The impact of workplace physical activity interventions on university employees health, wellbeing and behaviour change

By

Ayazullah Safi

MA, BA (Hons), PGCert FHEA, PGCert RPHE, MHFA

Doctoral Thesis

This Doctor of Philosophy thesis is submitted in partial fulfilment of its requirements in Faculty of Health, Education and Life Sciences at the Birmingham City University.

28 April 2021

Abstract

The benefits of participating in regular physical activity are wide-ranging and well-accepted globally, yet physical inactivity is increasing, especially amongst adults. Occupations involving sedentary behaviour are considered a leading contributor to the inactive lifestyle responsible for many health-related problems. An increasing number of occupations involving predominantly sedentary work and the incidence of work-related health issues is becoming more prevalent, with evidence suggesting that adults spend approximately 60% of their waking time at work. Moreover, higher educational institutions are arguably one of the predominant sources of influence on society and can play a significant role in developing the nation and changing attitudes. Despite this, research in physical activity, sedentary behaviour, health and wellbeing substantially lacks in these settings. Therefore, this thesis adds to the limited knowledge about physical activity, sedentary behaviour, health and wellbeing interventions on university employees in the workplace.

To elucidate this, several studies were conducted to evaluate existing physical activity levels and sedentary behaviour, followed by the exploration of barriers to physical activity amongst employees. The outcomes of these investigations contributed to the subsequent design and implementation of five physical activity, health and wellbeing interventions within the university. The five interventions were:

- Accessibility and the availability of exercise resources in the workplace
- Reducing sitting time through sit and stand workstation amongst university employees
- Exploring the impact of seated, standing and walking meetings in the university setting
- Getting university employees on the stairs: The impact of points of decision prompts
- Promoting PA amongst employees through the 10,000 steps team-based competition

Findings concluded that there is potential for physical activity, sedentary behaviour, health, and wellbeing interventions to be extended to other settings to promote physical activity engagement, reduce sitting time, and improve employees health and wellbeing. For instance, findings of intervention one indicate, employees engaged in 1287 minutes of physical

activity/exercise throughout the intervention period and staff reported positive mood, work productivity and stress relief by having access to the exercise resources in the workplace. The intervention two findings indicate that having access to the height-adjustable sit-stand workstation resulted in sedentary behaviour reducing from 1974 to 821 minutes. Standing time increased from 439 minutes to 923 minutes across the week. The results of intervention three demonstrated that staff indicated enhanced anger, fatigue, tension, and vigour post seated meeting instead of standing and walking meetings. The outcomes of this thesis demonstrate that these interventions can be generalizable and physical activity, sedentary behaviour, and health-related interventions must be tailored to the needs of employees in other settings. The intervention four results demonstrated that 84 participants noticed the banners, 54 were influenced to take the stairs, 68 felt physical, and 66 felt mental benefits of taking the stairs, whilst 88 suggested that the banners displayed in the workplace will influence them to take the stairs in future. Intervention five showed that the daily average steps increased from 5959 to 10308, and staff reported motivation, competitiveness, enjoyment, active and behaviour change due to 10,000 steps challenge intervention. These findings support the implementation of physical activity, sedentary behaviour, and health-related interventions across settings. This thesis contributes to the existing knowledge of behaviour theories, including the Trans-theoretical Model, Self-determination theory and Social-Ecological Model in the subject of exercise psychology associated with public health, physical activity, sedentary behaviour, health, and wellbeing of employees in the university workplace.

Acknowledgements

First, I would like to thank God for everything in my life.

There are many people to whom I am in debt of appreciation, gratitude and without them this thesis would have not possibly been completed. I would like to thank my supervisors Dr Natalie Walker and Dr Matthew Cole for their advice, support and guidance throughout this thesis from day one. I would also like to thank Dr Adam Kelly for joining the supervisory team towards the completion of my thesis and his support and guidance have been vital since he joined.

I am grateful for the opportunity of being one of the 50 STEAM Scholars at Birmingham City University and this PhD was funded as part of the University's £3 million initiative to create new subject knowledge and to power cultural, societal and economic improvements.

I am grateful to my wonderful and supportive family for their support and prayers throughout my academic career. My special thanks and gratitude goes to my elder brother Zia Safi, his wife Wahida Safi and my younger brother Yahya Safi, my niece Nila Safi and nephew Edriss Safi.

Thank you to my friends Fatema Khatun, Angela Kumah, Irfan Khawaja and Sheikh Sela for their support, I would also like to thank Lynn Horsfield for her support during the interventions of this thesis. Finally, I would like to thank all the employees for their time and participation in this research.

Preface

Research reported in this thesis has directly led to the following publications:

Refereed Journal Articles

Safi, A. Cole, M. Kelly, A. and Walker, N. (2021) An Evaluation of Physical Activity Levels amongst University Employees. *Advances in Physical Education*, 11, 158-171. Doi: 10.4236/ape.2021.112012.

Safi, A., (2019). The researcher on a mission to get staff exercising in the office. Publisher Muscle & Fitness: page 141: date 01/05/2019. https://internationalprintmonitoringservice.vuelio.co.uk/file/displaypdf?articleid=341390&clientname=109016_Birmingham City University_PRINT&filename=469985181.pdf.

Safi, A., (2019). The researcher on a mission to get staff exercising in the office. Publisher Birmingham City University Press office: 13 June 2019. https://www.bcu.ac.uk/news-events/news/the-researcher-on-a-mission-to-get-staff-exercising-in-the-office.

Refereed Conference Proceedings

Safi, A., Kelly, A. L**.,** Cole, M., & Walker, N. (December 2019). *Promoting physical activity amongst university employees through the'10,000' step challenge.* Paper presented at the annual British Psychological Society Department of Sport & Exercise Psychology (BPS DSEP) Conference in Birmingham, West Midlands, England. Abstract ***Winner of the 'Best Student Poster Presentation Award'.***

***Safi, A.,** Kelly, A. L., Cole**,** M., & Walker, N. (2019, November). *An evaluation of physical activity levels amongst university employees.* Paper presented at the annual British Association of Sport and Exercise Science (BASES) Conference, Leicester, Leicestershire, England. Abstract

Safi, A., (2019). Physical activity, health and wellbeing interventions in the university workplace. Presentation presented at the 14th annual health conference, at the Birmingham City University. 02 July 2019.

Safi, A., (2019). The importance of engaging in regular physical activity on health and wellbeing. Presentation presented at the RESFEST annual conference, at the Birmingham City University. 03 July 2019.

***Safi, A.,** Cole., M., and Walker., N, (2018). 'A comparison of two widely used physical activity monitoring methods to determine physical activity rates of university employees. Paper/presentation presented at the Public Health Institution Conference, at the Liverpool John Moore University. 04 July 2018.

***Safi, A.,** Cole., M., and Walker, N., (2018). 'Do university employees meet the physical activity guidelines' (within or outside the workplace)? Paper presented at the Population Health and Prevention Conference by Public Health England at Leeds, 07 March 2018.

***Safi, A.,** Cole., M., and Walker., N, (2018). 'The impact of physical activity intervention on university employees behaviour change, health and wellbeing. Paper presented at the BASES Division of Physical Activity for Health Divisional Day conference, Coventry University, 08 February 2018.

Contents

List of tables

List of figures

Chapter 1.0 Introduction

1.1 Background and Context

Physical activity (PA) is defined as 'any bodily movement that causes energy expenditure by using the skeletal muscles' (Caspersen et al., 1985). In contrast, exercise is a subcategory of PA and defined as 'structurally planned activity for a purpose and is conducted frequently' (Elmagd, 2016). Additionally, physical inactivity is the action by which individuals do not conduct the recommended levels of PA. Physical inactivity is documented as one of the major public health concerns (Dumith et al., 2012; González et al., 2017). According to the World Health Organisation (WHO, 2019), adult 18-64 years old are recommended to participate in a minimum of 150-300 minutes of moderate-intensity PA or 75-150 minutes of a combination of moderate to vigorous (MVPA) intensity activities across the week. The guideline recommends that adults must also conduct muscle-strengthening activities involving all the major muscle groups at least two or more days a week (WHO, 2019). Physical inactivity is considered as a worldwide epidemic that necessitates a global action because it is widely acknowledged as a vital contributor to morbidity and linked to an increased risk of mortality (Church et al., 2011; Lee et al., 2012; Kohl et al., 2012; Löllgen et al., 2009; Monninkhof et al., 2007; Van Uffelen et al., 2010; Lindsay et al., 2016). Research suggests that approximately five million people die every year due to inadequate PA engagement worldwide (Lee et al., 2012). Henceforth, physical inactivity is considered a severe threat to health and wellbeing. Consequently, sustainable and comprehensive PA programmes are vital in encouraging PA engagement at local, regional, national and international levels to positively change and improve health and wellbeing worldwide (Fletcher et al., 2018; Martins et al., 2019).

1.2 Physical inactivity in Europe and the UK

More than half of the European Union (EU) population seldom engage in PA or participate in sports activities (Hallal et al., 2012; Kornbeck, 2015). The Sport and PA Special Eurobarometer 472 (2017) also reported that almost 50% of the EU population never participate in PA or play sport (EU, 2018). The estimation shows that physical inactivity causes approximately 6% of the total mortality within the EU (Kazi, 2013). Furthermore, physical inactivity imposes a significant economic burden on the EU regarding health and wellbeing, such as obesity, cardiovascular disease, and mental health, including anxiety and depression (Centre for Economics and Business Research; CEBR, 2015). The costs related to physical inactivity to EU

members are more than £70 billion every year and if the current trends continues, the costs may rise to £109 billion by 2030 (CEBR, 2015).

Physical inactivity is also a significant issue for the UK population. According to the British Heart Foundation (BHF, 2017), 20 million adults are inactive. The figures from the health survey for England shows that there are 16.8 million inactive adults in England alone (BHF, 2017). The BHF (2017) defined inactivity as those engaging in less than 30 minutes of PA throughout the week. Differences reported in physical inactivity between genders illustrate that 32% of men and 42% of women lead an inactive lifestyle (CEBR, 2015). Physical inactivity is the fourth-largest cause of ill health and the leading cause of obesity, diabetes, and dementia, which directly contributes to one in six deaths in the UK (GOV.UK, 2014). The estimation shows that physical inactivity is responsible for approximately 17% of all mortality in the UK (CEBR, 2015).

Furthermore, people in the UK are 24% less active now than they were in 1961, and if this trend continues, the figure of inactivity may rise to 35% by 2030 (Lee et al., 2012; Ng and Popkin, 2012). Consequently, the increase in physical inactivity may negatively impact people's lifestyle, the National Health Service (NHS), and the economy. For instance, the annual direct cost of physical inactivity to the UK economy is £7.4 billion (GOV.UK, 2014). Additionally, the annual indirect costs to the economy, including the loss of productivity and health care, are estimated to be approximately £18.9 billion (Townsend et al., 2012; Yach et al., 2006). The health-related diseases and economic burden could reduce if inactive individuals adopt lifestyle changes and participate in regular PA (CEBR, 2015). Previous research suggests that the cost of physical inactivity could reduce if all sectors come together and take actions (Hallal et al., 2012; Kohl et al., 2012). For instance, according to the Office for National Statistics (ONS, 2020), in the UK, over 32 million adults are in employment and occupations involving sedentary behaviour are the main contributors to inactive lifestyle (BHF, 2017). Thus, focusing on workplace PA, health, and wellbeing can provide an opportunity for reaching a large proportion of the adult population.

1.3 Physical activity benefit

The health and wellbeing benefits of engaging in regular PA is indisputable (Bendíková, 2014; Cooper and Barton, 2016; Warburton and Bredin, 2017). The growing evidence across disciplines, including exercise psychology, exercise physiology, public health, epidemiology and behavioural sciences, have emphasised that engaging in regular PA is essential. It is

associated with reduced mental and physical health risks (Lai, 2018). Moreover, regular PA engagement has consistently been reported to aid in the prevention of many chronic diseases, including cardiovascular disease, type II diabetes, colon cancer, hypertension and musculoskeletal disorders (Garber et al., 2011; Griffiths et al., 2012; Lear et al., 2010; O'Donovan et al., 2013; Shih et al., 2018). PA participation also enhances feelings of wellbeing (Cooper and Barton, 2016), self-esteem (Awick et al., 2017), decreases anxiety and depression (Kelley et al., 2018; Rebar et al., 2015). Despite the wide-ranging benefits, the WHO (2018) reported that over 60% of the population do not meet the recommended PA guidelines. Thus, they may not receive the health benefits associated with PA participation. Most people failing to meet the recommended PA guideline is partially due to an increased sedentary behaviour during occupational and recreational activities (WHO, 2018). However, there is a gap in the research regarding not evaluating the current PA levels or recommending programmes that may improve PA, health and wellbeing. There is also a gap in the research concerning a comprehensive approach for promoting PA and health (Knox et al., 2017).

1.4 Physical activity promotion strategies

The benefits of engaging in PA to individuals, the community, and the economy are clear and briefly explored in section 1.3. The WHO has developed various strategies intended for health and wellbeing promotion through PA engagement. It is beyond the scope of this thesis to explore all of the existing strategies suggested. However, a summary of the pertinent findings from existing PA, health, and wellbeing strategies is explored.

The WHO has developed a global strategy known as the 'Global Action Plan on Physical Activity 2018–2030: More active people for a healthier world'. This strategy is focused on reducing worldwide physical inactivity by 15% until 2030. Moreover, 'PA strategy for EU Region 2016-2025' is focused on reducing physical inactivity by 10%, premature mortality by 25% and blood pressure by 25% (WHO, 2015). This strategy focuses on encouraging governments and stakeholders to work together to improve all citizens' PA levels in the EU region to adopt a healthy and active lifestyle (WHO, 2015).

The Public Health England (PHE) also developed strategies to help improve PA levels of its nation. For instance, everybody active every day, health matters, getting every adult active every day (GOV.UK, 2016). The vision of PHE is to promote 1) an active society such as creating a social movement; 2) Moving professionals such as activating networks of expertise; 3) active environment such as creating suitable spaces and; 4) moving at scale such as scaling

up interventions that can help people be active (GOV.UK, 2016). To achieve this vision, the PHE suggested that all sectors must work together at national and local government levels, including schools, communities, voluntary organisations, employers and businesses, leisure and sports providers, health and social care professionals (PHE, 2014).

The large majority of the adult population create the world's workforce and spending over 60% of their daily waking time in the workplace (Ryde and Brown, 2017). There is a gap in the research about the all-inclusive approach in PA and health as studies lacked insight into comprehensive approach to tackle physical inactivity in the workplace (Knox et al., 2017). However, occupational health experts and management need to begin identifying and providing cost-effective, feasible methods of embedding PA in the workplace. Embedding PA in the workplace may help reduce physical inactivity (GOV.UK, 2016).

1.5 Workplace PA, health policies and strategies

Improving PA and the health of employees in the workplace is not without challenges. Several policies and strategies have been introduced, including the WHO Healthy Workplace Model (2010) proposed as a framework, health and wellbeing-related intervention. This framework brings together four ample avenues of influences, as shown in Figure 1.

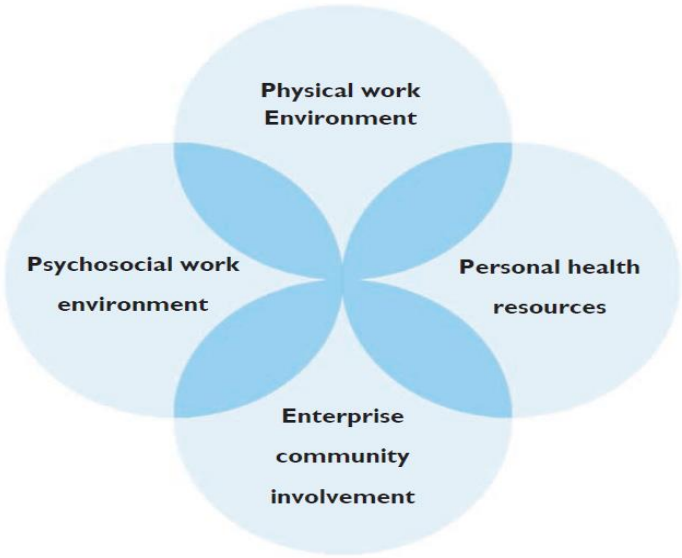

Figure 1: Avenues of influence for a healthy workplace (Burton, 2010 p.3)

The 'Physical Environment' refers to the availability of physical space and access to appropriate equipment for employees. The second avenue is the 'Personal Health Resources' that includes information, resources, opportunities and flexibility provided by the workplace to employees

for supporting their physical and mental health. The 'Psychosocial Work Environment' includes workplace culture, attitudes, values, beliefs and daily practices, affecting staff's mental and physical wellbeing. The final section of the model demonstrates the importance of 'Enterprise Community Involvement. This refers to the engagement of social and physical wellbeing in the community within which the workplace operate, such as working with community planners to build bike paths and pavements (Burton, 2010).

This model introduced the workplace as a critical setting for health promotion and suggested that workplaces can create supportive and comprehensive environments for employees (Burton, 2010; WHO, 1986). The 'Global Strategy on Occupational Health for All' recommended areas for actions highlighting the importance of utilising workplaces to change employees lifestyle. Factors to improve health and wellbeing included a range of staff opportunities to be physically active every day (Burton, 2010; Rantanen, 1996). These strategies show that the issue of promoting health and wellbeing in the workplace are essential. However, these policies and strategies are aimed worldwide, which means the governments and working organisations could develop their policies and strategies suitable for their organisations, employees, and population. Technology enhancement, economic development, transportation and workplace demands have also contributed to PA's decline in the workplace. For the WHO to achieve its mission, governments' worldwide need to start focusing on employees PA levels, health and wellbeing as this may contribute to the global target of reducing physical inactivity (WHO, 2018).

Focusing on PA, health and wellbeing in the workplace is recently reported in the UK's government guidelines and policies. The first review of employees health and wellbeing was conducted in 2007 (Black, 2008a). The Secretary of Health, Work and Pension (HWP) called upon workplaces and medical professionals to provide evidence-based reviews on workers' health (Black, 2008a). A range of organisations (n = 267), including academic institutions, responded. The key themes that emerged from this policy indicated strong support for the health and wellbeing initiatives, management commitment and specific policies to be generated that include interventions for healthy living (Black, 2008a). These themes presented strong support for PA promotion in the workplace (Black, 2008a).

Additionally, in 2008 the Secretary of HWP piloted a working-age population review known as the 'Working for a Healthy Tomorrow'. This was the first baseline review that recognised employees health in the UK (Black, 2008b). This review proposed a 'Fit for Work Service'

based on a multidisciplinary approach and called on the government to introduce health and wellbeing service in workplaces (Black, 2008b). This led the UK government to produce guidance on the 'Workplace Health: Applying All Our Health' (GOV.UK, 2018b). The guidance focused on numerous factors, directly and indirectly, linking to health. This guidance was measured through the 'Public Health Outcomes Framework (PHOF). The PHOF is responsible for outlining how thriving public health is being improved and protected (PHOF, 2018).

As part of workplace health guidance, PHE produced an introduction to its health and wellbeing directorate. The mission of PHE was to promote wellbeing and create healthier and safer environments (PHE, 2018). The additional aim of the PHE was to safeguard the places where people work and ensure their health is promoted (PHE, 2018). As part of 'applying all our health', PA engagement was introduced for employees. This guidance explored the importance of PA in the workplace and outlined the core principles for all organisations to understand the specific activities and interventions that can be beneficial (GOV.UK, 2018a). PA guidance called on team leaders and managers to promote the PA culture in the workplace. The PA guidance also called on organisations' hierarchy to participate in PA and lead as a role model in the workplace (GOV.UK, 2018a).

Other available policies have focused on PA, health and wellbeing in a general capacity, such as 'Everybody Active', 'Every Day and Moving at Scale' (PHE, 2014). The National Institute for Clinical Excellence (NICE) also produced guidance for PA, health and wellbeing promotion in the workplace, including promoting mental wellbeing at work (NICE, 2009a) and managing long-term sickness and incapacity (NICE, 2009b), promoting PA in the workplace (NICE, 2008) and workplace health policy and management practices (NICE, 2016). These policies and strategies concluded that organisations must provide precise regulation on how to improve PA, health and wellbeing in the workplace. The research suggested that small and medium-size businesses must be supported to provide health programmes for employees (Knox et al., 2017). Besides, comprehensive policies are needed to overcome health issues, as current measures are inadequate for a positive impact on employees health (Knox et al., 2017).

Furthermore, various PA, health and wellbeing policies have been produced and the impact of these policies in the workplaces are well-understood (Knox et al., 2017). PA promotion policies within workplaces are thought to be more sustainable than individual-level policies (Barr-Anderson et al., 2011; Knox et al., 2017). Thus, workplaces need to provide opportunities and facilities for employees to be active. Indeed, Knox et al. (2017) showed that employees who

had facilities and classes for activities reported the most positive behavioural outcomes than those who did not have access. Therefore, workplaces must develop PA and health-related policies that support various dimensions both at individual and organisational levels.

In summary, creating an active environment was the focus of all the strategies. Environmental interventions, including providing safe sidewalks, parks and cycling routes have shown to be positively influential (Bauman et al., 2012; Bauman et al., 2008). Additionally, there is an increasing interest in environmental changes for PA, health and wellbeing promotion, particularly in the workplace settings. Targeting workplaces to improve employees PA levels and reduce sedentary behaviour has recently led to the wider research. Previous research suggested that a large proportion of the adult population could benefit from PA programmes targeting workplace health and wellbeing promotion (Bennie et al., 2010; Laforest et al., 2009; Troiano et al., 2008). The workplace is understood to be an ideal place for health promotion, not only to prevent occupational injuries but to improve general health and wellbeing (Engbers et al., 2005; Wyatt et al., 2015). Previous literature exploring PA, health and wellbeing interventions in the workplace identified lack of time, lack of facilities, and management support as PA participation barriers. It concluded that future interventions must be comprehensive, multi-dimensional and multi-behavioural to attract a range of individuals to engage in PA behaviours (Dalager et al., 2016; Mozaffarian et al., 2012).

1.6 PA in the workplace

PA, health and wellbeing interventions in the workplace are becoming increasingly popular, especially with a range of benefits to employees health and wellbeing, such as reducing the risk of chronic diseases including diabetes (Shih et al., 2018), obesity (Balaskas et al., 2018) and stroke (Lachman et al., 2018). Moreover, the positive outcome of PA, health and wellbeing interventions in the workplace has suggested that such interventions can improve health, wellbeing, productivity and reduced absenteeism (Leininger et al., 2015b; Suárez-Reyes and Van den Broucke, 2016). For instance, research has shown that regular PA engagement in the workplace has positively increased the effects on feelings of wellbeing (Cooper and Barton, 2016), improved self-esteem (Awick et al., 2017) and decreased anxiety and depression (Kelley et al., 2018; Rebar et al., 2015). Despite the numerous benefits of engaging in regular PA to both employees and organisation, the ONS (2016) estimated that 137.3 million working days were lost due to sickness in the UK. The latest figure from the ONS (2017) revealed that employees took an average of over four sickness absence days per year. According to the

ONS, the common reasons for absence were reported to be a cough and cold (24.8%), followed by pain in the back, neck and upper limb (22.4%) and other conditions including mental health such as stress, depression and anxiety (11.5%). Previous research shows that participating in regular PA can reduce the risk of all causes of morbidity (Church et al., 2011; Griffiths et al., 2012).

Despite the increasing number of interventions concentrating on employees PA levels, health and wellbeing, most of the workplaces are yet to consider implementing such programmes (Leininger et al., 2015a). In addition, research reported that PA and health interventions in the workplace has been poorly documented because of the lack of advice on how to embed such programmes in employees daily working lifestyle (Black, 2008b; Jackson et al., 2014; Warburton et al., 2006). Nevertheless, research suggests that PA, sedentary behaviour, health and wellbeing interventions are challenging but feasible, across settings (Hallal et al., 2012; Kohl et al., 2012). Workplace policies, culture and staff flexibility are reported to have a major effect on individual's PA and health (Lee et al., 2012). Reis et al. (2016) advocated, physical inactivity can be improved if policymakers, public health researchers, and leisure recreation sectors embrace challenges and provide PA and health interventions for employees in the workplace.

Despite the mixture of findings in past studies, no clear guidelines exist to comprehend which interventions are most suitable to be carried out in the workplace. Conversely, most of the studies included grey literature and did not apply theoretical approaches to interventions prior to implementation (Cotton & Hart, 2003; Stansfeld & Candy, 2006). Most of the applied interventions failed to identify baseline PA levels, sedentary behaviour, health and did not consider the fundamental purpose of employees engagement and disengagement in such interventions in the workplace. The reasons behind participating and not partaking in regular PA and health-related interventions in the workplace have been investigated and it remained unclear to why employees decided not to engage in such interventions (Edmunds et al., 2013). However, Edmunds et al. (2013) did not conduct a baseline study and only interviewed employees who were already participating in PA and health-related programmes. Interviewing employees who were not willing to partake in PA and health programmes may have yielded different findings. Despite the mixture of findings, organisations often face challenges about the approaches and investment in implementing PA and health-related interventions (To et al., 2013). As such, policymakers and occupational health experts must identify and provide economic and feasible PA, health and wellbeing interventions in the workplace to improve employees health and wellbeing.

Employees typically spend around 60% of their daylight hours in the workplace (Ryde and Brown, 2017). Hence, it is necessary to target work settings where individuals spend most of their time completing tasks in a sedentary or minimal physical effort (Ryde and Brown, 2017). Research has suggested the common reasons for adults not engaging in PA are lack of time because of the workload and lack of access to resources (Bardus et al., 2014; da Silva et al., 2017). Therefore, employees having access to PA and exercise resources at work may help them engage in more positive PA behaviours. It could be suggested that the workplace is an ideal place to promote PA levels and tackle sedentary behaviour amongst the adult population. This is because the workplace is a suitable environment to improve PA, health and wellbeing. After all, a large proportion of the adult population can be accessed (Soler et al., 2010; Suárez-Reyes and Van den Broucke, 2016).

It must be noted that the workplace policies, culture and national differences affect employees PA engagement which in turn can impact their health and wellbeing. For instance, where PA interventions are implemented in the workplace, these have revealed to be effective where the management, policies and the workplace culture are considered (Lee et al., 2012). The habit of engaging in regular PA can be implemented in the workplace if policymakers and management clearly emphasise the importance of PA, health and wellbeing as fundamental to their business (Kohl et al., 2012). Despite the strong evidence indicating the benefits of PA and health interventions, there appears to be limited research focused on employees in the workplace, particularly within university settings (Hadgraft et al., 2015; Leininger et al., 2015b). The subsequent section summarises the existing knowledge regarding PA, health and wellbeing in higher education institutions.

1.7 PA Promotion in Higher Education Institutions

There are 162 higher educational institutions (HEI) in the UK with more than 378,000 members of staff with a range of job roles (Dooris et al., 2017). HEI's are an essential setting for PA health and wellbeing interventions because they play an essential role in shaping and developing citizenship and societal changes (Dooris et al., 2017). HEI settings are arguably one of the predominant sources of influence. They can play a significant role in developing the nation and changing societies. However, PA research focused on HEI settings are substantially lacking. Research has suggested that universities supporting PA health and wellbeing programmes observed benefit in various ways, including improved productivity,

higher staff retention, greater loyalty, and reduced sickness absences (Flint et al., 2016). However, these findings are limited as the researchers did not capture the baseline PA levels and health data before implementing interventions and classified many employees as homogeneous. On the contrary, a university environment is highly heterogenous, regarding a diverse workforce encompassing a range of job roles. Thus, consideration of these variances among employees may yield different outcomes. Consequently, PA and health promotion programmes in the HEI settings remain poorly documented (Suarez and Broucke, 2016).

Besides, Worksite Health Promotion Programmes (WHPP) have also been acknowledged as essential in enhancing a mixture of educational and environmental support for activities aiming at improving employees PA and health (Green and Kreuter, 1991). The UK Healthy Universities Network (http://www.healthyuniversities.ac.uk) have proposed an approach that can be helpful to be embedded during an interventions exploring a cultural change. This approach is focused on supporting, developing and implementing a university wide approach for PA, health and wellbeing improvements, helping staff to be active and healthy (Orme and Barna, 2010). Previous literature suggested that senior executive community in universities are disengaged and have negative attitudes towards PA and health interventions (Naaldenberg et al., 2009). If participatory structure and opportunities are offered and integrated into the core business, health and wellbeing may be better applied (Best et al., 2003; Naaldenberg et al., 2009). Thus, it is important for universities to have health promotion programmes and include it in their policies (Centeio and McCaughtry, 2017; Leininger et al., 2015b; Sarmiento and Sarmiento, 2017).

Universities are key organisations and can play a dynamic role in tackling health and wellbeing of employees (Dooris, 2006; Dooris and Doherty, 2010a; 2010b). For instance, two universities in the UK were selected as 'exemplary', one implemented healthy universities approach (e.g. PA and health initiatives) and the other did not have the initiative and had not yet considered the approach (Newton et al., 2016). The results of the later university, proposed that high-ranking management recognised health as an individual's responsibility, health and wellbeing were also regarded as a separate issue to university values and goals of the business (Newton et al., 2016). In contrast, Bauer and Jenny (2012) reported that the organisation is responsible for health and wellbeing of employees. Although, Newton et al. (2016) provided some insight to the UK universities nonetheless the study reported various limitations such as data collected through documentary analysis, semi-structured interviews and observation field notes. Previous research suggested that the case studies lack systematic handling and evidence (Hodkinson and Hodkinson, 2001; Yin, 2013). PA and health intervention must be tailored and

implemented in accordance to the requirements and interest of employees (Brown, 2014; Brown et al., 2015). Moreover, Leininger et al. (2015b) implemented an intervention aiming to promote PA levels among university employees, no significant differences were found across four different campuses. Most of the existing research implemented PA and health related interventions within universities did not explore valuable information about pre and post PA levels and health prior to interventions and categorised employees as homogenous. Considering the heterogeneity of university and employees when interventions are delivered might have yield different results. Thus, baseline studies and interventions are require to target university employees PA, sedentary behaviour health and wellbeing (Gilson et al., 2009).

1.8 Sedentary behaviour in the workplace

Adults spend approximately 60% of their daily waking hours at work and the figure differs across working and non-working days (Waters et al., 2016). Research shows that employees spend around 77% of their waking time being sedentary in a typical working day compared to 70% in non-working days (Waters et al., 2016). It is clear that employees working in a sedentary environment are more likely to spend a prolonged time sitting (Burn et al., 2017; Prince et al., 2017). For instance, the public service employees spend most of their working hours sedentary (Griffiths et al., 2012), and health care specialists in the UK have the highest level of sickness absence, dissatisfaction, distress, and burnout compared to other occupational settings; the main reason reported being longer hours and most of those hours are spent sedentary (Dawson, 2009; Deckard et al., 1994; Edwards and Burnard, 2003; Evans et al., 2006; Wyatt et al., 2015). Research suggested that the main barriers for university employees particularly academics to engage in regular PA and health programmes either within or outside of the work is lack of time and due to workload (Che et al., 2017). Research has shown that academics typically work more than 40 hours per week, and this can include early mornings, late evenings, and weekends (Das et al., 2013).

Previous research reported that university employees spent approximately 75% of the working day seated (Fountaine et al., 2014). However, research has suggested differences between time-spent sittings during working days compared to non-working days (McCrady and Levine, 2009; Thorp et al., 2012). Thorp et al (2012) reported that 62.9% of the time was spent sitting in non-working days compared to 70.4% of workdays. Likewise, McCrady and Levine (2009) found significantly more time (597 minutes) of workdays compared to (484 minutes)

non-working days being sedentary. Most of the previous studies agreed that employees spent most of their time sedentary (Fountaine et al., 2014; McCrady and Levine, 2009). Moreover, research in relation to employees spending majority of working day in a seated position with minimum physical movements has suggested that such behaviour can lead to negative impact on health, wellbeing and productivity levels compared to physically active individuals (Clemes et al., 2015; Edge et al., 2017; Healy et al., 2011; Waters et al., 2016).

Additionally, research suggests that the commute to work as being one of the main barriers to PA engagement by university staff (Leininger et al., 2015a). However, this study had several limitations such as the use of self-reported tools and low response rate of 8.5%. Research has suggested that balanced policies are needed to provide university employees with key developments to preserve self-managed aspects of work and home-life (Che et al., 2017; Kaewpan et al., 2017). A study conducted by Donaldson-Feilder et al. (2017) questioned employees by asking 'what makes PA hard to participate'. The responses were categorised into six themes: 1) working patterns; 2) other commitments; 3) seasonal changes; 4) lack of motivation; 5) health issues; and 6) facilities. To identify barriers participants were further questioned about "what could help you to participate in PA". Similarly, six themes were identified: 1) easy access to the gym and other fitness equipment; 2) support from others; 3) motivation; 4) adapting job roles; 5) resolution of health problems; and 6) more free time. This study had limitations such as the use of self-reported questionnaire and participants had no further choice of expressing their perspectives besides answering the two questions asked. Moreover, most participants did not answer all of the questions, and the attrition rate may have influenced the interpretation of the results.

Additionally, the gap in terms of methods validity, reliability and some researchers even adapting the existing methods for data collection without testing the validity and reliability still remains. Additionally, most research classified employees as homogenous and failed to distinguish between job roles. For instance, Olsen et al (2018) failed to contemplate heterogeneity of employees in terms of sedentary behaviour, job roles and PA levels and participants were not provided with intervention information. Workplace interventions need to be organised in a specific and dynamic approach, suitable for the working environment and must include a range of job roles for a comprehensive insight (Joyce et al., 2016). Therefore, an assessment of the current PA levels, sedentary behaviour and the heterogeneity of job roles and gender are important factors to be considered prior intervention. For instance, research suggested that well-designed studies to evaluate current PA levels and sedentary

behaviour of employees are needed prior organising PA and health-related programmes in the workplace (Malik et al., 2014).

1.9 The Problem with Existing Research

Most of the existing literature to date has solely applied self-reported methods to measure PA levels and sedentary behaviour within the workplace and failed to evaluate PA levels and sedentary behaviour pre/post-intervention before implementing the interventions (Bernaards et al., 2007; Davis et al., 2011). Research has suggested that the self-reported methods are commonly used because it is an easy and cost-effective way of collecting data, but this has some limitations due to the methods subjectiveness. Participants may over/underestimate their activity levels. As such, findings may then require objectively monitoring to validate their accuracy (Schaller et al., 2016; Bevier et al., 2020). However, failing to evaluate the current PA levels and sedentary behaviour may be why previous research is unable to continue. More importantly, it is unclear whether the intervention has increased PA levels engagement because the baseline data was not collected. Research indicates that the focus of most studies were to promote PA without measuring baseline activity levels; thus, such studies impact can be questioned. This shows a gap in the literature that requires further investigation (Proper and van Mechelen, 2008).

A workplace consists of different job roles. Each job may involve different flexibility levels in terms of autonomy around working practices and the job's physical and sedentary demands. For instance, the administration staff may be required to be present at their desk in a sedentary position with a little autonomy because of their job demands. In contrast, the estate (maintenance) staff may be required to move around the building physically. Thus, the estate might be expected to have higher levels of PA. Therefore, it is essential to consider employees as a heterogeneous group regarding job roles and gender regarding PA levels and sedentary behaviour. Also, research suggests, the impact of workplace PA and health interventions are questionable and, in some cases, contradictory due to the applied methods and inconclusive findings (Dugdill et al., 2008). Moreover, some PA and health interventions have targeted a small proportion of employees and only for a short period ranging from 1-4 weeks. Thus, the data outcomes are not particularly applicable to the broader sector (Adlakha et al., 2015; Butler et al., 2015; Cooper and Barton, 2016).

Overall, there is a lack of comprehensive systematic approaches in assessing and improving PA, health, wellbeing and reducing sedentary behaviour in the workplace. Existing studies

applied either a quantitative or qualitative method and reported various limitations depending on which method was used. Research has noted that applying a mixed-methods approach could provide more detailed data and insight into 'why' and 'how' (Smith et al., 2017). In contrast, to previous literature, this thesis has employed a mixed-method approach to gain an insight into PA levels, sedentary behaviour and barriers of employees as a baseline before implementing interventions and exploration of the efficacy of such interventions. This thesis contributes to the limited research about workplace PA, sedentary behaviour and health. It adds to the scarce research considering job roles, genders PA levels, sedentary behaviour, health and wellbeing of employees in the workplace, particularly within university settings.

1.9.1 Problem statement about the university used in this research

The university explored within this thesis conducted a 'Staff Engagement Survey' in 2015. The results indicated that 'staff feel that the university is not interested in their wellbeing' (Staff Engagement Survey, 2015: 9). PA levels, sedentary behaviour, health and wellbeing and the related barriers and facilitators of employees within this university is currently unknown. This university has approximately over 2000 employees working weekly on various sites (i.e., campuses) across the city. Although many employees work on these campuses, there is a lack of facilities promoting PA (e.g. no gyms or exercise facilities) available on either campus. Besides, before the commencement of this research, this university did not have sport, PA and wellbeing courses/teams, which may have been helpful in terms of providing opportunities and education related to PA, sport and exercise engagement that might have supported a better staff engagement outcome on PA, health or wellbeing. The impact of such support and opportunities on health and wellbeing for staff in the workplace at this institution needs exploration. Hence, this thesis aimed to investigate PA levels, sedentary behaviour and identifying barriers and facilitators before conducting any PA and health-related interventions. In order to explore future opportunities for staff to engage in PA and reduce sedentary behaviour; as a result, this may improve employees health and wellbeing. Moreover, this PhD is one of the 50 STEAM Scholars at Birmingham City University. It was funded as part of the university's £3 million initiative to create new subject knowledge and power cultural, societal and economic improvements.

1.9.2 Aims of this PhD Thesis

Despite the well-known benefits of engaging in PA, there is a lack of research regarding PA, health and wellbeing concerning the HEI settings and more specifically, for the participant

university. Thus, the mixed-method research aims to understand the current PA levels and sedentary behaviour of university employees. Additional aims of this thesis were to understand why university employees engage/disengage in PA behaviour and whether PA, health and wellbeing interventions in a university setting are effective. There are three discrete studies that led to five discrete interventions in this thesis as detailed below:

Study 1: A baseline study to evaluate self-reported PA levels and sedentary behaviour of university employees. This study also sought to understand the different types of PA that employees engaged in, whilst also establishing how much PA was undertaken within and outside of the workplace.

Study 2: This study objectively monitored and subjectively evaluated daily PA levels and sedentary behaviour amongst university employees across the week.

Study 3: This study aimed to investigate the barriers to PA behaviour amongst university employees qualitatively. These findings informed the five interventions as detailed below.

Interventions: The interventions targeted at improving PA behaviour, health wellbeing and reducing sitting time amongst university employees. The interventions were:

- Accessibility and the availability of exercise resources in the workplace
- Reducing sitting time through sit and stand workstation amongst university employees
- Exploring the impact of seated, standing and walking meetings in the university setting
- Getting university employees on the stairs: The impact of points of decision prompts
- Promoting PA amongst employees through the 10,000 steps team-based competition

1.9.3 Overall thesis objectives

1. Investigate university employees current PA levels and sedentary behaviour to establish a baseline via subjective and objective instruments.

2. Explore the barriers and facilitators of university employees experiences of PA engagement and wellbeing initiatives across the job roles.

3. Identify the impact of a series of interventions on university employees PA, health and wellbeing in the workplace.

Chapter 2.0 Theoretical models/theories

2.1 Introduction

A substantial proportion of the existing research focused on PA, health and wellbeing lack explanation of the theoretical approaches underpinning their research (Buchan et al., 2012; Sutton, 2008). Research has indicated that theories facilitate and help understand what works and what does not work; from the basis of individuals' intention of why they participate or choose not to participate in PA, health and wellbeing programmes (Brug et al., 2005; Fishbein and Cappella, 2006; Nevill, 2014; Nigg et al., 2008; Prochaska et al., 2008). Applying theoretical models to PA, health and wellbeing programmes are essential to understand the underlying mechanisms of behaviours. One of the most suitable ways to better understand PA, health and wellbeing is to recognise the relevant behaviour change theories since the most successful health promotion programmes are underpinned by applicable behaviour change theories (Glanz, 2008).

The most commonly used theoretical models of behaviour change and health are the Health Belief Model (Hochbaum et al., 1952); the Theory of Reasoned Action (Ajzen and Fishbein (1988); the Theory of Planned Behaviour (Ajzen, 1991); the Transtheoretical Model (Prochaska et al., 1992); the Self-Determination Theory (Deci and Ryan, 1985) and the Social Ecological Model (McLeroy et al., 1988) that are used in the workplace related to the adoption of PA, sedentary behaviour, health and wellbeing interventions. The following section briefly explains each of the aforementioned theoretical models and details the ones underpinning this thesis.

2.2 Health Belief Model (HBM)

The HBM was developed in 1950s as an attitude-based model to understand why people failed to use the health promotion services provided (Becker et al., 1977; Janz and Becker, 1984). The foundation of the HBM is that it consists of two components: 1) the desire to avoid disease and 2) the 'belief' that an action can cure the disease (Wayne, 2016). The HBM suggest that people do not usually seek health promotion unless they are vulnerable, recognise the condition as threatening and are confident that the recommended actions will have a positive impact (Clarke, 2013). For example, if an individual has a negative health condition such as diabetes, heart disease or obesity and the recommendation is to participate in regular PA then

their participation in PA, will be dependent upon their positive expectations of undertaking the recommended action, and how this will help them avoid the negative health condition. Harrison et al. (1992) reported that the value of applying HBM for changing PA behaviour is not fully effective, as it was developed for diseases avoidance rather than as a health promotion model (Biddle and Ashford, 1988; Lindsay-Reid and Osborn, 1980). Therefore, it is not the most valid theoretical framework to be used in this thesis, especially in the HEI context. Because the HBM believes that all individuals have access to the equal amount of information and does not consider the environmental and economic factors that may forbid certain people from continuing with the recommended actions (Wayne, 2016).

2.3 The Theory of Reasoned Action and the Theory of Planned Behaviours

The Theory of Reasoned Action (TRA) believes that the behaviour can be recognised by person's attitudes (Ajzen and Fishbein, 1980; Al-Suqri and Al-Kharusi, 2015) and it is focused on attitude and behavioural intention (Nevill, 2014). The TRA also believes that the intention is responsible for behaviour (i.e. the intention influences the action) and this is determined by the social pressure or 'subjective norms' (i.e. influenced by what others think about person's behaviour) (Vallerand et al., 1992). The TRA use personal attitudes, social or 'normative' factors to determine behaviour intention, which lead to predict the actual behaviour (Al-Suqri and Al-Kharusi, 2015; Tsai et al., 2012).

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) is an extension version of the TRA and it is used to predict and understand the outcome of individual intention towards health-related behaviour and health prevention programmes (e.g. PA, weight loss and smoking cessation (Ajzen and Fishbein, 1988). Despite the wider use of TRA and TPB in terms of predicting behaviour change it is not the most applicable theories to be applied in this thesis particularly in the HEI context because neither theory can explain individual's behaviour change (Sharma and Kanekar, 2007). For example, employees at HEI consist of various job roles. Whilst some may have control over their behaviour such as academics and other may not have control over their behaviour (i.e. receptionists or professional services) to participate in regular PA and health interventions (Armitage and Christian, 2003; Sharma and Kanekar, 2007). Behaviour change may not occur and the challenge of changing the intention into behaviour could remain if individuals do not have complete control over their behaviour (Clarke, 2013; Milne et al., 2000). Therefore, changing people's behaviour is challenging, although behaviour change models can help understand people's processes. Thus, it is essential to note that this thesis is deductive because it has adopted existing associated theories and models for

targeting behavioural determinants at various levels. A range of theoretical models and their application to the research studies in the thesis are explored below.

2.4 The Trans-theoretical Model (TTM)

The TTM views behaviour change as a development course rather than a single event (Prochaska et al. 1992). It determines that people drive through five stages as their behaviour changes from unhealthy to healthy (Adams and White, 2004). The five stages are: 1) Pre-contemplation: in which the individual is sedentary with no intention to change current behaviour; 2) Contemplation: the individual is sedentary but has some intention to change in next six months; 3) Preparation: the individual is exercising intending to be more active in the next six months; 4) Action: the individual has been regularly active but for less than six months; and 5) Maintenance: the individual is regularly active for more than six months (Adams and White, 2004; Wood et al., 2002). Also, Adams and White (2004) suggested that the TTM includes ten social and psychological process that is important when intervening to change behaviour as it is transitioning through the stages as explored in Table 1. Moreover, the stages and process of change are presented in Figure 2.

Table 1. The social and psychological process of change (adapted from Adams and White, 2004, p.238)

Process of change	Alternate label	Examples
Consciousness raising	Increasing awareness	I am remembering the information people have given me on how to take more exercise
Dramatic relief	Emotional arousal	I respond emotionally to warnings about sedentary behaviour
Environmental re-evaluation	Social re-appraisal	I consider the view that my sedentary behaviour may be harmful to the environment (through increased car use)
Social liberation	Environmental opportunities	I find society changing in ways that make it easier to be active
Self-re-evaluation	Self-re-appraisal	my sedentary behaviour makes me feel disappointed in myself
Stimulus control	Re-engineering	I make my home more conducive to physical activity

Helping relationships	Supporting	I have someone who listens when I need to talk about activity
Counter conditioning	Substituting	I find that being active is a good substitute for being sedentary
Reinforcement Management	Rewarding	I reward myself when I am active
Self-liberation	Committing	I make commitments to be active

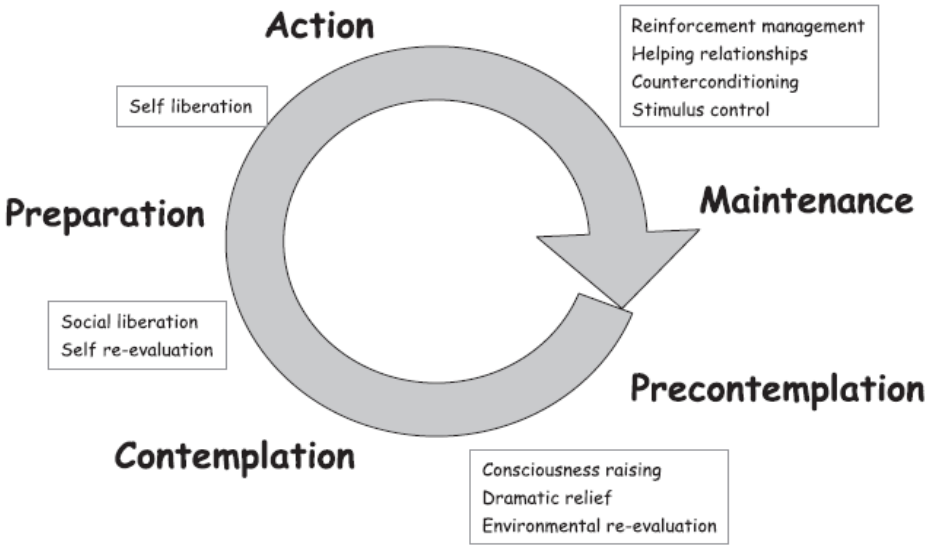

Figure 2. The TTM of behaviour change with stages identified in bold and processes in boxes (from Adams and White, 2004, p.239)

TTM was identified as a relevant model for this thesis regarding PA, health and wellbeing interventions development. For instance, changing behaviour from sedentary to active and improving health and wellbeing in the workplace requires an understanding of the current challenges employees face before introducing interventions (Arrogi et al., 2017; Clarke, 2013; Grande et al., 2015). Consequently, a range of interventions may be necessitating for diverse population subject to their existent stage of behavior (Adams and White, 2004). Also, the TTM provides stages that people go through for a behaviour changing process. This is useful for this research as it allows an evaluation of employees current behaviour stage, the changes required, and a structure for conceptualising the multi-dimensions for change, offering intervention strategies for both individuals and the workplace (Clark, 2013).

Moreover, TTM differentiates the behaviour change as a dynamic and recommends that persons progress through stages when trying to change behaviour (Lenio, 2006; Prochaska et al., 1992). A critical review by Adams and White (2003) examined if stage-based PA interventions were influential in terms of promoting PA engagement. Overall findings showed that 73% of the studies with a follow-up within six months suggested that interventions with stage-based were constructive in continuing through stages and maintaining healthy active behaviour than control conditions.

Furthermore, research supported the use of the TTM and suggested that it is the most suitable model to understand employees current behaviour (Mahmoodabab et al., 2013). It also provides direction for intervening to change employees (unhealthy) stage to the next stage (healthy). In return, this will help promote PA and employees health, which benefits the workplace (Mahmoodabab et al., 2013).

2.5 Self-Determination Theory

The Self-Determination Theory (SDT) examines a range of phenomena that motivate people to take action (Deci and Ryan, 1985; Ryan and Deci, 2000). The SDT suggest there are three basic human psychological needs: 1) competence, where an individual has a need to achieving things and be able to take challenges, 2) autonomy which includes being self-directed or be in control; and 3) relatedness, which includes having a mutual connection with others and a sense of belonging (Deci and Ryan, 1985; Olafsen et al., 2017). The three needs being met contribute to an individual's motivation towards PA, health and wellbeing as long as the needs are satisfied (Deci and Ryan, 1985; Ryan et al., 2010). Olafsen et al. (2017) suggested that the consideration of contentment is achieved when competence, autonomy and relatedness needs are supported; in contrast, it can lead to a negative health impact when not supported (Clarke, 2013).

The SDT takes a multidimensional approach that highlights why some people are motivated to change their behaviour and others are not (Daley and Duda, 2006). It was suggested, there are different type of motivations, including intrinsic motivation, in which individuals undertake something because it is inherently exciting and enjoyable. Extrinsic motivation refers to things driven from the outside, such as doing something for the rewards (Deci and Ryan, 19985; Ryan and Deci, 2000). Moreover, Amotivation refers to a lack of intentionality resulting in the relative absence of motivation. Individuals do not observe the contingency between their behaviour and the outcome, as explored in Figure 3 (Vlachopoulos et al., 2008). The research

suggested that Amotivation is linked with dropout from the PA and sport (Pelletier et al., 2001; Vlachopoulos et al., 2008).

There are different subcomponents of extrinsic motivations related to SDT viewing this motivational type on a continuum. External regulation is an extrinsic motivation (i.e., less autonomous and conducted due to the outside requirements or conceivable prize, which is seen as an externally perceived locus of causality). The introjected regulation is also an extrinsic motivation and includes taking on guidelines but not fully accepting them (Deci and Ryan, 1985). This includes instruction by contingent self-esteem, mentioning character as a standard form of introjection (Deci and Ryan, 1985). Regulation through identification involves a more autonomously driven form of extrinsic motivation (Deci and Ryan, 1985). This includes deliberately accepting guidelines for the sake of achievement to be acceptable and necessary. However, integrated regulation is the most autonomous extrinsic motivation (Deci and Ryan, 1985). This occurs when regulations are integrated, such as self-evaluation, beliefs or personal needs (Deci and Ryan, 1985). Despite the shared qualities, the integrated motivation regards extrinsic as the aim for achieving, rather than the within satisfaction or curiosity in the activity as explored in Figure 3 (Deci and Ryan, 1985).

The SDT is also a relevant theory to this thesis because it provides different reasons for behavioural engagement and ensures the adoption of different motivations within a domain (Deci & Ryan, 1985, 2000). The SDT may help explain the effect of regulatory styles and shifting motivation towards intrinsic forms within the university context and across job roles, PA, health and wellbeing. The university is a diverse setting with different job roles, and some employees may have more autonomy than others. For instance, academics may have more autonomy than administration staff and identifying the impact of autonomy on employees daily work is essential. Previous research has combined the SDT and the TTM to better understand the stages of change and individuals' motivations towards behaviour change (Clarke, 2013; Conner and Norman, 2005; Mullan and Markland, 1997).

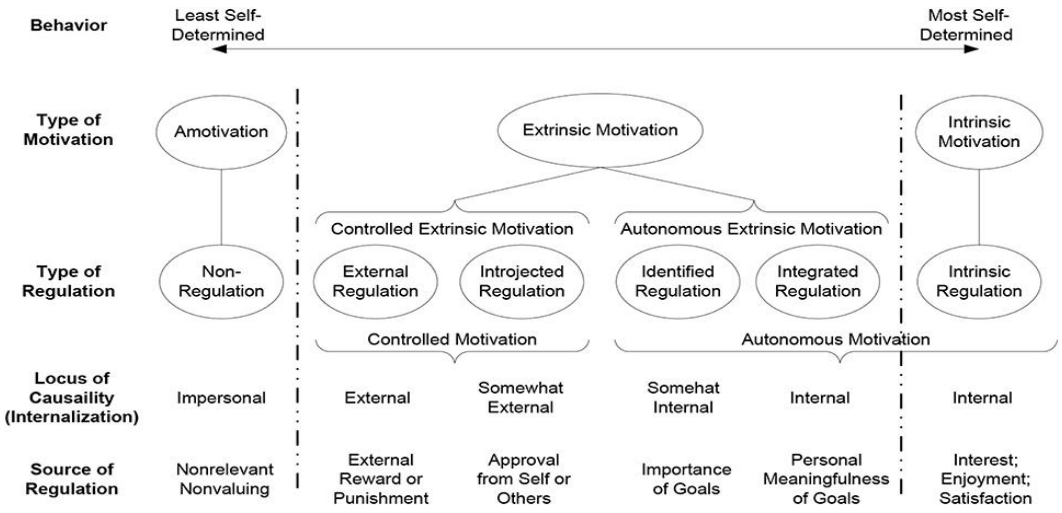

Figure 3. The Self Determination continuum motivation (from Deci and Ryan, 2000, p. 72)

2.6 Social-Ecological Model (SEM)

The SEM (McLeroy et al., 1988) suggests people's behaviour is not merely influenced by intrapersonal characteristics but also by various social factors. Hence, this model is particularly relevant to this thesis in the context of both individualisation and the workplace. The SEM has four different levels: 1) intrapersonal, which refers to the characteristics of an individual that influence behaviour change, such as attitude, knowledge and expectations. 2) interpersonal community, which refers to social networks such as family, friends, co-workers, shared identities and relationships that may impact behaviour. 3) organisational, which refers to the rules, regulation and strategies that may promote or endanger employees health. 4) policy/environment, which refers to the policies, advocacy and environmental structures that impact employees health and wellbeing (McLeroy et al., 1988).

The SEM helps identify opportunities to promote PA, health and wellbeing of individuals or groups, determining various factors that may impact (Metzler et al., 2013). According to the WHO (1984), health, behaviour and PA participation can increase if the environment and policies support healthy choices and educate employees regarding healthier choices. Besides, research suggests that the possibility of health and behaviour change interventions are more likely to be successful when multiple factors are considered (Golden et al., 2015; Metzler et al., 2013). Furthermore, utilising the SEM as a framework for PA, health and wellbeing interventions in the workplace is needed to consider individual, environmental and policy

factors (Stokols, 1992). Previous research examined different workplaces in the context of policies/environment. It concluded that employees had different perceptions of how the workplace environment and policies impacted their health and wellbeing (Ettner and Grzywacz, 2001; Sallis et al., 2015).

