Increasing physical activity and reducing sedentary time in middle-aged males

Emma Sharelle George
16148550

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Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

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Abbreviations

7-day PAR – seven day physical activity recall
95% CI – 95% confidence interval
AAS – Active Australia Survey
AOR – adjusted odds ratio
BMI – body mass index
BP – blood pressure
CHD – coronary heart disease
CVD – cardiovascular disease
DBP – diastolic blood pressure
GP – General Practitioner
GWS – Greater Western Sydney
HbA1c – haemoglobin A1c
HC – hip circumference
HDHK – Healthy Dads, Healthy Kids
HDL – high-density lipoprotein
HRmax – maximum heart rate
HRrest – resting heart rate
HSC – Higher School Certificate
IPAQ – International Physical Activity Questionnaire
ITT – intention to treat
LDL – low-density lipoprotein
LEEE – leisure time exercise energy expenditure
LGA – Local Government Area
LiSM-PAN – Life Style Modification for Physical Activity and Diet
LPA – light physical activity
LTPA – leisure-time physical activity
METs – metabolic equivalent units
MOS-PF – Medical Outcomes Study Physical Functioning scale
MVPA – moderate-to-vigorous physical activity
NSW – New South Wales
OH&S – Occupational Health and Safety
OR – odds ratio
PACE – Patient-centered Assessment and Counseling for Exercise
RPE – rate of perceived exertion
SBP – systolic blood pressure
SD – standard deviation
TC/HDL-C – total cholesterol/high density lipoprotein cholesterol
UWS – University of Western Sydney
VO_{2\text{max}} – maximal oxygen consumption
VO_{2\text{peak}} – peak oxygen uptake
WC – waist circumference
WHO – World Health Organization
Abstract

The health-related benefits of regular physical activity have been well-established, as have the risks associated with insufficient physical activity. Despite the benefits, an alarming proportion of Australians fail to participate in sufficient physical activity. Males form a particularly hard-to-reach population group for the promotion of healthy lifestyles, and physical activity interventions exclusively designed for and targeting males are sparse. The primary aim of this PhD research, with a focus on males, was to increase levels of physical activity and reduce sedentary time in middle-aged (35-64 years) males employed in a university setting (University of Western Sydney, UWS). The secondary aims of this PhD research were to determine whether physical activity and sitting time are associated with chronic disease, and to understand male perceptions of physical activity and sedentary time in a university-based setting. A series of three major studies were conducted to achieve these aims.

Using baseline data from the longitudinal 45 and Up Study, Study 1 examined the association between chronic disease, leisure-time physical activity and sitting time in a sample of 63,048 males aged between 45 and 64 years. The 45 and Up Study is a large-scale cohort study providing much-needed data on a range of health conditions and underlying determinants of health. Baseline data on self-reported chronic disease (including heart disease, cancer, diabetes, high blood pressure, and combined chronic disease), sitting time, physical activity, and a range of covariates including age and BMI, were used for cross-sectional analyses. Crude, partially adjusted, and fully adjusted odds ratios, and 95% confidence intervals were
calculated using binary logistic regression. Findings suggest that males who were more physically active were significantly less likely to report ever having diabetes. Higher volumes of sitting time were also significantly associated with diabetes and overall chronic disease, independent of leisure-time physical activity and other potentially confounding factors.

Through focus group research, Study 2 explored males’ individual perceptions of physical activity and sitting time, as well as perceived barriers and motivators that influence these behaviours. A series of five semi-structured focus groups were held across two campuses at UWS, with a total of 15 participants. Health and family were commonly reported motivators for physical activity, whereas time constraints and work commitments were major barriers to physical activity participation. Sedentary time was a perceived “by-product” of participants’ university employment, as a substantial proportion of their days were spent sitting, primarily at a computer. Participants believed that physical activity should be recognised as a legitimate activity at work, embedded within the university culture and endorsed using a top-down approach. Findings from this research were used to inform the final design of the following study.

The third and final study for this PhD was the ManUp UWS Study, a randomised controlled trial designed to increase physical activity and reduce sedentary time in middle-aged male university employees. A total of 56 male employees from UWS were recruited and randomised to either a 12-week internet-based physical activity program or a program where participants only received printed materials on physical activity, sedentary time, and health. At 24-week follow-up, there were no significant group-by-time effects observed for any of the primary
or secondary outcomes, however, modest improvements in weight, BMI, and waist circumference were observed across time for both groups. Despite employing a large number of robust strategies to recruit participants, less than half of the required sample size was recruited. Attempts to recruit participants were exhaustive, although male employees were still reluctant to participate. The difficulty in recruiting middle-aged males for this study lends support to the notion that this is a hard-to-reach population group. Most participants, however, reported several positive aspects associated with their involvement in the Study, and many reported (in the process evaluation) that they felt they had increased their physical activity and reduced their sedentary time over the 12-week intervention period.

Findings from this PhD research have addressed gaps in the literature by targeting a hard-to-reach and underrepresented population group for the promotion of healthy lifestyles. These findings have contributed to a growing body of evidence on the independent health risk of both physical activity and sedentary time. The insights into barriers and motivators related to physical activity and sedentary time generated through this research emphasised the importance of encouraging breaks in sedentary time and recognising physical activity as a legitimate health-promoting activity that is supported and encouraged by employers during working hours. Health promotion initiatives should focus not only on encouraging people to lead physically active lifestyles, but also to be aware of the association between sitting time and health outcomes.
Chapter 1

Introduction

1.1 Operational definition of key terms

To assist the reader of this thesis, the operational definitions of the key terms used throughout the thesis are outlined below.

Physical activity – The term “physical activity” can be defined as “any bodily movement produced by skeletal muscles that requires energy expenditure” (Caspersen, Powell, & Christenson, 1985, p. 126). Physical activity is associated with a range of positive health outcomes and may be categorised according to the domain, duration, intensity, or the energy expended (Caspersen et al., 1985). Moderate and vigorous physical activity intensities are often expressed in metabolic equivalent of task units (METs) (World Health Organization, 2010a). For adults, physical activity intensity of 3.0 – 5.9 METs is categorised as moderate-intensity, and intensity of 6.0 or more is categorised as vigorous (World Health Organization, 2010a).

Sufficient physical activity – Although there are a range of definitions of sufficient physical activity, according to the World Health Organization (WHO) (2010a), 150 minutes or more of moderate-intensity and/or vigorous-intensity physical activity on a weekly basis is conducive to gaining health benefits in adults aged between 18 and 64 years. Australian physical activity guidelines also use this recommendation (Australian Institute of Health and Welfare, 2010). For additional
health benefits, the WHO recommends that adults aged between 18 and 64 should participate in 300 minutes or more of moderate-intensity physical activity weekly (World Health Organization, 2010a).

**Exercise** - Exercise can be defined as “a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective” (World Health Organization, 2010a, p. 52).

**Sedentary** - The term “sedentary” (from the Latin *sedere* – “to sit”) is used to describe low levels of physical activity. Sedentary behaviour is characterised by activities such as sitting or lying down, requiring minimal bodily movement and involving energy expenditure of 1.0 – 1.5 METs (Pate, O’Neill, & Lobelo, 2008). Recently, the Sedentary Behaviour Research Network developed and endorsed a more comprehensive definition of sedentary behaviour (Sedentary Behaviour Research Network, 2012). Building upon the definition above, the Network also specified that sedentary behaviour should involve being “in a sitting or reclining posture” (Sedentary Behaviour Research Network, 2012, p. 540).

### 1.2 Background

This background section will only briefly highlight the important and relevant literature to set the context for this large body of work. Further review of literature is covered in Chapter 2 and in the background sections of Chapters 3-5. The health-related benefits related to regular participation in physical activity have been well established, as have the risks associated with insufficient physical activity. Despite the recognised benefits, an alarming proportion of Australians fail to participate in
sufficient physical activity. Males form a particularly hard-to-reach population group for the promotion of healthy lifestyles, and physical activity interventions exclusively designed for and targeting males are sparse.

