes of uninterrupted sitting reduced post prandial glucose by 24-30% respectively and insulin concentration by 23% across a 5 h period (Dunstan et al., 2012). This finding appears consistent across healthy individuals where short frequent bouts of LPA (2min LPA following 20 min SB) significantly reduced post prandial glucose (-17.5%) and insulin (-25.1%) compared to continuous sitting (Chastin et al., 2018). While greater intensity appears to produce greater perceived physiological benefits, intensity does not need to be high to induce positive changes

(Dunstan et al., 2012). This may be of particular importance among desk-based workers who reported that performing moderate intensity activities in the workplace was not acceptable working behaviour and therefore a barrier to PA (Hadgraft et al., 2016a).

Encouragingly, acute cardiometabolic changes have been observed across longer-term studies. Overweight or obese desk-based workers demonstrated significantly reduced fasting glucose and post-prandial glucose responses following 5 days of sit-stand transitions every 30 minutes, compared to continuous sitting (Thorp et al., 2014b). Frequent postural transitions (every 30 minutes) between sitting and standing was also found to significantly reduce subjective musculoskeletal discomfort and fatigue over five days, with a positive trend towards improved productivity (Thorp et al., 2014a). Furthermore, following accumulated walking (3 x 10 min bouts) and a continuous walking condition (1 x 30 min bout), SBP and plasma triglycerides were significantly reduced (6% and 16% respectively) with effects maintained the following day compared to a continuous sitting condition in a sample of healthy males (Miyashita et al., 2013). This provides some evidence of the potential long-term health and productivity benefits of embedding frequent postural transitions and activity breaks into real world working practice, although more research is warranted to evaluate the impact of break strategies on productivity.

2.4 Health promotion in the workplace

Since the industrial revolution, the advancement of technology and automation of job roles has contributed to a wealth of timesaving and labour saving devices in the workplace (Hallal et al., 2012). This technological revolution has accelerated the development of white-collar job roles, with an estimated 70-75% of the global workforce now relying on computers at work (Toomingas et al., 2012). Technology has facilitated methods of rapid communication, increased worker efficiency and enhanced productivity and profitability (Hallal et al., 2012; Parry and Starker, 2013). As a consequence however, manual load

(Dunstan et al., 2010b) and daily and occupational energy expenditure has decreased (Ng and Popkin, 2012) and for employed individuals, the majority of daily sedentary time is typically accrued during working hours (Ryan et al., 2011). Global trends in PA and SB appear to be linear, and anticipated forecasts predict that PA will continue to decline with adults expected to be 30% less physically active in 2030 compared to 1961, with SB anticipated to exceed 51 h/week by 2030 (Ng and Popkin, 2012).

Sedentary time accounts for between 60% (Clemes et al., 2014) to 80% (Graves et al., 2015b) of a working day for desk-based workers. Furthermore, contact centre call agents have been identified as the most sedentary and least active cohort during working hours, compared to office and customer service workers (Thorp et al., 2012). Of concern is that UK desk-based workers accrue the majority (52%) of their sedentary time in bouts ≥30 minutes and 25% in prolonged bouts exceeding 55 minutes (Ryan et al., 2011), which has shown to have a detrimental impact on cardiometabolic (Dunstan et al., 2012), musculoskeletal (Thorp et al., 2014a) and psychosocial health (Kilpatrick et al., 2013). The workplace is therefore increasingly identified as a pivotal setting to target inactivity and SB (NICE, 2008) due to exposure to forced and prolonged periods of SB (WHO, 2010).

The World Health Organisation's definition of a healthy workplace encompasses the physical, mental and social constructs within the wider definition of health (WHO, 1946, p.100). A healthy workplace is therefore classified as an environment '*where everyone works together to achieve an agreed vision for health and wellbeing of workers and the surrounding community. It provides all members of the workforce with physical, psychological, social and organisational conditions that protect and promote health and safety, enables managers and workers to increase control over their own health and to improve it, and to become more energetic, positive and contented"* (WHO 2010 p.16). There is a consensus that employee health, business success and economics are inextricably linked (WHO 2009). The business case for protecting employees from potential hazards that could cause injury or illness (WHO 2010) extends beyond the

immediate corporate benefits such as reduced sickness absence, increased employee retention and increased loyalty among employees (NICE 2008). Indeed, addressing employee health is considered an ethical obligation for employers, drawing upon the principle of corporate social responsibility whereby investing in employee health is morally the right thing to do (WHO 2010). Investing in initiatives which promote employee health and wellbeing has the potential to directly and indirectly enhance financial performance, and promote a positive company reputation (Carroll and Shabana, 2010). In addition to the financial incentives for promoting positive employee health (Carroll and Shabana, 2010), employers are under legal obligation to maintain the health and safety of their employees at work, with businesses increasingly held accountable for ensuring the physical and mental health of their employees is maintained (WHO, 2010, NICE, 2014, HSE, 2002). Current workplace legislation requires companies to adhere to health and safety regulations (Health and Safety at Work Act, 1974), such as mandatory display screen assessments (HSE, 2002). Increasingly, there are calls encouraging employers to adapt working cultures and environments to promote increased opportunities for incidental PA and reduced SB (*Global action plan on physical activity*, WHO 2018). A synthesis of global workplace policy however highlights that SB was yet to be acknowledged within workplace policies (Coenen et al., 2017a). This highlights a distinct disparity between translation of workplace PA and SB recommendations into organisational working practice. Importantly, without formal recognition within legislation, employers are not currently accountable for embedding PA or SB strategies into working practices.

2.5 Factors influencing PA and SB in the workplace

The SEM conceptualizes that an individual's behaviour occurs in a complex interacting system across intrapersonal, interpersonal, environmental, organisational and political contexts (Sallis, Owen and Fisher, 2008). An individual's engagement in PA and SB is therefore influenced by multiple factors that should not be viewed in isolation (Kelly and

Barker, 2016). Developing an understanding of the factors influencing PA and SB in workplaces, and contact centres specifically, can inform the development of effective behaviour change techniques and guide the implementation of appropriate intervention strategies (Michie et al., 2008). To the authors knowledge, to date there have been no studies exploring the specific contextual factors influencing high SB and low PA among contact centre workers. This following synthesises cross sectional and observational evidence on the factors influencing occupational PA and SB, in line with the SEM.

2.5.1 Intrapersonal factors

Non-modifiable physical, biological and genetic factors are associated with occupational SB, independent of overall PA (Biddle et al., 2010; Chastin et al., 2016; O'Donoghue et al., 2016; Smith et al., 2016). Across all domains, age is positively correlated with SB and PA, with older adults typically engaging in higher SB and lower PA than younger adults (O'Donoghue et al., 2016). A review of observational workplace studies identified that gender is a correlate of PA, with males typically more active than females at work (Smith et al., 2016), although across all domains, females were found to engage in less SB than males (O'Donoghue et al., 2016). Low socio-economic status, minority ethnic backgrounds, blue-collar job roles and smokers are independent correlates associated with higher occupational PA (Smith et al., 2016). While these observational findings do not indicate causality, socio-economic factors such as full-time employment and type of employment (i.e. white collar job roles) have been associated with higher occupational SB (O'Donoghue et al., 2016). Furthermore, higher levels of education are positively associated with occupational SB due to professional roles being typically more sedentary than non-professional roles (O'Donoghue et al., 2016). Higher sedentary time accrued during working hours is positively correlated with higher SB across other lifestyle domains during the working week, and SB is greater on workdays compared to non-workdays (Smith et al., 2016). This is of particular importance among contact centre workers who

have been identified as the most sedentary cohort during working hours compared to office workers and customer service representatives (Thorp et al., 2012), and provides further evidence of the importance of the workplace for influencing workday and whole day PA and SB.

Cross sectional data identified that the majority (67%) of Swedish office workers (*n*=533) reported sitting at work as a habitual behaviour (Nooijen et al., 2018). This is consistent with a thematic review of 32 qualitative studies across desk-based workers from Australia, United Kingdom and the USA, where office workers perceived specific job demands to be synonymous with seated working postures, and therefore described sitting at work as a habit (Hadgraft et al., 2018). Habitual behaviours are modifiable, however once formed, habits are more resistant to change than non-habitual behaviours (Webb and Sheeran, 2006). This poses a particular challenge for developing effective workplace SB and PA interventions in the contact centre setting where job tasks are typically repetitive and monotonous, and occur in a stable working environment (Ouellette and Wood, 1998; Miller, Hendrickse and Management, 2016).

Swedish employees identified that a lack of motivation was a barrier to sitting less at work (Nooijen et al., 2018). Motivation is positively associated with overall PA (Bauman et al., 2012) and inversely associated with SB (O'Donoghue et al., 2016). In the workplace, reports of high fatigue (Chau et al., 2016b), poor knowledge of the impact of SB, and low awareness of alternative strategies or the optimum dosage and frequency for breaking up occupational sitting (De Cocker et al., 2015) may offer some explanation into the factors influencing motivation to sit less at work. Providing educational resources and tailored individual feedback have been common strategies for enhancing an individual's knowledge and reflective motivation surrounding their sitting and PA behaviour in the workplace (Kelly and Barker, 2016). While enhancing knowledge and awareness appears important for facilitating behaviour change, and is recognised as a formal behaviour change technique (Cane, O'Connor and Michie, 2012; Michie et al., 2013), a large

proportion of everyday behaviour occurs during non-conscious, automatic activity which is largely triggered by environmental cues (Marteau, Hollands and Fletcher, 2012). Moreover, implementing educational approaches alone has shown modest to no effects on increasing PA (Malik, Blake and Suggs, 2014) or reducing SB (Chau et al., 2010). Among Swedish call agents, knowledge of workplace recommendations to achieve 5-10 minute breaks from sitting per hour in accumulated or uninterrupted standing/walking, was not associated with reductions in work day sedentary time (Toomingas et al., 2012). Attitude and intention is also a correlate of SB and PA (Bauman et al., 2012; O'Donoghue et al., 2016). Congruent with findings among office workers however, intention is not always indicative of actual PA and SB. Desk-based workers who were positively inclined towards participating in general PA and nutritional health promotion strategies at baseline demonstrated low actual participation (11% of 26%) (Rongen et al., 2014). Therefore, in addition to educational strategies to enhance individuals knowledge, awareness and motivation, changes to the working environment and social and organisational context in which habitually low PA and high SB occur, may offer a more potent trigger for changing behaviour (Sallis and Owen, 2015; Marteau, 2018).

2.5.2 Interpersonal factors

Compared to intrapersonal factors, less is known about the interpersonal barriers and facilitators influencing occupational SB and PA. Socially, management beliefs towards PA and co-workers attitudes and PA behaviours are related to lower occupational SB and higher PA (Smith et al., 2016). Indeed, desk-based workers often emphasise the need to foster increased co-worker and management support to actively encourage a reduction in SB and increase in PA (McGuckin, Sealey and Barnett, 2017; Hadgraft et al., 2018). In contrast, Swedish office workers did not report cultural factors and social norms as a barrier to sitting reduction in the workplace (Nooijen et al., 2018). This is contrary to qualitative workplace studies where social norms surrounding acceptable working

practices were commonly identified as an important factor for shifting perceptions towards a working culture which facilitates greater PA and negates SB (Such and Mutrie, 2017). Following a cluster RCT promoting 15-minute booster PA breaks at work over 6 and 12 months, the authors concluded that the absence of management support contributed to diminished employee enthusiasm and impacted reduced overall attendance in the structured PA intervention (Taylor et al., 2013). Management support therefore is perceived as both a barrier and facilitator to behaviour change in workplace settings (van Uffelen et al., 2010).

Manager's report a conflict between striving for optimum profitability and productivity and implementing PA and SB interventions for employees (Hadgraft et al., 2018). Addressing manager's individual attitudes and intentions towards SB and PA therefore appears important for promoting positive management outlook, which may help to foster changes to employees PA and SB in the workplace (Brakenridge et al., 2016a). Contact centre managers however identified the nature of contact centre work as a barrier to promoting PA, despite perceived benefits associated with enhanced productivity, team work and staff morale (Renton, Lightfoot and Maar, 2011). Acknowledging the integral role of managers in the delivery of effective and sustainable interventions is therefore imperative and should be considered within wider organisational policies and working practices (NICE 2014).

Management support strategies include promoting management participation in PA and SB interventions, management endorsement of intervention strategies and implementing dedicated workplace champions (Terry et al., 2008; Pronk and Journal, 2014). Following a non-randomised multi-component intervention implementing low-cost intervention strategies, management support was perceived as a key mechanism contributing to a reduction of -24 minutes among desk-based workers in a University setting (Mackenzie, Goyder and Eves, 2015). Furthermore, a cluster RCT implementing organisational support strategies with and without an activity tracker resulted in significant reductions in total and prolonged occupational sitting time at 12 months (Brakenridge et al., 2016a). Indeed,

harnessing increased organisational and management support appears important for influencing SB in the workplace at 12-months, while changes at 3 months were not significant, indicating that such strategies may take longer to embed into working practice and thus longer to impact sitting time at work.

2.5.3 Organisational factors

From an organisational perspective, high workload and productivity demands are inextricably linked to profitability, and are often reported as barriers to implementing PA and SB strategies in the workplace (De Cocker et al., 2015; Hadgraft et al., 2018). Consequently, high workload and time constraints appear to compound employee perceptions around the need to justify any absences from their workstation, with concerns of being penalised or viewed as unproductive if not seated at a computer (McGuckin, Sealey and Barnett, 2017; Hadgraft et al., 2018). Potential strategies to address management and employee concerns over productivity include low-cost approaches such as modifying job roles to allow greater variation between sedentary and non-sedentary job tasks (Gilson et al., 2011) and increasing purposeful PA such as walking meetings (McGuckin, Sealey and Barnett, 2017). Despite conducting a formative phase to tailor intervention strategies towards office workers needs in a university setting, walking meetings were found to be both helpful for increasing PA and challenging or impractical to instigate (Mackenzie, Goyder and Eves, 2015). Implementing such strategies within contact centres may also conflict with call agents daily work due to minimal task variation and low autonomy over their working day (Miller et al., 2015). Consequently, call agents have limited opportunities to accrue incidental PA at work (Toomingas et al., 2012) therefore tailoring intervention strategies to occupation, setting and job role may be more appropriate than a ‘one size fits all approach’ (Mackenzie, Goyder and Eves, 2015).

In addition to management support as discussed in section 2.5.2, wider organisational buy in to interventions is commonly influenced by the need to justify a return on investment of

either time or resource costs (Brakenridge et al., 2016a; Hadgraft et al., 2018). Thus, organisational and management priorities must be taken into consideration when designing workplace interventions. In the absence of robust evidence to date demonstrating the impact of reduced sitting and increased PA on key work related outcomes, organisations are recommended to adopt a preventative approach to implementing strategies, which may improve the overall health and wellbeing of their employees (WHO *Healthy Workplace Framework,* 2009; *WHO Global Action Plan,* 2018). Further research is warranted to develop a robust, evidenced-based business case to enhance organisational buy-in and develop recommendations for working policies surrounding implementation of effective and sustainable SB and PA strategies.

Arguably, wider legislative or regulatory workplace policy has the potential to influence sedentary working practices and PA at an individual, local (i.e. workplace) or national level (Bauman et al., 2012). To date no studies have explored the relationship between government and organisational level policy and workplace SB and PA (Bauman et al., 2012; Smith et al., 2016). The System of Sedentary behaviours (SOS) framework was developed to promote exploration of the political and economic determinants on SB, however to date, this has yet to be applied within the workplace context (Chastin et al., 2016).

2.5.4 Environmental factors

Employee PA and SB is influenced by a reciprocal relationship between individual perceptions and the physical working environment (Umstattd et al., 2011). Features of the external physical environment such as walkability, street connectivity (Bauman et al., 2012) and aesthetics (Umstattd et al., 2011) are correlates of increased PA, while features such as availability of green space are associated with reduced occupational SB (Smith et al., 2016). Interestingly, the availability of shower facilities, lockers, and work site bicycle

storage to support active modes of transport to and from work, was associated with greater occupational SB, while positively associated with PA (O'Donoghue et al., 2016).

The physical working environment can exert a strong influence over low PA and high SB at work, with office furniture typically designed to facilitate seated working postures (Hadgraft et al., 2018). Furthermore, adapting the physical working environment to promote stair use and increase opportunities for employees to accrue incidental PA during the working day (i.e. location of printing, washroom and water fountain facilities) has been identified as both a barrier and facilitator for behaviour change (Hadgraft et al., 2018). Environmental adaptions to the built environment however can be costly and a potential barrier to implementation among employers without sufficient justification for a return on investment (Mackenzie, Goyder and Eves, 2015; Hadgraft et al., 2018).

2.6 Workplace PA and SB interventions

Over the last decade there has been a proliferation of workplace PA and SB intervention research (Peachey et al., 2018). Broadly, workplace interventions targeting workplace PA and/or SB can be grouped into three intervention types; 1) behavioural and educational interventions, which target the individual level and are often aligned to specific behaviour change techniques (Michie et al., 2013); 2) environmental interventions, which involve changes to the physical structure or working environment alone; and 3) multi-component interventions, which encompass behavioural, educational and environmental components (Chu et al., 2016; Peachey et al., 2018). Each intervention strategy has shown to elicit modest to significant sitting reductions, with the strongest reductions in sitting time observed following the implementation of height-adjustable workstations (-100 min/workday) compared to the implementation of computer prompts (-14 min/workday), policy changes (-15 min/workday) and information and counselling (-19 min/workday) (Shrestha et al., 2018b). Implementing environmental interventions, particularly height-

adjustable workstations, therefore appear to be most effective for reducing SB in the workplace.

Within the literature there is a clear need for more robust, high quality trials to be developed to measure the impact of interventions on PA and SB change over time (Shrestha et al., 2015). One systematic review and meta-analysis synthesised findings from 26 parallel and treatment comparison RCT's and quasi-experimental trials among white-collar (desk-based) workers (Chu et al., 2016). The risk of bias was assessed according to the Cochrane quality assessment criteria (Higgins and Green, 2008) to determine whether the trials were of high (n=2), good (n=10) or fair (n= 14) quality. Similar to Shrestha et al. (2015), factors affecting methodological quality and scientific rigor included inadequate description of the process of group allocation or randomisation, analyses not being adjusted for baseline behavioural outcomes, and, outcome assessments not independent or blinded (Chu et al., 2016). While the type of study design (RCT vs Non-RCT) did not appear to impact SB reduction (-38.9 vs -40.2 min/8h workday, respectively), the quality and scientific rigor of the interventions did have a greater impact on worktime sitting reduction compared to poorer quality trials (-48.3 min/8 h workday to 36.6 min/8 h workday respectively). Adopting a rigorous intervention design, including validated measures appears important for enhancing scientific rigor and effectiveness and importantly evaluation of a randomised trial is considered to be important for informing for policy and guidelines (NICE 2014).

On average, interventions introducing height-adjustable workstations have observed a reduction in sitting time by -77 to -100 min/8 h workday (Neuhaus et al., 2014b; Shrestha et al., 2018b). Intervention studies reporting an objective measure of SB have typically observed greater reductions in sitting time compared to self-reported measures (-66.7 vs -23.3 min/8h workday, respectively) (Chu et al., 2016), which indicates that individuals are likely to underestimate their total sitting reduction. Furthermore, self-reported outcomes are unable to determine the pattern of SB accumulation over time (Graves et al., 2015a),

which has important implications for cardiometabolic health markers such as post prandial glucose and insulin (Dunstan et al., 2012). Thus, height-adjustable workstations appear most effective for reducing SB at work, and interventions testing their effectiveness using objective rather than subjective tools are important for improved accuracy.

Implementing height-adjustable workstations are commonly perceived as an acceptable workplace strategy among desk-based employees (Grunseit et al., 2013), although acceptability was not always associated with reduced self-reported sitting time when height-adjustable workstations were installed without guidance or support (Wilks, Mortimer and Nylén, 2006; Grunseit et al., 2013). Additional education and guidance on the benefits of reducing sitting time and shifting cultural perceptions around acceptable working behaviours were among identified strategies to enhance workstation usage (Grunseit et al., 2013), which supports the development of multi-component interventions which target behavioural, educational and environmental components (Chu et al., 2016). Compared to non-intervention (usual practice) controls, implementing multi-component interventions (all of which included a height-adjustable workstation), were found to be the most effective type of intervention among desk-based workers for reducing SB (-88.8 min/8h workday), followed by environmental interventions implementing changes to the physical structure or environment (i.e. introducing height-adjustable workstations or treadmill workstations) (-72.8 min/8hworkday) (Chu et al., 2016). To date, no studies have explored the extent to which the addition of an environmental component can enhance the effects of a multi-component intervention (Buman et al., 2017). This may be of interest to employers seeking to deliver effective and cost effective strategies to improve the health and wellbeing of their employees, where costly strategies such as height-adjustable workstations are a potential barrier to implementation (Mackenzie, Goyder and Eves, 2015).

Despite the positive intervention findings on SB reduction at work in traditional office workers, less is known about the effectiveness of SB interventions in the contact centre

setting. To date, only two trials have investigated the effect of a multi-level intervention on call agents sitting time at work. The '*Opt to Stand'* quasi-experimental trial compared the provision of height-adjustable workstations, daily emails and brief training on workday sitting and PA, to a control group (Chau et al., 2016c). Due to poor compliance to objective monitoring, participants self-reported data was used to identify a reduction in sitting time (-64, -76, -100min/workday) and increased standing (73, 96, 51 min/workday) compared to controls at weeks 1, 4 and 19, respectively. While positive, the short term follow-up and subjective assessment of sitting and standing may underestimate intervention effects on behavioural outcomes and thus provides limited knowledge of the effectiveness and sustainability of this multi-level intervention (Chau et al., 2016c). Furthermore, following the '*Sit Less Move More'* intervention, consisting of emails, posters and timer lights to prompt sitting reduction among emergency call agents with individual height-adjustable workstations, call agents identified high levels of fatigue, and high work pressures, as barriers to sitting less during the 11-week intervention (Chau et al., 2016b). Although no effectiveness data has been published, these findings provide useful fidelity and contextual considerations for future interventions in this setting (Wierenga et al., 2013). A cross sectional study among Swedish contact centre workers highlighted that access to a height-adjustable workstation and knowledge of a recommendation to accumulate 5-10 minutes of uninterrupted sitting did not appear to influence the amount of sitting time during working hours (Straker et al., 2013). In contact centres, additional individual and organisational factors are thought to negatively influence postural transitions between sitting and standing and adherence to breaks to SB (Toomingas et al., 2012), however to date these potential factors have not been explored prior to the development of formal PA and SB intervention strategies. Developing an understanding of these influential contextual factors is advocated as an important prerequisite to enhance the effectiveness and sustainability of tailored intervention strategies in future trials (Craig et al., 2008), and is warranted in the contact centre setting.

Across intervention studies, changes to workday sitting time has been primarily displaced with increased standing and to date, workplace interventions have failed to identify and implement effective intervention strategies to influence PA (Malik, Blake and Suggs, 2014). A review of 58 workplace PA intervention identified the most common methods to promote PA at work included promotional messages and information (n= 39), followed by counselling and support strategies (n= 13) and structured PA sessions (n=6) (Malik, Blake and Suggs, 2014). While many studies reported improvements in PA, findings were largely based on self-reported measures and non-validated surveys (Malik, Blake and Suggs, 2014), which limits the validity of the findings. Implementing 15-minute booster breaks (Taylor 2013) and high intensity interval training (Kinnafick et al., 2018) during work hours was found to improve office workers perceived enjoyment, stress, health awareness and social interaction, and sessions were perceived as acceptable for increasing PA while addressing crucial time constraints at work (Dugdill et al., 2008). A lack of management support (Taylor et al., 2013) and the intensity of structured PA sessions (Kinnafick et al., 2018) however influenced perceptions surrounding maintaining PA. While higher intensity PA is important for greater cardiometabolic health, replacing short periods of sitting (30 min) with LPA has shown to significantly reduce the risk of the metabolic syndrome (Van der Berg et al., 2017). The lack of observed change in stepping time and LPA in the workplace over short (3 month) and long-term trials (12 months) may indicate why to date there is equivocal evidence demonstrating changes to cardiometabolic health outcomes (Graves et al., 2015a; Healy et al., 2017). Findings from an 8-week randomised controlled trial (RCT) among office workers significantly reduced workday sitting (-80.2 min/8h workday) and observed beneficial changes to total cholesterol and endothelial function of the brachial artery (Graves et al., 2015a). Experimental studies have observed acute significant and clinically meaningful changes in post-prandial glucose and insulin by reducing prolonged sitting bouts alone (Dunstan et al., 2012) .

To date, the effectiveness of reduced occupational sitting on musculoskeletal discomfort is mixed. Experimental studies found that frequent transitions to sitting (every 30 minutes) improved musculoskeletal discomfort over 5 days (Thorp et al., 2014a). However following a 6 month SB contact centre intervention, participants with a standing-biased workstation reported significantly more neck pain than those with a height-adjustable workstation (Pickens et al., 2016). Similarly, at 12 months a large proportion of attrition in Stand UP Victoria was due to adverse effects experienced primarily due to musculoskeletal discomfort (Healy et al., 2016b). Increased musculoskeletal discomfort may be due to a learning effect from increased standing (Buckley et al., 2015), with evidence that prolonged standing (>4h) is associated with an increased incidence of lower back and lower extremity pain (Coenen et al., 2016). Promoting frequent postural transitions between seated and standing postures at work and avoidance of prolonged static standing may have important implications for individuals who report musculoskeletal discomfort at work (Hadgraft et al., 2018) and businesses due to improved absenteeism (Office for National Statistics, 2016).

Compared to asymptomatic individuals, there was significant variation in sitting reduction among individuals with pre-existing lower back pain following a 3 month RCT, in favour of individuals with no musculoskeletal pain (34.6 min/8h work day, 5.1 min/8h workday respectively) (Coenen et al., 2017b). To combat the potential impact of increased standing on musculoskeletal pain, Johnston et al. (2019) devised an intervention which included exercises to specifically target the core stabilizer muscles in office workers at risk of lower back pain, alongside installation of a height-adjustable workstation. Compared to a workstation group without exercises, there were no significant differences in subjective musculoskeletal discomfort after 4 weeks. This implies that height-adjustable workstations may be an appropriate short-term strategy for individuals at risk of lower back pain, however longer term trials are warranted and future trials should consider the importance

of emphasising frequent postural changes between seated and standing postures, rather than an absolute sitting reduction (Buckley et al., 2015).

A contact centre SB intervention comparing objective productivity metrics (considered as the number of successful calls taken per hour) between seated controls and a stand-biased or height-adjustable workstation intervention found that participants averaged 0.5 more successful calls per hour compared to their seated counterparts, despite less tenure in their current role (Garrett et al., 2016). Similar to findings among office workers (Graves et al., 2015b), the introduction of height-adjustable workstations in an Australian contact centre reduced call agent's sitting time without impacting negatively on objective productivity metrics (Chau et al., 2016c). Further, the SMArT intervention was the first workplace intervention to observe significant changes to sitting time as well as favourable changes in psychosocial and work factors such as job performance and work engagement (Edwardson et al., 2018). Collectively therefore, findings from multi-component workplace SB and PA interventions have demonstrated that the impact of reducing sitting time may produce favourable outcomes for both individuals and employers however, to date there is little evidence of this in contact centres.

2.7 Habits and behaviour change

As identified in section 2.1, the development of many chronic health conditions is strongly influenced by modifiable lifestyle factors, including PA and SB. Further, section 2.5 and 2.6 discussed factors that could be targeted within interventions to positively change PA and SB at work. Regarding the reporting of such behaviour change interventions, previous research suggested there was little consensus on the method of reporting, with great disparity in the terminology used to describe core intervention components and behaviour change techniques (Michie et al., 2009). On average, interventions consist of between one and fourteen behaviour change techniques (Michie et al., 2009), therefore such

inconsistent reporting can be problematic for standardising definitions of behaviour change strategies and identifying effective techniques to replicate in future trials (Abraham and Michie, 2008). A recent systematic review and meta-analysis identified 20 trials between 2003-2017 using behaviour change strategies to reduce sitting time at work (Peachey et al., 2018). The average reduction in occupational sitting was -23.8 min/day, however only 8 trials reported using a behaviour change framework to underpin their intervention. Similarly, Gardner et al. (2016) found that the majority (58%) of SB interventions in the workplace (*n*=14) and community (*n*=12) did not report a behaviour change framework to underpin their behaviour change interventions. Insufficient description of behaviour change techniques and the intervention development process potentially hinders the replication of interventions and can impact the ability to draw effectiveness and cost effectiveness comparisons (Michie et al., 2009). This limited evidence base and poor reporting of behavioural intervention components may contribute to inadequate knowledge of effective behavioural and educational trials compared to multi-component and environmental approaches (Chu et al., 2016; Peachey et al., 2018). Theory-based interventions are therefore important for facilitating in depth understanding of effective and successful intervention components and provide a basis for improving the impact and evaluation of targeted trials (Michie et al., 2008).

To that end, the interventions in this thesis are underpinned by the COM-B system, which is a behaviour change model which allows interventions to be constructed at the individual level though a targeted and staged approach (Michie, Van Stralen and West, 2011). The central tenant of the COM-B model relies on an individual's physical and psychological capabilities, reflexive and automatic motivation and the physical and social opportunities to perform the target behaviour (Figure 2.1). The interrelated nature of the COM-B model demonstrates the bi-directional relationship between increasing an individual's capabilities or opportunities to increase motivation to change their behaviour. Likewise, increasing an individual's motivation can lead to increased opportunities and capabilities over time due

to changes in their behaviour (Michie, Van Stralen and West, 2011). The COM-B system holds automatic motivation at the forefront of behaviour change and is the first behaviour change model to encompass a comprehensive, conceptual model of behaviour which recognises that a large proportion of every day behaviour occurs automatically (Wood, Quinn and Kashy, 2002; Michie, Van Stralen and West, 2011). The COM-B system has strong links to the SEM as it recognises the multiple interrelated factors that may independently and simultaneously act to influence behaviour (Michie, Van Stralen and West, 2011).

Aligned to the principles of the COM-B system therefore, the factors influencing PA and SB identified in section 2.5 may thwart or facilitate PA and SB behaviour change. For an individual to feel capable to sit less and move more they must possess either the physical attributes and/or the psychological abilities. In addition, the physical and social environment must be conducive to facilitate opportunities to reduce SB and increase PA by providing suitable environmental cues, resources and interpersonal (i.e. management) support. Finally, motivation is influenced by reflexive motivation which involves conscious planning and evaluation and automatic motivation which is more impulsive and unconscious (Lally et al., 2010). Importantly, an individual's motivation to perform the target behaviour must sufficiently outweigh the motivation to not perform that behaviour (Gardner, de Bruijn and Lally, 2011). This highlights the conflict between automatic and reflective processing in the formation or termination of habitual behaviour where there current evidence demonstrates a large variation in the time taken to reach a plateau of perceived automaticity of a behaviour (18 to 254 days, median 66 days) (Lally, 2010).

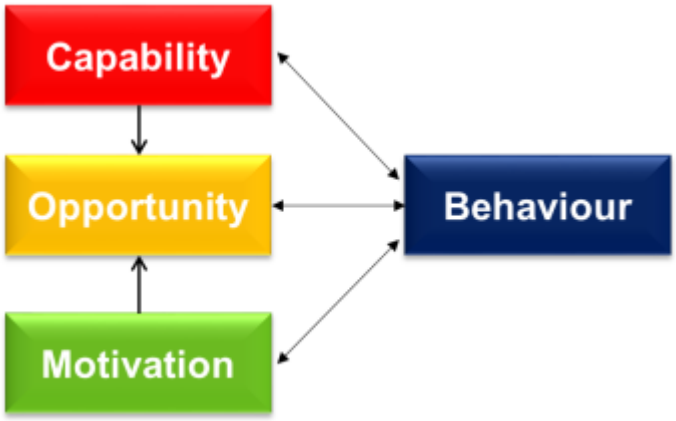

Figure 2.1 The COM-B model.

The COM-B model is central to the Behaviour Change Wheel (Figure 2.2), which provides an evidence-based foundation for providing a comprehensive range of intervention functions and strategies which are likely to influence behaviour change (Michie, Van Stralen and West, 2011). A review of 19 existing behaviour change frameworks (including social cognitive theory and the transtheoretical model) identified nine behaviour change functions and seven independent policy categories that were fundamental in changing behaviour (Michie, Van Stralen and West, 2011). The Behaviour Change Wheel's non-linear approach therefore offers a reliable method for characterising 'active' intervention components in line with the COM-B model, and identifying appropriate behaviour change techniques to promote PA and SB behaviour change in the contact centre setting (Michie, Van Stralen and West, 2011).

Figure 2.2. The Behaviour Change Wheel outlining pragmatic intervention components to target the COM-B system.

Underpinning intervention strategies in behaviour change theory is central to providing an insight into the processes and mechanisms influencing change, which in turn can inform the design of future interventions and policy makers (Cane et al., 2012). Aligned to phase 1 of intervention development in the MRC framework (Craig et al., 2008), an integral stage in understanding how to change behaviour is to first develop a holistic understanding of the interrelated contextual factors that influence behaviour, prior to intervention development (Norris, 2014). To date no contact centre trial has explored such influencing factors on call agents PA and SB, yet this exploratory process is advocated as a crucial prerequisite for identifying core factors within the COM-B system.

Adopting a multi-stakeholder approach through triangulation of multiple perspectives from senior management, middle management and call agents from across multiple contact

centres during this phase is therefore a novel approach to intervention development in the contact centre setting and has strong theoretical links to the SEM (Sallis, Owen and Fisher, 2008; Norris, 2014). After exploring the influential factors, the behaviour change wheel provides a systematic model for identifying tailored intervention strategies to target the behavioural needs of the contact centre agents within the specific working context (Norris, 2014). Once suitable intervention functions and categories have been identified within the behaviour change wheel, specific behaviour change techniques can be selected for the 'active' intervention ingredients to enhance agents capabilities, opportunities and motivation to sit less and move more at work (Michie, Van Stralen and West, 2011; Michie et al., 2013). For the first time, this body of work sets out to use a recognised behaviour change theory to underpin the development and implementation of strategies to support call agents to sit less and move more. This novel approach aims to tailor SB and PA strategies and enhance the effectiveness and sustainability of behaviour change in future trials.

2.8 Summary

The profusion of SB across all lifestyle domains has been linked with an increased risk for all-cause and premature mortality and the development of chronic diseases such as cardiovascular disease, type II diabetes and some cancers, with negative effects present after accounting for levels of PA. The workplace is a key setting to target low PA and high SB as the majority of daily sitting is accrued during working hours. Of concern is that the majority of worktime sitting is accrued in prolonged bouts >30 minutes, a pattern which is detrimentally associated with cardiometabolic, psychosocial, musculoskeletal and work outcomes. Intervening to reduce total and prolonged occupational sitting time and increasing PA in line with the recommendations for desk-based workers therefore has the potential to benefit both individuals and organisations. To date, multi-component and

environmental interventions have been the most effective for significantly reducing desk-based workers total and prolonged sitting time, although to date, no intervention has successfully increased occupational PA. Furthermore, there is little evidence demonstrating a 2-4 h sitting reduction in line with the workplace recommendations. Call agents have been identified as one of the most sedentary and least active occupational groups during working hours (Thorp et al., 2012), To date, the dearth of evidence exploring the potential contextual factors influencing SB and PA, and, a lack of robust evidence demonstrating effective methods to intervene in the contact centre setting, highlight a need to develop tailored SB and PA interventions in this setting.

Chapter 3.

General Methods

3.1 Intervention development and evaluation

This chapter provides an overview of the process of intervention development and evaluation aligned to the MRC Framework (Craig et al., 2008) across the three empirical studies within this thesis. Adopting a systematic approach to intervention development is considered best practice, and conducting formative work is an important prerequisite to the piloting, evaluation and implementation of formal intervention strategies (Craig et al., 2008). Conducting a developmental phase is an important step in identifying what is already known about workplace interventions and establishing the most appropriate and effective methods that have been used to conduct process and outcome evaluations (Craig et al., 2008). Piloting and feasibility testing is the next stage for highlighting pragmatic and logistical considerations (Lancaster, Dodd and Williamson, 2004) that may influence the acceptability and feasibility of an intervention or hinder the impact and delivery of a subsequent trial (Eldridge et al., 2016b).

Pilot and feasibility trials aim to explore key uncertainties in the intervention design and provide rich, contextual data to help refine and justify the design of subsequent trials (Whitehead et al., 2014). For the purpose of this thesis and consistent with the conceptual framework of Eldridge et al. (2016b), pilot studies are considered as a subset of feasibility trials. Aligned with the objectives of a feasibility study, study 2 (chapter 5) used qualitative and quantitative methodologies to explore whether it was practical and realistic to deliver a multi-component PA and SB intervention in a contact centre (Eldridge et al., 2016a). Consistent with the objectives of a pilot trial, study 3 (chapter 6) included a randomised approach to deliver and evaluate a small-scale version of the intended RCT (Eldridge et al., 2016b). Within the literature, it is acknowledged that pilot trials will likely be underpowered for the primary outcomes, but can provide invaluable information about key study phases including recruitment, randomisation, data collection and intervention

delivery (Levati et al., 2016). Key objectives for the pilot and feasibility interventions therefore include;

1) Testing the practicalities and processes involved in delivering the protocol (i.e. recruitment, retention, randomisation, data collection and intervention delivery) (Lancaster, Dodd and Williamson, 2004);

2) Monitoring the resources required to conduct the intervention (i.e. budget for consumables, travel, researcher and participant time considerations for data collection and intervention delivery) (Lancaster, Dodd and Williamson, 2004)

3) Experience and management of human, data and logistical elements within the project (Thabane et al., 2010).

Ongoing process evaluation is advocated for exploring how and why interventions work in relation to the acceptability and feasibility of intervention phases and components, to enhance the effectiveness and sustainability of subsequent trials and evaluation (Whitehead, Sully and Campbell, 2014; Moore et al., 2015). Further, adopting a mixed-methods approach using both qualitative and quantitative methods is advocated to determine how and why an intervention is effective, and identify how it can be replicated or reproduced in relation to the specific context (NICE, 2014; Eldridge et al., 2016a). Accordingly, the trials in studies 2 and 3 use quantitative and qualitative research methods to collect data on outcome and process measures. Studies two and three also conform to the guidelines for Consolidated Standards of Reporting Trials (CONSORT) (Moher et al., 2010) and are reported in line with the Template for Intervention Description and Replication (TIDieR) to maintain transparency and to provide clear reporting of the interventions evaluated (Hoffmann et al., 2014). Steps were taken to minimise bias throughout each trial and are described within the relevant chapters (5 and 6), however the intervention components and on-site data collection made it impossible to blind

participants to the intervention they received, or the researchers to the treatment allocation (Higgins and Green, 2008).

3.2 Epistemology

Throughout this thesis a pragmatic epistemology was adopted to generate understanding from human experience and gain insightful and relevant knowledge in relation to the real world context under investigation (Vaismoradi, Turunen and Bondas, 2013; Willig, 2013). Adopting a pragmatic epistemology allows specific research questions to be established, which subsequently guides the course of methodologies and analytic techniques used (Willig, 2013). The methodologies adopted throughout this thesis were therefore selected to align to the intervention development phases outlined in the MRC framework (Craig et al., 2008) (section 3.1) and as such, have drawn upon both qualitative and quantitative methods (Willig, 2013; NICE, 2014).