Universities are multidimensional in structures and environmental contexts (i.e. job roles, policies, economic and stakeholders). Therefore, the SEM is also an appropriate theory for this thesis, as it considers individual and environmental factors. Moreover, employees physical and mental health is connected to the type of work they carry out daily. However, the complex connection between employees and environmental policies has yet to be explored. Previous research has mainly focused on individual-based interventions related to PA, health and wellbeing (Essiet et al., 2017; Golden and Earp, 2012; Golden et al., 2015).

2.7 Summary of the models underpinning this thesis

There are several diverse theoretical behaviour change models. However, as discussed above, the three models underpinning this thesis are TTM, SDT and SEM. The utilisation of multiple theoretical models follows previous research in the field as suggested; integrating different theoretical models leads to multifaceted interventions that aid in designing and merging theoretical knowledge across disciplines (Buchan et al., 2012; Landry and Sdmon, 2002; Mullan and Markland, 1997). The mixture of theoretical frameworks is reported to be beneficial compared to those that only used a single theoretical model. Multi-theories can acknowledge discrepancies in individuals, groups and organisational factors (Johnson et al., 2008; Montano and Kasprzyk, 2015). Studies underpinned by different theoretical models are recognised to be effective and contribute to each model and increase overall strength by gaining an unique insight (Glanz, 2008). Nevill (2014) noted that PA, health and wellbeing interventions are effective when researchers recognise the factors that change individuals' behaviour. Hence, this is not viewed as a single factor. Behaviour change can be evaluated through theoretical models. It helps facilitate what works and what does not work across the different context of peoples' behaviour (Nevill, 2014). Therefore, applying diverse theoretical models is imperative in this thesis due to the nature of different studies in this thesis.

Targeting university employees across job roles and exploring current PA levels, sedentary behaviour and barriers to PA, health and wellbeing interventions according to the theoretical models are essential. Previous research suggested that future interventions must be tailored to participants needs and choices (George et al., 2014). Besides, research is required to

explain the impact of PA, health and wellbeing interventions in the university setting because of the heterogeneity and broader impact of this setting in society nationally and internationally (Gilson et al., 2007; Morgan et al., 2009; Prosser et al., 2007). Thus, the combination of models have been selected for this thesis as research suggests that applying multiple theories provide a pragmatic integration of each theory and in turn leads to a holistic understanding of each theoretical model (Webb et al., 2010). The combination of theories will yield better results in PA, sedentary and health behaviours interventions compared to utilising individual theory (Nigg et al., 2002).

Chapter 3.0 Methodological approach

3.1 Introduction

This chapter provides an insight into the methodological approach taken in this thesis. This includes the philosophical position, research design: the exploratory sequential design and research approaches of this thesis.

3.2 The philosophical position

This thesis is designed from pragmatic ontological perceptions. Pragmatism recognises various philosophical approaches that can help understand the world (Ihuah and Eaton, 2013). Pragmatism is based on the belief that a single method cannot provide an exclusive representation. Several realities can be observed from a combined range of philosophical positions (Creswell, 2014; Saunders et al., 2012). It is recommended that the most crucial factor of a philosophical position is that it can be constructed based on the research questions (Creswell and Clark, 2011). Therefore, in this thesis, the epistemological position is mixed between positivism and interpretivism (Carson et al., 2001; Levy, 2006). Hence, the subsequent methodological approaches adopted are quantitative, qualitative, or mixed methods depending on the thesis's unique study and intervention. In a positivist approach, the confirmations of hypothesis or theories are deductive as a process (Creswell, 2013; Denzin and Lincoln, 2017). Deductive reasoning is based on evidence of taking the present information to predict new research outcomes (Denzin and Lincoln, 2017). Positivist research has the potential of taking numerical figures as a universal truth because of their fundamental beliefs in neutral realism (Harvey and Land, 2016; Polit and Beck, 2004). Whereas, the interpretivism approach regards reality as formed and established based on participants experiences sharing social spaces (Moon and Blackman, 2015). Interpretivism believes that the truth can be examined through a multiplicity of structured realities (Johnson and Onwuegbuzie, 2004). For example, a subjective description can be applied to a shared setting's flexible process (Harvey and Land, 2016; Polit and Beck, 2004). Interpretivism is linked with qualitative research, and the generation of theories is usually indicated in the process (Howell, 2013).

Previous research has reported that a single methodological approach is not ideal, as some questions, in the overarching research, may require the combination of methods, known as

the mixed-methods approach (Creswell, 2009; Creswell et al., 2011; Saunders et al., 2009; Teddlie and Tashakkori, 2003). The objectives of evolving mixed-methods include various methods for data collection such as triangulation, complementary, development, initiation, corroboration and expansion of the data (Greene et al., 1989). Triangulation consists of practice such as observing things in multiple perceptions (Denscombe, 2014). The underlying principle of viewing something from multiple insights can provide a better insight to understand the phenomena under research (Creswell and Plano Clark 2011). Understanding things from a range of perceptive can improve accuracy and provide an inclusive image of topics under investigation (Denscombe, 2010). The additional aim of mixed-methods is complementary, which aims to elaborate, clarify and improve findings of one way or another (Creswell, 2014; Greene et al., 1989). The purpose of 'corroboration expansion' applies numerous means to highlight the extent and complexity of the subjects under-researched (Greene et al., 1989). Applying expansion in mixed-methods is beneficial because it integrates a range of study (Gray, 2013). For instance, PA levels can be assessed using quantitative approach whilst qualitative methods can explore participants perception of PA engagement. The clarification or development uses the outcomes of one method to develop another (Gray, 2013). This method starts with a quantitative phase and follows by qualitative especially when the depth of understanding is required (Creswell, 2014). Therefore, in this instance, the mixed-methods approach has been adopted to exploit the potential to observe each method's effectiveness differently and accurately (Brannen and Moss, 2012; Emadian and Thompson, 2017; Martin Ginis et al., 2017). The mixed-methods approach increases the strength and reduces weaknesses of paradigms in qualitative and quantitative research when used in isolation (Clarke, 2013; Johnson and Onwuegbuzie, 2004). This thesis's methodological approaches were guided by each study's aims and objectives to ensure that the most valid, reliable and feasible method was applied for the research questions. The subsequent section briefly discusses the research questions and how methodological approaches were dictated for each of the studies and interventions within this thesis:

Study 1: The research questions in this study were typically positivistic (e.g., do university employees meet the recommended PA guideline and how much time they spend sedentary). Thus, quantitative numerical data were required and subsequently collected via questionnaires to evaluate the current PA levels and time spent sedentary.

Study 2: The research questions in this study were also typically positivistic (e.g., how much time university employees spend being active and sitting across the week). The numerical data in this study was collected via objectively monitoring employees for a whole week using

an accelerometer, and participants retrospectively completed the same questionnaire as in study 1.

Study 3: Despite the lean towards positivism in study 1 and 2, the interpretivist approach was needed for study 3 as dictated by the research question (e.g., the barriers and facilitators of participating in PA). The qualitative approach was required because insight into the participants feelings, beliefs and attitudes were needed in a way that would not have been possible to collect numerically (Doody et al., 2013; Hill-Mey et al., 2013).

Interventions: PA, sedentary behaviour, health and wellbeing interventions were designed and evaluated in this study. The mixed-methods approach was used for interventions to evaluate the impact of each applied intervention on PA, sedentary behaviour, health and wellbeing. Moreover, some lived experience of the interventions required exploring through qualitative approaches, and some variables needed measuring objectively (e.g. step counts).

3.3 Research design: The exploratory sequential design

This thesis applied the exploratory sequential design. In this design, studies are conducted in different stages (Creswell and Clark, 2018). The current thesis started with quantitative studies followed by a qualitative approach in study 3, which then informed mixed-methods interventions. Figure 4 shows the research design of this thesis diagrammatically.

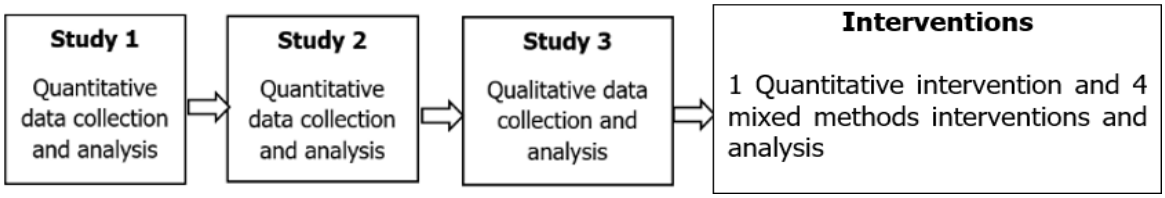

Figure 4. Exploratory sequential design of this thesis (adapted from Creswell and Clark, 2018)

Applying the cross-sectional design provides a better insight into the study. It focuses on collecting one type of data at a time, making it accessible to describe, implement and report (Creswell and Clark, 2018). This design allows the complexities of the phenomenon in this thesis. The purpose of this exploratory sequential design was that each study's results informed the next, which becomes particularly important when there was a need to develop and test interventions (Creswell et al., 2004; Greene et al., 1989). This thesis's methodology remains consistent throughout with variance to distinguish between each study's aims and objectives. The length of data collection and the number of participants within each study

varied depending on the studies aims and objectives and outlined in each study methods chapter. The cross-sectional design was used for quantitative and qualitative studies. The results from both approaches were analysed, synthesised and interpreted according to the aims and objectives of studies and interventions. The quantitative and qualitative data were equally essential in this thesis. Shared data collected via different approaches provide better insight for accuracy and illustration purposes because it works effectively and allow to observe views differently (Brannen and Moss, 2012; Cook and Silverman, 2013). The subsequent section details the research approach of this thesis.

3.4 Research approaches of the thesis

Two quantitative studies were conducted as the baseline. The methods, participants recruitment, ethical approval and procedure of study one is explored in section 4.5 and for study two these are detailed in section 5.3. This was followed by a qualitative study and the methods and procedures used are discussed in section 6.3. This study informed the development and implementation of five PA, sedentary behaviour, health and wellbeing interventions in the university setting. The four interventions followed a mixed-methods approach as explored in sections 7.4; 8.3; 10.3; 11.3 and one intervention followed a quantitative approach as explored in section 9.3. Adopting a quantitative approach explores how much PA is happening, whereas the qualitative approach provides the justifications of the aforementioned numerical data which provide a better insight of the issues being researched. As briefly aforementioned studies of this thesis were quantitative, qualitative and mixed but the overarching approach of the thesis is adopting the pragmatism approach and the reflection of a mixed-methods Ph.D. overall. A mixed-methods approach is influential and accurate in developing better dialogues to gather the most reliable information (Smith et al., 2017). The following section explores the baseline study 1 of this thesis. It begins with an introduction, a detailed literature review, methods, results, discussion and conclusion.

Chapter 4.0

Study 1. The evaluation of PA levels and sedentary behaviour of university employees

4.1 Introduction

Historically, physical demands such as walking, farming, hunting, toolmaking, and household chores were part of daily routines (Engbers et al., 2005). However, with the transition into a post-industrial society and the growth of technology in the workplace and at home, there has been a considerable decline in PA levels in more recent decades (Engbers et al., 2005). A large body of research shows that PA engagement has reduced and sedentary behaviour has increased at work and home (Choi et al., 2010; Kerr et al., 2001; Lakdawalla and Philipson, 2007; Levy and Murnane, 2003). Moreover, adults spending around 60% of their daily waking time at work and the time they spent sedentary differs between working and non-working days (Waters et al., 2016). Research shows that employees spend around 77% of their waking time being sedentary in a typical working day compared to 70% in non-working days (Waters et al., 2016). Studies from Australia, Scotland, and Sweden concluded that employees spend around 66-82% of their sedentary working hours (Parry and Straker, 2013; Ryan et al., 2011; Thorp et al., 2012). Physical inactivity presents various morbidity issues, including cardiovascular diseases such as heart disease, obesity, blood pressure, diabetes, and the benefits of PA are well-known, reducing the risk of chronic diseases including diabetes, obesity, stroke, anxiety and depression(Awick et al., 2017; Cooper and Barton, 2016; Kelley et al., 2018; Lachman et al., 2018; Rebar et al., 2015; Shih et al., 2018).

These are essential considerations that need to be measured as a society as these factors may have a subsequent effect on the workforce and economy. Upon reviewing the existing literature, it is has become apparent that the workplace PA, health and wellbeing is an under-researched area. The subsequent sections provide a detailed literature review for this study.

4.2 Workplace PA - Literature review

The focus on PA, sedentary behaviour, health, and employees wellbeing is becoming a recognised issue across settings. According to Redeker et al. (2019), organisations' efforts to encourage PA participation to reduce absenteeism and improve life quality. Workplaces

supporting employees to engage in PA have shown to have long-term positive behaviour change, improved health, and increased work productivity (Leininger et al., 2015b).

Previous research showed that an average organisation with 250 employees is estimated to lose approximately £250,000 yearly due to sickness absence (Wills and Linneker, 2012). The sickness absence cost to organisations and the overall economy demonstrates that it is important to start focusing on reducing prolonged sedentary behaviour and increasing PA, which might improve employees overall physical and mental health (Coffey et al., 2014). Studies across work settings concluded that improving PA and reducing sedentary behaviours are important for employees health and reducing absenteeism (Freak-Poli et al., 2014; Graves et al., 2015; Puig-Ribera et al., 2015; Stephens et al., 2014; Thomley et al., 2011). Despite studies emphasising the importance of improving PA and overcoming sedentary behaviour in the workplace, it is yet to be established for the amount of time staff spend either physically active or sedentary in a typical working week. Previous research failed to determine baseline data about the current PA levels and sedentary behaviour of employees. Research indicated the focus of existing studies was to promote PA without understanding the current PA levels of participants; thus, their interventions failed to continue, which shows a gap in the literature (Proper and van Mechelen, 2008).

Studies have also acknowledged the importance of improving PA and overcoming sedentary behaviour on employees health, wellbeing and absenteeism in the workplace (Graves et al., 2015; Stephens et al., 2014). However, predominant existing research on PA has failed to recommend the types of approaches required in achieving these factors; thus, there is paucity in the existing literature that may apply to employees and working settings. For instance, staff in a sedentary environment might be spending less time being active than those whose job may involve physical effort. Therefore, assessing the current PA levels, sedentary behaviour, and the heterogeneity of job roles and gender are important factors to be considered. The research has suggested that well-designed studies to evaluate employees current PA levels and sedentary behaviour are needed before organising further PA and health-related interventions in the workplace (Malik et al., 2014). This study attempts to overcome the literature gap by collecting baseline data of the current PA levels and sedentary behaviour of university employees before making intervention suggestions.

4.3 PA in the Higher Education workplace

Focusing on university employees PA and health might lead to a healthier community that will not merely contribute to the absence of diseases but also improve how well employees can flourish (Dooris et al., 2017). PA and health promotions are relatively new areas of research interest in university settings. Few universities have combined PA and health programmes; this varies across countries and universities because there are cultural differences concerning PA, sedentary behaviour, and health worldwide (Suárez-Reyes and Van den Broucke, 2016). Indeed, universities worldwide are showing an interest in employees PA and overcoming sedentary time. However, PA, sedentary behaviours, and this population's health remain poorly documented (Suárez-Reyes and Van den Broucke, 2016).

Despite the poorly documented approaches, existing studies have limitations such as PA and sedentary behaviour being predominantly measured via self-reported questionnaires, with the validity and reliability of methods not being provided (Becerra Heraud, 2013; Muñoz and Cabieses, 2008; Sirakamon et al., 2017; Suárez-Reyes and Van den Broucke, 2016). A further limitation is that studies concluded that university employees must participate in interventions, but baseline data, definition and explanations of what they meant by workplace interventions were missing (Fountaine et al., 2014). A study by Finkelstein et al. (2012) aimed to assess university employees daily steps in working and non-working days. The results showed that university staff did not meet the recommended PA guideline in either working or non-working days. The actual steps were taken on a non-working day, and the recommended daily steps guideline that was adapted in the study of Finkelstein et al. (2012) were not reported.

A mixed-methods study by Copper and Barton (2015) in the UK involved two questionnaires; a short form of the International Physical Activity Questionnaire (IPAQ), a stage of change questionnaire, and focus group interviews. This study measured a range of factors, including PA levels and the wellbeing of university employees. The findings revealed that 42% of the university population failed to meet the WHO (2020) recommended that PA guidelines and females were less active than males. Findings also showed that academic staff were less active compared to the support staff. The actual value of the differences and reasons behind this were not reported—the data of both applied questionnaires contrasted in terms of PA levels of employees meeting the guidelines. The change questionnaire stage reported that 58% of participants met the PA guideline, whereas IPAQ reported 77% (Cooper and Barton, 2015). The two assumptions provided for the contrast were that all staff members participated in a change questionnaire stage, and only 62% completed the IPAQ. Secondly, it is possible that

participants who have completed the IPAQ over-reported their PA levels (Cooper and Barton, 2015). This study did not provide the validity and reliability of the methods used. The authors assumed that participants might have over-reported PA levels despite not meeting the recommended PA guidelines.

Butler et al. (2015) assessed PA (i.e., steps) and university employees health. They revealed that obese staff spent less time being active compared to overweight and individuals with a healthy range. This study's limitations were that employees across job roles were classified as homogenous, and only a few male staff members participated. However, this study would have offered better insight into the under-researched population if employees were categorised and analysis were provided per job roles, such as the similarities and differences between academic, IT, receptionists, estates and support staff. Tapps et al. (2016) evaluated university employees interest in PA and a healthy lifestyle. The results indicated that 30.4% of participants reported being members of the fitness club, and 25.3% were frequently or very frequently active in the workplace (Tapps et al., 2016). This study also had limitations such as the differences between 'frequently and very frequently active' employees were not provided or how PA levels varied across members of the fitness clubs and those not being members. An additional limitation of this study was that data collected through an online survey, and the questionnaire was reworded. Rewording an existing questionnaire can change the integrity, validity and reliability of the actual method, and hence the results must be viewed with caution. The research suggested that changing the existing questionnaires can change the whole meaning of methods. A pre-test is essential to ensure questions work as intended and is understood by those who are likely to respond to them, which was not the case in Tapps et al. (2016) study (Dikilitaş and Griffiths, 2017; Hilton, 2017; Wanner et al., 2017).

Lindsay et al. (2016) conducted a cross-sectional analysis of university employees PA levels and sedentary behaviour. Participants have split accordingly, comprising of academics 32.7% and professional staff 67.3%, with 29.4% male and 70.6% female. The findings indicated that PA levels of both academics and professional staff were significantly lower, whereas sedentary behaviour was significantly higher. The findings displayed that male employees were spending more time being active compared to females. Lindsay et al. (2016) concluded that PA is decreasing, and sedentary behaviour is rapidly increasing within HEI setting due to the enhancement of technology and staff workloads.

Most of the university setting research has predominantly focused on academics, Faculty and professional staff (Newton et al., 2016). However, universities employ a range of other job roles, including campus services (Estates) and housekeeping employees, whose PA levels are less well-understood (Das et al., 2016; Gaalema et al., 2017; Stringhini et al., 2017; Venn and Strazdins, 2017). This shows a gap in the literature as previous research has not captured the growing diverse population in terms of job roles in this environment. Evaluating, comparing, or contrasting PA levels and time spent sitting amongst this population per job roles and gender is essential (Das et al., 2016). Das et al. (2016) were the first to examine the housekeepers' PA levels within the university setting. The questionnaire findings showed that most of the participants met the PA guideline, and the majority of those interviewed believed to be acquiring enough PA because of their job demands. Therefore, research is needed to evaluate and compare PA levels and sedentary behaviour across gender and job roles within the broader university environment.

Previous research has failed to highlight what proportion of employees within a university context engages in PA and how this differs across job roles, gender and location. Thus, future research is necessary to understand the current PA levels and time spend sedentary. Therefore, it is important to evaluate how gender, job role, and different departments play a role in how much time employees spend engaging in PA and sedentary behaviour.

4.4 Study aim and objectives

This study aimed to evaluate PA levels and sedentary behaviour of university employees. This study also sought to document the different types of PA such as walking, moderate or vigorous intensity employees participated in and how much PA was undertaken at work and outside of the workplace.

4.5 Methods

This study was conducted on employees at the second largest of five universities in Birmingham, based in West Midlands, England. At the time of the study, the university had 2143 employees, split across three main campuses known as City Centre, City South, and City North, with additional locations across the city, such as the Jewellery Quarter. This university consists of four faculties: (a) Arts, Design, and Media (ADM); (b) Business, Law, and Social

Sciences (BLSS); (c) Computing, Engineering, and the Built Environment (CEBE), and; (d) Health, Education and Life Sciences (HELS).

Regarding the methods used in this study, there are various direct and indirect subjective and objective measures of PA and sedentary behaviour, and each method has advantages and disadvantages. Subjective measurement includes questionnaires, logbooks and interviews. These self–reported measures are commonly used in assessing PA levels and sedentary behaviour because they are easy and cost-effective (Brannen and Moss, 2012; Smith et al., 2017). The widely used self–reporting measure of PA and sedentary behaviour is the IPAQ (Cleland et al., 2014; Lai, 2018; Ryan et al., 2018). The IPAQ consists of short and long forms (IPAQ-LF). The former measures PA's duration and intensity across four dimensions; vigorous, moderate exercise, walking and sitting time (Craig et al., 2003; Lai, 2018). Whereas the latter consists of five domains:

1. Job-related PA measures the type of PA participants conducted as part of their work. In this domain, participants are asked to report days, hours and minutes they have engaged in a vigorous type of PA (i.e. too breathless to hold a conversation whilst performing an activity), moderate (i.e. increased breathing and heart rate, but an individual is able to hold a conversation), and walking type of activities as part of their work in the last seven days (Craig et al., 2003).

2. Transportation-PA, this domain collects data in days, hours and minutes related to an individual's transportation, such as travelling from place to place, including work, stores and movies. This domain asks how the travel was conducted (e.g. motor vehicles such as train, bus, bicycle, car or walking) in the last seven days (Craig et al., 2003).

3. Housework, house maintenance and caring for family, ask about PA conducted at home such as housework, gardening, general maintenance work and caring for the family. In this domain, participants are required to report activities conducted at either vigorous or moderate level such as heavy lifting, chopping wood, shovelling snow or digging in the garden yard in the last seven days (Craig et al., 2003).

4. Recreation, sport and leisure-time PA asks about activities that participants engaged exclusively as part of the recreation, sport, exercise or leisure purposes. Participants are required to report activities such as walking, vigorous exercise (i.e. running or fast

cycling) and moderate exercise (i.e. cycling or swimming at a regular pace) in hours and minutes in the last seven days (Craig et al., 2003).

5. Time spent sitting asks about the time individuals spent a sedentary while at work, home, doing course work, or leisure. This includes time spent sitting at a desk, reading, sitting, or lying down (i.e. watching television) (Craig et al., 2003).

The IPAQ is the most valid and reliable questionnaire with concurrent validity between the short and extended versions showing a moderate to substantial positive relationship range of 0.45 to 0.65 (Bull et al., 2009). Previous research has confirmed the validity and reliability of this instrument for measuring PA levels and sedentary behaviour in various settings and countries (Herrmann et al., 2013; Mathews et al., 2016; Wanner et al., 2017). The IPAQ-LF was deemed the most appropriate tool for this study because it provides information on five domains that comprehensively collect baseline data on time spent being active and sedentary throughout the seven days. The validity and reliability of the IPAQ-LF have been investigated in 12 different countries with more than 2000 participants in three periods, with the repeatable data showing the agreement between each time data when compared reported be Spearman's r = 0.81 (Craig et al., 2003; Hagströmer et al., 2008; Rosenberg et al., 2008). Moreover, studies across setting and countries concluded that IPAQ-LF is the most acceptable method to measure PA levels and time spent sitting in the adult population (Polito et al., 2016; Päivärinne et al., 2019; Wibowo et al., 2019; Zafiropoulos et al., 2019).

4.5.1 Participant recruitment

Participants were recruited via an email sent to all 2143 employees inviting them to participate in this research. The email contained all the information, including the study's purpose, how the data would be collected and an online questionnaire link for employees to complete if they agreed to participate. The online survey link was closed after one month of the data collection. Tables 2, 3, and 4 provide breakdowns of participants by gender, Faculty and job roles.

Table 2. The breakdown of participants in numbers and percentages by gender

Total population numbers	Participants who responded	Females	Male
2143	400	269	131
	19%	67%	33%

Table 3. The breakdown of participants according to Faculty in numbers and percentages

Faculties	ADM	BLSS	CEBE	HELS	Other
Total employees	270	317	268	603	685
Total participants responded	60	30	40	148	122
	22%	9%	15%	25%	18%
Female participants	34	27	22	107	76
	57%	90%	55%	72%	62%
Male participants	26	3	18	41	46
	43%	10%	45%	28%	38%

Table 4. The breakdown of participants according to job roles in numbers and percentages

Job roles	Number of participants	Females	Males
Academics	190	124	66
		65%	35%
Academic services	98	65	33
		66%	34%
Marketing and Communication	34	28	6
		82%	18%
Library staff	35	20	15
		57%	43%
Estate staff	20	14	6
		70%	30%
IT staff	23	18	5
		78%	22%

4.5.2 Ethical Approval

After attaining the access permission from the head or manager of each Faculty and department to approach their respective staff (see appendix 1 request for access permission

and appendix 2 access permission granted). Then the ethical approval was gained from the BCU Faculty Academic Ethics Committee (FAEC) (see Appendix 3 for the ethics certificate for the first three studies). The confidentiality and right to withdraw were clearly explained to participants before the data collection.

4.5.3 Participant's Informed Consent

The information sheet and consent form were sent to employees via email (see Appendix 4). Participants signed and returned the consent form and then an online link for the questionnaire was emailed to them for completion (see Appendix 5). Participants were asked at the end of the online survey if they would like to participate in this research's future studies by providing their name and work email address if they wish to be contacted in the future.

4.5.4 Procedure

All responses to the duration provided in the online IPAQ-LF were converted from hours into minutes as per the IPAQ-LF guideline (e.g. if the value of two hours were reported that were converted into 120 minutes for analysis purpose as per IPAQ-LF guideline). The data were categorised per the IPAQ-LF guideline of each domain, including job-related PA, transportation-PA, housework, house maintenance, and caring for family, recreation, sport and leisure-time PA and time spent sitting.

Participant's time spent engaged in moderate or vigorous activities across all domains were combined as MVPA, as per the IPAQ-LF guidelines and analysed as MVPA. Time spent in walking activities and sitting were also analysed and reported as a separate category as per the IPAQ-LF guideline.

4.5.5 Statistical Analysis

Data were analysed via the international business machines (IBM) statistical package for the social sciences (SPSS) software Version 24. Data were analysed using descriptive statistics of the median and interquartile range (IQR) for gender and job roles. A Shapiro-Wilk test was used to determine normality for gender and job roles' total MVPA, work MVPA, transportation MVPA, leisure MVPA, domestic and yard MVPA and time spent sitting in minutes. The descriptive statistics of MVPA across all domains are presented in Table 5. The data between genders were not normally distributed across all domains as determined by the Shapiro-Wilk test ($p < 0.001$). A non-parametric Man-Whitney U test was conducted to determine if any

significant differences between gender and the Kruskal-Wallis H test were conducted to determine if there were significant differences between PA levels and PA levels sedentary behaviour. For all statistical analysis, the level of significance was set at $p < 0.05$.

4.6 Results

Table 5. The descriptive statistics and statistical differences between MVPA in all domains of IPAQ-LF in minutes throughout the week

	Total	**Male**	**Female**	
Components	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	*Inferential Statistics*
Total MVPA (mins)	330 *(449)*	450 *(500)*	300 *(385)*	*U* = 13,421.000, z = -3.870, *p* <0.001*
Work MVPA (mins)	0.0 *(50)*	*0.0 (60)*	0.0 *(43)*	*U* = 17,563.000, z = -0.060, *p* = 0.952
Transportation MVPA (mins)	0.0 *(0)*	0.0 *(60)*	0.0 *(0.0)*	*U* = 14,171.500 z = -5.045, *p* <0.001*
Leisure Time MVPA (mins)	50 *(200)*	120 *(240)*	20 *(180)*	*U* = 14,326.500 z = -3.159, *p* = 0.002*
Domestic and garden activity (mins)	120 *(254)*	130 *(260)*	110 *(240)*	*U* = 16,300.500, z = -1.222, *p* = 0.222
Total Sedentary behaviour (mins)	2880 *(1785)*	2520 *(1740)*	2940 *(1785)*	*U* = 19,115.000 z = 1.378, *p* = 0.168

** Statistically significant at 0.05 level*

The inferential statistics demonstrated a significant difference between genders, with males spending more time in total MVPA (mean rank = 232.55 mins) than females (mean rank = 184.89). In addition, significant differences evident in transportation MVPA between males (mean rank = 226.82) and females (mean rank = 187.68) and a significant difference was also observed in the leisure domain, with males spending more time engaging in leisure time MVPA (mean rank = 225.64) than females (mean rank = 188.26). There were no significant differences ($P > 0.05$) in any other domains between genders PA behaviours.

Table 6. The descriptive statistics and statistical differences between walking domains of IPAQ-LF in minutes throughout the week.

	Total	***Male***	***Female***	
Components	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	*Inferential Statistics*
Total time walking (mins)	290 *(330)*	300 *(370)*	280 *(300)*	U = 16,571.500, z = - 0.966, p = 0.334
Work time walking (mins)	0.0 *(90)*	15 *(120)*	0.0 *(60)*	U = 15,987.500, z = - 1.613, p = 0.107
Transportation time walking (mins)	110 *(155)*	125 *(165)*	100 *(160)*	U = 16,340.000, z = - 1.183, p = 0.237
Leisure time walking (mins)	90 *(160)*	90 *(160)*	80 *(165)*	U = 17,048.000, z = - 0.531, p = 0.595

There were no significant differences in any domains of walking between genders, as explored in Table 6. The descriptive statistics for work and transportation MVPA were zero, but IQR differs between job roles. The highest median within work MVPA was observed in the IT staff, and the lowest being estate staff. The median showed that estate staff were spending most of their weekly time sitting, followed by library staff as detailed in Table 7.

Table 7. The descriptive statistics and statistical differences across all domains of IPAQ-LF between job roles

	Academics	Academic services	Marketing & Communication	Library	Estate	IT	
Components	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	*Inferential Statistics*
Total MVPA (mins)	330 *(443)*	333 *(495)*	325 *(271)*	360 *(450)*	363 *(405)*	300 (360)	χ^2 (5) = 2.212, *p = 0.819*
Work MVPA (mins)	0.0 (50)	0.0 (38)	0.0 (63)	0.0 (45)	0.0 (23)	0.0 (120)	χ^2 (5) = 2.067, *p = 0.840*
Transportation MVPA (mins)	0.0 (0)	0.0 (0)	0.0 (5)	0.0 (0)	0.0 (0)	0.0 (120)	χ^2 (5) = 4.415, *p = 0.529*
Leisure MVPA (mins)	60 (203)	60 (240)	43 (191)	100 (240)	0.0 (38)	0.0 (65)	χ^2 (5) = 13.394, *p= 0.020**
Domestic & garden MVPA (mins)	120 (233)	95 (224)	90 (210)	150 (255)	270 (368)	120 (270)	χ^2 (5) = 7.280, *p = 0.201*
Total Sitting time (mins)	2880 (1680)	2745 (1673)	2850 (2205)	2940 (2580)	3480 (2490)	2430 (1800)	χ^2 (5) = 2.920, *p = 0.712*

There was a significant difference in the leisure category MVPA between job roles; consequently, a pairwise comparison, using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons, was utilised to determine where the differences were. The post - hoc analysis revealed no significant differences in leisure times MVPA between job roles. There were also no significant differences in any other domains or job roles for PA or sedentary behaviours.

The median of university employees across job roles shows that marketing and communication staff spent most of their time engaged in work-related walking, followed by academics. In contrast, marketing and communication staff shows to be engaging in transportation-related

walking compared to other employees. However, there were no significant differences in any components of walking across job roles, as showed in Table 8.

Table 8. The descriptive statistics and statistical differences of Walking time in minutes across all domains of IPAQ between job roles

Job roles	Academics	Academic services	Marketing & communication	Library	Estate	IT	
Components	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	Median *(IQR)*	*Inferential Statistics*
Total time walking (mins)	300 *(320)*	288 *(303)*	365 *(493)*	260 *(280)*	215 *(495)*	165 *(475)*	χ^2 (5) = 6.124, *p = 0.294*
Work time walking (mins)	10 *(90)*	0.0 *(76)*	18 *(105)*	0.0 *(80)*	5 *(143)*	0.0 *(90)*	χ^2 (5) = 1.265, *p = 0.938*
Transportation time walking (mins)	120 *(151)*	100 *(158)*	135 *(229)*	100 *(140)*	120 *(158)*	60 *(100)*	χ^2 (5) = 8.822, *p = 0.116*
Leisure time walking (mins)	78 *(160)*	90 *(180)*	120 *(146)*	80 *(220)*	35 *(173)*	60 *(180)*	χ^2 (5) = 4.314, *p = 0.505*

4.7 Discussion

The primary purpose of this study was to evaluate the PA levels and sedentary behaviour of university employees. This study aimed to compare the PA levels and sedentary behaviour between genders and job roles to determine if it influenced PA levels recorded. Findings show this population spent an average of 330 minutes engaged in total MVPA throughout the week. Compared to the WHO (2019) PA guidelines of 150 -300 minutes, participants exceeded the minimum suggested guidelines. This finding shows a mixture of PA that includes all four categories of the IPAQ-LF without distinguishing between the workplace and across other domains of the IPAQ-LF. Thus, in spite of the higher levels of PA, employees are spending around 77% of their daily working time inactive in the workplace (Thorp et al., 2012). Therefore, it is understandable that the typical workplace may be limiting towards PA because

of the decreasing amount of PA being conducted. Previous research have recommended that the prolonged sedentary behaviour and the absence of PA prospects in the workplace could have contrary effects on mental health and wellbeing (Ma, Ma, Wang, & Kim, 2020; Zhu et al., 2020).

Interestingly, when one considers the time solely spent engaging in MVPA within the workplace, this was reported to be a median of zero minutes across the week. The most common PA conducted at work was walking, which is considered a light form of exercise. As a result, there appears to be a distinct lack of MVPA being conducted within this sample of employees, which arguably represent the wider workforce. Additionally, participants exceeding the recommended guidelines may indicate that the data is skewed by high levels of MVPA in a small number of participants, as demonstrated by a median of zero. Therefore, it is clear that most employees conduct very little or no work-related MVPA at all. One possible explanation for the lower level of PA could be likely to the requirement of university employment being predominantly sedentary-based roles (e.g., working at a desk), which results in MVPA not being a functional requirement (Fountaine et al., 2014). Despite the higher levels of total MVPA, employees also reported being spending 2880 minutes of their weekly time being sedentary. This aligns with previous research suggesting that approximately 77% of workers daily working time is spent inactive in the workplace (McCrady and Levine, 2009; Thorp et al., 2012; Fountaine et al., 2014). It is evident that the typical workplace may be restrictive toward PA due to the diminishing amount of PA being conducted throughout the week. This can have important implications for employees health and wellbeing. Previous research has suggested that the lack of PA opportunities in the workplace could have adverse effects on mental health and wellbeing (Wang et al., 2020; Zhu et al., 2020). In addition, if the working environment provides opportunities for PA engagement, this may yield more facilitative results in terms of employees health and wellbeing. Thus, the key stakeholders need to consider how universities can support their employees to obtain greater PA levels and reduced sitting time during their working hours.

The differences between genders demonstrated that male participants were spending more time engaging in total MVPA and total work PA compared to females. Current findings align with previous research, suggesting that males are more active than females (Guthold et al., 2018; Olney et al., 2018; Page et al., 2009). The difference for MVPA between genders could result from gender choices when engaging in activities that may involve high-intensity exercise. The interaction between gender and culture could have also affected the total MVPA results, which this study did not consider. For instance, historically, females have engaged in

lower levels of PA, with women from ethnic minority groups generally engaging in even lower levels, which could explain the difference observed in this study (Lindsay et al., 2016; Guthold et al., 2016; Olney et al., 2018). Previous research also suggested that social support within the workplace, such as a walking group, was highly valued by female employees (Morris et al., 2019). However, the outcome of this study suggests that males and females are the least active at work. These findings are aligned with previous literature (Alkhajah et al., 2012; Chau et al., 2013; Thivel et al., 2018)—as such, considering a gender-specific approach encouraging greater PA levels at work may be a more fruitful approach rather than implementing solitary interventions.

This finding also suggests that this population engaged in 290 minutes of total walking through all IPAQ-LF domains, with males spending more time engaged in walking than females. The findings determined that participants spent the least amount of time engaged in walking activities while at work as the median was zero compared to transportation and leisure-time walking. Additionally, this study's outcome also suggests that female employees spent 420 minutes more sedentary than males. The findings contrast with Nooijen et al. (2018), suggesting that males were more sedentary than female employees ($X^2 = 7.61$, $p < 0.01$). Female participants reporting higher sedentary time could be due to the number of employees who completed the IPAQ-LF being female and the number of female employees also being higher within each job roles, as explored in Tables 2 and 4. Therefore, employees must be encouraged to walk more whilst at work.

Regarding the job role, the IT staff recorded the lowest number of minutes for total MVPA, followed by Marketing & Communications and Administration Services. This may be an expected finding due to the nature of their role, whereby staff are required to spend the majority of their day at desks. The results also showed that university employees, regardless of their job role, engaged in a median of zero minutes at work and transportation-related MVPA compared to other IPAQ-LF components. This shows the scope for future research to investigate this population's PA levels in the workplace holistically. When focussing on the nature of the job role, it could be anecdotally predicted that estates staff would engage in a higher PA since their job requirements are considered more physically demanding. For example, previous research revealed that staff within maintenance roles, such as manual and physical labour, generally elicit higher PA levels than employees within the professional or administrative staff (Fountaine et al., 2014; Schofield et al., 2005; Steele and Mummery, 2003). However, in contrast with previous research, this study's findings revealed that estates staff also spent a comparable amount of active time to that of library and IT staff. Thus, these

results could reflect the desk-based responsibilities and the campus services by both library and IT staff.

The results between job roles illustrated that Marketing and Communication staff spent most of their time engaging in total walking, followed by academic staff throughout the week. The Marketing and Communication staff also spent most of their time walking whilst at work. The nature of Marketing and Communication staff involves cross-campus communications, venue scouting, and actively promoting university through events (e.g., open days, taster sessions). Thus, the increased amount of walking resulted in total work PA compared to other job roles is unsurprising. This study demonstrated that Marketing and Communication and Academic staff are more likely to conduct workplace PA than other university job roles. Further research is required to explore how different jobs roles are exposed to different PA types during working hours to ensure appropriate interventions are developed to match the needs of the diverse population within a university setting.

Regarding work-related MVPA, employees across job roles reported a median of zero. This suggests that workplaces are increasingly becoming more sedentary, resulting in the reduction of PA behaviour (McGuckin et al., 2017). The technology enhancement increased work demands, and policies requiring employees to be at their desk may contribute to the reduction of MVPA in the workplace. For example, research has demonstrated that the occupational structure from physical to machinery has already contributed to the decline in PA (Egbers et al., 2005). This is evident in the work-related MVPA when compared to the other IPAQ-LF domains examined in this study. The current findings support previous studies examining the PA levels across settings and reported that employees are spending the least amount of time engaging in PA at work (Ash, 2012; Chau et al., 2013; Chen and Cheng, 2016). Previous research recommended a goal-setting strategy for improving PA behaviour in the workplace, such as walking up and down the stairs and walking during a break (McGuckin et al., 2017). Indeed, PA levels could improve if the workplace provides additional flexibility and autonomy for employees to engage in more PA opportunities, which includes longer lunch break or multiple short breaks throughout the working day. If PA engagement opportunities are not provided, this could lead to further sedentary lifestyles in the workplace. A sedentary lifestyle is a well-known harmful factor for health, including enhanced risk of diabetes, poor mental health, increased mortality and reduced productivity (Gibson et al., 2017; Jang et al., 2012; Ma et al., 2017; Wibowo et al., 2019). Thus, future research is encouraged to explore the effectiveness of strategies for reducing sedentary behaviour and improving PA engagement; based on both genders and job role. Moreover, this study's findings contribute to the existing

literature through the evaluation of PA and sedentary behaviour across gender and job roles, as well as the smaller field of research explicitly focused on the university setting.

4.8 Limitations

The present study is not without limitations. First, the PA and sedentary behaviour were not directly measured. PA and sedentary behaviour were evaluated based on an online self-reported IPAQ-LF. The data collected via IPAQ-LF and this tool's use is every day, easy to complete and cost-effective to measure these behaviours. Despite the popularity, validity, and reliability of the IPAQ-LF, it is self-reported, and research shows that there is a possibility that participants either over/underestimate the amount of time they spent being active or sitting in a self-reported measurement (Adams et al., 2005; Bauman et al., 2009).

Moreover, the IPAQ-LF was a single assessment for data collection in this study. Indeed, previous studies have used IPAQ-LF alongside PA monitors such as accelerometer and stated that the bias might present within IPAQ-LF PA and sedentary behaviour data (Altamirano et al., 2018; O'Neill et al., 2017). Studies have also reported that IPAQ overestimates MVPA and underestimates time spent sitting (Gennuso et al., 2013; Ryan et al., 2018). Hence, results must be viewed with caution. Therefore, future research is required to confirm present findings and gain an insight into this population PA levels and sedentary behaviour across job roles through objective means, such as using an accelerometer, to evaluate differences between genders and job roles.

4.9 Conclusion

In contrast to the existing literature, this study found that university employees exceeded the recommended PA guidelines of 150-300 minutes across the week. However, it was revealed that employees spent the least amount of time being active in the workplace, which could negatively affect their health and wellbeing due to most of their time spent sitting. Nevertheless, gender differences were demonstrated, whereby male employees were significantly more active than females across the total MVPA and worked MVPA. Since employees were least active in the workplace, it could be suggested that workplace PA and health interventions could offer valuable outcomes. The self-reported methodology allowed insight into the differences reported across genders and job roles. Furthermore, this population found to be spending an increased amount of time being sedentary which could negatively affect their health and productivity. There is an indication that more research needs

to be conducted with university employees, evaluating their PA and sedentary behaviours through objective measurements such as accelerometers, to confirm and contrast the current self-reported results

Chapter 5.0

Study 2. A comparison of physical activity levels and sedentary behaviour amongst university employees through prospective and retrospective methods

5.1 Background

The benefits of engaging in regular PA and minimising sitting have been well recognised and detailed in section 1.3. In addition to health and wellbeing benefits, employees participating in regular PA can also benefit the organisation due to potential reduction in absenteeism, increased productivity and economic growth (Bouchard et al., 2012; Hall et al., 2015; Pereira et al., 2015; Reed et al., 2014). Therefore, research in such a field can contribute to better working environments, thus improving company growth and staff health and wellbeing.

Despite previous research related to adults PA levels and sedentary behaviour, objectively monitoring PA levels and time spent sitting of employees in an HEI context is scarce. As aforementioned, most previous research has utilised self-reported methods and recommended that future research objectively measure PA and sitting time. Research has also advocated that objective methods such as accelerometers are more valid and reliable for measuring PA levels and sedentary lifestyle due to providing accurate data compared to self-reported measure (Clemente et al., 2016; Corder et al., 2013; Sparling et al., 2015). For example, previous studies have compared accelerometer and self-reported measures and reported that accelerometers showed lower PA levels than self-reported measures where there was an over-estimation of the MVPA (Cradock et al., 2004; Peterson et al., 2015). Previous research has also utilised various accelerometer and IPAQ methods to evaluate PA levels and sedentary behaviour (Dubbert et al., 2004; Taraldsen et al., 2011; Sylvia et al., 2014; van der Ploeg et al., 2015). The commonly agreed reported conclusion was that using a combination of tools provide an accurate depiction of overall time, activities, intensity and sedentary behaviour (Dubbert et al., 2004; Taraldsen et al., 2011; Sylvia et al., 2014; van der Ploeg et al., 2015). Thus, to accurately measure time spent engaged in PA and sitting, it is crucial to use the combination of methods as it is more likely to overcome the individual weaknesses of using a single method (Brannen and Moss, 2012; Smith et al., 2017).

The accelerometer has been applied to overcome subjective measurement limitations and is widely utilised for PA and sedentary behaviours quantification (Broderick et al., 2014; Varela

Mato et al., 2017). Miyachi et al. (2015) objectively collected PA levels and sedentary behaviour data for 24 hours a day for a whole week, concluding that the accelerometer was the most suitable method for collecting PA levels and sitting times. The existing literature has emphasised the necessity for objectively monitoring PA levels and sedentary behaviour (Clemente et al., 2016; Sparling et al., 2015). There is also a need to combine methods for measuring PA levels and sitting time to provide better insight into the variances individuals provide in both objective and subjective instruments. For instance, using a combination of tools provides an accurate depiction of overall time, activities, intensity, and sedentary behaviour (Dubbert et al., 2004; Taraldsen et al., 2011; Sylvia et al., 2014; van der Ploeg et al., 2015). Thus, to accurately measure time spent engaged in PA and sitting, it is important to use the combination of methods as it is more likely to overcome the individual weaknesses of using a single method (Brannen and Moss, 2012; Smith et al., 2017). Indeed, a mixed-methods approach of objectively and subjectively measuring PA levels and sedentary behaviour specifically in university employees across gender and job roles is lacking, with previous research suggesting that high quality of studies within the workplace are needed (Caporali et al., 2016, Reis et al., 2016). As mentioned in section 4.9 of this thesis, PA levels and sitting time of university employees need to be evaluated via an objective tool to confirm or draw comparisons with the existing results.

After an extensive literature search, limited studies have illustrated university employees PA levels and sedentary behaviour between genders and job roles. However, no studies were found that combined both accelerometer and IPAQ-LF questionnaires. Thus, this is the first study to assess PA levels and sedentary behaviour concurrently through objective and subjective methods. As such, this study may contribute to the limited knowledge related to the evaluation of PA levels and sedentary behaviour of university employees across gender and job roles by applying two extensively established methods.

5.2 Study aims and objectives

This cross-sectional study aimed to monitor university employees daily activities and sedentary behaviour objectively across a whole week. The secondary aim was to obtain greater insight into the potential differences in both accelerometer and IPAQ-LF methods undertaken in this study when recordings PA and sedentary behaviours.

5.3 Methods

This study was conducted at the same university, as detailed in section 4.5. The subsequent sections provide information about participants recruitment, research procedure, consent form, and research measures, including explanation and justification of using accelerometer in the light of existing literature.

5.3.1 Participant recruitment

Participants from study one, who expressed an interest in participating in future research of this thesis were contacted through an email to determine if they were still willing to participate in this study. The 259 employees (females *n* = 164 and males *n* = 95) who provided their details to be contacted were sent an email providing all the information about this study to establish if they were willing to partake. A total of 64 employees (male = 33; female = 31) volunteered to participate in this study. The number of participants in this study was in accordance with the previous literature (Sasaki et al., 2017). Table 9 provides the breakdown of participants per job roles and genders.

Table 9. The breakdown of participants according to job roles

Job roles	Participants that responded	Female participants	Male participants
Academics	25	11 44%	14 56%
Administrative Staff	20	13 65%	7 35%
Professional Services	19	7 37%	12 63%

5.3.2 Participants Informed Consent

Participants were provided with an information sheet alongside a consent form (Appendix 8). An ActiGraph was given to individual participants after returning the completed consent form. The usual ethical procedures were applied as detailed in section 4.5.4.

5.3.3 Research Measures

The use of IPAQ-LF in this study was to determine the validity check between the objective and subjective recordings of PA behaviour of employees. The IPAQ-LF is the most valid, reliable and commonly used questionnaire for the tool for measuring PA levels and sedentary behaviour (Craig et al., 2003; Gustafson and Rhodes, 2006; Haskell et al., 2007). More information including justification about the use of IPAQ-LF has been provided in section (4.5) of this thesis.

The accelerometer used in this study was the ActiGraph wGT3X-BT is a small activity monitor that captures the activity data via the solid-state of the 3-axis (ActiGraph, 2017). Objectively monitoring PA and sedentary behaviours have attracted researchers attention (Pedišić and Bauman, 2014; Sasaki et al., 2017; Troiano et al., 2014). Technological improvements in research and consumer-based activity monitoring have caused an expansion in the range of devices that are now available to both researchers and individual consumers (Chen et al., 2012; Ferguson et al., 2015; Strath et al., 2013). Different motion devices include pedometers, inclinometers, and accelerometers typically used in research, with the latter being the most widely used motion sensor to monitor PA in both clinical and free-living settings (Chen et al., 2012). For instance, the two most popular PA and sedentary behaviour monitors are GT3X+ and wGT3X-BT for evaluating sedentary behaviour, light PA and MVPA (Park, 2017). Previous research concluded that both monitors had demonstrated high intra-monitor reliability with acceptable validity criteria (Miller, 2015; Park, 2017). Moreover, the researchers concluded that ActiGraph is considered the most valid and reliable tool for measuring such behaviours (Aggio et al., 2015; Trost and Tudor-Locke, 2014).

5.3.4 Sampling Rate of ActiGraph

The sampling rate is the pre-arranged frequency of the ActiGraph that constitutes to collect data, and the unit for sampling rate is recognised as 'hertz' (Sasaki et al., 2016). Hertz is the frequency of seconds that occurs during the ActiGraph collecting the motions (Sasaki et al.,

2016). With the advanced technological monitors, such as ActiGraph, that are widely applied tool for examining PA and sedentary behaviours, the sampling rate is between 30 and 100 hertz (Brønd and Arvidsson, 2015; Chow et al., 2017; Sasaki et al., 2016; Varela Mato et al., 2017). The availability of different frequency in ActiGraph provides flexibility to the researchers on selecting various sampling rate ranging from 10-100 hertz (John and Freedson, 2012). This study's sampling rate was set to 100 hertz, and data collected in a raw acceleration to reprocess in the future. Previous research has suggested that a sampling rate of <100 hertz does not appropriately count or collect short bursts of activities (Brønd and Arvidsson, 2015). PA and sedentary behaviours data must be collected in high hertz and raw form (Sasaki et al., 2016; Troiano et al., 2014; Zhang et al., 2012). This is because it can provide the potential to process both raw and filtered data, and minimises the confounding impact on the sampling rate and can be transformed to counts (Sasaki et al., 2016; Troiano et al., 2014; Zhang et al., 2012).

5.3.5 Counts of ActiGraph

The raw data of ActiGraph converts into counts. The analogue digitises counts to digital converter to identify time spent in various activities such as sedentary behaviour and both time and intensity of light, moderate or vigorous PA (Hart et al., 2011; Rowlands and Stiles, 2012; Sasaki et al., 2016). Counts are directly connected to the magnitude of acceleration and represent the total post-filters in raw data (Sasaki et al., 2016). Counts also have different values related to the frequency and intensity of the raw acceleration (ActiGraph, 2018b; Sasaki et al., 2016). There are two main stages of counts. Stage one is a signal rectification that transfers negative signals such as signals opposite to gravity's direction into similar positive signals. Stage two is propriety filtering which includes numerous filters for a range of epoch purposes (Sasaki et al., 2016).

5.3.6 Epochs of ActiGraph

Epochs are quantified as the time for which counts are combined for identifying the intensity of activities for data analysis purposes (Bassett Jr et al., 2012). For identification of activities and intensities, such as sedentary, light, moderate or vigorous, previous research used 60 seconds epochs (Copeland and Esliger, 2009; Freedson et al., 1998; Hendelman et al., 2000; Miller et al., 2010; Sasaki et al., 2011; Swartz et al., 2000). Previous literature has also applied the common epochs of 60 seconds because early PA monitors were not modelled to collect activity counts in shorter epochs such as ten seconds (Sasaki et al., 2016). It can, therefore,

be suggested that the existing literature based on the 60 seconds epochs counts missed valuable data about sedentary behaviour and concerning the intensity levels.

According to Sasaki et al. (2016), technological advancements have made it easy to collect activity counts in epochs as short as one second and raw data as high as 100 hertz. Indeed, previous research has utilised different epochs length and concluded that the best epoch duration to collect adults PA counts had not been systematically investigated (Corder et al., 2007; van Berkel et al., 2013). Therefore, shorter epoch lengths may be more accurate and reduce misclassifications of measuring PA levels and sedentary behaviour compared to higher epochs (Aadland and Ylvisåker, 2015; Gabriel et al., 2010). Epoch length in existing literature vary but advanced monitors, such as ActiGraph, recorded shorter epochs (Orme et al., 2014; Park, 2017; Sasaki et al., 2016). Therefore, the current study applied the ten seconds of epoch following previous literature (Banda et al., 2016; Corcoran et al., 2016; Crouter et al., 2015; Gabriel et al., 2010).

5.3.6 Cut points of ActiGraph

Cut points categorise the intensity of collected data such as sedentary, light, moderate or vigorous intensity (ActiGraph, 2018a). Previous research used different cut-off point to identify PA intensities (Matthew, 2005; van Berkel et al., 2013). The present study employed the most commonly used cut-off points by Freedson et al. (1998). Freedson et al. (1998) cut-off points defined sedentary behaviour from 0-99 counts per minute (CPM), light from 100-1951 CPM, moderate from 1952-5724 CPM, vigorous from 5725-9498 CPM, and anything higher than 9499 CPM are classified as very vigorous. The sum of moderate and vigorous formed the category of MVPA. In Freedson et al. (1998), the CPM cut-off points apply to any CPM regardless of the file's epoch length (ActiGraph, 2018a). In addition, the majority of similar studies have applied Freedson et al. (1998) cut-off points for PA intensity identification (Hart et al., 2011; Healy et al., 2008; Lyden et al., 2011; Sasaki et al., 2016; Sasaki et al., 2017; Sirard et al., 2011; van Berkel et al., 2013); thus the methods of this study are in agreement with substantial existing evidence.

5.3.7 Monitor placements of ActiGraph

PA monitors can be positioned in various places on the body, such as hip, wrist, wrist, and ankle or even in the pocket. Device positions can affect the monitoring's accuracy, which can result in either overestimating or underestimating the accuracy of data collection (Takacs et

al., 2014). For instance, Hasson et al. (2009) assessed the validity of PA monitoring, and participants placed the monitor in their pockets. The results of PA levels were five times higher compared to the monitors on the hip. Due to the varying results, there is no generally accepted position or standardisation for wearing an ActiGraph. However, researchers must exercise caution to ensure the assessment is as accurate as possible.

PA monitors' position must be suitable for participants and relevant to research when assessing PA and sedentary behaviours via monitors (Hasson et al., 2009; Takacs et al., 2014). In this study, participants were informed that the monitor has to be worn on the wrist like a watch. Previous literature has supported the use of ActiGraph around the wrist because the examinations have shown that participants are more likely to remember to wear the ActiGraph and the comparative results against other locations were more accurate representation of the PA levels and sedentary behaviours (Diaz et al., 2018; Dieu et al., 2017; Ellingson et al., 2017; Koster et al., 2016; Troiano et al., 2014). Instruction for wearing the monitor around the wrist was provided using the wGT3X-BT+ActiLife user guide 2017 (see Appendix 9). Participants were required to wear an ActiGraph on the non-dominant wrist to avoid the possibility of exaggerating or underestimating activities. The dominant hand is more likely to be used for tasks compared to the non-dominant hand. Therefore, there is a chance of exaggerating participants activities than ActiGraph around the non-dominant wrist in this study was in accordance with previous research (Bai et al., 2016; Case et al., 2015; Diaz et al., 2015; Doherty et al., 2017; Mannini et al., 2013; McCracken et al., 2017).