1.2.1 Male health

Research into the area of male health is gaining momentum in countries across the world, and has been highlighted by the release of a range of male-specific health reports and policies (Australian Institute of Health and Welfare, 2011b; Department of Health and Ageing, 2010b; Department of Health and Children, 2008; European Commission, 2011). On average, Australian men have a shorter life expectancy and experience higher rates of chronic diseases, such as coronary heart disease and type 2 diabetes, compared to their female counterparts (Department of Health and Ageing, 2010b). High blood pressure, overweight or obesity, physical inactivity, and low fruit and vegetable intake are just some of the main modifiable risk factors which contribute to poor health and the burden of disease in Australian males (Department of Health and Ageing, 2010b). Australian data shows that cancer and other tumours were the leading cause of death in both males and females aged between 45 and 64 years, while cardiovascular disease, including both coronary heart disease and stroke, was the second highest cause of death in this age group (Australian Institute of Health and Welfare, 2010).

The current Australian National Male Health Policy (Department of Health and Ageing, 2010b) was developed in consultation with Australian men to address challenges and specific priority areas in male health. These priority areas are related to issues such as health outcomes, health equity across all ages and population groups, preventive measures, informing policy, and access to health care
(Department of Health and Ageing, 2010b). The policy highlights that males can be a hard-to-reach population group in terms of health intervention, and that designing preventive health initiatives targeting males can be challenging (Department of Health and Ageing, 2010b).

Two recently published reviews on physical activity interventions have highlighted the need for intervention studies to specifically target males (George et al., 2012; Waters, Galichet, Owen, & Eakin, 2011). Although a large number of physical activity intervention studies have been conducted, Waters et al. (2011) found that few studies reported intervention effects by gender, and these authors suggested that doing so would be advantageous. Less than 35% of the participants in the 32 studies included in the review by Waters et al. (2011) were male, indicating that males are often underrepresented in health promotion initiatives. George et al. (2012), in a literature review linked to the current thesis and the wider ManUp study (Caperchione et al., 2012; Duncan et al., 2012; Taylor et al., 2013; Vandelanotte et al., 2013), focused on physical activity intervention effectiveness, specifically for male participants. A total of 23 intervention studies with a physical activity component were included in the review, and although 14 of these studies demonstrated significant increases in physical activity outcomes, only a small proportion of these studies targeted males specifically (George et al., 2012).

In relation to designing successful interventions and initiatives that would appeal to Australian males, participants involved in consultations for development of the National Male Health Policy emphasised the importance of enjoyment associated with health-promoting behaviours such as physical activity. Positive features identified for inclusion in health promotion initiatives included simplicity and
efficiency, in terms of time and cost, as well as encouraging small changes along the way to reaching larger goals (Department of Health and Ageing, 2010b).

1.2.2 Physical activity

Participation in regular physical activity has the potential to reduce the risk of developing a range of noncommunicable diseases such as cardiovascular disease (CVD), diabetes, and some forms of cancer (Australian Institute of Health and Welfare, 2008a). Regular physical activity has also been positively associated with higher levels of mental health and wellbeing (Blumenthal et al., 2007; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005; Paluska & Schwenk, 2000). Despite an abundance of strong evidence surrounding physical activity and its associated health benefits, an alarmingly high proportion of Australian adults fail to achieve sufficient levels of physical activity conducive to health benefits (Brown, Bauman, & Owen, 2009; Owen, Bauman, & Brown, 2009).

Early physical activity guidelines suggested adults should participate in aerobic exercise at an intensity of 60-90% of their maximum heart rate (HR_{max}), for between 15-60 minutes, on three to five days each week (American College of Sports Medicine, 1978). Over the ensuing years, there has been a shift in the focus of physical activity recommendations, and these guidelines were revised in 1990, with more emphasis given to muscular strength and endurance, and regular participation in moderate physical activity (American College of Sports Medicine, 1990). The landmark United States Surgeon General’s Report on Physical Activity and Health (US Department of Health and Human Services, 1996) was a significant turning point in physical activity recommendations and promotion. This report recommended that adults participate in at least 30 minutes of moderate physical activity on most
days of the week to achieve health benefits. Health-related benefits of regular physical activity became more widely recognised, and the emphasis on duration, rather than intensity, encouraged people to incorporate a range of activities into their daily routines (US Department of Health and Human Services, 1996).

Current Australian guidelines recommend that adults accumulate at least 30 minutes of moderate-intensity physical activity on most days, and this can be supplemented with bouts of vigorous activity for increased health benefit. This recommended amount of activity can also be accumulated over a number of shorter sessions of around 10 to 15 minutes (Department of Health and Ageing, 1999). These recommendations are consistent with those set by the WHO (2010a). Australian adults are encouraged to participate in regular vigorous physical activity, and incidental physical activity, such as taking the stairs or cycling to work (Department of Health and Ageing, 1999). In 2007-2008, less than half of Australian males reported participating in sufficient levels of physical activity – that is, 150 minutes or more of moderate and/or vigorous physical activity in a one-week period (Australian Institute of Health and Welfare, 2010).

1.2.3 Sedentary time

What was once typically characterised as not meeting recommended levels of moderate or vigorous physical activity, the definition of “sedentary” has evolved over recent years (Pate et al., 2008; Sedentary Behaviour Research Network, 2012), and there is a growing body of evidence demonstrating the deleterious impact that prolonged sedentary time has on health. Independent of physical activity levels, high volumes of sedentary time are associated with a range of chronic diseases (Dunstan et al., 2005; George, Rosenkranz, & Kolt, 2013; Healy, Matthews, Dunstan, Winkler,
Higher volumes of time spent being sedentary have also been shown to increase the risk of being overweight or obese (Sugiyama, Healy, Dunstan, Salmon, & Owen, 2008), and risk of developing metabolic syndrome (Dunstan et al., 2005; Healy et al., 2008). Further, higher levels of daily sitting have been found to increase the risk of both CVD and all-cause mortality (Katzmarzyk et al., 2009; Patel et al., 2010; Warren et al., 2010).

At this point in time, there are no clear guidelines regarding sedentary time and the point at which it becomes detrimental to health. The National Heart Foundation of Australia, however, recommends that adults limit the amount of time they spend sitting and engaging in sedentary activities such as watching television or using a computer (National Heart Foundation of Australia, 2011). Based on existing evidence illustrating the deleterious effects of sitting time on health, it has been suggested that researchers and policy makers begin to consider including recommendations for overall sitting time, or breaks in sitting time, in addition to established guidelines for physical activity (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008).

1.2.4 Overweight and obesity

The measure of body mass index (BMI) is used to classify underweight, overweight and obesity in adult populations, and is calculated as weight (kilograms) divided by the square of the height (metres) (World Health Organization, 2006). Individuals with a BMI of <18.50 are classified as being underweight, while those with a BMI of 25.00 to 29.99 are classified as overweight, and those with a BMI of ≥30 are classified as obese (World Health Organization, 2006). According to data
from the 2007-2008 National Health Survey, approximately 44% of Australian males aged between 35 and 64 years were overweight and approximately 30% were classified as obese (Australian Bureau of Statistics, 2009). Individuals who are overweight or obese have an increased risk of developing a range of chronic diseases, including diabetes, hypertension, heart disease and some forms of cancer (Field et al., 2001). According to the WHO, overweight and obesity account for 2.8 million adult deaths annually (World Health Organization, 2013).

1.2.5 The ageing population

The life expectancy of Australians has increased over recent decades, and is one of the highest in the world. This trend, paired with periods of low fertility, has resulted in a rapidly ageing Australian population. For example, in 2010, the median age of the Australian population was 36.9 and by the year 2031, the median age of the Australian population is estimated to be 40.3 (Australian Institute of Health and Welfare, 2012). The ageing population places increasing demand on health and welfare services, and health expenditure and the proportion of older people within a population “strongly influences morbidity and mortality for many chronic conditions, and demand for health and aged care services” (Australian Institute of Health and Welfare, 2012, p. 46). In 2007, 83% of premature deaths in Australian adults under the age of 75 were caused by chronic diseases (Australian Institute of Health and Welfare, 2010b). In order to reduce the burden of chronic disease, it is imperative to design health promotion initiatives and lifestyle modification interventions targeting risk factors (such as physical inactivity) in those who are at high risk of developing these conditions. Hugo, Taylor, and Dal Grande emphasise the importance of developing targeted health interventions for middle-aged Australians (also known as
the ‘Baby Boomer’ generation) as they believe that “this is a final window of opportunity before they enter the older age groups” (2008, p. 204).