Personal epistemology relates to an individuals' 'way of knowing' and seeks to understand how an individual constructs and interprets their own reality in order to build knowledge and construct truths (Reybold, 2002). Personal epistemology therefore draws upon cognition and psychological constructs. When 'a way of knowing' becomes a 'way of being', personal knowledge manifests in behaviours and actions (Reybold, 2002). A pragmatic epistemology acknowledges that an individual's 'way of knowing' affects both their decisions and actions, which correlates to 'ways of being' and consequently influences their behaviour (Reybold, 2002). Study 1 takes a qualitative approach to explore key stakeholders' 'way of knowing' to construct a wider understanding of the factors influencing PA and SB across the contact centre setting. Studies 2 and 3 adopt a mixed-methods approach across quantitative methods to objectively measure PA and SB, health, wellbeing and work-related outcomes and to qualitatively explore participant perspectives to determine how and why the recruitment, randomisation (study 3 only),

data collection and intervention delivery were perceived as acceptable and feasible. Triangulating multiple stakeholder perspectives allowed the data to be explored, analysed and contextualised in relation to the wider social and environmental context (Willig, 2013), and aimed to enhance the degree to which findings can be transferred to other contact centre settings (Smith, 2018).

3.3. Mixed Methodology

Mixed methods research is a distinct research approach that combines both qualitative and quantitative methodologies to develop a robust and holistic understanding in response to a complex research question (Creswell, 2014). While there is no singular definition of mixed methods research, it is characterised by using a combination of methodologies to build a more complete insight of a phenomena (Creswell, 2009), involves analysis of both forms of data and is rigorously collected analysed and integrated into study design, analysis and interpretation (Creswell, 2014).

Mixed methods research is still considered to be a relatively new concept in relation to the study of social and human sciences (Creswell, 2009; Sparkes, 2015) although it is widely acknowledged that mixed methods approaches can harness the strengths and address the limitations that occur within both forms of data. Mixed methods research also seeks to explore the extent of convergence, corroboration or difference between both qualitative and quantitative data through triangulation of methodological techniques, which in turn can be effective for enhancing the validity of a study (Sparkes, 2015). There are however a number of inherent challenges associated with delivering mixed methods research including the volume of requisite skills required to conduct, analyse and interpret a wide range of data collection procedures and techniques (Creswell, 2014). Furthermore, due to the complexity and variety of data collected, mixed method research can be time and resources intensive. On the contrary, mixed methods research welcomes a pragmatic, collaborative and multidisciplinary approach, appropriate for intervention and evaluation

and is advocated within the MRC framework for designing, developing and evaluating complex, real world interventions (Moore et al., 2015). Aligned to the pragmatic epistemology and underpinning theoretical concepts within this thesis therefore, the overarching research aim drove the development of a sequential, multiphase mixed methods design (Figure 3.1) (Sparkes, 2015). Due to the early stage of the intervention, greater emphasis was upon exploration, understanding and the process of intervention development over effectiveness outcomes, therefore, there is a greater weighting towards the qualitative findings in the studies presented. None the less, integrating both process and outcome evaluation throughout the iterative research process helped to refine and inform the intervention design, analysis, implementation and evaluation across the trials (Figure 3.1) (Yin, 2006).

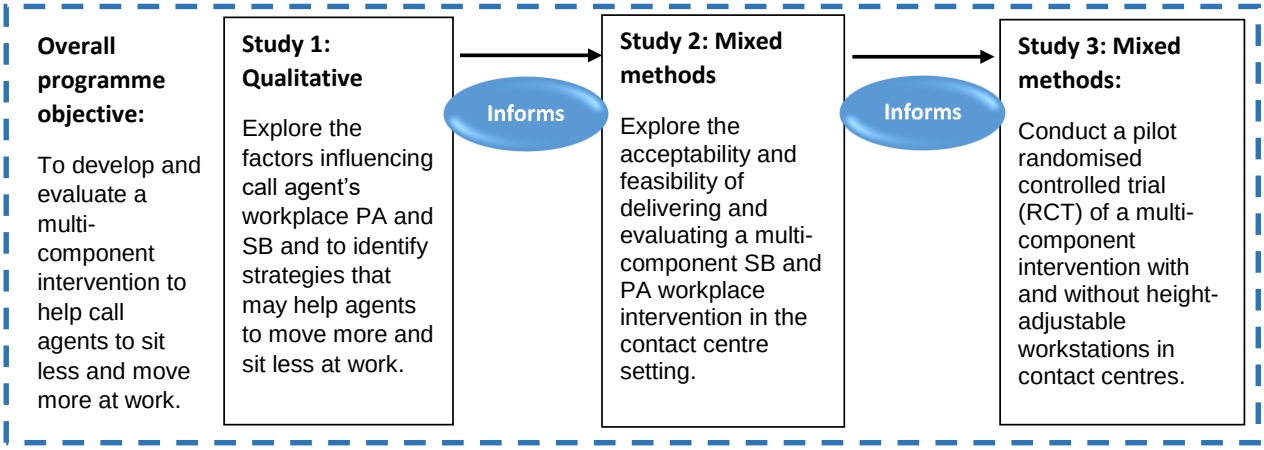

Figure 3.1. An overview of the sequential multiphase mixed methods model presented in this thesis.

3.3.1. Positionality Statement

The author is a White British female who studied an Undergraduate degree in Sport and Exercise Science where she qualitatively explored female academic perspectives of a

health and wellbeing policy at a UK University for her major project. The author is qualified as a personal trainer and has a qualification in Health inequalities via the Royal Society of Public Health. Her experience working as a community Health Trainer champion and a Health and Wellbeing officer in areas of low socio-economic status in the North West of England ranged from delivering healthy eating and PA among primary school children, male healthy weight management sessions, social inclusion, wellbeing and PA for adults > 50 years and workplace wellbeing and health checks. In addition to 7 years as a learning support worker for young adults with Autistic Spectrum and associated disorders, her applied and academic experiences have highlighted the importance of promoting positive health behaviours for the benefit of physical and mental health outcomes across a variety of age groups and populations. Each applied workplace setting was person-centred and promoted an autonomous environment where self-reflection, goal setting, social support were encouraged and evidence based health information and guidance was provided.

Despite having prior knowledge in sport and exercise science and experience in both applied and research settings, the author approached the research study as an outsider, having had no prior experience with contact centres or their established working cultures and practices. In an attempt to develop a comprehensive understanding of the complexities and interrelationships of the factors influencing call agents sitting and PA at work both prior to, and following formal intervention strategies, the author followed methodological processes detailed in section 3.4.1 to enhance credibility and trustworthiness within the qualitative data collection, analysis and interpretation. The author acknowledges that her prior knowledge and experiences as well as approach to the research with an established research question and analysis framework may have influenced the lens in which the data were collected, analysed and interpreted.

3.3.2. Qualitative data collection

Across all studies (1-3) focus groups and interviews were transcribed verbatim, with participants anonymised during transcription. A thematic approach was adopted, which allowed the flexibility to identify themes across the complete data set, in relation to the factors influencing agents workplace PA and SB (Braun and Clarke, 2006; Braun and Clarke, 2014). Analysis began concurrently with data collection through a reflective commentary, which contained the researcher's initial thoughts and emerging patterns in the early stages of analysis (Shenton, 2004; Vaismoradi, Turunen and Bondas, 2013). Higher-order themes were generated from emerging patterns within the initial coded data, and further grouped into levels within SEM. Sub-themes provide a structure to complex higher-order themes by adding a rich context to the research question beyond the pre-defined categories of the SEM (Braun and Clarke, 2006). At this stage the coding framework was presented by the first author and reviewed by all authors during a debriefing session that allowed refinement and further defining of emerging themes (Vaismoradi, Turunen and Bondas, 2013), with this triangulation adding credibility and trustworthiness to the analysis process (Shenton, 2004).

During familiarisation, transcripts were read, initially coded and further analysed to identify higher-order themes using NVivo version 11 (QSR International Pty Ltd). Sub-themes emerged through an inductive process when transcripts were re-read to add rich context to the research question beyond the pre-defined categories (Braun and Clarke, 2006). Triangulation meetings between authors (AM, LG, RM) discussed emerging themes and refined the thematic framework, with this process enhancing the credibility of the analysis process (Shenton, 2004). Findings are reported in line with the COREQ checklist (Tong, Sainsbury and Craig, 2007).

3.3.3. Behavioural outcomes and analysis

Call agent's work and leisure time sitting, standing and stepping, plus time accrued in sitting bouts ≥30 minutes and steps taken were assessed continuously for 7 days using an activPAL monitor. Placement was standardised to the anterior midline of the upper right thigh, with monitors inserted into a flexible waterproof sleeve (PAL Technologies, Glasgow, UK) and attached using a hypoallergenic waterproof adhesive strip (Tegaderm 3M, Bracknell, UK). Agents were provided additional waterproof sleeves, adhesive strips and an instruction leaflet on correct placement should they wish to change the dressing. To promote wear compliance and derive work times, agents were instructed to report the time they started and finished work (when applicable), went to bed, went to sleep, woke up and got out of bed in a daily diary (Edwardson et al., 2017). Agents were instructed to return their monitors and completed diaries to the centre contact at the end of the monitoring period.

Activity data was downloaded using manufacturer software (PAL technologies, Glasgow, UK) and processed using ProcessingPAL-V1.0, Leicester, UK. This software using a validated algorithm to separate valid waking wear data from everything else (i.e. time in bed, prolonged non-wear, invalid data). A day was considered invalid if there was limited postural variation (i.e. ≥95% of wear time in one activity), limited steps (<500 steps/day) or <10 h valid waking wear time (Winkler et al., 2016). This algorithm has demonstrated almost perfect ($k>0.8$ for 88% of participants) agreement with the traditional diary method (Winkler et al., 2016). Summary data from the algorithm was quality checked using heat maps against participant diaries to check whether the algorithm had successfully been applied to the data (Edwardson et al., 2017). Corrections were made if the self-reported waking time was not consistent with the algorithm output (Winkler et al., 2016). Participants' workdays and times were manually entered into a csv template and uploaded into the software, which enabled the calculation of work time PA and SB.

3.3.4. Surveys

3.3.4.1. Demographic information

To describe the sample characteristics, participants in studies 1-3 completed a non-validated survey, adapted from a previous trial (Graves et al., 2015b). Participants self-reported their age, gender, ethnicity, marital status and education level (sociodemographic factors), employment history, employment status, job category, hours worked per week and main work tasks (work history), the number of people in their office (work environment), and, occupational transportation mode.

3.3.4.2. Wellbeing

In studies 1 and 3 participants completed a 12-item survey to measure functional health and wellbeing (SF12v2) (Ware, 1996) across 8 health domains. The standard scoring algorithm aggregated domain scores into higher-order sub-scales of a physical (PCS, %) and mental component summary (MCS, %). Mean scores below 50% indicated a below average physical or mental health status (Ware et al., 2008). PCS and MCS have displayed high internal consistency ($\alpha > .80$) and have been widely used to provide an overview of health status (Ware, 1996).

3.3.4.3. Work limitations questionnaire

In studies 2 and 3 the work limitations questionnaire (WLQ) was used as a standardised self-administered tool for measuring the extent to which chronic health problems impact employees absenteeism and presenteeism at work (Lerner et al., 2001). The WLQ was developed following focus groups with individuals with various chronic physiological and psychological conditions, and has demonstrated high internal consistency and reliability (Chronbach's α ranging from 0.89-0.91) when piloted in clinical settings with patients with rheumatoid arthritis, epilepsy and chronic headaches (Lerner, 2002; Prasad et al., 2004).

In workplace settings, total time spent sedentary has been positively associated with presenteeism, mental-interpersonal difficulties and reduced work output, with the strongest positive association between SB and poor time management (Brown et al., 2013; Edwardson et al., 2018). In contrast, there appeared to be a significant, inverse relationship between LPA and presenteeism (Brown et al., 2013).

The WLQ is a 25-item questionnaire consisting of a 2-week recall across four dimensions of job demands at work; time management, physical demands, mental-interpersonal, and output (Lerner et al., 2001). Participant responses were reported using a 5 point Likert scale ranging from 1 (Difficult all of the time 100%) to 5 (Difficult none of the time 0%). A sixth option was available if the question did not apply, and was considered as missing data during analysis (Lerner, 2003). Response scales were calculated using the Lerner (2003) scoring method and domains with >50% missing data or not applicable removed from the respective domain, but were included in the work limitations index and overall productivity loss score. Questions were scored (1-5), summed and a mean score was calculated for each individual domain using the number of non-missing items per scale. Scale scores were calculated for each domain (= 25*(mean score-1)). Scale scores were converted into a work limitations Index. Finally, productivity loss score ranging from 0 (least limited) to 100 (most limited) was calculated (=1-exp(-WLQ index) to reflect the overall percentage of productivity lost over the previous two weeks (Lerner, 2003).

3.3.4.4. Musculoskeletal discomfort

Participants in studies 2 and 3 self-reported previous 7-day and 12-month musculoskeletal discomfort using the Nordic Musculoskeletal Questionnaire (NMQ)(Crawford, 2007). This standardised 27-item questionnaire originally developed by Kuorinka et al. (1987), to identify workers experience of discomfort across 9 symptom sites including the neck, shoulders, elbows, wrist/hands, upper back, lower back, hips/thighs/buttocks, knees and

ankles/feet (Dickinson et al., 1992). The NMQ is widely used across a number of occupational settings including manual and office workers, hospital and factory workers (Coenen et al., 2016). The NMQ is not used in clinical practice as a diagnostic tool (Crawford, 2007) however it was found to be highly repeatable among outpatients with upper limb disorders who completed the NMQ following a 1-week interval (Palmer et al., 1999). Furthermore the NMQ demonstrated high sensitivity and specificity (71-88%) among hospital outpatients, (66-92%) compared with clinical examination (Ohlsson et al., 1994).

During analysis for study 3, symptom sites were pooled into the following categories; upper back, lower back, upper extremities (neck, shoulders, elbow, wrists/hands) and lower extremities (hips, knees, ankles) (Healy et al., 2016b; Healy et al., 2017). Using a 12-month and 7-day recall, pooled symptom sites were classified as either a) non-problematic in the last 12-months or 7-days, b) problematic but does not interfere with daily activities, or c) problematic and does interfere with daily activities.

3.3.4.5. Health and Quality of life

Participants in studies 2 and 3 self-reported health related quality of life using the Euro-Quality of Life-5 Dimensions questionnaire (EQ-5D) (Herdman et al., 2011). The EQ-5D provides a standardised 5-item measure of health for clinical and economic evaluation across mobility, self-care, pain/discomfort, anxiety/depression and usual activities. The EQ-5D has five response categories ranging from 0 (no problem) to 5 (severe/extreme problem) across each domain, allowing a total of 3125 unique health states to be generated, which are linked to pre-determined weighted scores to assess quality-adjusted life years (QALYs). Each score is associated with a health status that ranges from 0 (death) to 1 (perfect health) (Payakachat, Ali and Tilford, 2015). The EQ-5D also contains a single item visual analogue scale, which asks participants to rate their current health status between 0 and 100. The EQ-5D is recommended for clinical and cost-effective

analysis by the National Institute of Health and Clinical Excellence (NICE, 2014) and is an appropriate tool for diverse populations, demonstrating acceptable internal consistency (0.73) and good construct validity among patients with coronary heart disease (De Smedt et al., 2013). Narrative analysis of the EQ-5D across 56 health conditions showed the tool to be sensitive to detect clinically meaningful changes over time across 25 (45%) conditions (Payakachat, Ali and Tilford, 2015). In conditions including alcohol dependency, schizophrenia, limb reconstruction and hearing impairment however, the EQ-5D was not found to be responsive to change (Payakachat, Ali and Tilford, 2015).

3.3.5. Anthropometry: Stature, body mass and body composition

Using standard anthropometric techniques in studies 2 and 3 (Lohman, Roche and Martorell, 1988) and with call agents wearing light clothing and no shoes, stature was measured to the nearest 0.1cm using a portable stadiometer (Marsden HM 250P, Leicester Height Measure, Seca Ltd, Birmingham, UK) and body mass to the nearest 0.1 kg using a calibrated mechanical flat scale (Seca Clara 803, Seca Ltd, Birmingham, UK). Body mass index was calculated as mass divided by stature (kg/m^2). Waist and hip circumference were measured to the nearest 0.1 cm using an inelastic anthropometric tape (Lufkin W606PM, Apex Tool Group Ltd., Sparks, MD, USA). For all outcomes, if the difference between the two measures taken exceeded >1%, a third measure was taken and the mean calculated.

3.3.6. Cardiometabolic markers

In studies 2 and 3 and in accordance with standardised guidelines (Frese, Fick and Sadowsky, 2011) following 15 minutes of seated rest, an automated sphygmomanometer (Omron, Omron Healthcare, UK) measured resting blood pressure on the brachial artery of participants bare right arm two times, at one minute intervals. If the difference between the two measures was ≥5 mmHg, a third measure was taken and the mean calculated.

Study Map

Study aims	Objectives
Study 1: To explore the factors influencing call agent's workplace PA and SB and identify strategies that may help agents to move more and sit less at work.	• To use a qualitative methodology to explore the perspective of call agents, their team leaders, and senior staff across multiple contact centre settings.
Study 2: To explore the acceptability and feasibility of delivering and evaluating a multi-component SB and PA workplace intervention in the contact centre setting.	• To conduct a process evaluation to assess response, recruitment and attrition rates, completion rates for all outcome measures. • To explore the acceptability and feasibility of the intervention from participant and organisational perspectives.
Study 3: To conduct a pilot RCT of a multi-component intervention with and without height-adjustable workstations in contact centres.	• To assess the response, recruitment and attrition rates, and completion rates for outcome measures. • To assess the acceptability of randomisation to an intervention with and without a height-adjustable workstation from participant perspectives. • To assess the acceptability of an intervention with and without a height-adjustable workstation from participant and organisational perspectives. • To monitor any adverse effects, such as injuries and disruption to working practices. • To derive estimates of the preliminary effect of the interventions on sitting time at work, and other behavioural, health and work outcomes.

Chapter 4.

Multi-stakeholder perspectives of factors that influence contact centre call agents' workplace physical activity and sedentary behaviour

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4.1 Introduction

High levels of SB are associated with distinct metabolic and physiological processes (Hamilton, Hamilton and Zderic, 2007; Burton, 2010). These processes increase the risk of developing cardiovascular disease, type 2 diabetes, some cancers and premature mortality, after controlling for PA levels (Burton, 2010; Dunstan, Thorp and Healy, 2011; Lee et al., 2012). Frequent breaks to prolonged sitting are also associated with favourable cardiometabolic profiles (Healy et al., 2008b; Dunstan et al., 2013b). Accordingly, further to public health guidelines to accrue 150 minutes of moderate or 75 minutes of vigorous intensity PA weekly, adults are recommended to reduce the time spent in total and prolonged periods of SB (Department of Health, 2011).

Occupational sitting contributes up to two thirds of office worker's daily sedentary time (Alkhajah et al., 2012; Mackenzie, Goyder and Eves, 2015). Further, adults in mainly desk-based occupations are exposed to forced periods of inactivity and static seated postures, which are ergonomic hazards in the physical work environment (Burton, 2010). Workplaces that employ mainly desk-based workers are therefore vital settings to prevent exposure to such hazards, via targeted reductions in total and prolonged SB and PA promotion (Black, 2008; NICE, 2008; Burton, 2010; Coenen et al., 2017a). This is supported by recommendations for mainly desk-based workers to accumulate 2-4 h per day of standing and LPA during working hours, with emphasis on regularly breaking up seated work [7].

The work of call agents in contact centres is typically monotonous (Sprigg, Smith and Jackson, 2003) and characterised by a high volume of customer service interactions that require telephone and computer assistance (Toomingas, 2005). Compared to traditional office workers, call agents have less perceived autonomy over their working tasks (Sprigg, Smith and Jackson, 2003), and spend more time at work sedentary and desk-based (90% vs 77%) (Thorp et al., 2012; Toomingas et al., 2012; Straker et al., 2013), often in periods of ≥30minute bouts (Thorp et al., 2012). This suggests that call agents are at greater risk

for non-communicable disease than traditional office workers, and the factors influencing call agents workplace PA and SB may differ from traditional office workers.

Currently, there is limited awareness of the factors that influence PA and SB at work in highly sedentary contact centre call agents. Multi-level trials in traditional office workers suggest that targeting influential factors across organisational, environmental, interpersonal and intrapersonal levels, as outlined by the SEM, are more effective than interventions targeting factors at a single level (Bronfenbrenner, 1977; McLeroy et al., 1988; Neuhaus et al., 2014b; Healy et al., 2016a). In accordance with the limited evidence in this setting, no published research has reported the use of formative work to determine the specific factors influencing call agents SB and PA prior to the development of targeted intervention strategies. This approach is supported by the MRC framework (Craig et al., 2008), which advocates formative work as a key phase of intervention development prior to piloting, evaluation and implementation, to enhance the effectiveness and sustainability of tailored intervention strategies. In line with the MRC framework therefore, and underpinned by the SEM (Bronfenbrenner, 1977), the primary aim of this study was to explore the factors influencing call agent's workplace PA and SB and identify strategies that may help agents to move more and sit less at work.

4.2 Methods

4.2.1 Study design

This qualitative cross-sectional study used focus groups and interviews to explore contact centre stakeholder perspectives. Questionnaires were completed after the focus group or interview to describe the sample. Qualitative findings are reported in line with the consolidated criteria for reporting qualitative research (COREQ) checklist (Tong, Sainsbury and Craig, 2007). Ethical approval was obtained from Liverpool John Moores research ethics committee (16/SPS/033).

4.2.2 Participants and setting

A convenience sample of participants were recruited from four private contact centre companies with branches in the North West of England, situated in both urban (*n*=2) and rural (*n*=2) settings (Table 4.1). Two of the four centres implemented height-adjustable workstations and frequent break schedules as remedial measures for employees with musculoskeletal or chronic medical conditions, following a display screen equipment assessment (HSE, 2002). Each company expressed interest in the study following an invited presentation by the research team at a North West of England contact centre forum. After individual meetings to discuss the study aims and requirements, each company provided gatekeeper consent to recruit their employees and conduct the research in their centre. Call agents, team leaders and senior staff (consisting of human resources, head of centre, support team and engagement manager roles) received a recruitment message and participant information sheet, developed by the research team, via each company's internal e-mail system. Employees were eligible if they were ≥18 years old and ≥0.8 full time or part time equivalent worker in a call agent, team leader or senior staff role. All call agents operated in inbound call taking roles. Participants had 2 weeks to express interest by contacting the main author via email or an assigned contact within each centre. Interested and eligible participants (call agents *n*=20, team leaders *n*=11, senior staff *n*=12) provided written informed consent. There was no racial or gender bias in participant selection.

Table 4.1. Descriptive company information for the participating contact centres across the three empirical studies. Each company was located in the North West of England (within a 50-mile radius of the research institution) and was affiliated with the Call North West forum. All companies handled inbound call taking and operated in large open plan office environments.

Company 1 (Study 1)	Company: Private Limited Industry: Utilities Company size 1001- 5000 employees Number of call agents *n*= <100 seats Location Wigan, UK No height-adjustable workstations installed at the time of data collection Team leader ratio 1:14 Large ratio of agency to full time staff ~ 70:30 at the time of data collection.
Company 2 (Study 1)	Company: Private not-for-profit Industry: Social housing Company size 201-500 employees Number of call agents *n*= ~16 seats Location Manchester UK Mental health workplace champions in place on site. No height-adjustable workstations installed at the time of data collection Team leader ratio 1:8
Company 3 (Studies 1 and 2)	Company: Public Industry Telecommunications Company size > 10,000 employees Number of call agents *n*= ~280 seats Location: Manchester UK Rotational shift pattern working five 7.5 hour shifts a week between 8am and 9pm, 5 days out of 7- Monday – Sunday Provided a number of height adjustable workstations for individuals with a pre-existing medical or musculoskeletal condition following a display screen and occupational health assessment. Team leader ratio 1:20
Company 4 (Study 1)	Company Private Limited company Industry: Utilities Company size 101-5000 employees Number of call agents *n*= <100 seats Location: Warrington UK Provided a number of height adjustable workstations for individuals with a pre-existing medical or musculoskeletal condition following a display screen and occupational health assessment. Team leader ratio 1:10

4.2.3 Focus groups and interviews

Aligned to the pragmatic epistemology throughout this thesis, focus groups were used to elicit in-depth insights across the three key stakeholder groups within four contact centres. Focus groups have similarly been used to explore employee and employer attitudes towards potential SB and PA intervention strategies (De Cocker et al., 2015), and employee perceptions of a SB workplace intervention (Chau et al., 2014). Compared to

quantitative methods such as surveys, focus groups can highlight attitudes and assumptions within a population, with participant interactions able to explore the extent to which perspectives are consistent and/or contrary (Robinson, 1999). The aim was to recruit a minimum of 4-8 participants per focus group, in line with previous recommendations (Kitzinger, 1995; Tong, Sainsbury and Craig, 2007). Due to the number of call agents who expressed interest, conflicting work schedules, and, staffing numbers for team leaders and senior staff, focus group size ranged between 2-6 participants, and three one-on-one interviews were conducted (two with team leaders and one with a senior staff member). Data collection took place on site at each company's North West branch during working hours between July-October 2016. Accordingly, the first author who is experienced in qualitative research, conducted six semi-structured focus groups with call agents, two with team leaders and four with senior staff. To increase homogeneity, participants were grouped according to job role to reflect the hierarchical organisational structure (Shenton, 2004). A team leader was present during two call agent focus groups in company 3, however their contributions were considered important to the research objectives and did not appear to impact the agents willingness to openly discuss their perspectives and experiences (Kitzinger, 1995). To maintain participant confidentiality and safeguard participants and the researcher, data collection occurred in a meeting space familiar to all participants that could be overseen, but not overheard. All focus groups and interviews were recorded using a digital audio recorder and ranged from 29-87 minutes duration (mean 56 ± 14 min).

To enhance the credibility and trustworthiness of the data, the focus group schedule was developed in line with organisational, environmental, interpersonal and intrapersonal levels of the SEM (Bronfenbrenner, 1977; McLeroy et al., 1988), and grounded within current literature advocating a multi-level approach to workplace intervention development (Neuhaus et al., 2014c; Healy et al., 2016c). The protocol for delivering the focus groups and interviews was standardised, using the semi-structured schedule as a guide to promote a commonality throughout the focus groups. To allow participants to respond

openly and freely however, flexibility in the order and sequence of questions was permitted (Kitzinger, 1995). Questions addressed perceived factors influencing call agents workplace PA and SB. Within this, discussion areas included current working practices and initiatives that promote or negate SB and PA, perceived roles and responsibilities for promoting health and wellbeing, and employee perspectives on the current workplace recommendations (Buckley et al., 2015). The first author developed the focus group schedule, which was reviewed by two members of the research team (LG, RM) during team briefing sessions. No pilot interviews or focus groups were conducted prior to data collection, although consistent themes emerged across the 12 focus groups and 3 interviews, which suggests saturation was reached (Tong, Sainsbury and Craig, 2007).

4.2.4 Qualitative analysis

The method of qualitative analysis is described in detail in section 3.4.1. The SEM provided the point of departure framework for the deductive analysis. During the inductive process, transcriptions were read and re-read to familiarise the researcher with the complete data set, and initial codes were generated from a piece of text that related to factors influencing workplace SB and PA (Vaismoradi, Turunen and Bondas, 2013), prior to being imported into QSR NVivo software 10 package.

4.2.5 Survey and questionnaires

Participants descriptive demographic information and wellbeing reported as described in section 3.4.1.3. The International PA Questionnaire (IPAQ) (long form) assessed habitual PA over the previous 7-days (Booth et al., 2003). Twenty-seven questions assessed the frequency and duration of moderate and vigorous-intensity PA and walking activities undertaken across four domains (occupational, transport, household and recreation). Total PA scores were calculated through summation of duration and frequency of each activity across each domain, and classified as low (<600 MET min/week), moderate (600-

2999 MET min/week) or high activity (≥3000 MET min/week). Estimated weekend and weekday sitting time values are not included in total PA score. Previous studies have shown good test-retest reliability (0.8), with fair-moderate criterion validity between IPAQ and accelerometer data (0.33, 95% CI 0.26-0.39) (Booth et al., 2003).

The Workforce Sitting Questionnaire assessed previous 7-day workday and non-workday sitting during travel, work, watching TV, using a computer (at home) and during other leisure activities (Chau et al., 2011). Total sitting time for a typical workday and non-workday were calculated by summing sitting times across each domain. Participants reported the number of workdays during the previous 7-days, which allowed a weighted mean for total sitting time per day to be calculated. The questionnaire has good-to-excellent test-retest reliability (0.65-0.80) (Chau et al., 2011).

4.3 Results

The sample were predominantly female, White British, single and full-time employees (Table 4.2). Agents predominately had ≤3 year tenure in their current role. All participants reported their daily working tasks were mainly seated although call agents reported a higher volume occupational sitting time than both team leaders and senior team leaders. Self-reported previous 7-day PA ranged between 460-925 MET min/week for agents, 537-1190 MET min/week for senior team leaders and 150-4690 MET min/week for team leaders, with team leaders typically reporting the highest PA levels. Team leaders and senior team leaders reported average physical health scores while agents reported below average physical health scores. Both team leaders and call agents had lower than average mental health scores according to the US mean (50 ± 10%), with scores lowest for team leaders (Ware et al., 1998; Ware et al., 2008).

Table 4.2. Descriptive characteristics of contact centre employees by job role

	Senior Team (*n*= 12)	Team leaders (*n*= 11)	Call agents (*n*= 20)
Age (years)	40.3 ± 9.9	38.6 ± 12.2	41.1 ± 15.3
Female	7 (58)	5 (45)	10 (50)
White British	12 (100)	10 (91)	19 (95)
Single	3 (25)	5 (45)	15 (75)
Full-time employment	9 (75)	9 (82)	15 (75)
Tertiary education	10 (83)	5 (45)	10 (50)
Tenure (≥ 3 years)	6 (50)	9 (82)	3 (15)
Physical health summary (%)	52 ± 10 (28 – 65)	53 ± 4 (47 – 58)	49 ± 9 (30 – 65)
Mental health summary (%)	51 ± 6 (38 – 57)	44 ± 10 (31 – 50)	47 ± 10 (24 – 66)
Total PA (MET min/week)	869 (563)	1609 (1428)	964 (1125)
Occupational sitting time (min/day)	390.0 ± 111.4	333.0 ± 122.8	419.4 ± 57.1

Table presents data as means ± SD, or n (%). Total PA data is presented as median (IQR); The range of physical and mental component scores are also presented. *Note*: Data is missing for 1 agent, 1 team leader and 2 senior team leaders due to the participants leaving data collection after the focus group/interview but before survey completion. Each participant received an email to request the data, however participants did not respond.

Factors from all levels of the SEM were perceived to influence call agent's PA and SB at work. Higher-order and sub-themes are presented in accordance with levels of the SEM and presented schematically (Figure 4.1). Throughout the results, data extracts are presented with participant number (e.g. P21), job role (AG=Agent, TL=Team leader, ST=Senior team), company number (1-4) and an indication of focus group or interview contribution (FG or I).

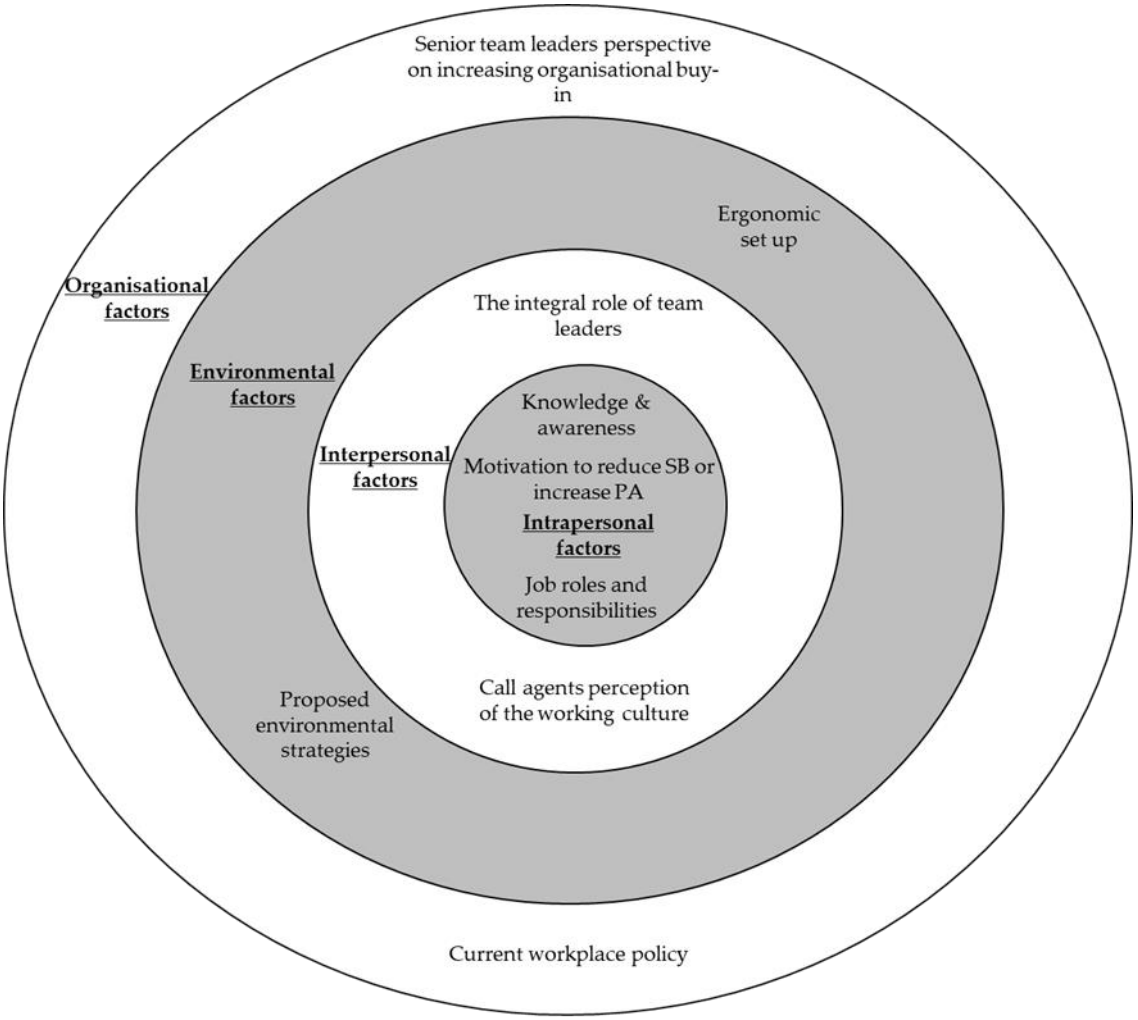

Figure 4.1 An overview of the higher order themes that represent factors influencing call agents workplace PA and SB across four levels of the SEM.

4.3.1 Intrapersonal factors

4.3.1. Knowledge and awareness

4.3.1.1 Call agent's awareness and perception of high SB

Consistent with the Workforce Sitting Questionnaire data, agents were aware they spent the majority of a typical working day seated and desk-based. Call agents reported that minimal variation in their work tasks reduced the opportunities to break their SB and be active at work.

> "*I'm sat down really. I don't move, I really don't move. So it's completely sedentary until break about quarter past one and I'm sat down then as well*." P38 (AG4 FG)

Agents commonly acknowledged the presence of negative physical (weight gain and musculoskeletal discomfort) and psychological (low mood and low energy) effects following prolonged occupational and daily sitting.

> "*I've put on weight, and my back kills sometimes, yes, from just having like really long days sat down, especially on the days that I don't do anything after work as well. So like if I'm sat down all day at work, and then I go home and I'm sat in a chair at home or whatever when I go home, my back's killing me*." P28 (AG4 FG)

Despite the sedentary nature of the job, agents perceived a number of benefits to moving more and sitting less, including feeling more alert on calls and less fatigued, improved general mood, wellbeing, social relationships and productivity, weight loss, and reduced musculoskeletal discomfort.

> *"I've noticed that you kind of, when you're up and about, you're constantly moving and generally sort of feel a bit better by sort of moving and doing more things. […] You may then get better working environments and more effective work from each individual if you do introduce more activity throughout the day*." P36 (AG4 FG)

3.1.1.2 Knowledge of national guidelines and workplace recommendations for PA and SB

Compared to agents and team leaders, the majority of senior team leaders were educated to a tertiary level. Education level however did not appear to influence knowledge and awareness of national PA guidelines (Department of Health, 2011) and recommendations for mainly desk-based workers (Buckley et al., 2015), which was low to non-existent across agents, team leaders and senior team leaders.

> *"Really? I didn't know about that [workplace recommendations]. I was just more thinking about it's my eyes. I didn't actually think me as like my body and everything*." P6 (AG1 FG)

In response to the workplace recommendations (Buckley et al., 2015), most agents and team leaders felt that achieving a reduction of 2-4 h of total sitting was "a hell of a lot of time" (P32 TL3 FG) and even "laughable" (P8 AG1 FG) in the current working

environment. Most agents were unsure how they could feasibly reduce or break up their sitting time to meet the recommendations.

> *"[Reducing sitting by 2-4 h/day] That's just not feasible working here, I don't think. It would just be virtually impossible to cut [sitting] down by so much*." P6 (AG1 FG)

Accordingly, all stakeholder groups proposed further education and training as a strategy to promote knowledge and awareness of national guidelines and workplace recommendations for PA and SB, and additionally, the relationship between PA, SB and health.

> *"[I would] just like more information on what the benefits are of doing it [breaking sitting time], be that health-wise or be that job-wise. Because obviously, at the moment you know realistically you shouldn't be sat down all day, because it's not good for you, but you don't know the reasons, like what's the benefits*." P1 (TL1 FG)

4.3.2. Motivation to reduce SB or increase PA

When reflecting on factors influencing SB and PA at work, several call agents felt a lack of energy and feeling "lethargic" (P22 TL3 FG) reduced their daily motivation to break up sitting time, take active breaks or be more physically active during or after work.

> *"It's the fact that I think you just feel so drained and so tired from looking at the screen and just sitting there […] and I just think you don't feel motivated*." P4 (AG1 FG)

Several call agents identified sitting as an ingrained behaviour in their daily work routine, including during break times.

> "I would spend it [break times] at my desk, or if I think I've got enough time, I go into the little short room with the sofa. I go and lie on the sofa." P33 (AG3 FG)

All agents reported high daily call volumes, and several reported frequent exposure to incivility during customer calls. These agents subsequently emphasised that a primary

motive to break away from their workstations was to preserve their positive mental health rather than a desire to take an active break.

> *"…so I tend to go in there, plug myself into my iPod, listen to a book, and so three quarters of an hour, just take myself away. I'm still sat. I don't walk anywhere. But I kind of take myself away from work, and then come back mentally afterwards."* P15 (AG2 FG)

In contrast, some agent's awareness and perception of their prolonged sitting motivated them to break away from their workstations during scheduled break times, or seek opportunities to break up sitting time during the day, to mitigate the negative effects of prolonged sitting.

> *"I find with myself, when I'm sat down for too long, I tend to feel it more than anything, so I find that even if the opportunity to go up and do a brew run, say, getting myself moving, it tends to help kind of getting the blood flowing, shall we say, so when I do sit back down again and I'm back on my calls, it helps with keeping me alert, I think.*" P34 (AG3 FG)

To promote awareness of, and increase agent motivation for future PA and SB strategies, agents suggested their organisations could use frequent verbal (during team meetings and one-to-ones), visual (posters, notice boards and flyers in communal areas) and electronic (via email, intranet or the internet) promotional messages.