5.3.8 ActiGraph monitoring for valid data and inclusion criteria for this study

For PA and sedentary behaviours data to be considered valid and reliable, the participants must wear the monitor for several hours each day (Sasaki et al., 2016). The number of days and hours differ across studies (Hart et al., 2011; Jerome et al., 2009). For instance, the monitoring of PA levels and sedentary behaviour ranges from 24 hours a day for a whole week (Hart et al., 2011) to ten hours per day for a minimum of three days (including one day of the weekend) (Park, 2017). Other studies monitored PA and sedentary behaviours between three to five days (Aadland and Ylvisaker, 2015) and as little as two days (Rowe et al., 2007), all of which are suggested to provide valid data about the PA levels and sedentary behaviours. The criteria for wear time differ across studies, which could be due to the variables of interest.

Nevertheless, most of the large-scale studies have reached a consensus that a minimum of three days of objective monitoring is required for consistent prediction of PA and sedentary

behaviours (Aadland and Ylvisåker, 2015; Choi et al., 2012; Matthews et al., 2012; Park, 2017; Sasaki et al., 2017; van Berkel et al., 2013). Therefore, the minimum inclusion criteria for participants data to be included in this study were three days, with ten hours of wear time each day or 1800 minutes' worth of data across the whole week. Participants were instructed that these 10 hours' needs to be during the wakeful part of the day and at work. After scrutinising the ActiGraph data, all 64 participants met the inclusion criteria and were included for analysis.

5.3.9 Statistical Analysis

Before the data analysis, participants were categorised according to gender (i.e., male and female) and job role (i.e., Academics, Admin staff, and Professional Services) across the university, as explained in section 5.3.1. The ActiGraph data was downloaded via ActiLife software as DAT and CSV excel for each participant and uploaded into the 'scoring' in ActiLife software for calculation before exporting. Data was exported as excel (xlsx) through the option of 'create batch view file in hourly/daily/summary details' for a complete individual data set in minutes. Similarly, all responses to the online IPAQ-LF's duration time in options were converted from hours into minutes as per the IPAQ-LF guidelines. The level of significance for analysis and SPSS version were identical to that outlined in section 4.5.5.

Time spent engaged in ActiGraph and IPAQ-LF light PA, MVPA and sedentary behaviours were not normally distributed between males and females as examined by Shapiro – Wilke's test (p <0.05) and by visual inspection of normal Q-Q plots and box plots. The distribution minutes between gender and job role in both ActiGraph and IPAQ-LF across all domains were not similar. Consequently, a Mann-Whitney U test was conducted to determine if there were differences between ActiGraph and IPAQ-LF, light PA, MVPA and time spent sitting between males and females. A Kruskal – Wallis H test was conducted to determine if there were differences in ActiGraph and IPAQ-LF light PA, MVPA and sedentary behaviour between job roles. Additionally, a Spearman's rank-order correlation was conducted to measure any association between the ActiGraph and IPAQ-LF light PA, MVPA and sedentary behaviours. Furthermore, a Wilcoxon signed-rank test was conducted to evaluate the differences between ActiGraph and IPAQ-LF light PA, MVPA and sedentary behaviours.

5.4 Results

The descriptive statistics of the median, IQR, mean and SD of the wear time and the inferential statistical differences for total light, MVPA and time spent sitting and between genders in ActiGraph and IPAQ-LF are presented in table 10 with no significant difference. There were no significant differences between light, MVPA and time spent sitting across both ActiGraph and IPAQ-LF, as detailed in table 11. Moroever, no significant differences were found between light, MVPA and sedentary behaviour between ActiGraph and IPAQ-LF amongst job roles as explored in Table 12.

Table 10. Descriptive statistics and statistical differences of ActiGraph and IPAQ – LF light PA, MVPA, and sedentary behaviour in minutes between genders

		Total		Male		Female		
Tools	**Components**	Median *(IQR)*	Wear time mean and *(SD)*	Median *(IQR)*	Wear time mean and *(SD)*	Median *(IQR)*	Wear time mean and *(SD)*	Inferential Statistics
ActiGraph	Light PA (mins)	688 *(635)*	920 *(467)*	712 *(892)*	882 *(593)*	666 *(567)*	872 *(471)*	U = 446.000, z = -0.880, p = 0.379
	MVPA (mins)	552 *(574)*	876 *(604)*	553 *(860)*	692 *(528)*	539 *(573)*	809 *(531)*	U = 466.000, z = -0.638, p = 0.523
	Sedentary time (mins)	1079 *(4244)*	3907 *(391)*	1179 *(4664)*	4086 *(1396)*	1036 *(4202)*	3907 *(1620)*	U = 467.000, z = -0.598, p = 0.550
IPAQ-LF	Light PA (mins)	290 *(405)*		240 *(390)*		300 *(400)*		U = 521.000, z = 0.948, p = 0.343
	MVPA (mins)	280 *(400)*		320 *(398)*		240 *(465)*		U = 521.000, z = 0.218, p = 0.898
	Sedentary time (mins)	2670 *(1620)*		2520 *(1620)*		3080 *(1740)*		U = 569.500, z = 0.780, p = 0.436

Table 11. Descriptive statistics and statistical differences of ActiGraph and IPAQ –LF light PA, MVPA and sedentary behaviour amongst job roles

		Academic		Administration		Professional Services		
Tools	**Components**	Median *(IQR)*	Wear time mean and *(SD)*	Median *(IQR)*	Wear time mean and *(SD)*	Median *(IQR)*	Wear time mean and *(SD)*	Inferential Statistics
ActiGraph	Light PA (mins)	717 *(710)*	920 *(467)*	659 *(732)*	882 *(593)*	676 *(672)*	872 *(481)*	$\chi2$ (2) = 0.647, p = 0.723
	MVPA (mins)	607 *(657)*	876 *(604)*	496 *(542)*	692 *(528)*	553 *(826)*	809 *(531)*	$\chi2$ (2) = 2.684, p = 0.261
	Sedentary time (mins)	1178 *(4141)*	3907 *(1391)*	1069 *(4553)*	4086 *(1396)*	1035 *(4442)*	3907 *(1620)*	$\chi2$ (2) = 0.258, p = 0.879
IPAQ-LF	Light PA (mins)	240 *(340)*		265 *(421)*		330 *(525)*		$\chi2$ (2) = 0.803, p = 0.669
	MVPA (mins)	240 *(390)*		300 *(336)*		210 *(515)*		$\chi2$ (2) = 0.897, p = 0.639
	Sedentary time (mins)	2700 *(1800)*		2700 *(1179)*		2640 *(2220)*		$\chi2$ (2) = 0.439, p = 0.803

Spearman's rank-order correlation analysis determined the relationship to be monotonic, from the scatterplot visually examined. There was no significant correlation between ActiGraph and IPAQ-LF light PA between employees, $r_s\,(64)$ = 0.442, p = 0.098. However, there was a significant weak to moderate correlation between the ActiGraph and IPAQ-LF MVPA, $r_s\,(64)$ = 0.321, p = 0.010. There was no significant correlation in ActiGraph and IPAQ-LF sedentary behaviour, $r_s\,(64)$ = 0.047, p = 0.711. The Spearman's rank correlations and Wilcoxon Signed Rank Test for ActiGraph and IPAQ-LF are provided in table 12.

Table 12. Analysis of light, MVPA, and sedentary behaviour data between ActiGraph and IPAQ-LF

ActiGraph and IPAQ-LF	Spearman's Rank Correlations	Wilcoxon Signed Rank Test
Light PA	0.098	0.0005*
MVPA	0.321	0.0005*
Sedentary	0.047	0.385

Wilcoxon signed-rank test data are presented as the median in minutes for ActiGraph light PA (688), MVPA (552) and sedentary behaviour (1079). The IPAQ-LF median for light PA (290), MVPA (280) and sedentary behaviour (2670). There were significant differences between ActiGraph and IPAQ-LF light PA, z = - 6.139, p = 0.0005. There were also significant differences between ActiGraph and IPAQ-LF MVPA, z = - 4.962, p = 0.0005. However, differences between sedentary behaviour were not significant in both methods z = 0.869, p = 0.385.

5.5 Discussion

In the first study of this thesis, there was a need to measure PA levels and university employees sedentary lifestyle objectively. The purpose of the current study was to accurately validate the initial study's findings and reduce the bias that may be prevalent when using a self-reported questionnaire as previously outlined. Besides, this study's primary aim was to investigate the daily activities and sedentary behaviour of the same population throughout the week via the concurrent use of both objective and subjective measures and discover if there were differences in PA levels and sedentary behaviour genders and job roles. The ActiGraph findings shows that overall, this population spent a median of 688 minutes in light PA, 552 minutes in MVPA, and 1079 minutes spent being sedentary wearing the ActiGraph for 5703 minutes across the week. Whereas the IPAQ-LF results show that this population reported spending a median of 290 minutes engaging in light PA, 280 minutes spent conducting MVPA, and further 2670 minutes is spent being sedentary. The findings of this

study also show that this population exceeded the PA guidelines. The explanation and relevant literature were discussed in section 5.1, which is also applicable to this current section.

Employees in the current study appeared to underestimate their PA levels and over-reported sedentary behaviour in the self-reported IPAQ-LF compared to the ActiGraph results. The underestimation of light and MVPA in the IPAQ-LF may indicate that participants may not have considered reporting all activities such as walking to a meeting, kitchen, or a lecture room as part of the PA. In contrast, the ActiGraph records all type of physical movements. The additional reason for employees reporting an underestimation in the self-reported, light, and MVPA could be that IPAQ-LF collects data, as it does not regard activity conducted less than ten minutes, whereas, ActiGraph records the data constantly. Employees over-reporting their time spent sitting in the IPAQ-LF compared to the ActiGraph may indicate the social desirability and recall bias (Fountaine et al., 2014). The current findings are in line with previous research, suggesting that the self-reported methods underestimate and over-report findings because of the social desirability and individual ability to remember every activity and exact time (Fountaine et al., 2014; Malik et al., 2014).

Regarding the differences between genders, the ActiGraph results show that males were engaging in a greater amount of lighter PA, MVPA and more time sitting than their female colleagues. However, male employees wore the ActiGraph 10 minutes more during the light PA, whereas female ActiGraph wear time was 117 minutes more in MVPA and males wore the ActiGraph for 179 minutes more during the sedentary behaviour compared to females as detailed in table 10. The total differences between males (5660) minutes and females (5588) ActiGraph wear time was 72 minutes. Moreover, the IPAQ-LF results show that female engaged in a greater volume of light PA and time spent sitting. This is in line with previous research suggesting that social support, such as moving together in a walking group or engaging in less intense activities, were favoured by females, whereas males were more interested in high-intensity activities (Guthold et al., 2018; Morris et al., 2019). Although most of the weekly time was spent sedentary, which was consistent across both genders, findings demonstrate that females were spending a considerably longer time sitting. This also reflected that the time in which females engaged in light activities where the difference was greater by 46 minutes might negatively affect females' health and wellbeing. However, the differences in time spent engaged in MVPA between genders was minimal. Indeed, the present findings support previous research suggesting, females are generally less active than males (Lindsay

et al., 2016; Guthold et al., 2016: Olney et al., 2018). However, this area may need further investigation to rationalise the comparative differences and reasons behind the discrepancies reported by males and females.

Regarding the differences between job roles, the ActiGraph result shows that Academic staff engaged in greater light PA and MVPA than the Administration and Professional Services staff. This may be because the Academic staff are expected to conduct light PA through their daily responsibilities, including walking to and from the lectures, practical sessions, and student engagement activities. Whereas, the Administration and Professional staff are often required to be at desk and their role is generally more sedentary, this may contribute to their lack of engagement in light PA and MVPA. Although the Academic staff engaged in a greater amount of light PA and MVPA than the Administration and Professional employees, surprisingly, there still appears a large proportion of the Academic staff time spent being sedentary. Prolong time spent sitting is allied to lower work productivity, negatively affects mental health, and contributes to obesity (Puig-Ribera et al., 2015; Zhu et al., 2020). Thus, it is essential to consider potential work-related interventions to counteract these possible implications. In addition, the academic staff wore the ActiGraph for 5703 minutes, the administration staff wore time was 5658 and the professional services wore time was 5588 minutes across the week as detailed in table 11. As the academic staff ActiGraph wear time was higher compare to administration and professional services, thus academic reported higher engagement in light PA, MVPA and sedentary behaviour. Therefore, more research is needed to compare and contrast with present findings across job roles and working environments.

The second aim of this study was to draw comparisons between the ActiGraph and IPAQ-LF. The results indicated a clear distinction between the self-reporting and the monitoring device. For example, the IPAQ-LF shows under-reporting in the light PA and MVPA and over-reporting in the sedentary behaviour categories. The differences between ActiGraph and IPAQ-LF were demonstrated between overall light, PA, MVPA and sedentary behaviour and gender and job roles. The present findings contrast with previous research concluding that the self-reported measured showed an overestimation of the MVPA compared to the accelerometer (Cradock et al., 2004; Peterson et al., 2015). Regarding the accuracy of which method should be applied for assessing PA levels and sedentary behaviour, the present study supports previous research regarding using an objective device for collecting detailed insight compared to the subjective methods (Aggio et al., 2015; Trost and Tudor-Locke, 2014).

The findings of the Wilcoxon Signed-Rank test showed significant results between ActiGraph and IPAQ-LF light PA (p <0.01), MVPA (p <0.001) and no significant difference between sedentary behaviour (p = 0.385). The Spearman's Rank Correlations suggested a mixture of results between ActiGraph and IPAQ-LF, light, MVPA and sedentary behaviour. Results found a very weak correlation between both tools when assessing light PA (r = 0.098), MVPA (r = 0.321) and sedentary behaviour (r = 0.047) amongst university employees. The present findings contrast with previous studies examining the validity of IPAQ-LF against an accelerometer to assess MVPA and sedentary behaviour, r = 0.43–.56 (Cleland et al., 2018). The present findings are a novel contribution to the existing literature regarding ActiGraph and IPAQ-LF comparison and validity across light, MVPA and sedentary behaviour amongst university employees. The current findings also contribute to informing best practices of evaluating PA levels and sedentary behaviour. This practice can support the WHO global action for overcoming physical inactivity trends by 2025 and the global action plan of PA 2018-2030 by offering various combinations of measurement tools.

5.6 Limitation of the study

The present study is not without limitations. The strength and weaknesses of using IPAQ-LF have been provided in Section 4.5. The advantages of ActiGraph are that it typically collects accurate data and presents robust validity and competence for accumulating in-depth data of PA and sedentary behaviours. Additionally, it has a high battery life of 25 days, with 4 GB memory and data storage capacity for an extensive amount of time. Despite the strengths of using the ActiGraph, it may fail to identify activities individuals participate in, such as cycling, swimming, or loadbearing exercise (Strath et al., 2013). Furthermore, ActiGraph does not provide information about the purpose of activities unless PA log-books, diary or interviews are combined (Matthews et al., 2012). Moreover, the cost of ActiGraph and ActiLife software is also burdensome.

Another possible limitation of the ActiGraph could be that it records a higher amount of light PA and MVPA than the IPAQ-LF; this may be due to wearing an ActiGraph, unintentionally encouraged or prompts PA participation as evident in the light PA and MVPA. Previous research suggested that objectively monitoring PA levels can contribute to PA levels' bias and create competitiveness (Maura Lawless, 2017; Yap and James, 2010). However, motivating participants to prompt PA or reduce sedentary behaviour was not the focus of this study. Individuals were informed to continue with their usual behaviours whilst wearing the ActiGraph simply. Adapting the IPAQ-LF to university employees and across settings may support and

reduce bias, help employees with a recall of PA and sitting time, avert social desirability, and subsequently improve the accuracy of self-reported measure. The acknowledgement of reasons and location of engaging in PA and sedentary behaviour would have further enhanced this study.

5.7 Conclusion

This study suggests that the IPAQ-LF has underestimated light PA and MVPA and overestimated sedentary behaviour compared to ActiGraph data. It was evident that ActiGraph recorded male employees spending more time engaged in light PA, MVPA and sedentary behaviours. Conversely, females reported in IPAQ-LF to be spending more time engaged in light PA and sedentary behaviour. The findings showed that Academic staff wore the ActiGraph for longer and were spending more time engaged in light PA, MVPA and sedentary behaviour than Administration and Professional Services staff. Though this population is spending time engaged in light PA and MVPA, they also spent a considerably higher weekly time sedentary and sitting for a prolonged time. This could be one of the main factors of health-related diseases lower productivity. Thus, future studies are needed not to merely investigate the difference between PA levels and sedentary behaviour but to also assess the ActiGraph wear time and its impact on PA and sedentary behaviours and its potential implications

.

One of the reasons university employees reported a high volume of light and MVPA engagement could be that only those who have chosen to participate in this study were already or willing to be active. Thus, this undermines the strength and poses a challenge for gaining an insight into an entire organisation, as there could be individuals who are not active or willing to participate in such studies. Thus, the management of universities must strive to reduce sitting time and encourage employees to be active by enabling their needs and providing PA and health-related interventions that support an active and inclusive working environment for all. Therefore, future research is needed to explore such strategies' effectiveness based on genders and job roles. Moreover, considering health consequences interconnected with prolonged time spent sitting, future research is also needed to explore the challenges that university employees face regarding PA engagement both within and outside of the workplace (Escoto et al., 2010; Taylor et al., 2013; Conway et al., 2017). The subsequent section is the third study formed by this study to qualitatively explore barriers of this population to PA participation and reduce sedentary behaviour.

Chapter 6.0

Study 3. Barriers and facilitators to PA amongst university employees

6.1 Introduction

The present study aims to understand the perceived barriers and facilitators of PA, health and wellbeing of employees. The findings of study one and two of this thesis determined that university employees spent the majority of their weekly time sedentary, and the impact of spending prolonged time sitting has been detailed in sections 1.2 and 4.2. However, there is a need to understand why such behaviours occur from employees perspectives, particularly within universities, because of the different job roles and large workforces. Qualitatively measuring views can provide detailed insight into participant's feelings, beliefs and attitudes in a way that would not be feasible in other methods (Doody et al., 2013; Hill-Mey et al., 2013).

Research has suggested that most employees across settings have reported lack of time, little knowledge, lack of management support, poor self-efficacy, lack of social support and low self-motivation as barriers to PA, health and wellbeing initiatives (Trost and Tudor-Locke, 2014). Furthermore, lack of facilitates, workload balance, management support and workplace culture, including gender and ethnic background, were also reported as barriers to employees participation in PA and health programmes in the workplace (Al-Zalabani et al., 2015; Leonard et al., 2017; Ware et al., 2008). Some research has examined the impact of workplace PA and health interventions specific to university employees. And results highlighted that barriers to PA amongst participants were lack of time, management support, and not knowing the health benefits of engaging in PA (Byrne et al., 2011). Workplace culture, workload, limited breaks and individual attitudes towards PA related initiatives were also suggested as barriers to this population (Bright et al., 2012; Kouvonen et al., 2005; Kruger et al., 2007; Phipps et al., 2010; Tavares and Plotnikoff, 2008).

The existing literature has solely focused on identifying barriers to PA behaviour but did not acknowledge the facilitators or ways to overcome these barriers in the workplace, particularly in university settings. However, workplace barriers may require a holistic approach as staff face various complications. A 'one-size-fits-all' approach may remain unsuccessful within a

multidisciplinary workforce such as university environment. Some research recommended that environmental, management and co-workers support could be utilised in facilitating PA and health-related barriers in the workplace (Crespo et al., 2011; Ferraro et al., 2013; Kilpatrick et al., 2017). Besides, providing flexible access, resources, and a range of facilitates at the employees discrete may help overcome barriers and potentially serve as facilitators (Bale et al., 2015; Hasson et al., 2014). However, most of the research did not explore employees perspectives or feelings about what they want in terms of PA, health or wellbeing programmes. It did not investigate whether employees will engage in such programmes if they were to be provided in the workplace. Hence, understanding facilitators to PA and health behaviours in the workplace, particularly within the university settings, are scarce. There is a need for exploration to identify ways to facilitate barriers, leading to tailored PA and health-related interventions that potentially help overcome the existing obstacles and promote PA engagement (Escoto et al., 2010; Taylor et al., 2013; Conway et al., 2017).

6.2 Study aims and objectives

This study's objectives were to explore the barriers and facilitators to PA (within and outside of the workplace), health and wellbeing of university employees through focus groups. An additional aim was to explore if different barriers and facilitators were identified based on job roles and what types of PA, health and wellbeing initiatives individuals might commit to engaging in.

6.3 Methods

This study's participants were also recruited from the same university as the previous studies of this thesis. Information about university context, staff and structure were discussed in section 4.5. Additional information about the university's various faculties, the number of current employees, and the breakdown of gender across each faculty were provided in section 4.5.1. The following section provides details regarding participant recruitment for this study, research procedure, pilot study, participants consent, and research measures, including a rationale for using the qualitative focus group approach.

6.3.1 Participant recruitment

Participants were recruited through an opportunistic sample using those who had participated in earlier studies of this thesis. Participants from study 1 and 2, who expressed an interest in participating in future research were contacted through an email to determine if they were still willing to participate in this study. The 259 employees (females *n* = 164 and males *n* = 95) were sent an email providing all the information about this study to establish if they were willing to partake. From the original pool of 259 participants, 101 employees were classified as inactive (female *n* = 77; male *n* = 24) and 158 were classified as active (female *n* = 98; male *n* = 68). The 'active' participants were classified as those who met the PA guideline; 'inactive' participants were those who did not meet the criteria and acquired less than 150 minutes of MVPA across the week. From the original pool of 259 participants, 221 employees (85%) replied, expressing their interest in the present study, but 41 employees participated. Figure 5 provide a breakdown of employees who participated in this study.

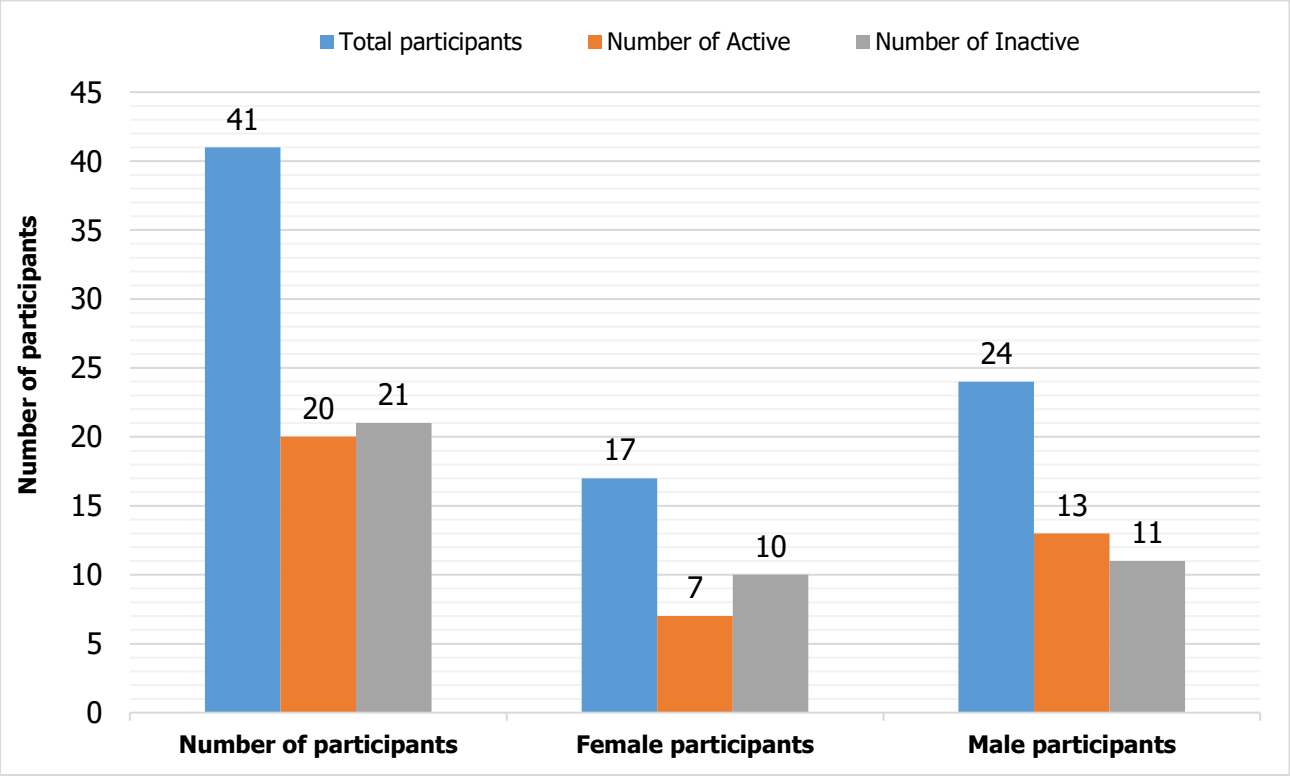

Figure 5. The breakdown of participants by activity levels and gender

Categorising participants into groups according to their PA levels was vital. It provided an opportunity to compare active and inactive employees and explore differences and reduce potential bias in responses in the focus groups. Analysing the perceptions from separate groups (i.e., active and inactive) may help provide a comprehensive insight into the actual barriers and facilitators that this population may face. Where active and inactive participants are recruited to the same focus group, there would be potential for data analysis and socially desirable answers and may reduce the potential bias from one over the other. An online doodle link specific to both groups was created with time, date, room, and location, allowing employees to choose location, date, and time per their availability to attend the focus group. Participants were not informed of their PA levels, and categorising whether the group was active or inactive was only known to the researcher. The researcher chose to withhold disclosing the participants about such labels because it may have influenced their views regarding barriers and facilitators.

6.3.2 Research procedure

This study adopted a qualitative approach as it is the most suitable approach for understanding employees lived experiences and their perceived barriers and potential facilitators to PA. The focus groups were also relevant to the objective of this study, where the requirements were to compare active and inactive individuals' barriers to PA. Separating this study's objective was rationalised accordingly; thus, participants may feel a sense of camaraderie in the group. The categorisation of the two distinct groups in this research would suggest that individuals within groups may share similar attitudes regarding PA barriers and facilitators. Hence the willingness to share would become more apparent.

Previous research suggested that focus groups are appropriate in settings where power differences exist between participants and decision-makers, mainly when daily use of language and culture of the under-researched population is of interest and requires exploring organised issues (Morgan and Krueger,1993). This may apply to university settings with a variety of job roles and levels featuring. Previous research proposed that a focus group is an enjoyable experience and provides an opportunity for individuals to hear others' perception regarding the same issue (Patton, 2002; Thomas et al., 2015). Guest at al. (2017) stated that several sensitive and personal disclosures were more likely to occur in a focus group setting, with some sensitive themes compared to individual interviews. Thus, this study used focus groups to understand the specifics of collective barriers and facilitators to PA. Indeed, an individual interview may not have been sufficient to share ideas in focus groups brought out

emerging themes, which may not have been exclusively possible to be commented on in an individual interview. For example, discussion surrounding the workplace culture about barriers may not have been comfortable for an employee to discuss in an individual interview. Lambert et al. (2008) suggested that individual interviews pose power and resistance issues, which may have adverse effects on the data, which is why focus groups seemed to be the most fitting choice.

Therefore, eight semi-structured focus groups in two campuses and four faculties consisting of various job roles were conducted. The focus groups were conducted to gain an insight into respondents' attitudes, feelings, beliefs and experiences related to barriers, facilitators and desire for PA and health initiatives that they may want to engage if offered. In accordance with previous literature, a minimum of five employees participated in each focus group (Krueger, 2014). The use of four or five participants means that rapport can be built, which affords more opportunity to share ideas (Krueger, 2014). The participants in seven focus groups were made up of five employees each. A single group was composed of six participants; all focus group participants aligned to the same activity level (i.e., active or inactive). The same set of questions were asked from active and inactive participants. The questions guide was developed according to the focus group methodology by Krueger (1998). The process of (Krueger, 1998) includes five steps, 1; planning such as developing schedule and steps requires in identifying the type of resources needed, 2; recruitment such as contacting the participants and inviting them to partake in the research, 3; moderation, that is undertaken by the recorder or an assistant, 4; analysis, undertaken by the researcher and 5; reporting, the findings in writing. The questions posed in this study are provided in Appendix 10. The researcher underwent focus group training with the supervisory team that aided the development of questions guide applying appropriate literature, undertaking the role of moderator and a pilot of data analysis procedures (Krueger, 1998).

6.3.3 Pilot Study

Previous research discusses the importance of pilot studies in general but piloting in existing qualitative research before the study is limited (Beebe, 2007; Lancaster et al., 2004; Padgett, 2016). The pilot study provides an opportunity to modify, review approaches and improve experience with adopted techniques (Kim, 2011). Therefore, before starting the focus groups in this study, two pilot focus groups were conducted. A total of 13 critical peers (male n = 7; females n = 6) participated in the pilot study. Participants were divided into two groups; active participants (n = 7: 4 males; 3 females) and inactive participants (n = 6: 4 males; 2 females).

For the analysis of the pilot study's results the six-steps framework of Braun and Clarke (2006) used as detailed in (Table 13). The use of six-steps framework is viewed as the most suitable to follow when analysing data, as it provides structure for conducting analyses through stages (Maguire and Delahunt, 2017). Applying the six-steps framework for the pilot study analysis of this thesis provided a valuable demonstration of how the data analysis has been conducted through stages (Pope and Ziebland, 2000). The six-steps framework and the trustworthiness criteria applied in this study has further detailed in section (6.4 and 6.4.1).

The pilot focus groups were conducted with staff who were not the actual study participants. The pilot focus groups were video recorded with informed consent for researcher evaluation. Upon the observation conducted in a pilot study, the researcher was recommended by the supervisory team to use more 'follow up questions to probe for more information. As per moderating/facilitating in focus groups, the researcher revised his technique and subsequent questions for the main study.

6.3.4 Focus Group Procedure

During the focus groups, introductions were made by the researcher regarding the study. The participants were explained the research aims, stating that the discussion was surrounding PA barriers and potential facilitators. Participants were informed to express their job role before providing input about the first question to enable the researcher to later explore the barriers and potential facilitators across job roles. The questions were introduced one by one to receive an adequate response from participants. The researcher moderated the conversation and used prompts for clarity or requests for further information when required as per Kruger's (1998) recommendations. The broad themes directed by the moderator were to seek discussion on:

- Level of awareness of the recommended PA guidelines
- Clarification of the WHO recommended PA guidelines
- Barriers related to meeting these recommended PA guidelines in the workplace
- Facilitators that would support meeting these PA guidelines in the workplace

Taking this approach-built group reciprocity created an intimacy; therefore, sensitive research topics (i.e., lack of PA) could be discussed in-depth and participants were encouraged to share and provide supporting or contrasting statements (Kruger, 2014). The researcher influence was minimised by opting to remain silent during the discussions, infrequently prompting the

group when discussions reached stagnation and then followed with further questions as per the guidelines of Kruger (2014).

6.4 Thematic Analysis

The semi-structured focus groups data were analysed using thematic analysis (TA). The focus groups were transcribed verbatim, checked and coded according to the framework by Braun and Clarke (2006). The TA is a qualitative data analysis approach that identifies, organises, allows interpretation and reporting themes that are instigated from the set of data (Braun and Clarke, 2006; Nowell et al., 2017). Maguire and Delahunt (2016) suggested that TA aims to identify themes that are important for exploring specific issues. TA provides insight into individuals' current activities in a way that allows the researcher to determine the participants perspective of a given situation (Maguire and Delahunt, 2016). TA is a commonly applied technique in qualitative research as it provides a systematic and transparent structure for the data analysis (Alhojailan, 2012).

Furthermore, previous research have supported the use of TA as the appropriate approach to explore an issue (Alhojailan, 2012; Javadi and Zarea, 2016). TA provides implicit and explicit analysis and identifies ideas and themes that emerged from the data (Braun & Clarke, 2006). Therefore, the TA approach was considered appropriate for this study because it provides a clear view of issues and allows the researcher to combine themes associated with each other (Alhojailan, 2012).

The six-step framework by Braun and Clarke (2006) was considered the most appropriate for this study's analysis (as shown in Table 13). Previous research supported and recommended using the six-step framework (Horntvedt et al., 2018; Janes et al., 2018; Vaismoradi et al., 2013). The six-step framework is regarded as the most effective to follow when analysing data, as it provides a structure for conducting analyses through stages (Maguire and Delahunt, 2017). The six-step framework stages are not linear and provide flexibility to the researcher to move forward and backwards between stages throughout analysis (Maguire and Delahunt, 2017). Applying a framework to analyse themes provides a valuable demonstration of how the data analysis has been conducted through the stages (Pope and Ziebland, 2000).

Table 13. The six-step framework of TA applied to this study (adapted from Braun & Clarke, 2006; Maguire and Delahunt, 2017)

Steps	Examples of each step
Step 1: Become familiar with the data	In qualitative analysis, it's important for the researcher to read and re-read the transcript and become familiar with data
Step 2: Generate initial codes	The researcher should start to organise the data in a meaningful and systematic way (e.g., coding is the best way of reducing a lot of data into small meaningful junks)
Step 3: Search for themes	Organising codes help identify themes that emerge from the data
Step 4: Review themes	This step helps to review and amend the preliminary themes developed in step 3 and at this point, the researcher can read themes and see if make sense. After this, related themes can be color-coded
Step 5: Define themes	This step is the final modification of emerged themes identified in above steps. This step aimed to highlight what each theme is about and if there is sub-themes and how sub-themes interact and associate with the main theme
Step 6: Write-up	This is the final step of writing the study and reporting the analysis

6.4.1 Trustworthiness

The growth of qualitative research in the subject of exercise psychology and public health has increased (Green and Thorogood, 2018; Jones et al., 2012; Pitney and Parker, 2009; Smith and McGannon, 2018; Smith and Sparkes, 2013; 2016; Young and Atkinson, 2012). Despite the growth, further development of qualitative research is needed to overcome gaps such as the data analysis trustworthiness (Nowell et al., 2017; Smith and McGannon, 2018). Trustworthiness is a process of supporting findings worth paying attention to (Lincoln and

Guba, 1985). There are many criteria for assessing trustworthiness in qualitative research that has been proposed (Polit and Beck, 2013; Schreier, 2012). However, previous research has applied different ways of presenting their trustworthiness in qualitative research, such as catalytic validity (Lather, 1986), empathetic validity (Dadds, 2008), tacit knowledge (Altheide and Johnson, 1994), and big-tent criteria (Tracy, 2010). Moreover, Lincoln and Guba (1985) suggested that five conditions for trustworthiness, includes credibility, dependability, conformability, transferability and authenticity, need to be combined to construct trustworthy of qualitative research. The five conditions are explained in the subsequent section and their application to the present study.

Credibility is the truth about the participant's views, interpretations, and illustration of the researcher's views (Polit and Beck, 2012). Credibility in this study was tested with member checking of results and data interpretations as per Lincoln and Guba (1985). This was to ensure there was an agreement between the researcher's interpretation and the intended information presented by the participant. Research has suggested that an agreement between member checking is essential for an accurate account of the data analysis. It provides an opportunity to explore if interpretations were reasonable and precise (Clarke, 2013). Member checking is an essential part of qualitative research because it reduces the probability of misinterpretation (Clarke, 2013; Lincoln & Guba, 1985). The data in this study was a member checked from the raw data through to complete analysis. For instance, once the themes, sub-themes and examples were extracted it were checked with participants if were an accurate depiction.

Dependability is the data's reliability in a correlated environment (Polit and Beck, 2012; Tobin and Begley, 2004). Dependability in this study was achieved by agreeing on the identified themes and groupings of those themes by the Director of Studies, an experienced qualitative researcher. This was important to establish to ensure consistent findings between two independent individuals and their interpretation of the data. The dependability was maintained through audio recording, transcripts and supervision meeting logs. The researcher analysed focus groups data and identified themes, sub-themes and examples from the raw data. A meeting was scheduled with the director of studies to discuss how themes, sub-themes and examples were identified and their relevance to the study. The director of studies checked and re-checked, identified themes and sub-themes alongside examples. Regarding the thematic categories and sub-themes, there were some issues relating to the semantics present. After an initial discussion, the director of studies and the researcher agreed on an

action plan and 100% agreement was reached by the clear and logical process. Tobin and Begley (2004) reported that the researcher must certify that the research process is logical, traceable and documented (Nowell et al., 2017).

Confirmability is the researcher's ability to represent the actual responses of participants and not the biases or viewpoints of him/herself (Polit and Beck, 2012). Transferability refers to the findings that apply to other settings or clusters (Houghton et al., 2013; Polit and Beck, 2012). Transferability was essential to consider mainly for people who were not involved in this study. Conformability for this study was confirmed through participant involvement. Once the data was analysed accordingly, a set of findings were shared with the participants to verify whether they still feel the barriers and facilitators discussed in the focus groups were adequately represented in the research findings. Authenticity is the researcher's ability to explore the feelings and emotions of participants in a realistic way (Polit & Beck, 2012). Authenticity is important for the readers to understand the spirit of experience through participant's quotes, as explained in the results section. The process of completing data trustworthiness must be clear to the researchers' even if their epistemological and ontological approaches are different because they rely on methodological arguments and techniques (Green, 2000). As aforementioned, the present study used the commonly applied trustworthiness model of Lincoln and Guba (1985), which is regarded as the most fitting for research purposes (Nowell et al., 2017).

6.5 Results and Discussion

This section will provide the results and discuss the findings presented, which is common in qualitative research. The themes and sub-themes are presented in charts commencing with shared main themes and sub-themes in Figure 6 and discussed accordingly with examples extracted from the raw data. The analysis took place separately for active and inactive focus groups. However, themes and sub-themes for both active and inactive groups are presented in the same charts but discussed separately accordingly for the sub-themes commencing the discussion of the active participants followed by the inactive group.

6.5.1 Summary of the shared results

1. PA guideline

Approximately 46% of participants demonstrated awareness of the recommended PA guidelines, such as the 150 minutes of moderate PA engagement throughout the week or even walking, such as 10,000 steps per day. Most of these came from the active group (*n* = 16) but not exclusively (*n* = 3) from the inactive group. 28% of academics, 7% of administrator's staff, 5% of professional services, and 6% of the senior management from both genders were aware of the recommended PA guidelines.

2. Commute to work

Around 7% of the participants suggested that they take active or a combination of active and inactive commutes to work. These included purposely parking the car away from university to walk a small proportion of the journey, commute using public transport such as bus, train, walking or cycling.

"A combination of drive to the station then train to the City and walking" (Female administration).

Previous research has emphasised the importance of an active commute and the component of subjective wellbeing and reported that people undertaking active commute has reported being happy, positive mood and living a meaningful life (Schneider and Willman, 2019). Previous research explained that active travel satisfaction is related to various factors, including attitudes and broader aspects of life (De Vos and Witlox, 2017; Singleton, 2019). Despite, these studies not being focused on university employees, they provide an insight into the benefits of active commute. The present study provide an insight into the type of commute that university employees are engaged. Figure 6 provides details about the shared theme of general barriers to PA and sub-themes.

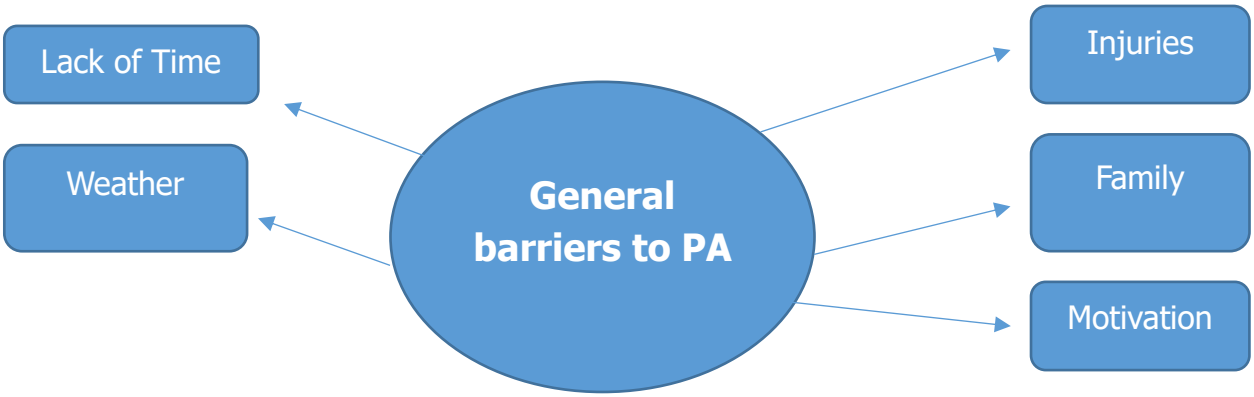

Figure 6. Shared main theme and sub-themes emerged from both active and inactive groups

3. General barriers to PA

Regarding the general barriers, 80% of the participants, including 63% inactive and 17% of the active groups, reported lack of time as a barrier to PA engagement. This includes around 27% of administrators' staff, 23% academics, 19% senior management and 11% professional service staff. It is worthy to note that 67% of female employees who participated in this study reporting lack of time as a barrier to their PA engagement. The lack of time was the commonly reported barrier to PA participation between employees across job roles, which could be due to their workload. The present findings support previous research regarding lack of time being a commonly reported barrier to PA engagement (Deliens et al., 2015; Edmunds et al., 2013; Hunter et al., 2018).

Moreover, 29% participants suggested that the weather and the winter's darkness prevented them from engaging in PA. Some employees noted that they are likely to engage in PA (e.g. walking or jogging), but it is often difficult due to the UK's poor weather conditions. The present findings align with previous research concluding that the extreme weather, including cold temperature and the winter's darkness, negatively affects PA participation (Smith et al., 2018) and might be a significant concern for females. This aligns with current findings as 57% of females in the present study reported the weather as a barrier to PA.

2% of the participants reported injuries averting them from engaging in regular PA. Active employees injuries were typically related to exercise engagement, and the inactive individuals' injuries were related to gardening at home and moving items to the new house. The inactive individuals suggested that they would not participate in physical activities as it may cause them further injury. In contrast, the active employees reported that they would start exercising

as soon as they are fit to do so. This could be due to the knowledge, benefits and motivation of active employees whereas, inactive employees may lack knowledge and motivation to partake in exercise. The injuries sustained and averting further PA engagement is a novel contribution as it has not been previously reported in the workplace literature.

Moreover, 41% of the participants suggested family as a barrier to their PA engagement. This included 29% of inactive and 12% active participants. 15% of academics, 11% administrator staff, 10% professional services staff and 5% senior management also outlined family as a barrier to PA engagement. This was particularly salient for female participants, with 70% reporting this as a particular barrier. Present findings support previous research suggesting that family burden, especially childcare responsibilities, preventing them from engaging in PA (Chan et al., 2020; Hyun et al., 2018). Universities are diverse organisations with a range of job responsibilities. Thus, participants perceived family commitments restricting them from being active because they spent two to three days away from home. When they return, they try to spend as much time with their family, and most of that time is spent being sedentary. An example of family time is illustrated below:

"*I live an hour and a half away from work; I stay 2-3 nights away from home every week because I am away most of the week, so when I go home, I try to spend as much time with family/children as possible and most of that time is spent sitting because I am tired and this affects my family/children too"* (Administrator staff).

This barrier may negatively impact employees PA engagement, health, or wellbeing and influence family and children's lifestyle. For instance, family support is essential for an active and healthy lifestyle and this is evident in previous research suggesting that family/parental support found to be helping family/children meeting PA and other health behaviour guidelines such as reduced screen time and vegetable consumption (Payper et al., 2016). Leung et al. (2017) applied Eccles expectancy theory to examine the influence of family/parental support regarding children PA. Results revealed that children of active families/parents were also typically active. To overcome/facilitate family-related barrier, the influence of family support must be considered not merely for staff but also for their family/children as it plays an important role in developing an active and healthy lifestyle (Payper et al., 2016).

Finally, a lack of motivation was also noted as a barrier to approximately 51% of participants. This included 43% inactive and 8% active participants. Furthermore, 19% professional service, 14% administrator, 11% senior management and 7% academic staff reported this theme as a barrier to PA participation. This finding aligns with previous research suggesting

that lack of motivation was one of the most commonly perceived barriers to PA participation (Frikkel et al., 2020; Rhodes et al., 2020). Employees reporting lack of motivation as a barrier could be due to their lack of intrinsically motivation. Additionally, lack of management support and working environment can also impact employees motivation towards PA engagement.

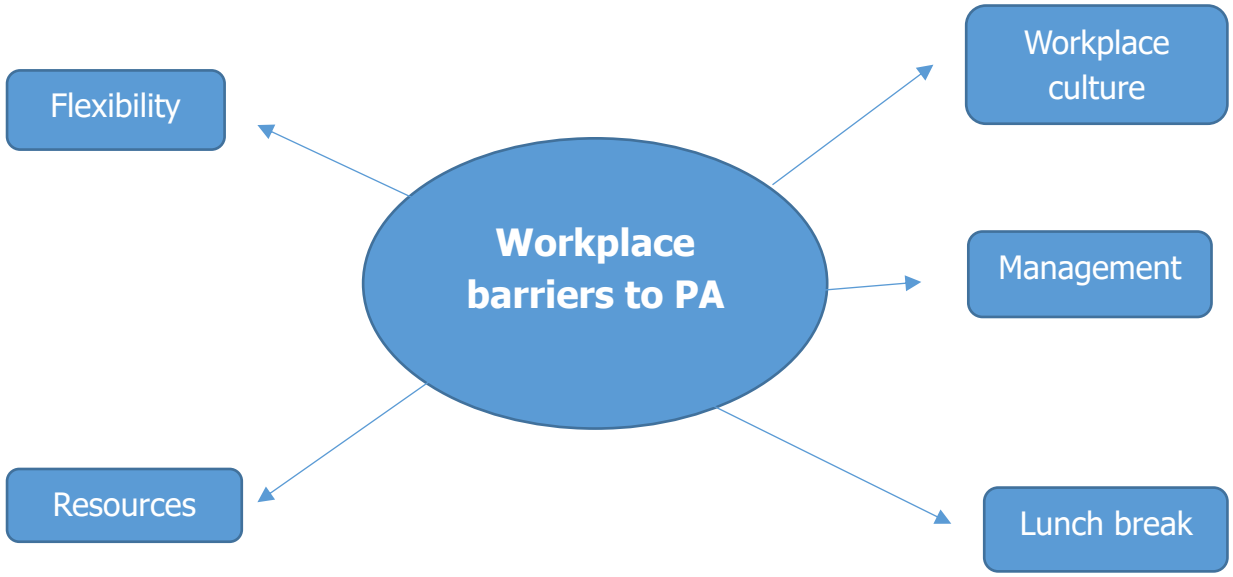

Figure 7. Shared main theme and sub-themes emerged from both active and inactive groups

4. Workplace barriers to PA

Regarding the workplace barriers to PA, approximately 58% of the participants reported workplace culture as a barrier to PA participation. This included 26% of administrators, 18% professional services, 9% academics and 5% senior management staff. 37% of the inactive participants and 21% of the active participants reported this theme. Moreover, over 75% of the participants reported lack of management support as one of the perceived barriers to their PA engagement in the workplace. This was particularly salient in the inactive participants (67%) and the female participants (63%). Besides, 51% suggested that short lunch breaks and adequate flexibility were barriers to PA Participation. This appeared to be particularly salient for administrator' staff (25%) in comparison to 19% professional services, 5% senior management, and 2% academics.

The present findings are similar to previous research suggesting that physical inactivity culture and lack of flexibility are barriers to PA engagement in a typical workplace (Edmunds et al., 2013). Universities are a diverse environment regarding job roles, power differences and gender. Thus, the existence of different workplace barriers within this workplace may be apparent. The lack of incentives, inflexibility and management support were also identified as one of the main obstacles to PA engagement within the university setting (Leininger et al., 2015). Moreover, present findings regarding working flexibility and management support lend support to Leininger et al. (2015). In the current study, academic employees are perceived to have more flexibility compared to other staff, and this could be a reason why most employees suggested this as a perceived barrier, as illustrated by examples below:

"If flexibility was there, for example, we can stay until late or leave early to attend the exercise classes would be really appreciated" (Male administrator).

"Depends on your role whether you got that flexibility. The staff need to have flexibility. I think staff need a flexible approach" (Male professional staff).

"*I would be able to take a long enough break to have a swimming session"* (Senior lecturer).

Of the 85% participants, 63% inactive and 22% active reported a lack of resources as a barrier to PA engagement in the workplace. Employees stated, changing facilities, including showers, were inadequate and there is only one shower in the City Centre Campus. Participants suggested, if staff exercise or cycle to work, they would need appropriate facilities; without the facilities, it may demotivate staff to partake in PA. The number of staff and students at this university means there is a real need for appropriate facilities if PA is promoted. Overall, the lack of facilities appeared to be one of the common barriers across all participants. This may be one of the critical barriers preventing employees from choosing a healthy and active lifestyle in the workplace, as illustrated below.

"*I think the university of any size have decent sports and shower facilities. Our university with 25000+ students and around 2000 staff, and we have one shower at the City Centre campus. Surely something needs to be done about this, because, look if there is no sports and exercise facilities and no showers, I mean yeah, it's a real struggle. Yes, I exercise outside of the Uni because there are no facilities here or when I cycle or walk to work, I am soaked (sweating), and I need to have a shower. There is one shower, and that's on the 3rd floor, and that really puts me off"* (professional service, female).

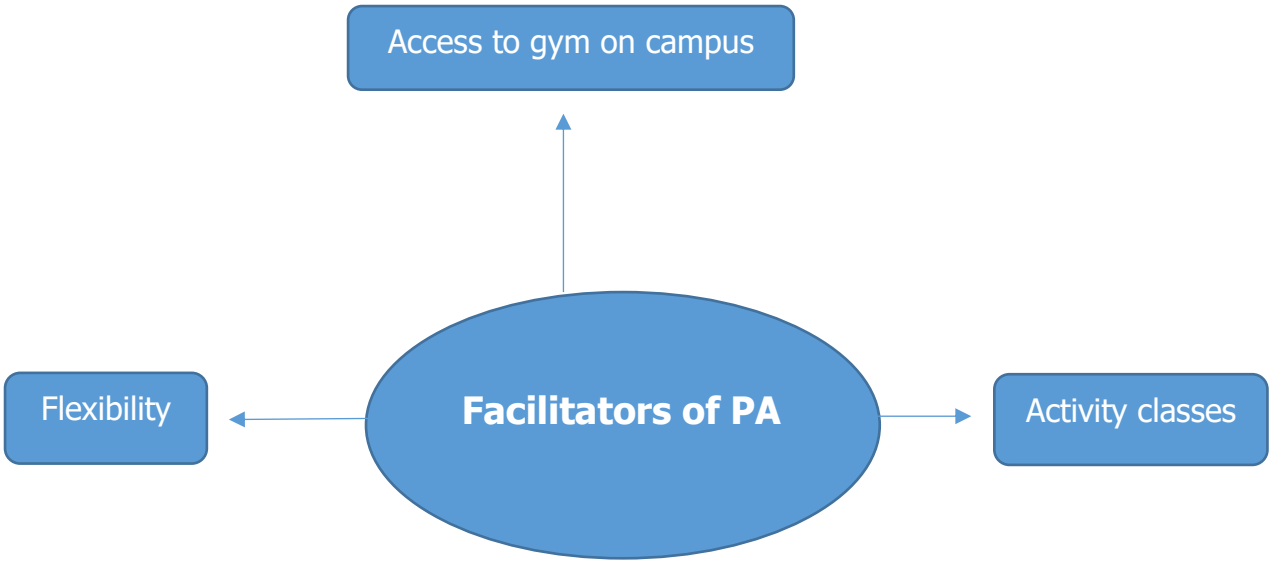

Figure 8. Shared main theme and sub-themes emerged from both active and inactive groups

5. Facilitators of PA

Regarding PA facilitators, having open access to a gym on campus may overcome their barriers to PA as they would be more likely to engage in PA/exercise if access to resources were provided. This was reported by 33% of the administrators, 29% of professional services, 21% of academics and 7% senior management. Participants in the active group (55%) reported this more than the inactive group (35%). Additionally, over 65% of the total participants (53% inactive and 12% active) perceived that activities including dancing, yoga, walking, running, and competitive sports would facilitate their engagement with regular PA in the workplace. Some quotations from employees as examples are illustrated below:

"We were under the impression that there would be a gym, but it never happened. Someone needs to be an entrepreneur and open a gym on campus, and I think it will do well. I joined a gym near my house, and it is another university's gym, as we don't have anything like it here, so university here needs to open a gym" (Associate professor).

"The University invested a lot of money on Doug Ellis, but now everybody is relocating, and it's a shame that nothing like that is brought down here (Edgbaston campus). Staff and students would really appreciate a gym with easy access near here (City Centre campus). I think a gym would make the university more attractive as well" (Administrator staff).

"*I am really confused like we have a brand-new building, but there isn't a gym for staff or students, I mean, that is ridiculous. Other small colleges and universities have a gym, and why can't we have it here at Edgbaston Campus"* (Assistant lecturer).

Previous research provided walking clubs, gym access and activities ranging from dancing, yoga, counselling and nutrition advice has suggested that access to the gym and walking clubs were the most effective in improving PA engagement. Employees showed overall satisfaction with the organisation and suggested that the workplace facilitate their PA engagement and take their health and wellbeing serious (Hunter et al., 2018; Hammerback et al., 2015; Watts and Mâsse, 2013). A recommended facilitator of PA shared by both groups in this study is the need for the university to consider a flexible policy and allow employees longer breaks or work from home to promote PA engagement as illustrated below:

"I think you need more than 30 minutes break. We tend to be in academic services our hours are set like 9-5 and have 30 minutes lunch, and you can't do PA in 30 minutes of break, this workplace is not flexible, and even if we had a flexible policy like working from home, sometimes this will help most staff go for a walk or do some sort of activity at home" (Professional services).

"If this university was flexible and allowing us to be away from the desk for longer or work from home at least two days a week, it would help many staff do more PA (Administrator staff).

The need for flexibility was proposed by 46% of participants. This includes 33% of the inactive groups and 13% of the active groups, with 37% female participants suggesting this need. In this study, not having sufficient flexibility is more of a barrier to females than males and this is not only related to the workplace but also family. For instance, this was particularly relevant for female participants, with 70% reporting family as a barrier to their PA participation because of the perceived family commitments, including childcare responsibilities restricting them from being more active. Previous research evaluated the impact of flexible working policies on employees, such as working from home and the subsequent impact on PA levels and sedentary behaviour (Olsen et al., 2018). The results suggested that flexible working policies did not change PA levels (Z= -.29, p>0.05) and surprisingly, sitting time was recorded higher on days when staff worked from home (Z=-2.02, p >.05) compared to in office (Z = - 4.16, p > 0.001). Suppose PA engagement does not improve with flexible policies such as allowing staff to work from home. In that case, a workplace needs to consider alternatives such as providing access to the gym or other PA and health-related initiatives and resources to employees at work with

flexibility to engage in PA. The following section is focused on the results and discussion exclusive to each group such as active and inactive commencing with figure 9 and then discussing the results of active group followed by the inactive group respectively.