### 1.2.6 The ManUp Study

This thesis is based on, and extends on the substantive ManUp Study – a larger research project carried out in Gladstone, Queensland, Australia (Duncan et al., 2012). The ManUp Study was carried out by a team from Central Queensland University, the University of Western Sydney (UWS), The Australian E-Health Research Centre, and the CSIRO Centre for Human Nutrition, and was funded by Queensland Health (Health Promotion Queensland – Population Health Branch). Gladstone is an area of relatively low socioeconomic status, with approximately 40% of Gladstone residents being low income earners, and over 50% of residents holding no formal educational qualification (Gladstone Regional Council, 2006). The aim of the substantive ManUp Study was to examine the effectiveness of innovative strategies (internet and mobile (cell) phone-based) to engage middle-aged males living in the Gladstone region in healthy physical activity and nutrition behaviours. The findings of the ManUp Study are discussed in Chapter 2 and Chapter 5. The series of studies in this thesis utilise specific aspects of the substantive ManUp Study, namely the internet-based intervention, to promote physical activity and reduce sedentary time in a university environment in Sydney, Australia.

### 1.3 Research aims

The primary aim of this PhD research is to improve male health, increase levels of physical activity, and reduce sedentary time, by encouraging healthy behaviour change and reducing the risk of poor health associated with biomarkers of disease in
middle-aged (35-64 years) males employed in a university setting (UWS). In order to
develop such an intervention, it is important to first consider demographic
characteristics and underlying determinants of health and chronic disease, and to
understand perceived motivators, barriers and contextual factors related to physical
activity and sedentary time. The secondary aims of this PhD research were, therefore,
to determine whether physical activity and sitting time are associated with chronic
disease, and to understand male perceptions of physical activity and sedentary time
in a university-based setting. A series of three major studies were conducted to
achieve these aims, and each study will be outlined in this chapter and discussed in
subsequent chapters.

1.4 Research objectives

To achieve the aforementioned aims of this PhD research, the following
objectives were developed:

- Perform an extensive and critical review of the literature on intervention
  studies and qualitative studies on physical activity and sedentary time, with a
  specific focus on middle-aged males.

- Explore the association between physical activity, sitting time, chronic
disease and a range of health and demographic variables using existing,
robust cross-sectional Australian data.

- Investigate men’s perceptions of physical activity and related issues, such as
  barriers and enablers for participating in physical activity through a series of
  focus groups.
• Conduct a randomised controlled trial to test the effectiveness of a 12-week internet-based physical activity intervention (ManUp UWS) in comparison to a control group receiving only generic printed materials on physical activity, sedentary time, and health.

• Evaluate participants’ perceptions on specific components of the ManUp UWS program, and identify contextual factors associated with the effectiveness of the program using a process evaluation.

1.5 Outline of the thesis

This thesis contains six chapters, and the content of each chapter is detailed below:

• The current chapter (Chapter 1) presents the aims and objectives of this PhD research, highlights the importance of physical activity and sitting time as factors that independently affect health, and introduces the theme of male health.

• Chapter 2 presents the findings of an extensive and critical literature review on intervention studies targeting physical activity and sedentary time in middle-aged males. Aspects of the physical activity component of this literature review have been published in Sports Medicine (George et al., 2012).

• Chapter 3 describes the methods and presents the findings of a cross-sectional analysis examining the association between chronic disease, physical activity, sitting time and a range of health and demographic variables (Study 1). This study used baseline data from The 45 and Up Study, a longitudinal cohort
study of 267,153 adults aged 45 years and over, residing in New South Wales (NSW), the most populous state in Australia. The 45 and Up Study baseline questionnaire captured rich data on a range of health and demographic related variables, including physical activity levels, socioeconomic variables, dietary behaviours, and the presence of chronic disease. Aspects of this study have been published in the *International Journal of Behavioral Nutrition and Physical Activity* (George, Rosenkranz, & Kolt, 2013).

- Chapter 4 discusses the findings of a qualitative study into males’ individual perceptions of physical activity and sitting time, as well as perceived barriers and motivators that influence these behaviours (Study 2). The findings from this study informed the development and adaptation of the intervention tested in Chapter 5. A journal article based on this research has been published in the *American Journal of Men’s Health* (George, Kolt, Rosenkranz, & Guagliano, 2013).

- Chapter 5 presents the findings of a randomised controlled trial conducted to evaluate the effectiveness of the 12-week ManUp UWS internet-based physical activity intervention for middle-aged male university employees (Study 3). The results of a process evaluation assessing participants’ perceptions of the program and its components will also be discussed.

- Finally, Chapter 6 synthesises the information presented in this PhD thesis in its entirety (i.e., all studies), and considers implications for future research and the development of health promotion initiatives and policy.

### 1.6 Significance of the thesis

Several key outcomes are expected as a result of this PhD research.
Study 1 will address a gap in the current literature by examining the association between chronic diseases, physical activity and sedentary (sitting) time in middle-aged Australian males.

Study 2 will provide insight into the barriers and motivators related to physical activity and sedentary behaviour in male university employees. The findings of this study will help to inform the final shaping of the ManUp UWS intervention, tested in Chapter 5.

Study 3 will utilise an understudied and underrepresented population group that traditionally spends a substantial proportion of time sedentary. The findings of this study will inform future work for those working in sedentary occupations such as university-based settings.

1.7 Synopsis

Independently, physical activity and sedentary time have been established as major modifiable risk factors for a range of chronic diseases. Males are generally underrepresented in health promotion initiatives, and have been identified as a particularly hard-to-reach population group for this purpose. The prevalence of chronic disease in the male population in Australia warrants concern, and requires the development of effective and sustainable programs to promote healthy active lifestyles. Chapter 2 expands on the key concepts introduced in the current chapter by providing a comprehensive summary of literature relevant to this thesis. The literature review focuses primarily on intervention studies promoting physical activity and reducing sedentary time and healthy lifestyle behaviours in males, and
studies exploring perceptions of physical activity and sedentary time, to establish a comprehensive picture of current approaches to physical activity promotion.
Chapter 2

Literature Review

A peer-reviewed journal article based on aspects of this literature review has been published in *Sports Medicine* (George et al., 2012, Appendix A).

Authorship details:

George (80%), Kolt (5%), Duncan (3%), Caperchione (3%), Mummery (2%), Vandelanotte (3%), Taylor (2%), Noakes (2%).

Introduction

Chapter 1 provided an overview of this PhD thesis and introduced the background, research questions, and expected outcomes for each of the three studies. This chapter builds upon the information provided in Chapter 1 by presenting an in-depth and critical review of the literature pertaining to this body of research. This review will focus on intervention studies targeting physical activity and sedentary behaviour in middle-aged males, and the barriers and motivators related to participation in physical activity and time spent sedentary. An overview of the literature related more specifically to Study 1 will be presented at the beginning of Chapter 3.

The classification of “middle-aged” varies within the literature, so to be as inclusive as possible a broad classification of “middle-aged” was employed for this PhD research. Adults aged 65 years and over are generally classified as “older” adults (World Health Organization, n.d.), and interventions targeting adults over the
age of 65 years are likely to be quite different to those for younger adult populations. The definition of “middle-aged” that was employed for this body of research was, therefore, being aged between 35 and 64 years.

2.1 Background

As discussed in Chapter 1, participation in regular physical activity is associated with a range of health benefits, including reduced risk of developing noncommunicable diseases such as cardiovascular disease, cancer, and diabetes (Australian Institute of Health and Welfare, 2008a, 2008b; Bauman, 2004; Wilmore, Costill, & Kenney, 2008; World Health Organization, 2009b), and is also associated with improved mental health (Blumenthal et al., 2007; Dunn et al., 2005; Paluska & Schwenk, 2000). Despite a strong body of evidence supporting physical activity for health benefits, a high proportion of adults lead low-active lifestyles. In Australia, for example, less than half of adult males reported participating in sufficient levels of physical activity (Australian Institute of Health and Welfare, 2010).