> *"…it's not really promoted on a daily basis. Because it's the same with advertising. If you don't advertise it, if you're not going to notice it."* P34 (AG3 FG)

While agents reflected upon the factors influencing their daily motivation to move more and sit less, team leaders and senior team leaders contrastingly focused on previous uptake by agents to formal health and wellbeing initiatives, including running clubs, lunchtime walks, yoga, subsidised gym memberships and team competitions. Team leaders and senior team leaders often attributed poor uptake and limited longevity of initiatives to low call agent motivation, and perceived low motivation as a barrier influencing agent's engagement in future workplace initiatives.

> *"…the challenge they [team leaders] have is getting [health and wellbeing initiatives] off the ground. It's not because of the effort we put into it, it's because of the effort that the individual wants to give back. That's the challenge*." P24 (ST3 I)

> "*You might find that people will ask for something, even push for, but not use when it's delivered and the opportunity's there."* P34 (TL4 I)

Previous delivery of formal health and wellbeing initiatives across all centres was non-compulsory, therefore agents were able to choose whether to engage or not.

> *"We don't want to be kind of dictating to people what they do and how they do it you know, poking people when they've been sat down for too long.*" P18 (ST1 FG)

> *"…well you can take the horse to water can't you but you know there's only so much you can, you can do, you can put it there, you can make it as, you know as available as possible but it then does rely on peoples sense of self responsibility to engage in that."* P11 (ST2 FG)

Accordingly, several senior team leaders emphasised the importance of understanding their call agents wants and needs in relation to health and wellbeing, before developing future initiatives to promote PA and reduce SB in agents at work.

> *"[We need] wellbeing interventions that are tailored to the specific wants and needs of our agents, and for that, we require agent feedback […] we need to understand what the specific definition of wellbeing is for the individual to work for us in our contact centres […] unless we get to that definition, then it's likely that whatever we try and do, […], we'll miss the mark, because we're not actually creating a solution that is fixing the problem, because the problem hasn't been identified."* P26 (ST2 FG)

4.3.3. Job roles and responsibilities

Agents, team leaders and senior team leaders acknowledged that in order to meet their job requirements and maintain productivity levels, agents need to be seated to take calls while simultaneously inputting information into the computer systems.

> *"That's the job, isn't it? You're employed to be sat down to take calls.*" P34 (AG3 FG)

> *"I just think, well, they're paying me to do a job, so why should they pay me for doing my exercises."* P9 (AG1 FG)

Agents frequently reported a major barrier to sitting less at work was the potential negative impact on their productivity, which some felt could jeopardise their job security.

> *"There's no requirement within that role for us to get up and wander around. There's nothing within the job description that says we need to do that."* P15 (AG2 FG)

> *"I've not been here that long, to be honest, and I think that's probably why I'm more anxious about security of the job*." P4 (AG1 FG)

Several agents expressed a unique desire for increased autonomy over their working practices, although interestingly, autonomy was not always perceived as a facilitator for moving more and sitting less.

> *"I'd just like to be able to work standing up if I choose to, to have a desk that you can perhaps move up so that I can stand up for half an hour, because I'm fed up of sitting down."* P16 (AG2 FG)

> *"It's like me, I choose to sit down all day, I choose to sit in the bistro. It's not the company making me do that, that's just the way I am."* P15 (AG2 FG)

Encouragingly, call agents, team leaders and senior team leaders similarly supported the notion of agents becoming more active and less sedentary at work. Team leaders perceived that part of their role was to instigate PA and SB reductions in agents, and suggested their unique knowledge of their team's dynamics and individual agents could help tailor PA and SB approaches to meet individual agents' needs and preferences.

> *"…I manage a team of people and I've got you know different types of people, some that are quite active, some that aren't quite as active as each other."* P23 (TL3)

> *"I think something that we could tailor to the individual needs as well."* P21 (TL3 FG)

Team leaders however perceived a high workload as a barrier to initiating and promoting PA and SB strategies at work. To that end, team leaders highlighted the need to consider the burden placed upon middle management in the design and implementation of future interventions.

> *"… you've got a pile of escalations that have piled up, a pile of credits that have piled up, a load of emails that your line managers have sent you and they say 'well why haven't you done that?' […] Sometimes you're distracted, being a manger because of all the tasks that you have to do in a day, I don't know how you find the balance to be honest."* P20 (TL3 FG)

To offset the burden placed upon team leaders, several team leaders and senior team leaders suggested implementing localised workplace champions.

> *"You'll get a fantastic management buy-in to those kind of theories, because it's offloading a responsibility to a third party in a recognised format […] somebody like a workplace champion would […] decide to be involved, raise awareness […] none of this would be for everybody, but to have, again, a workplace champion in place that understood, was a point of contact […] I can see that working really quite well"* P43 (TL4 I)

Senior staff in company 1 recognised workplace champions as an opportunity to develop specific role requirements and provide professional development training for existing call agents.

> *"…I think that's definitely something that we can take away isn't it as an idea. […] is anybody interested […] almost like applying for a role."* P18 (ST1)

In addition, workplace champions were perceived as a strategy to shift attitudes surrounding workplace PA and SB, and, to promote sitting reductions and active breaks. At the time of data collection, company 2 used workplace champions to tackle mental health at work, with one team leader describing that it felt intuitive to include discussions of mental and physical health within their mental health champion role.

> *"Most definitely yeah. I mean well that's just part and parcel if it isn't it that you know, in mental health, if someone's feeling down or you know ' get up and go and take some fresh air' 'take yourself out of a situation' it all comes part of that […] it's definitely within conversations that we have with staff on a day to day basis you know yeah, mentally and physically."* P13 (TL2 I)

In contrast to the agents and team leaders who provided insights in to their individual roles, senior team leaders offered a broad organisational perspective, focusing on the "duty of care" (P24 ST3 I) to their employee's health and wellbeing. Each senior team

leader deemed their company responsible for fostering a workplace environment that enables agents to move more and sit less.

> *"I think we [company 1] should encourage it. I think we should at least make people aware of the things that they can do, and perhaps that's something we maybe, we don't talk enough about or promote that we do allow people to go and make themselves a brew and have a walk or if they want to go downstairs then because that is quite a thing to promote and talk about that people can do that kind of thing in the workplace*" P18 (ST1 FG)

Interestingly though, team leaders and senior team leaders identified a conflict between promoting agent health and wellbeing, and, business needs including meeting targets, remaining productive and adhering to personal time allocations for comfort and scheduled breaks, which were all continuously monitored

> *"…we have reports which effectively tell us at any given moment of the day, the status of an agent's phone."* P26 (ST3 FG)

> *"Am I trying to achieve something that I can turn round to my bosses and go, "Look, we improved performance", or am I actually trying to turn round and say, "People are happier"? You've got to prioritise."* P26 (ST3 FG)

4.3.2. Interpersonal Factors

4.3.2.1. Call agent's perception of the working culture

Within discussions on sitting and PA at work, agents identified the concept of a working culture within each company, which they described as typically sedentary in nature in office spaces and break out areas. Agents therefore identified the working culture as a factor influencing their SB and PA at work.

> *"…we're in the culture that we are in where we are just quite happy to sit at our desks […] There needs to be a bit of enthusiasm led by the business.*" P35 (AG4 FG)

Agents commonly felt that any break in addition to scheduled break times, for example to attend a meeting, complete a working task or take a comfort break, would be judged

negatively by others in the current working culture. When specifically discussing PA promotion and SB reduction, most agents and some team leaders were conscious that fellow agents and team leaders would perceive agents as unproductive, strange or disruptive if they frequently broke up their sitting.

> *"…if everyone was doing it, everybody else would just go, "Look at them skiving again going outside", and, "How many calls have you took today?"* P9 (AG 1 FG)

> *"…some staff probably feel as though, "If I go away from my desk, they're [team leaders] going to think I'm skiving or not doing my work."* P2 (TL1 FG)

4.3.2.1.2. The integral role of team leaders

Agents, team leaders and senior team leaders considered team leaders integral in influencing agents PA and SB at work. Team leaders were identified as the "key levers to pull" P27 (ST3 FG) for initiating a shift in culture towards more active and less sedentary call agents. Agents were aware that team leaders were prone to skipping break times and eating at their desks or during meetings, yet felt that team leaders were able to influence agents' PA and SB at work by visibly demonstrating the target behaviours within their own working practices.

> *"So if all team managers and whoever and it came from top down and led by example; so if there all acting a certain way, it becomes the culture within the contact centre and then subconsciously you are going to be more active because you're not realising it. You're not making a conscious effort to a certain point because everybody is doing it and then it becomes normal."* P35 (AG4 FG)

Some team leaders and senior team leaders were also aware that their own behaviour at work could influence call agent behaviour and the culture surrounding PA and SB.

> *"So everybody does need to have a break so that they come back fresh, but what we do is, we just slog through it, because everybody just does now, […] our leaders do that as well. I'm not saying it's their fault, it's absolutely not their fault, but no one else will change until they see them [team leaders] actually changing first."* P25 (ST 3 FG)

4.3.3. Environmental factors

4.3.3.1 Ergonomic set-up

Agents, team leaders and senior team leaders identified the call agent's physical connection to their workstation, via a headset, as the main environmental barrier preventing agents from sitting less at work. This connection is essential for accurately inputting customer information onto the computer systems during calls, and ultimately maintaining productivity.

> *"You can't leave. You've got to capture the information whilst you're on the phone. It's got to be correct and accurate. So I think that's a major barrier.*" P36 (AG4 FG)

Agents and team leaders considered the potential impact of standing while on calls in the current ergonomic environment, and perceived poor posture and prolonged static standing as key barriers to this, and a potential musculoskeletal health hazard.

> *"The headset, you know, you'd be bending over again and again. It's not ideal. The best way to actually do the job I do, is actually being sat down."* P38 (AG4 FG)

4.3.3.2 Proposed environmental strategies

Agents, team leaders and senior team leaders identified height-adjustable workstations as a tangible solution to enable agents to break up their sitting time while maintaining productivity.

> *"I'd like to see us […] come up with a, not radical but something different like we might have banks of desks that you know that are permanently up or different ways that they can sit, or when they've been sat for a few hours and think 'I'm going to move over to this hot desk and I'm going to work here because I can stand."* P12 (ST2 FG)

Uniquely however, senior team leaders acknowledged the cost associated with implementing height-adjustable workstations as a potential organisational barrier for companywide implementation.

> *"I can absolutely see the benefits of them [height-adjustable workstations] I really, truly can it's just thinking about how you practically do it within this kind of working environment isn't it, without incurring a massive cost."* P18 (ST1 FG)

One agent also articulated how implementing height-adjustable workstations alone may not elicit sustained changes in sitting behaviour over time.

> *"So it's just a standing up desk? I probably wouldn't. I think that's more due to a bit of laziness, or it's, what can I say? I think it'd be more the novelty of it might wear off after a certain amount of time, and then I'd probably think, "I want to sit down now."* P3 (AG3 FG)

Subsequent discussions with team leaders and senior members identified alternative strategies to reduce workplace SB and address the environmental restriction preventing agents breaking up SB at work. Strategies included prompting walking, standing or active one-to-one and team meetings, short frequent breaks, prompts to break sitting time, wireless headsets, initiating more discussions about general health and wellbeing with agents, and, demonstrating buy-in to a PA and SB initiative through their own working practices.

> *"You don't have to do your 1:1 sat in a room do you? You could go for a walk."* P20 (TL3 FG)

> *"We [team leaders] could promote it, walking up the stairs let's have a challenge for the week, whoever does the most steps, get in stepometers or something."* P13 (TL2 I)

Agents and team leaders however questioned the acceptability of implementing a hot desk system of height adjustable workstations, and the feasibility of portable equipment.

> *"[In relation to using a hot desk] the IT never works somewhere else, and you get your own desk with your stuff, your information and everything. You can't transport all that around."* P16 (AG2 FG)

In addition, team leaders and senior staff expressed reservations to implementing short-frequent breaks due to the potential negative impact on agent's adherence to break times and in turn, productivity. Many agents also perceived a short break (e.g. 5-minutes) as inadequate.

> *"[Regarding short frequent breaks] there's more opportunity to not be adhering to it."* P26 (ST3 FG)
>
> *"I mean, five minutes. What would you do in five minutes? You may as well just stand up at your desk and then sit back down again."* P28 (AG3 FG)

Considering call volumes in each centre were susceptible to large and sporadic fluctuations, agents and team leaders believed it was important to integrate SB reduction and PA promotion strategies into daily working practices. Senior team leaders had a similar perception that it would improve engagement in, and the sustainability of health initiatives, whilst minimising disruption to productivity.

> *"I think it's trying to build it into your job [...] I like standing up or moving around a bit and twisting, so you can do that on the phone, but it's how to do all the typing things and other things as well."* P8 (AG 1 FG)
>
> *"… also so that it [reducing sitting] can be done no matter whether it's busy or it's quiet, because again, I think we too easily take on ideas when it's really easy to do it, but if it becomes harder, obviously they go out the window […]. If we hit red alert, it means we've got two to three calls queuing, then everything is pulled."* P32 (TL3 FG)

4.3.4. Organisational Factors

4.3.4.1. Senior team leader's perspective on increasing organisational buy-in

All senior team leaders offered a unique insight into the organisational motives for promoting PA and reducing SB at work among agents. Motives consistently included reducing sickness absence, improving tenure and optimising productivity, with an underlying ethos that promoting healthier lifestyles at work would mutually benefit agents and the business.

> *"…if staff are healthier and happier then they're going to be more engaged within the workplace.*" (P18 ST1 FG)

All senior staff however indicated that in order to invest in future interventions, an evidence-based business case was essential. Senior team leaders described that the business case should demonstrate the impact of an intervention on business outcomes (productivity, customer service scores, average call handling times, sickness absence and employee engagement) and employee health and wellbeing. While this suggests impact measurement was not solely driven by financial gain, documenting clear cost savings was perceived important for demonstrating a return on investment and gaining organisational investment of time or money.

> *"They [the senior team] want to understand the usual things, why you want to do it [reduce sitting and increase PA], what the benefits for the business is going to be, the benefit to the individual, what are the risks associated if you don't do it [reduce sitting and increase PA], a cost, and then what's their return on investment for doing it [reduce sitting and increase PA]."* P42 (ST4 FG)

> *"I would love to be able to measure the output of the wellbeing intervention from the perspective of engagement/other business metrics such as absence [...] So we're trying to make a culture change, but you can't make a culture change without your leaders, but you also can't make a culture change without investment, and you don't get investment unless you can prove the benefit."* P26 (ST3 FG)

Measuring the impact of an intervention however highlighted a challenging paradox between delivering effective strategies to promote agents physical and psychological health, while pursuing the core business needs for return on investment.

> *"…there's an uncomfortable sort of, it's almost a paradox to talk about ROI [return on investment] and wellbeing in the same breath"* P26 (ST3 FG)

4.3.4.1.2. Current workplace policy

Despite all four centres previously delivering PA initiatives to promote agent health and wellbeing, SB reduction and PA promotion did not appear defined or addressed within organisational policies or working practices.

> *"We are trying to pull together a health and wellbeing strategy for [employee], but […] I would say at the moment [sitting time and PA] it's probably not defined.*" P25 (ST3 FG)

Several current working policies within the centres, such as being allowed to eat lunch at desks, or using work computers during scheduled breaks, seemed even to discourage PA and promote SB in agents.

> *"… it is very easy just to sit there when you're having your breaks or your lunches and stay behind your computer and actually do anything."* P23 (TL3 FG)

Furthermore, across all centres, agents, team leaders and senior team leaders identified the display screen equipment assessment (HSE, 2002) as a prerequisite to receiving any ergonomic adaptations. Across each company, only call agents with chronic health or musculoskeletal conditions were identified as having access to approved display screen equipment strategies, including height-adjustable workstations, short and frequent breaks, and chair modifications.

> *"They have the choice of standing or sitting, depending on what they want to do. We have at least two of those [height-adjustable workstations] sets here, but they're for occupational health reasons only."* P32 (TL3 FG)

Agents acknowledged little to no organisational support in their current job role to move more and sit less. Integrating PA and SB reduction into agent and team leader roles was therefore proposed by agents as a way to enhance employee engagement and accountability to move more and sit less at work.

> *"There's no requirement within that role for us to get up and wander around. There's nothing within the job description that says we need to do that.*" P15 (AG2 FG)

> *"…if [promotion of active breaks and sitting reduction] was in the team leader's job description it might be a help.*" P9 (AG1 FG)

Notably, an underlying theme expressed by agents and senior staff in each centre was the importance of delivering workplace initiatives in which employees felt valued and invested in.

"…that comes down to your employees that are happy to come into work and of course with initiatives like this it's that whole sense of the employees that they feel the companies invested in them, values them which again can of course have positive effects in terms of things we've kind of touched on, morale, productivity, things like that." P17 (ST1 FG)

4.4. Discussion

This is the first study to explore factors influencing contact centre call agent's workplace PA and SB, from the perspective of call agents, their team leaders, and senior staff. Call agents described factors influencing their motivation to move more and sit less at work, including continuous performance monitoring, job security concerns, incivility on calls and a desire for increased autonomy over their highly controlled working practices. In contrast, team leaders and senior team leaders identified a conflict between promoting productivity and targets to call agents, while encouraging them to move more and sit less. Further, senior team leaders offered a unique insight into the organisational motives for health and wellbeing initiatives, and the importance of an evidence-based business case for future investment in PA and SB interventions. Common influential factors identified by agents, team leaders and senior team leaders were low knowledge and awareness of PA and SB as health-related behaviours, and PA and SB guidelines and recommendations, and, a sedentary working culture. This culture seemed compounded by perceived peer judgment, agent's ergonomic set up and little-to-no recognition of PA promotion and SB reduction in organisational policies and job roles. In accordance with these factors, and the second study aim, strategies identified to help call agents move more and sit less at work included acknowledgement of PA and SB within policy and job roles, height-adjustable workstations, education and training sessions and greater interpersonal support.

Senior staff in the present study described that the organisational motives for implementing PA and SB strategies were to improve employee health, wellbeing and performance. Despite this, PA and SB were not acknowledged within current

organisational policies or job roles. Existing practices, including being allowed to eat lunch at desks, and using work computers during scheduled breaks, appeared to discourage PA and promote SB in agents. In addition, adherence to current UK workplace legislation meant that call agents in these centres typically received remedial ergonomic support, namely to reduce existing musculoskeletal discomfort, only after a chronic medical or musculoskeletal condition was diagnosed (HSE, 2002). Accordingly, current policies, practices and legislation counter recommendations for desk-based workers to stand and be active work for at least 2 h/workday (Buckley et al., 2015) and, organisations to have a workplace SB policy in which tasks and job roles are redesigned to include the promotion of, and opportunities for, standing and light activity (Coenen et al., 2017a). Contact centres should therefore consider a preventative rather than treatment approach within their policies to support call agents health and wellbeing. This is especially important given call agents accrue a greater proportion of workplace SB (Thorp et al., 2012), and have higher levels of stress and depression (Sprigg, Smith and Jackson, 2003), compared to other desk-based occupations.

Preventative, health promotion initiatives recalled by call agents, team leaders and senior staff focused on formal PA opportunities, with no initiatives to reduce SB identified. PA strategies identified included lunch time walking groups and exercise sessions, which have been shown effective for increasing self-reported PA among white collar workers (Malik, Blake and Suggs, 2014). Participants in the present study however indicated that such formal PA initiatives were not successful, due to the requirement of additional offline time, and perceived low agent motivation for the initiatives. As proposed by the participants therefore, alternative less formal strategies embedded into current working practices, such as walking, standing or active meetings, should be considered in future contact centre trials. This approach may also help to alleviate the conflict identified by team leaders and senior team leaders between promoting agent's health and wellbeing, and ensuring productivity and performance are maintained.

Similar to research in traditional office workers (De Cocker et al., 2015; Hadgraft et al., 2016a) and contact centre managers (Renton, Lightfoot and Maar, 2011), productivity concerns and a sedentary working culture were perceived to negatively influence call agents PA and SB at work. The influence of these factors seems heightened in the contact centre setting however, by the continuous objective monitoring of call agents productivity metrics and personal time, and agents perception that sitting less at work could reduce their productivity and hence jeopardise their job security. Equally, high daily call volumes and large, sporadic fluctuations in call volumes limit opportunities for agents to break up their sitting time. Agents consequently desired more autonomy over their working practices, which is supported by evidence that call agents have lower perceived autonomy at work than desk-based workers (Sprigg, Smith and Jackson, 2003). Accordingly, this provides further evidence to suggest that to promote physical and mental health in call agents, without influencing productivity, PA and SB strategies should be embedded within current working practices.

Another key factor negatively influencing call agents workplace PA and SB was their ergonomic set-up, in which agents were physically connected to their computer system via a headset. This is consistent with ergonomic restrictions identified in previous studies (De Cocker et al., 2015; Hadgraft et al., 2016a; Such and Mutrie, 2017), with workers required to sit to complete computer-based tasks. Accordingly, call agents and team leaders believed the current working environment did not enable agents to reduce their workplace sitting by the recommended levels (Buckley et al., 2015). To overcome this influential factor, all stakeholders suggested height-adjustable workstations as a sitting-reduction strategy that could be embedded within current working practices.

Height-adjustable workstations were a core component of interventions reducing total and prolonged sitting in highly sedentary office-workers (Alkhajah et al., 2012; Graves et al., 2015b; Healy et al., 2016c) and contact centre call agents (Straker et al., 2013; Chau et al., 2016b). Interventions including height-adjustable workstations have observed

favourable changes to HDL cholesterol (Alkhajah et al., 2012; Graves et al., 2015b), blood glucose (Healy et al., 2017), and suggested productivity is maintained in traditional office workers (Neuhaus et al., 2014b; Graves et al., 2015b) and improved in contact centre call agents (Chau et al., 2016c; Garrett et al., 2016). These findings therefore suggest height-adjustable workstations have the potential to improve employee health and business metrics. Consistent with previous research however (Mackenzie, Goyder and Eves, 2015; Hadgraft et al., 2016a), senior staff in the present study identified cost as a barrier to companywide implementation of height-adjustable workstations. To minimise costs, senior staff proposed a hot desk system, though agents and team leaders questioned the acceptability of this, which is somewhat supported by findings that a hot desk system did not reduce sitting time in university white-collar workers (Gilson et al., 2011). Therefore, in accordance with senior team leaders perceptions in the present study and previous research (Hadgraft et al., 2016a), justifying a return on investment seems important for obtaining organisational investment for wide scale implementation of height-adjustable workstations in contact centres. Research is warranted to explore the effectiveness and the cost-effectiveness of PA and SB interventions in contact centres.

Across each contact centre, team leaders were perceived as integral for changing the prevalent sedentary working culture, by modelling target behaviours, supporting agents to break up their sitting time and instigating active working strategies. This is congruent with PA and SB trials using team leaders and managers to provide interpersonal support to traditional office workers (Brakenridge et al., 2016b; Edmunds and Clow, 2016). Team leaders in the present study however perceived their workload as a barrier to promoting SB and PA strategies to their agents. Team leaders and senior team leaders subsequently suggested workplace champions as a strategy to discourage the prevalent sedentary working culture and provide agents with greater interpersonal support to move more and sit less. Workplace champions have been identified as an integral (Brakenridge et al., 2016b; Edmunds and Clow, 2016) and cost-effective (Mackenzie, Goyder and Eves,

2015) component in multi-component workplace PA and SB interventions in other settings, and should be considered in future contact centre trials where return on investment is vital for organisational buy-in.

Consistent with findings from a sit-stand trial in emergency call centre workers (Chau et al., 2016b), call agents perceived social barriers of self-consciousness, appearing unproductive to colleagues and disrupting colleagues, to reduce their motivation to sit less and move more at work. This is similar to findings in traditional office workers, where negative perceptions from colleagues and expectations around appropriate (i.e. sedentary) working norms were barriers to breaking up their sitting time (Hadgraft et al., 2016a). Enhancing peer support can facilitate behaviour change (Michie et al., 2013) and appears important for promoting an activity-permissive workplace culture (Such and Mutrie, 2017). Moreover, consistent with findings in Flemish employees and executives (De Cocker et al., 2015), poor knowledge and awareness of SB and PA as health-related behaviours, and their associated guidelines and recommendations, were perceived by all stakeholder groups to contribute to the sedentary working culture and attitudes towards SB reduction and PA promotion. Knowledge enhancement is a widely recognised health behaviour change technique (Michie et al., 2013), advocated at employee and management levels (De Cocker et al., 2015; Coenen et al., 2017a). Further, a previous multi-component intervention found education and training to be an effective component in reducing prolonged bouts of sitting and increasing PA at work in Australian office workers (Smith, Pedersen and Cooley, 2013). Research is warranted however to assess the efficacy of interpersonal support, and education and training sessions within the contact centre setting.

4.4.1. Strengths and limitations

This is the first study to qualitatively explore multi-stakeholder perspectives on factors influencing contact centre call agent's workplace PA and SB. The methodology enabled triangulation of stakeholder perspectives across multiple organisations and job roles, which reflects a more representative sample and revealed logistical, acceptability and feasibility considerations that would not have been obtained from recruiting from a single job role, contact centre or sector. Aligned to the MRC framework, this study forms the initial formative phase of a larger body of work in contact centres, and the findings will be used to tailor future interventions to the needs of stakeholders with the hope of enhancing intervention effectiveness and sustainability (Craig et al., 2008). The process of data collection, triangulation and data analysis followed a thematic methodology to increase the credibility and trustworthiness of the findings (Shenton, 2004; Braun and Clarke, 2006). The findings are reported in line with the COREQ checklist to enhance the studies credibility and rigor (Tong, Sainsbury and Craig, 2007), and were anchored to the widely recognised and adopted SEM to guide future research in this field, particularly trials (Sallis, Owen and Fisher, 2008).

Similar research in contact centres in different sectors, regions and countries may identify alternative influential factors, with research warranted to determine the generalisability of the findings. The findings and conclusions are based on cross-sectional perspectives of volunteering participants who did not participate in workplace PA and SB strategies in this study. Future trials should therefore evaluate the acceptability and feasibility of the proposed PA and SB strategies in contact centres and employees who did not participate in this study, to determine their effect on call agent behaviour and health, and business outcomes (Craig et al., 2008). Questionnaire data are open to error from social-desirability bias and poor cognitive recall (Gittelman et al., 2015), however, given the focus of the

research question, self-report data was deemed appropriate to describe the sample. The number of participants per focus group was at times below the recommended 4-8, however consistent themes emerged across the focus groups and interviews with varying sample size. The focus group schedule was not piloted, however the schedule was grounded by existing research, current recommendations, and refined by the research team who are experienced in conducting qualitative research.

4.5. Conclusion

This original study explored multi-stakeholder perspectives of the factors influencing call agent's workplace PA and SB across four contact centres. Agents offered insights into the impact of high occupational sitting and low PA on their physical and mental health, and factors influencing their motivation to move more and sit less at work. Team leaders, although pivotal in influencing behaviours, identified their own workload, and agents' requirement to meet targets, as factors influencing their ability to promote agents to move more and sit less at work. Further, senior team leaders offered a broader organisational perspective on influential factors, including business needs and the importance of return on investment from PA and SB interventions.

While many factors influencing call agents' workplace PA and SB were consistent with those in traditional office workers, unique factors including continuous monitoring of productivity metrics and personal time, a physical connection to their workstation, and low autonomy over their working practices, seemed to limit call agent's motivation and opportunity to move more and sit less at work. Further, participants stated that previous formal PA initiatives during or after work were unsuccessful due to the need for additional offline time and agent motivation. Accordingly, embedding a multi-level intervention into current working practices seemed important for the multiple stakeholders, while addressing productivity concerns. In accordance with the MRC framework for developing

complex interventions, the present study informed the multi-component intervention which was evaluated for acceptability and feasibility in study 2 to provide original evidence and contribute to the development of organisational policy and practice in the contact centre sector.

Study Map

Study aims	Objectives	Main findings
Study 1: To explore the factors influencing call agent's workplace PA and SB and identify strategies that may help agents to move more and sit less at work.	• To use a qualitative methodology to explore the perspective of call agents, their team leaders, and senior staff across multiple contact centre settings.	• Key factors influencing call agents workplace PA and SB were continuous performance monitoring, job security concerns, incivility on calls and a desire for increased autonomy over working practices. Team leaders and senior team leaders identified a conflict between promoting productivity and targets to call agents, while encouraging them to move more and sit less. • Strategies identified that may help call agents move more and sit less at work included acknowledgement of PA and SB within policy and job roles, height-adjustable workstations, education and training sessions and greater interpersonal support.
Study 2: To explore the acceptability and feasibility of delivering and evaluating a multi-component SB and PA workplace intervention in the contact centre setting.	• To conduct a process evaluation to assess response, recruitment and attrition rates, and completion rates for all outcome measures. • To explore the acceptability and feasibility of the intervention from participant and organisational perspectives.	
Study 3: To conduct a pilot RCT of a multi-component intervention with and without height-adjustable workstations in contact centres.	• To assess the response, recruitment and attrition rates, and completion rates for outcome measures. • To assess the acceptability of randomisation to an intervention with and without a height-adjustable workstation from participant perspectives. • To assess the acceptability of an intervention with and without a height-adjustable workstation from participant and organisational perspectives. • To monitor any adverse effects, such as injuries and disruption to working practices. • To derive estimates of the preliminary effect of the interventions on sitting time at work, and other behavioural, health and work outcomes.	

Chapter 5.

A multi-component workplace intervention to help contact centre call agents sit less and move more: a feasibility study

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5.1. Background

Contact centres are a priority setting for PA and SB interventions, as call agents have higher levels of obesity compared to customer service and office employees (Thorp et al., 2012) and spend up to 90% of their working day seated (Toomingas et al., 2012; Straker et al., 2013; Pickens et al., 2016). Moreover, call agents' sitting time is often accrued in prolonged periods >30 minutes (Straker et al., 2013) – a pattern detrimentally associated with musculoskeletal discomfort (Thorp et al., 2014a; Coenen et al., 2016) and fasting blood plasma glucose (Thorp et al., 2014b). Two recent multi-component interventions in desk-based workers observed beneficial changes of 40-45 min/workday in occupational sitting and standing, relative to controls at 12 months (Healy et al., 2016a; Edwardson et al., 2018). These changes were observed alongside significant and beneficial changes to fasting glucose, cardiometabolic risk (Healy et al., 2017), job performance, work engagement, presenteeism and psychological factors of quality of life and anxiety (Edwardson et al., 2018). Accordingly, this evidence supports the development and evaluation of workplace SB and PA interventions that aim to improve health and work-related outcomes in the 4% (~766, 000 adults) of the UK adult population who work in contact centres (Babel, 2015).

Factors contributing to low PA and high SB at work among call agents are multifaceted and include high productivity requirements, sedentary working cultures and sitting-based workstations (De Cocker et al., 2015; Hadgraft et al., 2016a; Morris et al., 2018). In contrast to desk-based workers in other sectors however (i.e. non-contact-centre), study 2 (chapter 4) identified that call agents are less able to sporadically break up their sitting time and move at work due to a physical connection to their computer via headsets, a lack of autonomy over their workload, and the need to maintain high call volumes to meet continuously monitored productivity targets (Morris et al., 2018). It is important therefore

that the development of interventions in contact centres takes into account these unique, multi-level and interacting influences on SB and PA (Sallis, Owen and Fisher, 2008).

While multi-component interventions have successfully reduced occupational sitting time in desk-based workers (Healy et al., 2016a; Edwardson et al., 2018), limited research has investigated the effect of PA and SB interventions in contact centre call agents. The provision of height-adjustable workstations reduced call agents' self-reported occupational sitting time (Pickens et al., 2016) and increased objectively-assessed productivity (Garrett et al., 2016) compared to seated workstation controls over 6 months. Similarly, a multi-component pilot study in 16 call agents, which also included the provision of height-adjustable workstations, observed favourable changes in call agents' self-reported workplace sitting and standing time compared to 15 seated controls after 1, 4 and 19 weeks (Chau et al., 2016c). These findings are however based on small samples and subjective measures of PA and SB. There is a need for more robust evaluation of PA and SB interventions in contact centres.

Development and piloting is recommended prior to the definitive evaluation of complex interventions (Craig et al., 2008; Moore et al., 2015). In line with the aims of delivering a pilot and feasibility trial (Thabane et al., 2010), the present study focused on exploring the acceptability and feasibility of recruitment, data collection, and the intervention components and delivery, therefore, effectiveness data is not presented (Eldridge et al., 2016a). Such systematic development allows researchers to experience the delivery of a small-scale version of the intended subsequent trial (Arain et al., 2010) and seeks to enhance the likely effectiveness and sustainability of the trial (Lancaster, Dodd and Williamson, 2004; Cavill, Roberts and Rutter, 2012). To date, no PA or SB intervention in the contact centre setting has been developed in this manner (Chau et al., 2016c; Garrett et al., 2016; Pickens et al., 2016).

Following original formative research presented in study 1 (chapter 4) (Morris et al., 2018), this study aimed to explore the acceptability and feasibility of delivering and evaluating a multi-component SB and PA workplace intervention in the contact centre setting.

Objectives were to conduct a process evaluation to assess response, recruitment and attrition rates, completion rates for all outcome measures, and explore the acceptability and feasibility of the intervention from participant and organisational perspectives (Lancaster, Dodd and Williamson, 2004; Arain et al., 2010).

5.2. Methods

5.2.1. Study design

Data for this 8-week non-randomised pre-post feasibility study was collected between July-September 2017. Liverpool John Moores University (17/SPS/003) granted ethical approval.

5.2.2. Recruitment

Recruitment was required for the organisation, a movement champion, team leaders, and individual call agents (see Figure 5.1).

5.2.2.1. Recruitment of organisation

A large telecommunications contact centre (>500 employees) who contributed to study 1 (Chapter 4, Table 4.1) (Morris et al., 2018) expressed interest through informal discussions. The research team discussed the study aims, objectives, requirements and feasibility considerations with a gatekeeper from the organisation, who consented to onsite recruitment, data collection and intervention delivery during work hours. The gatekeeper identified a member of middle management for the role of centre contact to the research team and participants, who agreed to support recruitment, data collection and intervention delivery. The gatekeeper approved the centre contact to organise offline time for agents to engage in data collection and relevant intervention components. One office floor in the contact centre dedicated to inbound call agents was identified. Across

the office floor were 20 work pods, each housing 14 call agents, with one team leader per pod. Accordingly, the floor housed 20 team leaders and 280 call agents.

5.2.2.2. Recruitment of movement champion

A movement champion was appointed to provide daily verbal support for agents to sit less and move more, and encourage team leaders to promote the sit less and move more message to their agents. The gatekeeper and centre contact identified a staff member in the organisation to be approached for the role. The staff member agreed and met the inclusion criteria: a) full time staff member in a support role in the organisation (≥0.8 full time or part time equivalent worker), b) access to a work telephone and desktop computer with internet, c) aged ≥18 years, d) ambulatory, e) no planned absence for ≥2 weeks during the intervention, f) not pregnant, and g) provided written informed consent for the role.

5.2.2.3. Recruitment of team leaders

In May 2017, on behalf of the research team, the centre contact emailed the 20 team leaders a participant information sheet and invitation to a researcher-led, drop-in session that provided an overview of the study and intervention. Team leaders were informed that their call agents would only be invited to participate, if they, the team leader, were interested and eligible to participate. Team leaders had one week to express interest in participating to the centre contact by email, telephone or an expression of interest form, with two email reminders sent during this period.

5.2.2.4. Recruitment of call agents

In May-June 2017, on behalf of the research team, the centre contact emailed call agents managed by an interested and eligible team leader. The email included a participant information sheet and invitation to two researcher-led, drop-in sessions that provided an

overview of the study and intervention. Call agents had two weeks to express interest in participating to the centre contact by email, telephone or an expression of interest form, with two email reminders sent during this period.

5.2.3. Eligibility and selection

The research team screened interested team leaders and call agents face-to-face or by telephone for the following eligibility criteria: a) full time staff member (≥0.8 full time or part time equivalent worker) in a team leader or call agent role, respectively, b) access to a work telephone and desktop computer with internet, c) aged ≥18 years, d) ambulatory, e) no planned absence for ≥2 weeks during the intervention, f) not pregnant, g) no known cardiovascular or metabolic disease (agents only). Interested employees were notified of study acceptance via an email from the centre contact on behalf of the research team. Written informed consent was obtained and baseline assessment scheduled. Participants were allocated a unique identification number for assessments including focus group contributions. There was no racial or gender bias in participant selection.

5.2.4. Intervention

5.2.4.1. Theoretical basis and Intervention development

In line with the SEM (Bronfenbrenner, 1977; Sallis, Owen and Fisher, 2008), factors influencing call agents' workplace PA and SB, identified in study 1 (chapter 4) (Morris et al., 2018), were targeted via intervention components at the organisational, environmental, interpersonal and intrapersonal level (Sallis, Owen and Fisher, 2008) (Table 5.1). Factors were mapped to pragmatic intervention components within the behaviour change wheel to enhance agents capability, opportunity and motivation to sit less and move more at work (Michie, Van Stralen and West, 2011), and progress towards accumulating 2-4 h/day of standing and light activity (light walking) during working hours (Buckley et al., 2015).

Table 5.1. Intervention components and delivery timeline.

Intervention component	SEM Level	Intervention week								
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Education and training session for team leaders and the movement champion	Intrapersonal/ Interpersonal/ Organisational	**x**								
Individual feedback	Intrapersonal		**X**							**X**
Education and training session for call agents	Intrapersonal		**X**				**x**			
Emails	Intrapersonal		**X**	**x**	**x**	**x**	**x**	**x**	**x**	**X**
Height-adjustable workstations	Environmental		●	●	●	●	●	●	●	●
Team leader support	Interpersonal		●	●	●	●	●	●	●	●
Movement champion	Interpersonal		●	●	●	●	●	●	●	●

Week 0 pre-intervention delivery.
x Administered intervention component ● Ongoing intervention component.

5.2.5. Intervention Procedures

5.2.5.1. Organisational level

To demonstrate organisational buy-in and foster a supportive environment, team leaders and call agents were told at recruitment that senior management had approved the appointment of a centre contact and a movement champion, the installation of height-adjustable workstations, and offline time for agents to engage in data collection and relevant intervention components.

5.2.5.2. Environmental level

5.2.5.2.1. Installation of height-adjustable workstations

Following baseline, the research team installed 14 height-adjustable workstations (Posturite, DeskRite 100 small, UK) during work hours. Call agents had a height-adjustable workstation installed onto their desk if they had an occupational health need (determined by a prior display screen assessment (HSE, 2002)) or a technical need (i.e. hardware or software requirement) that would prevent them from moving between their desk and a hot-desk on their pod that had a height-adjustable workstation installed on it. Participants without an occupational health or technical need only had access to a height-adjustable workstation installed onto a hot-desk in their pod. The feasibility of this hot-desk system was explored during process evaluation, as a hot-desk policy was not in place at the company. The computer monitor(s) and keyboard were housed on the workstation, which could be quickly raised and lowered by hand to enable seated or standing work. Participants were not prescribed an amount of time to use the workstation. Each workstation had a laminated sheet attached to its surface detailing the intervention aim to sit less and move more, and safe ergonomic postures during seated and standing use, as recommended (Posturite). After follow up data collection, the research team uninstalled the workstations.