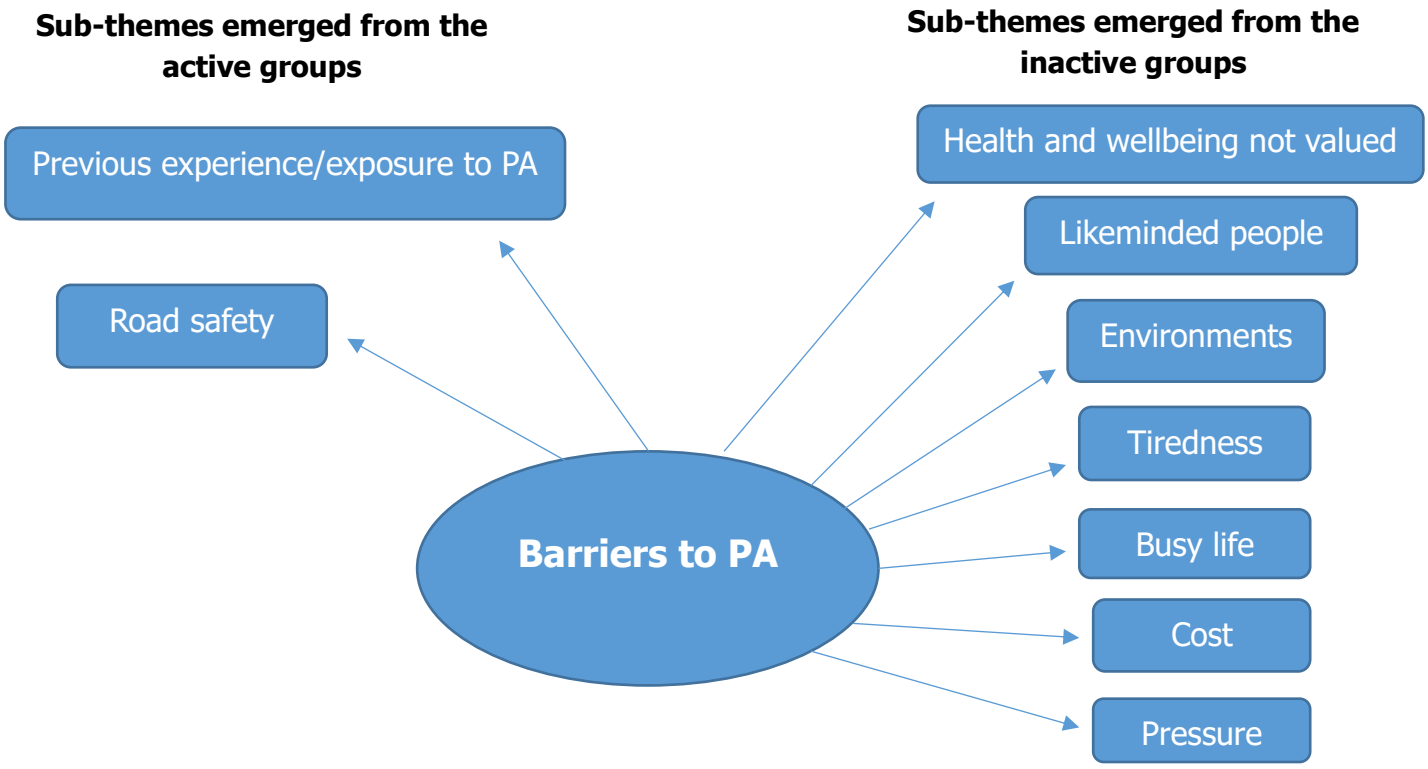

Figure 9. The main theme and sub-themes emerged and related to each active and inactive group

6.5.2 Summary of the active and inactive groups results and discussion

1. Discussion of the barriers to PA specific to the active group

Approximately 25% of the active group participants, including 17% academics and 8% administrators' staff, reported negative previous experience/exposure as barriers to their PA participation.

"When I was in school, I hated PE and I was doing anything just to get out of the class".
(Female administrator staff)

"My PE teacher was a bobby as he made me hate exercising." (Male academic)

Previous experience/negatively exposure to PA engagement could be due to their experiences in schools and their involvement in physical education sessions. The present findings support previous research reporting that having negative previous/childhood experience can affect PA participation in adulthood (Gothe and Kendall, 2016).

Furthermore, 35% of active group, including 15% academics, 13% professional services, and 7% administrator' staff, suggested road safety as a perceived barrier to their PA participation.

"I started cycling but there isn't a safe route for cycles, and I wouldn't start again until there is safe roads because I know how bad people drive". (Female assistant lecturer)

The current findings support previous research where road safety has been highlighted as one of the barriers to PA where individuals fear for their health and safety due to a lack of cycling routes in the UK (Bauman et al., 2008; Cleland et al., 2015).

2. Discussion of the barriers to PA specific to the inactive group

This group also suggested a range of barriers preventing them from engaging in PA. The environment was reported as a barrier by 42% of the inactive participants (including 27% of females and 21% professional services, 13% administrators', 5% academics and 2% senior management staff). Workplace or community sectors providing opportunities for individuals to engage in PA are regarded supportive environments that play a positive role in encouraging active behaviour. However, unsupportive environment, including fear for safety, is regarded as intermediated and leads to inactive behaviour and considered as barrier to PA participation. Recent research suggested that individuals working or residing in an environment in which PA is regarded as necessary are more likely to perceive fewer barriers to PA, therefore, engage in more regular PA than an environment where PA is not a social norm (Safi & Tony, 2021).

"There are canals to run, and I been there with my students, but I wouldn't recommend it for a male or female. It's pretty intermediated, and there are security issues with the canals; it's not a fantastic place to go there, especially alone" (Male senior lecturer).

Tiredness, busy lifestyle, the cost of gym membership and lack of likeminded people and workplace pressure have been reported as perceived barriers to PA participation amongst this population. Tiredness was reported as perceived barrier to PA by approximately 71% including 37% of male and 34% of female participants. Being too tired to participate in PA was similarly observed within this population regardless of their gender. This could be due to workplace pressure, busy lifestyle, and participants not being surrounded by like-minded individuals (i.e.,

colleagues and family/friends) to encourage PA participation either within or outside of the workplace. The current findings align with recent research suggesting that the sensitivity to work colleagues' behaviour may well reflect a broader need to be perceived as a barrier to PA participation (Safi & Tony, 2021; Jindo et al., 2020).

"I think people are so tired after work, and they may just be looking forward to tea, dinner, and TV" (Male head of the Department)

The cost of PA was also reported as a particular barrier for the inactive employees (62%), especially by females (69%), administrators (31%) and professional services (54%) compared to academics (31%) and senior management (15%). This could be due to the salary differences that academics and senior management typically tend to be on a larger scale than other job roles. Despite showing interest, some participants were already engaging in PA but gave up because of the cost.

"Yeah, the cost is a big one for me. I used to swim once a week, but I can't anymore, and there aren't like-minded people to go with, and my family isn't here. I am tired after work as well, so yeah, I mean that affect my motivation to go all the way to another university and use their swimming pool" (Professional service).

Although the participant university has an affiliated membership for staff to use another university's exercise facilities at a discounted rate, most of the employees appear not to have engaged with this opportunity because of the cost.

"Well, the cost is a big factor when I go to the swimming, although I have the associated thing in Aston pool it does bring the cost down but still it's not cheap, and I don't think I can subscribe to a long term because I don't know if I can commit to it cost-wise as well as because of all the other reasons we just mentioned" (Lecture, female).

Previous research (e.g., Harris et al., 2019) suggested that people from lower socioeconomic status reported a lack of PA engagement, which may be a contributing factor seen in the current findings. As detailed in the SEM, the organisational rules, regulation and strategies can either promote or endanger employees health (McLeroy et al., 1988). See the example from the raw data below.

"Cost is another big factor I used to pay for the gym, but then I cancelled it because I couldn't afford it" (Senior lecturer, male. "I used to go swimming once a week, and I don't anymore because it's too costly" (senior management).

As detailed in section 2.3, individuals may be motivated differently for various reasons, (i.e., intrinsically or extrinsically). If their needs related to competency, autonomy and relatedness are met, it can contribute to the intrinsic motivations and result in more positive PA behaviour (Ankli and Palliam, 2012; Deci and Ryan, 19985; Ryan and Deci, 2000).

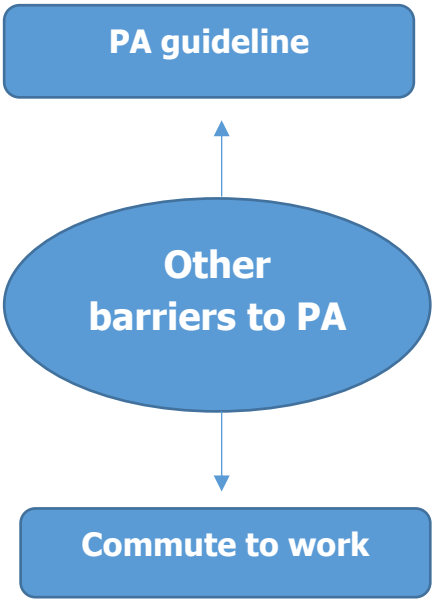

Figure 10. The main theme and sub-themes emerged and related to inactive group only

3. PA guidelines

Approximately 81% of the participants were not aware of the recommended PA guidelines. Despite this, they engaged in a discussion. They discussed their perceptions of desirable PA guidelines, such as one hour per day of aerobic exercise, an hour a day of walking activities or less than an hour if an individual wants to stay fit. Not being aware of guidelines may be correlated to PA engagement behaviour, which is evident from the examples below.

"I am not aware what the recommendation is, but I would say you need an hour of a day walking or some kind of moving around away from your desk" (professional services).

"I don't know what the recommendation is, but I think it may be less than one hour a day as a minimum of an hour sound better if you want to stay fit, but I don't know the recommendation" (Senior lecturer).

After discussing the first question related to PA guidelines, and most of the inactive participants not being aware of guidelines, they were then provided with the PA guideline of

150-300 minutes of MVPA for further discussion. The intensities of PA/exercise, such as light, moderate and vigorous, were also explained. After the explanation, participants were asked if they felt it was possible to meet the recommended PA guideline either within or outside of the workplace. The mixture of responses suggested that a limited number of participants noted they could meet the guidelines by walking to and from work.

"I can easily meet the moderate level like walking as I can just start walking to and from the train station from now on rather than catching a bus" (professional services).

However, most inactive participants suggested that it would be difficult to achieve the recommended guidelines because a range of factors needs consideration when exercising, including other responsibilities that takes priority and need to be done throughout the day rather than engaging in PA or exercise. For example:

"I don't take particular exercise for me that's often problematic because I got so many other things to do in a day" (senior management).

4. Inactive commute

90% of the inactive participants (including 37% administrator staff, 26% academics, 23% professional services and 4% senior management) reported they have an inactive commute to work and perceived this as a barrier to their PA participation. 73% of females reported an inactive commute to the workplace. Participants choosing inactive commute could be due to the distance, lack of education or lack of time, as reported one of the main perceived barriers to PA engagement in this study. Educating or being aware of the health and wellbeing benefits related to active commute may lead people to choose an active or a combination of active commute to the workplace. Previous research compared active and inactive commuters and reported that individuals being aware of the associated benefits of active commutes, especially those living in a close distance and actively commuting to work, reported a positive effect on mood states, energy level, better health and enhanced productivity compared to inactive commuters living in the distance and not being aware of the associated benefits of PA engagement (Page and Nilsson, 2017).

For instance, in this study, most inactive employees were not aware of the recommended PA guidelines. Thus, this may have been one of the contributing factors to inactive commute. Most of the inactive participants were noted to be using inactive commute to work, such as mainly driving, which affects PA levels, increases sedentary behaviour, and may negatively

impact their health and wellbeing. As detailed in section 2.2, that behaviour change takes place through stages. Participants in this group noted they mainly take inactive commute such as driving and parking near the office to avoid walking. This is known as the precontemplation stage of the TTM, in which individuals may not be conscious of the impact of their behaviour and has no intention to change (Adams and White, 2004).

"I commute to work in the car, and then I try to find a car park space near my office, so I don't have to walk much" (senior management).

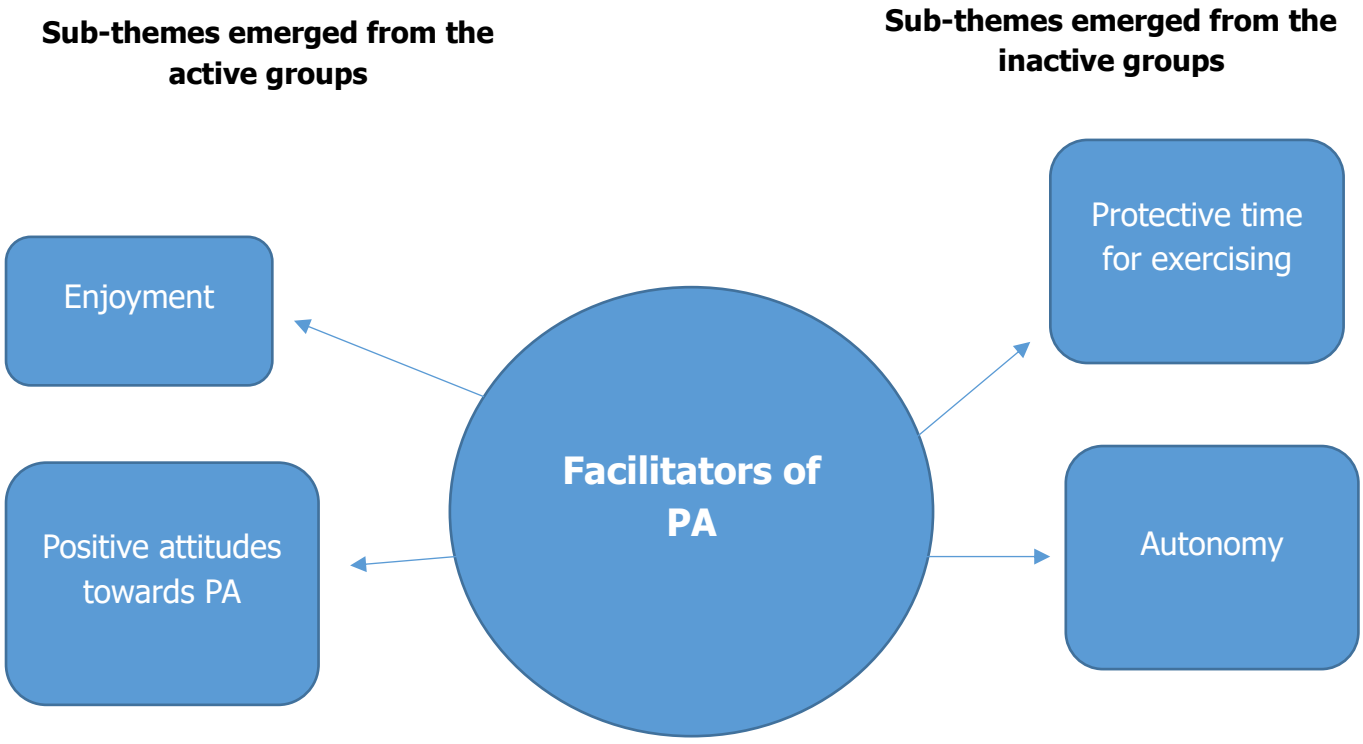

Figure 11. The main theme and sub-themes emerged and related to each active and inactive group

1. Discussion of the Facilitators to PA specific to the active group

The things that would further facilitate PA for the active group included personal factors such as perceived enjoyment (45% of the participants) and positive attitudes towards partaking in PA/exercise (25% participants). Some participants suggested they use weekends to exercise to compensate for their workplace weekly sedentary behaviour.

*"I am quite interested in exercise and I enjoy it. Yeah I try to use weekends for exercise but something enjoyable here at work would be very helpful". (*Male lecturer)

This shows that employees can be self-motivated and have a positive attitude to PA when they have time and autonomy. As mentioned in section 2.3, self-determination theory emphasised the three main requirements. One of the critical necessities for a human is autonomy, such as self-directed or control (Deci and Ryan, 2002). When individuals have freedom, it can lead to motivation and satisfaction and in turn, this results in higher wellbeing (Ryan et al., 2010; Olafsen et al., 2017). Interventions focused on promoting PA, health and wellbeing could positively improve PA engagement if autonomy is considered.

Active participants also reported that they enjoy partaking in PA. Suppose they miss the opportunity to engage in exercise. In that case, this means they even miss it mentally because they are aware that being sedentary is harmful to their health and wellbeing, as illustrated below:

"I run, and I enjoy it and I been doing it for two and half years, and I am happy to continue doing it, but if I miss it, I miss it, and I miss it mentally." (Female senior lecture).

As explored in section 2.2, the counter conditioning process, when an individual identifies being physically active as a favourable substitute for being sedentary. For instance,

"I have positive attitudes towards PA. Yeah very interested and would love to do more whilst at work". (Female senior management)

The positive attitudes leads to self-re-evaluation in self-re-appraisal, such as their sedentary behaviour making them feel disappointed. This then can lead to the maintenance stage, which could produce a healthy and active lifestyle. Moreover, the SEM suggests that people's behaviour/attitude is not only influenced by the intrapersonal characteristics but also by social factors including the interpersonal community, an organisation such as the policies, rules and overall environment influence behaviours, attitudes and knowledge that may impact health (McLeroy et al., 1988). For instance:

"My attitude is positive but depends on the daily schedule really" (Male Professional services).

The subsequent section is focused on the results and discussion that are unique to inactive employees.

2. Discussion of the Facilitators to PA specific to the inactive group

Approximately 76% of the participants in this group suggested having autonomy would facilitate their PA engagement. 67% suggested having a protected time for exercising in the workplace would help them engage in PA behaviours. This was particularly salient for the administrative and professional services (33% and 21%, respectively). Moreover, participants suggested that protected time would help them move away from their desks and be more active. The HEI has entry passes for the 'Botanical Garden', which might be used for 15-20 minutes of a day, but this can only be utilised if the staff is protected to move away from their desk.

"It's too tempted to sit at a desk and have lunch. It's simple rather than get out at lunchtime and walk is too difficult. If there were a protective time to exercise, that would have been helpful; even having passed to the Botanical Garden for 15-20 mins walking in a garden would actually help a lot. However, that time has to be protective so staff can freely move away from their desk without worrying" (Lecturer).

"There should be some protective time during the day if staff wanted to do some exercise or something else that would help them refresh". (Male senior management)

As detailed in section 6.6.2, having autonomy can lead to intrinsic motivation and satisfaction, leading to active behaviours.

"I don't have that freedom to go and do some exercise when I want as we tend to be in academic services and our hours are kind of set you do kind of 9 - 5, so if there is some freedom during my working hours I would exercise". (Female professional services)

Staff recognising and suggesting ways that may help them change from sedentary to active behaviour, demonstrates they are thinking about the change. Hence might be in the contemplation or preparation stage of the TTM and may need supportive interventions to help them move into the active phase of behaviour change. Moreover, the SEM suggest that policies, rules, management and overall working environment influence employees behaviour and attitudes towards their health and wellbeing (McLeroy et al., 1988). Previous research suggested, workplace policies, culture and staff flexibility significantly affect individuals' PA and health behaviour (Lee et al., 2012). Advocating, physical inactivity can be improved if management, policymakers, public health experts and leisure recreation sectors embrace challenges, led by an example and provide tailored PA and health interventions for employees

in the workplace (Reis et al., 2016). Staff are likely to be productive, positive, loyal, lead an active and healthy lifestyle if their workplace and management are supportive (Ryan et al., 2010; Olafsen et al., 2017).

6.6 Limitations of study

This study found its strengths in obtaining insight into the barriers and facilitators of PA behaviours for university employees according to their current PA engagement and between job roles. However, this study is not without limitations, including not exploring participants education levels, ethnicity and age, which might influence their perceptions. Despite the limitations, current findings provide meaningful and transferable results regarding university employees barriers and facilitators to PA behaviour. These outcomes can be applied to design PA, sedentary behaviours, health and wellbeing interventions for the under-research population in the workplace and are influential to study three of the current thesis.

6.7 Conclusion

This study aimed to understand the barriers to university employees PA engagement. The additional aim was to identify facilitators to PA engagement suggested by this population. As indicated, individuals in the management positions do not take time out for lunch, and lack of management support was also stated as one of the main barriers between job roles and genders preventing PA engagement. This demonstrates unhealthy behaviour led by the senior management and the type of unhealthy workplace culture this university has. The unhealthy culture may negatively impact employees PA behaviour, retention, productivity, sickness absence, job satisfaction and long-term health and wellbeing. To facilitate PA engagement a comprehensive approach is needed to accommodate PA in the workplace for different job roles and genders. The outcome of this study suggests that future research must focus on comprehensive interventions, regardless of job roles, to promote active lifestyle workplace culture. Future research must focus on providing educational, motivational and informative interventions concerning the importance of engaging in PA, its effect on health, wellbeing and the alternative ways to meet the PA guidelines whilst at work without needing to go to the gyms as explored in sections 7-11.

The present findings suggested that having open access to the gym, exercise activity classes on campus would go some way to overcome the barrier to PA participation. However, these would also help them engage in PA/exercise, which may positively change the university's

current unhealthy culture. Having access to the various activity classes such as walking, and sport-related competitions would be beneficial and may serve as a facilitator and contribute to employees PA behaviour. Though, opening a gym is not in the scope of this thesis. However, an intervention with placing exercise equipment in staff offices and providing them with open access to additional resources is feasible. This will help monitor staff engagement in using the exercise equipment daily or weekly and potential impact on their health. The result of this intervention may lead this university to open a gym with open access to staff as detailed in section 7.5.

Another suggested facilitator was enjoyment and attitudes towards engaging in PA/exercise and reducing sedentary workplace behaviour. Employees indicated that due to workload and lack of facilities in this university, they use weekends to engage in PA/exercise to compensate for their sedentary behaviour, which applies to the different job roles and genders. However, as discussed in section 5.5, this population spent most of their weekly sedentary time; thus, providing an adjustable height desk to employees may serve as a facilitator because it may allow them to sit and stand throughout their working day.

Employees suggested that having protected time, for PA engagement even 15-20 minutes, and having passes to the Botanical Garden may help them engage in active workplace behaviour. This study identified generalisable and specific barriers and facilitators from university staff perception about PA engagement. The findings contribute to the scarce literature in terms of evaluating obstacles and facilitators of university employees. These findings can be applied to form PA, sedentary behaviour, health and wellbeing-related interventions, as briefly mentioned. This study's results can inform future practices aiming to reach university employees and the broader workplace PA engagement. The subsequent section details the interventions of this thesis.

Chapter 7.0
Interventions to enhance PA and reduce sedentary behaviour amongst university employees

The findings of study three has formed five interventions aiming to promote PA engagement, reduce sedentary behaviour, improve health and wellbeing amongst university employees in the workplace. Some of the interventions were delivered simultaneously and participants were different in each intervention. The interventions are briefly outlined below:

1. Accessibility and the availability of exercise resources in the workplace

Lack of access to exercise equipment/exercise classes and facilities, including no access to gym, were commonly reported barriers to employees in this workplace, as explored in study 3 of this thesis. The key suggested facilitator to promote PA behaviour was to have a gym in this university workplace with open access. Opening a gym was not in the scope of this project, but other opportunities to explore equipment access were adopted to help overcome this barrier. For instance, the intervention was adopted, requiring exercise equipment to be relocated to large staff offices and monitor employees engagement as explored in section 7.2.

2. Promoting more active behaviours in the workplace through sit and stand workstation provision

As evidenced from the first two studies of this thesis that demonstrated employees spending 2880 minutes being sedentary across the week as explored in sections 4.6 and 5.5. Moreover, employees are spending a significant amount of time at work. This shows that the physical demands of jobs are declining. This decline leads employees to spend most of their weekly time sitting. The increased sedentary occupations is one of the main contributors to obesity and diabetes (BHF, 2016). The sedentary lifestyle is also related to health issues including obesity, high blood pressure and chronic diseases because of the way it affects circulation as individuals seldom use muscles and bones whilst in a seated position (Cheung and Chow, 2012; Chin et al., 2017; Grunseit et al., 2017; Mackenzie et al., 2017). The workplace environment and culture contributes to sedentary behaviour and it is vital to understand these factors because they impact employees behaviour, as suggested by the SEM (McLeroy et al., 1988). Therefore, intervention was adopted, providing height-adjustable workstation to monitor if providing a height-adjustable workstation as adjunct to the normal desk space can

reduce sedentary behaviour and improve health, wellbeing, QoL and productivity in the workplace as detailed in section 8.1.

3. Exploring the impact of seated, standing and walking meetings in the university setting

As aforementioned that employees spent a significantly higher amount of time being sedentary therefore meetings are regarded as essential in the workplace. For meetings colleagues across job roles come together for a shared purpose of allowing communication, data sharing and verdict production (Shumski et al., 2018). Despite the importance of meetings, lack of research investigating the influence of meetings on employees mood states, energy level, sedentary behaviour and PA (Rogelberg, Shanock, & Scott, 2012; Shrestha et al., 2016). Employees spend an average of 360 minutes preparing and attending meetings throughout the working week (Rogelberg et al., 2006). Allen et al. (2014) have suggested that for those in managerial roles, around 75% of their working hours are spent preparing, attending or leading meetings and most of that time is spent in a sedentary position. Moreover, lack of time, management support and supportive workplace culture were some of the barriers reported by employees in study 3 of this thesis in section 6.5. For instance, employees stated several activities continue during lunchtime, including departmental meetings, which impact their ability to be active. They have no option but to sit with little flexibility to move around during such meetings physically. Therefore, intervention was adopted to compare, standing and walking meetings with the usual seated meeting to explore potential impact on university employee's mood states as detailed in section 9.1.

4. Getting university employees on the stairs: The impact of points of decision prompts

This population has reported a range of barriers to PA in study three of this thesis, including lack of time, workplace culture, access to resources, cost, busy working lives and lack of autonomy (see sections 6.5.1, 6.5.2 and 6.5.3). Thus, simple way such as promoting stair use may encourage employees to change their sedentary to active decisions. This is particularly pertinent in the TTM, where the move from the contemplation stage to action for behaviour changes may result from cognitive strategies to change thinking. For instance, consciousness-raising is a process that actively leads to more awareness of the present situation and the decisional balance considers the advantages and disadvantages of behaviour change which leads to acknowledging positives and negatives of changing behaviour and the consequences (Kim, 2020; Liu et al., 2018). Encouraging employees to use the stairs rather than lifts could

contribute to their PA in the workplace. This is an intervention that can be helpful in facilitating the barriers outlined by displaying a motivational and educational PA, health and wellbeing banners near lifts and stairs focused on promoting stairs use as an alternative to the lifts in the university workplace as detailed in section 10.1.

5. Promoting PA amongst employees through the 10,000 steps team based competition

As detailed in section 6.5 that university employees noted access to resources, activity classes, protective time, flexibility and enjoyment would potentially facilitate their PA engagement in the workplace. In addition, walking has generally been acknowledged as a convenient and free form of exercise that can integrate into everyday life (Audrey et al., 2014). Thus, this intervention aimed to promote PA among university employees via a team-based competition targeted towards the recommended 10,000 steps per day as detailed in section 11.1. The subsequent section provide a contextual overview including justification for each intervention, aims/objectives, methods, results, discussion, limitations and conclusion for each intervention as a chapter; commencing with intervention one.

7.1. Intervention 1: Accessibility and the availability of exercise resources in the workplace

7.2 Contextual overview

Research has suggested that the absence of PA resources and facilities are associated with poor PA engagement amongst adults (Kilpatrick et al., 2017; Roux et al., 2007). Research has explored more than 11,500 participants in 11 countries. The results suggested resources, including the availability of cycling and low-cost recreation facilities, influenced PA levels (Sallis et al., 2009). However, interventions need to be well-thought before implementing. It is outlined that interventions might not support employees PA engagement and health unless they are tailored to the environment (Donaldson-Feilder et al., 2017). A combined intervention focused on equipment provision adjusted to individuals and the working environment showed significant reduction in blood pressure and cholesterol, whereas intervention only focused on individuals showed that participants put on weight and reported higher BMI (Donaldson-Feilder et al., 2017; Goetzel et al., 2010). Adopting PA, health and wellbeing interventions may require active participation, supporting and adjusted policies. This includes workplace practices to foster, create/provide accessible information and access to PA resources whilst at work, as detailed in section 2.4 of this thesis. Convenient scheduling of activities and cohesively working also demonstrated a critical role in employees PA behaviour (Shain and Kramer, 2004). Workplaces and employees need to work together both intrapersonally and interpersonally, as suggested by the SEM to develop an inclusive plan when implementing PA and health-related interventions.

For instance, a short-term PA, health and wellbeing designed intervention was conducted on more than 430 university employees to evaluate their interest in three areas (Tapps et al., 2016). The areas included 1) PA: such as exercise programme, strength training and walking clubs; 2) nutrition: this included cooking classes, healthy eating and weight watchers and 3) lifestyle: included stress reduction, sleep improvement, smoking cessation, time management, overall health and wellbeing (Tapps et al., 2016). The results indicated that over 30% of participants reported being members of a fitness club and over 25% were either frequently or very frequently active in the workplace (Tapps et al., 2016). However, it was not identified if participants who were reported as members of the fitness clubs and those 'frequently or very frequently active in the workplace, met the PA guidelines and how this differ between 'frequently and very frequently active' individuals, across job roles and genders. These

participants job roles were also not identified (i.e. academics, administration, or estate). Thus, it is not possible to conclude the effect of their job role and PA behaviour or if their job required them to be physically active. Previous research compared PA levels of PE teachers versus non-PE teachers and concluded that job roles involving active movements were found to be accumulating more PA (PE teachers =8,858 steps; non-PE teachers =6897 steps, $p<0.05$) (Cheung and Chow, 2012).

A study conducted by Alkhatib (2015) in two different UK based universities investigating if time spent sitting and associated risk factors could be minimised through work based exercise intervention. The campus-based intervention was ten weeks long and involved two supervised treadmill exercise sessions per week. Each exercise session lasted for 25 minutes of moderate exercise. The findings revealed that exercise intervention enhanced maximal and submaximal cardiorespiratory volume for both genders ($p < 0.05$). The results further proposed that the job roles and genders had no effects on prolong sitting risk factors, including BMI, diastolic blood pressure and VO_2max. This study concluded that the exercise intervention was highly effective in terms of improving cardiorespiratory capacity by 5% in VO_2max ($p < 0.05$) and an 18% enhancement in ventricular tachycardia (Alkhatib, 2015). This intervention showed that embedding PA in the working hours and providing resources make it accessible for employees to engage in regular PA while improving their health.

Moreover, there is limited available data focused on accessibility and PA resources within universities. Hence, comprehensive plan of PA and health improvement strategies with tailored interventions to facilitate PA are needed. Inclusive intervention in the workplace can effectively increase PA levels, which may lead to public health and clinical significance (Alkhatib, 2015). In summary, most of the existing literature concluded that providing PA/exercise resources access will promote PA behaviour in the workplace.

7.3 Aims and objectives

This intervention aimed to provide university employees with access to exercise equipment by placing exercise bikes and rowing machines in staff offices and monitoring engagement with equipment. The additional aim was to compare participants health and wellbeing pre versus post-intervention to explore its usefulness.

7.4 Methods

The Monark cycles (ergomedic 874-E) were placed in five offices. A rower concept 2 model D ergometers was placed in one office (see Appendix 18 for pictures of the Monark cycle and concept 2).

As explored in section 3.0, there are multiple direct and indirect tools for measuring time spent engaged in PA/exercise. Consequently, for this intervention, a questionnaire and a PA logbook were used to measure the impact of providing exercise equipment on health, wellbeing and quality of life (QoL) pre versus post-intervention. Previous research shows that exercising for 30 minutes a day in a moderate intensity for five days a week can have a positive impact on QoL and wellbeing (Brown et al., 2003; Guimarães and Baptista, 2011; Puciato et al., 2018). However, there was a lack of variability as the sample primarily comprised of people who were already active. Thus, it was not clear if this can be applied to those who never or seldom engaged in PA within or outside of the workplace (Finch et al., 2017). High-quality pragmatic studies are needed, and workplaces must adopt solutions that suits employees (Reis et al., 2016; Ryde and Brown, 2017). Therefore, more research is needed to compare and contrast the impact of engaging in exercise for less than 30 minutes a day and with light intensity on QoL and wellbeing. Despite the knowledge and implication of physical inactivity much less is known about the PA, QoL and wellbeing within universities. Further research is vital to clarify the benefits of PA, health, QoL and wellbeing interventions amongst this population (Gilson et al., 2007; Hadgraft et al., 2015; Leininger et al., 2015a).

University employees are in unique positions that also influence their students' lifestyle choices (Cooper and Barton, 2015). Thus, conceptualising health, wellbeing and QoL of this population holistically and developing a habit of interconnections between work-related and non-work related impacts are essential (Sivris and Leka, 2015). Previous research has concluded, strategies of promoting PA, sedentary behaviour, QoL, health and wellbeing of employees are required as such interventions may be a positive addition to the worksite (Cooper and Barton, 2015; Haines et al., 2007). Research showed that PA, health and wellbeing programmes must build in multi-dimensional approaches and the impact of interventions must be pre and post measured (Fenton, 2014; Ivandic et al., 2017). It is necessary for future interventions to explore aspects that may facilitate PA levels, sedentary behaviour, health, QoL and wellbeing promotion between the under researched population (Butler et al., 2015; Chae et al., 2015; Dooris et al., 2017; Fountaine et al., 2014). Therefore, it is important to focus on PA, sedentary behaviour, health, QoL and wellbeing of university employees across job roles and genders.

As evidenced in sections 4.6 and 5.4 that employees are spending a substantial amount of time being sedentary and the effect of prolong sedentary behaviour has been outlined in section 1.8. As further explored in section 6.5.2, this population specified that their health and wellbeing are not valued by the university. However, given the importance of wellbeing and QoL in the workplace it seemed important to include the most valid and reliable wellbeing and QoL measures in this thesis as explored in section 7.4.1.

Participants in this thesis completed the standard Sport and Exercise Physical Activity Readiness Questionnaire (PARQ) before the intervention to ensure participants health and safety (see Appendix 23). After completing the PARQ, participants were given the 'Work Limitations Questionnaire Long-Form' (WLQ-LF; Lerner et al., 1998). The copy of this questionnaire cannot be shared due to the signed agreement with the author; however, the questionnaire is available from the 'Mapi Research Trust'. The other questionnaires included the 'WHO Quality of Life-BREF' (WHOQOL-BREF; Group, WHOQOL, 1994) (see Appendix 24); the 'Rand 36-items Health Survey' (SF-36; Ware & SherbourThe2) (see Appendix 25) and the 'Health Questionnaire EQ–5D–5L' (Herdman et al., 2011) (see Appendix 26). These questionnaires were selected as they ask a series of questions about employees health, wellbeing and QoL, ranging from day of completion and over the previous two and four weeks.

7.4.1 The WLQ-LF

The WLQ-LF was designed to investigate health implications interfering with specific aspects of job performance and the impact on work productivity (Munir, 2008). The WLQ-LF asks 25 job-related questions relates to the last two weeks, and answers are combined into four sub-scales:

1. 'Time Management' consists of five questions exploring the difficulty individuals may be facing in managing time and scheduling demands.

2. 'Physical Tasks' - exploring individuals' ability to perform daily job activities involving physical strength, stamina, movement, coordination and flexibility.

3. 'Mental/Interpersonal tasks' - nine items evaluated cognitive job tasks and job social interaction.

4. 'Output Demands' - five items focused on reducing work output, such as quantity and quality (Munir, 2008). The items range from 0 (limited none of the time) to 100 (limited all the time).

The questions of the WLQ-LF provides insight and replicate a comprehensive characteristic of some illnesses and productivity loss that may impact certain job activities (Munir, 2008; Lerner et al., 1998). The WLQ-LF has been validated with a diverse population, including people with chronic health issues such as osteoarthritis, depression, back pain and employees in various settings (Lerner et al., 1998; Lerner et al., 2001; Lerner et al., 2002; Munir, 2008). The WLQ-LF has revealed good construct and criterion validity. The scale is shown to be significantly related to the 'Medical Outcome Study Questionnaire Short Form 36 health Survey' that also measures physical and mental health (Lerner et al., 1998; Lerner et al., 2002). The inter-rater reliability measures found 79% of agreement and reliability coefficients were reported to range from 0.70 to 0.90 for all questions and 0.88 to 0.91 for items within each questionnaire scale (Lerner et al., 2002; Munir, 2008). Previous research supported the use of WLQ-LF for PA, health and sedentary behaviour interventions across a range of settings (Denis et al., 2007; Allen et al., 2007; Lewis and Malecha, 2011; Lusa et al., 2020; Muschalla et al., 2020).

7.4.2 WHOQOL-BREF

The WHOQOL-BREF is 26-items questionnaire developed by the WHO exploring four domains: 1) physical ability; 2) psychological; 3) social relationship; and 4) environment, and is focused on measuring QoL (Group, WHOQOL, 1994; Skevington et al., 2005). Scores for questions in each domain range from (1 – 5) and scores are scaled positively. For example, higher scores denote a higher QoL (Group, WHOQOL, 1994). The WHO (1994) defines QoL as 'individual's perception of their position in life in the context of culture and value systems in which they lives and in relation to their goals, expectations, standards and concerns' (Skevington et al., 2005). The WHOQOL-BREF is widely and culturally accepted assessment for QoL. It has been commonly utilised across settings ranging from general population, hospital patients, primary care settings and workplaces (O'Carroll et al., 2000; Isahak., 2017; An et al., 2019). The reliability and accuracy of WHOQOL-BREF are well established and the values for Cronbach's alpha were acceptable (>0.7). Each domain showed inter consistency, for example, physical 0.82, psychological 0.81, social 0.68 and environment 0.80 (Skevington et al., 2005).

7.4.3 The 'Rand Health Survey' (SF-36)

The SF-36 questionnaire assesses health status and consists of 36 questions grouped into eight categories: physical functioning; role limitations due to physical health; role limitations due to the emotional problems and energy/fatigue; emotional wellbeing; social functioning; pain; and general health. Each question is answered on a scale of 0 (lower functioning) to 100 (highest possible level of functioning) (Hays and Shapior, 1992). The reliability of SF-36 has been well established as 0.80 overall and over 0.90 within the physical and mental categories (McHorney et al., 1994; Ware et al., 1993). Failde et al. (2000) assessed the validity and reliability of SF-36 and found that the item-internal consistency per category for physical functioning was 0.55-0.84; social functioning 0.88-0.89 physical problem 0.86-0.91; emotional problem 0.93-0.95; mental health 0.73-0.80; vitality 0.76-0.80; pain 0.92-0.93 and general health was reported to be 0.53-0.78 and the validity was well validated. Failde et al. (2000) reported that the SF-36 is a valid, reliable and concise measure for assessing health status. Zhang et al. (2012) assessed the validity and reliability of the 36-SF and results showed similar findings to previous studies. Previous research has applied and supported the use of SF-36 in a range of populations and settings across the globe (Appleton et al., 2020; Bowman, 2019; Jones et al., 2019; Kaur et al., 2020; Ding et al., 2020).

7.4.4 Health Questionnaire EQ–5D–5L

The EQ-5D-5L is a 26 items health status questionnaire, consists of five categories: 'Mobility; Self-Care; Usual Activities (i.e. work, study, housework. family and leisure activities); Pain/Discomfort and Anxiety/Depression. The validity of EQ-5D-5L indicated that the test-retest reliability showed a moderate interclass coefficient >0.6 (Sonntag et al., 2013). Nolan et al. (2016) also concluded that the EQ-5D-5L is a valid and responsive measure for health status. Previous research has utilised and supported the EQ-5D-5L questionnaire in various settings and populations (McCaffrey et al., 2016; Crescioni et al., 2017; Gerlinger et al., 2019; Shields et al., 2020). However, it should be noted that all 26 items of this tool did not apply to the current intervention. Thus, only the last question concerning how individuals imagine their health 'today' using the scale of 0 (the worst health) to 100 (the best health one can imagine) was used for this intervention.

7.4.5 Participants

Via a central health and safety assessment, six offices were identified as suitable sites for placing fitness equipment for staff use (see Appendix 14 for the risk assessment). The Monark cycles 874E and rower concept 2 model D ergometers were placed in offices to promote maximum engagement opportunities without staff having to venture across campus. Figure 12 provide the breakdown of employees in six offices where equipment were located. A sample of 57 individuals participated in this intervention. This included 40 females and 17 males from a range of office locations in which most of the employees were females.

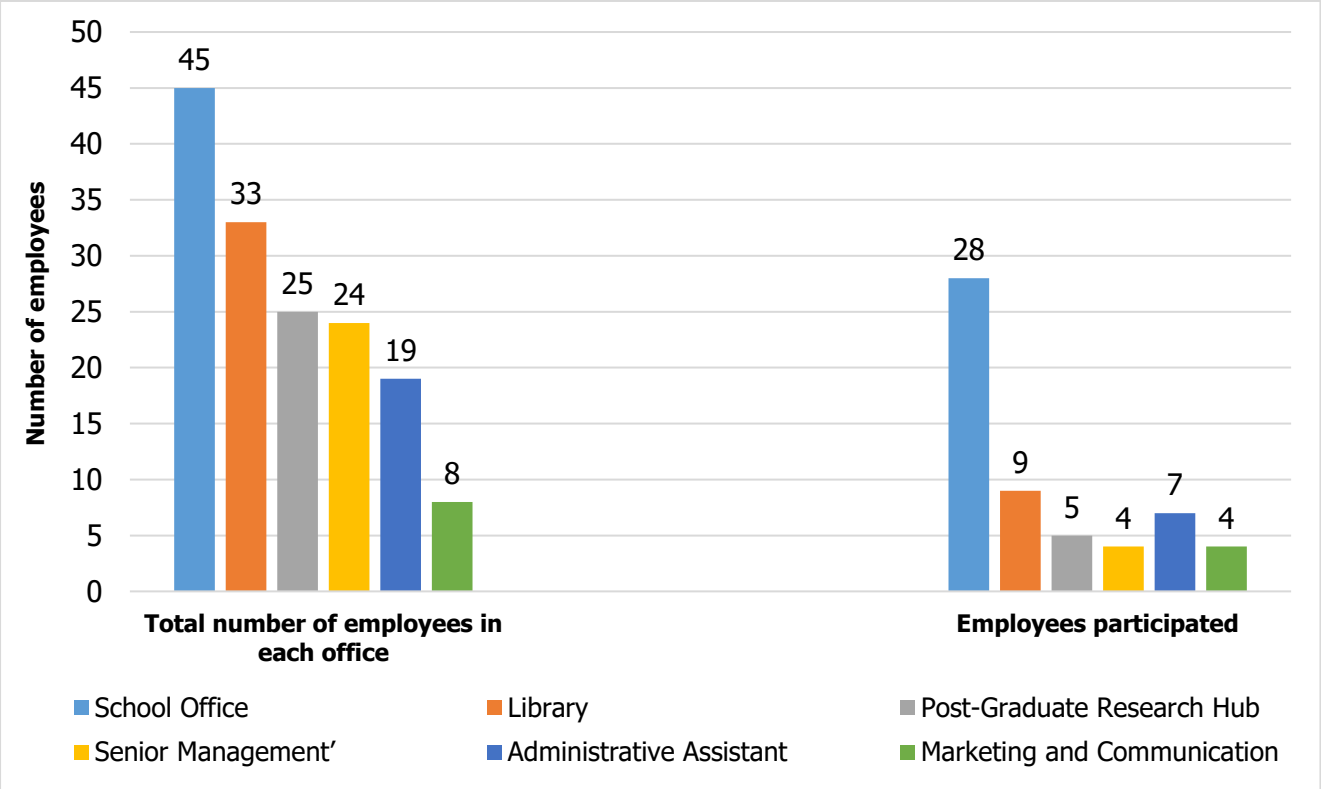

Figure 12. The Breakdown of employees according to offices

7.4.6 Ethical Approval

The process of ethical approval and access permission as detailed in section 4.5.2. Following an ethical approval and access permission prior to the data collection (see Appendix 15 for the access request letter). The ethical approval and access permissions apply to this thesis's five interventions (see Appendix 16 for ethical approval certificate and Appendix 17 for access permission approvals). The storage of data and participants being non-identifiable according

to the General Data Protection Regulation (2018), confidentiality and the right to withdraw was clearly explained to participants as aforementioned in section 4.5.2, and this applies to all five interventions in this study.

7.4.7 Procedure

Participants were informed that they have unlimited access to use the equipment during the working days throughout the intervention period for a total of 11 weeks. However, it must be noted that no changes to their working practices or policies were made (i.e., no changes to lunch break times/length or job requirements). A PA logbook was placed near the exercise equipment and participants were required to record their unique ID, date and time engaged in using the equipment. Participants had the opportunity to add further comments in the PA logbook provided (see Appendix 20 PA logbook with example). Before starting the intervention, the researcher provided a group induction of using the bike and concept 2. The step by step instruction on using the equipment was also placed near the written and images format (see Appendix 21 and Appendix 22). This was to ensure the safe and effective use of the provided equipment.

7.4.8 Statistical analysis

This intervention adopted a repeated measures design. The dependent variables were health, wellbeing, QoL and the number of time employees engaged using the exercise equipment, and the independent variable was the pre versus post for the 11 weeks intervention periods.

A range of statistical tests were conducted using SPSS software version 25. A Shapiro – Wilk's test was used to explore data normality, and 95% confidence interval and effect sizes were used throughout. This applies to all other interventions in this study unless stated otherwise. A Welch t-test was run to determine if there were differences between gender engagement with exercise equipment; the assumption of homogeneity was violated, as assessed by Levene's test for equality of variances ($p = 0.011$). Moreover, a Paired - Samples t-test was used to determine any significant difference in WLQ-SF categories, including productivity loss between pre versus post-intervention. The data were normally distributed in all categories of the WLQ-LF as examined by the Shapiro – Wilk's test ($p > 0.05$). The WHOQOL-BREF, Rand-36-SF and EQ-5D-5L tools data were not normally distributed as assessed by the Shapiro – Wilk's test ($p < 0.05$). Therefore, the Wilcoxon Signed-Rank test was conducted for each category within the tools pre versus post-intervention. Moreover, the logbook's qualitative

comments were also analysed; this was analysed via a thematic analysis approach, as described in section 6.5.

7.5 Results

The descriptive statistics relating to employees engagement with the exercise equipment are provided as mean and SD for the total intervention period in Figure 13. This figure also details the data by gender.

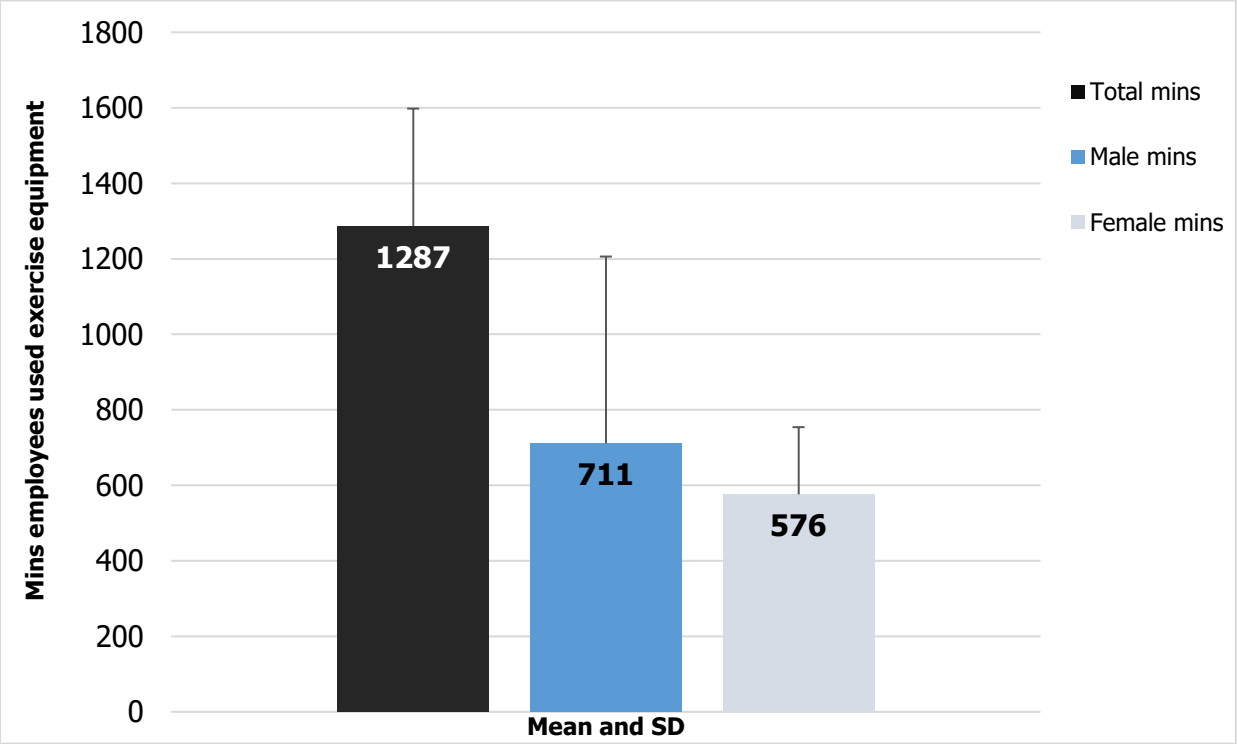

Figure 13. The breakdown of mean total time spent using the exercise equipment and across gender throughout the intervention period

Overall male employees show having higher mean engagement than females'. The mean difference was 138 minutes (95% CI, - 122 to 398). There were no significant differences in gender engaged using the exercise equipment throughout the 11 weeks intervention period, $t(17.767) = 1.114$, $p = 0.280$.

7.5.1 WLQ-SF – Categories

Inferential statistics identify no significant differences ($p > 0.05$) in any WLQ-LF categories between pre versus post-intervention, as shown in Table 14. Despite no significant differences identified, the descriptive statistics for the WLQ-SF demonstrate, employees reported lower 'Time Management, Mental Interpersonal tasks and Output tasks' post compared to pre-intervention.

Table 14. The descriptive statistics and Paired - Sample t-test results of the WLQ-SF categories between pre and post intervention

WLQ-SF	Mean *(SD) Pre-Intervention*	Mean *(SD) Post-Intervention*	95% CI	*Inferential statistics*	Effect size (*d =)*
Time Management	80 *(18)*	73 *(21)*	3.480 to 8.217	t (56) = 0.811, p = 0.421	0.11
Physical Tasks	23 *(23)*	23 *(20)*	- 5.952 to 6.385	t (56) = 0.070, p = 0.944	0.01
Mental Interpersonal Tasks	79 *(17)*	78 *(18)*	- 3.276 to 6.005	t (56) = 0.589, p = 0.558	0.08
Output Tasks	81 *(20)*	77 *(21)*	- 1.978 to 8.294	t (56) = 1.232, p = 0.223	0.16

7.5.2 Productivity loss in the WLQ-LF

The descriptive statistics for productivity loss in the WLQ-LF was higher pre compared to post-intervention, but no significant difference is evident, as demonstrated in Table 15.

Table 15. The descriptive statistics and Paired - Sample t-test results of the WLQ-LF categories between pre and post intervention

Mean *(SD)* Pre-Intervention	Mean *(SD)* Post - Intervention	95% CI	*Inferential statistics*	Effect size (*d =)*
19 *(3)*	18 *(4)*	- 1.291 to 0.310	t (56) = - 1.227, p = 0.225	- 0.16

7.5.3 WHOQOL-BREF – Categories

There were no significant differences in any of the WHOQOL-BREF categories between pre versus post-intervention (p >0.05). The descriptive statistics and results from the Wilcoxon Signed-Rank test are provided in Table 16.

Table 16. The descriptive statistics and Wilcoxon Signed-Rank test between the WHOQOL-LF categories pre and post 11 weeks intervention

WHOQOL-BREF	Median *(Range)* *Pre-Intervention*	Median *(Range)* *Post-Intervention*	Inferential statistics
Physical health	16 *(9)*	16 *(19)*	z = - 0.070, p = 0.944
Psychological	15 *(9)*	14 *(34)*	z = 0.582, p = 0.560
Social Relationship	15 *(15)*	15 *(20)*	z = 0.454, p = 0.650
Environment	15 *(7)*	15 *(19)*	z = 0.00, p = 1.000

7.5.4 RAND -36 –SF – Categories

There were significant differences in 'emotional and wellbeing' category between pre versus post-intervention *(*p < 0.05). However, there were no significant differences in any other categories (P > 0.05). The descriptive statistics and the Wilcoxon Signed-Rank test results for all categories are provided in Table 17.

Table 17. The descriptive statistics and Wilcoxon Signed-Rank test between the RAND-36-SF categories pre and post intervention

RAND -36 –SF	Median *(Range)* Pre-Intervention	Median *(Range)* Post-Intervention	Inferential statistics
Physical Functioning	90 *(60)*	95*(100)*	z = - 0.758, p = 0.448
Role Limitations Due to Physical Health	100 *(100)*	100 *(100)*	z = - 0.883, p = *0*.377
Role Limitations due to Emotional Problems	67 *(100)*	100 *(100)*	z = - 0.596, p = 0.551

Energy Fatigue	60 *(85)*	50 *(90)*	z = - 1.101, p = 0.271
Emotional Wellbeing	68 (72)	76 (96)	z = 2.285, p = 0.022*
Social Functioning	75 (88)	75 (100)	z = 0.160, p = 0.873
Pain	78 (88)	78 (100)	z = - 1.070, p = 0.285
General Health	70 (90)	64 (94)	z = - 1.880, p = 0.060

7.5.5 EQ-5D-5L Questionnaire

The descriptive statistics show that employees indicated higher health post-intervention, but there were no significant differences between pre versus post-intervention (p > 0.05), as shown in Table 18.