Compared to females, males have a lower life expectancy (World Health Organization, 2010b) and higher mortality rates attributable to chronic diseases (Department of Health and Ageing, 2010b; Williams, 2003). Having high blood pressure, being overweight, being physically inactive, and having a low fruit and vegetable intake are the main modifiable risk factors that contribute to poor health and the burden of disease in males. Physical inactivity is one of the five leading risks of mortality worldwide (Department of Health and Ageing, 2010b; World Health Organization, 2009a).
Low levels of sufficient physical activity and the subsequent effects on the health of males warrants concern. Males form a particularly hard-to-reach population group for the promotion of healthy lifestyles (Department of Health and Ageing, 2010b; Morgan, Warren, Lubans, Collins, & Callister, 2011), as they are less likely than women to undertake positive health measures such as seeking advice from health professionals, or attending health education sessions (Deeks, Lombard, Michelmore & Teede, 2009). As such, implementing preventive health initiatives targeting males can be challenging (Department of Health and Ageing, 2010b). In addition to being a hard-to-reach population group, males are also underrepresented in health promotion interventions. For example, in a review of participant characteristics, response, and retention rates in physical activity interventions, Waters, Galichet, Owen and Eakin (2011) found that less than 35% of participants in the 32 studies included in their review were male. Moreover, few of the studies included in the review analysed and reported intervention effects by sex (Waters et al., 2011). This is important as males and females may respond differently to interventions and without stratifying the analyses, the potential moderating effect of sex may influence the effect size (Bauman, Sallis, Dzewaltowski, & Owen, 2002).

Several reviews of physical activity interventions have been published (Bravata et al., 2007; Eakin, Glasgow, & Riley, 2000; Foster, Hillsdon, & Thorogood, 2009; Hutchison, Breckon, & Johnston, 2009; Jenkins, Christensen, Walker, & Dear, 2009; Kahn et al., 2002; Kroeze, Werkman, & Brug, 2006; Müller-Riemenschneider, Reinhold, Nocon, & Willich, 2008; Norman et al., 2007; Vandelanotte, Spathonis, Eakin, & Owen, 2007; Wong, Gilson, van Uffelen, & Brown, 2012), although only
one of these reviews has focused specifically on male participants (Wong et al., 2012).

This literature review will focus primarily on intervention studies published within the last 20 years that have either targeted males specifically, or those that have included both males and females and have examined intervention effects separately by sex. For interventions targeting sedentary time, however, all available studies targeting adults will be included in this review as this evidence base is less-developed (Owen et al., 2011). Intervention studies will be categorised by the primary method of delivery to allow for comparisons to be drawn between similar studies, and to assist in understanding which delivery methods have the greatest potential.

2.2 Intervention studies to increase physical activity

A systematic search of several scientific databases (MEDLINE, CINAHL, ScienceDirect, Web of Science, PsychINFO, the Cochrane Library, and SPORTDiscus) was conducted to identify intervention studies and qualitative studies published in the English language, between 1990 and 2013. This search initially yielded a large number of physical activity intervention studies, however, only a small portion of these studies targeted males or presented findings separately for males and females. Studies designed to increase physical activity and having reported intervention effects by sex or targeted males specifically will be discussed in this section. Through this approach, successful intervention elements for males will be identified and discussed. Interventions will be discussed under the headings of face-to-face interventions, group-based interventions, community-based interventions, internet-based interventions, and print based interventions.
2.2.1 Face-to-face interventions

One of the most commonly utilised modes of delivery for physical activity interventions is a face-to-face approach. While this approach is favourable, and enables researchers to build a rapport with participants, it can be quite costly and time-consuming (Steele, Mummery, & Dwyer, 2009), so is not always feasible, particularly in large-scale studies. Face-to-face physical activity intervention studies are summarised in Table 2.1.
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
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</table>
| Swinburn et al. (1998)                    | 456 sedentary adults (175 men) | Face-to-face, Print-based | Physical activity                            | Intervention  
  - Green Prescription  
  - Questionnaire  
  - Verbal advice from General Practitioner (GP)  
  - Written advice based on goals  
 Control group  
  - Questionnaire  
  - Verbal advice on physical activity only (no written) | 6 weeks   | There was a significant increase in number of individuals in Green Prescription group participating in any recreational physical activity (p = 0.004).  
 Although not statistically significant, the number of individuals increasing their overall physical activity was higher in the Green Prescription group (78%) compared with the control group (65%).  
 A substantial increase in duration of physical activity was observed in both groups, and this increase was close to reaching significance in male participants. |
| The Writing Group for the Activity Counseling Trial Research Group (2001) | 874 inactive primary care patients without clinical CVD (479 men) | Face-to-face, Print-based | Maximal oxygen consumption (VO$_{2\text{max}}$)  
 Self-reported total physical activity | Advice group  
  - Physician advice on physical activity  
  - Existing educational materials provided  
  - Limited advice on physical activity from health educator  
 Assistance group  
  - Same as advice group  
  - Plus 30-40min counselling session, telephone call 1 week later, interactive mail, electronic step-counter | 24 months | No significant between-group differences in either VO$_{2\text{max}}$ or self-reported total physical activity were observed for male participants. |
Table 2.1 continued.

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<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
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<tbody>
<tr>
<td>Harrison et al. (2005)</td>
<td>545 sedentary adults (182 men) with additional CHD risk factors ≥ 18 years United Kingdom</td>
<td>Face-to-face, Print-based</td>
<td>Meeting physical activity target</td>
<td>Physical activity intervention: One 1-hour consultation with an exercise officer Tailored information provided Subsidised 12-week leisure pass to a local facility</td>
<td>12 weeks (with 6 and 12 month follow-up)</td>
<td>There were no significant interactions observed for sex. A non-significant increase of 5% was observed in intervention group, compared to the control group, for participation in ≥90 mins of moderate/vigorous physical activity/week (25.8% vs. 20.4%, p = 0.18) at 12-month follow-up. The intervention increased satisfaction with the information provided, but did not influence adherence with physical activity.</td>
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<td>Bolognesi et al. (2006)</td>
<td>96 Overweight or obese adults (45 men) 21-70 years Italy</td>
<td>Face-to-face</td>
<td>BMI Abdominal girth (waist circumference, WC) Stage of change of physical activity Self-efficacy</td>
<td>Physical activity intervention: PACE assessment GP delivered counselling based on stage of readiness for physical activity Individualised physical activity program</td>
<td>5-6 months</td>
<td>Male participants in the intervention group experienced a decrease in BMI and WC at follow-up (vs. baseline). More than 50% of non-active participants (at baseline) progressed to a more advanced stage of readiness for physical activity (at follow-up). Self-efficacy increased significantly in the intervention group, and the effect was stronger in male participants.</td>
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Table 2.1 continued next page.
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<th>Study</th>
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<th>Outcomes</th>
<th>Intervention details</th>
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<th>Main findings</th>
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<tbody>
<tr>
<td>Østerås and Hammer</td>
<td>● 131 healthy adults in sedentary work (80 men)</td>
<td>Face-to-face</td>
<td>Primary</td>
<td><strong>Physical activity intervention</strong>&lt;br&gt;Initial 30 min interview to identify obstacles and develop plan for individualised physical activity program&lt;br&gt;Follow-up counselling offered</td>
<td>6 months</td>
<td>● For male participants, significant increase in VO(_{2\text{max}}) were observed (p &lt; .001).&lt;br&gt;● Significant increases in levels of physical activity were observed for the intervention group (p &lt; .001).&lt;br&gt;● There were no significant changes in BMI or the number of days/week with a minimum of 10 mins of walking.</td>
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<td>● Mean age 41.2 ± 9.4 years</td>
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<td><strong>Cardiorespiratory capacity (VO(_{2\text{max}}))</strong></td>
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<td><strong>Diet</strong></td>
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<td>Coghill and Cooper</td>
<td>● 67 middle-aged, hypercholesterolemic males</td>
<td>Face-to-face</td>
<td><strong>BMI</strong></td>
<td><strong>Intervention group</strong>&lt;br&gt;Sustained walking program&lt;br&gt;Instructed to walk briskly for at least 30 mins on five or more days/week</td>
<td>12 weeks</td>
<td>● Compared to the control group, participants in the intervention group significantly improved TC/HDL-C (total cholesterol/high density lipoprotein cholesterol) and significantly reduced their weight and BMI.&lt;br&gt;● Compliance rate for the walking program was 97.6%.</td>
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<td></td>
<td>● Aged 45-65 years</td>
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<td><strong>Skin fold thickness</strong></td>
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<td>● England</td>
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Swinburn, Walter, Arroll, Tilyard and Russell (1998) examined the role of a “Green Prescription” on physical activity levels. A Green Prescription in this context is a physician-delivered written prescription of physical activity advice delivered through primary care settings. The Green Prescription scheme in New Zealand (the focus of this study) is a nationally funded scheme. In this study the intervention group received verbal physician advice plus written advice based on goals (Green Prescription) and the control group received verbal physician advice only. Significant increases in recreational physical activity were observed for the Green Prescription group and participation in overall physical activity was also increased in the Green Prescription group, although this increase was not statistically significant (Swinburn et al., 1998). A nonsignificant increase in the duration of physical activity was seen in both the Green Prescription and the control groups, and this was close to reaching statistical significance in male participants (Swinburn et al., 1998). Although not statistically significant, these results suggest that advice from reputable sources may be able to impact on the physical activity of males.