5.2.5.3. Interpersonal level

5.2.5.3.1. Team leader and movement champion support

Between baseline and height-adjustable workstation installation, team leaders and the movement champion were invited to a 30-minute researcher-led, education and training session. The session reinforced the intervention aim for call agents to sit less and move more at work in accordance with workplace recommendations (Buckley et al., 2015), provided a rationale for the intervention, and an overview of the intervention timeline. Team leaders and the movement champion were engaged in guided discussions regarding their respective roles. Team leaders were specifically educated, trained and encouraged to a) encourage walking in their one-to-one and team meetings with agents,

b) discuss agent experiences of the intervention during one-to-one and team meetings, c) provide daily verbal support and encouragement to agents to sit less and move more, and d) forward a weekly intervention email to their agents. The movement champion was specifically encouraged to provide daily verbal support for agents to sit less and move more, and encourage team leaders to complete the above actions. Team leaders and the movement champion left the session with a laminated information sheet that detailed the intervention aim, timeline and components, and suggested strategies to promote their agents to sit less and move more at work.

5.2.5.3.2. Weekly emails

Team leaders forwarded weekly intervention emails to their participating call agents. The emails, which contained a non-modifiable infographic, were designed by the research team and emailed to team leaders via the centre contact. The infographic encouraged and suggested ways for call agents to break up prolonged periods of sitting and be active during scheduled breaks and lunch. Suggestions included breaking their sitting time after each phone call, using the height-adjustable workstation, and walking breaks. Team leaders were instructed to copy the research team into the emails to assess fidelity.

5.2.5.4. Intrapersonal level

5.2.5.4.1. Education and training sessions

The centre contact, on behalf of the research team, emailed the call agents, movement champion and team leaders (for information only) a calendar invite to a 40-minute researcher-led, group education and training session in intervention week 1 and 5. Sessions reinforced the intervention aim to sit less and move more at work in accordance with workplace recommendations (Buckley et al., 2015). Sessions introduced (week 1) and reinforced (week 5) the benefits of moving more and sitting less each day at work and the risks of prolonged sitting and standing. Using the intervention components as a point

of departure, agents engaged in guided discussions to identify how they could utilise each intervention component to facilitate their behaviour change. Agents were given the opportunity to discuss their intervention experiences, including barriers to sitting less and moving more. In week 1 agents wrote a short-term goal to help them sit less and move more at work, for example, '*I will go for a walk during my lunch break tomorrow'*. This goal was discussed and reflected on in the week 5 session.

5.2.6. Data collection

Each call agent attended a 1 h assessment in a designated room at work at baseline and 8 weeks (follow-up). For convenience and to promote arriving in a fasted state, agents were allocated an arrival time between 08:00-12:00 on Monday, Tuesday or Wednesday, with the time and date replicated at follow up. To promote privacy, confidentiality and comfort, screens were used and trained researchers conducted all assessments. This 1 h session included cardiometabolic health and anthropometric assessments, survey completion, and fitting each agent with an activPAL monitor (PAL Technologies, Glasgow, UK), to continuously assess PA and SB for 7 days. Prior to data collection, agents were instructed via email to wear light clothing, fast for 10 h, avoid the consumption of alcohol, tea and coffee for 12 h, and avoid strenuous exercise for 24 h. At baseline, the email included a food and fluid form for agents to complete across the 24 h prior to their assessment. The form was collected by the research team and returned to the participant before follow up, with instructions to replicate their food and fluid intake across the 24 h prior to the assessment.

5.2.7. Outcomes

5.2.7.1. Recruitment, retention and attrition

Similar to a previous intervention (Johnston et al., 2019), the recruitment rate was the percentage of participants who completed baseline assessments from the total number

of agents within teams of an interested and eligible team leader. Retention was considered the percentage of participants who completed baseline and 8-week data collection. Reasons for attrition and missing data for outcome measures were recorded throughout.

5.2.7.2. Acceptability and feasibility - Focus groups and interview

Participants were invited to a focus group (call agents, team leaders) or interview (movement champion) within 2 weeks of the follow up assessments to assess acceptability and feasibility of the recruitment strategy, data collection procedures and intervention components. The focus groups and interview were conducted in homogenous occupational groups to promote open discussions, to elicit in-depth insights into participant perspectives and experiences, and to provide context to agents' acceptability and feasibility survey responses (Kitzinger, 1995). Team leaders and the movement champion also reflected on barriers or facilitators experienced in implementing their respective roles. The protocol for delivery was standardised by using a semi-structured focus group/interview schedule to maintain a level of commonality across the groups (Krueger and Casey, 2002), while allowing flexibility in the order and sequence of questions to promote participants to respond openly and freely, using probes where appropriate to elicit depth from responses (Kitzinger, 1994). Four focus groups were conducted with call agents, two with team leaders, and one interview with the movement champion, with each audio recorded, transcribed verbatim and anonymised during this process.

5.2.7.3. Acceptability and feasibility - Surveys

At follow up, call agents completed a 33-item questionnaire, containing 5-point Likert-type questions adapted from a previous trial (Graves et al., 2015b). Response scales ranged from (1) strongly agree to (5) strongly disagree. To help establish suitable procedures for

delivering the intervention in future trials and to build on the qualitative data, survey items explored the acceptability and feasibility of data collection and each intervention component, and agents' willingness to receive each intervention component in the future. The assessment of the perceived effectiveness of each intervention component was viewed as an acceptability index, based on previous positive associations observed between perceived effectiveness and actual effectiveness (Dillard and Ha, 2016).

5.2.7.4. Anthropometry: Stature, body mass and body composition

Participants stature, body mass and body composition was measured using standardised anthropometric techniques outlines in section 3.4.4.

5.2.7.5. Cardiometabolic markers

Participant's blood pressure was measured according to the procedure outlined in section 3.4.4. In addition, a 15ml fasting blood sample was taken from the antecubital vein of one arm using standard venepuncture technique (Vacutainers Systems, Becton-Dickinson, USA). Samples were collected into vacutainers containing edetate disociom or lithium heparin, immediately labelled with the unique participant number, and stored on ice during transportation to University laboratories for later analysis of glucose, total cholesterol and triglycerides.

5.2.7.6. Survey measures and outcomes

Call agents provided demographic information using an adapted survey outlined in section 3.4.3.1. Agents self-reported presenteeism using the Work Limitations Questionnaire (Lerner et al., 2001), absenteeism using the Health and Work Questionnaire (Shikiar et al., 2004), musculoskeletal symptoms during the last 7-days, three and twelve months, across nine symptom sites, using the 27-item Nordic Musculoskeletal Questionnaire (Dickinson et al., 1992; Palmer et al., 1999), remembered and experienced wellbeing

using the Pemberton Happiness Index (Hervás and Vázquez, 2013), and, health and quality of life using the EQ-5D questionnaire (Herdman et al., 2011).

5.2.8. Behavioural outcomes

5.2.8.1. Sitting, standing and stepping time

Participants behavioural outcomes were objectively measured and analysed according to the procedure outlined in section 3.4.2.

5.2.8.2. Analyses

5.2.8.3. Acceptability and feasibility

Taking a pragmatic approach (Willig, 2013) and in accordance with the study aim, deductive thematic analysis explored patterns and identified themes within the raw focus group and interview data, in relation to participant perceptions of the acceptability and feasibility of the recruitment strategy, data collection procedures and intervention components (Braun and Clarke, 2006). Exploration of multiple stakeholder perspectives provided broader insights than a single stakeholder group, and perspectives were contextualised in relation to the wider social and environmental context (Willig, 2013). Qualitative data was further processed and analysed using the procedures described in section 3.4.1.

Process evaluation surveys were analysed using SPSS version 22 (IBM, New York, USA) to describe the frequency (%) of distribution across responses (Sullivan and Artino Jr, 2013). Baseline sociodemographic and work characteristics, and anthropometric, cardiometabolic, blood pressure, activPAL and survey data were analysed to describe the sample. Completion rates of all outcome measures at baseline and follow-up were identified to inform the acceptability and feasibility of the data collection procedures.

5.3. Results

In line with the study aims, results from the process evaluation surveys and focus groups/interview are presented together, with verbatim quotes to explore the acceptability and feasibility of recruitment, data collection and intervention delivery. To describe the sample, only baseline demographic, anthropometric and behavioural data are presented. Quotes are attributed by job role (AG=Agent P1-16, TL=Team Leader P1-5, MC=Movement Champion) and data collection method (FG=Focus group, I=Interview). Mean interview and focus group length was 37.1 ± 7.4 minutes.

5.3.1. Recruitment and retention

Of the 20 team leaders who received the recruitment email, 8 expressed interest (40%) with 6 eligible (30%: Figure 5.1). Subsequently, of the 84 call agents who received the recruitment email, 31 expressed interest (37%) with 25 eligible (30%).

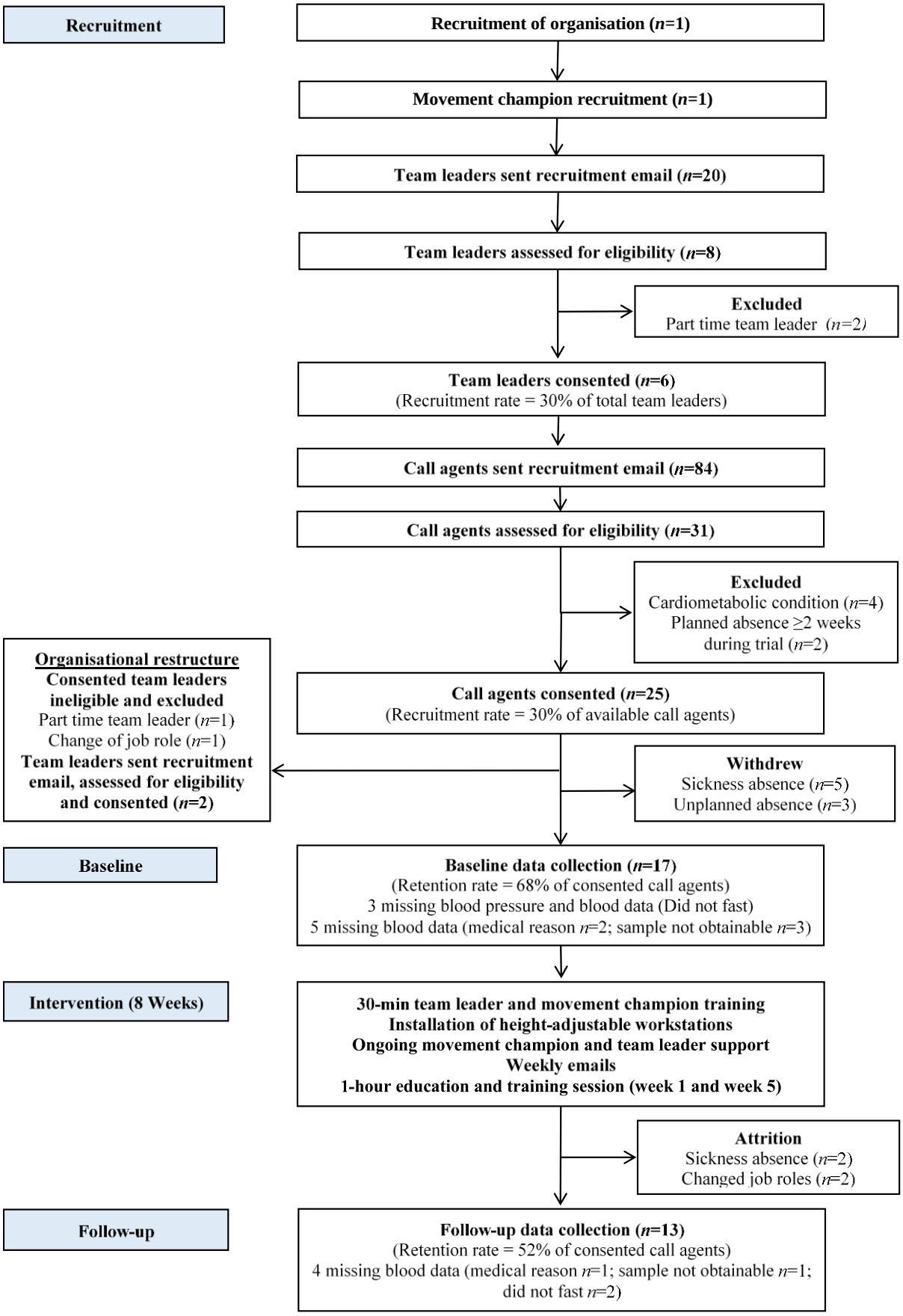

Figure 5.1. CONSORT flow diagram of key study phases for call agents

5.3.1.1. Recruitment – Team leaders

Recruitment occurred at a time of high workload, which resulted in low team leader attendance at the researcher-led, study information session (4 of 20 = 20%).

> *"I think I was so busy when* [recruitment] *first came round."* (TL4 FG)

> *"…As an organisation in the last 6 months we've gone through a real change in workload, so our workload has been quite heavy."* (TL2 FG)

Consequently, low team leader engagement during recruitment appeared to negatively influence team leader perceptions of the burden of the intervention.

> *"I think a lot of people would have looked at it* [recruitment email] *and thought more work if I [am] being honest with you."* (TL3 FG)

To promote team leader recruitment, one team leader suggested establishing a clear overview of the organisational structure and engaging additional stakeholders, such as team leader managers.

> *"So I think if that* [education and training session] *had been delivered to our* [team leader managers], *then to the team managers within the* [manager] *meetings* […] *You'd probably get more backing from everybody because we're all kind of,* […] *one person will say 'oh I'll do it' 'oh well I'll do it' and then everybody decides that they're going to do it."* (TL1 FG)

5.3.1.2. Recruitment - Call agents

All agents reported a high volume of daily work emails and perceived the lengthy recruitment email as ineffective.

> *"We do get a lot of emails* […] *we get a lot of junk emails as well, because people send emails out saying they're doing* […] *all sorts of rubbish, and you just think like, literally, I just need to get on with my work."* (AG16 FG)

To promote call agent recruitment, clear, concise and engaging recruitment materials and face-to-face interaction were suggested.

> *"I think personally, you should just come in to team meetings and explain what you are, what you're after, and then sign people up there and then*." (AG20 FG)

One team leader described that many agents felt deterred from expressing interest or were unable to participate due to the eligibility criteria requiring the absence of cardiovascular or metabolic disease.

> *"…other people wanted to do it* [the study] *but obviously they didn't meet the criteria,* […] *I think it would have been really great if some of the others, but obviously because of the medical reasons they couldn't be involved in it, but it would be really great moving forward if we could kind of encourage that* [participation]." (TL2 FG)

Further, the two researcher-led, drop-in sessions occurred during 'red alert' where call volumes in the centre are unexpectedly high, and non-essential offline time is prohibited. Consequently, as offline time to attend the sessions was considered non-essential by the organisation, the agents were prevented from attending.

> *"We've been so busy lately on the phone that even our own normal team leader meetings we've not been able to get offline for."* (AG10 FG)

5.3.2. Data collection

Of the 25 consenting agents, 17 (68%) and 13 (52%) completed baseline and follow-up, respectively, with attrition (24%) due to sickness, unplanned absence and job role changes (Figure 5.1). Call agents reported the survey completion as feasible (Appendix 1) with no missing data from those issued surveys (17/17 at baseline, 13/13 at follow-up). Anthropometric assessments were reported as feasible (Appendix 1), though one agent felt uncomfortable when a member of the opposite sex took their measurements.

"I felt a bit uncomfortable having, it was a guy doing my measurements, and I felt a bit uncomfortable with that […] *I would have preferred a woman to do that, but maybe again, that's just me* […] *just because I'm self-conscious about the way I...Because I know I'm overweight anyway, so I just felt a bit, you know. It made me more uncomfortable." (*AG18 FG)

Despite most agents reporting the blood pressure assessment, blood sampling and associated fasting as feasible (Appendix 1), medical factors and forgetting to fast led to missing data (Figure 5.1). To promote compliance to fasting, agents suggested a text message reminder 24 h before each assessment.

"On the first [assessment]*, I didn't fast* […] *I think a text would be really good, because* [you forget] *if you're off for a couple of days."* (AG23 FG)

Most agents reported the 7-day activPAL monitoring as feasible (Appendix 1). Fifteen of 17 agents (82%) and 10 of 13 agents (77%) fitted with an activPAL at baseline and follow up, respectively, provided ≥3 valid days of data (Table 5.2). Ten agents provided ≥3 valid days of data at both time points and 17 agents provided ≥1 valid workday at baseline. Call agents were predominantly female, White British, full-time employees, educated to tertiary level with ≥3 year tenure (Table 5.2). At baseline, on average, agents were pre-hypertensive (Frese, Fick and Sadowsky, 2011), overweight (National Institute for Health and Care Excellence, 2014), had an elevated waist circumference (World Health Organization, 2016), were sedentary for >10h per day and spent 82% of work hours sitting, 15% standing and 3% stepping (Table 5.2).

Table 5.2. Baseline characteristics of participating call agents (n=17).

Female	14 (78)
Age (years)	39.3 ± 11.9
White British	15 (83)
Married	7 (41)
Full-time employee	16 (94)
Tenure in current role ≥ 3 years	10 (56)
Tertiary education	11 (61)
Daily hours worked (h/day)	7.4 ± 1.0
Weekly hours worked (h/week)	37.3 ± 2.1
Systolic blood pressure (mmHg)	124.5 ± 12.9
Diastolic blood pressure (mmHg)	86.6 ± 7.2
Body mass index (kg/m^2)	33.6 ± 8.3
Waist circumference (cm)	111.4 ± 32.4
Hip circumference (cm)	120.5 ± 19.3
Waist-to-hip ratio	0.92 ± 0.25
Activity outcomes	
Daily	
Waking wear time (min/day)	906.6 ± 80.3
Valid wear (days)	5.0 ± 1.8
Sitting time (min/day)	642.0 ± 88.2
Standing time (min/day)	178.2 ± 76.8
Stepping time (min/day)	86.4 ± 39.6
Steps (steps/day)	7215 ± 3507
Sit-to-upright transitions/day	56.1 ± 19.1
Time sitting in bouts <30 minutes (min/day)	306.0 ± 96.6
Time sitting in bouts ≥30 minutes (min/day)	336.0 ± 154.8
Workplace	
Total work time (min/day)	473.9 ± 73.9
Valid wear (days)	3.1 ± 1.3
Sitting time (min/day)	376.1 ± 136.3
Standing time (min/day)	72.4 ± 23.3
Stepping time (min/day)	25.4 ± 13.1

Data is presented as n (%) or mean ± SD.

5.3.3. Intervention components and delivery

This section details the results of the process evaluation survey (Table 5.3), focus groups and interview in line with the SEM (Sallis and Owen, 2015).

Table 5.3. Participating call agents' perceived effectiveness of each intervention component.

	1	2	3	4	5
How effective did you find the height adjustable workstation in helping you to sit less and move more at work?	73%	9%	-	-	18%
How effective did you find the movement champion in helping you to sit less and move more at work?	36%	27%	27%	9%	-
How effective did you find the weekly team leader emails in helping you to sit less and move more at work?	64%	27%	-	9%	-
How effective did you find the weekly team meeting in helping you to sit less and move more at work?	36%	9%	18%	9%	18%
How effective did you find the walking 1:1 meetings with your team leader in helping you to sit less and move more at work?	9%	18%	27%	-	36%
How effective did you find the two education and training sessions in helping you to sit less and move more at work?	91%	9%	-	-	-

1= very effective, 2 = somewhat effective, 3 = neutral, 4 = somewhat ineffective, 5 = very ineffective.

5.3.3.1. Organisational level

Team leaders were positive about the appointment of a centre contact who managed the scheduling of agents' study-related offline time.

> *"From a manager perspective it was good that the exceptions* [for offline time] *were put in by centre contact, rather than us trying to call those in."* (TL3 FG)

Despite being told the study had organisational support, some agents' desire to sit less and move more at work appeared influenced by their awareness of meeting productivity targets.

> *"You're literally doing calls for eight hours, you're very restricted with the time that you have, because whatever you're signed into on the PC is a statistic that goes towards your end-of-month, and if you're not where you're supposed to be, it doesn't go in your favour, to be honest."* (AG16 FG)

Lastly, participants indicated that to receive a workstation modification (e.g. ergonomic chair), current organisational processes required agents to have a display screen equipment assessment (HSE, 2002) and existing musculoskeletal or chronic health

problem. With respect to this, all stakeholders believed that implementing height-adjustable workstations as a preventative measure would demonstrate increased organisational buy-in and may mutually benefit agent health and the business.

> *"The obvious one there is the price of these desks* [height-adjustable workstations] *ever coming onto site, what do we have to do? We've spent between £900 and £3,000 on a chair that is adapted for that individual person, so special chairs from a workstation assessment like back problems, it's like right workstation assessment, you're recommended to have this chair, some of them are absolutely fantastic all singing, all dancing, they do everything apart from answer the phone call for you… compared to £170* [height-adjustable workstation cost] *that could do the same thing."* (TL3 FG)

5.3.3.2. Environmental level

5.3.3.2.1. Initiation, maintenance and termination of height-adjustable workstations

The majority of call agents reported the height-adjustable workstations as somewhat-to-very effective for helping them to sit less at work (Table 5.3), easy to use, and most felt comfortable using the workstation in the presence of others (Appendix. 1). Seeing other agents use the workstation in the standing position was the most common trigger for standing work, and this appeared more prominent among teams with multiple height-adjustable workstation users.

> *"We kind of prompted each other as well, don't we? Because when one went up, you noticed the other one went as well."* (AG14 FG)

> *"AG5, used* [the height-adjustable workstation] *a lot. They would stand up a lot, and I think with us, it was definitely more support because more of us had them."* (AG18 FG)

In contrast, during focus groups, several agents reported feeling self-conscious during standing work among seated colleagues, which appeared to negate workstation use over

time. This perception of social conformity to seated work was largely attributed to low participant numbers within teams.

> *"Maybe that's why, because no one else was doing it* [standing], *and you just feel a bit, a little bit daft just standing up."* (AG23 FG)

Accordingly, a common challenge described by agents was keeping motivated to use the workstation in the standing position. Compounded by the lack of social support, some agents forgot to use their workstation in the standing position and reverted to seated working habits over time.

> *"*[Initially] *I was like using it quite a lot. As the sort of eight weeks went on, I slowly and slowly used it less and less, or I would forget to use it. Like I'd get to like six o'clock in the evening, and I'd be like, "I've not even stood up today". I'd be like, "Right, let's stand up."* (AG16 FG)

In contrast, several agents described having a daily routine across the intervention of frequent postural changes between sitting and standing, primarily triggered by work-based cues including times of the day and dealing with challenging customer calls.

> *"I soon got in a routine where I knew I was coming in and I was eating breakfast, maybe half hour or an hour, get up, and then that would be me up* [standing] *pretty much the majority of the day, sit down after my lunch and then back up again. I just fell into that routine."* (AG8 FG)

> *"I find that if you've got a really shouty customer or anything like that, you've got an awkward account and you need to assert yourself, it* [the height-adjustable workstation] *went straight up."* (AG14 FG)

5.3.3.2.2. Hot-desk feasibility

Call agents with a height-adjustable workstation installed onto their desk (*n*=10) believed that ownership of an individual workstation was important for enhancing acceptability and feasibility of the workstations. Two of the four call agents who only had access to a height-

adjustable workstation on a hot-desk on their pod indicated that they did not use the workstation at all during the trial, and reported the height-adjustable workstation as very ineffective (Table 5.3). The main barrier influencing hot-desk use for these agents was the time to move equipment and belongings between desks. One team leader described how switching between desks could negatively affect agent productivity, due to the specialist equipment and software required to conduct their job efficiently.

> *"People get used to their own comforts and they make their own kind of their desks, they arrange their desks how they need it so it goes with their flow and it can really, really, it can be quite a big upheaval for somebody to move their workstations* […] *they've got their own equipment like mouse mats or something like that then it can take some time for them to set up that workstation how they need it, you're losing time."* (TL1 FG)

5.3.3.2.3. Perceived effects of height-adjustable workstations

While a minority of agents reported that they had more musculoskeletal symptoms on the days they used the workstations (Appendix 1), many agents described that standing work contributed to perceived reductions in musculoskeletal symptoms. Most agents were willing to continue to have access to the height-adjustable workstations, all agents would have a workstation if offered by their employer, and, all agents were willing to receive further advice and guidance for using the workstation to optimise health (Appendix 1).

> "*I used to always finish my shift, and I'd have a pain right down the middle of my back, that I haven't got that when I've been using the desk* [height-adjustable workstation]. *So on them five days when I wasn't able to stand, the pain was back, but then when I was able to use the desk again, it's gone."* (AG20 FG)

A minority of agents felt more tired on the days they used the height-adjustable workstations (Appendix 1), though other agents perceived that workstation use reduced

their levels of fatigue across the working day, which was consistent with team leader's perceptions.

> *"So you get a lull in the day don't you when you're tired* […] *I've noticed because P9, one of my guys I can see when, if we have a pocket of availability and he's on an early shift by, after his lunch* […] *I need to get him a call through because I can see* [he's tired]*, but I don't see that now because he stands up.*" (TL1 FG)

Agents strongly disagreed that use of the workstation had a detrimental impact on their work-related productivity or work quality (Appendix 1) and there were no participant withdrawals from the intervention due to adverse events. Work-related benefits from using the workstations, perceived by agents and team leaders, included improved projection and tone of voice while standing on calls, which was deemed important as interaction between agents and customer's is primarily based on verbal communication.

> "*It is all vocal, and like they keep saying to us over the years, "Smile on a call, because the customer will hear it". The same with stand*[ing] *up, you project your voice a bit more when you need to be assertive."* (AG14 FG)

One team leader identified that their call agent appeared more empowered while standing to deal with challenging calls. This was reflected by several agents who described greater confidence and assertiveness while standing during calls, which they felt benefited their call control.

> *"Do you know one thing that I noticed looking back now, when P13 had some of his more difficult conversations the desk* [height-adjustable workstation] *would go up* […] *and he would stand, and I think that gave him a sense of empowerment."* (TL4 FG)

> "[Using the height-adjustable workstations] *you feel more confident. That's going to help you with an awkward call, and you put your foot down verbally* […] *you're feeling better, so you've probably got more call control.*" (AG14 FG)

Agents and team leaders suggested that improved call control helped performance indicators, with a team leader describing how one agent displayed reduced average handling time across the study.

> "[Call agent] *really benefitted from it* [use of the height-adjustable workstation]*. He liked it so much and it helped him, in fact it helped him you know reduce his AHT* [average handling time] *so he did really well, yeah he's made some big, big reductions."* (TL5 FG)

5.3.4. Interpersonal level

5.3.4.1. Weekly emails

From the 8 weekly emails to be sent by the 6 team leaders, the research team received 28 out of 48 (58%). Team leaders perceived the emails as a prompt to talk to their agents about the intervention, and a useful resource to demonstrate their buy-in to the intervention.

> *"The only thing that I was doing was when the mails were coming through on a Monday, that's when I would pick up with P13 so that would be the catalyst for the conversation with P13 to tell him, or ask him how it's going, that mail was a conversation starter for me to be fair."* (TL4 FG)

Agents typically found the weekly email easy to digest, aesthetically pleasing and useful for increasing their knowledge and awareness of SB and PA. Accordingly, most agents found the emails somewhat-to-very effective in helping them to sit less and move more (Table 5.3) and were willing to receive weekly emails in the future (Appendix 1).

> *"I've never, the whole time I've been here, sat and done foot exercises or leg exercises under my desk* […] *but it* [the weekly email] *did trigger that often and I have been doing it and I have found it beneficial and I wish I'd done it from the get go you know, it would have been a lot better for me because some days my legs*

have been that swollen I've not been able to barely walk so it's made a huge big difference." (AG10 FG)

5.3.4.2. Movement champion support

The movement champion attended the team leader training session and the first agent education session, yet felt it was challenging to consistently implement their role and engage and prompt the agents. This was attributed to the agent's varied shift patterns, break schedules, and dispersion across the office.

> *"…for me it* [the intervention] *was a little bit messy because there were like stragglers and people on different teams* […] *that's the bit that made it difficult to kind of remember exactly who was on it and who you were prompting."* (MC I)

Most agents and team leaders felt it was important to have a movement champion, yet, consistent with the movement champion's perceptions, were often unsure of the movement champion's role, with one team leader expressing the need to promote greater agent-movement champion interaction.

> "*From* [Movement champion's] *point of view it would be good to make sure that they're following through and checking on those individuals, say are you sitting are you standing, how's it going, because I haven't seen any of that."* (TL1 FG)

Agents typically reported little-to-no interaction with the movement champion, and agents who did interact with the champion described how the champion's prompts centred on sitting reduction and workstation use, over promotion of active break times.

> *"…if* [the movement champion] *come round to promote movement, and seeing P05 and P18 stood up using them* [the height adjustable workstation] *she wouldn't have said anything because she sees them using them.*" (AG10 FG)

Agents were willing for the movement champion to continue in their role (Appendix 1) but suggested localised champions within teams would increase the perceived effectiveness of this component (Table 5.3), provide them with greater support, and overcome the

challenge the champion faced with engaging agents across shift patterns and office locations.

> "*If it's on your team it's more relevant,* [Movement champion] *has so much else to do, its finding the time to do it when the people that's they're targeting are all there* […] *it's not always easy."* (AG11 FG)

5.3.4.3. Team leader support

Most agents were willing to receive future team leader support to sit less and move more during team and one-to-one meetings (Appendix 1). Despite this, the amount of team leader support appeared inconsistent, and agents identified the weekly team leader meetings and walking one-to-one meetings as the least effective intervention components (Table 5.3).

> *"…walking one-to-ones, that didn't happen. I really wanted to do one of them."* (AG20 FG)

> *"We had our team meeting, and* [team leader] *was like, "Right, guys, rather than sitting down today, we're going to go outside". So we all walked and went to the grassy area outside, and it was a nice day, we had our team meeting out there, and then he made us all do like five star jumps, and it was just a laugh* […] *It was something different* […] *before that, I would literally just get up out of one seat, go to like a break-out room and sit down in another seat, get my phone out, probably just go on my phone for like fifteen minutes or something.*" (AG16 FG)

Agent perceptions appeared consistent with team leaders. While some team leaders reported infrequent intervention-related conversations with agents, others described how they encouraged active team and one-to-one meetings, contributed additional information to the weekly emails, and, provided frequent, ongoing encouragement to use the height-adjustable workstation.

"For me it was more around meetings, like 1:1 coaching sessions, not necessarily walking them but let's get up from our desks let's get up and go somewhere else and it wasn't always the nearest break out area, it was lets go somewhere that we don't normally go we got at least a couple of minutes' walk there and back." (TL3 FG)

Two team leaders did not attend the team leader training session, which appeared to affect their knowledge of the intervention and subsequent promotion of the intervention aims to their agents.

"*I think for me personally from the very beginning, I probably would have liked, I know we said about a brief, but I probably would have liked a bit more of a run down as I was very unsure of what it was that I was signing up to for at least 2 or 3 weeks."* (TL1 FG)

5.3.5. Intrapersonal level

5.3.5.1. Education and training sessions

Agents perceived the education and training sessions to be very effective for helping them to sit less and move more at work (Table 5.3). Agents found the sessions motivating, informative and enjoyed the social interaction with other agents, with the majority of agents willing to attend further education and training sessions (Appendix 1). Thirteen agents (76%) attended the week 1 session and 10 agents (59%) the week 5 session.

"I felt really motivated at the end of that [training session]*. Like I came out, and me and P21 went for a walk, like with our cigs. We decided to go for a walk around the building smoking, rather than waiting there, and for about a week I was doing that on all my lunch, like putting my headphones in and going for a walk."* (AG23 FG)

Willingness to attend further education and training sessions appeared to be influenced by the incentive of offline time at work, as the majority of agents appeared reluctant to relinquish personal time to attend sessions during lunch breaks.

"For me, I wouldn't want to give up any of my time on any of my breaks or lunches to do anything outside what I'm already doing on my lunch or breaks." (AG13 FG)

Finally, agent's engagement in the intervention and in particular, the education and training sessions appeared to raise their awareness of sitting, PA and the impact on health.

"[Engagement in the intervention] *pointed out to more myself and you as well (P10) and I'm expecting I presume whoever else is doing it, that how unhealthy were being just sitting, just sitting and eating and drinking, because you do that a lot because you're sat at a desk,* […] *we do need to move and improve things for ourselves."* (AG11 FG)

5.4. Discussion

This mixed-methods study is the first to explore the acceptability and feasibility of a multi-component SB and PA intervention and associated evaluation, in the contact centre setting. The recruitment strategy in the present study needs refining to promote team leader interest, and avoid organisational procedures that prevent agents from engaging in recruitment sessions. While call agents perceived the data collection procedures feasible, strategies to increase adherence to pre-data collection fasting requirements are needed. Regarding the intervention components, education and training sessions, height-adjustable workstations and weekly emails respectively, were perceived most effective at supporting call agents to sit less and move more at work. The findings provide original evidence to the limited literature on PA and SB interventions in contact centres, and in accordance with guidance for intervention development (Moore et al., 2015), offer significant logistical and pragmatic considerations for future interventions in this setting.

Team leaders are perceived as pivotal in changing call agent perceptions of workplace PA and SB (Morris et al., 2018) and are frequently utilised in workplace interventions (Shrestha et al., 2015; Gardner et al., 2016). Accordingly, to provide call agents in the

present study with interpersonal support from their team leader, all team leaders were invited to participate, with only call agents in the team of an interested and eligible team leader subsequently invited to participate. This recruitment strategy contributed to only 30% of team leaders and 6% of call agents on the target office floor participating. Low team leader recruitment was attributed in part to the timing of recruitment, high workload, and a failure to engage team leader managers during recruitment. Thus, the pool of agents to recruit from was limited, with the agent recruitment rate below average compared to office-based trials (33%) (Robroek et al., 2009). Future similar trials are advised to recruit at the call agent level, or engage wider stakeholders to promote team leader buy-in, which appears consistent with employee perceptions from a previous workplace intervention (Brakenridge et al., 2017). In addition, implementing a compulsory team leader component may optimise call agent recruitment and promote greater consistency in intervention support given to agents by team leaders. To enable this, future trials are recommended to establish a clear overview of the organisational staffing structure and identify key stakeholders to engage with during a trials planning phase.

Call agent recruitment was further impacted by the exclusion of interested participants with a known cardiovascular or metabolic condition. This eligibility criterion is widely adopted in workplace interventions (Neuhaus et al., 2014b; Healy et al., 2017; Edwardson et al., 2018), however a review suggests that at risk populations can achieve greater glycaemic benefits following frequent breaks to sitting and light PA, compared to healthy individuals (Dempsey et al., 2016b). Further, the principle of proportional universality supports targeting the most at risk populations in order to yield the greatest proportional health benefits (Marmot and Allen, 2015). This poses an important consideration for eligibility criteria in trials to prevent the onset and treatment of chronic conditions. To that end, recruiting ‘healthy’ individuals without pre-existing cardiometabolic conditions may limit the apparent effectiveness of interventions on such health indicators. It may also limit the generalisability of the findings across contact centre call agents who have an elevated cardiometabolic risk compared to other occupational groups (Thorp et al., 2012).

A red alert event in a contact centre results in the immediate removal of non-essential offline time for call agents. Red alert events are unique to contact centres compared to traditional offices, and in the present study, affected the research team's ability to engage with call agents during recruitment drop-in and education and training sessions. Consequently, some agents' exposure to the intervention was reduced, which could reduce intervention efficacy (Moore et al., 2015). Red alert also occurred during data collection, which made it challenging to collect data in agents. Senior contact centre staff have identified that evidencing the impact of a PA or SB intervention is crucial if organisations are to adopt and implement the intervention (Morris et al., 2018), which is consistent with findings in a recent review (Coenen et al., 2017a). Accordingly, researchers must be aware of red alert events in this setting, and work with contact centres to ensure offline time for call agents to engage in study procedures is protected.

Call agent attrition (48%) was largely due to job role changes and absence, with the attrition rate higher than a previous contact centre trial (Pickens et al., 2016). The average annual attrition in contact centres is 21%, with attrition often higher in the first 90 days of employment (Contact Babel, 2017). The high attrition rates observed in this sector and present study will make it challenging to evaluate long-term changes in behaviour and health, wellbeing, and productivity indicators, and this must be considered when planning sample sizes for future trials (Cavill, Roberts and Rutter, 2012). Agents generally perceived the 1-h data collection sessions as acceptable and feasible. Missing data was most prevalent for the 7-day activity monitoring, and blood pressure and blood sampling, with the latter due to participants forgetting to fast. Adherence to fasting requirements is essential for evaluating changes to fasting glucose, cholesterol and triglycerides, and the proposed strategy of text message reminders may reduce missing cardiometabolic data in future trials. Importantly however, the majority of agents felt comfortable with the data collection procedures employed.

Call agents perceived the education and training sessions, weekly emails and height-adjustable workstations as the most effective intervention components. The education

sessions and weekly emails appeared to increase agents' awareness of their PA and SB levels, and the workstations were perceived as a key enabler for reducing and breaking up sitting time. Similar to a previous trial (Chau et al., 2016c), call agents found it easy to transition between seated and standing work with the workstation, with no adverse effects on productivity reported. Adopting a multi-level, multi-component approach appears promising for interventions in this setting and supports an ecological approach to real world intervention design (Bronfenbrenner, 1977).

Consistent with previous research, agents citied various health and work-related benefits to reduced sitting at work, including reduced musculoskeletal symptoms (Karakolis and Callaghan, 2014), improved health awareness (Brakenridge et al., 2017) and reduced fatigue (Thorp et al., 2014a). Novel benefits perceived by agents included improved optical health, and improved tone of voice, confidence and assertiveness during customer calls while standing compared sitting. Several agents felt this perceived confidence had a positive impact on their call control, and team leaders perceived their agents as more engaged and empowered when standing on calls, with suggestions of improved productivity. This perceived productivity finding is supported by objective data from a previous contact centre trial (Garrett et al., 2016) and the collective findings suggest that height-adjustable workstations may be effective for reducing sitting time and increasing standing time in contact centres, while maintaining or improving productivity. Future trials should investigate changes in objectively measured productivity, PA and SB outcomes in call agents to support or refute this currently limited evidence, and inform the business case for contact centre interventions.

The observed perceived benefits support a preventative approach to implementing ergonomic aids within contact centres to optimise employee health and productivity. This is in contrast to current occupational and ergonomic policy that requires agents to have a pre-existing medical or musculoskeletal condition in order to receive adapted chairs or height-adjustable workstations (HSE, 2002). Consistent with a recent review therefore (Coenen et al., 2017a), contact centre managers may benefit from greater education on

the risks of high daily sitting to call agent's cardiometabolic (Arnold and Walsh, 2015; World Health Organization, 2016) and musculoskeletal health (Thorp et al., 2014a), and the benefits of substituting sitting time with periods of standing and light PA (Buckley et al., 2015). Changing occupational policies and job roles to acknowledge PA and SB, and, providing support for agents and team leaders to implement strategies into daily working practices, could reflect this hazard accordingly and promote a shift away from sedentary working practices for a significant proportion of the adult working population (Babel, 2015). Dealing with challenging customer calls was reported by agents as a key prompt to work in a standing position. To the authors' knowledge, this original finding is unique to the contact centre setting, and contradicts observations in other desk-based workers who, with access to a height-adjustable workstation, reverted back to seated postures to conduct challenging or complex tasks (Graves et al., 2015b). This suggests that future contact centre trials can target the high volume of daily phone calls, especially challenging calls, as cues for agents to break up their sitting time. Interestingly, a high proportion of calls in this setting are complaints based, which exposes agents to frequent customer incivility that is reported to negatively influence wellbeing (Arnold and Walsh, 2015). Standing on calls in the present study was perceived to increase agents' confidence and assertiveness, and supports a recent trial that reported sitting reduction as a gateway to stress relief (Goode A. D., 2018). Accordingly, the promotion of standing-based work in contact centres may not only reduce sitting time, but support and protect call agents' wellbeing, with further research required on this topic.