Table 18. The descriptive statistics of EQ-5D-5L pre and post intervention median (range) and mean (SD)

EQ-5D-5L	Median *(Range)* Pre-Intervention	Median *(Range)* Post -Intervention	Inferential statistics
How's your health today?	70 *(95)*	80 *(95)*	z = 1.724, p = 0.085

The comments recorded in the PA logbook about having access and using the exercise equipment are transcribed as themes, sub-themes and examples from the raw data. Five themes emerged: positive mood, work productivity, motivational/arousal, stress relief and environmental factors all including a range of sub-themes as detailed in Table 19

Table 19. A summary of the themes and examples of raw data from participants comments recorded in the PA logbook

Themes	**Sub-themes**	**Participants comments**
	Feel good	*"Feel good to workout in between work as my day is usually too busy and this changed my mood".*

Positive mood	Energetic	*"Makes you feel energetic and it changes mood for the rest of the day".*
	Active	*"I have been sitting all morning and I was stiff, and I lost the focus, good to have the bike in our office. Every time I use it, I feel active and it wakes me up".*
Work Productivity	Productivity	*"Enjoyed it done it early today and wanted to do more saw effect on productivity yesterday".*
	Time	*"Time went faster than yesterday. Energised to get more work done".*
Motivational/arousal	Motivation	*"Made me feel ready for the day, motivated me to go to gym after work".*
	Target	*"Set a target of 10km a day".*
	Behaviour change	*"Got me out of breath and felt good starting gradually as haven't done this type of exercise in a while, I am so motivated to continue doing this".*
Stress relief	Stress	*"I was pre-stressed, but this has helped me".*
	Away from computer	*"Good to be away from PC and much needed piece of equipment to have in office".*
Environmental Factors	Environment	*"Good start to my day but office is too warm".* *"Feel good room seems less hot now and I missed going on the bike all these days".*
	Change	*"I've been in front of a computer screen until early hours loved the changed as it feels good and I missed it, but the room is so hot for the past few days and it is not possible to use the bike".*

7.6 Discussion

This intervention aimed to explore the effects of providing access to the exercise equipment and monitor if this promoted positive PA engagement. An additional aim was to compare the impact of such access on employee's health, wellbeing, QoL and perceived productivity pre versus post-intervention. As detailed in section 6.7, employees suggested that having open access to the fitness facilities/activities would not only facilitate barrier to PA but will help improve their PA engagement, health and wellbeing. As briefly aforementioned, opening a

gym was not in this thesis's scope, but providing access to the exercise resources such as bikes and rowers was realistic to deliver.

Employees engaged in a total mean of 1287 minutes of exercise during the 11 weeks. This finding is almost four times higher when compared to the IPAQ-LF results from study one of this thesis, where staff appeared to engage in a total of 330 minutes of MVPA overall. More specifically, considering the IPAQ-LF workplace domain, MVPA engagement was reported as zero (see section 4.6). Also, the present findings revealed greater PA engagement than identified in study two ActiGraph results of this thesis. Study two suggested that, on average, employees engaged in a total of 552 minutes of MVPA overall (see section 5.5). The outcome of this intervention suggests that providing access to exercise equipment had a positive impact on employees PA behaviour in the workplace. Thus, this intervention shows, providing access to exercise resources in the workplace promote PA behaviour; however, it is important to consider if such behaviour continues when intervention ceases.

These results also indicate that male employees appear to be engaging in 135 more minutes using the exercise equipment than females. It should be noted that the offices in which the exercise equipment were placed had more female staff members located than males, and potentially female employees might not be wanted to engage in an exercise in front of their colleagues. Some female employees verbally stated to the researcher that they would not be comfortable exercising in front of others in the office during the daily inspection visit. Future interventions may consider single-sex facilities/access only to accommodate the need for different gender. Another potential reason for female staff not being engaging in as much exercise as male counterparts could be that the exercise equipment might have understood as requiring a high volume of energy, fitness level, strength or power. Research suggests that generally, males tend to participate in intense exercise than females (Arredondo et al., 2016). The current findings support the previous two studies of this thesis, where males appeared to be more active than females. The outcome of this intervention also supports previous research suggesting that females are less active than males (Guthold et al., 2001; Olney et al., 2018). These findings shows there is split between genders PA behaviour in the HEI and it could impact employees health and wellbeing differently. Thus, universities may consider focusing on gender specific interventions to help promote PA behaviour.

The comments provided in the PA logbook demonstrates that providing access to the exercise equipment were well received and had a perceived positive impact on employees mood, productivity, motivation and stress level. As mentioned in section 6.5, various PA barriers were

proposed, including lack of facilities (i.e. access to the gym). The comments recorded in the logbook indicate that providing exercise equipment with open access can positively influence employee PA engagement, leading to a healthier, active lifestyle in the workplace. Despite the positive impact of access to exercise equipment, environmental factors affect the engagement, as suggested in Table 19. This included the offices being hot, which made it difficult for some staff to use the exercise equipment. Future interventions adopting this approach and providing access to the facilities/resources must ensure to consider environment and comfort of being able to exercise. Despite the offices being hot, this intervention's outcome suggests that it positively increased adherence and awareness amongst this population about the importance of engaging in PA behaviour. As suggested, when offices were 'hot', they 'missed' using the equipment. This might be a feature of staff moving from contemplation or preparation into the action stages of the TTM when removing a barrier to the behaviour that the offices were hotter than usual, which made it difficult for some staff to access the exercise equipment. This shows, when offices were warmer than usual, participants behaviour using the bike may have relapsed. As the temperature improved, they were already in a preparation stage and moved to the action stage, then to a maintenance stage, leading to a healthy and active lifestyle. As suggested by the SDT, the fulfilment of three basic needs contributes to PA motivation, health, and wellbeing as long as the needs are satisfied, which was the case in this intervention (Deci and Ryan, 1985; Ryan et aal 2010). This aligned with SEM and suggested that the workplace environmental structure impact employees health and wellbeing (McLeroy et al., 1988). Therefore, providing access to exercise resources benefits participants health/wellbeing and contributes to the organisation, including perceived improved productivity and retention.

Although, no significant differences were found in the WLQ-LF categories, but better time management post-intervention was evident in the descriptive statistics. This could be that employees have found an alternative time management strategy, including planning prompts or scheduling. As noted by employees, using the exercise equipment helped them better prepare for the working day and made them more energised, as explored in Table 19. Previous research suggests planning prompts, such as completing certain tasks at a specific time, is one of the many ways to set specific times for an activity (Malkoc and Tonietto, 2019). Besides, higher mental interpersonal and output tasks were noted in the descriptive statistics post-intervention. There were limited alternatives to leave the desk before accessing the equipment and hence continuing to sit down in front of the computer. It might also reflect the cathartic effects of exercise as outlined by (Scheff, 1979; Csikszentmihalyi, 1990; Nesti, 2007; Watson, 2007; Johnson, 2014). The outcome of this intervention showed that providing access to

resources did not influence perceived productivity level. The present findings are in contrast with previous research concluding that engaging in exercise improves productivity among employees (Proper and van, 2019; Jindo et al., 2020).

There appeared to be no significant impact on QoL; however, this intervention was adopted as examined by the WHOQOL-BREF ($p > 0.05$). Previous research suggested that engaging in moderate-intensity exercise for a minimum of 30-60 minutes a day for five days a week has shown a positive effect on QoL (Brown et al., 2003; Guimarães and Baptista, 2011; Puciato et al., 2018). The present findings contrast with aforementioned previous research regarding exercise engagement and increased perceived productivity. However, this intervention's focus was not on the intensity of exercise and staff were not required to engage in a specific number of minutes of exercise. Using the exercise equipment was optional. Thus, current findings may contrast with previous literature as participants engaged in an average of 117 minutes weekly but possibly at a lighter intensity using the exercise equipment instead of previous literature of 30-60 minutes moderate to vigorous PA per day. Therefore, it may explain no impact on the QoL compared to the previous research (Guimarães and Baptista, 2011; Puciato et al., 2018). Consequently, future studies could consider exploring the appropriate dose-response of such activity for positive impacts on QoL.

It should be noted that engaging in as little as 117 minutes of exercise at work appeared to positively impact emotional wellbeing measured via the RAND-36-SF. The present findings support previous research suggesting that engaging in exercise, including walking for as little as 10 minutes per day, can help improve wellbeing (Anding et al., 2015; Afsar et al., 2018; Manfredini et al., 2017). However, the impact in previous research was observed after the 12 months as opposed to the current 11-week intervention. Thus, it would be valuable to explore more long term impacts of such interventions in the future. The descriptive statistics shown a positive effect on emotional problems post-intervention. This could be due to stress because of the workload, deadlines, meetings or prolonged sedentary behaviour pre-intervention with no access to exercise equipment; as opposed to during intervention, which may have served as an opportunity to take small breaks and step away from the desk to engage in exercise for as little as 5-10 minutes anytime. This have helped reduce emotional problems, but the impact was not statistically different. Previous research suggested that regular PA participation improved feelings of wellbeing, self-esteem and reduced depression/anxiety (Awick et al., 2017; Cooper and Barton, 2016; Kelly et al., 2018; Robert et al., 2015). Positive effects on perceived health in EQ-5D-5L was also evident post-intervention in the descriptive statistics

and this could be due to having access to the exercise equipment. However, the impact was not statistically different. Thus, providing access to the exercise equipment may have given employees a reason to leave their desk even for as little as 5-10 minutes to engage in exercise and improve their perceived emotional wellbeing. The findings of this interventions support previous research suggesting that PA engagement improves perceived wellbeing (Kelley et al., 2018; Robert et al., 2015).

7.6.1 Limitations

The present intervention provides understanding result about providing access to exercise equipment for university employees health, wellbeing, QoL and how this increases the amount of time spent engaged in exercise in the workplace. However, this intervention is not without limitations; this includes self-reported questionnaires and the subjectivity that is prone to bias. Additionally, exercise equipment was placed in six offices and only for 11 weeks. Therefore, exploring the long term impact of such an initiative is warranted. Another limitation of this intervention was not having a control and non-control groups of participants. Had there be a control and non-control groups this might have yielded different results. Further limitation of this intervention was that no follow up study was conducted to evaluate if employees continue/maintain their active behaviour when intervention ceased. However, the key reasons for not being able to conduct the follow up study were lack of time, funding, the coronavirus (covid-19) pandemic and national lockdown as most of staff especially university employees had to work from home during the pandemic. Future research is required to explore the impact of exercise equipment in different settings and within control and non-control groups.

7.6.2 Conclusion

In summary, this intervention found that providing access to exercise resources promotes PA behaviour in the workplace and facilitates barriers to PA. This intervention could be extended to a range of settings such as banks, offices, schools, colleges, general practitioners and other disciplines with diverse range of job roles involving sedentary behaviour for promoting an active lifestyle amongst employees. This intervention found that male employees spent more time engaging in exercise compared to females. Having access to exercise resources for 11 weeks did not impact QoL, but lack of access and resources was one of the common barriers to PA participation in this university. Thus, providing access to exercise equipment with open access for as little as 11 weeks can positively affects employees exercise engagement and

wellbeing. Future research is needed across settings to monitor the impact of providing access to exercise equipment, staff engagement and the effect on their health, wellbeing, QoL and productivity in a longitudinal, control and non-control groups with more exercise equipment resources and facilities longer than 11 weeks. The subsequent chapter provide details about intervention two of this thesis beginning with a contextual overview in chapter 8.

Chapter 8.0

Intervention 2: Promoting more active behaviours in the workplace through sit and stand desk provision

8. 1 Contextual overview

The sedentary lifestyle in the workplace is increasing. The physical demands of jobs are declining, as evidenced in the first two studies of this thesis that employees spent most of their weekly time sitting. For instance, the results of study one demonstrated employees self-report spending 2880 minutes being sedentary throughout the week as explored in sections 4.6 and 5.5. Moreover, employees are spending a significant amount of daily time at work. The raise of sedentary occupations are directly contributing and the leading causes of obesity and diabetes (BHF, 2016). Moreover, previous research suggested that employees spend most of their time either sedentary or in a position that does not require a high energy expenditure level (Chin et al., 2017; Grunseit et al., 2017). The sedentary lifestyle is linked with health issues including obesity, high blood pressure and chronic diseases because of the way it affects circulation as individuals seldom use muscles and bones whilst in a seated position (Cheung and Chow, 2012; Chin et al., 2017; Grunseit et al., 2017; Mackenzie et al., 2017).

The workplace environment and culture contribute to sedentary behaviour, and it is crucial to understand these factors because they directly impact employees behaviour, as suggested by the SEM (McLeroy et al., 1988). Alkhajah et al. (2012) attempted to explore the impact of an intervention to promote more active working via substituting working desks with the sit-stand workstation. The intention was to allow employees the opportunity to change between sitting and standing when working and to encourage active working behaviour one week after using the new workstation. The sitting time in the experimental group reduced by 143 minutes per working day compared to the control group (Alkhajah et al., 2012; Ojo et al., 2018). Thus, sedentary behaviour's effects must not be ignored, as it can negatively impact employees long-term health and wellbeing. Moreover, sedentary behaviour and the impact of the intervention on university employees is scarce. A small number of studies have focused on exploring sedentary behaviour within universities and interventions typically have only been explored from one week to four weeks (Alkhajah et al., 2012; Butler et al., 2015; Gilson et al., 2009; Neuhaus et al., 2014). Hence, this population seems to be the main target for

interventions aiming to reduce sitting time. The advantages and disadvantages of sedentary behaviour on employees and broader working environment have been detailed in section 4.2 and more specifically, within a university context as explored in section 4.3.

8.2 Aims and objectives

This intervention aimed to monitor if providing a height-adjustable workstation as an adjunct to the normal desk space can reduce sedentary behaviour and improve health, wellbeing, QoL and productivity in the workplace.

8.3 Methods

An L-E-VATE medium sits and stands workstation was placed on the top of employees existing desk. The stand adjuster was suitable for dual monitors providing sufficient space for regular office work. The height-adjustable seat and stand module is retrofittable and can be added to any existing desk or workstation for easy change into a height adjustable sit and stand desk. As part of this intervention participants completed the same questionnaires and PARQ used in intervention one (as detailed in section 7.4) pre and post intervention.

8.3.1 Participants

A total of 10 employees (female n = 8) and male n = 2) participated in this intervention. Before the intervention, participants had to provide baseline data for one whole working week to determine the time they spent sitting or standing in a typical week for comparison post-intervention.

8.3.2 Procedure

After participants provided one week of baseline data utilising their standard workstation alongside the time recoding log-sheet, were used to measure the sit and stand time and any impact on health, wellbeing, perceived productivity and QoL pre versus post-intervention. The date and time were agreed with participants, campus services and IT technician teams to take the height-adjustable workstations to the offices. Participants were informed that they had access to the sit and stand desk for eight weeks as part of this intervention. Time log-sheets were provided to every participant to record their unique ID, date, the time they sat down or stood up to work at their desk and any comments on activity use (see Appendix 28-time log-

sheet with example). Additionally, the researcher provided an individual demonstration of how to lift and lower the seat and stand desk safely. Given the safety consideration and the sit and stand desks maintenance, daily visits were made by the researcher to ensure the equipment was correctly maintained.

8.3.3 Statistical analysis

The hours recorded in the log-sheets for sitting and standing behaviour were converted into minutes for descriptive analysis purposes and are provided as mean and SD for each week. The WLQ-LF, WHOQOL-BREF, RAND-36-SF and EQ-5D-5L data were analysed and compared per category pre versus post-intervention using a range of statistical procedures including a Shapiro – Wilk's test (p = > 0.05) for data normality, 95% confidence interval and the effect sizes for statistically significant findings. Paired – sample t-tests were used for data gleaned through questionnaires to determine any differences in pre versus post-intervention measures. The descriptive statistics were provided pre versus post-intervention for each category as means and SD.

8.4 Results

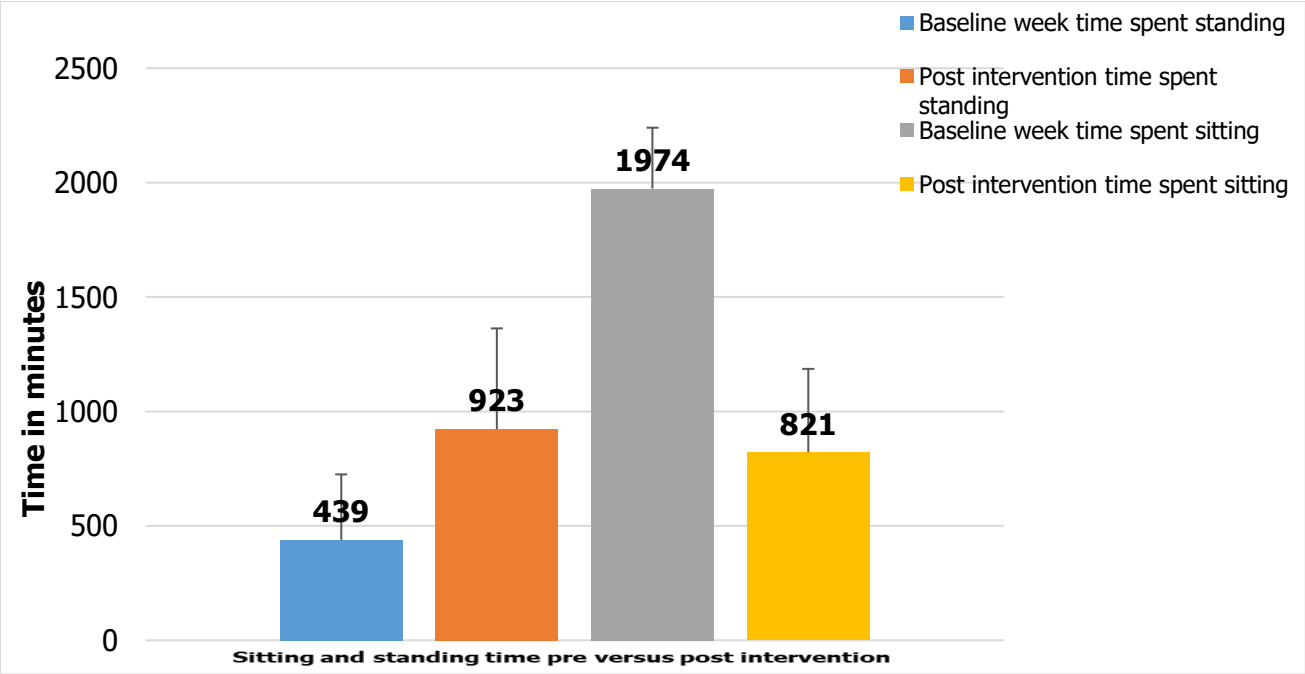

Figure 14. The descriptive statistics of baseline week time spent sitting and standing versus post intervention in minutes

The height-adjustable workstation reduced the sitting time by 1153 minutes. Whereas, standing time increased by 484 minutes throughout the intervention period. It should be noted that the standing time did not increase by the same amount of sitting time reduction because not all of the standing time behaviour is attributed to the height-adjustable workstation. This is because employees daily/weekly working activities change—the weekly sitting and standing time raw data results are provided in Appendix 38. Furthermore, a summary of the themes identified alongside sub-themes and examples extracted from the log-sheet are provided in Table 20.

Table 20. Summary of themes and examples extracts from participants comments

Themes	Sub-Themes	Participants comments
Positive mood	Energetics	*"Strange adjusting to new desk and standing but feel more energetic".*
	Mood	*" "Feel happy and my mood changed for better".*
Work Productivity	Productivity	*"Feel productive. Lots of work done".*
Energy Status	Tired	*"Feel tired and lethargic".*

Participants reported a positive mood, enhanced work productivity but increased tiredness due to having access to the height-adjustable workstation. The descriptive statistics, 95% CI, and Paired Sample t-tests and the effect size for the WLQ-LF categories are provided in Table 21 and productivity loss is provided in Table 22.

Table 21. The WLQ-LF categories results between pre and post intervention

WLQ-LF	Mean *(SD) Pre-Intervention*	Mean *(SD) Post-Intervention*	95% CI	Inferential statistics	Effect size (*d =)*
Time Management	88 *(11)*	77 *(25)*	- 6.230 to 27.230	$t(9) = 1.420$, $p = 0.189$	0.45
Physical Tasks	33 *(18)*	39 *(22)*	- 22.222 to 11.389	$t(9) = - 0.729$, $p = 0.484$	0.23
Mental Interpersonal Tasks	85 *(12)*	79 *(20)*	- 9.945 to 22.167	$t(9) = 0.861$, $p = 0.412$	0.27

Output Tasks	80 *(27)*	85 *(20)*	- 32.237 to 21.237	*t* (9) = - 0.465, *p* = 0.653	0.15

The descriptive statistics showed differences in each category of the WLQ-LF between pre versus post-intervention. However, there were no significant differences in any data from the WLQ-LF categories (p >0.05). There were also no significant differences in productivity loss (p<0.05) evident.

Table 22. WLQ-LF productivity category results between pre and post intervention

Mean *(SD)* Pre-Intervention	Mean *(SD)* Post - Intervention	95% CI	*Inferential statistics*	Effect size (*d =)*
20 *(3)*	19 *(4)*	- 3.586 to 4.171	*t* (9) = 0.171, *p* = 0.868	- 5.13

There were also no significant differences in any category of the WHOQOL-BREF (p >0.05) between the two time points.

Table 23. The WHOQOL-BREF categories results between pre and post intervention

WHOQOL-BREF	Median *(Range) Pre-Intervention*	Median *(Range) Post-Intervention*	95% CI	*Inferential statistics*	Effect size (*d =)*
Physical health	16 *(3)*	17 *(2)*	- 2.689 to 1.204	*t* (9) = - 0.863, *p* = 0.410	- 0.27
Psychological	16 *(2)*	16 *(2)*	- 0.913 to 0.513	*t* (9) = - 0.635, *p* = 0.541	0.20
Social Relationship	17 *(2)*	17 *(2)*	- 1.516 to 1.249	*t* (9) = - 0.218, *p* = 0.832	- 0.07
Environment	16 *(2)*	17 *(2)*	- 1.959 to 1.259	*t* (9) = - 0.492, *p* = 0.634	- 0.16

There were significant differences in 'physical health' 'role limitation due to physical health', 'energy fatigue', and 'social functioning' categories (p <0.05) between pre versus post-intervention. No other significant differences were identified (p > 0.05).

Table 24. The RAND- 36-SF questionnaire pre and post intervention results

RAND -36 –SF	Median *(Range)* Pre-Intervention	Median *(Range)* Post-Intervention	95% CI	*Inferential statistics*	Effect size (*d =)*
Physical Functioning	80 *(10)*	90 *(11)*	- 14.461 to – 5.539	t (9) = - 5.071, p = 0.001*	- 1.60
Role Limitations Due to Physical Health	80 *(37)*	95 *(11)*	- 43.214 to – 13.214	t (9) = - 1.203, p = 0.0260*	- 0.38
Role Limitations due to Emotional Problems	77 *(39)*	87 *(23)*	- 39.846 to 19.846	t (9) = - 0.758, p = 0.468	- 0.24
Energy Fatigue	39 *(10)*	62 *(17)*	- 28.438 to – 17.112	t (9) = - 9.098, p = 0.001*	- 2.88
Emotional Wellbeing	83 *(9)*	80 *(8)*	- 2.256 to 7.856	t (9) = 1.253, p = 0.242	0.40
Social Functioning	81 *(24)*	90 *(14)*	- 17.233 to – 0.267	t (9) = - 2.333, p = 0.045*	- 0.74
Pain	71 *(23)*	81 *(13)*	- 24.802 to 3.802	t (9) = - 1.661, p = 0.131	- 0.53
General Health	71 *(18)*	70 *(19)*	- 9.105 to 2.105	t (9) = - 1.413, p = 0.191	- 0.45

There were no significant differences between pre versus post-intervention (p > 0.05).

Table 25. The EQ-5D-5L pre and post intervention results

EQ-5D-5L	Mean *(SD)* Pre-Intervention	Mean *(SD)* Post - Intervention	95% CI	*Inferential statistics*	Effect size (*d =)*
How's your health today?	81 *(11)*	83 *(11)*	- 12.508 to 8.708)	t (9) = - 0.405, p = 0.695	- 0.13

8.5 Discussion

Sedentary behaviour reduced throughout this intervention and importantly the standing time has increased. The inactive workplace culture has a major negative impact on individuals health and this leads to sedentary behaviour and as advocated that the health of employees can improve and the prolong sitting can reduce if the workplace embraces the challenge of tackling sedentary culture (Lee et al., 2012; Reis et al., 2016). University employees adhering to standing throughout this intervention might suggest, they understood the negative impacts of sedentary behaviour and the positive effects of standing on the way they function. While participants were adjusting to the new working station, this may also help them be more energetic and happier, as noted in Table 20. This university could consider providing height-adjustable workstation to employees. This could be a cost-effective strategy for reducing sedentary behaviour and improving standing time, social functioning, energy fatigue and physical functioning in the workplace. Previous research suggested universities that focused on health promotion programmes, including reducing sedentary behaviour, into their policies. Results highlighted that employees reported improved physical, mental health and perceived productivity (Centeio and McCaughtry, 2017; Kitt and Howard, 2013; Leininger et al., 2015b; Plotnikoff et al., 2015; Sarmiento and Sarmiento, 2017). Therefore, this university could also consider integrated opportunities for tackling sedentary workplace culture into the core business, health and wellbeing strategy.

The timeliness and impact of this intervention are essential to note. Changes in sit and stand times were evidenced as the findings shows that sitting time reduced from 1974 minutes reported in the baseline week to an average of 821 minutes every week. More importantly, the standing time increased from 439 minutes in the baseline week to 923 minutes during the intervention period. As revealed in study one and two of this thesis, employees spent a substantial amount of time being sedentary, ranging from 1079 minutes (as recorded by the

ActiGraph) to 2880 minutes (as reported in the IPAQ-LF). As evidenced in this intervention, providing a height-adjustable workstation indicates that employees sedentary behaviour can be impacted positively, and standing time can be improved.

Moreover, participants comments recorded in log-sheets support the sit and stand findings and demonstrates that the benefits of having access to the height-adjustable workstation to improve positive mood and work productivity. In addition to the benefits, prolong standing time can cause tiredness, as suggested by some participants in this intervention, but more research is needed to explore this across settings. The present findings add to the broader literature concerning height-adjustable workstation intervention reducing sitting time in the workplace, specifically in the university setting. The outcome of this intervention support previous research suggesting that providing height-adjustable workstation reduced sitting time amongst employees (Shrestha et al., 2018; Jindo et al., 2020). This intervention has also demonstrated that providing a height-adjustable workstation facilitate a sustainable change in the university workplace sedentary and standing behaviour amongst employees, which may positively contribute to a healthy and active working environment.

Despite no significant the descriptive statistics showed that this intervention demonstrated a positive effect on the WLQ-LF categories, including 'time management, mental interpersonal and productivity', comparing baseline to post-intervention. Previous research assessed the impact of workplace intervention focused on sitting less and moved more over 19 weeks and found no distinctive effect on improving employees health, mental wellbeing or productivity (Puig-Ribera et al., 2017). Dutta et al. (2014) conducted four weeks of intervention focused on sedentary office workers and found no effect on health, wellbeing or productivity. The WLQ-LF is a generally utilised method across disciplines, but surprisingly few studies have focused on the impact of the sit-stand intervention and its effect on the WLQ-LF questionnaire (Allen et al., 2007; Lewis and Malecha, 2011; Lusa et al., 2020; Puig-Ribera et al., 2017).

Moreover, it should be noted that employees reported higher difficulty scores in physical tasks post-intervention. This could be due to lifting and lowering the height-adjustable workstation, which may have caused slight difficulties to some participants, potentially due to their age or physical ability. Thus, they might have found it hard to lift or lower the height-adjustable workstation and hence the resulting scores. The data of age, gender and job roles were not collected as part of this intervention. To the author's knowledge, this is the first study to monitor the impact of height-adjustable workstation on WLQ-LF survey; thus, more research is needed to confirm or contrast the present findings.

Despite no significant the descriptive statistics showed that the WHOQOL- BREF data's overall findings indicated a positive effect on physical health and environment categories following this intervention. Previous research focused on office workers PA engagement also found an overall satisfaction in all WHOQOL- BREF subscales (Arslan et al., 2019). This intervention's improvement could be because of the flexibility of height-adjustable workstation that allowed university employees to sit or stand during working days. Previous research indicated that prolong sitting relates to adverse health conditions, including obesity and high blood pressure (Chau et al., 2013; Church et al., 2011; Thayer et al., 2010). Thus, the effects of sedentary behaviour in the workplace must not be ignored, as it may negatively impact employees long-term health and wellbeing. Therefore, it can be predicted, if such devices were to be adopted in the long term, there could be a positive contribution to reduced health conditions such as obesity, high blood pressure and poor circulation, potentially reducing absenteeism. Additionally, should the use of height-adjustable workstation be adopted across the HEI, this might also support the notion that this university is supportive and take employees health and wellbeing seriously, which was identified as a barrier in study 3. This also aligns with the SEM, highlighting that environment/policies and workplace structure impact employees health and wellbeing (McLeroy et al., 1988).

Finally, there appeared to be a positive effect on RAND-36-SF, physical functioning, physical health, energy fatigue and social functioning following this intervention. This indicates that the intervention did not merely reduce sitting or increased standing time but also contributed to other perceived PA categories, including mobility and muscular strength, by allowing employees to lift and lower the height-adjustable workstation. Previous research indicated that using the height-adjustable workstation contributes to PA levels (Jindo et al., 2020). However, measuring the impact of the height-adjustable workstation on PA levels was not the focus of this intervention. Sitting for prolonged time can cause back and neck pain (Mackenzie et al., 2017). Thus, this may indicate why employees reported better results post-intervention as height-adjustable workstation allowed them to stand more whilst working. The current findings support previous research suggesting that improving standing time at work resulted in better physical functioning (Pronk et al., 2012).

Additionally, the descriptive statistics of this intervention demonstrated, participants reported positive improvement on their health in the EQ-5D-5L post interventions. This could be that

employees sitting time has massively reduced, and standing time has increased throughout the intervention and employees might have started to notice the positive differences.

8.5.1 Limitation

This intervention provided insightful findings of the height-adjustable workstation's effect on university employees sit and standing time. Despite the useful findings, intervention has some limitations. This includes a small number of participants. And it was not possible to compare gender and job roles sit and stand time and the impact on their health, wellbeing, perceived productivity, and QoL. The additional limitation of this intervention was the duration and as explored in section (2.4) that behaviour change is a process rather than an event and it can take time to change and then to continue/maintain. A further limitation of this intervention was having no control group. Had there be a control and non-control groups for comparing and contrasting the sit and stand time might have yield different results. Another limitation of this intervention was the withdrawing of sit and stand workstation at end of the intervention period with no follow-up study. Conducting a follow-up study to assess if employees maintain the standing behaviour post intervention or returned back to their usual sedentary behaviour would have further improved this intervention. However, reasons for not being able to conduct the follow up study were lack of time, funding, the covid-19 pandemic and the national lockdown as most of staff especially the university employees had to work from home during the pandemic/lockdown. Thus, similar interventions with extended period and larger sample size, with control/non-control groups and follow up studies are needed as this may yield different results amongst employees in different settings.

8.5.2 Conclusion

In summary, this intervention found that providing a height-adjustable workstation has reduced employees sitting time by an average of 1153 minutes weekly. The standing time has increased from 439 to 923 minutes per week. This intervention has served as one of the proposed facilitators by university employees, as detailed in section 6.7. The outcome of this intervention can be used to change the sedentary behavioural culture of the workplace into an active way of working which may result promoting PA behaviour. The present findings can be generalised to other settings, including offices, banks, general practitioner and other workplaces that may require employees to be present at their desk. The current findings contribute novel knowledge to general literature related to the height-adjustable workstation and workplaces and more specifically, to the university setting.

Chapter 9.0

Intervention 3: Exploring the impact of seated, standing and walking meetings in the university setting

9.1 Contextual overview

Employees meet regularly in the workplace (Cohen et al., 2011), and a meeting is known as a gathering of two or more people for a discussion on work-related topics (Leach et al., 2009; Mroz and Allen, 2017). Meetings are regarded as essential in the workplace. For example, colleagues across job roles come together for a shared purpose of allowing communication, data sharing and verdict production (Shumski et al., 2018). Despite the importance of meetings, there is a lack of research investigating the influence of meetings on employees mood states, energy level, sedentary behaviour and PA' (Rogelberg, Shanock, & Scott, 2012; Shrestha et al., 2016). Employees in the Western world spend an average of six hours preparing for and attending meetings throughout the working week (Rogelberg et al., 2006). Allen et al. (2014) have suggested that for those in managerial roles, around 75% of their working hours are spent preparing, attending or leading meetings and most of that time is spent in a sedentary position.

A lack of time, management support and less supportive workplace culture were some of the barriers reported by employees in study 3 of this thesis in section 6.5. For instance, employees stated several activities continue to occur during lunchtime, including departmental meetings, which impacted their ability to be active. They have no option but to sit with little flexibility to physically move around during such meetings. Previous research has suggested that workplace meetings negatively affect productivity and causes short-term effects (Farrell, 2014; Griffel, 2015). According to Shanock et al. (2013), employees across job roles admitted circumstances in which they have chosen to be seated, smile and tolerate meetings, which negatively affected their mood states. Negative mood states are linked to adverse work-performance and creativity (Eisenberger et al., 2001; Grawitch et al., 2003). Therefore, it is essential to identify an approach that fosters a positive mood and employees overall wellness (Kruskal et al., 2019).

Traditionally, meetings are conducted in a seated position, and with the technological enhancements, employees are now spending over 80% of their working day in a sedentary

position (Cornelius, 2017; Garrett et al., 2016). The alternative to seated meetings is to adopt a policy to engage with a walking meeting that is considered more beneficial and can enhance energy levels and mood states and reduce sedentary behaviour (Parker and McCammon, 2016; Shumski et al., 2018; Huntley et al., 2015). Previous research suggested that having the opportunity to walk during the working day can reduce stress, anxiety, depression and improve energy, mood states and work-performance (Cocchiara et al., 2020; Emerson et al., 2020; Kim et al., 2019; Thayer et al., 2005). Huntley et al. (2015) converted the seated meetings to walking for university staff by developing a core component of walking meeting protocol that included 25-30 minutes' walking path on campus to achieve the daily recommended steps. It was concluded that walking meetings are a potential alternative to overcoming workplace sedentary behaviour (Huntley, 2015). Also, university staff in this thesis are spending most of their time sedentary (as detailed in sections 4.5 and 5.5), which can put them at risk of health-related diseases, including obesity (Chau et al., 2012). Participants from study three suggested that workplace culture and management support would be serving as a potential facilitator to their barriers to PA and sedentary behaviour, as explored in section 6.5.3. Having explored the existing literature, no study appears to have compared the impact of sitting, standing and walking meetings on employees mood states and energy level.

9.2 Aims and objective

This intervention aimed to compare the standing and walking meetings with the usual seated meeting to explore the potential impact on university employee's mood states.

9.3 Methods

This intervention was conducted within the same university as other studies of this thesis, and employees at one campus of this university were the targeted population for this intervention.

9.3.1 BRUMS

The impact of seated, standing and walking meetings were measured using the BRUMS survey (Brandt et al., 2016). In this survey, participants were asked to describe their feelings associated with a list of words using a five-point Likert scale ranging from 0 = not at all; 1 = a little; 2 = moderately; 3 = quite a lot and 4 = extremely (see Appendix 37 for the BRUMS survey). The higher score indicates negative affect except in vigour scale of the BRUMS.

9.3.2 Participants

A sample of 61 employees participated in this intervention. See Appendix 35 for the email sent to participants and Appendix 36 for the information sheet and consent form.

9.3.3 Procedure

Participants in this intervention were required to engage with three types of meetings: the usual seated meeting adopted as a standard at this institution, a standing meeting and a walking meeting. Each meeting was within a one-week time frame. For the walking meeting, employees had access to free passes to the Botanical gardens, which was approximately five minutes' walk away from the university campus, to facilitate this to happen. Employees had to complete the BRUMS questionnaire pre and post-meeting for each of the three meeting conditions. Participants were required to record their participant ID number each time for identification and data comparison purposes.

9.3.4 Statistical analysis

The data for the pre versus post meetings were organised as per the six categories of the BRUMS guidelines: 'Anger', 'Confusion', 'Depression', 'Fatigue', 'Tension' and 'Vigour'. Data between categories were not normally distributed as assessed by a Shapiro – Wilk's test ($p < 0.05$). Therefore, a Wilcoxon Signed-Rank test was conducted to determine if there were a significant difference in mood states between pre versus post-intervention for each meeting. The scores were approximately symmetrically distributed in each category pre versus post meetings as examined by a histogram with a superimposed normal curve. A Kruskal – Wallis H test was conducted to determine if there were significant differences between meetings pre versus post. The distribution scores for all scales in seated, standing and walking meetings were not similar amongst the groups, as examined by the visual inspection of a boxplot. Subsequently, to establish which type of the meeting was different to others and on which scale, a pairwise comparison was performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons with post hoc analysis. Table 26 provide the descriptive statistics and statistical differences between pre versus post seated meetings, followed by the standing meetings in Table 27 and walking meetings in Table 28.

9.4 Results

The results demonstrate, the tension significantly increased post seated meeting ($p < 0.05$) and there were no significant differences in any other category of the BRUMS between pre versus post seated meeting.

Table 26. The descriptive statistics and Wilcoxon Signed-Rank test results between pre and post seated meeting

BRUMS	Mean *(SD) Pre-seated meting*	Mean *(SD) Post-seated meeting*	Inferential statistics
Anger	1.64 *(2.89)*	1.70 *(2.64)*	$z = 0.687$, $p = 0.492$
Confusion	2.44 *(3.15)*	2.36 *(3.32)*	$z = -0.182$, $p = 0.855$
Depressing	1.98 *(3.13)*	1.93 *(3.22)*	$z = 0.339$, $p = 0.735$
Fatigue	4.16 *(3.36)*	4.51 *(3.87)*	$z = 0.768$, $p = 0.442$
Tension	2.67 *(1.85)*	3.32 *(2.80)*	$z = -3.085$, $p = 0.002$*
Vigour	5.61 *(3.19)*	5.69 *(3.62)*	$z = 0.526$, $p = 0.599$

Participation in standing meetings significantly reduced levels of confusion, tension and vigour ($p<0.05$) compared to pre-meeting levels.

Table 27. The descriptive statistics and Wilcoxon Signed-Rank test results between pre and post standing meeting intervention

BRUMS	Mean *(SD) Pre-standing meeting*	Mean *(SD) Post-standing meeting*	Inferential statistics
Anger	0.54 *(1.29)*	0.44 *(1.32)*	$z = -1.016$, $p = 0.310$
Confusion	1.31 *(2.12)*	0.82 *(2.05)*	$z = -2.507$, $p = 0.012$*
Depressing	0.41 *(1.04)*	0.36 *(1.02)*	$z = -0.540$, $p = 0.589$

Fatigue	2.84 *(3.28)*	2.36 *(2.93)*	z = - 1.705, p = 0.088
Tension	1.20 *(2.32)*	0.72 *(1.56)*	z = - 2.408, p = 0.016*
Vigour	6.74 *(3.88)*	4.85 *(3.24)*	z = - 4.395, p = 0.005*

The results of walking meeting indicates a significant reduction in anger, confusion and depression categories post walking meeting ($p < 0.05$). In contrast, significant increases were evident in fatigue, tension, and vigour categories post-walking ($p < 0.05$). There were no significant differences evident in the 'anger' category (p>0.05).

Table 28. The descriptive statistics and Wilcoxon Signed-Rank test results between pre and post walking meeting intervention

BRUMS	Mean *(SD) Pre-walking meeting*	Mean *(SD) Post-walking meeting*	Inferential statistics
Anger	0.57 *(1.32)*	0.31 *(0.87)*	z = - 1.401, p = 0.161
Confusion	1.36 *(2.69)*	0.72 *(1.81)*	z = - 1.968, p = 0.049*
Depressing	0.69 *(1.68)*	0.38 *(1.21)*	z = - 2.055, p = 0.040*
Fatigue	2.74 *(1.70)*	2.94 *(2.17)*	z = - 3.416, p = 0.001*
Tension	1.39 *(0.77)*	2.49 *(2.15)*	z = - 2.181, p = 0.029*
Vigour	5.11 *(3.69)*	7.80 *(4.30)*	z = 4.900, p = 0.005*

The post-hoc analysis revealed significantly higher levels of fatigue for seated meetings versus standing (p<0.05) and walking meetings (p<0.05). Additionally, vigour category was significantly higher following walking meetings versus seated meetings (p<0.05) and standing meetings (p<0.05). There were no significant differences in any other categories between any meetings as detailed in Table 28. A pairwise comparison was performed utilising Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Subsequently, to establish

which type of the meeting was different to others and in which scales. There was a significant difference in a vigour scale between standing versus seated meetings (p = 0.002). The significant difference was also evident between standing versus walking meeting (p = 0.005) and between seated versus walking meetings (p = 0.002). No significant differences were found in any other scales in either 'seated, standing or walking' meetings intervention.

Table 29. The mean rank and Kruskal – Wallis H test results between seated, standing and walking meetings

BRUMS	Seated meeting Mean *(SD)*	Standing meeting Mean *(SD)*	Walking meeting Mean *(SD)*	Inferential statistics
Anger	.07 *(1.526)*	-.10 *(.851)*	-.26 *(1.315)*	χ2 (2) = 3.174, p = 0.205
Confusion	-.08 *(1.810)*	-.49 *(1.445)*	-.64 *(2.302)*	χ2 (2) = 2.459, p = 0.292
Depressing	-.05 *(2.171)*	-.05 *(.921)*	-.31 *(1.218)*	χ2 (2) = 0.544, p = 0.762
Fatigue	.34 *(2.435)*	-.48 *(2.110)*	-1.03 *(2.258)*	χ2 (2) = 9.318, p = 0.009*
Tension	-.82 *(2.149)*	-.48 *(2.038)*	-.62 *(2.146)*	χ2 (2) = 2.714, p = 0.257
Vigour	.08 *(2.923)*	-1.89 *(2.916)*	2.69 *(3.552)*	χ2 (2) = 47.481, p = 0.005*

9.5 Discussion

The present intervention aimed to determine standing and walking meetings on university employees mood states versus a usual seated meeting. The seated meetings' findings indicates that employees reported higher scores in all scales except at the vigour scale. The vigour scale scores were high in walking meetings compared to seated and standing which indicates that walking meetings positively affect employees mood states and energy levels. These findings support previous research suggesting, walking meeting positively contributes to the mood states (Huntley et al., 2015).

Employees demonstrating enhanced anger, fatigue, tension and vigour post seated meeting could be due to the relevance of the meeting to their job role and lack of flexibility to physically move around either during or after the meetings. As previous research shown that employees

chose to hide and tolerate meetings that has little relevance to their job roles (Shanock et al., 2013). Employees attending meetings may also hide their feelings because of the fear and frustration about the workplace changes or workload discussed during the meetings. Previous research suggested that hiding feeling during meetings leads to tension, fatigue and can cause negative emotions (Shanock et al., 2013; Thomas et al., 2018). However, the theoretical and empirical understanding of 'why' staff engages in such behaviour remains limited (Thomas et al., 2018). However, previous research suggested that employees admitted circumstances in which they have chosen to be seated, smile and tolerate even if the meeting was not part of their job, which negatively affected their mood states (Shanock et al., 2013).

As detailed in section 5.4 of this thesis, employees are spending a high proportion of their day sedentary, and meetings conducted in a seated position can further contribute to their sitting time. This may be one of the factors of why employees may report higher negative scores in most scales to post seated meetings, which could negatively impact their mood states, energy level, and productivity. The outcome of this t intervention supports previous research across settings suggesting that short-term anger and negative effect were evident in seated meetings (Farrell, 2014; Griffel, 2015; Shanock et al., 2013). Employees not expressing their anger or fatigue during seated meetings may be due to their professionalism or the importance of meeting. Purposely tolerating the meetings may further contribute to tension, anger, fatigue and sedentary behaviour, which may negatively contribute to lower work productivity.

Employees indicating a higher pre score versus lower post score for standing meetings could be due to adjusting to the new standing meeting conditions because changing behaviour and altering to a new way may take some time, as explored in section 2.2. The findings indicate that making simple changes from seated to standing meetings, positively impact employees mood states, improving energy level, productivity and reducing sedentary behaviour. In contrast, to seated meetings, as they contribute to the already increased sedentary behaviour, the standing meetings may have reduced employees sitting time. However, no study was found to have examined the consequence of standing meetings on employees. Thus, this intervention contributes novel findings to this area and call for future research to confirm or contrast the present findings across settings.

Employees reporting higher confusion and depression during the pre-walking meeting could be due to their workload or work pressure; as shown in the post walking meeting, the score has reduced. For instance, participants reporting a higher score in the confusion category pre-walking intervention may indicate that they were not used to conducting walking meetings.

As such, walking, talking or taking notes may have confused some individuals pre-meeting. The result shows that conducting walking meeting either inside or outside of the university campus is possible and has positively reduced depression post-walking meetings. This could be that having access to the Botanical Garden or walking in the campus may have served as a protective time for exercising as proposed by employees as one of the potential facilitators in section 6.5. This intervention supports previous research concluding that walking in groups demonstrated reduced depression and improved positive effect on mental wellbeing (Marselle et al., 2019; Rias et al., 2020).

The university in which this intervention was conducted could apply the present findings as a framework for promoting PA and reducing employees sedentary behaviour by providing more opportunities for walking meetings. This institution's management could also consider walking meetings because most of their working time is spent in meetings and this could be an opportunity to overcome the workplace sedentary culture and lead by an example (Allen et al., 2014). This could highlight to other employees that it is possible to walk around during the working days. This may also help in overcoming sedentary workplace culture and promote PA, health and wellbeing amongst staff. As detailed in sections 4.6 and 5.6, employees in this university spent most of their time sedentary, which can contribute to stress, depression and anger instead of walking meetings. As demonstrated, walking meetings improved employees vigour category score from 5 pre-intervention versus approximately 8 post-walking meetings. This shows that engaging in walking meetings can improve being lively, energetic, active and alert, which can positively impact employees mood states and work performance. The findings of this intervention aligns with previous research suggesting that having the opportunity to walk during the working day can improve PA, energy level, mood states and work-performance (Cocchiara et al., 2020; Emerson et al., 2020; Kim et al., 2019; Thayer et al., 2005).

When all three conditions seated, standing and walking meetings were compared to establish the best condition to conduct the meetings. A significantly higher level of fatigue was suggested in a seated meeting compared to standing and walking. In comparison, employees described significantly higher level of vigour for walking meetings versus seated and standing meetings. This shows that walking meetings impacted employees being lively, energetic, active and alert, which could positively influence their mood and productivity levels. However, future research is required to explore seated, standing and walking meetings from employees perspectives across settings.

9.5.1 Limitations

Despite the positive and novel contribution, this intervention has some limitations, such as data per gender and job roles were not collected as this may have yield different results. Another limitation was a single measurement method was used for meetings. Future research must combine objective tools such as accelerometer with BRUMS to measure the actual time employees spend in seating, standing and walking meetings and the impact on their mood states. Future research may also consider having a control and non-control groups with follow-up studies for longer period to assess the impact of standing and walking on health, wellbeing and productivity levels in the workplace.

9.5.2 Conclusion

In summary, the results of this intervention indicated that walking meetings reduced anger, confusion, depression, fatigue, tension and improved vigour scale score amongst this population. The standing meetings also demonstrated a positive effect on employees mood states, but employees reported a negative impact on seated meetings. Having explored the existing literature, no study was found comparing the impact of sitting, standing and walking meetings on staff. Thus, this is the first study to investigate the impact of meetings in different conditions on employee's mood states. The present intervention contributes novel findings to the scarce workplace meeting literature and particularly within a university setting.

The present findings could be utilised as evidence to support shifting the current workplace sedentary behaviour culture by providing opportunities and promoting walking meetings. The standing and walking meetings could be embedded by this university's management as most of their time is spent in meetings. Thus, leading by an example, and demonstrating that it is possible to walk around the workplace whilst in a meeting. The present findings could be generalisable to other settings, particularly when the walking meeting strategy seems feasible across organisations, and within the university environment. The walking meeting strategy may also make effective changes, inform future workplace policies about the importance of walking meetings, overcome sedentary workplace culture, and positively improves employees mood states.

Chapter 10.0

Intervention 4: Getting university employees on the stairs: The impact of points of decision prompts

10.1 Contextual overview

Employees proposed various PA barriers in study three, including lack of time, workplace culture, access to resources, cost, busy working lives and lack of autonomy (see sections 6.5.1, 6.5.2 and 6.5.3). Thus, highlighting the benefits of engaging in PA and proposing strategies of being active in simple ways may encourage employees to change their sedentary decisions into active choices. This is particularly pertinent in the TTM, where the move from the contemplation stage to action for behaviour changes may result from cognitive strategies to change thinking. For instance, consciousness-raising is a process that actively leads to more awareness of the present situation, and the decisional balance considers the advantages and disadvantages of behaviour change which leads to acknowledging the positive and negatives of changing behaviour and it is consequences (Kim, 2020; Liu et al., 2018).

Encouraging employees to use the stairs than lifts may contribute to their PA in the workplace. This intervention can easily challenge the barriers outlined. It does not require a cost; it is essentially not time demanding, does not require additional resources, and does not to be added to an already busy working life. Stair climbing is a practical form of vigorous activity in contrast to organised sport and exercise (Åvitsland et al., 2017; Engelen et al., 2018). Using the stairs does not require exercise equipment and can easily be integrated into individuals' daily routine (Jennings et al., 2017). Previous research has focused on stair use in various settings and reported positive findings in PA, health and wellbeing (Åvitsland et al., 2017; Jennings et al., 2017). For instance, Graham et al. (2013) conducted a stair use intervention in the workplace and found that the PA levels increased. Interventions conducted in public settings such as train stations and shopping centres aiming to promote stair use demonstrated enhanced PA behaviours (Aksay, 2014; Eves et al., 2009).

Most of the interventions focused on promoting PA behaviour through stairs use applied point-of-decision prompts (PODP). The PODP are motivational signs designed to offer an alternative suggestion to change behaviour. For instance, signs are placed near stairwells and lifts, encouraging people to take the stairs (Crozier, 2019). The PODP promote zero-point thinking,

such as partaking in some PA, is better than none (Powell et al., 2011). For instance, if individuals see the signs placed near lifts with motivational or educational messages about the importance of using the stairs and the impact on their health and wellbeing, it may increase stair climbing as an alternative, healthy behaviour (Powell et al., 2011). Previous research suggests PODP improved stair use from 2.2% to 11% across different settings (Bauman et al., 2017; Olander and Eves, 2011; Nocon et al., 2010; Soler et al., 2010). Moreover, the evidence indicates greater effectiveness of the stair use interventions when combined with motivational and directional messaging (Jennings et al., 2017). For example, "can't get to the gym? Take the stairs, get your workout and shape your muscles in the staircase, and for FREE" (Engelen et al., 2018 p. 182). However, it is recommended that future interventions combining educational, encouraging, time and health-related benefits of taking the stairs may produce different outcomes (Engelen et al., 2018). Thus, banners with messages that encompass PA guidelines, health benefits, and time pressure of the daily life in the workplace may have positive effects (Dugdill et al., 2008; Engelen et al., 2018).

Previous research has applied a range of methods to measure the impact of stair use, including observation. Observation is a systemic approach to viewing people's actions and behaviour (Jamshed, 2014). There are different type of observation approaches, including participant observation that refers to the meaning individuals give to their actions. Structured observation refers to recording the frequency of an individual's actions (Saunders et al., 2000; Jamshed, 2014). Also, the observation approach includes data collection covertly, where the observer hides their identity and overt observation refers to participants being aware that they are being observed (Jamshed, 2014). However, previous research generally has placed automatic counting devices in elevators and stairs to record the impact of such interventions, but inconsistencies were documented compared to observational data in different settings (Marshall et al., 2002; Titze et al., 2001). Therefore, the observation approach provides an opportunity to understand persons views and interpret their attitudes and behaviour towards evaluating their action in practice (Gray, 2004). For understanding participant's actions and frequency, both participants structure alongside a covert observation were applied to capture the use of stairs and lifts in this intervention.

10.2 Aims and objectives

This intervention aimed to evaluate the effectiveness of displaying a motivational and educational PA, health and wellbeing banners near lifts and stairs on promoting the stairs use as an alternative to the lifts in the university workplace.

10.3 Methods

One campus location was selected for this study. The buildings were chosen based on the proximity of the functioning of lifts and stairs and the building having four floors. Thus, the possibility of observing behaviour linked to the intervention was more likely. After consulting the campus services, two buildings were selected on one campus. The chosen buildings had a set of lifts and stairs closest to the main entrance and those lifts were chosen to capture the most individuals possible.

Four banners (468 x 280 centimetres) were placed near the stairs and lifts. These banners had different motivational and educational messages, as outlined below and displayed in Figure 15.

- Meeting the daily PA guideline,
- The mental health benefits of PA,
- The time management to fit PA with a busy life and
- Praise for the stair climber

Figure 15. The banners displayed at university campus

10.3.1 Participants

A total of 103 university employees participated in this intervention. The demographic data were not recorded as part of this intervention.

10.3.2 Procedure

The manual observations of behaviour were conducted three times per day for 60 minutes each time from 9:00 – 10:00, 12:00 – 13:00 and 16:00 – 17:00 for 12 weeks. For instance, the researcher observed individuals approaching the lifts and then monitored who might use the stairs. Then, individuals were approached and enquired if they are willing to spare 5-10 minutes to answer some questions regarding their choice of using the stairs. A random sample of individuals were approached to ask if they were willing to participate in a short survey about their perception about banners. The first question posed was to ascertain if they were staff or students. If identified as a student, they were excluded from the study because the focus was on employees. If staff member agreed to participate, an information sheet alongside a consent form was handed after signing the consent form (see Appendix 29 for the information sheet and consent form). The individual was then handed a survey with a series of short questions to complete. The questions were focused on if the banners were noticed, had any physical or psychological impact and how many floors individuals climbed (for a complete list of questions, see Appendix 30 for questions).

10.3.3 Statistical and thematic analysis

The participants were asked if they had noticed the banners initially. They were also asked how many flights of the stairs they have climbed. One floor represented 21 steps, and quantitative findings are reported as means and SD in Figure 16. The qualitative data was analysed via thematic analysis and presented as themes, sub-themes and examples from the raw data. The process of thematic analysis was provided in section 6.4.

10.4 Results and discussion

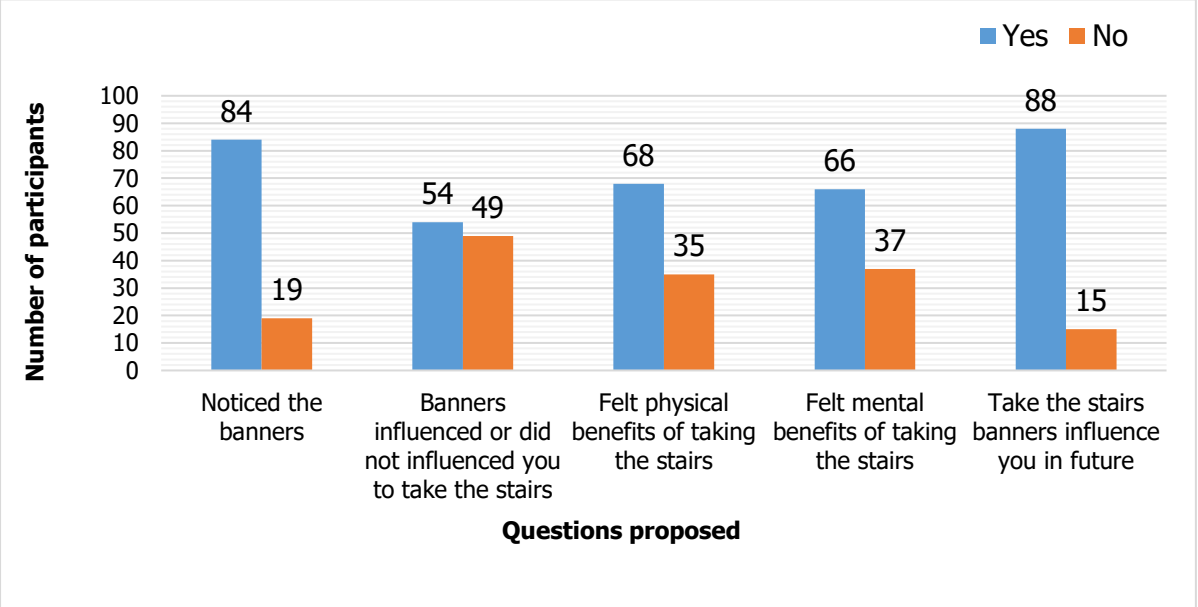

Figure 16. The breakdown of employees noticing and their views on PA and health promotion banners

Eighty-four participants noticed the banners, and 54 reported that banners influenced their decision to take the stairs. Furthermore, 68 felt the physical benefits of taking the stairs, and 66 felt the mental benefits. Concerning such an intervention in the future, 88 participants felt such banners would influence their behaviours in the future.