The Activity Counseling Trial (2001) compared three intervention groups in relation to increasing levels of physical activity: (1) an advice group, that received printed materials plus physician advice; (2) an assistance group, that received printed materials, physician counselling, interactive mail, and behavioural counselling; and (3) a counselling group, that received printed materials, physician counselling, interactive mail, behavioural counselling, regular telephone counselling, and behavioural classes. All three intervention groups were instructed to meet the same physical activity target, based on national physical activity guidelines for adults, and were encouraged to increase their physical activity levels gradually (The Writing
Group for the Activity Counseling Trial Research Group, 2001). The intervention ran over a 24-month period, with measurements taken at baseline, 6-, and 24-month time points. Mediators of physical activity participation were targeted using elements of Social Cognitive Theory, and the majority of the intervention, apart from the physician advice, was delivered by trained health educators in primary care settings. The authors reported no significant between-group differences in maximal oxygen consumption (VO$_{2\text{max}}$, assessed using a treadmill exercise test) or self-reported physical activity (assessed using the 7-day physical activity recall) for male participants (The Writing Group for the Activity Counseling Trial Research Group, 2001).

Harrison, Roberts and Elton (2005) randomly allocated 545 sedentary adults (182 males) to a physical activity intervention group that received advice on physical activity during a one-hour consultation with an exercise officer, a subsidised 12-week leisure pass, and a written information pack; or a control group receiving written information only. During the one-hour consultation, which was held at one of three leisure centres, participants were given individualised advice based on their preferences and abilities. During the 12-week intervention period, participants in the intervention group were encouraged to attend a minimum of two physical activity sessions at the leisure centre per week, and were also given additional information on other activities held outside the leisure centre, in the local area. At the end of the 12-week intervention period, participants no longer received the subsidy for the leisure centre, and were invited to attend an exit interview where physical activity progress was reviewed, and further opportunities for increasing or maintain physical activity were identified. No significant increases in physical activity were observed for male
or female participants at 12-month follow-up (Harrison et al., 2005). A particular strength of this study was the inclusion of a 9- and 12-month follow-up period, which allowed for examination of longer-term physical activity changes.

Bolognesi, Nigg, Massarini and Lippke (2006) examined the impact of a brief physical activity counselling program in overweight or obese adults (45 males) aged 21-70 years in a primary care setting. Participants assigned to the experimental group received the Patient-centered Assessment and Counseling for Exercise (PACE) protocol, which involved general practitioner (GP) counselling and development of a realistic exercise program, based on patients’ readiness to participate in physical activity. Participants in the usual care control group did not receive a PACE assessment, meaning that their GP did not have any information on their readiness for participation. Sessions with participants who were identified as “precontemplators” focused on identifying barriers related to participation in physical activity, as well as the benefits of physical activity and advantages of becoming physically active (Bolognesi et al., 2006). In addition to identifying potential barriers for physical activity participation, “contemplators” were asked to develop an achievable, “realistic” physical activity program detailing the types of activities, the duration for the activities, and any support they may need to successfully undertake their individualised program. On completion, both the GP and the participant signed the physical activity program as a way of committing to carrying it out and following through. “Contemplators” were then given a diary in which they recorded their physical activity participation (including type and time) and any issues or obstacles they experienced (Bolognesi et al., 2006).
Participants who were already physically active on a regular basis were congratulated and encouraged to continue to be active. These participants received information related to maintaining their physical activity level and ensuring they did not “relapse” by providing information on overcoming potential barriers. Compared to the usual care control group, participants in the experimental group decreased their BMI, and the effect was greater for males (Bolognesi et al., 2006). Experimental group participants also reduced their abdominal girth, and the majority of participants who were inactive at baseline, progressed to a more advanced stage of readiness for physical activity. Male participants in the experimental group also increased their self-efficacy.

Østerås and Hammer (2006) assessed the effectiveness of a pragmatic physical activity intervention (one face-to-face interview and an individualised physical activity program) in 131 healthy Norwegian adults (80 males). During interviews, participants identified obstacles and developed a plan for an individualised physical activity program and were offered follow-up counselling. Male participants significantly increased their cardiorespiratory capacity (VO2max), although no significant changes in BMI were observed for males. Changes in physical activity were reported only at the group level and were not separated for sex so potential differences in training effects cannot be determined. The experimental group did, however, significantly increase their level of physical activity (Østerås & Hammer, 2006). This individualised physical activity program produced promising results, although rather than including a control group, the experimental group was compared with the average population.
Coghill and Cooper (2008) assessed the effectiveness of a 12-week program of sustained walking paired with professional support in a sample of 67 middle-aged hypercholesterolemic, non-smoking males aged between 45 and 65 years. Although this program targeted males with an existing condition, it is one of the few intervention studies targeting males only, and may provide valuable insight into the development of male-centred programs. Participants were randomly allocated to one of two groups – an intervention group that was instructed to walk briskly for a minimum of 30 minutes on at least five days in a one-week period for a total of 12 weeks, or a control group that was instructed to maintain their current lifestyle. Prior to undertaking the program, participants in the intervention group were trained so they were able to “walk at an intensity equivalent to a RPE [rate of perceived exertion] of 12-14” (Coghill & Cooper, 2008, p. 546). All participants wore a Caltrac accelerometer and recorded their wear times, energy expenditure, and RPE for each bout of activity. Participants also met one-on-one with one of the researchers every four weeks to ensure they were continuing to participate and had the opportunity to address any issues regarding the program.

Compared to the control group, participants in the intervention group significantly improved TC/HDL-C (total cholesterol/high density lipoprotein cholesterol) and significantly reduced their weight and BMI (Coghill & Cooper, 2008). Physical activity was not a primary outcome of this study, although it is of interest to note that the compliance rate for the walking program was 97.6% (Coghill & Cooper, 2008). Considering the significant improvements in the aforementioned outcome measures, these findings suggest that participation in a sustained walking program has the potential to improve important lifestyle-related health outcomes that
are known risk factors for heart disease and type 2 diabetes.

After the study was completed (Coghill & Cooper, 2008), the authors carried out a subsequent qualitative study with a subsample of participants allocated to the intervention group (Coghill & Cooper, 2009). These participants were interviewed by telephone and were asked about motivating and de-motivating factors related to participation in physical activity. Participants identified that health was the primary motivator for participating in physical activity both during and after the trial. For participants who were no longer adhering to physical activity in this subsample, a “lack of continued professional support” was identified as one of the main reasons for their lack of adherence (Coghill & Cooper, 2009, p. 26). This finding highlights the importance of support when promoting physical activity.