Seeing agents use a height-adjustable workstation in the standing position was a prominent trigger for agents to work in a standing position. Equally, low participant numbers meant that agents were often situated in teams of mainly desk-based agents, and similar to findings in traditional office workers (Such and Mutrie, 2017; Hadgraft et al., 2018) and call agents (Chau et al., 2016b), social pressure to conform to seated work appeared to negatively influence agent's motivation to use the height-adjustable workstation in the standing position. Refining the recruitment strategy to increase agent

participation and locate participants more proximally to one another appears important for increasing interpersonal support to use height-adjustable workstations in the standing position (Michie, Van Stralen and West, 2011).

Consistent with previous research (Gilson et al., 2012), agents identified that ownership of personal space, time to change between desks, and specialist equipment needs were barriers to using a height-adjustable workstation on a hot desk. Researchers and practitioners are therefore advised to provide contact centre call agents with individual workstations, as supported by previous research (Michie, Van Stralen and West, 2011). Height-adjustable workstations are however expensive, and cost is a barrier to employers investing in such equipment (Mackenzie, Goyder and Eves, 2015; Hadgraft et al., 2016a). Accordingly, future research should determine the cost-effectiveness of workplace trials that include the provision of individual height-adjustable workstations (Levati et al., 2016).

The 'move more' intervention aim appeared to lack consistent implementation in this study. Similar to findings from a workplace SB intervention (Mackenzie, Goyder and Eves, 2015), the movement champion in the present study was perceived to have low engagement with agents and focus on encouraging agents to sit less rather than move more. Further, reliance was placed on team leaders to implement standing or active meetings, and prompt agents to take active breaks. Replacing sitting time with standing may not be enough to elicit desired cardiometabolic adaptations in healthy individuals (Winkler et al., 2018), and strategies to increase PA, in addition to SB reduction, are encouraged (Dempsey et al., 2016b; Van der Berg et al., 2017). To date though, effective and sustainable strategies for increasing workplace PA appear unknown (Malik, Blake and Suggs, 2014). Given call agents have low autonomy over their working practices and few opportunities to accrue incidental PA at work, future trials should explore the acceptability of refining or introducing organisational policies that may facilitate PA at work, such as frequent or longer breaks and greater task variation, alongside greater support and education for agents to be active during break times.

5.4.1. Strengths and limitations

This is the first study to use mixed-methods to explore the acceptability and feasibility of an informed, multi-level, multi-component intervention, underpinned by behaviour change theory, in the unique and challenging contact centre setting. The study adopted a pragmatic approach to implementing tailored intervention components to a real word setting, as guided by the MRC framework (Craig et al., 2008). The process evaluation and engagement of multiple stakeholders to explore the acceptability and feasibility of the recruitment strategy, data collection procedures and intervention components has provided original knowledge to refine and justify the current intervention and improve its likely effectiveness and sustainability (Craig et al., 2008; Moore et al., 2015). One limitation of the study is the recruitment of a single contact centre who expressed an interest in the research. This introduces a potential bias towards the perceived acceptability and feasibility of the intervention components and methodology used in the present trial. Furthermore findings are limited by a small sample of call agents. Future trials should refine the recruitment processes as discussed, to optimise agent engagement and explore the feasibility of randomisation to a control group. Future trials exploring this can report on completion and attrition rates across treatment arms. Similar to previous trials (Graves et al., 2015b), the study was conducted over 8-weeks, with longer term follow ups able to explore the sustainability and effectiveness of interventions (Cavill, Roberts and Rutter, 2012). Longer-term trials should consider the high attrition rate and transient workforce in contact centres compared to traditional office settings (Contact Babel, 2017).

5.5. Conclusions

This study has identified unique, pragmatic considerations for conducting a multi-level, multi-component PA and SB intervention and associated evaluation in highly sedentary

call agents in the challenging contact centre setting. The intervention was perceived positively, with call agents and team leaders describing numerous perceived positive effects on behavioural, health and work-related outcomes. The findings provide evidence to refine the recruitment strategy to optimise agent engagement, enhance compliance to data collection requirements, and enhance the likely effectiveness and sustainability of the intervention components. Developing this complex intervention in an iterative manner, in accordance with frameworks for intervention development, has provided valuable considerations for tailoring future interventions to the contact centre setting. Findings were used to refine and justify the design and delivery of a small-scale pilot RCT (study 3, chapter 6) of a multicomponent intervention with and without height-adjustable workstations in the contact centre setting.

Study Map

Study aims	Objectives	Main findings
Study 1: To explore the factors influencing call agent's workplace PA and SB and identify strategies that may help agents to move more and sit less at work.	• To use a qualitative methodology to explore the perspective of call agents, their team leaders, and senior staff across multiple contact centre settings.	• Key factors influencing call agents workplace PA and SB were continuous performance monitoring, job security concerns, incivility on calls and a desire for increased autonomy over working practices. Team leaders and senior team leaders members identified a conflict between promoting productivity and targets to call agents, while encouraging them to move more and sit less. • Strategies identified that may help call agents move more and sit less at work included acknowledgement of PA and SB within policy and job roles, height-adjustable workstations, education and training sessions and greater interpersonal support.
Study 2: To explore the acceptability and feasibility of delivering and evaluating a multi-component SB and PA workplace intervention in the contact centre setting.	• To conduct a process evaluation to assess response, recruitment and attrition rates, and completion rates for all outcome measures. • To explore the acceptability and feasibility of the intervention from participant and organisational perspectives.	• Six (of 20) team leaders were recruited, with 17 of 84 call agents completing baseline assessments and 13 completing follow-up. • High workload influenced recruitment. Call agents perceived assessments as acceptable, though strategies are needed to enhance fidelity. Education sessions, height adjustable workstations and emails were perceived as the most effective components; however, height-adjustable hot-desks were not perceived as feasible in this setting.
Study 3: To conduct a pilot RCT of a multi-component intervention with and without height-adjustable workstations in contact centres.	• To assess the response, recruitment and attrition rates, and completion rates for outcome measures. • To assess the acceptability of randomisation to an intervention with and without a height-adjustable workstation from participant perspectives. • To assess the acceptability of an intervention with and without a height-adjustable workstation from participant and organisational perspectives. • To monitor any adverse effects, such as injuries and disruption to working practices. • To derive estimates of the preliminary effect of the interventions on sitting time at work, and other behavioural, health and work outcomes.	

Chapter 6.

A multi-component workplace intervention to help contact centre call agents sit less and move more: a pilot randomised controlled trial

6. Introduction

Contact centre call agents sit for 80-90% of their time at work, often in prolonged periods >30 minutes (Toomingas et al., 2012; Morris et al., 2019). Total and prolonged periods of SB are associated with increased risk factors for chronic diseases and all-cause mortality in adults even after controlling for PA (Ekelund et al., 2016; Maddison et al., 2015; Biddle et al., 2016). Call agents are therefore at risk of the deleterious effects of high total and prolonged sitting time (Thorp et al., 2012).

The sedentary nature of call agency work has been attributed to high call volumes, high productivity requirements, and sitting-based workstations where a call agent is physically connected to their computer via a headset (Sprigg, Smith and Jackson, 2003; Straker et al., 2013; Chau et al., 2016c; Morris et al., 2018). Accordingly, call agents have low autonomy over their working practices compared to other desk-based occupations, and few opportunities to break up their sitting time and engage in PA at work (Morris et al., 2018). Strategies acknowledging these influential factors are warranted to help contact centre call agents sit less and move more at work.

Few SB and PA interventions have been conducted in contact centres. In a 24h emergency contact centre, high work stress and low management support negated call agents engagement in intervention strategies (height-adjustable workstations, prompting timer lights to stand, emails, posters) to help them sit less at work (Chau et al., 2014). Conversely, the introduction of height-adjustable workstations in an Australian contact centre reduced call agents self-reported sitting time relative to controls, without impacting objectively-assessed productivity (Chau et al., 2016c). More recently, as described in study 2 (chapter 5), an 8-week multi-component intervention that provided call agents with height-adjustable workstations, plus education and training sessions, weekly support emails and support from team leaders and a workplace champion, was perceived

positively, with call agents and team leaders describing numerous perceived positive effects on behavioural, health and work-related outcomes (Morris et al., 2019). These collective findings somewhat support previous studies that found height-adjustable workstations alone, and as a component within multi-component interventions, are effective at reducing sitting time at work in sedentary workers, with multi-component trials appearing more effective (Shrestha et al., 2018a). Despite this, high costs may prevent the implementation of height-adjustable workstations by organisations. Further, no study to date has explored the acceptability and preliminary effects of a multi-component intervention in the contact centre setting with and without the provision of height-adjustable workstations. Such research will inform future trials in this setting, guidance on workplace health promotion, and organisational investment in height-adjustable workstations.

To that end, this study aimed to evaluate a pilot RCT of a multi-component SB and PA intervention with and without height-adjustable workstations in the contact centre setting. The findings will inform the development of a full trial evaluating the impact of the intervention(s) on sitting time at work in call agents. Objectives of this study were:

1. To assess the response, recruitment and attrition rates, and completion rates for outcome measures.
2. To assess the acceptability of randomisation to an intervention with and without a height-adjustable workstation from participant perspectives.
3. To assess the acceptability of an intervention with and without a height-adjustable workstation from participant and organisational perspectives.
4. To monitor any adverse effects, such as injuries and disruption to working practices.
5. To derive estimates of the preliminary effect of the interventions on sitting time at work, and other behavioural, health and work outcomes.

5.2 Methods

6.2.1. Study design

This study was part of a 9-month trial that included two groups, with participants randomised at the individual level. Both groups received a multi-component intervention to Sit Less and Move More, either with (SLAMM+) or without (SLAMM) the provision of individual height-adjustable workstations (Clinical trials number: NCT03733288). This chapter reports findings from the first 12 weeks of the trial due to the PhD timescales. Ethical approval was granted from Liverpool John Moores University (18/SPS/001).

6.2.2. Recruitment and planning

6.2.2.1. Recruitment of organisation

Large contact centres (>100 seats) in the North West of England affiliated with the Call North West Forum (https://callnorthwest.org.uk/) received a recruitment tender document via email in January 2018 (Appendix 2). Similar to a previous workplace trial (Dunstan et al., 2013a), the tender outlined the research aims, objectives and anticipated trial timescales. Organisations had 3 weeks to submit a statement of interest via email to the research team, detailing their suitability for the study in line with the predetermined essential and desirable criteria (Table 6.1).

Table 6.1. Organisation eligibility criteria

Essential
1. The organisation can meet the proposed key dates for the research study. 2. The organisation has one or more branches/worksites in the North West of England. 3. The organisation employs a minimum of 100 call agents, who each have access to a work telephone and desktop computer with internet, and, are aged ≥18 years. 4. Organisations with only one branch/worksite in the North West of England house call agents across; a) two or more buildings in the branch/worksite, and/or, b) two or more office floors* in the branch/worksite, and/or, c) two or more clearly defined areas* on the same office floor within the branch/worksite. *Office floors were considered clearly defined if they were separated by partitions, full or partial walls, corridors or walkways.
Desirable
1. The organisation has one or more branches/worksites within 50 miles of Liverpool city centre. 2. The organisation has >50% of call agents employed as full time staff (22.5 h or more). 3. Call agents have access to wireless headsets.

The research team reviewed the applications and met the applicants at their worksite to discuss their suitability. None of the applying organisations met the inclusion criteria of having multiple sites, floors or an area of clear segregation between offices. This increased the risk of contamination between groups (Edwards et al., 1999), however, due to project timescales, the organisations were still considered. The only difference between the groups was the provision of height-adjustable workstations, and results in a previous trial randomised at the individual level suggest the risk of contamination between groups would be low from this environmental intervention component (Graves et al., 2015). The research team notified the applicants if they were successful (one organisation) or unsuccessful (two organisations) and why, via telephone and a subsequent email.

6.2.2.2. Planning phase

A gatekeeper at the successful organisation provided written consent for the trial in March 2018. The gatekeeper identified one contract in the contact centre, dedicated to inbound

call agents, from 6 potential contracts operating independently within the same worksite. The contract was situated in an open plan office, which housed 215 call agents and operated a hot desk procedure. Across the contract, one team leader was assigned to a team of 15-20 agents. The gatekeeper identified an employee as the point of contact for the research team (the 'centre contact'). The centre contact, from middle management, agreed to the role and to support the trial. A meeting with the gatekeeper and centre contact discussed the trial timeline, organisational structure, and identified stakeholders to engage in the planning phase. Stakeholders included two senior team leaders, two members of the organisations planning team, and a staff member to serve as 'interim-centre contact' if the centre contact was unavailable. Three further meetings with these stakeholders and the centre contact discussed logistical considerations and barriers to recruitment, randomisation, data collection and intervention delivery, including scheduling offline time for call agents to engage in trial activity. At 12 weeks, stakeholders were invited to take part in a single focus group (centre contacts, planning team members) or interview (senior team leaders, including the organisational gatekeeper) to explore the acceptability and feasibility of delivering the intervention. Written informed consent was obtained prior to data collection.

6.2.3. Team leader engagement and recruitment

Team leaders were invited via email to attend a 30-minute researcher-led briefing at work during work hours in May 2019 (13 of 20 attended). The briefings discussed the trial aims, objectives and timescales, and the team leaders' role to encourage and support their call agents to engage with the intervention. A small group task was used to discuss and develop strategies the team leaders could use to encourage and support the agents, with perceived concerns and barriers discussed. Team leaders were trained on the importance of call agents being free to participate in the intervention without pressure, manipulation or coercion. Team leaders were told they would be invited to participate in focus groups after

the first 12-weeks of the intervention. In week 11 (September 2018), the centre contact (on behalf of the research team) emailed the team leaders (*n*=20) a participant information sheet and consent form outlining the aim of the focus groups. Team leaders had 1 week to express their interest to the centre contact by email or in person.

6.2.3.1. Call agent recruitment and selection

All call agents within the designated contract were sent a recruitment email to attend a recruitment meeting (Figure 6.1). The research team advertised the trial to call agents during 15-minute recruitment meetings (max 20 agents) at work during work hours in June 2018. The trial aims, objectives, timescales, assessments and eligibility criteria were discussed. Agents were informed that following baseline data collection, they would be randomised to SLAMM or SLAMM+. Recruitment posters designed by the research team were distributed to the centre contact who positioned them around the workplace. Agents had 2 weeks to express interest to the centre contact by submitting an expression of interest form via email or in person. The research team screened interested agents in person or by telephone for the following eligibility criteria: a) full time staff member (≥0.6 full time or part time equivalent worker) in a call agent job role; b) access to a work telephone and desktop computer with internet; c) aged ≥18 years; d) ambulatory; e) no health problems that would impact their ability to stand for 10 minutes at a time; f) no planned absence >3 weeks during the first 12 weeks of the intervention; g) no planned relocation to another workplace/site during the first 12 weeks of the intervention; h) not pregnant. The research team informed agents of their acceptance onto the study in person or via telephone. Written informed consent was obtained and baseline assessment scheduled. Participants were allocated a unique identification number for assessments including focus group contributions. There was no racial or gender bias in participant selection.

6.2.4. Stand Up Champion recruitment

Call agents were told in the recruitment meetings that they could become a Stand Up Champion. The Champions were to advocate the intervention through their working practice and encourage agents to sit less and move more at work, while ensuring valid consent was maintained. Agents could opt-in for the role on the expression of interest form, with no limit to the number of Champions.

6.2.5. Intervention components

6.2.5.1. Theoretical basis and Intervention development

In line with the SEM (Sallis, Owen and Fisher, 2008), tailored intervention components which were informed by factors influencing call agents' workplace PA and SB (study 1, chapter 4) (Morris et al., 2018), and refined by study 2 (chapter 5), targeted organisational, environmental, interpersonal and intrapersonal levels (Table 6.2). Intervention components were mapped to the behaviour change wheel (Michie, Van Stralen and West, 2011) to enhance agents capability, opportunity and motivation to sit less and move more at work and progress towards accumulating 2-4 h/workday of standing and light activity (light walking) during working hours (Buckley et al., 2015).

Table 6.2. Intervention components and delivery timeline.

Intervention component	SEM level	Intervention week												
		0	1	2	3	4	5	6	7	8	9	10	11	12
Team leader recruitment brief	Intrapersonal/ Interpersonal/ Organisational	X												
Individual feedback	Intrapersonal		X								X			
Education and training sessions	Intrapersonal		X		X						X			
Weekly emails	Interpersonal		X	X	X	X	X	X	X	X	X	X	X	X
Daily goals	Intrapersonal		X	X	X	X	X	X	X	X	X	X	X	X
Team leader support	Interpersonal		●	●	●	●	●	●	●	●	●	●	●	●
Stand Up Champion	Interpersonal		●	●	●	●	●	●	●	●	●	●	●	●
Height adjustable workstations (SLAMM+)	Environmental		●	●	●	●	●	●	●	●	●	●	●	●

Week 0 indicates pre-intervention delivery.
X Administered intervention component ● Ongoing intervention component.

6.2.6. Intervention procedures

6.2.9.1. Organisational level

To demonstrate organisational buy-in and foster a supportive environment, team leaders and call agents were told at recruitment that senior management had approved the appointment of a centre contact and Stand Up Champions, the installation of individual height-adjustable workstations (for the SLAMM+ group), and offline time for agents to engage in data collection and education and training sessions.

6.2.9.2. Environmental level component

Height-adjustable workstation: After randomisation, SLAMM+ participants had a height-adjustable workstation (Posturite, DeskRite 100, dual screen sit-stand platform, or a

Varidesk, height-adjustable workstation) installed onto their individual workstation. Workstation model was randomly allocated to individuals during installation. Workstations allowed participants to conduct their work in a seated or standing position, with flexibility to frequently alternate between postures throughout the working day. Workstation installation occurred outside of operating hours, with support from the centre contacts and with approval from the onsite facilities team. An A5 laminated sheet was attached to each workstation to remind participants of their safe and effective use. The research team briefed participants on safe and effective workstation use during the first education and training session (week 1).

6.2.9.3. Interpersonal level components

Weekly emails: Participants received a weekly email, in the form of a non-modifiable infographic (Example email: Appendix 3). The infographic encouraged participants to sit less and move more at work by frequently transitioning between postures and walking during breaks and lunchtimes. The content was informed by participant-ideas from the education and training sessions, and previous studies (Buckley et al., 2015; Maddison et al., 2016; Morris et al., 2018; Morris et al., 2019). Each infographic was designed by the research team and forwarded to the centre contact for dissemination. The centre contact emailed the weekly infographics to all team leaders and participants (weeks 1-12). The centre contact was asked to copy the lead author into the weekly emails to assess fidelity of this component.

Team leader support: Team leaders were encouraged to include the trial as an agenda item in their weekly team meetings and 1:1 sessions with call agents. Team leaders were asked to reinforce the intervention messages daily by encouraging participants to sit less and move more, and encourage participants to discuss their engagement with, and experience of the intervention, including factors influencing their workplace sitting and PA.

Call agent and team leader focus groups explored the implementation of this component for the process evaluation.

Stand Up Champions: The Stand Up Champions were encouraged to advocate the intervention aims through their own working practice and encourage other agents to sit less and move more at work. The Champions and their role was communicated and reinforced in each education and training session where Champions were trained with regards to valid consent to emphasise that individuals are free to participate without pressure, manipulation or coercion to sit less and move more. Call agent and team leader focus groups explored the implementation of this component for the process evaluation.

6.2.9.4. Intrapersonal level components

Education and training sessions: Participants were emailed a calendar invitation from the centre contact for three education and training sessions (intervention week 1, 3 and 9). The research team delivered the 30-minute sessions during work hours on-site. The sessions introduced (week 1) and reinforced (weeks 3, 9) the sit less, move more intervention aim, identified the benefits of reducing SB and increasing PA each day at work, and ways to do this, with an emphasis on active breaks and lunchtimes. In week 1, participants worked in groups to co-develop ways to sit less and move more at work, with the ideas embedded in subsequent weekly emails.

Daily goals: The education and training sessions introduced a daily goal and self-monitoring tool to enhance agents automatic motivation to sit less and move more at work (Michie, Van Stralen and West, 2011). This tool was guided by current workplace guidelines (Buckley et al., 2015) where frequent sit-stand transitions, and gradual increases in standing and walking time are encouraged. To support adherence to the daily goals and self-monitoring, each participant received a daily log diary and a stopwatch (week 1) (Example log diary: Appendix 4). Thereafter, participants were encouraged to

use the stopwatch to monitor their standing work time (week 1-12) and walking time (week 4-12). The log diary suggested timed increments across the trial aligned to the minimum workplace recommendations (Buckley et al., 2015). Agents were encouraged to set their stopwatch and then break up their sitting time when prompted by the timer. In weeks 3 and 9 all participants reflected on their daily log data and daily habits during discussions in the education and training sessions. Participants were also asked to share good practice examples and experiences of how they used their daily log diary and stopwatch to prompt sitting reduction at work.

Individual feedback: During the first education and training session, participants were provided with an A4 sheet detailing their individual stature, mass, BMI, BP, glucose and cholesterol feedback from their baseline health check (Appendix 5). Feedback presented during the session was delivered on a group level and explained in relation to normative and threshold data. In week 9, agents each received an individual heat map from their baseline activPAL data during the education and training session (Appendix 6). This included a breakdown of total time spent sitting, standing, and stepping each day to promote agents reflective motivation to sit less and move more at work (Michie, Van Stralen and West, 2011).

6.2.7. Data collection

The centre contact emailed participants a calendar invite to a 1 h assessment at baseline and 12-weeks, which included fasting and clothing requirements. Assessments included objective PA and SB monitoring, anthropometric and cardiometabolic outcomes, and survey completion (Table 6.3). Testing was conducted by trained researchers and occurred in a comfortable, well-ventilated, quiet room at work during working hours, with screens used to maintain confidentiality and promote comfort during anthropometric and cardiometabolic assessments. To promote attendance and fasting compliance, the research team sent participants a text message 24 h before assessments. Messages

were sent from a university account for this reason only. Participants were asked to avoid smoking and active transport on the morning of the assessment, and fast for ≥8 h, avoid alcohol, tea or coffee for ≥12 h, and avoid strenuous exercise for ≥24 h, prior to assessments. Participants completed a food and fluid intake and PA diary across the 24 h before the baseline assessment. Participant's baseline diary was returned to them and they were asked to replicate their baseline intake and PA in the 24 h prior to the 12-week assessment.

6.2.8. Outcomes

Table 6.3 describes the outcomes at baseline and 12 weeks. The measurement of sitting, standing and stepping time, anthropometric outcomes, cardiometabolic outcomes (blood pressure), sociodemographic and job characteristics, musculoskeletal symptoms, health-related quality of life, work factors and process evaluation, were identical to those in study 2 and are described in detail section 3.4.3. Therefore, here only original outcomes measured in this study are described in detail, which were cardiometabolic outcomes (glucose and total cholesterol), sleep quality, occupational fatigue, need for recovery and self-reported habit index.

Table 6.3. Outcomes assessed across the trial.

Outcome measures	Assessments
Sitting time, standing and stepping	(activPAL) Occupational and daily sitting, standing and stepping time, prolonged (≥30 minutes) sitting and standing time, steps taken (Diary) Wake and sleep times, wear times and worktimes only
Anthropometric	Stature, body mass, waist and hip circumferences
Cardiometabolic	Total cholesterol, glucose, systolic and diastolic blood pressure (Diary) 24-h food and fluid consumption diary
Sociodemographic (survey)	Age, gender, ethnicity, marital status, education, smoking status, diet, alcohol consumption, sleep quality, medication, cardiometabolic condition, contraception and menstruation (females only).
Musculoskeletal symptoms (survey)	Nordic Musculoskeletal Questionnaire
Psychosocial health (survey)	Wellbeing (SF-12v2) Health-related Quality of Life (EQ5D)
Work factors (surveys)	Work limitations, job satisfaction, work engagement, need for recovery
Job characteristics (survey: baseline only)	Job title and category, employment status, staff type, tenure, number of people in office, working tasks, hours worked (per week, per day), mode of occupational transport
Process evaluation	**Assessments**
Response and recruitment rates	Organisational applications Participant expression of interest, screening and consent forms Attendance registers at recruitment briefs Fidelity to weekly emails.
Attrition and outcome measure completion rates	Reason for withdrawals recorded Reasons for missing data recorded
Acceptability and feasibility	12-week survey to explore acceptability and feasibility of recruitment, randomisation, data collection and intervention delivery (both groups). Height-adjustable workstation use survey and Self report Habit Index (SLAMM+ only). Focus groups with call agents (randomised sub sample) and stakeholders (centre contacts and planning team members, and team leaders), interviews with senior team leaders after 12 weeks to explore implementation intervention components. Audit of planning meetings including, content, actions and attendees.

	The number of weekly emails circulated by the centre contact recorded to assess fidelity. Attendance registers at education and training sessions.

6.2.8.1.Outcome measures

6.2.8.1.1 Cardiometabolic outcomes

Participants provided a fasting blood sample from one finger a minimum of two times via standard finger prick technique. Samples were immediately analysed for blood glucose and total cholesterol using an Accutrend blood analyser (Accutrend Plus, Roche, USA). Samples were not stored.

6.2.8.1.2 Sleep quality

The Pittsburgh Sleep Quality Index 1-month recall measured sleep quality and disturbances (Ağargün, Kara and Anlar, 1996). Nineteen items assessed seven components of sleep quality (subjective sleep quality, latency, duration, habitual self-efficiency, sleep disturbances, use of medications to aid sleep, daytime dysfunction) (Buysse et al., 1989). Each component was scored on a scale of 0-3 and summed to calculate a Global Sleep Quality Index, with all components weighted equally. Global scores ranged from 0-21, with higher scores indicating a worse quality of sleep (Buysse et al., 1989). The index has acceptable test-retest reliability and validity among asymptomatic (good) sleepers and those with clinical sleep disorders (Buysse et al., 1989; Buysse et al., 1991; Backhaus et al., 2002), with high sensitivity (89.6%) and specificity (86.5%) for distinguishing good and poor sleepers compared to ‘gold standard’ (polysomnography) and laboratory diagnosis (Buysse et al., 1989).

6.2.8.1.3. Work engagement

The 9-item Utrecht Work Engagement Scale (Schaufeli et al., 2006) assessed work-related wellbeing via three subscales of engagement, namely vigour (mental resilience and high energy at work), dedication (the sense of pride, enthusiasm and involvement in ones work) and absorption (being engrossed and attached with work) (Schaufeli and Bakker, 2003). The scale has good construct validity (Seppälä et al., 2009) and high internal consistency (Schaufeli and Bakker, 2003). Mean scores for each sub-scale were calculated using the number of items per scale, and total work engagement was calculated as the mean of the subscales (Schaufeli and Bakker, 2003).

6.2.8.1.4. Need for recovery

The Need for Recovery Scale measured the extent to which occupational fatigue (emotional, cognitive and behavioural symptoms) experienced as a result of work, can be recuperated or reversed (Van Veldhoven, Broersen and medicine, 2003). Occupational fatigue can result in feelings of overload, irritability and social withdrawal, and has been linked to absenteeism, presenteeism and loss of productivity in Dutch workers (Van Veldhoven, Broersen and medicine, 2003). The scale consists of 11 items which were summed and transformed onto a scale of 0-100, with higher scores representing a higher need for recovery (De Croon et al., 2006). The scale displayed fair test-retest reliability over 2-years in unstable working environments, which are characterised by reorganisation, change of supervisor and management and or working hours and activities (De Croon et al., 2006) and are akin to the dynamic contact centre setting (Morris et al., 2018). The need for recovery scale is sensitive in detecting an increase in fatigue as a result of working hours (De Croon et al., 2006).

6.2.9. Process measures

6.2.9.1. Recruitment, retention and attrition rates and completion rates for outcome measures

Similar to a previous intervention (Johnston et al., 2019), the recruitment rate was the percentage of participants who completed baseline assessments and were randomised to a group, from those who expressed interest in the trial. Retention was considered the percentage of participants who completed baseline and 12-week data collection. Reasons for attrition and missing data for outcome measures were recorded throughout.

6.2.9.2. Acceptability and feasibility

Participants engaged in a semi-structured focus group or interview within 2 weeks of the 12-week assessments to assess the acceptability and feasibility of the recruitment strategy, randomisation, data collection procedures and intervention delivery. Team leaders, centre contacts, planning team staff and senior team leaders were asked specifically to discuss barriers and facilitators experienced in implementing the trial. The focus groups and interviews were audio recorded, transcribed verbatim and anonymised during this process.

At 12 weeks only, call agents completed a 33-item questionnaire, containing 5-point Likert-type questions adapted from a previous trial (Graves et al., 2015a) and described in detail in study 2 (chapter 5). In brief, survey items explored the acceptability and feasibility of key study phases and agents' willingness to receive each intervention component in the future. The assessment of the perceived effectiveness of each intervention component was viewed as an acceptability index, based on previous positive associations observed between perceived effectiveness and actual effectiveness (Dillard and Ha, 2016). In addition, SLAMM+ participants answered additional questions regarding their perception and pattern of use of the height-adjustable workstation across the trial.

6.2.9.3. Self-report habit index

At 12 weeks only, SLAMM+ participants completed the 12-item self-report habit index (Gardner et al., 2012) to assess the extent to which use of the height-adjustable workstation was performed unconsciously (automaticity of behaviour), the frequency of use and the relevance to an individual's self-identity (Gardner et al., 2012). Standardised habit scores were calculated according to the Gardner et al. (2012) formulae. Habit strength is presented as a mean (SD) percentage where a higher percentage represents a stronger habit and scores >50% are considered as the presence of a habit (Gardner et al., 2012). The index has high internal and test-retest reliability, high convergent validity, and was found to be sensitive for differentiating between habit frequency (i.e. daily or weekly) (Verplanken and Orbell, 2003). Further, the strength of a habit appears to moderate the intention to perform PA and nutrition-related behaviours (Gardner, de Bruijn and Lally, 2011).

6.2.10. Analyses

6.2.10.1. Behavioural outcomes

Worktime behavioural outcomes derived from the activPAL data were standardised to an 8 h working day (average min/8h workday) and whole day outcomes were standardised to a 16 h day, as reported in previous workplace interventions (Chu et al., 2016; Healy et al., 2016b). Similar to a previous trial, participants were included in complete case worktime and whole day analyses if they provided ≥1 valid worktime day at baseline and 12 weeks and ≥1 workday and ≥1 non-workday at baseline and 12 weeks respectively (Edwardson et al., 2018). A worktime day was considered valid if total worktime was in ≥90% agreement with participant's work and wear time diary (Edwardson et al., 2018). Whole day data was considered valid if there were ≥10 h wear time, ≥500 steps/day and

suitable postural variation (<95% of wear time spent in one activity) (Winkler et al., 2016).

6.2.10.2. Acceptability and feasibility

In line with the pragmatic epistemology, deductive thematic analysis explored patterns and identified themes within the raw focus groups and interview data to explore participant perceptions of the acceptability and feasibility of the recruitment and planning phase, data collection and intervention (Braun and Clarke, 2006) (qualitative methodology described in detail in section 3.4.1.). To minimise detection bias (Cochrane, 2011), a sub-sample of participants from SLAMM (*n*=9) and SLAMM+ (*n*=10) were randomly selected using a random number generator to attended one of four agent focus groups, conducted by a member of the research team who was not involved in delivery of the education and training sessions. A separate focus group was held with a convenience sample of team leaders, and the centre contacts and planning team members. Three individual interviews were held with senior team leaders. Process evaluation surveys were analysed using SPSS version 22 (IBM, New York, USA) to describe the frequency (%) of distribution across responses (Sullivan and Artino Jr, 2013).

6.2.10.3. Statistical analysis

Data was analysed statistically using SPSS with the alpha level set at p≤0.05. Analysis of covariance compared intervention effects at 12 weeks from baseline. The variable change score (12 weeks minus baseline) was the dependent variable, with the treatment arm (SLAMM vs SLAMM+) the independent variable (Field, 2010). In all analyses, covariates include the baseline values for the variable to control for any imbalances at baseline (Vickers and Altman, 2001). Anthropometric, sociodemographic and job

characteristics were tested as potential confounders for all outcomes. Confounders were entered as covariates if significant associations ($p \leq 0.05$) were observed with changes in an outcome, and the effect on the mean difference between groups exceeded 20% (Graves et al., 2015b) (Appendix 7). For changes in activity outcomes, baseline values of the other workday and whole day activity behaviours (total sitting, standing and stepping time) were tested as potential confounders (Healy et al., 2016b). If standardised residuals were normally distributed, as assessed by the Shapiro-Wilk's test ($p > 0.05$), results and associated *p* values were presented. If the residuals were not normally distributed the raw data were transformed (log and square root transformations were tried), change scores were recalculated, and the ANCOVA was rerun on transformed data. If the residuals were still not normally distributed data were analysed using the Man Whitney U test to determine whether there were any changes between groups (uncontrolled for covariates) and associated *p* values were presented (Field, 2010). The mean results of the log or square root transformation ANCOVA were back-transformed and presented as meaningful units (Hopkins et al., 2009). Levenes test of homogeneity of variance was not violated for any analyses (Statistics, 2017). Post hoc analysis was performed using a Bonferroni adjustment for type I error (Field, 2010). Adjusted change scores and 95% confidence intervals for the difference in change between groups are presented. Owing to missing data (Figure 6.1), a per-protocol analysis was conducted.

6.2.10.4. Randomisation

To minimise selection bias, a member of the research team not involved in recruitment, randomly assigned individuals to SLAMM or SLAMM+ using a random number generator after baseline. Randomisation was stratified by participants who had baseline data for the cardiovascular outcome of blood pressure variability (another assessment in this trial;

method and results not shown). Participants were informed of their group allocation via email from the centre contact (on behalf of the research team).

6.3. Results

The results are presented by chronological trial phase with process and outcome measures integrated throughout. Acceptability and feasibility results from the surveys and focus groups/interviews are presented together, with verbatim quotes attributed by job role, participant number (AG=Agent P1-59, TL=Team Leader P1-5, CC=Centre contact P1-2, PT=Planning team P1-2, STL=senior team leader P1-3) and data collection method (FG=Focus group, I=Interview). Mean interview and focus group length was 43.4 ± 10.1 minutes.

6.3.1. Recruitment, retention and randomisation

6.3.1.1. Organisational recruitment

The tender process yielded expressions of interest from three organisations (response rate = 18.8%: Figure 6.1). The successful organisation was a private company with one worksite in an urban area of high deprivation in North West of England (Public Health England: Health Profiles, 2018). The company operated in six sectors of public service provision. Across the independent contracts, the average call handling time varied (6-15 minutes) and each contract dealt with inbound calls only. Worksite offices were large, open plan and at the time of recruitment, consisted of a high proportion of agency contracts (70%). Team leaders were responsible for up to 16 agents per team. Height-adjustable workstations were available to agents completing a necessary Display Screen Equipment assessment.

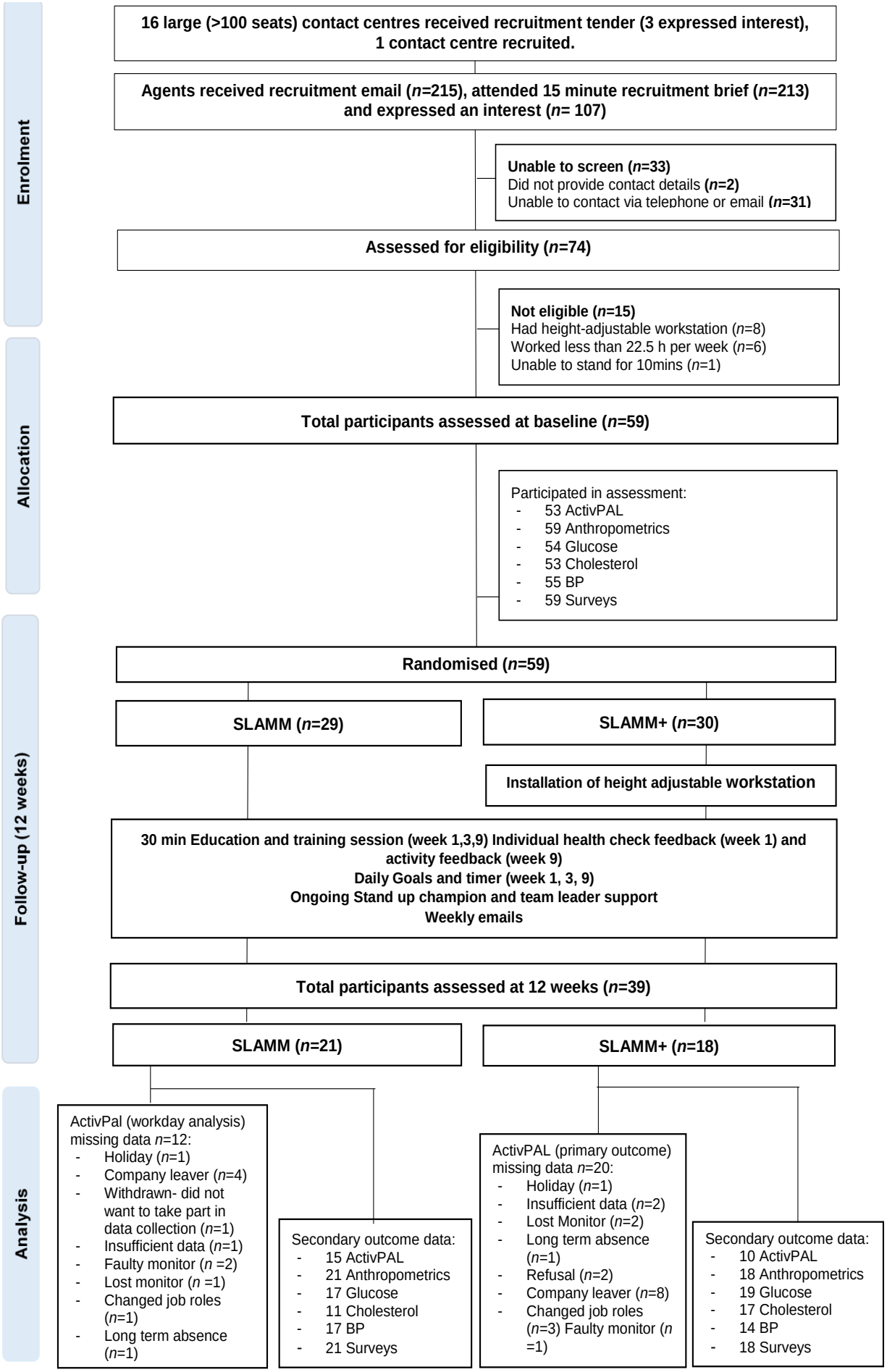

Figure 6.1 CONSORT flow diagram of key study phases for call agents.