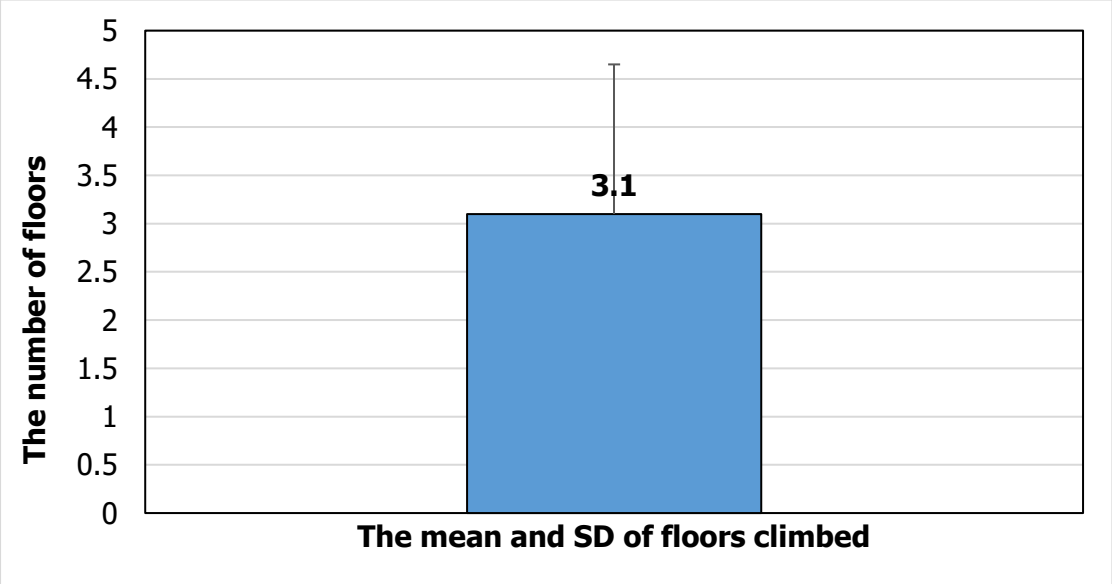

Figure 17. The descriptive statistics of mean and SD of employees climbing stairs in daily basis after seeing the banners

Of those people who said they will take the stairs in the future (*n*=88) it could be argued that this intervention has shown to be positive in promoting PA behaviour via stairs use. On average, employees reported, they took 63 steps ascending and descending the stairs multiple times in a typical working day since seeing the banners. Stair climbing is regarded as a vigorous form of PA. Employees being encouraged to take the stairs may increase PA levels and provide an alternative access to exercise resources free of charge. This can be undertaking during working hours at no detriment to work time, unlike needing to attend an exercise class or gym (Åvitsland et al., 2017; Engelen et al., 2018). Thus, this intervention may have served as a facilitator for employees to further PA in the workplace. The outcome of this intervention support previous research suggesting that motivational signs placed by lifts and stairs encouraged people to take the stairs (Allais et al., 2017; Crozier, 2019).

Themes, sub-themes and examples extracted from the raw data, recorded in the interviews with individuals post-observation to understand their views, reasons and any impact of taking the stairs after seeing the banners are explored in Table 29.

Table 29. Themes, sub-themes and examples extracted from the raw data

Themes	Sub-Themes	Examples	Number of participants
Motivation	Encouraging	*"I find the banners and stairs signs very motivational and I take the stairs since seen them as it gives me a sense of achievement and it showed me an easy way, like taking the stairs can help me stay active and healthy".*	54
	Influencing	*"The banners are influential and motivational because sometimes you need a reminder as most are pre-occupied with workload and don't always think about their health".*	57
	Health reasons	*"Using stairs because it is a healthy option and I want to remain healthy and that's what motivates me".*	60
Promoting physical activity	Encouraging being Active	*"After seeing the banners, I now use the stairs to walk and move more when I am at work so I can stay active".*	53
	Fitness	*"After seeing these posters, I am now trying to be fitter, so I use stairs".*	33
	Exercise	*"I am trying to exercise more since I've seen the banners".*	21
Behaviour change	Aware of benefits	*"The banners influenced me and made me aware of the benefits of using the stairs and that changed my behaviour towards stairs taking instead of lifts".*	30

	Change of behaviour	*"The banners already influenced and changed my behaviour. I no longer take lift since I have seen these banners".*	64
	Reminder of behaviours	*"They made me aware that a little bit of physical activity adds up such as taking the stairs. So yeah, it made me think about using the stairs again next time and the banners are great reminders as it makes you change your behaviour".*	87
Physical benefits	Health	*"Felt it - taking the stairs is good for my heart and health in general".*	40
	Strengthen legs	*"Yes, felt the benefit on my legs as my legs are strengthening since I've started taking the stairs".*	26
	Energy	*"Sometimes if I don't take stairs, I feel less energetic- walking up the stairs gives me energy, thanks to these posters".*	19
	Heart rate	*"It gets my heart pumping especially as I'm at the top floor, I used to take lift but since I've seen these banners, I will never take lift again as I felt the benefit of taking the stairs".*	23
	Losing calories	*"Since I've started taking stairs, I feel like I am losing a lot of calories".*	47
Mental benefits	Wellbeing	*"Good for my wellbeing felt as though I'd been congratulated".*	39
	Anxiety & stress	*"Feel better when I take the stairs, helps reduce me anxiety and stress".*	21
	Confidence	*"I feel happy that I have taken stairs to achieve my target as it helps improve my confidence".*	23
Future direction	Banners across building on the campuses	*"I think these banners created a culture that this is what people need to do and I think these banners should be put everywhere in the building and wider university".*	83

Participants suggested observing the banners motivated them to take the stairs and included three sub-themes: encouraging, influencing and health reasons. This intervention supports previous research suggesting that displaying motivational, educational, time and health-related messages promotes PA behaviour in the workplace (Bellicha et al., 2015; Dugdill et al., 2008; Nocon et al., 2010; Webb et al., 2011). This demonstrates that intervention with short messages about the importance of PA, health and wellbeing play an important role in changing employees behaviour, allowing to choose more active and healthier behaviours in the workplace. The banners also helped employees in identifying easily accessible ways of being active in the workplace. For instance, more than 50 employees reported that they take stairs since observing the banners as this helped them find an alternative way to be active in

the workplace. Present findings support previous research where it has been reported that displaying such signs motivated people to take the stairs and improved their PA levels (Engelen et al., 2017; Halsey et al., 2012).

This demonstrates that this intervention has helped promote healthy and active behaviours amongst this population. As more than 85 employees suggested that the banners increased their awareness about PA participation. After seeing the banners, their behaviour changed towards taking the stairs rather than using the lifts. The present intervention supports previous research suggesting, displaying motivational, educational, time and health-related messages promotes PA behaviour in the workplace (Bellicha et al., 2015; Dugdill et al., 2008; Nocon et al., 2010; Webb et al., 2011).

The results also indicate that PA, health and wellbeing banners can yield rapid improvements in behaviour. These findings might indicate that several employees before this intervention may have been in the pre-contemplation stage of the TTM. Such strategies effectively change cognitions, support individuals to make changes and move them to contemplation, preparation, and then action stages. The present findings support previous research suggesting that a noticeable stair use promotion initiative positively changes employees behaviour (Engelen et al., 2017). Additionally, this intervention may have served as a facilitator to employees barriers to PA engagement, as discussed in sections 6.5. Taking stairs does not require managerial approval, does not require extra time, is free, contributes to PA levels, improves health and does not require unique exercise clothes. Thus, staff had autonomy to use the stairs for PA levels, health and wellbeing improvements/purposes.

In addition, to the behaviour change, employees also noted they felt both physical and mental benefits of using the stairs. For instance, 40 employees suggested that they noticed the health benefit of using the stairs after observing the banners. The benefits reported varied, including heart pumping, legs strengthening, reduced stress/anxiety and improved confidence. These findings indicates that taking the stairs contributes to physical and mental health as explored in Table 34. This intervention support previous research suggesting that taking stairs improves physical and mental health, including anxiety and stress (Mikkelsen et al., 2017; Kpame and Richard, 2020). Thus, university employees noticing the positive impact of displayed banners could help them continue using the stairs rather lifts, contributing to PA and increased work productivity in the workplace.

Regarding the future direction of PA, health and wellbeing banners, 83 participants suggested that PA, health and wellbeing promotion banners could be distributed across university for promoting healthy and active working culture. For instance, university being a heterogeneous setting comprised of different gender and job roles, and many employees might not be aware of the associated benefits of using the stairs. Thus, displaying such banners across university may create an active culture and help employees to understand that there is an easy and cost-effective way of being active and healthy in the workplace. Therefore, future research may consider displaying posters with statistics to help imply the importance of taking the stairs in the workplace and must be generalised to other settings. Thus, future research could display comprehensive text messages on banners targeting different people in the workplace.

10.4.1 Limitations

This study found its strengths in obtaining insight into employees perspective about the PA, health and wellbeing banners. To the author's knowledge, this is the first intervention to target university staffs PA, health and wellbeing through displaying the motivational and educational messages by lifts and stairs in banners format. This intervention is also the first to provide quantitative and qualitative analysis regarding the impact of displaying these banners. Despite its strength, this intervention has limitations, including employees baseline data of how many floors of the stairs they undertook before intervention were not collected. Had this intervention collected the pre intervention stairs data and compared it post intervention would have further enhanced this intervention. Another limitation of this intervention was no follow-up study was conducted to assess if employees were still taking the stairs after the banners were removed. Had there been a follow-up study the quality of this intervention would have been further improved. However, the explanations for not conducting the follow-up study post intervention were mainly due to the covid-19 pandemic and national lockdown as most of staff especially the university employees had to work from home during the pandemic. Future research is required to explore the impact of exercise equipment in different settings and with control and non-control groups for longer period and with larger sample sizes.

10.4.2 Conclusion

In summary, this intervention identified reasons for taking the stairs and how influential they were to employees. This intervention also identified specific perspectives of employees about the banners displayed. The present findings contribute to the scarce literature about

promoting PA, health and wellbeing through motivational and informational messages displayed. However, this intervention's outcome can be utilised to design future PA, health and wellbeing interventions for the wider workforce, shopping malls and community-based interventions, specifically within university settings. Before implementing interventions, future research must understand the underlying reasons of why targeted group do not engage in PA, health or wellbeing initiatives. For instance, this intervention derived from study 3 of this thesis as employees noted facing various barriers to PA in the workplace and proposed a potential facilitator. Thus, this intervention successfully served as a facilitator to university employees regarding behaviour change, adherence and workplace culture.

Chapter 11.0

Intervention 5: Promoting PA amongst employees through the 10,000 steps team based competition

11.1 Contextual overview

Walking has generally been acknowledged as a convenient and free form of exercise that can integrate into everyday life (Audrey et al., 2014). The benefits of walking are well-established and include reducing the risk of cardiovascular diseases, diabetes, obesity and depression (Audrey et al., 2014; Gilson et al., 2013). The PA guidelines are established to encourage individuals to engage in regular PA behaviour. Walking is the most accessible form of PA that most individuals can embed into their everyday life (Sprow, 2020). The walking guidelines differs regarding the recommended number of steps. For instance, Patel et al. (2016b) recommended 70,00 steps per day, whereas, Wattanapisit and Thaname (2017) suggested 10,000 steps per day. However, steps less than 5,000 are recognised as sedentary (Hanson and Jones, 2015) while, steps between 5,000 -7,499 are identified as low active (Murtagh et al., 2014). Moreover, steps from 7500 to 9,999 would be regarded as somewhat active, and 10,000 steps are generally classified as active (Wattanapisit and Thaname, 2017). Recording 12,500 or more per day is highly active (Tudor-Locke and Bassett, 2004; Wattanapisit and Thaname, 2017). Nonetheless, 10,000 steps per day is a generally accepted guideline globally (Andrade et al., 2014; Petry et al., 2013; Warburton et al., 2010; Wattanapisit and Thaname, 2017).

A range of workplace walking programmes reports a mixture of findings about health, wellbeing and methodological approaches (Gilsone et al., 2013; Haslam et al., 2018; Mansi et al., 2015; Omran et al., 2018). Despite walking interventions featuring in the workplace, the methods and approaches used are questionable as most of the studies have mainly applied subjective methods for measuring steps (Brown et al., 2011; Cancelliere et al., 2011). However, studies have used more objective measures of accelerometers, and findings showed a significant effect in step counts for the intervention group compared to the control group ($p < 0.08$) (Chan et al., 2004; Gilson et al., 2007; Murphy et al., 2006). Also, Chan et al. (2004) recruited participants from five sedentary workplaces. They implemented an intervention to determine if accelerometer-based interventions increased steps taken per day instead of the self-reported methods. The results revealed, average steps increased from 7,029 ± 3,100 to

a plateau of 10,480 ± 3,224 and reported a significant decrease in BMI, waist circumference and resting heart rate. Therefore, the effectiveness of walking interventions is positive for increasing steps across various settings (Donnachie et al., 2017; Thomas and Williams, 2006).

Previous research has concluded, the impact of walking intervention is yet to be established compared/combined with other activities or incentives (Abraham and Graham-Rowe, 2009; Blake and Batt, 2015). For example, 26 weeks intervention was designed to assess if a financial incentive played a role in improving PA amongst hospital staff (Losina et al., 2017). The PA engagement was objectively measured, and intervention was designed for individuals and team-based. The results indicated, providing a financial incentive successfully increased the daily step counts (Losina et al., 2017). The importance of using financial incentives has increased across settings because research has shown that external/extrinsic motivation is linked with PA participation. For instance, Patel et al. (2016b) conducted 13 weeks intervention to determine if a financial incentive increased team-based competitive step count. The team with the most recorded steps was announced as a winner daily. The teams that achieved the daily recommended steps were awarded $50 (Patel et al., 2016b). The findings revealed that competitive nature and financial incentives had motivated the teams to walk more. However, the daily recommended steps in this study were set to 7,000. Other studies also indicated similar findings and recommended that offering extrinsic rewards influence social activities within teams associated with improving walking amongst workers across settings (Finkelstein et al., 2016; Patel et al., 2016).

Previous research provided general insight into the impact of step-counts, but most studies merely focused on financial incentives. Research has shown that providing financial incentives improving step-counts has been limited. Most of the research designed was grounded on the standard economic theory, which commonly accepts that people perform rationally (Barte and Wendel-Vos, 2017; Losina et al., 2017; Mitchell et al., 2013). Previous research suggested that social and behavioural economic research design and implementing the incentives have an important influence (Okie, 2007; Patel et al., 2016). Studies recommended that behaviour change interventions may be more influential when people participate together, especially when socially connected, such as friends, family or colleagues (Patel et al., 2016b; Katz et al., 2009; Odu, 2011; Tate et al., 2015). The existing interventions have several limitations that need to be addressed in the future research (Brown et al., 2011). For instance, the influence of team-based competitive interventions is unknown. Behaviour change and the team-based competitive interventions measuring step-counts objectively and exploring the influence of

intervention qualitatively may accomplish the gap regarding the walking intervention in the workplace.

Some studies conducted walking interventions on university employees, and the results found a significant effect between pre versus post-step-intervention ($p < 0.002$) (Gilson et al., 2007). Fountaine et al. (2014) evaluated the differences between job roles amongst university staff, and results established that the management accumulated significantly more steps than administrators and faculty staff ($p < 0.05$). However, university employees did not reach the recommended number of daily steps. The actual steps are taken and what they perceived as a daily recommended steps target were also not recorded (Finkelstein et al., 2012).

Moreover, step interventions' findings essentially considered the objective measure. A mixed-method approach using accelerometers to objectively measure step-counts and assess the intervention qualitatively perceived effectiveness are needed (Butler et al., 2015). As detailed in section 6.5 that university employees noted access to resources, activity classes, protective time, flexibility and enjoyment would be a potential facilitator to their PA engagement. Thus, this intervention may serve as a facilitator for PA participation in this university settings.

11.2 Aims and objectives

This intervention aimed to promote PA among university employees via teams-based competition targeted towards the recommended 10,000 steps per day.

11.3 Methods

One campus was chosen for this intervention. The steps data were collected through one ActiGraph Wgt3x-BT per group, and information about this tool have been detailed in section 5.3. For the ActiGraph to function, an ActiLife, software version 6.13.3 was required for initialisation and downloading the data as detailed in section 5.3. The steps data were recorded for one week as baseline and for seven weeks as part of this intervention. Post intervention individuals were sent a short open-ended survey to provide their views on the teams-based intervention (see Appendix 33 for an open-ended survey).

11.3.1 Participants

A total of 49 employees participated and formed eight separate teams for this intervention. Table 30 provides the breakdown of teams as per the employees job roles.

Table 30. The breakdown of participants in 10,000 steps challenge intervention

Total teams	Total staff in Department	Number of staff who participated in the intervention
Senior Admin management	14	4
Educational & Social work	16	7
Nursing & Midwifery	13	8
Sport & exercise	15	3
Health Sciences	12	8
Admin Assistant	16	4
Library	25	5
IT	10	10

11.3.2 procedure

An email was sent to the team leaders/managers and requested to circulate the invitation to participate as a department. The email included the ethics approval certificate, information sheet and consent form and an invitation to register their interest as a team or individually if they wish to partake (see Appendix 31 email and Appendix 32 for the information sheet and consent form). For a department to be eligible to participate, a minimum of three individuals were required to compete. If there were more than three people in one Department who wished to participate, they had the option to share the participation across the intervention period (e.g. one could decide which specific week to compete in the 10,000 steps challenge). The procedure was that each team had to nominate a leader responsible for collecting and returning the ActiGraph weekly. The researcher would visit every office and hand out the ActiGraph at 8:30 am, and the ActiGraph would start recording the data at 9:00 am on Monday till 17:00 on Friday. This was to represent a typical working day/week. The ActiGraph would then be collected after 17:00 on a Friday from offices before employees leave their workplace. Teams were to compete against each other using a generic league format across the seven

weeks, with each 'match' accumulating the total steps from teams to form respective results. Table 31 provide the breakdown of weekly fixtures for the seven weeks for each team.

Table 31. The breakdown of teams and fixture of 7 weeks steps challenge

Week 1	Sport & Exercise	VS	Academic Services Management
	Library	VS	IT
	Health Sciences	VS	Nursing & Midwifery
	Education & Social Work	VS	Admin assistants
Week 2	Sport & Exercise	VS	Library
	Academic Services Management	VS	IT
	Admin Assistants	VS	Health Sciences
	Nursing & Midwifery	VS	Education & Social Work
Week 3	Sport & Exercise	VS	IT
	Academic Services Management	VS	Nursing & Midwifery
	Library	VS	Admin Assistants
	Education & Social Work	VS	Health Sciences
Week 4	Sport & Exercise	VS	Admin Assistants
	Academic Services Management	VS	Health Sciences
	Library	VS	Education & Social Work
	IT	VS	Nursing & Midwifery
Week 5	Sport & Exercise	VS	Nursing & Midwifery
	Academic Services Management	VS	Education & Social Work
	Library	VS	Health Sciences
	IT	VS	Admin Assistants
Week 6	Sport & Exercise	VS	Education & Social Work
	Academic Services Management	VS	Admin Assistants
	Library	VS	Nursing & Midwifery
	IT	VS	Health Sciences
Week 7	Sport & Exercise	VS	Health Sciences
	Academic Services Management	VS	Library
	IT	VS	Education & Social Work
	Admin Assistants	VS	Nursing & Midwifery

Teams were awarded 1 point for each day they accumulated 10,000 steps. The team who accumulated the most steps in the week were awarded an additional 3 points for winning the 'match' in that specific week. Participants were aware that the team had an award with the most steps taken at the end intervention period (i.e., winner of the league). There was also a weekly update on the league, updating the daily and total steps and points accumulated, showing the teams that had won on that week as a form of incentive. This was to ensure participants were aware of how many steps they had taken each day and on that specific week (see Appendix 34, an example of the weekly league update).

11.3.3 Statistical and thematic analysis

Before the data analysis, teams were categorised according to their departmental names for analysis purposes. The descriptive statistics of ActiGraph data is analysed as a mean and SD for baseline and intervention daily steps. Also, the qualitative data was analysed via thematic analysis and presented as themes, sub-themes and examples from raw data. The process of thematic analysis is provided in section 6.4.

11.4 Results and discussion

Figure 18 shows the differences between baseline and intervention daily steps throughout the intervention period. Figure 19 provide the differences between the teams.

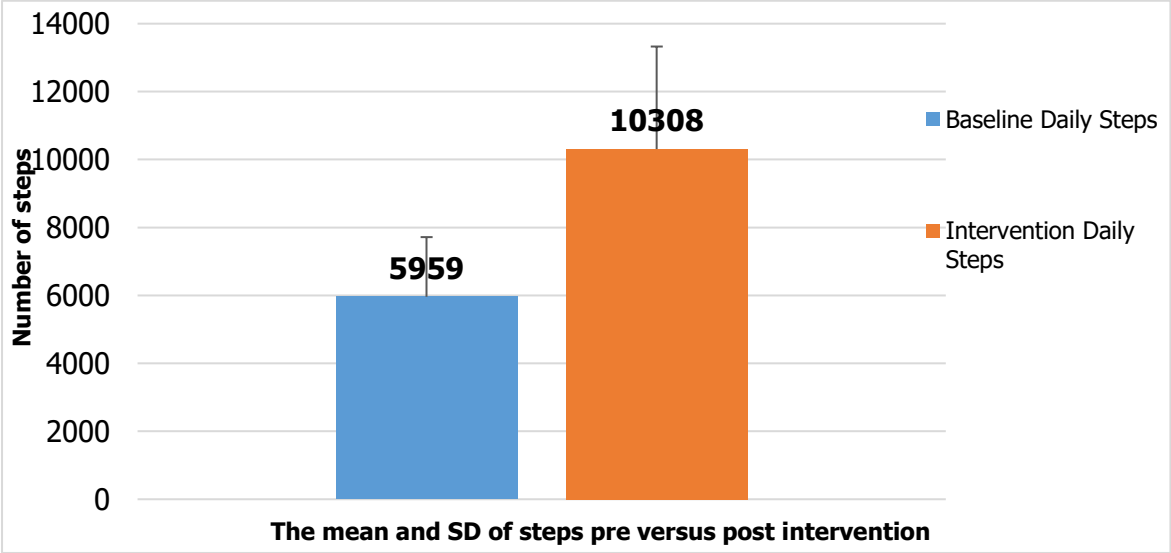

Figure 18. The mean and SD of university employees baseline daily and intervention steps

The baseline steps data shows that university employees were not meeting the 10,000 daily steps guideline (i.e., 5959 on average). However, the intervention data has shown that employees steps in this sample are higher, 10308 daily. The findings of this intervention suggest that this intervention helped increased step count towards the recommended daily allocation (i.e., an average increase of 4349 steps per day). Employees taking more steps could be due to the nature of this intervention's being a team-based competition with weekly incentives to compete and a prize for the winning team who wins the league at the end of the

intervention period. It is also possible that the ActiGraph itself may have served as a reminder to take steps and be more active. This may have changed employees behaviour and motivated them to go for walk, visiting colleagues rather than emailing/phoning or take the stairs instead of lifts in the workplace. The present findings support previous research suggesting that team-based competitions with extrinsic rewards increase daily step counts (Finkelstein et al., 2016; Losina et al., 2017).

Overall, employees accumulated over 10,000 steps in this intervention per day. However, discovering the differences between the baseline data and intervention amongst teams were essential to identify if this intervention has improved their daily steps between job roles and if any team have met the recommended steps guidelines as detailed in Figure 19.

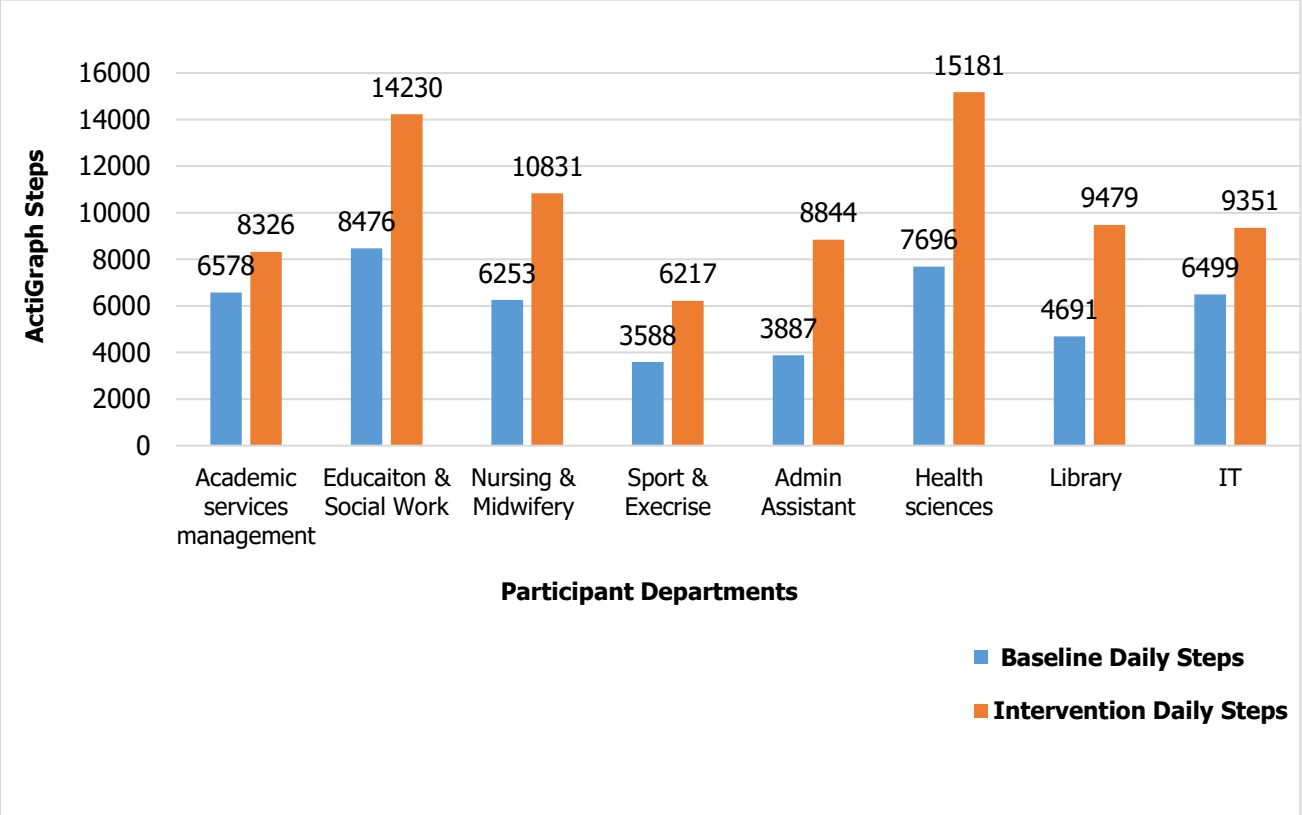

Figure 19. University employees daily baseline and intervention steps between job roles

The number of steps appears higher during this intervention than the baseline data. Three departments are shown to be meeting the recommended steps guideline of 10,000 steps, with 'Health Sciences' recording the highest daily average steps. The increased number of steps amongst all teams could be due to the competitive nature of this intervention's that staff may not have wanted to lose against another team. The outcome of this intervention support

previous research suggesting that the competitive nature of intervention motivated staff not to give up and lose to other teams (Finkelstein et al., 2016; Patel et al., 2016). Another potential reason for steps increment could be the prize incentive at the end intervention for the winning team.

Moreover, teams' recording different steps could also be because of their job roles as teams had different jobs ranging from academics, technicians to management and administration. Some jobs may have been more physically demanding than others. For instance, the 'academic services management' job requires staff to be sedentary, whereas the IT team requires staff to move around the building for IT-related issues.

Despite the increase in daily steps, not all teams met the 10,000 steps guideline but making comparisons with the baseline data it shows a positive increase (Andrade et al., 2014; Murtagh et al., 2014; Petry et al., 2013; Warburton et al., 2010; Wattanapisit, and Thaname, 2017). Participants in this intervention from the winning teams were awarded a £10 voucher each to 'Mr Mulligans'. They arranged a day to visit together for an indoor fun game and lunch as a team. The present findings support previous research suggesting, teams-based competition with an award incentive increased step counts (Finkelstein et al., 2016; Losina et al., 2017). Moreover, to understand the impact of this intervention from employees perspectives, the subsequent section discusses the themes, sub-themes and examples assembled from the raw data are provided in Table 32.

Table 32. Employees perspective about participating in the team-based 10,000 steps challenge intervention

Themes	Sub-Themes	Example	Number of teams
Motivation	Team	*"We as a team never go outside at lunchtime but with the challenge, we have tried to do this every day. It motivated us as a whole team to walk more".*	8
	Encouraged	*"It encouraged us to take longer routes rather than quickest".*	7
	Stairs	*"We were motivated and started to take the stairs instead of lift".*	4
Competition	Challenge	*"The whole team was competitive, and everybody just wanted to win, and we kept walking more".*	8
	Healthy competition	*"Nice to be involved in such a healthy and shared competition".*	4
	Interesting	*"It was an interesting experience as we were never involved in such an activity before".*	3

Enjoyment	Enjoyable	*"We felt excited and it was fun to get involved in a workplace challenge and compete with other departments".*	7
	Fun	*"It was great fun partaking in this competition, absolutely loved it ".*	3
	Excited	*"The whole team was very excited, and we kept talking about it all the time".*	3
Active	Fitness	*"We feel, it made us much fitter than before, and we started to take the stairs more often".*	6
	Walking	*"We got up and walk around more than we might have done otherwise".*	8
	Walking meetings	*"We were trying to take more walking meetings to record more steps and be active as we saw the positive effect*	5
Productivity	Alert	*"I think the challenge helped improved our productivity and we felt alert all the way from the start to end of each week".*	5
	Productivity	*"It made us more productive because we would go for a walk as a team and still manage to get our work done on time".*	4
	Refreshed	*"This challenge helped us by regularly walking around the building or outside which helped kept us fresh throughout the day".*	5
	Breaks	*"The 10,000 steps challenge gave us the opportunity to take regular breaks which really helped us in a working day".*	7
Behaviour change	Sedentary behaviour	*"We have been conscious of sitting for long times in the workplace. this intervention has changed our behaviour towards walking, now we look for an excuse to go for a walk in the workplace".*	8
	Consciousness	*"It made the team realise there are many benefits to walking and getting up within the working day and moving around is important. Getting fresh air throughout the day definitely helped. This challenge really changed us for better".*	5
	Communication	*"Improved our communication and we kept planning as to who wears the tracker and when and also, we were more inclined to speak to each other about non-work-related activity, something we never done before".*	6
	Gym	*"There has been noticeable difference in overall health and wellbeing during this period and the team felt this is necessary to continue and some colleagues have actually joined gym and started to*	2

		run and walk more often, thanks to this intervention".	
Awareness	Benefits	*"It has made us aware that being more active have psychologically and physical benefit".*	5
	Reminder	*"the tracker has acted as a reminder to make time to get up and walk around".*	4
	Lifestyle change	*"We noticed staff, were eating better, walking more, and smiling a lot because they became aware of something good. Full success 100%".*	4
	Healthy	*"Yes, it has made us more focused and conscious about keeping healthy at work and at home".*	6
Future Incentives	Health and Wellbeing	*"We would be keen in participating in more interventions like this within workplace, which would improve our health, and wellbeing".*	8
	Friendly	*"We will definitely participate again. It was an enjoyable challenge and was nice and friendly competition in the workplace".*	*5*
	Competition	*"It was an enjoyable experience, and everybody agreed they would partake in the same or something similar competitive programme in the future".*	*8*

With respect to the qualitative findings, a total of eight themes with several sub-themes were identified from the raw data providing an insight into employees perspectives about their participation in this intervention. All eight teams suggested, this intervention had motivated them to walk more for different reasons, including enjoyment, health, winning and perceived productivity. This shows that some participants were not reaching the 10,000 steps might still feel the benefits of participating in a competitive intervention, which may have led to increased step counts, relatedness and enjoyment.

Previous research has shown that autonomous extrinsic and intrinsic motivation lead to exercise engagement (Wilson e al., 2004; David et al., 2009). Therefore, introducing a team-based competitive intervention might be one of the best ways to engage employees in a dynamic behaviour in the workplace. The extrinsic motives such as monetary prize or pride at the end of intervention for the winning team with most steps were associated with participants motivation, competitiveness and behaviour change towards PA engagement.

"The whole team was competitive, and everybody just wanted to win, and we kept walking more".

This supports previous research, concluding that extrinsic motives are linked with PA/exercise participation and favourable outcome (Neace et al., 2020; Panao & Carraca, 2020). Moreover, participants in the present intervention stated that they never went outside during lunchtime. However, this intervention motivated them to go outside as a team for a walk. Thus, the positive effect on employees and changing behaviour from sedentary to active may have contributed to their health, wellbeing, perceived productivity and serve as an alternative strategy for the teams to be active, which may have served as a facilitator to employees PA participation.

"We as a team never go outside at lunchtime, but with the challenge, we have tried to do this every day. It motivated us as a whole team to walk more".

Previous literature mainly focused on participation, adherence and assessing variables in age, gender, culture and tended that sport or PA's competitive nature is typically for youth (David et al., 2009). Whereas Pfeiffer and Pate (2006) noted, adults are more likely to report competition as an essential factor for engaging in an action. Thus, this intervention provides a new concept of providing team-based competitive intervention that could improve PA levels, lead to enjoyment and perceived productivity and behaviour change among employees. The combined motivations share qualities with the intrinsic motivation that is regarded as extrinsic due to the goal that employees were trying to achieve was extrinsic, rather than inheriting enjoyment or interest in the task as explored in Figure 3 (Deci and Ryan, 1985).

"The whole team was competitive, and everybody just wanted to win, and we kept walking more".

Moreover, this intervention corroborates and contributes to SDT, as detailed in section 2.3. During this intervention, SDT was satisfied as evidenced by themes, sub-themes and examples provided alongside a positive outcome in Table 32. Previous research suggested that the three needs contribute to individuals motivation and competency towards PA, health and wellbeing as long as the needs are satisfied (Deci and Ryan, 1985; Ryan et al., 2010). Olafsen et al. (2017) concluded, consideration of satisfaction is achieved when competency, autonomy and relatedness needs are supported, and as such, this was the case in the present intervention.

Additionally, this intervention positively contributed and changed behaviour from sedentary to active and raised consciousness amongst employees and contributing to the TTM as detailed in section 2.2. Employees also noticed the positive outcome during this intervention have led them to join gym membership, started walking and running to work, and continuing the active behaviour was considered important. This supports previous research suggesting that change includes consciousness-raising and regarded as one of the most important factors for behaviour change to occur (Adams & White, 2004). Thus, changing behaviour is not simple, but making individuals' aware of the advantages/disadvantages and consequences of their actions on health, wellbeing and providing alternatives may help them contemplate as such was the case in this intervention as explained by participants.

"It made the team realise there are many benefits to walking and getting up within the working day and moving around is important. Getting fresh air throughout the day definitely helped. This challenge really changed us for the better".

After consciousness-raising, employees started to find alternative ways for achieving more steps, such as conducting walking meetings and walking to colleagues' desk rather than emailing, to take more steps against their opponents. This shows that this intervention contributed to employees creative thinking and making them aware of the alternative ways of meetings and being active rather than conducting meetings or emailing in a sedentary manner. Employees walking to colleagues' rather than emailing could positively change their usual sedentary behavioural culture in the workplace as this may have encouraged them to walk more than sitting for a prolonged time. As suggested by the TTM in section 2.2, stages are related to individuals' willingness to change their behaviour. Employees being motivated and competitive throughout this intervention have changed their behaviour from one stage to the next. For instance, this shows employees having autonomy, competence and relatedness to the teammates may have positively change behaviour and lead to a supportive working environment. This intervention supports and contributes to the TTM in terms of human behaviour changes through stages, as detailed in section 2.2.

Walking is proven to be beneficial for physical and mental health, and increased steps evident in this intervention may have positively contributed to employees health and wellbeing. The present findings support previous research concluding that the 10,000 steps challenge may positively change behaviour and improve health and wellbeing in the workplace (Hallam et al., 2018). Thus, employees recognising the benefits of walking during the working day may be the cause for the positive perceived influenced on behaviour change. Despite motivation,

competency and behaviour change, employees suggested that they are willing to participate in future workplace intervention if focused on PA, health and wellbeing. Employees willingness to engage in a similar intervention in the future, suggesting the success and positive impact of this intervention. This university and other work environments could adopt the approach of this intervention to plan same/similar interventions for prompting healthy and active lifestyle in the workplace for all employees in the future.

11.4.1 Limitations

Despite the present intervention revealing useful findings, though, it is not without limitations. One of the key limitations of this intervention was that it did not collect data per participant's gender within teams. Collecting data per gender would have provided a comparison between males and females and might have potentially yielded different results. Another limitation of this intervention was the number of teams and participants in each team. Further limitation of this intervention was that no follow-up study was conducted to evaluate if employees continued walking as teams in lunch times, taking the stairs instead of lifts or conducting walking meetings instead of usual seated meetings or to assess if their active behaviour has relapsed when the intervention ceased. However, the possible explanations for not conducting the follow-up study were lack of time, funding, the covid-19 pandemic and national lockdown as most staff especially the university employees had to work from home during this period. Future research must include the whole workplace if possible and provide an individual ActiGraph as this may provide more insight into the workplace's daily steps. Future research is also warranted to compare and contrast different working environment and employees and having a control and non-control groups may yield different findings about the 10,000 steps challenge within the working settings.

11.4.2 Conclusion

In summary, this intervention has increased employees daily steps by 4349. The 'Health Sciences' recording the highest incremental steps of 531,342 followed by the 'Education and Social Work' team accumulating 498,045 steps throughout this intervention. Despite improving step counts in all teams and sparking a positive atmosphere in the workplace, this intervention also motivated employees to continue engaging in walking and improving their perceived productivity and changing their PA behaviour. This intervention contributes to the existing workplace PA, health and wellbeing literature and more specifically, to the university settings.

Future research could build upon this intervention's framework, and the current findings can be generalised to other settings. Future team-based friendly competitive activities research is needed across settings and amongst university employees. Although all teams did not meet the 10,000 steps guideline, this intervention's recorded steps that have improved between teams and demonstrated the positive impact of competitive team-based intervention with prize incentives in the workplace.

Chapter 12. General Discussion

12.1 Introduction

The initial aims of this thesis were:

- To evaluate the current PA levels and time spent sedentary amongst university employees.
- To understand barriers and facilitators to PA, health and wellbeing within and outside of the university workplace.
- To implement PA, health and wellbeing interventions that improves PA levels, overcome barriers and reduce this population sedentary behaviour in the workplace.
- This thesis's overall aim was to identify ways in which staff can enhance their activity levels, optimise adherence, and in turn, improve health and wellbeing.

For achieving these aims, a series of studies were conducted and subsequently informed PA, health, wellbeing and sedentary behaviour interventions. This final chapter aims to bring together the studies findings as mentioned above in a discussion of PA, health and wellbeing, and the influence of interventions on university employees and make recommendations to the broader workplaces, particularly university settings, and suggest avenues for future research. The findings of each study will be summarised and the relative importance of each will be evaluated concerning workplace PA, health and wellbeing. A detailed theoretical contribution of this thesis will be outlined. The recommendations will be proposed based on the current discussion that may help address the limitations of the conducted studies to explain and further improve the present understanding. Finally, a brief conclusion will be presented.

12.2 Summary of findings

12.2.1 Study 1

Chapter four evaluated the PA levels and sedentary behaviour within university employees as a baseline study and determined if this population adhered to the recommended PA guideline and how this differed between genders and job roles. This study found different results in terms of PA levels and sedentary behaviour between genders and job roles. Overall, findings suggested that university employees exceeded participating in recommended PA guidelines

by accumulating more than 300 minutes of total MVPA throughout the week. Male employees were found to be spending more time engaged in PA than females across the week, and the differences between job roles were also evident, as detailed in section 4.6. Despite exceeding the recommended PA guideline, this population was spending the least amount of time being active in the workplace and spending over 2,800 minutes being sedentary across the week, which could negatively affect their health and wellbeing. These findings suggest that PA levels and time spent sitting indicates, employees in a range of job roles may report different PA levels and time spent sitting. This study suggested that future investigations are deemed necessary to objectively monitor PA levels and sedentary behaviours to confirm or compare current findings within university employees and across a range of settings.

12.2.2 Study 2

Chapter five objectively monitored PA levels and sedentary behaviour of this population. Accelerometer findings determined that male employees spent 14 minutes extra engaged in MVPA and 143 minutes more sedentary than their female counterparts. The PA levels and time spent sitting also varied between job roles, with Academics spending 111 minutes more than Administration staff and 54 minutes extra than Professional Services engaging in MVPA. Academics staff spent 109 and 143 minutes more being sedentary compared to Administration staff and Professional Services. These findings are alarming, considering health consequences interconnected with prolonging time spent sitting. Future research is needed to explore barriers qualitatively; this population may be facing PA engagement and potential facilitators in the workplace.

12.2.3 Study 3

This study was formed to gain an insight into the PA barriers and facilitators in a university setting. Workplace culture, lack of management support and access to resources were common barriers to PA participation. Correspondingly, access to gym on campus, activity classes, protective time for exercise and friendly competitive PA and health-related programme with flexibility/autonomy during the working days were some of the proposed facilitators. These facilitators may help promote PA participation and reduce sedentary behaviour amongst this population. These findings formed different PA, sedentary behaviour, health and wellbeing interventions to facilitate university employees. The following section briefly summaries the implemented interventions.

12.2.4. Accessibility and the availability of exercise resources in the workplace

This intervention aimed to monitor if providing access to exercise equipment prompts this population to engage in exercise and its impact on their health, wellbeing, QoL and perceived productivity. The findings demonstrated that employees used the exercise equipment for 1287 minutes during the intervention period, with male employees engaged in 135 more minutes than females. This shows that providing access to resources in the workplace can create a positive atmosphere and promote PA behaviour. Employees also noted that access to exercise equipment reduced sedentary behaviour and stress level and improved mood states and focus. This intervention has served as a facilitator to employees barrier to PA participation. This university could consider opening a gym onsite which may help employees being active and could generate income for university.

12.2.5. Reducing sitting time through sit and stand desk amongst university employees

This intervention aimed to monitor the impact of height-adjustable workstation on sitting and standing time, health, wellbeing, QoL and perceived productivity. The results indicated that sitting time reduced from 1974 to 821 minutes on weekly bases. In addition, the standing time has increased from 439 to 923 minutes throughout the intervention period. Employees suggested that having access to height-adjustable workstation helped them being energetic, productive and happy. In summary, sedentary behaviour decreased by more than 1,100 minutes and standing time has substantially increased throughout the intervention. This shows that access to height-adjustable workstation may facilitate the sedentary workplace culture, promote an active and healthy lifestyle among university employees.

12.2.6. Exploring the impact of seated, standing and walking meetings in the university setting

This intervention aimed to monitor differences between pre versus post seated, standing and walking meetings on mood states. The results showed that walking meetings are positively linked to a higher vigour level that positively contributes to being lively, energetic, active and alert. This shows a positive effect on mood states and reduced anger, confusion, depression, fatigue and tension compared to seated and standing meetings. These findings can be used to support altering sedentary workplace culture and promote an opportunity for a working

environment that embraces the prospect to engage in more active meetings within the university and across settings.

12.2.7. Getting university employees on the stairs: The impact of points of decision prompts

This intervention aimed to evaluate if placing PA, health and wellbeing banners by lifts and stairs promote stairs usage in the university workplace. From the 103 participants, 84 noticed the banners, 54 were influenced and took the stairs, 68 reported noticing physical, and 66 suggested mental benefits of taking the stairs because of the banners, and 88 stated that the banners would influence them to take stairs in the future. Participants suggested that the displayed banners have positively changed their behaviour about health and wellbeing benefits of taking the stairs. This further influenced and motivated them to take the stairs. In summary, placing PA, health and wellbeing banners in the university promote healthy and active lifestyle amongst employees. This university could consider placing such banners around all campuses for promoting healthy and active lifestyle in the workplace.

12.2.8. Promoting PA amongst employees through the 10,000 steps team based competition

This intervention aimed to promote PA through a team-based competition targeted towards the recommended 10,000 steps per day. The results shows that the daily steps increased from 5959 to 10308. The increased steps appears to be linked with competitive nature, team-based and prize for the winning team. Participants suggested, this intervention not only improved their daily or weekly steps but positively contributed to their productivity, team cohesiveness, motivation and changed their behaviour from sedentary to more active and healthier in the workplace. This university could consider implementing friendly competitive interventions across university. This may positively motivate employees and contribute to productivity, team cohesiveness and overcome sedentary workplace culture and promote active healthy lifestyle and in turn it may improve productivity and reduce absenteeism.

12.3. Theoretical contribution to strategies, policies and potential implications of this thesis

This deductive thesis contributes to the existing knowledge of behaviour theories such as TTM, SDT and the SEM in the subject of exercise psychology associated with public health, in PA, sedentary behaviour, health and wellbeing of employees in the university setting. In this

thesis, the application of models were effective in terms of staff having autonomy, higher motivation and relatedness. It also helped move employees through the stages of TTM as it provided approaches on personal, departmental and organisational levels that could be used in other universities and settings. This thesis provides an original insight into university employees PA levels and sedentary behaviour across gender and job roles subjectively and objectively, followed by qualitatively exploring barriers and facilitators to PA, health and wellbeing. These studies provided an approach and formed interventions that may improve PA levels, health and wellbeing and reduce sedentary behaviour. The additional contribution of this thesis was implementing PA, health and wellbeing promotion and reducing sedentary behaviour interventions for facilitating the barriers in the university workplace. Findings of interventions suggested a strategy that could be utilised by more comprehensive working settings to effectively improve workplace PA, health, wellbeing and overcome sedentary behaviour. The benefits of targeting employees in the workplace are that a large proportion of the adult population can be reached, regarding PA, sedentary behaviour, health and wellbeing.

The number of participants in each study and interventions of this thesis demonstrated the need for PA, health and wellbeing and reduced sedentary behaviour interventions to focus on employees. This supports previous research suggesting there is a need for PA and health promotion experts to collaborate with organisations to promote the importance of PA and health interventions in the workplace (Kerr et al., 2001a; Kazi, 2013). Additional contribution of the present research resulted from a comprehensive exploration of the active and inactive employees perspectives on PA participation barriers, as discussed in section 6.5. The findings of study three emphasised the critical issues, barriers and potential facilitator that may help interventions be successful on both organisational and individual levels. One of the main issues in the workplace is how poorly PA and health interventions are attended, and that is because those interventions frequently did not meet individual needs (Kazi, 2013). This thesis can confirm that interviews (consultations) with employees across gender, job roles and PA levels from their perspectives of what they require in terms of interventions can facilitate barriers and promote PA participation, health and wellbeing, reduce sedentary behaviour and may ultimately promote a healthy and active lifestyle in the workplace.

Regarding the impact on policy and practice, this thesis's outcome and materials could be used for the stage of change concerning PA, sedentary behaviour, health and wellbeing. For instance, this thesis's results and guidance could be used to communicate individuals' inactive

behaviour and potential health risk. Thus, persons in the pre-contemplation phase may benefit from information about health risks, whereas those in the contemplation/preparation stages may benefit by the applied direction (Kazi, 2013). Providing information, guidance and interventions may lead to individuals' competence. In contrast, others could be more self-sufficient and become aware of what/how to do it and relate it to others if required. In addition, this may lead to overall satisfaction in the workplace. Moreover, the present findings can be utilised to form or update the existing workplace strategies and policies in terms of health and wellbeing because interventions derived from employees served as facilitators for their barriers that this university has not previously advocated for their staff.

This thesis's outcome and information could contribute to and support various Public Health-agencies, strategies both nationally and internationally. For instance, this includes the WHO, the National Institute for Health Research, PHE, NICE, Sport England and workplace health and wellbeing policies and strategies. This thesis's approaches could be used to inform future strategies or contribute to the current ones concerning PA, sedentary behaviour, health and wellbeing. This further contributes to the WHO Global Initiatives, the global action plan for preventing and controlling non-communicable diseases, the global action plan of PA 2018-2030, WHO European Region 2016–2025, and the healthy workplace model. This thesis's outcome may also add to the national policies and strategies from the PHE, NICE, and Sport England, such as everybody active every day, and workplace health, mental wellbeing at work, and towards an active nation 2016 2021.

The findings related to sedentary behaviour throughout this thesis is essential and add to the increasing evidence suggesting that individuals spend most of their daily time at work. A substantial amount of that time is spent being sedentary. As explored in section 8.4 that employees are spending prolonged time at work. The majority of people are now employed in sedentary occupations (BHF, 2017), and the effect of sedentary behaviour is associated with many health issues, including obesity, high blood pressure and chronic diseases (Cheung and Chow, 2012; Chin et al., 2017; Grunseit et al., 2017; Mackenzie et al., 2017). Therefore, the impact of sedentary behaviour must not be ignored as it could harm employees long-term health and wellbeing. In addition, the outputs from this thesis suggests that the health and wellbeing experts may wish to follow the approach of this thesis by providing the height-adjustable workstation and changing the usual way of seated to standing and walking meetings or use this outcome to develop other interventions that may specifically target to reduce sedentary behaviour.

Furthermore, this thesis contributes to the limited research about workplace PA, sedentary behaviour, health and wellbeing, particularly in a university setting. Additionally, this thesis contributes to the minimal discussions surrounding genders and job roles and PA levels in the workplace. In summary, this thesis evaluated the existing PA levels, sedentary behaviour, barriers and potential facilitators of university employees and implemented interventions to reduce sitting time and promote PA, health and wellbeing of this population in the workplace.

12.4. The strengths and limitations of this thesis

The strength and weaknesses have been discussed at the end of each study and interventions. However, this thesis have many strengths and some weaknesses overall. For example, this thesis understood the effect of PA, sedentary behaviour, health and wellbeing interventions on university employees through using different theoretical models such as TTM, SDT and SEM. One of the main strengths of this research was applying a mixed-methods approach, and the number of participants in each study of this thesis. Moreover, throughout this thesis, the data collected from different perceptions, including males and females' employees from a range of job roles such as Administrative, Estate, Information Technology, Marketing & Communication, Academics to Senior Management. This provided the opportunity to compare and analyse among genders, job roles and demonstrated how effective interventions were for certain employees more than others. Another strength of this research was the design of the interventions and methodological approaches such as quantitative, qualitative and mixed methods interventions and thesis overall. Moreover, most of these interventions were the first to focus on university employees, adding further weight to this thesis's strength.

Participating in this thesis was voluntary and this displays the possible self-selection prejudice that is one of the limitations of this thesis. For instance, employees choosing to complete the online questionnaire, wear an ActiGraph for an entire week and partake in focus groups to share their perceptions about the workplace PA, health and wellbeing. The self-selecting participation may have skewed findings, but it is challenging to recognise whether the data were skewed in any particular way. Another limitation of this thesis was not having a control and non-control groups of participants. Had there be a control and non-control groups might have yielded different results. But overall, interventions results revealed different findings, primarily positive, but there were some negative with no significant effect, as discussed in the result sections of each intervention. A further limitation of this thesis was that it did not conduct any follow-up intervention to investigate if employees continued engaging in healthier behaviour after interventions ceased. To understand if behaviour change is continuing to

maintain or discontinued after the supporting intervention has ended, a follow-up examination is important (Gilson et al., 2010; Kazi, 2013). However, some of the key reasons for not conducting the follow up studies includes the limited time of this project, funding, the covid-19 pandemic and national lockdown as most of the workforces especially university employees had to work from home during the pandemic and lockdown in order to control the spread of virus. Future research is required to explore the impact of similar interventions in different working settings and across employees with control and non-control groups and a follow-up study. a further limitation of this thesis was that most of the utilised methods in this thesis were self-reported such as questionnaires. The issues surrounding subjective methods are discussed under the methods section of each study. However, the subjective methods applied in this thesis were deemed valid and reliable. Future interventions related to PA, sedentary behaviour, health and wellbeing are recommended to utilise a combination of subjective and objective methods.

12.5. Future research

This thesis offers future research about PA, sedentary behaviour, health and wellbeing interventions in the workplace. However, future research recommendations have already been discussed at the end of each study and interventions. Nevertheless, results from interventions are encouraging, but more research is needed to compare, contrast or confirm findings and test these interventions with other employees across HEI's. The effect must be evaluated pre versus post completion of interventions to demonstrate each applied intervention's long-term effect on health, wellbeing and behaviour change.

The information presented in chapters 4, 5 and 6 provides an insight into employees PA levels, sedentary behaviour and experience utilising self-reported questionnaire, ActiGraph and focus groups. The evidence about the importance of implementing and assessing PA, sedentary behaviour, health and wellbeing interventions collecting data with various methods are discussed in chapter 7. Therefore, this thesis's mixed-methods approach can provide a comprehensive way to recognise PA, sedentary behaviour, health and wellbeing related experience. Future research may wish to follow this approach to evaluate PA, sedentary behaviour and health-related issues by conducting multidisciplinary and mixed methods approaches. Moreover, the number of participants varied in each study and this demonstrates that it is possible to recruit a larger sample to engage in a research investigation. Thus, it is suggested that future research must aim to arrange PA and health-related initiatives because

of the substantial number of employees willing to participate. To attract the under-research population to participate in PA and health-related intervention, it is recommended that approaches and interventions be developed based on participants needs.

This thesis's interventions applied a valid measure for assessing the impact of physiological, psychological, QoL, health, wellbeing and perceived productivity, mood states, PA levels and sedentary behaviour of university employees. This thesis also identified some issues affecting workability, job satisfaction and organisational commitment towards employees health and wellbeing that could impact work output. Future research could monitor employees PA levels, sedentary behaviour, health and wellbeing for long-term and collect data in three phases such as pre, during and post interventions as opposed to pre and post. Future research could also measure the impact of PA and health-related interventions on employees performance output and absenteeism and monitor the physiological effect of engaging in exercise on employees. Additionally, future research may wish to combine multiple theoretical models for designing interventions that may be supportive in different levels, including individual and organisational. Future research is also required to evaluate PA objectively and health-related interventions on employees health, wellbeing, perceived productivity and the impact of such interventions for the organisation.