Based on results from these face-to-face interventions described above, several elements appeared to be successful in terms of increasing physical activity levels or motivation for change. These included:

- Offering advice from a reliable source, such as general practitioners or health educators (Bolognesi et al., 2006; Swinburn et al., 1998).

- Guiding participants through the process of identifying and overcoming barriers (The Writing Group for the Activity Counseling Trial Research Group, 2001).

- Setting achievable goals (Bolognesi et al., 2006; Swinburn et al., 1998).

- Encouraging gradual increases in physical activity (The Writing Group for the Activity Counseling Trial Research Group, 2001).
• Demonstrating the correct or desired intensity of activity prior to the beginning of the program (Coghill & Cooper, 2008).

• Including one-on-one meetings with researchers or similar personnel (Coghill & Cooper, 2008).

2.2.2 Group-based interventions

Group-based approaches allow participants to share their experiences and progress with other participants in the study, which can provide a level of support and perhaps, friendly competition, camaraderie, and encouragement. The group-based physical activity interventions identified in the literature are summarised in Table 2.2.
Table 2.2  Summary of group-based physical activity intervention studies.

Table 2.2 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Dunn et al. (1999) | 235 healthy sedentary adults (116 men) | Group-based | Primary: • Physical activity  
• VO_{2peak}  
Secondary: • Plasma lipid and lipoprotein cholesterol concentrations  
• Blood pressure (BP)  
• Body composition | Structured exercise intervention  
• Traditional exercise prescription  
• Supervised  
• Offered 5 days/week for 6 months at fitness facility  
• Free membership  
• Attendance minimum of 3 sessions/week  
Lifestyle group (comparison)  
• 1-hour meeting held 1 night/week for first 16 weeks  
• 1 night/fortnight until week 24  
• Participants were encouraged to engage in physical activity  
• No supervised program | 24 months (6 months intensive intervention + 18 months maintenance) | 6 month results  
• Significant increase in energy expenditure (EE) and cardiorespiratory fitness in both treatment groups.  
• Male participants in the lifestyle group participated in over twice as many sessions of moderate intensity activities compared with males in the structured exercise group.  
• Male participants in the structured group participated in almost three times more “hard” activity, compared with those in the lifestyle group.  
• Males in the structured group had significantly higher VO_{2peak} compared with males in the lifestyle group.  
24 month results  
• Significant increase in EE for both structured (p<0.001) and lifestyle (p= 0.002) groups.  
• A reduction in cardiorespiratory fitness was observed in both groups between 6-24 months.  
• Similar increases in physical activity were observed at 6 months, and similar decreases were observed from 6-24 months, for both groups.  
• Greater increases in fitness and in total and vigorous physical activity seen in male participants, though not significant.  

Table 2.2 continued next page.
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaukiainen et al.</td>
<td>76 unemployed male construction workers</td>
<td>Group-based</td>
<td>Musculoskeletal symptoms, LTPA, Perceived work ability, Physical capacity, Aerobic capacity</td>
<td>Physical activity intervention: At beginning of program, two smaller groups, Identical exercise programs, 90min sessions of exercise, Held twice/week, Supervised by an Occupational Therapist</td>
<td>14 weeks</td>
<td>Statistically significant increases in LTPA, muscular fitness of back and upper extremities, and balance were observed in intervention group, compared with the control group. No significant change in perceived work ability.</td>
</tr>
<tr>
<td>Bjørgaas et al.</td>
<td>29 overweight Caucasian males with type 2 diabetes</td>
<td>Group-based</td>
<td>Step count, VO\textsubscript{max}, Body weight, HbA1c</td>
<td>Physical activity intervention: 1.5hr exercise sessions, Held twice/week, Supervised by a physiotherapist</td>
<td>12 weeks</td>
<td>Participants in the exercise group significantly increased pedometer activity and VO\textsubscript{max}, and significantly decreased weight and HbA1c.</td>
</tr>
</tbody>
</table>

Table 2.2 continued next page.
Table 2.2 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| McTiernan et al. (2007) | 202 sedentary/unfit adults (102 men)             | Group-based        | Moderate/vigorous recreational physical activity | **Physical activity intervention**  
- Moderate-vigorous intensity aerobic exercise  
- Step count  
- Aerobic capacity ($VO_{2\max}$)  
- Body weight  
- BMI  
- Waist circumference (WC)  
- Hip circumference (HC)  
- Body fat percentage  
- Intra-abdominal, subcutaneous and total abdominal fat | 12 months | Male and female participants significantly increased mean moderate-vigorous physical activity  
Male participants in intervention group increased $VO_{2\max}$ while $VO_{2\max}$ for male participants in the control group decreased  
82.3% of males in the intervention group met ≥80% of their physical activity goal (360min/week),  
27.5% of men in the intervention group met or exceeded their physical activity goal.  
Male participants in the intervention group completed 370 ± 86min/week of physical activity.  
Males in the intervention group lost 1.8 kg of body weight, compared with 0.1 kg in the control group.  
Males in the intervention group also reduced BMI by 0.5 kg/m² (no change in control participants).  
Reduction of 3.3 cm in WC for male intervention participants, compared with a loss of 0.4cm in controls.  
Total fat mass decreased by 3.0kg in intervention males, compared with a gain of 0.2kg in controls. |
Dunn et al. (1999) recruited 235 healthy, sedentary, middle-aged adults (116 males) for a 24-month physical activity intervention. During the first six months, participants in the Structured Exercise group received a traditional physical activity prescription – “exercise intensity of 50%-85% of maximal aerobic power for 20-60 minutes” (Dunn et al., 1999, p. 329), were given a free membership to a fitness facility, and were offered supervised visits three to five days per week for the duration of the six-month intensive intervention period. This was compared to a Lifestyle group, where participants were encouraged to increase physical activity to meet recommended levels (minimum of 30 minutes of moderate-intensity activity on most, preferably all days each week). For the first 16 weeks of the program, participants assigned to the lifestyle group met in small groups for one hour each week to learn about behavioural strategies to increase physical activity (Dunn et al., 1999). From week 17 to week 24, meetings were held every second week, and unlike participants in the Structured group, those in the Lifestyle group did not receive free membership to the fitness facility or supervised sessions (Dunn et al., 1999). Participant input into the development of the structured exercise group may have influenced the increase in levels of physical activity during the six-month intervention stage. At six-month follow-up, both groups increased energy expenditure and cardiorespiratory fitness, although a decrease in these levels occurred between the six- and 24-month assessment points. These reductions may have occurred due to the substantial decrease in face-to-face and group-based contact during the latter stages of the intervention (Dunn et al., 1999).

Kaukiainen, Nygard, Virtanen and Saloniemi (2002) also delivered a male-only physical activity intervention. The intervention ran for 14 weeks and compared
a physical activity group receiving participating in supervised exercise sessions, held twice per week, to a control group, that attended two meetings and did not receive any physical activity guidance. For the first four weeks of the intervention, the physical activity group was divided into two smaller groups, that both participated in 90-minute sessions of physical activity, supervised by an occupational therapist. The groups were then combined into one larger group, and the supervised sessions ran for two hours (Kaukiainen et al., 2002). Each session focused on a specific theme (e.g., one session focused on exercises targeting the back, one focused on targeting the neck, etc.) and included a warm-up, followed by mobility and strength exercises, and a final stretching activity. Other activities such as swimming, volleyball, and badminton were gradually introduced, and the group spent approximately 15-20 minutes discussing body structure and function, and participation in activities during leisure time, and a progressive increase in physical activity intensity was encouraged (Kaukiainen et al., 2002). The authors noted a substantial decline in the number of participants attending the physical activity sessions. A total of 20 participants attended the sessions during the first month of the intervention, although this decreased to only 10 participants in the last month of the intervention. Compared to the control group, men in the intervention group reported significant increases in leisure time physical activity, muscular fitness, and balance (Kaukiainen et al., 2002).