6.3.1.2. Call agent recruitment, randomisation and retention

215 call agents were sent a recruitment email and 213 were engaged in recruitment meetings (Figure 6.1). Of the 215, 107 expressed interest (50%). Interested agents were screened for eligibility (*n*=74) and were considered unable to screen if they did not provide a contact email or telephone number (*n*=2) or did not respond to a minimum of two telephone calls or emails (*n*=31). 59 participants met the eligibility criteria, completed baseline assessments and were randomised (recruitment rate = 55%). Most participants were aware of the recruitment posters, and the randomisation process had high acceptability (Table 6.4). Senior team leaders felt the trial could have engaged a greater number of call agents if recruitment had occurred across the whole worksite, including all six independent contracts operating onsite, rather than the one identified for the present trial. Senior team leaders and team leaders however identified that obtaining additional buy-in from other senior management operating across the worksite would be challenging. Senior team leaders and team leaders suggested pre-screening agents based on the eligibility criteria to target the recruitment strategy towards eligible agents only and to minimise the potential impact of the 15-minute recruitment briefs on productivity while the call agents were offline (Table 6.5).

Of the 59 participants completing baseline, 39 completed the 12-week assessment (retention rate = 66%). Attrition was 33.3% for SLAMM+ and 27.5% for SLAMM. The majority of attrition (60%) was due to company leavers, of which 10% had <90 days tenure in their current role at baseline. Team leaders and senior team leaders acknowledged that turn-over in the organisation was typically high, particularly among new starters (Table 6.5). No withdrawals were due to adverse events.

Table 6.4. Acceptability and feasibility of recruitment and randomisation (pooled group data).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The 15-minute recruitment meetings helped me decide whether I wanted to take part in the intervention	49%	46%	5%	0%	0%
I was aware of the SLAMM recruitment posters around Serco	33%	54%	10%	0%	3%
I would prefer to be contacted for screening by my personal phone	21%	44%	21%	13%	3%
I would prefer to be contacted for screening by my personal email	23%	41%	28%	8%	0%
I would prefer to be contacted for screening by my work email	18%	41%	36%	5%	0%
I was aware and understood that I would be randomly selected to either the SLAMM or SLAMM+.	54%	46%	0%	0%	0%
I had no problem with being randomly selected to be in the SLAMM or SLAMM+.	59%	38%	0%	3%	0%

Table 6.5. Themes and illustrative quotes related to recruitment and retention.

Increasing reach	*"You've only got [call agents from contract 1], and [contract 1 accounts for] 17- 20% the size of the whole building, and you've got a proportion of that"* (STL2) *"More visuals around maybe, you know, "This is coming". More tasters and things, and, "If you want to sign up, these are the benefits". I think just more visuals*" (STL3, I)
Minimising recruitment burden	*"…There could have been more clarification early doors, because then there was the thing of people wanting to sign up that weren't allowed to sign up, and they lost productivity of people going to these briefings that were never going to be entitled to sign up."* (TL 2, FG)
Minimising attrition	*"So a lot of the people, from what I presume that signed up for this in the beginning, were fairly new staff, and it's the fairly new staff that don't always settle in this kind of work environment, whereas a lot of the staff that, once someone's been here after nine months to a year, there's less chance of them leaving the company"* (TL 1, FG) *"The difficulty is that a lot of people, the turnover of staff here is really high, and potentially, a lot of the people that are doing the study now probably weren't here a year prior"* (STL1, I)

6.3.2. Planning phase

The planning meetings and briefings helped team leaders and senior team leaders to understand the trial aims, objectives and timeline. In reality though, planning and running the trial was more time consuming than anticipated, particularly for the centre contacts who supported the trial on top of their normal job (Table 6.6). Team leaders and senior team leaders stated that the unpredictable and fluctuating call volumes, despite predicted forecasts, were an ongoing challenge to scheduling call agents offline time for data collection and education and training sessions. Senior team leaders believed improved communication between the organisation and research team could have helped manage the planned and ongoing organisational changes (i.e. office relocation, changes in call agent's and team leader's job roles) across the intervention (Table 6.6).

Table 6.6. Themes and illustrative quotes related to the planning phase.

Time burden	*"I think maybe myself and (STL2) probably maybe didn't appreciate how much time it would take with it getting agents off the floor, was probably something that maybe we should have thought about. I'm not saying we wouldn't have done it, but yes, that would have been one of our risks, I think*." (STL1, I)
	"I didn't think I was going to be involved as much as I was, but then obviously, because of how busy it was and time-consuming, it was just too much for (CC1) to do on her own, as well as her normal day-to-day work' (CC2, FG)
	"I think it [planning] took more time than I was expecting, but only because of the variations in the agents, so the shift times and stuff […] and you can't do that in a quick way" (PT1, FG)
Challenges for forecasting and planning offline time	*"You're trying to predict how many calls you're going to get in, based on what happened last month […] it's an estimate […] so the forecast might be sky high, and then it might be really […] and it can be really, really high where it's supposed to be really quiet, […] Every day is just different, and you just can't call it"* (TL4, FG)
	" it's not always practical to take people offline for any length of time. We're a contact centre, and it's choosing the right time, […] It's an impossible ask. You just do the best of a difficult situation" (STL2, FG)

Managing ongoing organisational changes	*"We could have given you more notice, more of a heads up, but it [the office relocation] was just one of those things […] I planned the desk moves in phases, and probably I just should have ensured that I copied you in and engaged with you, and I didn't do that […] the [height-adjustable workstations] was an afterthought, which it shouldn't have been, really."* (STL3, I)

6.3.3. Data collection

Most call agents found the text message reminder useful, the data collection feasible and comfortable, and felt supported by their organisation to attend (Table 6.7). Some call agents felt pressured by their team leader to return to work due to high call volumes, with this reflected by team leader, centre contact and senior staff comments on the impact of the data collection on maintaining service levels (Table 6.8). Centre contacts suggested that call agents attend data collection and education and training sessions in their breaks and lunch time, however this was not acceptable to call agents (data not shown). Centre contacts also felt that it would be beneficial to enhance their understanding of the data collection process to enable them to be more informed and provide additional support agents during this process.

Table 6.7. Acceptability and feasibility of data collection (pooled group data).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The text message and email about my health check was a useful reminder for me to fast.	59%	33%	5%	3%	0%
If the assessment protocol (Health Check) took place out of work hours I would not take part	13%	31%	36%	15%	5%
It was feasible for me to provide my body stature measurements	49%	44%	8%	0%	0%
It was feasible for me to have my blood pressure taken	56%	38%	5%	0%	0%
It was feasible for me to complete the survey booklet	54%	41%	5%	0%	0%
It was feasible for me to come into work in a fasted state	51%	41%	8%	0%	0%
It was feasible for me to provide a finger prick blood sample	56%	38%	5%	0%	0%
It was feasible for me to wear an accelerometer for 7 days	44%	44%	10%	3%	0%
It was feasible to complete the ultrasound scanning of my leg (methods not discussed in thesis)	49%	44%	8%	0%	0%
I felt supported by my organisation to complete the assessment protocol (Health Check) within work hours	54%	38%	8%	0%	0%
I felt comfortable completing the assessment protocol (Health Check)	62%	33%	3%	3%	0%

Table 6.8. Themes and illustrative quotes related to data collection

Participant experience	*"I thought the first [health check] was rushed, but not because of you, because of, obviously, our work. They [team leaders] wanted us to be quick so we could get back on the phone"* (AG 40, FG SLAMM+)
Enhancing team leader understanding	*"I think it would have been beneficial to understand what the [health] checks were about, because I was so involved in SLAMM, but then I wasn't, at the same time. […] I just got the scheduling information. I didn't really understand what was involved"* (CC2,FG)
Intervention sessions in participants own time	*"I think it was brought up that maybe agents who were wanting to participate could do it in their own time, so they'd have to work, either come in an hour earlier or have an hour later, or do it on their dinners"* (PT1, FG) *"I think sometimes, though, the forecasts can change, and everything can change, and a queue can start to form, and then we've got staff away [*during data collection and education and training sessions*], and then we [*team leaders*] start to stress, and there's a queue, like, "Why are they taking so long?"* (TL, FG)

6.3.3.1. Baseline characteristics

Participants descriptive demographic data are presented in Table 6.9. Participants were typically female, White British, single and educated at the tertiary level. Most participants were employed full time under agency contracts and worked at the company for <1 year. On average, participants were overweight, with a normal systolic and diastolic BP and were in a healthy range for fasting glucose and total cholesterol (Whelton et al., 2018). There were no significant between-group differences for baseline characteristics (age, ethnicity, gender, education, worker status, marital status) between those included and excluded in the workday sitting, standing and stepping analysis (data not shown). There were no significant or between-group differences at baseline between SLAMM and SLAMM+ participants for sociodemographic and work outcomes except for a higher proportion of smokers in SLAMM+ (p=0.036). For all participants combined, sitting occupied 80% (382.6 ± 75.8 min/8-h workday) of their time at work, with 41% (158.4 ± 136.0 min/8-h workday) of sitting accrued in prolonged periods >30 minutes. Standing and stepping occupied 15% (70.9 ± 73.6 min/8-h workday) and 5% (26.5 ± 10.8 min/8-h workday) of time spent at work, respectively. There were no significant between-group differences at baseline for any worktime or whole day behavioural outcomes (Table 6.9). All other data including baseline behavioural, survey, cardiometabolic and anthropometric outcomes are presented by group (SLAMM and SLAMM+), with adjusted change scores in table 6.10 and 6.11.

Table 6.9. Baseline characteristics by group, presented as means ± standard deviations or *n* (%).

	Total (n=59)	SLAMM (n=29)	SLAMM+ (n=30)	*p*-value
Age (years)	30.9 (11.6)	31.9 (11.5)	29.0 (12.0)	.437
White British	55 (94.8)	26 (89.7)	29 (100.0)	.206
Single	49 (84.5)	27 (55.1)	22 (44.9)	.318
Female	40 (67.8)	23 (57.5)	17 (42.5)	.063
Tertiary educated	33(58.9)	14 (42.4)	19 (57.6)	.174
Current smoker	28 (48.3)	10 (35.7)	18 (64.3)	.036*
Worker Status				
Full time	49 (84.5)	25 (51.0)	24 (49.0)	.717
Agency	45 (77.6)	24 (53.3)	21 (46.7)	.345
<1 year tenure	50 (86.2)	24 (48.0)	26 (52.0)	.543
Hours worked per week (h/week)	36.0 (3.8)	36.0 (4.2)	36.3 (2.9)	.365
Hours worked per day (h/day)	7.2 (0.9)	7.1 (01.0)	7.3 (0.8)	.384

6.3.3.2.Intervention effects

6.3.3.2.1. Sitting, standing and stepping time

Although no statistically significant between-group differences were observed for any behavioural outcome at 12 weeks, total and prolonged (≥30 minutes) sitting time at work reduced in SLAMM+ relative to SLAMM, and total and prolonged (≥30 minutes) standing time at work increased in SLAMM+ relative to SLAMM (Table 6.10). Further, relative to SLAMM at 12 weeks, SLAMM+ had reduced whole day total and prolonged (≥30 minutes) sitting time, and increased whole day standing and stepping time, and steps taken (Table 6.10).

6.3.3.2.2. Psychosocial health and work factors

There was a significant increase in mental wellbeing (mental component score) at 12 weeks in SLAMM+ relative to SLAMM (Table 6.11). There was no significant between-group difference at 12 weeks for physical wellbeing (physical component score), sleep quality, work limitations, job satisfaction, need for recovery and work engagement (Table 6.11).

6.3.3.2.3. Cardiometabolic, anthropometric and musculoskeletal outcomes

There were no significant between-group differences in anthropometric, cardiometabolic or musculoskeletal outcomes at 12 weeks (Table 6.11).

6.3.3.3. Perceived intervention effects

Several agents reported feeling less tired from sitting less at work, although having low motivation to stand up was perceived as a barrier to sitting less. Some agents felt more alert and less stressed at work as a result of sitting less and some reported that sitting less helped to overcome postprandial fatigue. Overall, agents from both groups found that engagement in the intervention increased their awareness of the amount of time they would spend sitting at work (Table 6.12).

Table 6.10. Behavioural outcomes with adjusted between-group differences [a]

	SLAMM (*n*= 17)		SLAMM+ (*n*= 10)		Adjusted change 0 to 12 weeks (95% CI) [b]	*p*-value
Occupational (minutes/8h workday)	Baseline	12 week	Baseline	12 week		
Number of valid workdays	3.8 (1.0)	4.2 (1.3)	2.9 (1.4)	3.6 (1.2)	-0.1 (-0.3, 0.04)	.134
Wear time	430.7 (79.3)	452.0 (99.2)	486.8(29.2)	431.4(86.5)	0.8 (-77.9, 79.5)	.984
Sitting time	405.7 (35.4)	375.3 (68.6)	380.5 (42.4)	337.4 (80.8)	-19.6 (-73.2, 33.9)	.455
Sitting time (≥30 minute bouts)	230.3 (96.8)	241.1 (109.9)	171.8 (145.8)	148.9 (111.8)	-37.2 (-121.4, 47.1)	.370
Standing time [c]	49.3 (30.6)	77.6 (66.3)	71.1 (38.1)	111.7 (77.7)	24.3 (-22.7, 71.3)	.296
Stepping time [d]	25.0 (8.5)	27.1 (11.7)	28.4 (10.2)	30.9 (9.6)	1.9 (-11.4, 15.2)	.768
Whole day (minutes/16h day)	**SLAMM (*n*= 15)**		**SLAMM+ (*n*= 10)**			
Number of valid days	7.0 (0.9)	6.9 (1.6)	5.7 (1.8)	5.9 (1.9)	-1.1 (-2.7, .59)	.194
Wear time	893.9 (45.9)	876.3 (46.1)	859.5 (38.3)	871.0 (60.0)	-9.2 (-60.9, 42.5)	.712
Sitting time [c]	669.2 (72.6)	660.6 (69.0)	691.9 (56.4)	649.8 (57.2)	-32.6 (-80.1, 15.0)	.168
Sitting time (≥30 minute bouts)	349.4 (106.7)	367.2 (114.0)	337.8 (116.9)	329.7 (83.0)	-43.8 (-118.7, 31.2)	.238
Standing time [d]	182.3 (47.5)	201.3 (66.0)	173.1 (42.3)	213.7 (51.2)	22.3 (-23.5, 68.1)	.321
Stepping time	108.5 (38.9)	98.1 (28.6)	95.0 (20.5)	96.5 (28.3)	8.4 (-4.9, 21.6)	.203

[a] Baseline and 12-week values are unadjusted mean (SD)
[b] Change scores and 95 % CIs are the differences between groups (relative to SLAMM) after adjustment by ANCOVA for the baseline value and cofounders (see Appendix 7 for additional confounders), with means back transformed to original units for transformed outcomes.
[c] Outcome modelled as log of outcome; results in tables are presented back-transformed to original unit.
[d] Outcomes modelled as square root of outcome; results are presented back-transformed to original unit and *p* value from non-parametric test.

Table 6.11. Psychosocial, musculoskeletal, anthropometric, cardiometabolic and work outcomes with adjusted between-group differences [a]

	SLAMM (*n*= 21)		SLAMM+ (*n*= 18)		Adjusted change 0 to 12 weeks (95% CI) [b]	*p*-value
	Baseline	12 weeks	Baseline	12 weeks		
Psychosocial						
Physical component score	50.3 (8.2)	50.1 (9.9)	48.3 (9.3)	46.5(8.2)	-4.1 (-11.0, 2.8)	.233
Mental component score	47.8 (7.5)	46.3 (10.2)	44.7 (13.8)	47.6 (9.8)	5.7 (0.7, 10.7)	.028*
EQ5D Index	0.9 (0.2)	0.9 (0.1)	0.8 (0.2)	0.8 (0.2)	0.1 (-0.1, 0.3)	.106
Musculoskeletal discomfort n (%)						
Upper extremities					0.0 (-0.4,0.5)	.705
No	11 (55)	9 (45)	10 (67)	8 (50)		
Yes, does not affect activity	6 (30)	7 (35)	5 (33)	6 (38)		
Yes, does affect activity	3 (15)	4 (20)	0 (0)	2 (13)		
Upper back					0.0 (-0.4, 0.4)	.438
No	14 (70)	15 (75)	11 (73)	11 (69)		
Yes, does not affect activity	5 (25)	4 (20)	4 (27)	3 (19)		
Yes, does affect activity	1 (5)	1 (5)	0 (0)	2 (13)		
Lower back					0.1 (-0.3, 0.4)	.528
No	9 (45)	9 (47)	5 (31)	4 (27)		
Yes, does not affect activity	8 (40)	7 (37)	7(44)	7 (47)		
Yes, does affect activity	3 (15)	3 (16)	4 (25)	4 (27)		
Lower extremities					-0.1 (-0.9, 0.4)	.769
No	10 (50)	10 (50)	6 (40)	8 (50)		
Yes, does not affect activity	4 (20)	5 (25)	6 (40)	6 (38)		

Yes, does affect activity	6(30)	5 (25)	3 (20)	2 (13)		
Sleep quality	8.3 (4.2)	7.5 (3.1)	7.7 (4.2)	6.2 (3.8)	-1.4 (-3.5, 0.7)	.174
Work Limitations [c]	19.5 (3.5)	18.3 (4.2)	19.0 (4.2)	18.8 (4.1)	0.02 (-2.7, 2.7)	.667
Job satisfaction	21.8 (2.4)	20.7 (4.7)	22.6 (3.7)	21.8 (2.7)	1.0 (-1.5, 3.5)	.408
Need for recovery	0.8 (0.1)	0.7 (0.1)	0.8 (0.2)	0.8 (0.2)	1.8 (-5.3, 9.0)	.600
Work engagement	3.1 (1.5)	3.0 (1.4)	3.0 (1.8)	2.7 (1.6)	0.004 (-0.5, 0.5)	.987
Vigour	2.7 (1.4)	2.6 (1.4)	2.7 (1.8)	2.8 (1.7)	0.01(-0.8, 0.8)	.978
Dedication [d]	3.4 (1.8)	3.1 (1.5)	3.2 (1.8)	3.1 (1.6)	0.01 (-0.6, 0.6)	.884
Absorption	3.1 (1.6)	3.1 (1.5)	2.9 (1.9)	2.7 (1.7)	-0.3 (-0.9, 0.3)	.372
Anthropometric and cardiometabolic						
Body mass index (kg/m^2)	28.3 (6.5)	28.4 (6.6)	32.6 (9.2)	33.0 (9.4)	0.3 (-0.3, 0.9)	.343
Body mass (kg)	76.2 (22.0)	76.9 (22.4)	89.0 (27.8)	90.2 (28.1)	0.5 (0.8, 1.9)	.420
Waist circumference (cm)	83.6 (15.8)	83.3 (15.5)	92.0 (20.9)	92.3 (20.5)	0.0 (-0.0, 0.0)	.348
Hip Circumference (cm)	104.0 (15.0)	103.8 (14.6)	114.0 (20.4)	113.8 (20.0)	0.2 (-1.6, 2.0	.659
Waist to hip ratio [c]	0.8 (0.07)	0.8 (0.1)	0.8 (0.1)	0.8 (0.1)	0.0 (-0.0, 0.01)	.783
Systolic blood pressure (mmHG) [d]	114.4 (16.8)	118.3 (17.9)	115.0 (13.9)	122.9 (16.4)	5.2 (-5.5, 15.7)	.544
Diastolic blood pressure (mmHG)	76.8 (9.6)	79.5 (11.2)	79.9 (9.0)	84.9 (14.4)	3.4 (-5.2, 12.0)	.422
Glucose (mmol/L)	4.0 (1.0)	4.8 (0.6)	4.5 (1.1)	4.9 (1.3)	0.4 (-1.0, 0.3)	.237
Cholesterol (mmol/L)	4.9 (0.7)	5.1 (1.1)	4.5 (0.7)	4.6 (0.6)	0.1 (-0.7, 0.6)	.837

[a] Baseline and 12-week values are unadjusted mean (SD) or n (%)
[b] Change scores and 95 % CIs are the differences between groups (relative to SLAMM) after adjustment by ANCOVA for the baseline value and cofounders (see Appendix 7 for confounders detail), with means back transformed to original units for transformed outcomes.
[c] Outcome modelled as log of outcome for work limitations, ratio; results in tables are presented back-transformed to original unit.
[d] Outcomes modelled as square root of outcome for systolic BP, dedication; results in tables are presented back-transformed to original unit and p value from non-parametric test.
*Significant (p <0.05)

Table 6.12. Themes and illustrative quotes related to the intervention components

Less fatigued	*"…look at the way I'm slouching, I'm like that in my chair, or on my desk or something, but if I'm standing up, then you can't really [slouch], can you? You do feel like you've got more energy, but it's getting the motivation to stand yourself up in the first place"* (AG40, FG, SLAMM+) *"I think when you feel tired as well, like after your dinner, and you don't want to stand up then, and then I just feel like if you sit and yawn and then stand up, it makes you a bit more awake, a bit more alert*" (AG9, FG, SLAMM+)
Less stressed	*"For me, it helps me with the stress. If I get stressed, I stand up, so it's helped me a lot about the stress calls"* (AG54, FG, SLAMM)
Musculoskeletal impact	*"I've started getting bad back pains from sitting down, so that desk's coming in handy"* (AG42, FG, SLAMM+) *"This morning my back was killing me. This morning I just stood up, and the pain seemed to ease when you're standing up"* (AG45, FG, SLAMM+) *Yes, when my back hurts, I might stand up, and then I think, "No". I can't stand up because there's too much to do. They're like, "Where are you going?"* (AG43, FG, SLAMM)
Increased awareness	*"You realise, 'God, I've been sat here for so long'."* (AG30 FG, SLAMM)
Interpersonal relationships	*"P13 came in and I had a new starter, and he was sat in his [height-adjustable workstation], and P13 came in and screamed at him. That was just out of order"* (CC2, FG)

6.3.4. Intervention acceptability and feasibility

SLAMM+ participants ranked the height-adjustable workstation as the most important intervention component for promoting them to sit less at work (Table 6.13) and developed a medium-strong strength habit (mean 68%, range 31-100%) for height-adjustable workstation use. The large variance in strength of habit is consistent with the variance observed in workday sitting (Table 6.10). SLAMM+ participants reported using the workstation daily (39%), 2-4 times per week (28%) and monthly (6%) or not at all (6%). The most common duration of standing work with the workstation was 30-60 minutes (44%) and 40% reported using the workstation in a standing position 1-4 h/workday. Most participants reported that workstation use did not negatively impact work quality, work

productivity, musculoskeletal discomfort or fatigue and most wanted further advice and guidance on workstation use. All participants felt comfortable using the workstations in the presence of others, and the focus groups revealed that grouping agents with workstations would help develop a sit-stand culture and minimise disruption to co-workers. SLAMM+ participants indicated that installation of an individual height-adjustable workstation among desk-based colleagues operating a hot-desking policy had a negative impact on interpersonal relationships due to non-participating co-workers using their allocated desk on occasion (Table 6.12). One suggestion to overcome this was to pool those with a height-adjustable workstation within the office to enhance interpersonal support (Table 6.14).

Of the common intervention components, both groups rated the individual feedback, education sessions and weekly emails in the top three for importance (Table 6.13) and effectiveness (Appendix 8). Increased knowledge and awareness of their behaviour and health as a result of individual feedback and education sessions (discussed in section 6.3.3.3), enhanced agents motivation to engage with the intervention. Interestingly, most agents described that offline time for the data collection and education sessions motivated them to sign up to the trial. Several agents found the weekly emails informative, but time and workload pressures reduced their ability to read the emails at work. Some agents found the suggestion of desk-based exercises within the weekly emails useful and completed them at work, however others felt that completing desk based exercises at work was not an acceptable behaviour.

The daily goals, team leader support and Stand Up Champions were perceived by both groups as least important and effective. Improper use of timers and their noise were perceived by participants and team leaders as distracting to co-workers and therefore unacceptable. Participants described having minimal interaction with team leaders for intervention-related purposes. Team leaders described how they supported intervention sessions and honoured requests for offline time but did not actively promote the sit less

and move more intervention message due to the conflict between promoting business metrics. Most team leaders felt they would engage more in the trial if they received feedback about the trial including participants' behaviour and health. While 22 of the 59 participants (32%; *n*=9 in SLAMM) opted to be a Stand Up Champion, participants were often unsure who the Champions were, and believed the centre contacts were more prominent drivers of the intervention (Table 6.14). Participant's willingness to receive each intervention component was consistent with the perceived effectiveness and importance rankings (data not shown). Despite ranking the daily goals, team leader support and Stand Up Champions as least important, most participants reported they would continue to receive them. Most agents in SLAMM and SLAMM+ would take the opportunity to have a height-adjustable workstation if offered by their employer.

Table 6.13. Intervention components ranked in order of importance by group.

	SLAMM	SLAMM+
Height-adjustable workstation	-	1
Individual feedback	1	2
Education and training sessions	2	3
Weekly emails	3	4
Daily goals	4	5
Team Leader Support	5	6
Stand Up Champion	6	7

Table 6.14. Themes and illustrative quotes related to the intervention components

Height-adjustable workstations	*"…some lad from my team robbed it off me […] We had a full-on argument about it, because he moved my desk from where I was sitting." (*AG55, FG, SLAMM+) *"Yes, especially because people, it's hot desking, isn't it? They don't have their own desk, so if one day they come in and someone was sat at their desk, with the [height-adjustable workstation], there's nothing they can do, especially if we're so busy"* (CC1, FG) *"Maybe [company] should do something where they put everyone in [height-adjustable] desks together. It's dead annoying, I think, when you have to keep putting your desk up and down, and everyone's looking at you"* (AG55, FG, SLAMM+)
Individual feedback	*"I would say that, […] just [the individual feedback] makes you aware more that you are sitting down. I mean, with me, I walk to work anyway, so I do, I'm active there, so I think I would probably try a little bit more in work if I didn't walk to work and walk home. But yes, it does make you aware of when you're sat and how you're sitting. I do slouch. I slouch really badly, and your back starts hurting then".* (AG30, FG, SLAMM) *"No, I didn't realise how much I sat down until the [activity feedback] with all the.... Mine [heatmap] was mostly red"* (AG1, FG, SLAMM)
Education and training sessions	*"To be honest with you, I have the same reason to take off the phones, but then I realised when I heard you in the [education session], well, this is about the project that is maybe interesting, so that's why it makes me a bit more interested, and that's why I take part".* (AG54, FG, SLAMM)
Weekly emails	*"If I'm being honest, I think it comes down to I'm not being seen doing them [desk based exercises suggested in weekly email]*" (AG24, FG, SLAMM)
Daily goals	*"The timer has been really frustrating. You can hear it when you're listening to calls. You can constantly hear an alarm clock going off, basically. Which can be quite distracting for other agents on the phone"* (TL 4, FG) *"…people tend to abuse [the timers], because people would set them and then just throw them under someone's desk, and they'll just beep"* (AG9, FG, SLAMM)
Team leader support	*"The agents haven't really communicated with us, because we've had nothing to do with the SLAMM project, it's been all CC1 and CC2, so it didn't really come through us".* (TL2, FG) *"My manager, when we've moved [office], she has made sure my desk is there. Like I've never been a day without my desk, but other than that, she's not like, "Come on, you should be standing up more", and all that.* (AG9, FG, SLAMM+)
Stand Up Champions	*"I couldn't tell you who any of them [stand up champions] are"* (AG40, FG, SLAMM+)

6.4. Discussion

This pilot RCT was the first to use mixed-methods to evaluate a multi-component SB and PA intervention with and without height-adjustable workstations in the contact centre setting. Senior team leaders, team leaders, centre contacts and planning team members perceived the SLAMM and SLAMM+ interventions as acceptable, although strategies were identified to manage organisational changes more effectively and refine the call agent recruitment process to minimise the perceived potential impact on productivity. Ongoing pressures to maintain service levels impacted the ability to plan offline time for call agents, which impacted data collection and delivery of the education and training sessions. Importantly, neither intervention disrupted working practices or caused adverse events. Findings suggest that both interventions reduced total and prolonged occupational sitting time after 12 weeks, with greater reductions observed in the intervention including a height-adjustable workstation. The following sections discuss the study findings in order of trial phase (recruitment, planning, data collection, intervention delivery) to address the study objectives.

The tender process adopted during organisational recruitment aimed to enhance organisational buy-in, enhance transparency and identify a suitable organisation to meet the needs of the study design and research timeline. The short timeline for organisational recruitment (3 weeks), compared to ≥1 year adopted in a previous trial (Dunstan et al., 2013a), may have limited the likelihood of companies being able to apply for the intervention. The low number of applicants may have impacted the ability to identify and recruit an organisation that could accommodate a clear area of segregation due to the open plan structure of the three interested contact centre work sites. This offers important contextual information for designing interventions in open plan contact centres, where randomising to a non-treatment control may not be feasible due to the high risk of contamination between groups (Higgins et al., 2011). To minimise the potential threat of contamination in future trials, cluster randomisation may offer a more feasible study

design, although clustered RCT's are typically more complex to design than individually randomised RCT's and require greater number of participants to achieve statistical power (Campbell, Elbourne and Altman, 2004).

Following study 2 (chapter 5) (Morris et al., 2019), the agent recruitment process was refined by removing the team leader recruitment phase to increase the reach of the intervention and to capture a more representative sample of call agents. The individual approach in the present trial engaged with 98% of the call agent population within the designated contract and yielded interest from 52% of call agents. However, as discussed, pre-screening agents based on eligibility criteria in future trials may be a more acceptable organisational strategy to limit the impact of recruitment on productivity. Of those interested, 80% were eligible, compared to only 30% of 'healthy' call agents who were eligible in study 2 (chapter 5) (Morris et al., 2019). This suggests that recruiting from a population of call agents who have an elevated cardiometabolic risk, including both healthy and 'at risk' individuals may enhance the reach, representativeness and generalisability of the findings (Thorp et al., 2012). Furthermore, targeting at risk populations has wider implications for public health through potentially greater benefits to cardiometabolic health (Marmot and Allen, 2015).

Following the results of study 2 (chapter 5), the planning phase was extended to allow time to identify and engage with appropriate organisational stakeholders who were integral in identifying logistical considerations and feasibility considerations across each study phase. Conducting this planning phase aimed to enhance stakeholder buy-in and highlight potential barriers such as scheduling offline time for call agents to engage in trial activity, which may impact data collection and intervention delivery. Consistent with study 2 (chapter 5) (Morris et al., 2019), large and fluctuating call volumes were a major barrier to scheduling offline time for agents despite anticipated forecasting. Consistent with study 2, maintaining critical call volumes took precedence and therefore impacted adherence to pre-planned offline time for intervention related sessions (Morris et al., 2019). Similarly, emergency contact centre workers highlighted that maintaining workload was paramount

and a barrier to sitting less, despite access to a height-adjustable workstation (Chau 2016). Missing, cancelling or delaying intervention sessions has the potential to affect the dose and fidelity of the intervention (NICE 2014), although as identified in study 2 (chapter 5), fluctuating call volumes appear unavoidable in contact centres (Morris et al., 2019). Addressing strategies surrounding call volumes during the planning phase is therefore important for establishing potential contingencies, although it should be acknowledged as an ongoing challenge in this setting.

During the planning phase team leaders were invited to a non-compulsory intervention briefing session to raise their awareness of and enhance their buy-in to the intervention. Similar to previous trials, it was highlighted that enhancing the interpersonal element among both team leaders and co-workers was an important factor for influencing PA and SB at work (Taylor et al., 2013; Mackenzie, Goyder and Eves, 2015; Brakenridge et al., 2016a). Team leaders reported that they did not actively promote the sit less and move more intervention message to their participating call agents, and acknowledged that their involvement was limited to honouring offline time for data collection and education and training sessions. During the trial, multiple staff changes, high staff turn-over and office relocation may in part explain the inconsistent engagement of team leaders in the unstable working environment (De Croon et al., 2006). Adopting this management support strategy was found to be effective for significantly reducing office workers SB over 12 months in the Stand UP Lend Lease trial (Brakenridge et al., 2016a) where participants perceived ongoing management support as an important motivator throughout the trial (Brakenridge et al., 2016a). Of note was that significant changes in sitting time were not observed until 12 months, suggesting that management support strategies may take longer to embed into working practice and thus longer to impact employees sitting behaviour (Brakenridge et al., 2016c). Proposed management support strategies included engaging team leaders and senior management in data collection and education sessions to enhance their own awareness of sitting and PA behaviour and the impact on health, wellbeing and work factors in the workplace.

Attrition in the present trial (34%) is consistent with other workplace trials (Malik, Blake and Suggs, 2014) and similar to a previous contact centre intervention (Pickens et al., 2016). Compared to a previous multi-component trial (Healy et al., 2016b), attrition in the present trial was largely due to company leavers and there were no withdrawals due adverse events. In contact centres, average annual attrition (21%) is higher than other sectors and is typically higher in the first 90 days of employment (Contact Babel, 2017). During agent recruitment, 18 agents (31% of recruited agents) who met the eligibility criteria had ≤90days tenure in their current role, of which 6 (10% of eligible agents) were company leavers at 12 weeks. This provides some evidence to refine the eligibility criteria in future trials to recruit those with >90 day tenure to minimise the risk of agent attrition at follow up. The high attrition rates observed in this sector (Contact Babel, 2017) and observed in study 2 (chapter 5) highlight the potential challenge for evaluating long-term changes in behaviour, health, wellbeing, and productivity indicators, therefore careful sample size planning is needed for sufficiently powered long-term evaluation in contact centres (Cavill, Roberts and Rutter, 2012). All agents were aware that they would be randomised to either SLAMM or SLAMM+ intervention arms and found randomisation to be an acceptable intervention process. Across the trial, greater attrition occurred in SLAMM+ at 12-weeks compared to SLAMM and was largely due a greater number of company leavers in SLAMM+. Ongoing monitoring and process evaluation in the present trial identified that while no attrition occurred due to adverse events, implementing an intervention arm with the addition of an individual height-adjustable workstation resulted in some reports of impaired co-worker relationships.

Findings suggest that both SLAMM and SLAMM+ intervention arms reduced worktime sitting at 12 weeks by -30 and -42 min/8h workday respectively. Differences between groups were not significant, although they appear consistent with previous findings in short term (3 month) multicomponent trials among office workers, when compared to usual practice and standardised to an 8h workday (Chu et al., 2016). Importantly, the present pilot trial was not powered to detect meaningful changes to occupational sitting

time and therefore the results should be interpreted with caution (Levati et al., 2016). Nevertheless, observed changes of >30 min/8h workday for both groups are of a similar magnitude to previous workplace interventions, and are potentially meaningful (Peachey et al., 2018). Despite this, observed changes are smaller than previous workplace interventions in office workers, which suggests there may be specific contextual factors such as job tasks and low autonomy within the contact centre setting which limit the magnitude of sitting reduction over 12-weeks (Morris et al., 2018). Significant differences in occupational sitting may have been observed if the SLAMM+ intervention was compared to a non-intervention control group. Indeed, it is likely that the educational and behavioural components delivered to both intervention arms had a positive impact on agents sitting behaviour, as reductions in workday sitting were observed in both groups. This is similar to findings in an office workplace PA intervention with or without the addition of a height-adjustable workstation (Johnston et al., 2019), and suggests that a low-cost intervention consisting of behavioural and educational strategies may be beneficial for reducing workday sitting time in contact centres. Further research is however warranted to determine whether observed changes can be maintained, or enhanced over time (Edwardson et al., 2018) and whether this is has an impact on cardiometabolic or work-related outcomes.

The reduction in worktime sitting in the present study appeared to be substituted by worktime standing for both groups, as worktime stepping was unchanged at 12 weeks. The pattern of sitting accumulation however differed between groups, with participants in SLAMM accumulating a greater proportion of their worktime sitting in prolonged bouts (>30 min) at 12 weeks compared to baseline, whereas SLAMM+ reduced their worktime sitting in prolonged bouts (>30 min). The pattern of sitting accumulation is an important mechanism for reducing cardiometabolic risk (Brown, Miller and Miller, 2003; Carter et al., 2018). Consistent with findings in other workplace interventions (Healy et al., 2016b) inclusion of the height-adjustable workstations may facilitate frequent postural transitions in this setting which appears more important for cardiometabolic health than longer or less

frequent breaks (Carter et al., 2018). Intervention strategies without the addition of a height-adjustable workstation however still observed beneficial reductions in workday sitting time, which may offer a more favourable, low-cost strategy for employers seeking to implement cost-effective strategies to support their employees to reduce their total, but not prolonged sitting time at work (Mackenzie, Goyder and Eves, 2015).

The magnitude of sitting reduction across the whole day appears similar to the worktime sitting reduction for both groups, which is consistent with findings in previous trials and suggests that these behavioural changes are likely a result of changes to worktime sitting rather than ambulation (Healy et al., 2016a; Edwardson et al., 2018). Between group comparisons in the present trial however, observed a reduction in steps taken across the whole day in SLAMM arm compared to SLAMM+. This may provide some evidence of a potential compensation effect and supports a whole day approach in future trials, to maintain or enhance reductions in sitting time both at work and non-work times, although more research is needed.

Replacing workday sitting time with standing may not be enough to elicit desired cardiometabolic adaptations in healthy individuals (Winkler et al., 2018), and strategies to increase PA, in addition to SB reduction, are encouraged (Dempsey et al., 2016b; Van der Berg et al., 2017). In the present trial, there were no significant changes to glucose or cholesterol between groups. Within group changes observed no change to cholesterol at 12 weeks but an increase in fasting glucose Previous workplace trials among office workers comparing intervention to usual practice controls also found sitting reduction to have little to no impact on biomarkers including glucose, cholesterol and triglycerides (Graves et al., 2015b; Healy et al., 2016b; Brakenridge et al., 2018; Edwardson et al., 2018). This this is contrary to acute experimental studies where greater glycaemic benefits following frequent breaks to sitting and light PA were observed among at risk populations, compared to healthy individuals (Dempsey et al., 2016b). Developing trials to support increased PA during working hours appear be necessary to achieve greater

cardiometabolic benefits, although multiple contextual factors in the contact centre setting appear to thwart call agents capabilities, opportunities and motivation to move more at work (Michie, Van Stralen and West, 2011).

Consistent with previous workplace trials among desk-based (Graves et al., 2015b) and contact centre workers (Chau et al., 2016c), the interventions did not negatively affect subjective productivity for both SLAMM and SLAMM+ participants. Compared to beneficial changes observed in a recent workplace trial (Edwardson et al., 2018), work outcomes were largely unchanged between and within groups, although longer trial duration is warranted to determine whether improvements to work outcomes occur. Future trials in this setting should seek to harness the wealth of objective business metrics within contact centres to support the evaluation of productivity in this setting. This could help enhance organisational buy-in and encourage organisations to implement strategies to encourage their agents to sit less and move more.

There is evidence that contact centre workers experience greater levels of psychological distress than other occupations such clerical, secretarial, technical support and professional jobs (Sprigg, Smith and Jackson, 2003). Within the literature there is some evidence to suggest that sitting less is a gateway to stress relief (Goode A. D., 2018), and sitting <6 h/workday can have beneficial effects on psychological distress (Teychenne, Costigan and Parker, 2015; White et al., 2017). The present trial observed a significant improvement in SLAMM+ participants' self-reported mental wellbeing scores at 12-weeks relative to SLAMM agents. This improvement may in part, be linked to the pattern of sitting accumulation at work where SLAMM+ agents reduced the amount of time spent in prolonged sitting (≥30 minutes) compared to SLAMM. There is little evidence to date demonstrating an association between patterns of sitting and standing postures on mood and mental health, although a recent experimental trial found that short frequent LPA breaks to sitting (2-minute break every 30 minutes) offset the decline in cerebral blood flow. While the break modality differed between studies, this may indicate a potential

mechanism for improving mental health (Carter et al., 2018). Implementing height-adjustable workstations to facilitate a reduction in prolonged sitting bouts may therefore have important implications for mental health in call agents. More experimental and observational trials are warranted to establish whether the type, frequency or intensity of break to prolonged sitting is important for attenuating reduced cerebral blood flow and establish whether this impacts mood and mental health.