12.6. Conclusion

In summary, upon reviewing the overall objectives outlined in chapter one and the findings of each study, interventions and the thesis as a whole, it can be determined that this thesis has accomplished its overall aim; contributing to the limited existing knowledge about the effect of PA, sedentary behaviour, health and wellbeing interventions on employees in the workplace, particularly within university settings. The unique approach of evaluating university employees PA levels and sedentary behaviour via questionnaire, followed by ActiGraph and qualitatively exploring perspectives, identified several characteristics as workplace barriers. Such interventions were implemented as facilitators. However, employees PA levels were exceeding the recommended guidelines in study one and two. Nevertheless, the higher sitting results were alarmingly considering the health and wellbeing implications of prolonged time spent being sedentary; the prolonged time spent sitting required identifying further ways for reducing sitting time amongst this population. The combination of TTM, SDT and SEM demonstrated changing behaviour and motivating employees towards choosing a healthy and active lifestyle and using models being useful during interventions. Thus, this university could

now consider changing its existing policies about staff health and wellbeing, workplace culture and provide access to exercise, health and wellbeing facilities across university campuses.

Findings demonstrated that providing exercise equipment to university employees has helped them be more active in the workplace. As a result, this had a positive effect on their health, and wellbeing. Moreover, height-adjustable workstation reduced employees sitting time by 1153 minutes and standing time increased by 484 minutes per week. Employees having access to height-adjustable workstation demonstrated positive effects on health, wellbeing, QoL and perceived productivity. Providing PA, health and wellbeing banners by lifts and stairs also showed positive effects in changing employees behaviour to take the stairs rather than lifts.

Similarly, 10,000 team-based steps challenge increased the daily steps by 4349, and overall, employees achieved the recommended 10,000 daily steps guideline during intervention. The findings of seated, standing and walking meetings intervention also showed that walking and standing meetings had a positive effect on university employees mood states compared to the seated meetings. Findings demonstrated the potential for this type of interventions to be extended to other workplaces for promoting PA levels reducing sitting time, improving health and wellbeing of employees. Overall, this thesis supports the implementation of PA, sedentary behaviour, health and wellbeing interventions within workplaces and the present findings can be generalisable to other settings.

13.0 References

Aadland, E., Andersen, J. R., Anderssen, S. A. and Kvalheim, O. M. (2013) Physical activity versus sedentary behavior: associations with lipoprotein particle subclass concentrations in healthy adults. *PLoS One,* 8(12), p. e85223.

Aadland, E. and Ylvisåker, E. (2015) Reliability of objectively measured sedentary time and physical activity in adults. *PLoS One,* 10(7), p. e0133296.

Abraham, C. and Graham-Rowe, E. (2009) Are worksite interventions effective in increasing physical activity? A systematic review and meta-analysis. *Health Psychology Review,* 3(1), pp. 108-144.

ActiGraph (2018a) Cut Points Feb 21, 2018 02:58PM CST, https://actigraphcorp.com/support/downloads/ [Accseed on the 22 April 2021].

ActiGraph (2018b) *What are counts?* https://actigraphcorp.com/white-papers/ [Accessed 22 April 2021].

Adam Noah, J., Spierer, D. K., Gu, J. and Bronner, S. (2013) Comparison of steps and energy expenditure assessment in adults of Fitbit Tracker and Ultra to the Actical and indirect calorimetry. *Journal of medical engineering & technology,* 37(7), pp. 456-462.

Adams, J. and White, M. (2002) A systematic approach to the development and evaluation of an intervention promoting stair use. *Health Education Journal,* 61(3), pp. 272-286.

Adams, J. and White, M. (2004) Why don't stage-based activity promotion interventions work? *Health Education Research,* 20(2), pp. 237-243.

Adams, S. A., Matthews, C. E., Ebbeling, C. B., Moore, C. G., Cunningham, J. E., Fulton, J. and Hebert, J. R. (2005) The effect of social desirability and social approval on self-reports of physical activity. *American journal of epidemiology,* 161(4), pp. 389-398.

Adlakha, D., Hipp, A. J., Marx, C., Yang, L., Tabak, R., Dodson, E. A. and Brownson, R. C. (2015) Home and workplace built environment supports for physical activity. *Am J Prev Med,* 48(1), pp. 104-107.

Aggio, D., Smith, L., Fisher, A. and Hamer, M. (2015) Mothers' perceived proximity to green space is associated with TV viewing time in children: the Growing Up in Scotland study. *Prev Med,* 70, pp. 46-49.

Ainsworth, B. and Buchholz, S. W. (2017) How to assess physical activity in clinical practice and for scholarly work. *The Journal for Nurse Practitioners,* 13(1), pp. 14-20. e12.

Ainsworth, B. E., Haskell, W. L., Herrmann, S. D., Meckes, N., Bassett Jr, D. R., Tudor-Locke, C., Greer, J. L., Vezina, J., Whitt-Glover, M. C. and Leon, A. S. (2011) 2011

Compendium of Physical Activities: a second update of codes and MET values. *Medicine & Science in Sports & Exercise,* 43(8), pp. 1575-1581.

Ajzen, I. (1991) The theory of planned behavior. *Organizational behavior and human decision processes,* 50(2), pp. 179-211.

Ajzen, I. and Fishbein, M. (1988) Theory of reasoned action-Theory of planned behavior. *University of South Florida*.

Al-Zalabani, A. H., Al-Hamdan, N. A. and Saeed, A. A. (2015) The prevalence of physical activity and its socioeconomic correlates in Kingdom of Saudi Arabia: A cross-sectional population-based national survey. *Journal of Taibah University Medical Sciences,* 10(2), pp. 208-215.

Alhojailan, M. I. (2012) Thematic analysis: A critical review of its process and evaluation. *West East Journal of Social Sciences,* 1(1), pp. 39-47.

Alkhajah, T. A., Reeves, M. M., Eakin, E. G., Winkler, E. A., Owen, N. and Healy, G. N. (2012) Sit–stand workstations: a pilot intervention to reduce office sitting time. *American journal of preventive medicine,* 43(3), pp. 298-303.

Alkhatib, A. (2015) High prevalence of sedentary risk factors amongst university employees and potential health benefits of campus workplace exercise intervention. *Work,* 52(3), pp. 589-595.

Allender, S., Foster, C., Scarborough, P. and Rayner, M. (2007) The burden of physical activity-related ill health in the UK. *Journal of epidemiology and community health,* 61(4), pp. 344-348.

Altamirano, K. M., Peterson, B. M., Miller, K. L. and Gardner, J. K. (2018) The University Faculty Physical Activity Inventory (UFPAI): A Preliminary Assessment of Physical Activity among Faculty at a Private University. *Journal of Physical Activity Research,* 3(1), pp. 41-46.

Altheide, D. L. and Johnson, J. M. (1994) Criteria for assessing interpretive validity in qualitative research.

Arrogi, A., Schotte, A., Bogaerts, A., Boen, F. and Seghers, J. (2017) Short-and long-term effectiveness of a three-month individualized need-supportive physical activity counseling intervention at the workplace. *BMC Public Health,* 17(1), p. 52.

Arroyo, H., Rice, M., Franceschini, M., Valenzuela, F., Alguero, L. and Avedaño, M. (2009) Una nueva mirada al movimiento de Universidades Promotoras de la Salud en las Américas. *Organización Panamericana de la Salud (OPS)*.

Artese, A., Ehley, D., Sutin, A. R. and Terracciano, A. (2017) Personality and actigraphy-measured physical activity in older adults. *Psychology and aging,* 32(2), p. 131.

Atkin, A. J., Gorely, T., Clemes, S. A., Yates, T., Edwardson, C., Brage, S., Salmon, J., Marshall, S. J. and Biddle, S. J. (2012) Methods of measurement in epidemiology: sedentary behaviour. *International journal of epidemiology,* 41(5), pp. 1460-1471.

Audrey, S., Fisher, H., Cooper, A., Gaunt, D., Metcalfe, C., Garfield, K., Hollingworth, W., Procter, S., Gabe-Walters, M. and Rodgers, S. (2019) A workplace-based intervention to increase levels of daily physical activity: the Travel to Work cluster RCT.

Awick, E. A., Ehlers, D. K., Aguiñaga, S., Daugherty, A. M., Kramer, A. F. and McAuley, E. (2017) Effects of a randomized exercise trial on physical activity, psychological distress and quality of life in older adults. *General hospital psychiatry,* 49, pp. 44-50.

Anna Puig-Ribera, Judit Bort-Roig, Maria Giné-Garriga, Angel M. González-Suárez, Iván

Martínez-Lemos, Jesús Fortuño, Joan C. Martori, Laura Muñoz-Ortiz, Raimon Milà , Nicholas D. Gilson and Jim McKenna. Impact of a workplace 'sit less, move more' program on efficiency-related outcomes of office employees. BMC Public Health. 2017; 10.1186/s12889-017-43678.

Arslan, S.S., Alemdaroğlu, İ., Karaduman, A.A. and Yilmaz, Ö.T., 2019. The effects of physical activity on sleep quality, job satisfaction, and quality of life in office workers. *Work*, *63*(1), pp.3-7.

Babakus, W. Ş. (2013) *A mixed-methods examination of physical activity and sedentary time among South Asian women in the United Kingdom*. University of Birmingham.

Baghurst, T., Tapps, T., Mwavita, M., Volberding, J. and Jayne, C. (2014) Effect of a 14-week program to reduce employee risk factors for metabolic syndrome (MetS). *Health Behavior and Policy Review,* 1(6), pp. 446-451.

Bai, Y., Welk, G. J., Nam, Y. H., Lee, J. A., Lee, J.-M., Kim, Y., Meier, N. F. and Dixon, P. M. (2016) Comparison of Consumer and Research Monitors under Semistructured Settings. *Med Sci Sports Exerc,* 48(1), pp. 151-158.

Balaskas, P., Jackson, M. E., Blundell, J. E., Dalton, M., Gibbons, C., le Roux, C. W., Al-Najim, W., Leslie, W. S., Whelan, K. and Gomersall, S. R. (2018) Aetiology of obesity in adults. *Advanced Nutrition and Dietetics in Obesity*, pp. 85-137.

Bale, J. M., Gazmararian, J. A. and Elon, L. (2015) Effect of the work environment on using time at work to exercise. *American Journal of Health Promotion,* 29(6), pp. 345-352.

Banda, J. A., Haydel, K. F., Davila, T., Desai, M., Bryson, S., Haskell, W. L., Matheson, D. and Robinson, T. N. (2016) Effects of varying epoch lengths, wear time algorithms, and activity cut-points on estimates of child sedentary behavior and physical activity from accelerometer data. *PLoS One,* 11(3), p. e0150534.

Banister, D. (2008) The sustainable mobility paradigm. *Transport policy,* 15(2), pp. 73-80.

Bankoski, A., Harris, T. B., McClain, J. J., Brychta, R. J., Caserotti, P., Chen, K. Y., Berrigan, D., Troiano, R. P. and Koster, A. (2011) Sedentary activity associated with metabolic syndrome independent of physical activity. *Diabetes care,* 34(2), pp. 497-503.

Bardus, M., Blake, H., Lloyd, S. and Suzanne Suggs, L. (2014) Reasons for participating and not participating in a e-health workplace physical activity intervention: A qualitative analysis. *International Journal of Workplace Health Management,* 7(4), pp. 229-246.

Barr-Anderson, D. J., AuYoung, M., Whitt-Glover, M. C., Glenn, B. A. and Yancey, A. K. (2011) Integration of short bouts of physical activity into organizational routine: A systematic review of the literature. *American journal of preventive medicine,* 40(1), pp. 76-93.

Bassett Jr, D. R., Rowlands, A. V. and Trost, S. G. (2012) Calibration and validation of wearable monitors. *Med Sci Sports Exerc,* 44(1 Suppl 1), p. S32.

Bauman, A., Ainsworth, B. E., Bull, F., Craig, C. L., Hagströmer, M., Sallis, J. F., Pratt, M. and Sjöström, M. (2009) Progress and pitfalls in the use of the International Physical Activity Questionnaire (IPAQ) for adult physical activity surveillance. *Journal of Physical Activity and Health,* 6(s1), pp. S5-S8.

Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J., Martin, B. W. and Group, L. P. A. S. W. (2012) Correlates of physical activity: why are some people physically active and others not? *The lancet,* 380(9838), pp. 258-271.

Bauman, A. E., Rissel, C., Garrard, J., Ker, I., Speidel, R. and Fishman, E. (2008) *Cycling: Getting Australia Moving: Barriers, facilitators and interventions to get more Australians physically active through cycling.* Cycling Promotion Fund Melbourne.

Becerra Heraud, S. (2013) Universidades saludables: una apuesta a una formación integral del estudiante. *Revista de Psicología (PUCP),* 31(2), pp. 287-314.

Beebe, L. H. (2007) What can we learn from pilot studies? *Perspectives in psychiatric care,* 43(4), pp. 213-218.

Bell, J. (2014) *Doing Your Research Project: A guide for first-time researchers.* McGraw-Hill Education (UK).

Bellicha, A., Kieusseian, A., Fontvieille, A.-M., Tataranni, A., Charreire, H. and Oppert, J.-M. (2015) Stair-use interventions in worksites and public settings—a systematic review of effectiveness and external validity. *Prev Med,* 70, pp. 3-13.

Bendíková, E. (2014) Lifestyle, physical and sports education and health benefits of physical activity. *European researcher,* 69(2-2), pp. 343-348.

Bennie, J., Timperio, A., Dunstan, D., Crawford, D. and Salmon, J. (2010) Environmental correlates of physical activity in Australian workplaces. *International Journal of Workplace Health Management,* 3(1), pp. 25-33.

Bernaards, C. A., Belin, T. R. and Schafer, J. L. (2007) Robustness of a multivariate normal approximation for imputation of incomplete binary data. *Statistics in medicine,* 26(6), pp. 1368-1382.

Black, C. M. (2008a) *Dame Carol Black's Review of the Health of Britain's Working Age Population: Summary of Evidence Submitted.* TSO.

Black, C. M. (2008b) *Working for a healthier tomorrow: Dame Carol Black's review of the health of Britain's working age population.* The Stationery Office.

Blake, H. and Batt, M. E. (2015) Employee perceptions of a pedometer walking intervention in a hospital workplace. *International Journal of Health Promotion and Education,* 53(5), pp. 257-270.

Blake, H. and Harrison, C. (2013) Health behaviours and attitudes towards being role models. *British Journal of Nursing,* 22(2), pp. 86-94.

Blake, H. and Lloyd, S. (2008) Influencing organisational change in the NHS: lessons learned from workplace wellness initiatives in practice. *Quality in Primary Care*.

Borodulin, K., Sipilä, N., Rahkonen, O., Leino-Arjas, P., Kestilä, L., Jousilahti, P. and Prättälä, R. (2016) Socio-demographic and behavioral variation in barriers to leisure-time physical activity. *Scandinavian journal of public health,* 44(1), pp. 62-69.

Bouchard, C., Blair, S. N. and Haskell, W. (2012) *Physical activity and health.* Human Kinetics.

Brannen, J. and Moss, G. (2012) Critical issues in designing mixed methods policy research. *American Behavioral Scientist,* 56(6), pp. 789-801.

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative research in psychology,* 3(2), pp. 77-101.

Bright, D. R., Terrell, S. L., Rush, M. J., Kroustos, K. R., Stockert, A. L., Swanson, S. C. and DiPietro, N. A. (2012) Employee attitudes toward participation in a work site-based health and wellness clinic. *Journal of pharmacy practice,* 25(5), pp. 530-536.

Broderick, J., Ryan, J., O'Donnell, D. and Hussey, J. (2014) A guide to assessing physical activity using accelerometry in cancer patients. *Supportive Care in Cancer,* 22(4), pp. 1121-1130.

Brønd, J. C. and Arvidsson, D. (2015) Sampling frequency affects the processing of Actigraph raw acceleration data to activity counts. *Journal of applied physiology,* 120(3), pp. 362-369.

Brown, H. E., Gilson, N. D., Burton, N. W. and Brown, W. J. (2011) Does physical activity impact on presenteeism and other indicators of workplace wellbeing? *Sports Medicine,* 41(3), pp. 249-262.

Brown, T. C., Volberding, J., Baghurst, T. and Sellers, J. (2015) Comparing current fitness center members' perceptions of the motivational climate with non-members. *Global health promotion*, p. 1757975915583478.

Brown, W., Miller, Y. and Miller, R. (2003) Sitting time and work patterns as indicators of overweight and obesity in Australian adults. *International journal of obesity,* 27(11), p. 1340.

Brug, J., Oenema, A. and Ferreira, I. (2005) Theory, evidence and Intervention Mapping to improve behavior nutrition and physical activity interventions. *International Journal of Behavioral Nutrition and Physical Activity,* 2(1), p. 2.

Buchan, D. S., Ollis, S., Thomas, N. E. and Baker, J. S. (2012) Physical activity behaviour: an overview of current and emergent theoretical practices. *Journal of obesity,* 2012.

Buckley, J. P., Mellor, D. D., Morris, M. and Joseph, F. (2014) Standing-based office work shows encouraging signs of attenuating post-prandial glycaemic excursion. *Occup Environ Med,* 71(2), pp. 109-111.

Bull, F., Adams, E., Hooper, P. and Jones, C. (2008) Well@ Work: Promoting active and healthy workplaces final evaluation report. *Loughborough: Loughborough University*.

Bull, F. C., Maslin, T. S. and Armstrong, T. (2009) Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *Journal of Physical Activity and Health,* 6(6), pp. 790-804.

Burn, N., Norton, L. H., Drummond, C. and Norton, K. I. (2017) Changes in Physical Activity Behaviour and Health Risk Factors Following a Randomised Controlled Pilot Workplace Exercise Intervention.

Burton, J. (2010) WHO Healthy Workplace Framework and Model. *Geneva, Switzerland: World Health Organisation,* 12.

Butler, C. E., Clark, B. R., Burlis, T. L., Castillo, J. C. and Racette, S. B. (2015) Physical activity for campus employees: a university worksite wellness program. *Journal of Physical Activity and Health,* 12(4), pp. 470-476.

Byrne, D. W., Goetzel, R. Z., McGown, P. W., Holmes, M. C., Beckowski, M. S., Tabrizi, M. J., Kowlessar, N. and Yarbrough, M. I. (2011) Seven-year trends in employee health habits from a comprehensive workplace health promotion program at Vanderbilt University. *Journal of Occupational and Environmental Medicine,* 53(12), pp. 1372-1381.

Cancelliere, C., Cassidy, J. D., Ammendolia, C. and Côté, P. (2011) Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC Public Health,* 11(1), p. 395.

Carr, L. J., Karvinen, K., Peavler, M., Smith, R. and Cangelosi, K. (2013) Multicomponent intervention to reduce daily sedentary time: a randomised controlled trial. *BMJ open,* 3(10), p. e003261.

Carson, D., Gilmore, A., Perry, C. and Gronhaug, K. (2001) *Qualitative marketing research.* Sage.

Case, M. A., Burwick, H. A., Volpp, K. G. and Patel, M. S. (2015) Accuracy of smartphone applications and wearable devices for tracking physical activity data. *Jama,* 313(6), pp. 625-626.

Caspersen, C. J., Powell, K. E. and Christenson, G. M. (1985) Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports,* 100(2), p. 126.

Cavill, N., Richardson, D. and Foster, C. (2012) British Heart Foundation Health Promotion Research Group.

CEBR (2015) The economic cost of physical inactivity in Europe. https://cebr.com/reports/the-costs-of-inactivity-in-europe/ [Accessed on the 22 April 2021] p. 83.

Celis-Morales, C. A., Perez-Bravo, F., Ibanez, L., Salas, C., Bailey, M. E. and Gill, J. M. (2012) Objective vs. self-reported physical activity and sedentary time: effects of measurement method on relationships with risk biomarkers. *PLoS One,* 7(5), p. e36345.

Cerin, E., Barnett, A., Cheung, M.-c., Sit, C. H., Macfarlane, D. J. and Chan, W.-m. (2012) Reliability and validity of the IPAQ-L in a sample of Hong Kong urban older adults: does neighborhood of residence matter? *Journal of aging and physical activity,* 20(4), pp. 402-420.

Cerin, E., Cain, K. L., Oyeyemi, A. L., Owen, N., Conway, T. L., Cochrane, T., Van Dyck, D., Schipperijn, J., Mitáš, J. and Toftager, M. (2016) Correlates of agreement between accelerometry and self-reported physical activity. *Med Sci Sports Exerc,* 48(6), p. 1075.

Chae, D., Kim, S., Park, Y. and Hwang, Y. (2015) The Effects of an Academic--Workplace Partnership Intervention to Promote Physical Activity in Sedentary Office Workers. *Workplace Health Saf,* 63(6), pp. 259-266.

Chan, C. B., Ryan, D. A. and Tudor-Locke, C. (2004) Health benefits of a pedometer-based physical activity intervention in sedentary workers. *Prev Med,* 39(6), pp. 1215-1222.

Chau, J. Y., Grunseit, A. C., Chey, T., Stamatakis, E., Brown, W. J., Matthews, C. E., Bauman, A. E. and van der Ploeg, H. P. (2013) Daily sitting time and all-cause mortality: a meta-analysis. *PLoS One,* 8(11), p. e80000.

Chau, J. Y., van der Ploeg, H. P., Merom, D., Chey, T. and Bauman, A. E. (2012) Cross-sectional associations between occupational and leisure-time sitting, physical activity and obesity in working adults. *Prev Med,* 54(3), pp. 195-200.

Chen, K. Y., Janz, K. F., Zhu, W. and Brychta, R. J. (2012) Re-defining the roles of sensors in objective physical activity monitoring. *Med Sci Sports Exerc,* 44(1 Suppl 1), p. S13.

Cheung, P. P. and Chow, B. C. (2012) Association of School Teachers' Occupational and Daily Physical Activity Level in Hong Kong. *International Journal of Sport and Health Science,* 10, pp. 23-29.

Chin, S. H., Kahathuduwa, C. and Binks, M. (2017) Is sedentary behaviour unhealthy and if so, does reducing it improve this? *International Journal of Clinical Practice,* 71(2).

Chirkov, V., Ryan, R. M., Kim, Y. and Kaplan, U. (2003) Differentiating autonomy from individualism and independence: a self-determination theory perspective on internalization of cultural orientations and wellbeing. *Journal of personality and social psychology,* 84(1), p. 97.

Choi, B., Schnall, P. L., Yang, H., Dobson, M., Landsbergis, P., Israel, L., Karasek, R. and Baker, D. (2010) Sedentary work, low physical job demand, and obesity in US workers. *American journal of industrial medicine,* 53(11), pp. 1088-1101.

Choi, L., Ward, S. C., Schnelle, J. F. and Buchowski, M. S. (2012) Assessment of wear/nonwear time classification algorithms for triaxial accelerometer. *Med Sci Sports Exerc,* 44(10), p. 2009.

Chow, J. J., Thom, J. M., Wewege, M. A., Ward, R. E. and Parmenter, B. J. (2017) Accuracy of step count measured by physical activity monitors: The effect of gait speed and anatomical placement site. *Gait & Posture,* 57, pp. 199-203.

Church, T. S., Thomas, D. M., Tudor-Locke, C., Katzmarzyk, P. T., Earnest, C. P., Rodarte, R. Q., Martin, C. K., Blair, S. N. and Bouchard, C. (2011) Trends over 5 decades in US occupation-related physical activity and their associations with obesity. *PLoS One,* 6(5), p. e19657.

Clark, P. G. (2013) Toward a transtheoretical model of interprofessional education: Stages, processes and forces supporting institutional change. *Journal of interprofessional care,* 27(1), pp. 43-49.

Clarke, K. (2013) *Physical activity referral schemes: adherence and physical activity behaviour change*. The University of Northampton.

Cleland, C., Ferguson, S., Ellis, G. and Hunter, R. F. (2018) Validity of the International Physical Activity Questionnaire (IPAQ) for assessing moderate-to-vigorous physical activity and sedentary behaviour of older adults in the United Kingdom. *BMC medical research methodology,* 18(1), p. 176.

Cleland, C. L., Hunter, R. F., Kee, F., Cupples, M. E., Sallis, J. F. and Tully, M. A. (2014) Validity of the global physical activity questionnaire (GPAQ) in assessing levels and change in moderate-vigorous physical activity and sedentary behaviour. *BMC Public Health,* 14(1), p. 1255.

Cleland, V., Hughes, C., Thornton, L., Venn, A., Squibb, K. and Ball, K. (2015) A qualitative study of environmental factors important for physical activity in rural adults. *PLoS One,* 10(11), p. e0140659.

Clemente, F. M., Nikolaidis, P. T., Martins, F. M. L. and Mendes, R. S. (2016) Physical activity patterns in university students: Do they follow the public health guidelines? *PLoS One,* 11(3), p. e0152516.

Coffman, M. J., Reeve, C. L., Butler, S., Keeling, M. and Talbot, L. A. (2016) Accuracy of the Yamax CW-701 Pedometer for measuring steps in controlled and free-living conditions. *Digital Health,* 2, p. 2055207616652526.

Coleman, K. J. and Gonzalez, E. C. (2001) Promoting stair use in a US–Mexico border community. *American journal of public health,* 91(12), pp. 2007-2009.

Coll, C. V., Domingues, M. R., Gonçalves, H. and Bertoldi, A. D. (2017) Perceived barriers to leisure-time physical activity during pregnancy: A literature review of quantitative and qualitative evidence. *Journal of Science and Medicine in Sport,* 20(1), pp. 17-25.

Colley, R. C., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J. and Tremblay, M. S. (2011) Physical activity of Canadian adults: accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. *Health reports,* 22(1), p. 7.

Conn, V. S., Hafdahl, A. R., Cooper, P. S., Brown, L. M. and Lusk, S. L. (2009) Meta-analysis of workplace physical activity interventions. *American journal of preventive medicine,* 37(4), pp. 330-339.

Conner, M. and Norman, P. (2005) *Predicting health behaviour.* McGraw-Hill Education (UK).

Conway, J., Tsourtos, G. and Lawn, S. (2017) The barriers and facilitators that indigenous health workers experience in their workplace and communities in providing self-management support: a multiple case study. *BMC health services research,* 17(1), p. 319.

Cook, E. L. and Silverman, M. J. (2013) Effects of music therapy on spirituality with patients on a medical oncology/hematology unit: a mixed-methods approach. *The Arts in Psychotherapy,* 40(2), pp. 239-244.

Cooper, K. and Barton, G. C. (2015) An exploration of physical activity and wellbeing in university employees. *Perspectives in Public Health,* 136(3), pp. 152-160.

Cooper, K. and Barton, G. C. (2016) An exploration of physical activity and wellbeing in university employees. *Perspectives in Public Health,* 136(3), pp. 152-160.

Copeland, J. L. and Esliger, D. W. (2009) Accelerometer assessment of physical activity in active, healthy older adults. *Journal of aging and physical activity,* 17(1), pp. 17-30.

Corcoran, M. P., Chui, K., White, D., Reid, K., Kirn, D., Nelson, M., Sacheck, J., Folta, S. and Fielding, R. (2016) Accelerometer assessment of physical activity and its association with physical function in older adults residing at assisted care facilities. *The journal of nutrition, health & aging,* 20(7), pp. 752-758.

Corder, K., Brage, S. and Ekelund, U. (2007) Accelerometers and pedometers: methodology and clinical application. *Current Opinion in Clinical Nutrition & Metabolic Care,* 10(5), pp. 597-603.

Corder, K., Craggs, C., Jones, A. P., Ekelund, U., Griffin, S. J. and van Sluijs, E. M. (2013) Predictors of change differ for moderate and vigorous intensity physical activity and for weekdays and weekends: a longitudinal analysis. *International Journal of Behavioral Nutrition and Physical Activity,* 10(1), p. 69.

Cradock, A. L., Wiecha, J. L., Peterson, K. E., Sobol, A. M., Colditz, G. A. and Gortmaker, S. L. (2004) Youth recall and TriTrac accelerometer estimates of physical activity levels. *Med Sci Sports Exerc,* 36(3), pp. 525-532.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A. and Sallis, J. F. (2003) International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise,* 35(8), pp. 1381-1395.

Crespo, N. C., Sallis, J. F., Conway, T. L., Saelens, B. E. and Frank, L. D. (2011) Worksite physical activity policies and environments in relation to employee physical activity. *American Journal of Health Promotion,* 25(4), pp. 264-271.

Creswell, J. W. (2013) Qualitative Inquiry & Research Design Choosing Among Five Approaches-3/E.

Creswell, J. W. (2014) *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage publications.

Creswell, J. W. and Clark, V. L. P. (2018) *Designing and conducting mixed methods research.* 3rd edn. Sage Publications.

Creswell, J. W., Fetters, M. D. and Ivankova, N. V. (2004) Designing a mixed methods study in primary care. *The Annals of Family Medicine,* 2(1), pp. 7-12.

Creswell, J. W., Klassen, A. C., Plano Clark, V. L. and Smith, K. C. (2011) Best practices for mixed methods research in the health sciences. *Bethesda (Maryland): National Institutes of Health*, pp. 2094-2103.

Crouter, S. E., Flynn, J. I. and Bassett Jr, D. R. (2015) Estimating physical activity in youth using a wrist accelerometer. *Med Sci Sports Exerc,* 47(5), p. 944.

Crozier, A. J. (2019) Step up: Exploring the impact of social prompts on stair use in a university setting. *Psychology of sport and exercise,* 41, pp. 99-106.

Curry, L. and Nunez-Smith, M. (2014) *Mixed methods in health sciences research: A practical primer.* Sage Publications.

da Silva, I. C. M., Mielke, G. I., Bertoldi, A. D., Arrais, P., Luiza, V. L., Mengue, S. S. and Hallal, P. C. (2017) Overall and Leisure-Time Physical Activity Among Brazilian Adults: National Survey Based-on the Global Physical Activity Questionnaire. *Journal of Physical Activity and Health*, pp. 1-17.

Dadds, M. (2008) Empathetic validity in practitioner research. *Educational Action Research,* 16(2), pp. 279-290.

Dalager, T., Justesen, J. B., Murray, M., Boyle, E. and Sjøgaard, G. (2016) Implementing intelligent physical exercise training at the workplace: health effects among office workers—a randomized controlled trial. *European journal of applied physiology,* 116(7), pp. 1433-1442.

Daley, A. J. and Duda, J. L. (2006) Self-determination, stage of readiness to change for exercise, and frequency of physical activity in young people. *European Journal of sport science,* 6(4), pp. 231-243.

Das, B. M., Rinaldi-Miles, A. I. and Evans, E. M. (2013) Exploring faculty and staff PA barriers at a large university. *California Journal of Health Promotion,* 11(2), pp. 61-72.

Das, B. M., Sartore-Baldwin, M. and Mahar, M. T. (2016) The Invisible Employee: University Housekeeping Employees Perceptions of Physical Activity. *Journal of Physical Activity and Health,* 13(9), pp. 952-956.

Davis, M. G., Fox, K. R., Hillsdon, M., Sharp, D. J., Coulson, J. C. and Thompson, J. L. (2011) Objectively measured physical activity in a diverse sample of older urban UK adults. *Medicine & Science in Sports & Exercise,* 43(4), pp. 647-654.

De Vos, J. and Witlox, F. (2017) Travel satisfaction revisited. On the pivotal role of travel satisfaction in conceptualising a travel behaviour process. *Transportation Research Part A: Policy and Practice,* 106, pp. 364-373.

Deci, E. L. and Ryan, R. M. (1980) The empirical exploration of intrinsic motivational processes. *Advances in experimental social psychology,* 13, pp. 39-80.

Deci, E. L. and Ryan, R. M. (1985) The general causality orientations scale: Self-determination in personality. *Journal of research in personality,* 19(2), pp. 109-134.

Deci, E. L. and Ryan, R. M. (2002) Overview of self-determination theory: An organismic dialectical perspective. *Handbook of self-determination research*, pp. 3-33.

Deliens, T., Deforche, B., De Bourdeaudhuij, I. and Clarys, P. (2015) Determinants of physical activity and sedentary behaviour in university students: a qualitative study using focus group discussions. *BMC Public Health,* 15(1), p. 201.

Denzin, N. K. and Lincoln, Y. S. (2017) *The Sage handbook of qualitative research.* Sage.

Diaz, K. M., Krupka, D. J., Chang, M. J., Kronish, I. M., Moise, N., Goldsmith, J. and Schwartz, J. E. (2018) Wrist-based cut-points for moderate-and vigorous-intensity physical activity for the Actical accelerometer in adults. *Journal of sports sciences,* 36(2), pp. 206-212.

Diaz, K. M., Krupka, D. J., Chang, M. J., Peacock, J., Ma, Y., Goldsmith, J., Schwartz, J. E. and Davidson, K. W. (2015) Fitbit®: An accurate and reliable device for wireless physical activity tracking. *International journal of cardiology,* 185, pp. 138-140.

Dietz, W. H., Brownson, R., Dreyzehner, J. J., Goetzel, R. Z., Marks, J. S., Merrigan, K. A., Powell, M. and Story, M. (2016) Chronic Disease Prevention: Tobacco, Physical Activity, and Nutrition for a Healthy Start.

Dieu, O., Mikulovic, J., Fardy, P. S., Bui-Xuan, G., Béghin, L. and Vanhelst, J. (2017) Physical activity using wrist-worn accelerometers: comparison of dominant and non-dominant wrist. *Clinical physiology and functional imaging,* 37(5), pp. 525-529.

Dikilitaş, K. and Griffiths, C. (2017) Collecting the Data. In: *Developing Language Teacher Autonomy through Action Research* Springer, pp. 107-127.

Doherty, A., Jackson, D., Hammerla, N., Plötz, T., Olivier, P., Granat, M. H., White, T., van Hees, V. T., Trenell, M. I. and Owen, C. G. (2017) Large scale population assessment of physical activity using wrist worn accelerometers: The UK Biobank Study. *PLoS One,* 12(2), p. e0169649.

Donaldson-Feilder, E., Lewis, R., Pavey, L., Jones, B., Green, M. and Webster, A. (2017) Perceived barriers and facilitators of exercise and healthy dietary choices: A study of

employees and managers within a large transport organisation. *Health Education Journal*, p. 0017896917712296.

Donnachie, C., Wyke, S., Mutrie, N. and Hunt, K. (2017) 'It's like a personal motivator that you carried around wi'you': utilising self-determination theory to understand men's experiences of using pedometers to increase physical activity in a weight management programme. *International Journal of Behavioral Nutrition and Physical Activity,* 14(1), p. 61.

Dontje, M. L., de Groot, M., Lengton, R. R., van der Schans, C. P. and Krijnen, W. P. (2015) Measuring steps with the Fitbit activity tracker: an inter-device reliability study. *Journal of medical engineering & technology,* 39(5), pp. 286-290.

Doody, O., Slevin, E. and Taggart, L. (2013) Preparing for and conducting focus groups in nursing research: part 2.

Dooris, M. and Doherty, S. (2010) Healthy universities—time for action: a qualitative research study exploring the potential for a national programme. *Health promotion international,* 25(1), pp. 94-106.

Dooris, M., Doherty, S. and Orme, J. (2017) The application of salutogenesis in universities. In: *The Handbook of Salutogenesis* Springer, pp. 237-245.

Dugdill, L., Brettle, A., Hulme, C., McCluskey, S. and Long, A. (2008) Workplace physical activity interventions: a systematic review. *International Journal of Workplace Health Management,* 1(1), pp. 20-40.

Dutta N, Koepp GA, Stovitz SD, Levine JA, Pereira MA. Using sit-stand workstations to decrease sedentary time in office workers: a randomized crossover trial. International Journal Environmental Research Public Health. 2014; 11:6653–65.

Edmunds, S. and Clow, A. (2016) The role of peer physical activity champions in the workplace: a qualitative study. *Perspect Public Health,* 136(3), pp. 161-170.

Edmunds, S., Hurst, L. and Harvey, K. (2013) Physical activity barriers in the workplace: an exploration of factors contributing to non-participation in a UK workplace physical activity intervention. *International Journal of Workplace Health Management,* 6(3), pp. 227-240.

Ekelund, U., Sepp, H., Brage, S., Becker, W., Jakes, R., Hennings, M. and Wareham, N. J. (2006) Criterion-related validity of the last 7-day, short form of the International Physical Activity Questionnaire in Swedish adults. *Public health nutrition,* 9(2), pp. 258-265.

Ellingson, L. D., Hibbing, P. R., Kim, Y., Frey-Law, L. A., Saint-Maurice, P. F. and Welk, G. J. (2017) Lab-based validation of different data processing methods for wrist-worn ActiGraph accelerometers in young adults. *Physiological measurement,* 38(6), p. 1045.

Elmagd, M. A. (2016) Benefits, need and importance of daily exercise. *Int. J. Phys. Educ. Sports Health,* 3, pp. 22-27.

Emadian, A. and Thompson, J. (2017) A Mixed-Methods Examination of Physical Activity and Sedentary Time in Overweight and Obese South Asian Men Living in the United Kingdom. *International journal of environmental research and public health,* 14(4), p. 348.

Engbers, L. H., van Poppel, M. N., Paw, M. J. C. A. and van Mechelen, W. (2005) Worksite health promotion programs with environmental changes: a systematic review. *American journal of preventive medicine,* 29(1), pp. 61-70.

Engelen, L., Bohn-Goldbaum, E., Crane, M., Mackey, M. and Rissel, C. (2019) Longer, More Active Commute, but Still not Very Active: Five-Year Physical Activity and Travel Behavior Change in a University Population. *International journal of environmental research and public health,* 16(13), p. 2420.

Engelen, L., Gale, J., Chau, J. Y. and Bauman, A. (2018) Are motivational signs to increase stair use a thing of the past? A multi-building study. *Health Promotion Journal of Australia,* 28(3), pp. 178-184.

Escoto, K. H., French, S. A., Harnack, L. J., Toomey, T. L., Hannan, P. J. and Mitchell, N. R. (2010) Work hours, weight status, and weight-related behaviors: a study of metro transit workers. *International Journal of Behavioral Nutrition and Physical Activity,* 7(1), p. 91.

Essiet, I. A., Baharom, A., Shahar, H. K. and Uzochukwu, B. (2017) Application of the Socio-Ecological Model to predict physical activity behaviour among Nigerian University students. *The Pan African medical journal,* 26.

Ettner, S. L. and Grzywacz, J. G. (2001) Workers' perceptions of how jobs affect health: a social ecological perspective. *Journal of occupational health psychology,* 6(2), p. 101.

EU (2018) Special Eurobarometer 472 - December 2017 "Sport and physical activity". http://eose.org/ressource/special-eurobarometer-472-on-sport-and-physical-activity/ [Accessed on the 22 April 2021] p. 133.

Evenson, K. R., Goto, M. M. and Furberg, R. D. (2015) Systematic review of the validity and reliability of consumer-wearable activity trackers. *International Journal of Behavioral Nutrition and Physical Activity,* 12(1), p. 159.

Eves, F. F., Webb, O. J., Griffin, C. and Chambers, J. (2012) A multi-component stair climbing promotional campaign targeting calorific expenditure for worksites; a quasi-experimental study testing effects on behaviour, attitude and intention. *BMC Public Health,* 12(1), p. 423.

Fenton, S.-J., Pinilla Roncancio, M., Sing, M., Sadhra, S. & Carmichael, F. (2014) Workplace wellbeing programmes and their impact on employees and their employing organizations: A scooping review of the evidence base. p. 59.

Ferguson, T., Rowlands, A. V., Olds, T. and Maher, C. (2015) The validity of consumer-level, activity monitors in healthy adults worn in free-living conditions: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity,* 12(1), p. 42.

Ferraro, L., Faghri, P. D., Henning, R., Cherniack, M. and Team, C. f. t. P. o. H. i. t. N. E. W. (2013) Workplace-based participatory approach to weight loss for correctional employees. *Journal of Occupational and Environmental Medicine,* 55(2), pp. 147-155.

Finkelstein, E. A., Khavjou, O. A., Thompson, H., Trogdon, J. G., Pan, L., Sherry, B. and Dietz, W. (2012) Obesity and severe obesity forecasts through 2030. *American journal of preventive medicine,* 42(6), pp. 563-570.

Fishbein, M. and Cappella, J. N. (2006) The role of theory in developing effective health communications. *Journal of communication,* 56(s1).

Fletcher, G. M., Behrens, T. K. and Domina, L. (2008) Barriers and enabling factors for work-site physical activity programs: a qualitative examination. *Journal of Physical Activity and Health,* 5(3), pp. 418-429.

Flint, E., Cummins, S. and Sacker, A. (2014) Associations between active commuting, body fat, and body mass index: population based, cross sectional study in the United Kingdom. *Bmj,* 349, p. g4887.

Flint, S. W., Scaife, R., Kesterton, S., Humphreys, L., Copeland, R., Crank, H., Breckon, J., Maynard, I. and Carter, A. (2016) Sheffield Hallam Staff Wellness service: Four-year follow-up of the impact on health indicators. *Perspectives in Public Health,* 136(5), pp. 295-301.

Fountaine, C. J., Piacentini, M. and Liguori, G. A. (2014) Occupational sitting and physical activity among university employees. *International journal of exercise science,* 7(4), p. 295.

Franklin, B. A., Brinks, J. and Sternburgh, L. (2010) Move more, sit less: a first-line, public health preventive strategy? *Preventive cardiology,* 13(4), pp. 203-208.

Fransson, E. I., Heikkilä, K., Nyberg, S. T., Zins, M., Westerlund, H., Westerholm, P., Väänänen, A., Virtanen, M., Vahtera, J. and Theorell, T. (2012) Job strain as a risk

factor for leisure-time physical inactivity: an individual-participant meta-analysis of up to 170,000 men and women The IPD-Work Consortium. *American journal of epidemiology*, p. kws336.

Freak-Poli, R. L., Cumpston, M., Peeters, A. and Clemes, S. A. (2013) Workplace pedometer interventions for increasing physical activity.

Freak-Poli, R. L., Wolfe, R., Wong, E. and Peeters, A. (2014) Change in wellbeing amongst participants in a four-month pedometer-based workplace health program. *BMC Public Health,* 14(1), p. 953.

Freedson, P., Bowles, H. R., Troiano, R. and Haskell, W. (2012) Assessment of physical activity using wearable monitors: recommendations for monitor calibration and use in the field. *Med Sci Sports Exerc,* 44(1 Suppl 1), p. S1.

Freedson, P. S., Melanson, E. and Sirard, J. (1998) Calibration of the Computer Science and Applications, Inc. accelerometer. *Med Sci Sports Exerc,* 30(5), pp. 777-781.

French, S. A., Harnack, L. J., Toomey, T. L. and Hannan, P. J. (2007) Association between body weight, physical activity and food choices among metropolitan transit workers. *International Journal of Behavioral Nutrition and Physical Activity,* 4(1), p. 52.

Frikkel, J., Götte, M., Beckmann, M., Kasper, S., Hense, J., Teufel, M., Schuler, M. and Tewes, M., 2020. Fatigue, barriers to physical activity and predictors for motivation to exercise in advanced Cancer patients. *BMC palliative care*, *19*, pp.1-11.

Gaalema, D. E., Elliott, R. J., Morford, Z. H., Higgins, S. T. and Ades, P. A. (2017) Effect of Socioeconomic Status on Propensity to Change Risk Behaviors Following Myocardial Infarction: Implications for Healthy Lifestyle Medicine. *Progress in cardiovascular diseases*.

Gabriel, K. P., McClain, J. J., Schmid, K. K., Storti, K. L., High, R. R., Underwood, D. A., Kuller, L. H. and Kriska, A. M. (2010) Issues in accelerometer methodology: the role of epoch length on estimates of physical activity and relationships with health outcomes in overweight, post-menopausal women. *International Journal of Behavioral Nutrition and Physical Activity,* 7(1), p. 53.

Gale, N. K., Heath, G., Cameron, E., Rashid, S. and Redwood, S. (2013) Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology,* 13(1), p. 117.

Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I.-M., Nieman, D. C. and Swain, D. P. (2011) Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in

apparently healthy adults: guidance for prescribing exercise. *Medicine & Science in Sports & Exercise,* 43(7), pp. 1334-1359.

Gennuso, K. P., Gangnon, R. E., Matthews, C. E., Thraen-Borowski, K. M. and Colbert, L. H. (2013) Sedentary behavior, physical activity, and markers of health in older adults. *Med Sci Sports Exerc,* 45(8), p. 1493.

George, E. S., Kolt, G. S., Rosenkranz, R. R. and Guagliano, J. M. (2014) Physical activity and sedentary time: male perceptions in a university work environment. *American journal of men's health,* 8(2), pp. 148-158.

Gibson, A.-M., Muggeridge, D. J., Hughes, A. R., Kelly, L. and Kirk, A. (2017) An examination of objectively-measured sedentary behavior and mental wellbeing in adults across week days and weekends. *PLoS One,* 12(9), p. e0185143.

Gilson, N., McKenna, J., Cooke, C. and Brown, W. (2007) Walking towards health in a university community: a feasibility study. *Prev Med,* 44(2), pp. 167-169.

Gilson, N. D., Puig-Ribera, A., McKenna, J., Brown, W. J., Burton, N. W. and Cooke, C. B. (2009) Do walking strategies to increase physical activity reduce reported sitting in workplaces: a randomized control trial. *International Journal of Behavioral Nutrition and Physical Activity,* 6(1), p. 43.

Glanz, K., Rimer, B. K. & Viswanath, K. (2008) Health Behavior and Health EducationTheory, Research, and Practice *San Francisco: Jossey-Bass,* 4th ed.

Golden, S. D. and Earp, J. A. L. (2012) Social ecological approaches to individuals and their contexts: twenty years of health education & behavior health promotion interventions. *Health education & behavior,* 39(3), pp. 364-372.

Gothe, N. P. and Kendall, B. J. (2016) Barriers, motivations, and preferences for physical activity among female African American older adults. *Gerontology and Geriatric Medicine,* 2, p. 2333721416677399.

GOV.UK (2014) Get everybody active every day. https://www.gov.uk/government/publications/everybody-active-every-day-a-framework-to-embed-physical-activity-into-daily-life. [Accessed on the 22 April 2021].

GOV.UK (2016) Health matters: getting every adult active every day. https://www.gov.uk/government/publications/health-matters-getting-every-adult-active-every-day. [Accessed on the 22 April 2021].

GOV.UK (2018a) Physical activity: applying All Our Health. [Accessed on the 22 April 2021].

GOV.UK (2018b) Workplace health: applying all our health. https://www.gov.uk/government/publications/workplace-health-applying-all-our-health. [Accessed on the 22 April 2021].

Graham, D. J., Linde, J. A., Cousins, J. M. and Jeffery, R. W. (2013) Environmental modifications and 2-year measured and self-reported stair-use: a worksite randomized trial. *The journal of primary prevention,* 34(6), pp. 413-422.

Grande, A. J., Cieslak, F. and Silva, V. (2015) Workplace exercise for changing health behavior related to physical activity. *Work,* 53(3), pp. 479-484.

Graves, L., Murphy, R., Shepherd, S. O., Cabot, J. and Hopkins, N. D. (2015) Evaluation of sit-stand workstations in an office setting: a randomised controlled trial. *BMC Public Health,* 15(1), p. 1145.

Gray, D. E. (2013) *Doing Research in the real world.* Sage.

Green, A. N., McGrath, R., Martinez, V., Taylor, K., Paul, D. R. and Vella, C. A. (2014) Associations of objectively measured sedentary behavior, light activity, and markers of cardiometabolic health in young women. *European journal of applied physiology,* 114(5), pp. 907-919.

Green, J. and Thorogood, N. (2018) *Qualitative methods for health research.* Sage.

Greene, J. C., Caracelli, V. J. and Graham, W. F. (1989) Toward a conceptual framework for mixed-method evaluation designs. *Educational evaluation and policy analysis,* 11(3), pp. 255-274.

Griffiths, K. L., Mackey, M. G., Adamson, B. J. and Pepper, K. L. (2012) Prevalence and risk factors for musculoskeletal symptoms with computer based work across occupations. *Work,* 42(4), pp. 533-541.

Grunseit, A. C., Chau, J. Y., Rangul, V., Holmen, T. L. and Bauman, A. (2017) Patterns of sitting and mortality in the Nord-Trøndelag health study (HUNT). *International Journal of Behavioral Nutrition and Physical Activity,* 14(1), p. 8.

Gusmer, R., Bosch, T., Watkins, A., Ostrem, J. and Dengel, D. (2014) Comparison of FitBit® Ultra to ActiGraph™ GT1M for assessment of physical activity in young adults during treadmill walking. *The Open Sports Medicine Journal,* 8(1).

Guthold, R., Stevens, G. A., Riley, L. M. and Bull, F. C. (2018) Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1· 9 million participants. *The Lancet Global Health,* 6(10), pp. e1077-e1086.

Hadgraft, N. T., Brakenridge, C. L., LaMontagne, A. D., Fjeldsoe, B. S., Lynch, B. M., Dunstan, D. W., Owen, N., Healy, G. N. and Lawler, S. P. (2016) Feasibility and acceptability of reducing workplace sitting time: a qualitative study with Australian office workers. *BMC Public Health,* 16(1), p. 933.

Hadgraft, N. T., Lynch, B. M., Clark, B. K., Healy, G. N., Owen, N. and Dunstan, D. W. (2015) Excessive sitting at work and at home: Correlates of occupational sitting and TV viewing time in working adults. *BMC Public Health,* 15(1), p. 899.

Hagger, M. S. (2009) Theoretical integration in health psychology: Unifying ideas and complementary explanations. *British Journal of Health Psychology, 14, 189–194.*

Hagströmer, M., Bergman, P., De Bourdeaudhuij, I., Ortega, F. B., Ruiz, J. R., Manios, Y., Rey-Lopez, J., Phillipp, K., Von Berlepsch, J. and Sjöström, M. (2008) Concurrent validity of a modified version of the International Physical Activity Questionnaire (IPAQ-A) in European adolescents: The HELENA Study. *International journal of obesity,* 32(S5), p. S42.

Haines, D. J., Davis, L., Rancour, P., Robinson, M., Neel-Wilson, T. and Wagner, S. (2007) A pilot intervention to promote walking and wellness and to improve the health of college faculty and staff. *Journal of American College Health,* 55(4), pp. 219-225.

Hall, J., Mansfield, L., Kay, T. and McConnell, A. K. (2015) The effect of a sit-stand workstation intervention on daily sitting, standing and physical activity: protocol for a 12 month workplace randomised control trial. *BMC Public Health,* 15, p. 152.

Hallal, P. C., Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., Ekelund, U. and Group, L. P. A. S. W. (2012) Global physical activity levels: surveillance progress, pitfalls, and prospects. *The lancet,* 380(9838), pp. 247-257.

Harris, T., Chaudhry, U. and Wahlich, C. (2019) How do we get adults and older adults to do more physical activity and is it worth it? *British Journal of Cardiology,* 26(1), pp. 8-9.

Hart, T. L., Swartz, A. M., Cashin, S. E. and Strath, S. J. (2011) How many days of monitoring predict physical activity and sedentary behaviour in older adults? *International Journal of Behavioral Nutrition and Physical Activity,* 8(1), p. 62.

Harvey, M. and Land, L. (2016) *Research Methods for Nurses and Midwives: Theory and Practice.* Sage.

Hasson, H., Villaume, K., von Thiele Schwarz, U. and Palm, K. (2014) Managing implementation: roles of line managers, senior managers, and human resource professionals in an occupational health intervention. *Journal of Occupational and Environmental Medicine,* 56(1), pp. 58-65.

Hasson, R. E., Haller, J., Pober, D. M., Staudenmayer, J. and Freedson, P. S. (2009) Validity of the Omron HJ-112 pedometer during treadmill walking. *Med Sci Sports Exerc,* 41(4), pp. 805-809.

Healy, G. N., Wijndaele, K., Dunstan, D. W., Shaw, J. E., Salmon, J., Zimmet, P. Z. and Owen, N. (2008) Objectively measured sedentary time, physical activity, and metabolic risk:

the Australian Diabetes, Obesity and Lifestyle Study (AusDiab). *Diabetes care,* 31(2), pp. 369-371.

Hendelman, D., Miller, K., Baggett, C., Debold, E. and Freedson, P. (2000) Validity of accelerometry for the assessment of moderate intensity physical activity in the field. *Med Sci Sports Exerc,* 32(9 Suppl), pp. S442-449.

Herrmann, S. D., Heumann, K. J., Der Ananian, C. A. and Ainsworth, B. E. (2013) Validity and reliability of the global physical activity questionnaire (GPAQ). *Measurement in Physical Education and Exercise Science,* 17(3), pp. 221-235.

Hill-Mey, P. E., Merrill, R. M., Kumpfer, K. L., Reel, J. and Hyatt-Neville, B. (2013) A focus group assessment to determine motivations, barriers and effectiveness of a university-based worksite wellness program. *Health promotion perspectives,* 3(2), p. 154.

Hilton, C. E. (2017) The importance of pretesting questionnaires: a field research example of cognitive pretesting the Exercise referral Quality of Life Scale (ER-QLS). *International Journal of Social Research Methodology,* 20(1), pp. 21-34.

Hochbaum, G., Rosenstock, I. and Kegels, S. (1952) Health belief model. *United States Public Health Service*.

Hochbaum, G. M. (1958) *Public participation in medical screening programs: A socio-psychological study.* US Department of Health, Education, and Welfare, Public Health Service, Bureau of State Services, Division of Special Health Services, Tuberculosis Program.

Horntvedt, M.-E. T., Nordsteien, A., Fermann, T. and Severinsson, E. (2018) Strategies for teaching evidence-based practice in nursing education: a thematic literature review. *BMC medical education,* 18(1), p. 172.

Houghton, C., Casey, D., Shaw, D. and Murphy, K. (2013) Rigour in qualitative case-study research. *Nurse researcher,* 20(4).

Howell, K. E. (2013) *An introduction to the philosophy of methodology.* Sage.

Hunter, J. R., Gordon, B. A., Bird, S. R. and Benson, A. C. (2018) Perceived barriers and facilitators to workplace exercise participation. *International Journal of Workplace Health Management,* 11(5), pp. 349-363.

Hyun, C., Post, A.E. and Ray, I., 2018. Frontline worker compliance with transparency reforms: Barriers posed by family and financial responsibilities. *Governance*, *31*(1), pp.65-83.

Ha, A.S., Chan, W. and Ng, J.Y., 2020. Relation between Perceived Barrier Profiles, Physical Literacy, Motivation and Physical Activity Behaviors among Parents with a Young Child. *International Journal of Environmental Research and Public Health*, *17*(12), p.4459.

Ivandic, I., Freeman, A., Birner, U., Nowak, D. and Sabariego, C. (2017) A systematic review of brief mental health and wellbeing interventions in organizational settings. *Scandinavian journal of work, environment & health,* 43(2), pp. 99-108.

Jackson, C., Lewis, K., Conner, M., Lawton, R. and RC McEachan, R. (2014) Are incremental changes in physical activity and sedentary behaviours associated with improved employee health? A 12-month prospective study in five organisations. *International Journal of Workplace Health Management,* 7(1), pp. 16-39.

Janes, G., Serrant, L. and Sque, M. (2018) Screaming silences: lessons from the application of a new research framework. *Nurse researcher,* 26(2).

Jang, T.-W., Park, S.-G., Kim, H.-R., Kim, J.-M., Hong, Y.-S. and Kim, B.-G. (2012) Estimation of maximal oxygen uptake without exercise testing in Korean healthy adult workers. *The Tohoku journal of experimental medicine,* 227(4), pp. 313-319.