Another study to utilise a group-based approach to increase physical activity compared a program of 1.5 hour exercise sessions held twice per week, and supervised by a physiotherapist, to a no treatment control group (Bjørgaas et al., 2005). A total of 29 overweight Caucasian males with type 2 diabetes mellitus
participated in this 12-week, group-based study. During the supervised exercise sessions, participants in the exercise group undertook a 15-minute warm-up, followed by 45 minutes of aerobic exercise at 50-80% of their maximum heart rate, 15 minutes of resistance exercise, and a 15-minute cool-down. Pedometer-measured activity was not recorded on days when participants attended the supervised exercise sessions (Bjørgaas et al., 2005). Compared with the control group, participants in the exercise group significantly increased pedometer activity and VO$_{2\text{max}}$, and significantly decreased body weight and haemoglobin A1c (HbA1c). It should be noted, however, that the sample size for this study was quite small. In addition, no further follow-up sessions were carried out, so the longer-term effects of this intervention cannot be established.

McTiernan and colleagues (2007) assessed the effectiveness of a 12-month physical activity intervention in 202 sedentary, unfit adults (102 males) aged between 40-70 years. The intervention group participated in a program of 60 minutes of moderate-to-vigorous physical activity (MVPA) on 6 days per week, which was achieved gradually over the first 12 weeks of the intervention. An exercise specialist facilitated sessions across four facilities on three days each week, and participants were asked to maintain the same intensity and duration as their supervised sessions while exercising at home or at the gym for an additional three days each week (McTiernan et al., 2007). To encourage participation and progress, participants also received regular exercise monitoring, feedback, and newsletters, and were invited to attend regular meetings and group events (McTiernan et al., 2007). Participants assigned to the control group did not make any changes to their physical activity levels or dietary intake over the intervention period and participated in quarterly
physical activity interviews. Once all data were collected, control group participants were invited to participate in exercise classes for a two-month period (McTiernan et al., 2007). When stratified by sex, results showed that 82.3% of male participants met the physical activity goal of 360 minutes per week over the intervention period. Male participants also reduced their BMI, waist circumference, and hip circumference (McTiernan et al., 2007).

Several of these group-based intervention studies demonstrated increases in physical activity. Successful intervention elements identified within these studies include:

- Delivering male-only interventions (Bjørgaas et al., 2005; Kaukiainen et al., 2002).
- Providing supervised physical activity sessions (Bjørgaas et al., 2005; Kaukiainen et al., 2002; McTiernan et al., 2007).
- Encouraging gradual increases in physical activity (McTiernan et al., 2007).
- Including one-on-one meetings with researchers or similar personnel (McTiernan et al., 2007).

2.2.3 Community-based interventions

Interventions based in a community setting can reach a substantial number of people and can encourage ownership and community spirit, yet there is a lack of, and a need for, sustainable community-based physical activity interventions (Prohaska et al., 2006). Although these types of interventions can also be delivered using face-to-face or group-based methods, the following interventions have been identified as
community-based interventions as they were delivered at the community level as opposed to being delivered at a more individual or group-based level. The community-based physical activity interventions identified in the literature are summarised in Table 2.3.
Table 2.3 Summary of community-based physical activity intervention studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown et al. (2006)</td>
<td>• Whole of community – (1,235 men) • ≥18 years • Australia</td>
<td>Community-based</td>
<td>• Level of physical activity • Step count</td>
<td><strong>Physical activity intervention</strong> • 10,000 Steps Rockhampton, Queensland • Pedometers to increase steps • Social marketing • Provision of physical activity advice from health professionals • Environmental support strategies used as intervention strategies</td>
<td>2 years</td>
<td>• Female participants were the “early adopters” with an increase in the proportion of “active” participants of 5%. • There was a 4.2% decrease in the proportion of “active” male participants in the intervention community. • There was an 8.9% decrease in the proportion of “active” male participants in the control community. • It appears that the 10,000 Steps intervention did not appeal to males.</td>
</tr>
<tr>
<td>De Cocker et al. (2007)</td>
<td>• 1,294 randomly selected adults (605 men) • 25-75 years • Belgium</td>
<td>Community-based</td>
<td>• Physical activity, including work, transportation, domestic, gardening and leisure-time physical activity (LTPA) • Step count • Awareness of project</td>
<td><strong>Physical activity intervention</strong> • Whole of community • Ghent, intervention community • Promoted 10,000 steps/day and meeting national physical activity guidelines</td>
<td>1 year</td>
<td>• Nearly half of intervention participants increased their steps/day (minimum increase of 896 steps/day). • Control participants reduced their steps/day by around 135 steps/day. • Male participants: average steps/day increased significantly ((p = .001)) • Participants in the following age groups also significantly increased steps/day: 25-45 years ((p=0.029)), 46-65 years ((p=0.009)), and 66-75 years ((p=0.002)). • Awareness of the intervention was higher in the intervention community compared to the control (63% vs. 10%, respectively) and female participants (compared with males).</td>
</tr>
</tbody>
</table>
Brown, Mummery, Eakin and Schofield (2006) and De Cocker, De Bourdeaudhuji, Brown and Cardon (2007) conducted community-based, multiple strategy interventions. Participants in both of these studies wore pedometers to measure daily step counts and were encouraged to meet a 10,000 steps per-day recommendation to increase physical activity.

Brown et al. (2006) implemented their 10,000 Steps per day intervention in the Australian community of Rockhampton, Queensland (1,235 male participants from the whole community). In addition to encouraging participants to reach 10,000 steps per day, this intervention also included social marketing, physical activity advice from health professionals, and environmental support strategies to encourage physical activity in the community (Brown et al., 2006). The study was implemented in several ways: through marketing strategies including radio, television, and print campaigns; by promoting the study through GPs; and by enhancing the local environment (e.g., repairing footpaths, installing maps and signs). Additionally, a dedicated “Local Physical Activity Taskforce” was established at the beginning of the intervention to ensure that the study would be relevant in the Rockhampton community (Brown et al., 2006, p. 3).

Results from the Rockhampton community were compared to a control community (Mackay, Queensland) that received no intervention. Interestingly, there was a reduction (albeit nonsignificant) in the proportion of males classified as “active” (those meeting recommended levels of physical activity based on the Australian physical activity guidelines) in both the intervention (−4.2%) and control (−8.9%) communities at two-year follow-up (Brown et al., 2006). Although the results from the study by De Cocker et al. (2007) showed a significant increase in
steps per day for male participants, it appears that the 10,000 Steps intervention did not appeal to male participants in the Australian study (Brown et al., 2006).

As a follow-up, a focus group study was carried out to investigate middle-aged males’ reactions to the strategies used in the 10,000 Steps Rockhampton intervention, as well as their perceptions of physical activity recommendations and related topics (Burton, Walsh, & Brown, 2008). In relation to participation in the 10,000 Steps intervention, although some males revealed that wearing a pedometer motivated them to increase their daily step count, the majority of males did not like the idea of wearing a pedometer for longer than a few weeks (Burton et al., 2008). For some participants, this was because they reported that they would gradually get to know how much walking was required to reach 10,000 steps and wouldn’t need to rely on the pedometer to monitor this (Burton et al., 2008). The majority of male participants in the focus group study also reported that they disliked the 10,000 Steps message that was promoted throughout the intervention, and felt that encouraging 30 minutes of physical activity each day sounded more appealing and more achievable (Burton et al., 2008). In order to increase motivation and participation, a number of strategies were suggested, including, introducing regular health check-ups at work, providing facilities in workplaces to encourage physical activity, and providing greater opportunities for physical activity in friendly, yet competitive atmospheres (Burton et al., 2008).

De Cocker et al. (2007) promoted the 10,000 steps recommendation in Ghent, Belgium, and a total of 1,294 adults (605 males) participated. This study was based closely on the 10,000 Steps Rockhampton study (Brown et al., 2006), using similar strategies from the social ecologic model. The 10,000 Steps message was promoted
to all adults in the Ghent community, and the study was implemented within the community in several ways: through local media and press conferences; through a dedicated project website; using street signs and walking circuits; selling and loaning pedometers in the community; disseminating project kits to workplaces and clubs or services for older adults; and by disseminating flyers and additional information to all schools, GPs, dieticians, physical therapists, and local associations. Results from the Ghent community were compared to a control community that received no intervention. After one year, 48% of participants in the intervention community increased their steps by at least 896 steps per day, compared with participants in the control community who decreased their daily steps by approximately 135 steps per day. Average steps per day increased significantly in male and female participants (De Cocker et al., 2007).