Consistent with study 2 (Morris et al., 2019), call agents in the present trial reported increased confidence and felt more alert at work when using a height-adjustable workstation. This appears unique to the contact centre setting (Morris et al., 2019) and contrasts observations in other desk-based workers who typically revert back to seated postures to conduct challenging or complex tasks (Graves et al., 2015b). Agents accounts of reduced fatigue, reduced stress and improved mood are similar to those in study 2 (Morris et al., 2019) and experimental studies following 5-minute MVPA bouts (Bergouignan et al., 2016), however more research is warranted to explore the association between the pattern of sitting accumulation and mental health in this setting.

Sitting reduction strategies appear to be a more acceptable and feasible strategy across contact centre and desk-based occupations compared to PA strategies where changes in ambulation or PA are yet to be achieved (Abraham and Graham-Rowe, 2009; Malik, Blake and Suggs, 2014; Healy et al., 2016b; Edwardson et al., 2018). Previous research has cited cultural factors surrounding perceived acceptable working behaviours and lack of opportunities to accrue daily incidental activity as barriers to PA at work (Hadgraft et al., 2018; Morris et al., 2018). Increased management support was also identified as a key factor influencing participant motivation and engagement in 15-minute structured PA breaks during working hours (Taylor et al., 2013). While contact centre managers perceived PA strategies favourably for promoting health, wellbeing and productivity, the nature of contact centre work limits opportunities for structured or incidental PA (Renton, Lightfoot and Maar, 2011) and more research is need to develop acceptable and feasible

PA promotion intervention components in both contact centre and workplace settings (Malik, Blake and Suggs, 2014). From an organisational perspective, it appears important to develop an evidenced-based business case before companies will consider adapting organisational policies to accommodate strategies such as increased task variation, longer or more frequent breaks (WHO 2018).

6.4.1. Strengths and limitations

A key strength of this study was the RCT design and mixed-methods approach to evaluate process and outcome measures. In accordance with MRC framework, acceptability and feasibility was explored across multiple stakeholder perspectives to inform the development of future trials in this setting (Moore et al., 2015). This unique, phased approach to intervention development within this setting (Studies 1 and 2) adds to the current limited body of evidence focused on reducing sitting time (Chau et al., 2016c; Pickens et al., 2016). Behavioural outcomes were objectively measured and the sample was more representative of the contact centre population who are exposed to greater SB than other occupations and have higher risk factors for cardiometabolic health (Thorp et al., 2012). The intervention was underpinned by the SEM (Sallis, Owen and Fisher, 2008) and the COM-B model of behaviour change (Michie, Van Stralen and West, 2011), with the detailed reporting of the trial methods enhancing the trials replicability and transparency. Participants identified components of the intervention which they perceived were most effective for promoting them to sit less and move more at work, however more research is warranted to determine which components mediate the changes observed in this intervention.

Strategies were adopted to minimise selection and detection bias throughout the trial (Eldridge et al., 2016a). Due to the nature of the intervention it was impossible to blind the participants to the intervention they received, however it was determined that there was a low risk of contamination between the groups as the only difference was the

environmental component which could not be transferred between SLAMM and SLAMM+ agents. Analysis was conducted on a complete case basis, which may highlight a potential attrition bias (Higgins and Green, 2008). Due to the aims of the pilot phase trial, the study was not powered for the worktime behavioural outcomes but provided recruitment and retention data to inform the development of a fully powered trial which should conduct intention-to-treat analysis to account for any attrition bias (Higgins et al., 2011). The trial was conducted in a single contact centre which may limit the external validity of the findings, however acceptability and feasibility results are comparable to a previous contact centre trial in a different organisation (Morris et al., 2019), which indicate that findings may be generalisable to the contact centre context.

6.5. Conclusion

This pilot intervention has identified that the process of recruitment, randomisation and data collection adopted in this trial were acceptable. Retention rates were largely due to company leavers and therefore company attrition should be factored into power calculations for scaling up the intervention for a larger trial. Overall, implementing a multicomponent intervention with and without a height-adjustable workstation was an acceptable and feasible strategy for promoting a reduction in total occupational sitting time without negatively impacting work-related outcomes. The addition of an environmental component facilitated a reduction in prolonged sitting bouts, which was observed alongside improved mental health of call agents, although more strategies to promote increased PA for both arms are warranted. Aligned to the MRC framework, future research should seek to refine the intervention based on the findings from study 2 and 3 (chapters 5 and 6) and evaluate the short and longer-term effectiveness of a full scale multi-component intervention with and without a height-adjustable workstation on behavioural, cardiometabolic, psychosocial and objectively measured work outcomes.

Study Map

Study aims	Objectives	Outcomes
Study 1: To explore the factors influencing call agent's workplace PA and SB and identify strategies that may help agents to move more and sit less at work.	• To use a qualitative methodology to explore the perspective of call agents, their team leaders, and senior staff across multiple contact centre settings.	• Key factors influencing call agents workplace PA and SB were continuous performance monitoring, job security concerns, incivility on calls and a desire for increased autonomy over working practices. Team leaders and senior team leaders members identified a conflict between promoting productivity and targets to call agents, while encouraging them to move more and sit less. • Strategies identified that may help call agents move more and sit less at work included acknowledgement of PA and SB within policy and job roles, height-adjustable workstations, education and training sessions and greater interpersonal support.
Study 2: To explore the acceptability and feasibility of delivering and evaluating a multi-component SB and PA workplace intervention in the contact centre setting.	• To conduct a process evaluation to assess response, recruitment and attrition rates, and completion rates for all outcome measures. • To explore the acceptability and feasibility of the intervention from participant and organisational perspectives.	• Six (of 20) team leaders were recruited, with 17 of 84 call agents (78% female, 39.3 ± 11.9 years) completing baseline assessments and 13 completing follow-up. • High workload influenced recruitment. Call agents perceived assessments as acceptable, though strategies are needed to enhance fidelity. Education sessions, height adjustable workstations and emails were perceived as the most effective components; however, height-adjustable hot-desks were not perceived as feasible in this setting.
Study 3: To conduct a pilot RCT of a multi-component intervention with and without height-adjustable workstations in contact centres.	• To assess the response, recruitment and attrition rates, and completion rates for outcome measures. • To assess the acceptability of randomisation to an intervention with and without a height-adjustable workstation from participant perspectives. • To assess the acceptability of an intervention with and without a height-adjustable workstation from participant and organisational perspectives. • To monitor any adverse effects, such as injuries and disruption to working practices. • To derive estimates of the preliminary effect of the interventions on sitting time at work, and other behavioural, health and work outcomes.	• 59 of 213 agents were recruited (30.9 ± 11.6 years, 68% female) with 39 completing baseline and 12 week follow up. • The process of randomisation was acceptable and there were no reports of adverse effects throughout the trial. • With the exception of the height-adjustable workstations, participants in SLAMM and SLAMM+ ranked the intervention components in a homogeneous manner with individual feedback, information and education sessions and weekly emails ranked the most important, and team leader support, Stand Up Champions and daily logs ranked the least important components for encouraging agents to sit less and move more. • Both SLAMM and SLAMM+ reduced their workday sitting, although the addition of the height-adjustable workstation appeared to support reduction in prolonged sitting bouts. There were no changes in stepping time, cardiometabolic, musculoskeletal, or work outcomes between groups, however mental

Chapter 7.

Synthesis of findings

7.1. Aims and objectives

In line with the MRC framework this thesis aimed to investigate the factors influencing SB and PA in contact centres, explore the acceptability and feasibility of implementing a multi-component sit less and move more intervention within a contact centre setting, and evaluate the preliminary effectiveness of a pilot RCT to reduce sitting and increase PA within a contact centre setting. This chapter summarises the findings of the three empirical studies presented in this thesis, before drawing upon the collective findings to critically discuss a) the development and evaluation of SB and PA interventions in the contact centre setting, b) the effectiveness of SB and PA interventions in the contact centre setting, and, c) implications for future research, policy and practice.

7.2. Major findings

In study 1, call agents, team leaders and senior team leaders across multiple contact centres identified that the key factors influencing call agents PA and SB at work were high workload, continuous monitoring of productivity metrics and personal time, and low autonomy over working practices. Strategies perceived to help agents move more and sit less at work were acknowledging PA and SB within organisational policy and call agent job roles, implementing height-adjustable workstations and education and training sessions, and, enhancing interpersonal support among team leaders and co-workers. These findings were used to inform a multi-component SB and PA intervention evaluated in study 2

In study 2, mixed-methods were used to evaluate the feasibility of an 8-week non-randomised pre-post SB and PA intervention in one contact centre. Whilst the recruitment strategy was perceived as acceptable, high workload limited team leader and subsequently agent recruitment. Strategies were identified to enhance fidelity to data collection, and while the intervention was perceived as acceptable, a number of factors influenced the feasibility of delivering the intervention components, including a hot desk system for height-adjustable workstation use, inconsistent team leader support, and low

engagement with the movement champion. These findings were used to refine the SB and PA intervention phases and components, which was further evaluated in study 3 (Table 7.1).

In study 3, mixed-methods were used to evaluate a pilot RCT of the refined multi-component SB and PA intervention, with (SLAMM+) and without (SLAMM) height-adjustable workstations, in one contact centre. Both interventions reduced total and prolonged sitting time at work, and a significant difference in mental health was found in SLAMM+ relative to SLAMM at 12 weeks. Except height-adjustable workstations, call agents in both arms ranked the individual feedback, education sessions, and weekly emails as the most important intervention components. While stakeholders perceived the key study phases as acceptable, fluctuating call volumes impacted offline time for agents to engage in data collection and education and training sessions.

Table 7.1. The process of developing and refining the key intervention phases across the three empirical studies.

Intervention Phase	Study 2	Study 3
Organisational recruitment	Following engagement in study 1, organisational gatekeepers from company 3 expressed an interest in delivering an intervention to promote their call agents to sit less and move more.	In line with a previous workplace trial (Dunstan et al., 2013a) and in an attempt to enhance organisational buy-in, 16 large (>100 seat) contact centres affiliated with the Call North West forum received a recruitment tender. Organisations had 3 weeks to express an interest and provide a written statement detailing their suitability for the study in line with the predetermined essential and desirable criteria.
Team leader recruitment	To enhance the interpersonal component of the intervention, during, all team leaders were invited to attend one of two recruitment drop in sessions which provided brief information about the project rationale and	Team leader recruitment was identified as a limiting factor during call agent recruitment in study 2 and was therefore removed in study 3 in an attempt to optimise call agent recruitment.

	timeline. Process evaluation revealed that low team leader recruitment was largely influenced by high workload which subsequently limited the potential reach during call agent recruitment.	
Agent recruitment	Call agents within the teams of interested and eligible team leaders (*n*=87) were invited to attend one of two researcher led drop in sessions during working hours. Interested call agents were screened for eligibility face to face or via telephone and were excluded if they had a pre-existing cardiometabolic condition.	All agents within the designated contract (*n*=213) attended a 15-minute researcher led intervention brief which provided an overview of the project rationale, timeline and intervention components. Participants had 2 weeks to express an interest and were screened for eligibility either face-to-face or via telephone. Call agent inclusion criteria was refined to include participants with any prexisting cardiometabolic onto the intervention.
Workplace champion recruitment	A single movement champion was appointed from a member of staff within the participating contact centre not currently employed as a call agent. Call agents suggested a strategy to enhance the effectiveness of the workplace champion component would be to recruit multiple champions. Strategies included localised champions within teams to support the implementation of the intervention and to act as role models for the sit less and move more intervention message.	During agent recruitment, all interested call agents were given the opportunity become a Stand Up Champion throughout the trial. Stand Up champions were encouraged during the three education and training sessions to advocate the intervention aims through their own working practice and encourage other agents to sit less and move more.
Randomisation	Study 2 was an 8-week non-randomised trial to explore the feasibility of delivering a	Study 3 was a 12-week pilot RCT trial, randomised at the individual level and stratified by

	multicomponent intervention within the contact centre setting.	BP variability. Both intervention arms received a multi-component intervention to sit less and move more either with (SLAMM+) or without (SLAMM)) the provision of a height adjustable workstation.
Data collection	Participants were scheduled a 1 hour slot to attend their health check during working hours. A member of the onsite planning team scheduled all data collection sessions and participants were sent an emailed calendar invitation and a minimum of one reminder by the centre contact. Assessments included objective activity monitoring, anthropometric and cardiometabolic outcomes (including a 15ml intravenous blood sample) and survey completion.	In addition to study 2, and in an attempt to enhance compliance to the fasting requirements, all participants were sent a text message reminder detailing the fasting and clothing requirements for data collection 24hours prior to their scheduled data collection session. All other data collection measures were the same, except that participants were asked to provide a finger prick blood sample instead of an intravenous sample and. the addition of surveys related to sleep quality, occupational fatigue, need for recovery and the self-reported habit index.
Intervention delivery		
Height adjustable workstations		
Study 1: Participants identified height-adjustable workstations as a potential strategy to facilitate a reduction in total and prolonged sitting time, while addressing team leader and senior team leaders concerns regarding productivity. **Research:** Height adjustable workstations have consistently been an effective environmental strategy to influence workers total and prolonged sitting time (Shrestha et al., 2018b).	Individual (n=10) and height adjustable hot desks (n=4) were installed for the duration of the 8 week intervention. Individual height adjustable workstations were perceived as acceptable and feasible, while hot-desks were not perceived as feasible in this contact centre setting.	Participants randomised to SLAMM+ intervention arm (n=29) were granted organisational approval to be allocated to an individual workstation for the duration of the intervention. SLAMM+ participants had an individual height-adjustable workstation installed.
Education and training sessions		
Study 1: Knowledge and	Two 30-minute education	In addition to the education and

awareness of national PA guidelines and recommendations for desk-based workers was identified as low to non-existent across all stakeholder groups. **Research:** Education and training is identified as a behaviour change function for influencing core components of the COM-B model (Michie, Van Stralen and West, 2011).	and training sessions introduced (week 1) and reinforced (week 5) the benefits of moving more and sitting less each day at work and the risks of prolonged sitting and standing. Using the intervention components as a point of departure, agents engaged in guided discussions to identify how they could utilise each intervention component to facilitate their behaviour change. Agents were given the opportunity to discuss their intervention experiences, including barriers to sitting less and moving more.	training sessions delivered in study 2, individual and group level feedback was integrated into the sessions in study 3 to enhance participants knowledge and awareness of their own health status and behaviour. Due to a longer duration of intervention, sessions were delivered during week one, three and nine to harness participants motivation to initiate and maintain behaviour change over the 12 weeks. Due to pragmatic considerations, sessions were also delivered to mixed groups consisting of SLAMM and SLAMM+ participants.
Individual feedback		
Research: Providing feedback on behaviour is recognised as a behaviour change technique (Michie et al., 2013) and has been used as an intervention strategy for promoting a significant reduction in sitting time in medium-term workplace settings (Shrestha et al., 2018b).	Participants were provided their individual cardiometabolic and anthropometric feedback following their baseline and 8 week assessment however it was not delivered as a formal intervention component. Data collected during the process evaluation focus groups highlighted feedback as an important function for raising awareness of health status and an effective strategy to encourage agents to sit less and move more.	Individual and group level feedback from participants baseline cardiometabolic and anthropometric outcomes were provided during week 3 education and training session. Individual and group level behavioural feedback including an individual heat map was provided in education session week 9.
Weekly emails		
Study 1: Knowledge and awareness of national PA guidelines and recommendations for desk-based workers was identified as low to non-existent across all stakeholder groups. Participants also identified	Weekly emails were perceived as an acceptable and feasible intervention component by agents and team leaders in study 2. Weekly emails acted as a prompt for agents to break	The method of delivery of the weekly emails was adapted from study 2 to study 3 by circulating the weekly emails via the centre contact alone to both agents and team leaders. This component was refined to increase fidelity and

sitting as an ingrained, habitual behaviour within the workplace setting. **Research:** Previous workplace interventions in traditional office (Edwardson et al., 2018) and contact centre settings (Chau et al., 2016a) have implemented informative intervention emails as part of multi-component interventions to reduce total and prolonged sitting time.	up their sitting time and trial various desk based PA and were a catalyst for intervention related conversations between team leaders and agents throughout the trial. The method of delivery in study 2 relied on team leader engagement to circulate the emails to their teams with only 58% of the weekly emails being sent during the trial.	consistency for participating call agents in the trial. . To minimise team leader burden and increase fidelity, team leaders were sent the weekly emails via the centre contact who was responsible for disseminating the emails among all participating call agents.
Team leader support		
Study 1: Team leaders were identified as pivotal role models for influencing PA and SB of call agents within the contact centres. **Research:** A recent trial identified that implementing management support strategies significantly reduced total and prolonged sitting time among office workers at 12 months (Brakenridge et al., 2016a).	Participating team leaders were invited to attend a single 30 minute education and training session between baseline data collection and intervention initiation to provide a rationale for, and an overview of the timeline of the intervention. Team leaders were responsible for circulating the weekly intervention emails to their participants during the intervention. Team leaders were also encouraged initiate walking, standing or active meetings, discuss agent experiences of the intervention and provide verbal support and encouragement to their agents to sit less and move more.	All team leaders (n=20) were invited to attend a single education and training session prior to call agent recruitment. The session outlined the rationale and timescales for the project and detailed and discussed strategies to encourage team leader engagement in promoting the sit less and move more intervention message throughout the trial. To minimise the burden on team leaders, weekly emails were circulated by the centre contact to all participating call agents and all team leaders within the allocated contract within the centre.
Workplace champions		
Study 1: Workplace champions were discussed as an interpersonal and potentially cost-effective strategy for promoting a reduction in total and prolonged sitting and increased opportunities for	In addition to the team leader component, the movement champion was encouraged to provide daily support to call agents to sit less and move more, and prompt team leaders to implement the above	All participating call agents were given the opportunity to become a Stand Up champion by advocating sit less and move more intervention aims into their working practice. The name of the champion was adapted in study 3 to prompt participants to

PA at work. **Research:** Workplace champions have been implemented as stand-alone (Goode A. D., 2018) or part of a multi-component intervention (Mackenzie, Goyder and Eves, 2015). Champions are recognised as a strategy to enhance interpersonal support.	actions. The movement champion was perceived as an acceptable and feasible strategy however call agents reported limited engagement with the movement champion throughout the trial, with prompts focussing on sitting less more over moving more.	break up their sitting time during working hours.
Daily goals		
Study 1: Call agents identified sitting as an ingrained, habitual behaviour in their work routine across all contact centres. **Research:** Behavioural regulation and goal setting are recognised behaviour change techniques (Michie et al., 2013). Behaviour change interventions to date have typically focused on addressing reflective motivation while the COM-B model acknowledges the influence of unconscious, habitual behaviour, particularly in stable settings such as the workplace (Ouellette and Wood, 1998) for influencing PA and SB.	In week 1 agents wrote a short-term goal to help them sit less and move more at work. This goal was discussed and reflected on in the week 5 session.	Predetermined daily goals and self-monitoring tools were provided to participants to enhance agents automatic motivation to sit less and move more at work (Michie, Van Stralen and West, 2011). This tool was guided by current workplace guidelines (Buckley et al., 2015) where frequent sit-stand transitions, and gradual increases in standing and walking time were encouraged. To support adherence to the daily goals and self-monitoring, each participant received a daily log diary and a stopwatch. Thereafter, participants were encouraged to use the stopwatch to self- monitor their standing work time (week 1-12) and walking time (week 4-12).

7.3. The development and evaluation of SB and PA interventions in the contact centre setting

The MRC provided the overarching framework for the thesis and guided the development, feasibility and pilot phases presented in studies 1-3 (chapters 4-6). As advocated by the MRC framework (Craig et al., 2008) and guidelines for implementing workplace PA interventions (NICE, 2014), studies 1-3 were theoretically grounded by the SEM (Sallis,

Owen and Fisher, 2008) and the subsequent intervention phases were underpinned by the COM-B model (Michie, Van Stralen and West, 2011). Developing a complex intervention grounded in theory was considered best practice for establishing an in depth understanding of PA and SB with a view to optimise PA and SB behaviour change within the contact centre setting (Craig et al., 2008).

In the absence of robust PA and SB interventions in the contact centre setting, study 1 drew on existing evidence and theory (Craig et al., 2008; Moore et al., 2015) to conduct a cross-sectional exploration of the factors that are likely to influence change (Craig et al., 2008; Moore et al., 2015). An important consideration during this developmental phase was to establish an understanding of the influential factors of PA and SB in contact centres (Michie et al., 2008), identify key stakeholder's expectations and establish key research and stakeholder objectives (NICE, 2014). This process helped to enhance the real world application of the research, improve stakeholder buy-in and tailor the subsequent interventions (studies 2 and 3) to the context and specific needs of the call agents within the contact centre setting (Craig et al., 2008; Michie et al., 2008; Thorpe et al., 2009).

Aligned to phase two of the MRC framework, the acceptability and feasibility of delivering a real world PA and SB intervention were tested using a non-randomised pre-post approach (study 2) and further piloted using a small scale RCT design to derive preliminary effectiveness (study 3). Accordingly, a vital component across the feasibility and pilot studies was conducting a process evaluation to investigate trial fidelity, implementation, and identify contextual factors and causal mechanisms rather than focus on the effects observed and treatment comparisons (Hardeman et al., 2005; Craig et al., 2008; Thabane et al., 2010; Billingham, Whitehead and Julious, 2013). Across the interventions presented in this thesis, the feasibility and pilot studies were regarded as an important prerequisite to inform the development of a full scale RCT (Whitehead, Sully and Campbell, 2014; Eldridge et al., 2016a).

A strength of using the MRC framework to develop the complex interventions evaluated was the inclusion of ongoing process evaluation to determine fidelity and quality of implementation (Moore et al., 2015). In study 2, the research team experienced the delivery and evaluation of the intervention and explored key uncertainties in the intervention design, which highlighted teething problems for the recruitment process and eligibility criteria, implementation of height-adjustable hot desks, a single workplace champion, and team leader support strategies. The feasibility study therefore provided rich, contextual data which helped to refine the key intervention phases delivered in the small-scale pilot RCT (study 3) (Thabane et al., 2010). However, long-term evaluation of intervention studies, particularly those aimed at behaviour change, are also encouraged to establish whether the short term impacts are sustainable over a minimum of 3, 6, 9 and 12 months (Craig et al., 2008; Cavill, Roberts and Rutter, 2012).

Study 3 was underpowered for detecting changes in sitting, standing and stepping time at work, and whilst conducting an outcome evaluation was not the primary aim of the pilot trial, findings indicate both SLAMM and SLAMM+ intervention arms reduced worktime sitting at 12 weeks. Differences between groups were not significant, although they appear consistent with previous findings in short term (3 month) multicomponent trials among office workers (Chu et al., 2016) and contribute robust, objective and contextual findings to the currently limited body of research within contact centre setting (Chau et al., 2016c; Pickens et al., 2016). Importantly, due to the small number of agents providing compete data at baseline and 12 weeks, results should be interpreted with caution (Levati et al., 2016). Nevertheless, deriving preliminary estimates of the effectiveness using outcome evaluation (study 3) helps to inform whether it is appropriate to scale up to a full scale trial (Eldridge et al., 2016a). To date however, the MRC framework provides limited guidance to determine when it is appropriate for a pilot trial to progress onto the next phase of intervention development. Including a cost effectiveness evaluation alongside process evaluation and preliminary outcomes is advocated as a useful stage, however an

economic evaluation was beyond the scope of the thesis and should therefore be considered in future trials.

7.3. Effectiveness of SB and PA interventions in the contact centre

Study 1 (chapter 4) engaged multiple stakeholders including senior team leaders, team leaders and call agents to explore the factors influencing PA and SB. This process helped to enhance the real world application of the research and identified strategies to tailor the subsequent interventions to the context and specific needs of the target population (Craig et al., 2008; Michie et al., 2008; Thorpe et al., 2009; NICE, 2014). To date, studies investigating factors influencing workplace PA and SB have commonly identified intrapersonal and interpersonal level factors of influence (O'Donoghue et al., 2016; Smith et al., 2016). Engaging both call agents and the wider organisational stakeholders during this developmental phase offered novel insights into the organisational and environmental influences on call agents PA and SB at work. This exploration formed the basis for identifying tailored behaviour change techniques (Michie, Van Stralen and West, 2011) to deliver pragmatic intervention strategies in studies 2 and 3. Building from study 1, a strength of this thesis was the use of quantitative and qualitative methods in studies 2 and 3, which provided further understanding of the challenging contact centre setting, and the factors within it that influence call agents SB and PA at work (Figure 7.1). The research highlighted influential factors unique to the contact centre setting, compared to traditional office settings, and will be of importance for informing future SB and PA interventions in this setting.

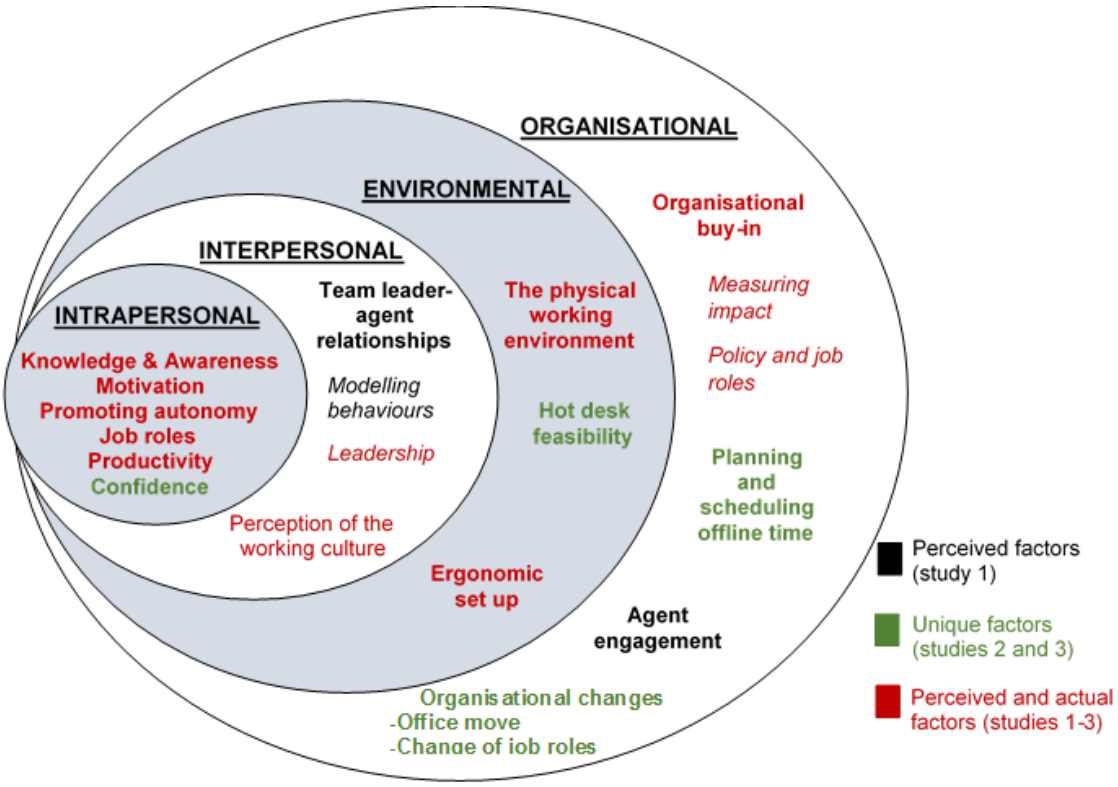

Figure 7.1. A thematic overview of the perceived factors influencing call agents workplace PA and SB from study 1 and actual factors influencing PA and SB identified following process evaluation of studies 2 and 3. Themes are presented across four levels of the SEM. Higher order themes are presented and linked to their associated sub-themes (*italics*)

Exploring perceived effectiveness of the interventions in studies 2 and 3 was considered an acceptability index, based on previous positive associations observed between perceived effectiveness and actual effectiveness (Dillard and Ha, 2016). Multiple perceived benefits were identified in studies 2 and 3, including reduced fatigue, increased awareness and improved productivity, which appear consistent with experimental and workplace trials (Thorp et al., 2014a; Bergouignan et al., 2016; Edwardson et al., 2018). Unique factors in study 2 identified that reduced sitting had a positive impact on agent's perceived confidence and assertiveness (Morris et al., 2019), and improved feelings of stress at work (study 3, chapter 6). Given that contact centre workers experience higher levels of psychological distress than other occupations (Sprigg, Smith and Jackson, 2003), the study 2 findings support notions that sitting less is a potential gateway for reducing stress (Teychenne, Costigan and Parker, 2015; Goode A. D., 2018). Study 3

built upon this, and provided evidence to suggest that frequent breaks to sitting time may be more beneficial for mental health than a reduction in sitting alone, though more research is needed to assess whether this apparent improvement in mental health is attributed to break frequency.

It was hypothesised in studies 2 and 3 that the environmental component would exert the strongest influence over changing agent PA and SB. While greater changes in sitting and standing were observed with the addition of height-adjustable workstations, a reduction in sitting time also occurred during SLAMM through a combination of non-environmental strategies. It is possible that significant differences in behavioural outcomes may have been observed if the SLAMM+ arm had been compared to a non-intervention control, rather than a multicomponent intervention without a workstation (Johnston et al., 2019). Indeed, both groups received education and training sessions, weekly emails and individual feedback, which were ranked as important intervention components and suggests that these may be important for changing call agents sitting time at work. Nonetheless, to the author's knowledge this was the first intervention to explore the preliminary effectiveness of a multi-component intervention with and without the addition of a height adjustable workstation in any workplace setting. The findings offer evidence of the short-term effectiveness of delivering alternative low-cost interventions to reduce sitting time at work, which may be favourable for organisations seeking to deliver cost effective strategies to improve employee health and wellbeing.

In line with the SEM (Sallis, Owen and Fisher, 2008) and COM-B system (Michie, Van Stralen and West, 2011), it is possible that there were multiple factors that influenced the workday sitting, standing and stepping outcomes, as changes were smaller than those observed in other desk-based trials (Danquah et al., 2017; Edwardson et al., 2018). For example, low participant numbers in SLAMM+ meant that SLAMM+ agents were often situated in teams of mainly desk-based workers (Morris et al., 2019). Social pressures to conform to seated work appear to negatively influence agent's and traditional office workers motivation to use height-adjustable workstations in the standing position (Chau

et al., 2016b; Such and Mutrie, 2017; Hadgraft et al., 2018; Morris et al., 2019). The working culture therefore appears to exert an important influence on agents SB. Attempts to refine the implementation of interpersonal support strategies in study 3 included engaging team leaders in education and training, and recruiting localised Stand Up Champions. Similar to findings in a workplace trial implementing low-cost intervention strategies (Mackenzie, Goyder and Eves, 2015), workplace champions and team leader support were not perceived as effective techniques for changing behaviour, though such strategies may take longer to embed into working practice and influence SB (Brakenridge et al., 2016a). Longer term evaluation is needed to determine whether these behavioural and educational intervention strategies are effective in supporting changes in SB and PA at work.

Across the two trials, two strategies were implemented including installation of height-adjustable hot-desks (study 2) and individual height-adjustable workstations (studies 2 and 3). Consistent with a short-term cross sectional study among Australian office workers, access to a hot-desk did not appear to be an acceptable strategy for encouraging SB reduction in an organisation where individuals were allocated to an individual workstation (Gilson et al., 2012). Conversely, in study 3, allocation of an individual workstation was an acceptable strategy among call agents, although in an established hot-desking environment, this appeared to have a negative impact on co-worker relationships. While this did not contribute to any participant withdrawals from the intervention, this may have negatively impacted the effect of the intervention on sitting behaviours. This emphasises the importance of fostering a supportive working culture and further strengthens the need to tailor intervention strategies to the specific context and working policies rather than adopting a one size fits all approach.

7.4. Implications for future research, policy and practice

7.4.1 Implications for future research

This thesis has contributed to the limited body of research for developing and implementing PA and SB interventions in the contact centre setting. While study 3 (chapter 6) observed positive changes in total workday sitting for multi-component interventions with and without a height-adjustable workstation, these changes were not significant. Moreover, there were no changes to cardiometabolic health outcomes, which is an important marker for reducing the risk of chronic disease development such as cardiovascular disease and type II diabetes. In the interest of public health, it is therefore important to consider additional factors that may optimise the impact of future interventions. Further research is needed to investigate the following questions;

1. Should future workplace interventions target PA or SB, or both?

A wealth of evidence indicates that multi-component interventions encompassing both behaviour change and environmental strategies are effective for reducing total and prolonged sitting during working hours (Chu et al., 2016). To date, observed changes in occupational sitting indicate that sitting is displaced by standing (Healy et al., 2016a; Edwardson et al., 2018) and findings from the 12-week pilot trial (chapter 6) and systematic reviews consistently highlight the lack effectiveness of interventions to increase worktime PA (Abraham and Graham-Rowe, 2009; Malik, Blake and Suggs, 2014). MVPA is consistently associated with the greatest benefits to cardiometabolic and psycho-social health (McKinney et al., 2016; Bull, 2018). Promoting MVPA however does not appear to be a feasible approach in the workplace, particularly in contact centre settings where time constraints and productivity requirements negate opportunities to accrue incidental activity at work (Renton, Lightfoot and Maar, 2011; Morris et al., 2018). Despite these contextual challenges, more research is needed to identify effective

strategies to enhance PA at work through a combination of structured and unstructured approaches (Buckley et al., 2015). While weaker associations are apparent, reallocating sitting to LPA has shown important metabolic benefits to postprandial glucose and insulin (Chastin et al., 2018), which appear to be clinically significant, particularly in populations at high risk of glycaemic impairments (Yates et al., 2015). This may have important implications in the contact centre setting where call agents are at risk of high exposure to daily sitting and are at an increased cardiometabolic risk (Boyce et al., 2007; Thorp et al., 2012). Crucially, organisations are encouraged to implement strategies to support PA and incidental activity in job role (WHO 2018).

2. What is the best design for future workplace intervention research?

The type of study design and method of evaluation is important for enhancing scientific rigor and credibility and determining the effects of an intervention on workday sitting time and PA (NICE, 2014). Within academic research, RCT's are widely considered the gold standard for evaluating the effectiveness of complex interventions (Campbell et al., 2000; Concato, Shah and Horwitz, 2000; Thorpe et al., 2009) and provide the best evidence for informing policy and guidelines (NICE, 2014). This thesis provides novel insights into the development and evaluation of a pragmatic RCT under normal real world conditions (Thorpe et al., 2009). Aligned to positivist principles, developing an RCT in this manner (studies 1-3) therefore provides better quality evidence in the hierarchy of research design compared to cross-sectional or observational approaches alone (Concato, Shah and Horwitz, 2000). While steps were taken to minimise the risk of bias and enhance scientific rigor and credibility it is possible that there was some contamination between SLAMM and SLAMM+ as call agents operated within a hot-desking environment. Further research may seek to minimise this risk and recruit multiple worksites to conduct a cluster randomised approach.

There is debate whether individually randomised trials limit the reach and real world application, by simplifying single health behaviours and controlling or factoring out the complex system of influence on health behaviour (Rutter et al., 2017). Working together with organisational stakeholders may identify the need for alternative non-randomised interventions, which may weaken the scientific rigor of the intervention design and subsequent evaluation, though arguably this approach has the potential to generate more impactful and ecologically valid evaluation (Craig et al., 2008).

3. Should future workplace research focus on other risk behaviours (smoking, alcohol, diet) as well as or instead of PA and SB?

Alongside the recommendations for office workers to sit less and move more, desk-based workers are encouraged to incorporate additional health promotion goals such as improved nutrition and smoking cessation to reduce the risk of cardiometabolic diseases and premature mortality (Buckley et al., 2015). The present body of work only targeted PA and SB during working hours, while health behaviours such as dietary intake and smoking, both independent risk factors for poor cardiovascular and metabolic health (Forouzanfar et al., 2016), were beyond the scope of this thesis. In addition to physical inactivity and SB, modifiable lifestyle behaviours such as diet, and smoking contribute to a more complex system of influence on the wider public health (Rutter et al., 2017). Within the literature, there is a call to shift the focus from ‘simple’ linear models of cause and effect, to consider the impact of complex systems which address multiple interdependent drivers for behaviour at a population level (Rutter et al., 2017). For example, correlates of PA identify that smokers are more physically active at work than non-smokers (Bauman et al., 2012). While these findings do not infer causality, higher PA is likely a result of steps accrued during smoking breaks compared to non-smokers. Evaluation of a single system of PA may determine that higher steps accrued during working hours is positive for health outcomes, however it is established that the health risks associated with smoking far outweigh the benefits of increased steps accrued during smoking breaks. Future research may warrant a more holistic ‘lifestyle’ approach, for example by shifting focus towards a

24 h behaviours including PA, SB and sleep (Chaput et al., 2014). Importantly, the COM-B model supports both individual and population level intervention development and may provide a suitable behavioural framework to establish population interventions, although the method of evaluating population level trials may require a different approach than traditional RCT approaches to determine effectiveness (Rutter et al., 2017).

7.4.2 Implications for policy

The most recent Global Action plan '*More active people for a healthier world'* (WHO 2018) has set a clear target to reduce the physical and economic burden of physical inactivity by 2030. Identified strategies to support this ambitious yet pertinent goal include targeting settings such as the workplace, and includes guidance on reducing total and prolonged SB in addition to achieving the PA guidelines. This may be particularly challenging given the current PA and SB climate predicts that PA will continue to decline, with adults expected to be 30% less physically active and exceed 51 sedentary h/week by 2030 compared to 1961 (Ng and Popkin, 2012). To influence meaningful change and to address the pertinent health concerns associated with modifiable lifestyle factors (Forouzanfar et al., 2016), there is a pressing need to better translate evidence into feasible interventions and sustainable working practice (Buckley et al., 2018). To date, there is a lack of SB recognition within workplace policy and practice (Coenen et al., 2017a), with some evidence to suggest it takes 17 years to translate ~14% of scientific evidence into real-world practice (Westfall, Mold and Fagnan, 2007). This is not conducive to achieving the Global Active Plan 2030 targets and the following recommendations outline potential strategies that may support this goal in the workplace setting.

Providing incentives for organisations to implement PA and SB strategies

In the absence of a robust business case providing organisations with a the justification for return on investment, employers are encouraged to adapt working cultures and environments to promote increased opportunities for incidental PA and reduced SB

(*Global action plan on physical activity*, WHO 2018). Implementing a financial incentive for organisations to implement strategies to promote active and less sedentary working practices may include taxable rebates for investment in height adjustable workstations, which have been consistently identified as an effective strategy for reducing workers total and prolonged sitting time (Shrestha et al., 2018b) and has the potential to mutually benefit individuals and employers (Buckley et al., 2015).

Promoting a preventative approach to PA and SB

Current workplace legislation requires companies to adhere to health and safety regulations (Health and Safety at Work Act, 1974), such as mandatory display screen assessments (HSE, 2002). The business case for protecting employees from potential hazards that could cause injury or illness (WHO 2010) should acknowledge the risks associated with high SB and low PA in the workplace given the wealth of empirical research to date. This has both an ethical, and financial incentive for employers (Carroll and Shabana, 2010), such as reduced sickness absence, increased employee retention and increased loyalty among employees (NICE 2008).