Javadi, M. and Zarea, K. (2016) Understanding thematic analysis and its pitfall. *Journal of Client Care,* 1(1), pp. 33-39.

Jerome, G. J., Young, D. R., Laferriere, D., Chen, C. and Vollmer, W. M. (2009) Reliability of RT3 accelerometers among overweight and obese adults. *Med Sci Sports Exerc,* 41(1), p. 110.

Jindo, T., Kai, Y., Kitano, N., Wakaba, K., Makishima, M., Takeda, K., Iida, M., Igarashi, K. and Arao, T. (2020) Impact of Activity-Based Working and Height-Adjustable Desks on Physical Activity, Sedentary Behavior, and Space Utilization among Office Workers: A Natural Experiment. *International journal of environmental research and public health,* 17(1), p. 236.

John, D. and Freedson, P. (2012) ActiGraph and Actical physical activity monitors: a peek under the hood. *Med Sci Sports Exerc,* 44(1 Suppl 1), pp. S86-89.

Johnson, R. B. and Onwuegbuzie, A. J. (2004) Mixed methods research: A research paradigm whose time has come. *Educational researcher,* 33(7), pp. 14-26.

Johnson, S. S., Paiva, A. L., Cummins, C. O., Johnson, J. L., Dyment, S. J., Wright, J. A., Prochaska, J. O., Prochaska, J. M. and Sherman, K. (2008) Transtheoretical model-based multiple behavior intervention for weight management: effectiveness on a population basis. *Prev Med,* 46(3), pp. 238-246.

Jones, I., Brown, L. and Holloway, I. (2012) *Qualitative research in sport and physical activity.* Sage.

Kazi, A. (2013) *Promoting physical activity in the workplace: a stage of change approach*. Loughborough University.

Kelley, G. A., Kelley, K. S. and Callahan, L. F. (2018) Community-deliverable exercise and anxiety in adults with arthritis and other rheumatic diseases: a systematic review with meta-analysis of randomised controlled trials. *BMJ open,* 8(2), p. e019138.

Kelly, S., Martin, S., Kuhn, I., Cowan, A., Brayne, C. and Lafortune, L. (2016) Barriers and facilitators to the uptake and maintenance of healthy behaviours by people at mid-life: A rapid systematic review. *PLoS One,* 11(1), p. e0145074.

Kerr, J., Eves, F. and Carroll, D. (2001) Can posters prompt stair use in a worksite environment? *Journal of Occupational Health,* 43(4), pp. 205-207.

Kilpatrick, M., Blizzard, L., Sanderson, K., Teale, B., Jose, K. and Venn, A. (2017) Barriers and facilitators to participation in workplace health promotion (WHP) activities: results from a cross-sectional survey of public-sector employees in Tasmania, Australia. *Health Promotion Journal of Australia*.

Kim, J., Tanabe, K., Yokoyama, N., Zempo, H. and Kuno, S. (2013) Objectively measured light-intensity lifestyle activity and sedentary time are independently associated with metabolic syndrome: a cross-sectional study of Japanese adults. *International Journal of Behavioral Nutrition and Physical Activity,* 10(1), p. 30.

Knight, A. and La Placa, V. (2013) Healthy universities: taking the university of Greenwich healthy universities initiative forward. *International Journal of Health Promotion and Education,* 51(1), pp. 41-49.

Knox, E. C. L., Musson, H. and Adams, E. J. (2017) Workplace policies and practices promoting physical activity across England: What is commonly used and what works? *International Journal of Workplace Health Management,* 10(5), pp. 391-403.

Koepp, G. A., Manohar, C. U., McCrady-Spitzer, S. K., Ben-Ner, A., Hamann, D. J., Runge, C. F. and Levine, J. A. (2013) Treadmill desks: A 1-year prospective trial. *Obesity,* 21(4), pp. 705-711.

Kohl, H. W., Craig, C. L., Lambert, E. V., Inoue, S., Alkandari, J. R., Leetongin, G., Kahlmeier, S. and Group, L. P. A. S. W. (2012) The pandemic of physical inactivity: global action for public health. *The lancet,* 380(9838), pp. 294-305.

Kornbeck, J. (2015) Lisbonisation without regulation: engaging with sport policy to maximise its health impact? *The International Sports Law Journal,* 15(1-2), pp. 112-122.

Koster, A., Shiroma, E. J., Caserotti, P., Matthews, C. E., Chen, K. Y., Glynn, N. W. and Harris, T. B. (2016) Comparison of sedentary estimates between activPAL and hip-and wrist-worn ActiGraph. *Med Sci Sports Exerc,* 48(8), p. 1514.

Kouvonen, A., Kivimäki, M., Elovainio, M., Virtanen, M., Linna, A. and Vahtera, J. (2005) Job strain and leisure-time physical activity in female and male public sector employees. *Prev Med,* 41(2), pp. 532-539.

Krueger, R. A. (2014) *Focus groups: A practical guide for applied research.* Sage publications.

Kruger, J., Yore, M. M., Bauer, D. R. and Kohl III, H. W. (2007) Selected barriers and incentives for worksite health promotion services and policies. *American Journal of Health Promotion,* 21(5), pp. 439-447.

Kurita, S., Yano, S., Ishii, K., Shibata, A., Sasai, H., Nakata, Y., Fukushima, N., Inoue, S., Tanaka, S. and Sugiyama, T. (2017) Comparability of activity monitors used in Asian and Western-country studies for assessing free-living sedentary behaviour. *PLoS One,* 12(10), p. e0186523.

Kruskal, J.B., Shanafelt, T., Eby, P., Meltzer, C.C., Rawson, J., Essex, L.N., Canon, C., West, D. and Bender, C., 2019. A road map to foster wellness and engagement in our workplace—a report of the 2018 summer intersociety meeting. *Journal of the American College of Radiology*, *16*(6), pp.869-877.

Kim, Y., 2020. Relationships of physical activity with the transtheoretical model constructs among Korean adults. *International Journal of Health Promotion and Education*, pp.1-10.

Lachman, S., Boekholdt, S. M., Luben, R. N., Sharp, S. J., Brage, S., Khaw, K.-T., Peters, R. J. and Wareham, N. J. (2018) Impact of physical activity on the risk of cardiovascular disease in middle-aged and older adults: EPIC Norfolk prospective population study. *European Journal of Preventive Cardiology*, p. 2047487317737628.

Laforest, S., Pelletier, A., Gauvin, L., Robitaille, Y., Fournier, M., Corriveau, H. and Filiatrault, J. (2009) Impact of a community-based falls prevention program on maintenance of physical activity among older adults. *Journal of aging and health,* 21(3), pp. 480-500.

Lai, W. P. B. (2018) *A workplace exercise intervention in China: an outcome and process evaluation*. University of Nottingham.

Lakdawalla, D. and Philipson, T. (2007) Labor supply and weight. *Journal of Human Resources,* 42(1), pp. 85-116.

Lancaster, G. A., Dodd, S. and Williamson, P. R. (2004) Design and analysis of pilot studies: recommendations for good practice. *Journal of evaluation in clinical practice,* 10(2), pp. 307-312.

Landry, J. B. and Sdmon, M. A. (2002) Self-determination theory as an organizing framework to investigate women's physical activity behavior. *Quest,* 54(4), pp. 332-354.

Lather, P. (1986) Issues of validity in openly ideological research: Between a rock and a soft place. *Interchange,* 17(4), pp. 63-84.

Lauritzen, J., Muñoz, A., Sevillano, L. and Civit, A. (2013) The usefulness of activity trackers in elderly with reduced mobility: a case study. *Studies in health technology and informatics,* 192, pp. 759-762.

Lear, S., James, P., Ko, G. and Kumanyika, S. (2010) Appropriateness of waist circumference and waist-to-hip ratio cutoffs for different ethnic groups. *European Journal of Clinical Nutrition,* 64(1), pp. 42-61.

Lee, I.-M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., Katzmarzyk, P. T. and Group, L. P. A. S. W. (2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *The lancet,* 380(9838), pp. 219-229.

Leininger, L. J., Adams, K. J. and DeBeliso, M. (2015a) Differences in health promotion program participation, barriers and physical activity among faculty, staff and administration at a university worksite. *International Journal of Workplace Health Management,* 8(4), pp. 246-255.

Leininger, L. J., Adams, K. J., Debeliso, M. and Orozco, B. Z. (2015b) Differences in Participation in University Worksite Health Promotion Programs and Physical Activity Between Faculty, Staff and Administration. *Medicine & Science in Sports & Exercise,* 47(5S), pp. 391-392.

Lenio, J. A. (2006) Analysis of the Transtheoretical Model of behavior change. *Journal of Student research,* 5, pp. 73-87.

Leonard, T., Hughes, A. E. and Pruitt, S. L. (2017) Understanding How Low–Socioeconomic Status Households Cope with Health Shocks: An Analysis of Multisector Linked Data. *The ANNALS of the American Academy of Political and Social Science,* 669(1), pp. 125-145.

Levy, D. (2006) Qualitative methodology and grounded theory in property research. *Pacific Rim Property Research Journal,* 12(4), pp. 369-388.

Levy, F. and Murnane, R. J. (2003) The skill content of recent technological change: An empirical exploration. *The Quarterly journal of economics,* 118(4), pp. 1279-1333.

Lewis, A. and Eves, F. (2012) Prompt before the choice is made: Effects of a stair-climbing intervention in university buildings. *British journal of health psychology,* 17(3), pp. 631-643.

Linaker, C., Harris, E. C., Cooper, C., Coggon, D. and Palmer, K. T. (2011) The burden of sickness absence from musculoskeletal causes in Great Britain. *Occupational medicine*, p. kqr061.

Lindsay, D. B., Devine, S., Sealey, R. M. and Leicht, A. S. (2016) Time kinetics of physical activity, sitting, and quality of life measures within a regional workplace: a cross–sectional analysis. *BMC Public Health,* 16(1), p. 786.

Löllgen, H., Böckenhoff, A. and Knapp, G. (2009) Physical activity and all-cause mortality: an updated meta-analysis with different intensity categories. *International journal of sports medicine,* 30(03), pp. 213-224.

Lyden, K., Kozey, S. L., Staudenmeyer, J. W. and Freedson, P. S. (2011) A comprehensive evaluation of commonly used accelerometer energy expenditure and MET prediction equations. *European journal of applied physiology,* 111(2), pp. 187-201.

Liu, K.T., Kueh, Y.C., Arifin, W.N., Kim, Y. and Kuan, G., 2018. Application of transtheoretical model on behavioural changes, and amount of physical activity among university's students. *Frontiers in psychology*, *9*, p.2402.

Ma, P., Yao, Y., Sun, W., Dai, S. and Zhou, C. (2017) Daily sedentary time and its association with risk for colorectal cancer in adults: a dose–response meta-analysis of prospective cohort studies. *Medicine,* 96(22).

MacDonald, B., Gibson, A.-M., Janssen, X., Hutchinson, J., Headley, S., Matthews, T. and Kirk, A. (2020) Should We Scale-Up? A Mixed Methods Process Evaluation of an Intervention Targeting Sedentary Office Workers Using the RE-AIM QuEST Framework. *International journal of environmental research and public health,* 17(1), p. 239.

Mackenzie, K., Till, S. and Basu, S. (2017) Sedentary behaviour in NHS staff: implications for organizations. *Occupational medicine,* 67(3), pp. 188-193.

Maguire, M. and Delahunt, B. (2017) Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars. *AISHE-J: The All Ireland Journal of Teaching and Learning in Higher Education,* 9(3).

Mahmoodabab, S. S. M., Mohammadi, M. and Abad, M. A. M. S. (2013) Application of Transtheoretical Model to Exercise in Office Staff. *Electronic physician,* 5(1), p. 588.

Malik, S. H., Blake, H. and Suggs, L. S. (2014) A systematic review of workplace health promotion interventions for increasing physical activity. *British journal of health psychology,* 19(1), pp. 149-180.

Mallya, S. D., Kumar, P., Sarah James, B. and Kamath, A. (2019) A Study to Estimate the Level of Physical Activity and Perceived Benefits and Barriers to Exercise among

Women in Coastal Karnataka. *Indian Journal of Public Health Research & Development,* 10(1).

Mammen, G., Gardiner, S., Senthinathan, A., McClemont, L., Stone, M. and Faulkner, G. (2012) Is this bit fit? Measuring the quality of the FitBit step-counter. *Health Fit J Can,* 5(4), pp. 30-39.

Manini, T. M., Carr, L. J., King, A. C., Marshall, S., Robinson, T. N. and Rejeski, W. J. (2015) Interventions to reduce sedentary behavior. *Med Sci Sports Exerc,* 47(6), p. 1306.

Mannini, A., Intille, S. S., Rosenberger, M., Sabatini, A. M. and Haskell, W. (2013) Activity recognition using a single accelerometer placed at the wrist or ankle. *Med Sci Sports Exerc,* 45(11), p. 2193.

Marshall, A., Bauman, A., Patch, C., Wilson, J. and Chen, J. (2002) Can motivational signs prompt increases in incidental physical activity in an Australian health-care facility? *Health Education Research,* 17(6), pp. 743-749.

Martin Ginis, K. A., Papathomas, A., Perrier, M.-J. and Smith, B. (2017) Psychosocial factors associated with physical activity in ambulatory and manual wheelchair users with spinal cord injury: A mixed-methods study. *Disability and rehabilitation,* 39(2), pp. 187-192.

Mathews, E., Salvo, D., Sarma, P. S., Thankappan, K. R. and Pratt, M. (2016) Peer Reviewed: Adapting and Validating the Global Physical Activity Questionnaire (GPAQ) for Trivandrum, India, 2013. *Preventing chronic disease,* 13.

Matthew, C. E. (2005) Calibration of accelerometer output for adults. *Med Sci Sports Exerc,* 37(11 Suppl), pp. S512-522.

Matthews, C. E., Hagströmer, M., Pober, D. M. and Bowles, H. R. (2012) Best practices for using physical activity monitors in population-based research. *Med Sci Sports Exerc,* 44(1 Suppl 1), p. S68.

Maura Lawless, R. (2017) Effects of a workplace-based lifestyle intervention on the physical activity levels of a sedentary occupational group.

McCracken, L. A., Ma, J. K., Voss, C., Chan, F. H., Ginis, K. A. M. and West, C. R. (2017) Wrist accelerometry for physical activity measurement in individuals with spinal cord injury–a need for individually calibrated cut-points. *Archives of physical medicine and rehabilitation*.

McEwan, M. (2013) Investigating academic cultural differences in an international classroom.

McGuire, K. A. and Ross, R. (2011) Sedentary behavior is not associated with cardiometabolic risk in adults with abdominal obesity. *PLoS One,* 6(6), p. e20503.

McLeroy, K., Steckler, A. and Bibeau, D. (1988) The social ecology of health promotion interventions. *Health education quarterly,* 15(4), pp. 351-377.

Metzler, M. W., McKenzie, T. L., van der Mars, H., Barrett-Williams, S. L. and Ellis, R. (2013) Health optimizing physical education (HOPE): A new curriculum for school programs—Part 1: Establishing the need and describing the model. *Journal of Physical Education, Recreation & Dance,* 84(4), pp. 41-47.

Miles, L. (2007) Physical activity and health. *Nutrition bulletin,* 32(4), pp. 314-363.

Miller, N. E., Strath, S. J., Swartz, A. M. and Cashin, S. E. (2010) Estimating absolute and relative physical activity intensity across age via accelerometry in adults. *Journal of aging and physical activity,* 18(2), pp. 158-170.

Miller, R. and Brown, W. (2004) Steps and sitting in a working population. *International journal of behavioral medicine,* 11(4), pp. 219-224.

Miyachi, M., Kurita, S., Tripette, J., Takahara, R., Yagi, Y. and Murakami, H. (2015) Installation of a stationary high desk in the workplace: effect of a 6-week intervention on physical activity. *BMC Public Health,* 15, p. 368.

Monninkhof, E. M., Elias, S. G., Vlems, F. A., van der Tweel, I., Schuit, A. J., Voskuil, D. W. and van Leeuwen, F. E. (2007) Physical activity and breast cancer: a systematic review. *Epidemiology,* 18(1), pp. 137-157.

Montano, D. E. and Kasprzyk, D. (2015) Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. *Health behavior: Theory, research and practice (*

Morgan, P. J., Lubans, D. R., Collins, C. E., Warren, J. M. and Callister, R. (2009) The SHED-IT randomized controlled trial: Evaluation of an internet-based weight-loss program for men. *Obesity,* 17(11), pp. 2025-2032.

Mozaffarian, D., Afshin, A., Benowitz, N. L., Bittner, V., Daniels, S. R., Franch, H. A., Jacobs Jr, D. R., Kraus, W. E., Kris-Etherton, P. M. and Krummel, D. A. (2012) Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American Heart Association. *Circulation,* 126(12), pp. 1514-1563.

Mullan, E. and Markland, D. (1997) Variations in self-determination across the stages of change for exercise in adults. *Motivation and Emotion,* 21(4), pp. 349-362.

Muñoz, M. and Cabieses, B. (2008) Universidades y promoción de la salud:¿ cómo alcanzar el punto de encuentro. *Rev Panam Salud Pública,* 24(2), pp. 139-146.

Murphy, M. H., Murtagh, E. M., Boreham, C. A., Hare, L. G. and Nevill, A. M. (2006) The effect of a worksite based walking programme on cardiovascular risk in previously sedentary civil servants [NCT00284479]. *BMC Public Health,* 6(1), p. 136.

Meneguci, J., Sasaki, J.E., Santos, A., Scatena, L.M. and Damião, R., 2015. Sitting time and quality of life in older adults: a population-based study. *Journal of Physical Activity and Health*, *12* (11), pp.1513-1519.

Neuhaus, M., Healy, G. N., Dunstan, D. W., Owen, N. and Eakin, E. G. (2014) Workplace sitting and height-adjustable workstations: a randomized controlled trial. *American journal of preventive medicine,* 46(1), pp. 30-40.

Nevill, D. S. (2014) Positive Interventions: Developing a Theoretical Model to Guide Their Development and Use.

Newitt, R., Barnett, F. and Crowe, M. (2016) Understanding factors that influence participation in physical activity among people with a neuromusculoskeletal condition: a review of qualitative studies. *Disability and rehabilitation,* 38(1), pp. 1-10.

Ng, S. W. and Popkin, B. (2012) Time use and physical activity: a shift away from movement across the globe. *Obesity Reviews,* 13(8), pp. 659-680.

NICE (2008) Physical activity in the workplace. https://www.nice.org.uk/guidance/ph13 [Accessed on the 22 April 2021].

NICE (2009a) Mental wellbeing at work. https://www.nice.org.uk/guidance/ph22. [Accessed on the 22 April 2021].

NICE (2009b) Workplace health: long-term sickness absence and incapacity to work. https://www.nice.org.uk/guidance/ph19. [Accessed on the 22 April 2021].

NICE (2016) Workplace health: management practices. https://www.nice.org.uk/guidance/ng13. [Accessed on the 22 April 2021].

Nielsen, K. (2013) How can we make organizational interventions work? Employees and line managers as actively crafting interventions. *Human Relations,* 66(8), pp. 1029-1050.

Nigg, C. R., Allegrante, J. P. and Ory, M. (2002) Theory-comparison and multiple-behavior research: common themes advancing health behavior research. *Health Education Research,* 17(5), pp. 670-679.

Nigg, C. R., Borrelli, B., Maddock, J. and Dishman, R. K. (2008) A theory of physical activity maintenance. *Applied Psychology,* 57(4), pp. 544-560.

Noar, S. M., Chabot, M. and Zimmerman, R. S. (2008) Applying health behavior theory to multiple behavior change: considerations and approaches. *Prev Med,* 46(3), pp. 275-280.

Nocon, M., Müller-Riemenschneider, F., Nitzschke, K. and Willich, S. N. (2010) Increasing physical activity with point-of-choice prompts-a systematic review. *Scandinavian journal of public health,* 38(6), pp. 633-638.

Nogueira, D., Faerstein, E., Rugani, I., Chor, D., Lopes, C. S. and Werneck, G. L. (2009) Does leisure-time physical activity in early adulthood predict later physical activity? Pro-Saude Study. *Revista Brasileira de Epidemiologia,* 12(1), pp. 3-9.

Nöhammer, E., Schusterschitz, C. and Stummer, H. (2010) Determinants of employee participation in workplace health promotion. *International Journal of Workplace Health Management,* 3(2), pp. 97-110.

Nowell, L. S., Norris, J. M., White, D. E. and Moules, N. J. (2017) Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods,* 16(1), p. 1609406917733847.

O'Donovan, G., Hillsdon, M., Ukoumunne, O. C., Stamatakis, E. and Hamer, M. (2013) Objectively measured physical activity, cardiorespiratory fitness and cardiometabolic risk factors in the Health Survey for England. *Prev Med,* 57(3), pp. 201-205.

O'Neill, B., McDonough, S., Wilson, J., Bradbury, I., Hayes, K., Kirk, A., Kent, L., Cosgrove, D., Bradley, J. and Tully, M. (2017) Comparing accelerometer, pedometer and a questionnaire for measuring physical activity in bronchiectasis: a validity and feasibility study. *Respiratory research,* 18(1), p. 16.

Olafsen, A. H., Niemiec, C. P., Halvari, H., Deci, E. L. and Williams, G. C. (2017) On the dark side of work: a longitudinal analysis using self-determination theory. *European Journal of Work and Organizational Psychology,* 26(2), pp. 275-285.

Oldridge, N. B. (2008) Economic burden of physical inactivity: healthcare costs associated with cardiovascular disease. *European Journal of Cardiovascular Prevention & Rehabilitation,* 15(2), pp. 130-139.

Olney, N., Wertz, T., LaPorta, Z., Mora, A., Serbas, J. and Astorino, T. A. (2018) Comparison of acute physiological and psychological responses between moderate-intensity continuous exercise and three regimes of high-intensity interval training. *The Journal of Strength & Conditioning Research,* 32(8), pp. 2130-2138.

Olsen, H. M., Brown, W. J., Kolbe-Alexander, T. and Burton, N. W. (2018) Flexible Work. *Journal of Occupational and Environmental Medicine,* 60(1), pp. 23-28.

ONS (2017) Sickness absence falls to the lowest rate on record. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/sicknessabsencefallstothelowestratein24years/2018-07-30#:~:text=The%20proportion%20of%20working%20hours,points%20to%201.9%25%20in%202017 [Accessed on the 22 April 2021].

Onufrak, S. J., Watson, K. B., Kimmons, J., Pan, L., Khan, L. K., Lee-Kwan, S. H. and Park, S. (2016) Worksite Food and Physical Activity Environments and Wellness Supports

Reported by Employed Adults in the United States, 2013. *American Journal of Health Promotion*, p. 0890117116664709.

Onwuegbuzie, A. J. and Collins, K. M. (2007) A typology of mixed methods sampling designs in social science research. *The Qualitative Report,* 12(2), pp. 281-316.

Orme, M., Wijndaele, K., Sharp, S. J., Westgate, K., Ekelund, U. and Brage, S. (2014) Combined influence of epoch length, cut-point and bout duration on accelerometry-derived physical activity. *International Journal of Behavioral Nutrition and Physical Activity,* 11(1), p. 34.

Östlund, U., Kidd, L., Wengström, Y. and Rowa-Dewar, N. (2011) Combining qualitative and quantitative research within mixed method research designs: a methodological review. *International Journal of Nursing Studies,* 48(3), pp. 369-383.

Owen, N., Healy, G. N., Matthews, C. E. and Dunstan, D. W. (2010) Too much sitting: the population-health science of sedentary behavior. *Exercise and sport sciences reviews,* 38(3), p. 105.

Owen, N., Leslie, E., Salmon, J. and Fotheringham, M. J. (2000) Environmental determinants of physical activity and sedentary behavior. *Exerc Sport Sci Rev,* 28(4), pp. 153-158.

Padgett, D. K. (2016) *Qualitative methods in social work research.* Sage Publications.

Page, A. S., Cooper, A. R., Griew, P., Davis, L. and Hillsdon, M. (2009) Independent mobility in relation to weekday and weekend physical activity in children aged 10–11 years: The PEACH Project. *International Journal of Behavioral Nutrition and Physical Activity,* 6(1), p. 2.

Page, N. C. and Nilsson, V. O. (2017) Active commuting: workplace health promotion for improved employee wellbeing and organizational behavior. *Frontiers in psychology,* 7, p. 1994.

Park, S. (2017) *Physical activity and sedentary behaviour in older adults: associations with physical and mental health*. University of Birmingham.

Parry, S. and Straker, L. (2013) The contribution of office work to sedentary behaviour associated risk. *BMC Public Health,* 13(1), p. 296.

Pathak, A. and Intratat, C. (2016) Use of semi-structured interviews to investigate teacher perceptions of student collaboration. *Malaysian Journal of ELT Research,* 8(1), p. 10.

Patton, M. Q. (2002) Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative social work,* 1(3), pp. 261-283.

Paul, S. S., Tiedemann, A., Hassett, L. M., Ramsay, E., Kirkham, C., Chagpar, S. and Sherrington, C. (2015) Validity of the Fitbit activity tracker for measuring steps in community-dwelling older adults. *BMJ Open Sport Exerc Med,* 1(1), p. e000013.

Pedersen, E. S. L., Mortensen, L., Brage, S., Bjerregaard, A. and Aadahl, M. (2018) Criterion validity of the physical activity scale (PAS2) in Danish adults. *Scandinavian journal of public health,* 46(7), pp. 726-734.

Pedišić, Ž. and Bauman, A. (2014) Accelerometer-based measures in physical activity surveillance: current practices and issues. *Br J Sports Med*, pp. bjsports-2013-093407.

Pereira, M. J., Coombes, B. K., Comans, T. A. and Johnston, V. (2015) The impact of onsite workplace health-enhancing physical activity interventions on worker productivity: a systematic review. *Occup Environ Med,* 72(6), pp. 401-412.

Person, A. L., Colby, S. E., Bulova, J. A. and Eubanks, J. W. (2010) Barriers to participation in a worksite wellness program. *Nutrition research and practice,* 4(2), pp. 149-154.

Peterson, N. E., Sirard, J. R., Kulbok, P. A., DeBoer, M. D. and Erickson, J. M. (2015) Validation of accelerometer thresholds and inclinometry for measurement of sedentary behavior in young adult university students. *Research in nursing & health,* 38(6), pp. 492-499.

Public health England (PH, 2014) Everybody Active Every day. https://www.gov.uk/government/publications/everybody-active-every-day-a-framework-to-embed-physical-activity-into-daily-life [Accessed on the 22 April 2021].

PHE (2018) Health and wellbeing: introduction to the directorate. https://www.gov.uk/government/publications/health-and-wellbeing-introduction-to-the-directorate/health-and-wellbeing-introduction-to-the-directorate [Accessed on the 22 April 2021].

Phipps, E., Madison, N., Pomerantz, S. C. and Klein, M. G. (2010) Identifying and assessing interests and concerns of priority populations for work-site programs to promote physical activity. *Health promotion practice,* 11(1), pp. 71-78.

PHOF (2018) Public Health Outcomes Framework. https://fingertips.phe.org.uk/profile/public-health-outcomes-framework [Accessed on the 22 April 2021].

Pitney, W. A. and Parker, J. (2009) *Qualitative research in physical activity and the health professions.* Human Kinetics Champaign, IL.

Polit, D. and Beck, C. (2012) Planning a nursing study. *Nursing Research. Generating and Assessing Evidence for Nursing Practice (9 edn, pp. 174–199). Philadelphia, PA: Lippincott Williams & Wilkins*.

Polit, D. F. and Beck, C. T. (2004) *Nursing Research: Principles and Methods.* Lippincott Williams & Wilkins.

Polit, D. F. and Beck, C. T. (2013) *Study guide for essentials of nursing research: appraising evidence for nursing practice.* Lippincott Williams & Wilkins.

Pope, C. and Ziebland, S. (2000) Mays n. *Qualitative research in health care. Analysing qualitative data. BMJ,* 320(7227), pp. 114-116.

Pratt, C. A., Lemon, S. C., Fernandez, I. D., Goetzel, R., Beresford, S. A., French, S. A., Stevens, V. J., Vogt, T. M. and Webber, L. S. (2007) Design characteristics of worksite environmental interventions for obesity prevention. *Obesity,* 15(9), pp. 2171-2180.

Prochaska, J. O., DiClemente, C. C. and Norcross, J. C. (1992) In search of how people change: Applications to addictive behaviors. *American psychologist,* 47(9), p. 1102.

Prochaska, J. O., Wright, J. A. and Velicer, W. F. (2008) Evaluating theories of health behavior change: A hierarchy of criteria applied to the transtheoretical model. *Applied Psychology,* 57(4), pp. 561-588.

Proper, K. and van Mechelen, W. (2008) Effectiveness and economic impact of worksite interventions to promote physical activity and healthy diet. *Geneva: World Health Organization*.

Prosser, R. A., Thomas, A. C. and Darling-Fisher, C. S. (2007) Physical Activity Intervention in an Academic Setting Focus Group Results. *Aaohn Journal,* 55(11), pp. 448-453.

Publich Health England, P. (2014) Everybody active, every day An evidence-based approach to physical activity.

Puig-Ribera, A., Martínez-Lemos, I., Giné-Garriga, M., González-Suárez, Á. M., Bort-Roig, J., Fortuño, J., Muñoz-Ortiz, L., McKenna, J. and Gilson, N. D. (2015) Self-reported sitting time and physical activity: interactive associations with mental wellbeing and productivity in office employees. *BMC Public Health,* 15(1), p. 72.

Quante, M., Kaplan, E. R., Rueschman, M., Cailler, M., Buxton, O. M. and Redline, S. (2015) Practical considerations in using accelerometers to assess physical activity, sedentary behavior, and sleep. *Sleep Health: Journal of the National Sleep Foundation,* 1(4), pp. 275-284.

Rantanen, J. (1996) Global strategy on occupational health for all. *AFRICAN NEWSLETTER ON OCCUPATIONAL HEALTH AND SAFETY,* 6, pp. 86-89.

Rawlings, G., Williams, R., Clarke, D., English, C., Fitzsimons, C., Holloway, I., Lawton, R., Mead, G., Patel, A. and Forster, A. (2019) Exploring adults' experiences of sedentary behaviour and participation in non-workplace interventions designed to reduce sedentary behaviour: a thematic synthesis of qualitative studies. *BMC Public Health,* 19(1), p. 1099.

Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J. and Vandelanotte, C. (2015) A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health Psychology Review,* 9(3), pp. 366-378.

Redeker, N. S., Caruso, C. C., Hashmi, S. D., Mullington, J. M., Grandner, M. and Morgenthaler, T. I. (2019) Workplace interventions to promote sleep health and an alert, healthy workforce. *Journal of Clinical Sleep Medicine,* 15(04), pp. 649-657.

Reed, J. L., Prince, S. A., Cole, C. A., Fodor, J. G., Hiremath, S., Mullen, K.-A., Tulloch, H. E., Wright, E. and Reid, R. D. (2014) Workplace physical activity interventions and moderate-to-vigorous intensity physical activity levels among working-age women: a systematic review protocol. *Systematic reviews,* 3(1), p. 147.

Reiff, C., Marlatt, K. and Dengel, D. R. (2012) Difference in caloric expenditure in sitting versus standing desks. *Journal of Physical Activity and Health,* 9(7), pp. 1009-1011.

Reis, R. S., Salvo, D., Ogilvie, D., Lambert, E. V., Goenka, S., Brownson, R. C. and Committee, L. P. A. S. E. (2016) Scaling up physical activity interventions worldwide: stepping up to larger and smarter approaches to get people moving. *The lancet,* 388(10051), pp. 1337-1348.

Rhodes, R. E., Mark, R. S. and Temmel, C. P. (2012) Adult sedentary behavior: a systematic review. *American journal of preventive medicine,* 42(3), pp. e3-e28.

Rind, E., Jones, A. and Southall, H. (2014) How is post-industrial decline associated with the geography of physical activity? Evidence from the Health Survey for England. *Social Science & Medicine,* 104, pp. 88-97.

Rosenberg, D. E., Bull, F. C., Marshall, A. L., Sallis, J. F. and Bauman, A. E. (2008) Assessment of sedentary behavior with the International Physical Activity Questionnaire. *Journal of Physical Activity and Health,* 5(s1), pp. S30-S44.

Rossen, J., Yngve, A., Hagströmer, M., Brismar, K., Ainsworth, B. E., Iskull, C., Möller, P. and Johansson, U.-B. (2015) Physical activity promotion in the primary care setting in pre- and type 2 diabetes-the Sophia step study, an RCT. *BMC Public Health,* 15(1), p. 647.

Rowe, D. A., Kemble, C. D., Robinson, T. S. and Mahar, M. T. (2007) Daily walking in older adults: day-to-day variability and criterion-referenced validity of total daily step counts. *Journal of Physical Activity and Health,* 4(4), pp. 435-447.

Rowlands, A. and Stiles, V. (2012) Accelerometer counts and raw acceleration output in relation to mechanical loading. *Journal of biomechanics,* 45(3), pp. 448-454.

Rowley, J. (2012) Conducting research interviews. *Management Research Review,* 35(3/4), pp. 260-271.

Ryan, C. G., Dall, P. M., Granat, M. H. and Grant, P. M. (2011) Sitting patterns at work: objective measurement of adherence to current recommendations. *Ergonomics,* 54(6), pp. 531-538.

Ryan, D. J., Wullems, J. A., Stebbings, G. K., Morse, C. I., Stewart, C. E. and Onambele-Pearson, G. L. (2018) Reliability and validity of the international physical activity questionnaire compared to calibrated accelerometer cut-off points in the quantification of sedentary behaviour and physical activity in older adults. *PLoS One,* 13(4), p. e0195712.

Ryan, R. M. and Connell, J. P. (1989) Perceived locus of causality and internalization: examining reasons for acting in two domains. *Journal of personality and social psychology,* 57(5), p. 749.

Ryan, R. M. and Deci, E. L. (2000) Self-determination theory and the facilitation of intrinsic motivation, social development, and wellbeing. *American psychologist,* 55(1), p. 68.

Ryan, R. M., Weinstein, N., Bernstein, J., Brown, K. W., Mistretta, L. and Gagne, M. (2010) Vitalizing effects of being outdoors and in nature. *Journal of Environmental Psychology,* 30(2), pp. 159-168.

Ryde, G. and Brown, H. E. (2017) Physical activity and workplace wellbeing. *The Routledge Companion to Wellbeing at Work*, p. 298.

Rhodes, S., Waters, D., Brockway, B. and Skinner, M., 2020. Physical activity behaviour and barriers to activity in adults at high risk of obstructive sleep apnoea. *Journal of primary health care*, *12*(3), pp.257-264.

s Calabr, M. A., Lee, J.-M., Saint-Maurice, P. F., Yoo, H. and Welk, G. J. (2014) Validity of physical activity monitors for assessing lower intensity activity in adults. *International Journal of Behavioral Nutrition and Physical Activity,* 11(1), p. 119.

Sallis, J. F., Bowles, H. R., Bauman, A., Ainsworth, B. E., Bull, F. C., Craig, C. L., Sjöström, M., De Bourdeaudhuij, I., Lefevre, J. and Matsudo, V. (2009) Neighborhood environments and physical activity among adults in 11 countries. *American journal of preventive medicine,* 36(6), pp. 484-490.

Sallis, J. F., Owen, N. and Fisher, E. (2015) Ecological models of health behavior. *Health behavior: theory, research, and practice. 5th ed. San Francisco: Jossey-Bass*, pp. 43-64.

Sasaki, J. E., da Silva, K. S., da Costa, B. G. G. and John, D. (2016) Measurement of physical activity using accelerometers. In: *Computer-assisted and web-based innovations in psychology, special education, and health* Elsevier, pp. 33-60.

Sasaki, J. E., John, D. and Freedson, P. S. (2011) Validation and comparison of ActiGraph activity monitors. *Journal of Science and Medicine in Sport,* 14(5), pp. 411-416.

Sasaki, J. E., Júnior, J. H., Meneguci, J., Tribess, S., Marocolo Júnior, M., Stabelini Neto, A. and Virtuoso Júnior, J. S. (2017) Number of days required for reliably estimating physical activity and sedentary behaviour from accelerometer data in older adults. *Journal of sports sciences*, pp. 1-6.

Saunders, M., Lewis, P. and Thornhill, A. (2009) Research Methods for business students 4th edition Pearson education limited.

Saunders, M., Lewis, P. and Thornhill, A. (2012) Research methods for business students (6th ended.) Harlow. *England: Pearson Education*.

Scarborough, P., Bhatnagar, P., Wickramasinghe, K. K., Allender, S., Foster, C. and Rayner, M. (2011) The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006–07 NHS costs. *Journal of Public Health,* 33(4), pp. 527-535.

Scheers, T., Philippaerts, R. and Lefevre, J. (2013) SenseWear-determined physical activity and sedentary behavior and metabolic syndrome. *Med Sci Sports Exerc,* 45(3), pp. 481-489.

Schneider, R. J. and Willman, J. L. (2019) Move closer and get active: how to make urban university commutes more satisfying. *Transportation research part F: traffic psychology and behaviour,* 60, pp. 462-473.

Schreier, M. (2012) *Qualitative content analysis in practice.* Sage Publications.

Schuna Jr, J. M., Swift, D. L., Hendrick, C. A., Duet, M. T., Johnson, W. D., Martin, C. K., Church, T. S. and Tudor-Locke, C. (2014) Evaluation of a workplace treadmill desk intervention: a randomized controlled trial. *Journal of Occupational and Environmental Medicine,* 56(12), pp. 1266-1276.

Shain, M. and Kramer, D. (2004) Health promotion in the workplace: framing the concept; reviewing the evidence. *Occupational and environmental medicine,* 61(7), pp. 643-648.

Shields, N., Bruder, A. M. and Cleary, S. L. (2019) An exploratory content analysis of how physiotherapists perceive barriers and facilitators to participation in physical activity among adults with disability. *Physiotherapy theory and practice*, pp. 1-9.

Shih, I.-F., Paul, K., Haan, M., Yu, Y. and Ritz, B. (2018) Physical activity modifies the influence of apolipoprotein E ε4 allele and type 2 diabetes on dementia and cognitive impairment among older Mexican Americans. *Alzheimer's & dementia: the journal of the Alzheimer's Association,* 14(1), pp. 1-9.

Shrestha, N., Kukkonen-Harjula, K. T., Verbeek, J. H., Ijaz, S., Hermans, V. and Pedisic, Z. (2018) Workplace interventions for reducing sitting at work. *Cochrane Database of Systematic Reviews,*(6).

Singleton, P. A. (2019) Walking (and cycling) to wellbeing: Modal and other determinants of subjective wellbeing during the commute. *Travel behaviour and society,* 16, pp. 249-261.

Sirakamon, S., Chontawan, R., Akkadechanun, T. and Turale, S. (2017) An ethnography of health-promoting faculty in a Thailand university. *Health promotion international,* 32(1), pp. 44-52.

Sirard, J. R., Forsyth, A., Oakes, J. M. and Schmitz, K. H. (2011) Accelerometer test-retest reliability by data processing algorithms: results from the Twin Cities Walking Study. *Journal of Physical Activity and Health,* 8(5), pp. 668-674.

Sivris, K. C. and Leka, S. (2015) Examples of holistic good practices in promoting and protecting mental health in the workplace: current and future challenges. *Safety and health at work,* 6(4), pp. 295-304.

Smith, B. and McGannon, K. R. (2018) Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International review of sport and exercise psychology,* 11(1), pp. 101-121.

Smith, B. and Sparkes, A. C. (2013) *Qualitative research methods in sport, exercise and health: From process to product.* Routledge.

Smith, B. and Sparkes, A. C. (2016) *Routledge handbook of qualitative research in sport and exercise.* Taylor & Francis.

Smith, B. J., Rissel, C., Shilton, T. and Bauman, A. (2017) Advancing evaluation practice in health promotion. *Health Promotion Journal of Australia,* 27(3), pp. 184-186.

Smith, K. C., Michl, G. L., Katz, J. N. and Losina, E. (2018) Meteorologic and geographic barriers to physical activity in a Workplace Wellness Program. *Journal of Physical Activity and Health,* 15(2), pp. 108-116.

Soenens, B. and Vansteenkiste, M. (2010) A theoretical upgrade of the concept of parental psychological control: Proposing new insights on the basis of self-determination theory. *Developmental Review,* 30(1), pp. 74-99.

Soler, R. E., Leeks, K. D., Razi, S., Hopkins, D. P., Griffith, M., Aten, A., Chattopadhyay, S. K., Smith, S. C., Habarta, N. and Goetzel, R. Z. (2010) A systematic review of selected interventions for worksite health promotion: the assessment of health risks with feedback. *American journal of preventive medicine,* 38(2), pp. S237-S262.

Sparling, P. B., Howard, B. J., Dunstan, D. W. and Owen, N. (2015) Recommendations for physical activity in older adults. *BMJ: British Medical Journal (Online),* 350.

Stackpool, C. M. and Porcari, J. (2013) *Accuracy of Various Activity Trackers in Estimating Steps Taken and Energy Expenditure*. University of Wisconsin--La Crosse.

Stahl, S. T. and Insana, S. P. (2014) Caloric expenditure assessment among older adults: Criterion validity of a novel accelerometry device. *Journal of health psychology,* 19(11), pp. 1382-1387.

Stephens, S. K., Winkler, E. A., Trost, S. G., Dunstan, D. W., Eakin, E. G., Chastin, S. F. and Healy, G. N. (2014) Intervening to reduce workplace sitting time: how and when do changes to sitting time occur? *British journal of sports medicine*, pp. bjsports-2014-093524.

Stokols, D. (1992) Establishing and maintaining healthy environments: Toward a social ecology of health promotion. *American psychologist,* 47(1), p. 6.

Strath, S. J., Kaminsky, L. A., Ainsworth, B. E., Ekelund, U., Freedson, P. S., Gary, R. A., Richardson, C. R., Smith, D. T. and Swartz, A. M. (2013) Guide to the assessment of physical activity: clinical and research applications: a scientific statement from the American Heart Association. *Circulation,* 128(20), pp. 2259-2279.

Stringhini, S., Carmeli, C., Jokela, M., Avendaño, M., Muennig, P., Guida, F., Ricceri, F., d'Errico, A., Barros, H. and Bochud, M. (2017) Socioeconomic status and the 25× 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1· 7 million men and women. *The lancet,* 389(10075), pp. 1229-1237.

Suárez-Reyes, M. and Van den Broucke, S. (2016) Implementing the Health Promoting University approach in culturally different contexts: a systematic review. *Global health promotion,* 23(1 suppl), pp. 46-56.

Sutton, S. (2008) How does the health action process approach (HAPA) bridge the intention–behavior gap? An examination of the model's causal structure. *Applied Psychology,* 57(1), pp. 66-74.

Swartz, A. M., Strath, S. J., Bassett, D. R., O'brien, W. L., King, G. A. and Ainsworth, B. E. (2000) Estimation of energy expenditure using CSA accelerometers at hip and wrist sites. *Medicine & Science in Sports & Exercise,* 32(9), pp. S450-S456.

Swenson, T. and Siegel, M. (2013) Increasing stair use in an office worksite through an interactive environmental intervention. *American Journal of Health Promotion,* 27(5), pp. 323-329.

Takacs, J., Pollock, C. L., Guenther, J. R., Bahar, M., Napier, C. and Hunt, M. A. (2014) Validation of the Fitbit One activity monitor device during treadmill walking. *Journal of Science and Medicine in Sport,* 17(5), pp. 496-500.

Tang, K. N. (2019) Leadership Styles and Organizational Effectiveness. In: *Leadership and Change Management* Springer, pp. 11-25.

Tapps, T., Symonds, M. and Baghurst, T. (2016) Assessing employee wellness needs at colleges and universities: A case study. *Cogent Social Sciences,* 2(1), p. 1250338.

Tavares, L. S. and Plotnikoff, R. C. (2008) Not enough time? Individual and environmental implications for workplace physical activity programming among women with and without young children. *Health Care for Women International,* 29(3), pp. 244-281.

Taylor, W. C., King, K. E., Shegog, R., Paxton, R. J., Evans-Hudnall, G. L., Rempel, D. M., Chen, V. and Yancey, A. K. (2013) Booster Breaks in the workplace: participants perspectives on health-promoting work breaks. *Health Education Research,* 28(3), pp. 414-425.

Teddlie, C. and Tashakkori, A. (2003) Major issues and controveries inthe use of mixed methods in the social and behvioral sciences. *Handbook of mixed methods in social & behavioral research*, pp. 3-50.

Thayer, J. F., Verkuil, B., Brosschotj, J. F., Kevin, K., West, A., Sterling, C., Christie, I. C., Abernethy, D. R., Sollers, J. J. and Cizza, G. (2010) Effects of the physical work environment on physiological measures of stress. *European Journal of Cardiovascular Prevention & Rehabilitation,* 17(4), pp. 431-439.

Thomas, J. R., Silverman, S. and Nelson, J. (2015) *Research methods in physical activity, 7E.* Human kinetics.

Thomas, L. and Williams, M. (2006) Promoting physical activity in the workplace: using pedometers to increase daily activity levels. *Health Promotion Journal of Australia,* 17(2), pp. 97-102.

Thomas, R., Hewlett, S., Swales, C. and Cramp, F. (2019) Keeping physically active with rheumatoid arthritis: semi-structured interviews to explore patient perspectives, experiences and strategies. *Physiotherapy,* 105(3), pp. 378-384.

Thomley, B. S., Ray, S. H., Cha, S. S. and Bauer, B. A. (2011) Effects of a brief, comprehensive, yoga-based program on quality of life and biometric measures in an employee population: a pilot study. *Explore: The Journal of Science and Healing,* 7(1), pp. 27-29.

Thorp, A. A., Healy, G. N., Winkler, E., Clark, B. K., Gardiner, P. A., Owen, N. and Dunstan, D. W. (2012) Prolonged sedentary time and physical activity in workplace and non-

work contexts: a cross-sectional study of office, customer service and call centre employees. *International Journal of Behavioral Nutrition and Physical Activity,* 9(1), p. 128.

Titze, S., Martin, B. W., Seiler, R., Stronegger, W. and Marti, B. (2001) Effects of a lifestyle physical activity intervention on stages of change and energy expenditure in sedentary employees. *Psychology of sport and exercise,* 2(2), pp. 103-116.

To, Q. G., Chen, T. T., Magnussen, C. G. and To, K. G. (2013) Workplace physical activity interventions: a systematic review. *American Journal of Health Promotion,* 27(6), pp. e113-e123.

Tobin, G. A. and Begley, C. M. (2004) Methodological rigour within a qualitative framework. *Journal of advanced nursing,* 48(4), pp. 388-396.

Townsend, N., Wickramasinghe, K., Bhatnagar, P., Smolina, K., Nichols, M., Leal, J., Luengo-Fernandez, R. and Rayner, M. (2012) Coronary heart disease statistics 2012 edition. British Heart Foundation. *London, UK*.

Tracy, S. J. (2010) Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative inquiry,* 16(10), pp. 837-851.

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T. and McDowell, M. (2008) Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc,* 40(1), p. 181.

Troiano, R. P., McClain, J. J., Brychta, R. J. and Chen, K. Y. (2014) Evolution of accelerometer methods for physical activity research. *Br J Sports Med*, pp. bjsports-2014-093546.

Trost, S. G., McIver, K. L. and Pate, R. R. (2005) Conducting accelerometer-based activity assessments in field-based research. *Med Sci Sports Exerc,* 37(11 Suppl), pp. S531-543.

Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F. and Brown, W. (2002) Correlates of adults' participation in physical activity: review and update. *Medicine & Science in Sports & Exercise,* 34(12), pp. 1996-2001.

Trost, S. G. and Tudor-Locke, C. (2014) Advances in the science of objective physical activity monitoring: 3rd International Conference on Ambulatory Monitoring of Physical Activity and Movement. *Br J Sports Med,* 48(13), pp. 1009-1010.

Tudor-Locke, C., Burkett, L., Reis, J., Ainsworth, B., Macera, C. and Wilson, D. (2005) How many days of pedometer monitoring predict weekly physical activity in adults? *Prev Med,* 40(3), pp. 293-298.

Vaismoradi, M., Turunen, H. and Bondas, T. (2013) Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences,* 15(3), pp. 398-405.

van Berkel, J., Proper, K. I., van Dam, A., Boot, C. R., Bongers, P. M. and van der Beek, A. J. (2013) An exploratory study of associations of physical activity with mental health and work engagement. *BMC Public Health,* 13(1), p. 558.

van Dongen, J. M., Proper, K. I., van Wier, M. F., van der Beek, A. J., Bongers, P. M., van Mechelen, W. and van Tulder, M. W. (2012) A systematic review of the cost-effectiveness of worksite physical activity and/or nutrition programs. *Scandinavian journal of work, environment & health*, pp. 393-408.

Van Holle, V., De Bourdeaudhuij, I., Deforche, B., Van Cauwenberg, J. and Van Dyck, D. (2015) Assessment of physical activity in older Belgian adults: validity and reliability of an adapted interview version of the long International Physical Activity Questionnaire (IPAQ-L). *BMC Public Health,* 15(1), p. 433.

Van Schooten, K. S., Rispens, S. M., Elders, P. J., Lips, P., van Dieën, J. H. and Pijnappels, M. (2015) Assessing physical activity in older adults: required days of trunk accelerometer measurements for reliable estimation. *Journal of aging and physical activity,* 23(1), pp. 9-17.

Van Uffelen, J. G., Wong, J., Chau, J. Y., van der Ploeg, H. P., Riphagen, I., Gilson, N. D., Burton, N. W., Healy, G. N., Thorp, A. A. and Clark, B. K. (2010) Occupational sitting and health risks: a systematic review. *American journal of preventive medicine,* 39(4), pp. 379-388.

Varela Mato, V., Yates, T., Stensel, D., Biddle, S. and Clemes, S. A. (2017) Concurrent Validity of Actigraph-Determined Sedentary Time Against the Activpal Under Free-Living Conditions in a Sample of Bus Drivers. *Measurement in Physical Education and Exercise Science,* 21(4), pp. 212-222.

Venn, D. and Strazdins, L. (2017) Your money or your time? How both types of scarcity matter to physical activity and healthy eating. *Social Science & Medicine,* 172, pp. 98-106.

Wanner, M., Hartmann, C., Pestoni, G., Martin, B. W., Siegrist, M. and Martin-Diener, E. (2017) Validation of the Global Physical Activity Questionnaire for self-administration in a European context. *BMJ Open Sport Exerc Med,* 3(1), p. e000206.

Warburton, D. E. and Bredin, S. S. (2017) Health benefits of physical activity: a systematic review of current systematic reviews. *Current opinion in cardiology,* 32(5), pp. 541-556.

Ware, J., Kosinski, M., Bjorner, J. B., Turner-Bowker, D. M., Gandek, B. and Maruish, M. E. (2008) sf-36v2 health survey: Administration guide for clinical trial Investigators. *Lincoln: QualityMetric Incorporated. Lincoln, RI, USA: QualityMetric Incorporated,* 1, p. 34.

Waters, C. N., Ling, E. P., Chu, A. H., Ng, S. H., Chia, A., Lim, Y. W. and Müller-Riemenschneider, F. (2016) Assessing and understanding sedentary behaviour in office-based working adults: a mixed-method approach. *BMC Public Health,* 16(1), p. 360.

Webb, O. J., Eves, F. F. and Kerr, J. (2011) A statistical summary of mall-based stair-climbing interventions. *Journal of Physical Activity and Health,* 8(4), pp. 558-565.

Webb, T. L., Joseph, J., Yardley, L. and Michie, S. (2010) Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of medical Internet research,* 12(1).

Welk, G. J., Kim, Y., Stanfill, B., Osthus, D. A., Calabro, A. M., Nusser, S. M. and Carriquiry, A. (2014) Validity of 24-h physical activity recall: physical activity measurement survey. *Med Sci Sports Exerc,* 46(10).

WHO (2015) Physical activity strategy for the WHO European Region 2016–2025. Copenhagen: World Health Organization.

Wibowo, R. A., Wasityastuti, W. and Sofro, Z. M. (2019) Low total physical activity, high total sitting time and high sitting time on a work day are correlated with low fitness in male working adults: a cross sectional study. *Bangladesh Journal of Medical Science,* 18(2), pp. 279-287.

Wills, J. and Linneker, B. (2012) The costs and benefits of the London living wage. *London: Queen Mary University of London*.

Wolff-Hughes, D. L., McClain, J. J., Dodd, K. W., Berrigan, D. and Troiano, R. P. (2016) Number of accelerometer monitoring days needed for stable group-level estimates of activity. *Physiological measurement,* 37(9), p. 1447.

Wong, J. Y., Gilson, N. D., Van Uffelen, J. G. and Brown, W. J. (2012) The effects of workplace physical activity interventions in men: a systematic review. *American journal of men's health*, p. 1557988312436575.

Wyatt, K. M., Brand, S., Ashby-Pepper, J., Abraham, J. and Fleming, L. E. (2015) Understanding how healthy workplaces are created: implications for developing a national health service healthy workplace program. *International Journal of Health Services,* 45(1), pp. 161-185.

Yach, D., Stuckler, D. and Brownell, K. D. (2006) Epidemiologic and economic consequences of the global epidemics of obesity and diabetes. *Nature medicine,* 12(1), pp. 62-66.

Yap, T. L. and James, D. M. B. (2010) Tailored e-mails in the workplace: A focus group analysis. *Aaohn Journal,* 58(10), pp. 425-432.

Young, K. and Atkinson, M. (2012) *Qualitative research on sport and physical culture.* Emerald Group Publishing.

Zechmeister, I., Kilian, R. and McDaid, D. (2008) Is it worth investing in mental health promotion and prevention of mental illness? A systematic review of the evidence from economic evaluations. *BMC Public Health,* 8(1), p. 20.

Zhang, S., Murray, P., Zillmer, R., Eston, R. G., Catt, M. and Rowlands, A. V. (2012) Activity classification using the GENEA: optimum sampling frequency and number of axes. *Medicine & Science in Sports & Exercise,* 44(11), pp. 2228-2234.

Zhu, X., Yoshikawa, A., Qiu, L., Lu, Z., Lee, C. and Ory, M. (2019) Healthy workplaces, active employees: A systematic literature review on impacts of workplace environments on employees physical activity and sedentary behavior. *Building and Environment*, p. 106455.

Zhu, X., Yoshikawa, A., Qiu, L., Lu, Z., Lee, C. and Ory, M. (2020) Healthy workplaces, active employees: A systematic literature review on impacts of workplace environments on employees physical activity and sedentary behavior. *Building and Environment,* 168, p. 106455.

14.0 Appendices

Due to the length of appendices an online link was created not to increase the size of this thesis. For accessing the appendices please click on the institution online link provided: https://mailbcuacmy.sharepoint.com/:f:/g/personal/ayazullah_safi_mail_bcu_ac_uk/Eh_5XPCeIulFhvFKSrKfdgkBQMl6pwuoB24zFgQWzSkxhA?e=GBfyJz. If you're an external (not from Birmingham City University) then you cannot access the link unless an access is given. In order, to gain an access to the appendices please email me on: Ayazullah.safi@mail.bcu.ac.uk with your email address and I will provide you the access accordingly.