7.4.3 Implications for practice

Engaging multi-stakeholders across senior management, team leader and call agent levels was invaluable for identifying pragmatic considerations and highlighting the challenges for implementing intervention strategies in this setting. As a result, a number of strategies were identified and helped to refine the intervention design in studies 2 and 3. In addition, stakeholder insights provided throughout this thesis have informed the following practical recommendations for implementing future PA and SB trials in this setting.

Developing a business case

Whilst employees expressed a duty of care to their employee's health and wellbeing, and understood the wider implications for business, there was a conflict between delivering PA and SB strategies while striving for optimum productivity and profitability. Researchers and organisations should therefore work together to establish an evidence-based business case to justify investment in health promotion strategies.

Education and training

Enhancing knowledge and awareness of the potential harmful effects of prolonged sitting and low PA in the workplace seems to be a driver for call agents, team leader and senior teal leaders' automatic and reflective motivation and buy-in. Contact centres are therefore recommended to embed educational information into working practices, such as staff inductions or annual training, on safe, comfortable and effective working postures and patterns.

Shifting culture

While sitting less appeared to be a more acceptable strategy within contact centres compared to PA strategies, contextual factors were still apparent and appeared to negate physically active and less sedentary working practices. Embedding strategies into working policies may enhance individual and team leader accountability, and acknowledgement during induction and training programmes may help to filter organisational PA and SB policies into working practice.

Summary

The overall aim of this thesis was to use the MRC framework to guide the development and evaluation of a multi-component intervention to help call agents to sit less and move more at work. Findings from studies 1-3 contributed to a greater understanding of the perceived and actual factors influencing PA and SB from multiple stakeholder perspectives. Overall, the thesis has indicated that following the MRC framework has

produced two interventions that appear acceptable in the contact centre setting, and, appear to have positive effects on sitting time, but not PA. Aligned to the MRC framework, future research should seek to refine the intervention based on the findings in this thesis, and evaluate the short and longer-term effectiveness of a full scale multi-component intervention with and without a height-adjustable workstation on behavioural, cardiometabolic, psychosocial and objectively measured work outcomes. If the findings are replicated in larger trials, it could have wider implications for policy and practice for the benefit of employees and employers.

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9. Appendix

Below is the list of appendices presented in the thesis in a chronological order;

1. Study 2: Process evaluation survey
2. Study 3: Company recruitment tender
3. Study 3: Example weekly email
4. Study 3: Example daily log diary
5. Study 3: Example individual health check feedback
6. Study 3: Example heat map activity feedback
7. Study 3: Confounding variables controlled for in analysis
8. Study 3: Process evaluation survey

Appendix 1. Study 2: Process evaluation survey

	1	2	3	4	5
Feasibility of data collection					
It was feasible for me to provide my body stature measurements (height, weight, waist circumference, hip circumference).	100%	-	-	-	-
It was feasible for me to have my blood pressure taken.	100%	-	-	-	-
It was feasible for me to complete the surveys.	100%	-	-	-	-
It was feasible for me to come into work in a fasted state.	73%	18%	9%	-	-
It was feasible for me to provide a 15ml blood sample.	91%	-	-	9%	-
It was feasible for me to wear an accelerometer for 7 days.	82%	9%	-	9%	-
I felt supported by my organisation to complete the assessment protocol within work hours.	91%	9%	-	-	-
Perceptions of the height-adjustable workstations					
The height adjustable workstation is easy to use.	90%	10%	-	-	-
I felt comfortable using the height adjustable workstation in the presence of others at my work.	90%	-	90%	-	-
My work-related productivity decreased while using the height adjustable workstation.	-	-	10%	90%	-
The quality of my work decreased while using the height adjustable workstation.	-	-	-	10%	90%
I was more tired on days I used the height adjustable workstation.	22%	11%	22%	44%	-
I had more musculoskeletal troubles on days I used the height adjustable workstation, for example back, muscle or joint pain, height adjustable workstation.	22%	11%	-	67%	-
I would welcome further advice and guidance for using the height adjustable workstations to optimise health gains.	51%	20%	20%	-	9%
Willingness to continue to receive each intervention component					
I would be willing to continue having access to the height adjustable workstation.	91%	-	-	9%	-
If I were offered a height adjustable workstation for my own desk, from my employer, I would take up the offer.	91%	9%	-	-	-

Appendix 2. Study 3: Company recruitment tender.

Promoting Health and Wellbeing in Contact Centres – The Move More, Sit Less Study

Liverpool John Moores University Tender

1. Background

1.1 Liverpool John Moores University

The Research Institute for Sport and Exercise Sciences (RISES) at Liverpool John Moores University (LJMU) are the number 1 institution for research quality in sport and exercise science in the UK, with 97% of our research classed as world leading or internationally excellent. We are dedicated to improving public health by delaying or preventing the effects of cardiovascular disease and diabetes, two complex diseases on the rise in our community. To achieve this, we work with our partners to develop innovative strategies, and test them in the real world to maximise the benefit for individuals and organisations.

1.2 The Study

Our research with contact centres has developed an innovative intervention that we plan to implement and evaluate in one organisation in the North West of England. The intervention aims to reduce and break up prolonged sitting time in call agents, and will be evaluated for effectiveness and cost-effectiveness. To achieve this the intervention targets change at the organisational, environmental, interpersonal and individual level.

2. Why your contact centre should get involved

who sit for a long time each day, especially in prolonged periods, have an increased risk of developing cardiovascular disease and diabetes, regardless of how much physical activity or exercise they do. This means that call agents, who sit for a large proportion of their working day in prolonged periods, are at high risk for ill health. Fortunately however, we know that breaking up prolonged periods of sitting and reducing total sitting time at work each day, can benefit both individuals (lower BMI and blood pressure, less musculoskeletal pain and fatigue, more alert and engaged) and organisations (less absence and presenteeism, improved productivity and performance). For these reasons, we have identified contact centres as a key setting in which to improve public health through our move more sit less intervention.

3. Scope

We wish to conduct a scientific trial of an intervention to reduce and break up workplace sitting in call agents recruited from one contact centre organisation, compared to control group of call agents from the same organisation. The study will take place over 9 months for all participants. Briefly, for the intervention group the study consists of three phases: baseline (pre-intervention), intensive intervention phase (3 months) where most interaction with study personnel occurs, and a maintenance intervention phase (6 months), which involves limited contact with study personnel. The control group will maintain their normal working practices. All participants will undergo study assessments at baseline, 3 months and 9 months. Measurement at baseline and 3 months will allow for assessment of initiation of behaviour change. Repeat assessment at 9 months will facilitate evaluation of maintenance of behaviour change, after the final intervention contact.

4. Study Objectives

- To build the evidence base on effective strategies for reducing workplace sitting across individual, organisational, environmental and interpersonal levels.

- To develop, implement and evaluate effective strategies for reducing workplace sitting with a focus on reducing and breaking up prolonged sitting in office workers.

5. Study Goals

The primary goal is to evaluate change in objectively-measured workplace sitting time and breaks in sitting time in call agents across the trial.

Our secondary goals are to:

- Evaluate change in workplace physical activity and non-workplace sitting time and physical activity, and cardio-metabolic markers of health and disease.
- Evaluate change in call agents' absenteeism, presenteeism, productivity, occupational fatigue, happiness, musculoskeletal troubles, quality of life and sleep.
- Evaluate the cost-effectiveness of the intervention from a business, societal and NHS perspective.

6. Expected Outcome

We aim to reduce call agents sitting time by 30-60 minutes each day and increase the number of breaks to sitting by 3-5 breaks per day. By identifying effective workplace strategies that reduce and break up sitting time in call agents, we will significantly contribute to the existing body of research for developing workplace interventions.

7. Contact Centre Roles and Responsibilities

The organisation and its branch(es)/worksite(s) will be recruited to be a partner in this study primarily through provision of access to its workplaces and employees as research participants. The study will take place over 9 months in which branches, worksites, office floors or office areas in the organisation will be randomly allocated to participate in the study as the "intervention" group or the "assessments only" (control) group.

Within this partnership, the organisation will be expected to:

Provide Senior Management approval and support for the study. This includes support for study planning, assessments and implementation of the intervention, as described below (and full protocol description).

Study planning

- Provide a room for conducting planning meetings with identified stakeholders.
- Identify an employee (likely from middle management) to be the point of contact (centre contact) for the research team across the study and:
    - Set up planning meetings with senior, mid-level and team managers to explain the study, the expected involvement and the randomisation process.
    - Assist with or arrange occupational Health and Safety personnel to participate in the planning meetings and support the study.
    - Schedule time during team briefings for the research team to advertise the study.
    - Liaise with the planning team to schedule offline requirements for the call agents for assessments and education and training sessions.
    - Email calendar invites to call agents for offline time (cc associated team leaders).
    - Schedule the training and education sessions with team leaders assigned to the intervention.
    - Assist with enquires in relation to the study implementation.

Assessments

- Provide a private room and access for research staff to undertake participant assessments.

Intervention implementation

- Provide a room for delivering education and training sessions to call agents and team leaders.

- Permit the installation of up to 45 height-adjustable workstations for individual participants. This will not require any additional infrastructure within the office, as each workstation is fitted to existing desks.

8. RISES Research Team Roles and Responsibilities

Within this partnership, RISES will:

- Implement the study within a 9-month pilot cluster-randomised controlled trial.
- Provide funds and training for the research team to undertake all activities associated with the study.
- Provide all equipment to conduct the assessments (including inclinometers) and implement the intervention (including height-adjustable workstations).
- Provide the education and training for team leaders, stand up champion(s) and participating call agents.
- Be responsible for all data collection, storage, analyses and interpretation and the disclosure of available data to participants and workplace as per protocol.

9. The Study Timeline and Work Plan

The key study stages are presented in figure 1. at the end of this tender document. The proposed timeline for the key study stages are:

- January 2018: Tender invitation and application window
- February 2018: Start 2-month planning phase with recruited organisation
- April 2018: Recruit and screen call agents
- May 2018- Conduct baseline assessments
- June-August 2018: Implement the 12-week intensive intervention phase
- September 2018: Conduct the second set of assessments at the end of the intensive intervention phase
- July-March: Implement the 6-month maintenance intervention phase
- March 2019: Conduct the final set of assessments at the end of the maintenance intervention phase

9.1 Recruitment

Organisations are asked to meet the following criteria to be considered eligible for the study.

Essential criteria

- ✓ The organisation can meet the proposed key dates for the research study.
- ✓ The organisation has one or more branches/worksites located within the North West of England.
- ✓ The organisation employs a minimum of 100 call agents, who each have access to a work telephone and desktop computer with internet, and, are aged ≥18 years.
- ✓ Organisations that have only one branch/worksite within the North West of England must house call agents across a) two or more buildings in the branch/worksite, and/or, b) two or more office floors in the branch/worksite, and/or, c) two or more clearly defined areas on the same office floor within the branch/worksite. Office floors are considered clearly defined if they are separated by partitions, full or partial walls, corridors or walkways. For queries please contact the research team.

Desirable criteria

- The organisation has one or more branches/worksites located within 50 miles of Liverpool city centre (postcode L3 3AF).
- The organisation has a high proportion of call agents employed as full time staff (22.5 h or more).
- Call agents have access to wireless headsets.

Call agents are asked to meet the following criteria to be considered eligible for the study.

a) Full time member of staff (22.5 h or more); b) Have access to a work telephone and desktop computer with internet; c) Aged ≥18 years; d) Able to walk; e) Not pregnant; f) Have no health problems that will impact their ability to stand for 10 minutes at a time; g) Have no planned absence for more than 3 weeks during the study; h) No planned relocation to another workplace/ site during the first 3 months of the intervention.

To recruit call agents, researcher-led information and question sessions (10-15 minutes) will be delivered during team briefs within working h (one session per team). Each session will explain the study and inclusion criteria. Agents will be informed that following baseline assessments, they may be randomly selected for the control group. All call agents will receive an email from the research team that includes a study overview and participant information sheet. Agents will have 2 weeks to express interest in taking part by completing an expression of interest form and giving the form to the centre contact. Interested agents will be screened for eligibility face-to-face or via telephone by a member of the research team. Eligible agents will be recruited until the target sample size of 45 is reached per arm. Eligible agents will be informed of their acceptance onto the study via email from the research team.

Stand up Champion Recruitment

The gatekeeper and/or centre contact and research team will co-develop the stand up champion roles and responsibilities which will likely involve being a role model for fellow call agents, and encouraging team leaders to implement, and call agents to engage with, the intervention. During call agent recruitment, agents will be told about the opportunity to be a stand up champion and that they can express interest in the role via the expression of interest sheet. There will be no limit to the number of stand up champions recruited, however this will be discussed with the gatekeeper during the planning phases to explore feasibility.

Team leader recruitment

Following baseline assessments and randomisation, all team leaders in the intervention arm will be invited to attend a semi-structured focus group at 3 and 9 months. Team leaders will be sent a participant information sheet and consent form via email from the research team, which outlines the aim of the focus groups. Team leaders will have an opportunity to express an interest throughout the trial period.

9.2 The Intervention

After baseline assessments, call agents in the intervention group will receive the following:

Environmental level: *Installation of height-adjustable workstations*

A sit-stand workstation (Posturite DeskRite 100 or Ergotron WorkFit-A) will be installed on their workstation. This allows participants to easily and quietly alternate their working posture between sitting and standing. Installation will occur outside of the agents' work h. Employees will each receive a workstation appropriate to their current computer set-up, and instruction on its use. Participants will receive written instructions on the correct ergonomic posture for sitting and standing, as recommended by the manufacturers.

Intrapersonal level: *Information and education sessions*

Participants will be invited to four education and training sessions (in intervention week 1, 3 and 7 and month 6 from baseline) at work during work hours. The sessions will introduce and reinforce the study aims and benefits of moving more and sitting less each day at work. Participants will develop ways to move more and sit less at work, share good practice/experiences, with the ideas embedded in subsequent weekly emails. The sessions will involve participants setting and reviewing/modifying a daily standing and walking goal in relation to their self-monitoring of behaviour and current guidelines outlined by Buckley et al. (2015).

Interpersonal level: *Team leader - training session*

Team leaders will be invited to a 1 h training session at work during work hours. The session will educate team leaders on their desired role to reinforce and encourage their agents to move more

and sit less each day, and why this is important. Team leaders will be trained with regards to valid consent so they understand from a research ethics perspective that they need to understand that they are responsible for the ensuring the principles of research ethics are abided by, and not just what might be considered good practice. This involves training team leaders to understand that individuals are free to participate without pressure, manipulation or coercion to move more and sit less. All call agents will be told to contact the research team directly via email or telephone if they experience any incivility (including pressure, manipulation or coercion to move more and sit less) during the trial from the team leaders. This session aims to enhance team leader buy-in and improve their knowledge and understanding of physical activity and sitting behaviours in the workplace.

Interpersonal level: *Emails*

Team leaders will email infographics to their team of call agents weekly during the intensive intervention period (weeks 1-12) and monthly during the maintenance intervention period (the 6 months after the intensive phase). The infographics will encourage agents to move more and sit less at work by frequently transitioning between postures and walking during breaks and lunchtimes. Infographic content will be informed by participant-ideas and previous literature. The infographics will be written by the research team and forwarded to the team leaders via the centre contact.

Interpersonal level: *Team leader - meeting agenda item*

Team leaders will be encouraged to include the intervention as an agenda item in weekly team meetings and their 1:1 sessions with call agents. Team leaders will be asked to reinforce the move more sit less intervention messages and encourage participants to discuss their engagement with, and experience of the intervention, including factors influencing them to move more and sit less. Team leaders will be trained on how they can respond to typical barriers to moving more and sitting less during the team leader training session while ensuring participants valid consent is maintained at all times.

Interpersonal level: Team leader - walking 1:1 meetings

Team leaders will be encouraged to incorporate walking into their 1:1 meetings with call agents while ensuring participants valid consent is maintained at all times.

Interpersonal level: *Stand up champion(s)*

The stand up champions will likely be asked to be a role model for fellow call agents, and encourage team leaders to implement, and call agents to engage with, the intervention. The stand up champion(s) and their role will be communicated and reinforced in each education and training session. Champions will be trained with regards to valid consent so they understand from a research ethics perspective that they need to understand that they are responsible for the ensuring the principles of research ethics are abided by, and not just what might be considered good practice. This involves training champions to understand that individuals are free to participate without pressure, manipulation or coercion to move more and sit less. All call agents will be told to contact the research team directly via email or telephone if they experience any incivility (including pressure, manipulation or coercion to move more and sit less) during the trial from the champions.

9.3 The Assessment Only "Control Group"

The purpose of this group is to serve as a comparison against the intervention group. Participants in this group will receive the same assessment as the intervention group at the same time-points. Participants within this group will be advised that the aims of the study are to examine the patterns of physical activity and sitting time in office workers, and how these may be associated with health, however, they will not use the height-adjustable workstation or receive the other intervention components. Control participants will be asked to maintain their usual working practice throughout the trial. Each member of the control group will receive individual feedback following each assessment and will automatically be entered into a prize draw to win a height-adjustable workstation or one of five activity monitors. The draw will occur after the 9-month data collection and winners will be notified via email from the centre contact, on behalf of the research team, on the day of the draw.

9.5 Budget

There are no costs to the organisation for assessments or intervention implementation. The estimated time considerations for each participant across the entire study are:

- Centre contact: Approximately 1 h per week to fulfil the role.
- Call agents (all): Attend three 1 h assessments.
- Call agents (intervention group): Attend four 1 h education and training sessions. A sub-sample of agents (max 15) will be invited to attend two 1 h focus groups.
- Team leaders (intervention group): Invited to attend two 1 h focus groups.
- Stand up champion(s): A sub-sample (max 5) will be invited to attend two 30-minute focus groups.

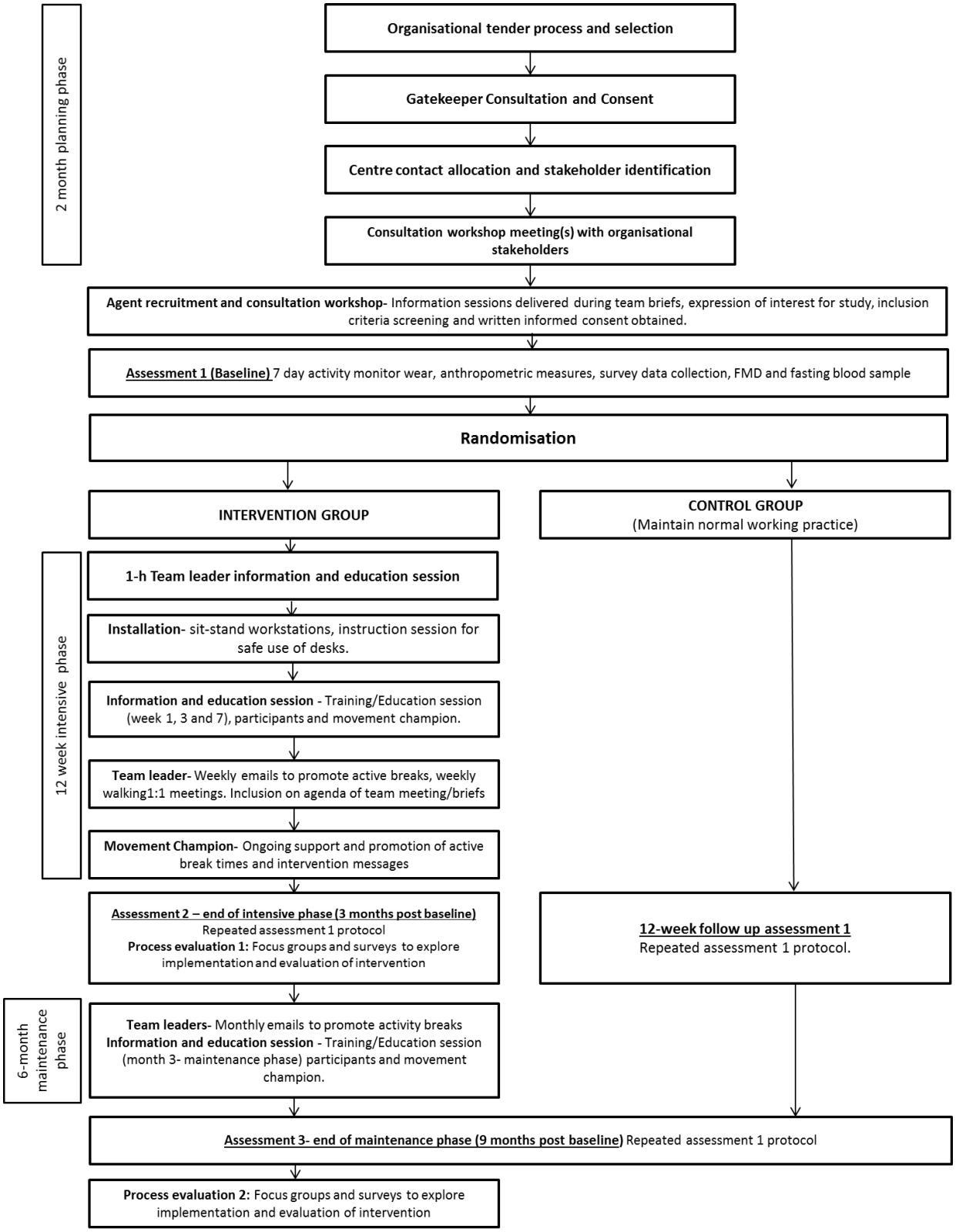


Figure 1. CONSORT flowchart detailing overview of study recruitment, randomisation and intervention components.

Application form:

Company Name: _

Company address: _

Company contact details: _

1. **Does your company meet the following essential criteria?** (Please mark each criteria with a tick or a cross)

- ☐ The organisation can meet the proposed key dates for the research study.
- ☐ The organisation has one or more branches/worksites located within the North West of England.
- ☐ The organisation employs a minimum of 100 call agents, who each have access to a work telephone and desktop computer with internet, and, are aged ≥18 years.
- ☐ Organisations that have only one branch/worksite within the North West of England must house call agents across either;

    - a) two or more buildings in the branch/worksite, and/or,
    - b) two or more office floors* in the branch/worksite, and/or,
    - c) two or more clearly defined areas* on the same office floor within the branch/worksite.

**Office floors are considered clearly defined if they are separated by partitions, full or partial walls, corridors or walkways. For queries, please contact the research team; a.s.millard@2016.ljmu.ac.uk*
Additional comments: _

2. ***Do you meet the following desirable criteria?*** *(Please mark each criteria with a tick or a cross)*

- ☐ The organisation has one or more branches/worksites located within 50 miles of Liverpool city centre (postcode L3 3AF).
- ☐ The organisation has a high proportion of call agents employed as full time staff (22.5 h or more).
- ☐ Call agents have access to wireless headsets.

Additional comments: _

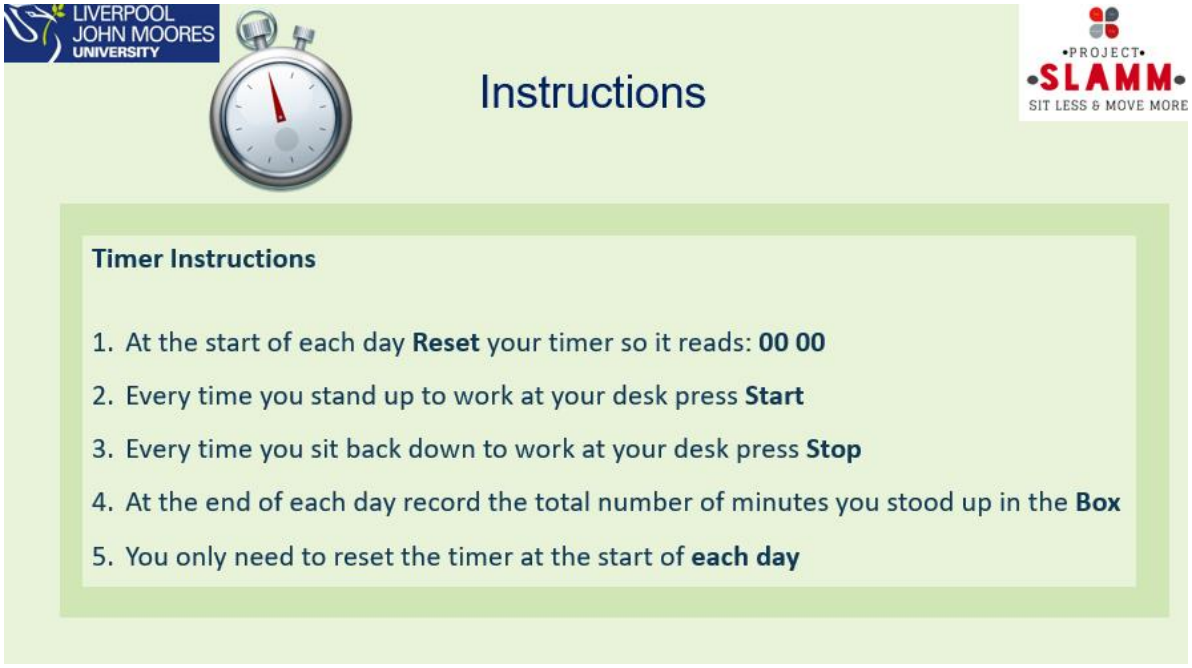
3. ***Please provide a statement of interest from your organisation detailing suitability to the study*** (*maximum length- 1 side of A4*):

The research team will review the applications and rank them based on suitability. If more than one suitable organisation applies, a meeting will be held with each organisation to discuss the organisation's suitability. All applicants will be notified of the final decision via telephone call and subsequent confirmation email from the research team, with feedback as to why they were unsuccessful (if applicable).

If you have any questions regarding this tender process please do not hesitate the contact the research team on **a.s.millard@2016.ljmu.ac.uk**.

Appendix 3. Study 3: Example weekly email

Appendix 4. Study 3: Example daily log diary



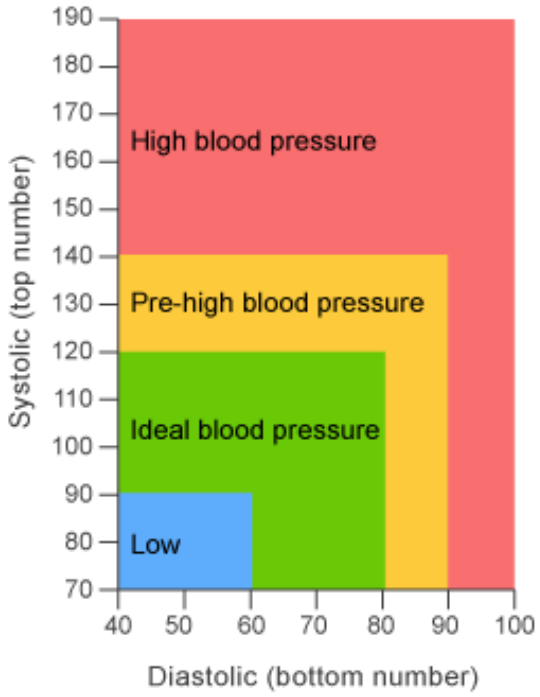
Appendix 5 Study 3: Example of individual health check feedback

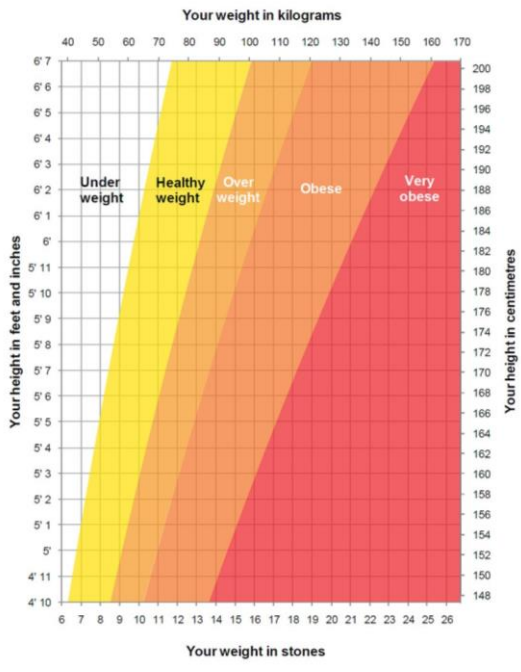
Feedback Sheet:

Participant Number: _ _ _ _ _ _ _

Anthropometrics	
Height (cm)	
Weight (kg)	
Body Mass Index (BMI)	
Waist (cm)	
Hip (cm)	
Blood measures	
Systolic Blood Pressure (mmHg)	
Diastolic Blood Pressure (mmHg)	
Glucose (mmol/L)	
Cholesterol (mmol/L)	

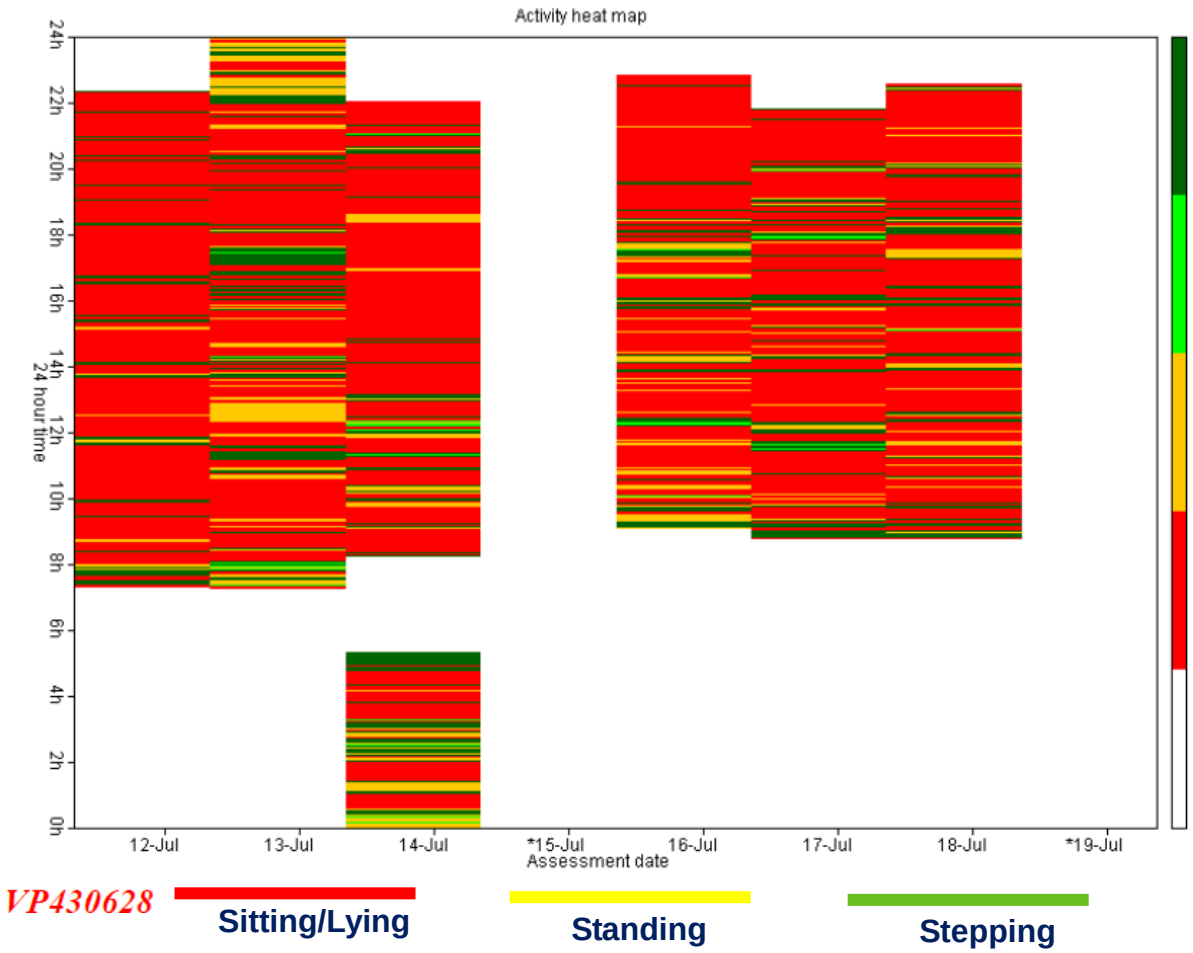
Glucose		**Cholesterol**	
Mmol/L	**Fasting**	**Mmol/L**	**Fasting**
Normal for healthy adults	4.0-5.9	Normal for healthy adults	5mmol/L or less





Appendix 6. Study 3: Example heat map and activity feedback

Agent activity monitoring- Individual feedback



Date	Waking wear time	Sitting time	Standing time	Total stepping time	Light stepping time	MVPA stepping time	Number of steps
Thu 12-07-2018	15.11	13.46	0.95	0.71	0.16	0.55	2150
Fri 13-07-2018	16.89	11.3	4.29	1.3	0.37	0.93	3695
Sat 14-07-2018	19.03	14.47	3.43	1.13	0.4	0.73	2985
Mon 16-07-2018	13.8	10.61	2.37	0.81	0.17	0.65	2572
Tue 17-07-2018	13.11	10.56	1.5	1.06	0.28	0.78	3098
Wed 18-07-2018	13.86	11.3	1.73	0.83	0.18	0.65	2577
Average	**15.302**	**11.95**	**2.378**	**0.973**	**0.258**	**0.715**	**2846 6**

Appendix 7 Study 3: Confounding variables controlled for in analysis

Occupational (minutes/8h workday)	
No of valid workdays >90%	Sitting total baseline, valid workdays
Sitting total	Baseline Sitting 0-30 minutes, age, stature, stepping time_0
Sitting 0-30 minutes	Baseline sitting >30 min, sitting0-30_0 and smoking
Prolonged sitting >30 min	Baseline standing total, smoking, stature
Standing total	Baseline Standing 0-30 minutes stature (LOG)
Standing 0-30 minutes	Baseline Standing >30 min, employment status and stature (LOG)
Stepping total	Baseline stepping 0-30 minutes, mass, BMI, Waist, Hip, Staff type and Hr per day, (Man Whitney U)
Whole day (minutes/16h wholeday)	
No of valid days	Baseline No of valid days, weartime days_0 (Man Whitney U)
Weartime	Baseline weartime, employment status, hr per week, sitting/standing/total stepping time_0
Total sitting	Baseline total sitting, ethnicity, stepping time_0 and age
Sitting 0-30 min	Baseline sitting 0-30min, staff type (LOG)
Prolonged sitting >30 min	Baseline sitting >30 min ethnicity
Standing	Baseline standing total, ethnicity, age, sitting time_0
Stepping	Baseline stepping
Number of steps	Controlled for employment status, sitting time_0, total stepping tie_0, staff type, hr per day (>20% change)- residuals normally distributed
Survey data	
SF12v2	
Physical component score	Baseline PCS, gender,education, absorption, sitting, standing, stepping_0
Mental component score	Baseline MCS, ethnicity, education, hr per day
EQ5D Index	Baseline EQ5D index, LE, cholesterol, UB,
Musculoskeletal discomfort	
Upper extremities	UE_0 (Man whitney U)
Upper back	Baseline UB, hr/day, employment, LB_0, (Mann whitney U)
Lower back	Baseline LB, h/week stafftype (Mann whitney U)
Lower extremities	Baseline LE, glucose, sitting time_0, education!
Sleep quality	Baseline sleep quality, mass, BMI, hip_o, stepping time_0
Work Limitations	Baseline work limitations, smoking, satisfaction,

	stafftype (LOG)
Job Satisfaction	Baseline job satisfaction
Need for recovery	Baseline need for recovery, job satisfaction, productivity, age and marital status
Work engagement	
Vigor	Baseline vigor, PCS, LE, dedication
Dedication	Baseline dedication, PCS, MCS, LE, Vigor, (SQRT)
Absorption	Baseline absorption
Engagement	Baseline engagement, PCS, LE, sleep, employment
Cardiometabolic	
Body mass index (kg/stature*)	Baseline BMI, education
Body mass (kg)	Baseline mass, education and recovery range
Waist circumference (cm)	Baseline waist circumference
Hip Circumference (cm)	Baseline hip circumference, UE, LE, productivity and absorption- residuals normally distributed
Systolic blood pressure (mm HG)	Baseline SBP, gender, hper week, h per day, , employment (Man Whitney U)
Diastolic blood pressure (mm HG)	Baseline DBP
Glucose	Baseline glucose, cardiometabolic condition, LE, gender
Cholesterol	Baseline cholesterol, cardiometabolic condition, Hr per day, MCS, DBP, AGE, Employment

Appendix 8 Study 3: Process evaluation survey

Feasibility of the data collection l (health checks) protocol (pooled SLAMM and SLAMM+)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I found the text message prompt a useful reminder for the health check	59%	33%	5%	3%	0%
I would be happy to attend data collection out of work hours	13%	31%	36%	15%	5%
It was feasible to have my body stature measures taken	49%	44%	8%	0%	0%
It was feasible to have my blood pressure taken	56%	38%	5%	0%	0%
It was feasible to complete the survey booklet	54%	41%	5%	0%	0%
It was feasible for me to arrive at work in a fasted state	51%	41%	8%	0%	0%
It was feasible for me to provide a finger prick blood sample	56%	38%	5%	0%	0%
It was feasible for me to wear an accelerometer for 7 days	44%	44%	10%	3%	0%
It was feasible for me to have my leg scanned (not in thesis)	49%	44%	8%	0%	0%
I felt supported by organisation to attend the health checks	54%	38%	8%	0%	0%
I felt comfortable during the assessment protocol	62%	33%	3%	3%	0%

SLAMM effectiveness of each component

	Very effective	Somewhat effective	Neutral	Somewhat ineffective	Very ineffective
Stand up champions	10%	43%	29%	10%	10%
Weekly emails	29%	62%	10%	0%	0%
Team Leader	10%	29%	33%	19%	10%
Three education sessions	43%	52%	5%	0%	0%
Health check feedback and monitor feedback	48%	43%	5%	5%	0%
Daily goals logs & Timer	33%	43%	24%	0%	0%
Paid hours	76%	19%	5%	0%	0%

SLAMM willing to continue to receive each component

	Strongly agree	Agree Neutral	Neutral	Disagree	Strongly Disagree
If I were offered desk by employer I'd take it	48%	29%	19%	5%	0%
Stand up Champions	14%	38%	43%	5%	0%
Regular emails	38%	57%	5%	0%	0%
Team leader continue	33%	52%	14%	0%	0%
Further education and training sessions	52%	48%	0%	0%	0%
Receive health check feedback	48%	52%	0%	0%	0%
Daily goals log and timer	33%	57%	10%	0%	0%

SLAMM+ desk use					
	Daily	**2-4 times per week**	**Weekly**	**Monthly**	**Never**
How frequently use workstation	39%	28%	22%	6%	6%
	<30 min	**30-60 min**	**1-2 h**	**2-3 h**	**3-4 h**
How long typically standing position per day	17%	44%	17%	17%	6%
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Easy to use	78%	22%	0%	0%	0%
Felt comfortable using desk in presence of others	83%	11%	0%	6%	0%
Decreased my work-related productivity	22%	17%	6%	33%	22%
Quality of work	22%	6%	0%	50%	22%
More tired	11%	11%	11%	39%	28%
More musculoskeletal troubles	17%	6%	6%	39%	33%
Would welcome further advice and guidance for using workstations	50%	28%	17%	28%	6%