Although similar, these two community-based, multicomponent interventions utilising pedometers and encouraging a 10,000 steps recommendation, produced mixed results. The study by De Cocker et al. (2007) showed promising results, and demonstrated a significant increase in steps per day for male participants, while the study by Brown et al. (2006) found that male participants became less active. It should be noted that the Brown et al. (2006) study did, however, conduct follow-up measurements two years after baseline, while the De Cocker (2007) study reported one-year follow-up findings, so longer term results of the latter study cannot be established.

2.2.4 Internet-based interventions

Internet technology is rapidly developing and has the potential to reach large numbers of people, including those who are from typically hard-to-reach population
groups (Vandelanotte et al., 2007). Although the results of internet-based behaviour change interventions appear promising, attrition rates tend to be quite high (Eysenbach, 2005; Neve, Morgan, Jones, & Collins, 2010). The Internet-based physical activity intervention studies identified in the literature are summarised in Table 2.4.
Table 2.4 Summary of internet-based physical activity intervention studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buis et al. (2009)</td>
<td>● 7,483 adults (1,853 males)</td>
<td>Internet-based</td>
<td>● Health status</td>
<td>Physical activity intervention</td>
<td>8 weeks</td>
<td>● Males less likely to join up to website compare with women who made up 75% of the sample.</td>
</tr>
<tr>
<td></td>
<td>● Primarily 18-59 years (4% aged ≥60)</td>
<td></td>
<td>● BMI</td>
<td>Active U</td>
<td></td>
<td>● Males also slightly less likely to join up to a competitive team (69% vs. 75% women).</td>
</tr>
<tr>
<td></td>
<td>● United States</td>
<td></td>
<td>● Weekly physical activity</td>
<td>Internet-based physical activity program</td>
<td></td>
<td>● The proportion of participants meeting physical activity goals was significantly higher in competitive teams (p &lt; 0.001).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Conducted during winter, free of charge.</td>
<td></td>
<td>● Sex was not a significant predictor of meeting physical activity goals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Participants received weekly email newsletters with content developed by health promotion experts</td>
<td></td>
<td>● Participation for online program decreased after week 3 of the 8 week program.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No control group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leahey et al. (2009)</td>
<td>● 5,333 adults (877 males)</td>
<td>Internet-based,</td>
<td>● Step counts</td>
<td>Physical activity intervention</td>
<td>16 weeks</td>
<td>● Intention-to-treat (ITT) analysis – physical activity increased for intervention completers (average 3,085 steps/day).</td>
</tr>
<tr>
<td></td>
<td>● ≥18 years</td>
<td>Community-based</td>
<td></td>
<td>Shape Up Rhode Island</td>
<td></td>
<td>● Reduction in proportion of participants classified as sedentary, low active or somewhat active at baseline, from 84% to 61%.</td>
</tr>
<tr>
<td></td>
<td>● United States</td>
<td></td>
<td></td>
<td>Team-based</td>
<td></td>
<td>● Increase in proportion of participants classified as active at baseline, from 16% to 40%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Online competition</td>
<td></td>
<td>● Step change was greater for male participants (p = 0.02), for less overweight individuals (p = 0.03) and those whose company paid for enrolment into the program (p = 0.05).</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No control group</td>
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</tbody>
</table>

Table 2.4 continued next page.
Table 2.4 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilson et al. (2013)</td>
<td>• 390 “lower active” participants (100 males) from a university setting</td>
<td>Internet-based</td>
<td>Workday step counts</td>
<td><strong>Intervention group</strong>&lt;br&gt;• First phase – increase daily step counts by 1,000 steps above initial baseline step counts.&lt;br&gt;• Second phase – short walks during the day to increase their step counts by 2,000 above baseline&lt;br&gt;• Third phase - encouraged longer walks of a higher intensity to increase step counts by 3,000 steps above baseline levels</td>
<td>6 weeks</td>
<td>• At 3-month follow-up, participants increased their workday walking by around 25% compared with initial baseline step counts.&lt;br&gt;• Those with the lowest step counts at baseline showed the greatest improvements with those deemed “inactive” at baseline increasing their walking by 49%&lt;br&gt;• No significant differences in step counts observed by sex, although participants in this study were predominantly females (~74%).</td>
</tr>
<tr>
<td></td>
<td>• Aged 45.6±10.8 years&lt;br&gt;• Australia, Canada, Northern Ireland, and United States</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No control group</td>
<td></td>
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</tbody>
</table>
The Active U intervention was an eight-week online physical activity program targeting staff and graduate students in a university setting (Buis et al., 2009). Participants registered individually and were also given the option of joining a competitive team. Each week, competitive teams were ranked according to the number of team members meeting their physical activity goals, and the rankings were published in a motivational newsletter designed to support participation, provide information on health and physical activity, and act as a friendly reminder to log their activity. Participants could select from 27 different physical activities for which they could set goals and track progress (Buis et al., 2009). In this study, it was found that physical activity levels increased initially, but then decreased after week three of the program, possibly suggesting that participants were not engaging with the online content. Sex of the participants was not associated with likelihood of achieving weekly physical activity goals, although it was found that participants who were members of competitive teams were more likely to meet their physical activity goals. Although this finding was not solely related to male participants, this may lend support to the notion that males respond to a degree of friendly competition (Burton et al., 2008; King, 1998). This study reported a large drop-out rate, particularly in male participants (Buis et al., 2009), which is not uncommon to internet-based health interventions (Eysenbach, 2005; Neve et al., 2010). This large drop-out could have influenced the findings of the study.

The 16-week Shape Up Rhode Island campaign was another internet-based physical activity intervention that incorporated a team-based component (Leahey et al., 2010). In a similar approach to that taken by Buis et al. (2009), participants could set individual goals and contribute to team goals, which were set by team captains.
(Leahey et al., 2010). The 16-week competition included eight two-week rounds, and participants were required to record their total step count at the end of each two-week period. Based on the step counts recorded online, feedback was given to participants in relation to their personal and team goals through the online system (Leahey et al., 2010). Male participants in the Shape Up Rhode Island intervention reported a greater increase in their daily step count than females. In line with other pedometer-based interventions (Brown et al., 2006; Gilson et al., 2013), however, only a small proportion of participants (16%) were male (Leahey et al., 2010).

Gilson et al. (2013) implemented an internet-based walking intervention titled Walk@Work with 390 “lower active” participants (100 males) who were not achieving 10,000 steps per day. Both academic (faculty) and administrative staff members were recruited from five university campuses from four different countries (Australia, Canada, Northern Ireland, and the United States) and were given a pedometer and access to an online program. The pedometer was only worn for the duration of the participants’ workday. In the first phase of the intervention, participants were asked to increase their daily step counts by 1,000 steps above initial baseline step counts. This phase focused primarily on increasing incidental activity during the workday and participants received ideas and tips to increase steps through the website, throughout the six-week program. The second phase of the intervention encouraged participants to look for opportunities to take short walks during the day to increase their step counts by 2,000 above baseline, while phase three encouraged participation in longer walks of a higher intensity to increase step counts by 3,000 steps above baseline levels (Gilson et al., 2013). At follow-up (three months after baseline), participants increased their workday walking by around 25% compared
with initial baseline step counts, and those with the lowest step counts at baseline showed the greatest improvements with those deemed “inactive” at baseline increasing their walking by 49%. There were no significant differences in step counts observed by sex, although participants in this study were predominantly females (~74%). Although these findings demonstrate that an automated internet-based program can increase workday step counts in university employees, the authors noted that “men seemed reluctant to participate” (Gilson et al., 2013, p. 286), suggesting that this type of intervention may not have appealed to male participants. This lends support to the findings of another intervention study designed to increase step counts (Brown et al., 2006), which found that a pedometer-based, walking intervention did not attract or retain as many male participants.

Although these internet-based interventions described above included a smaller proportion of male participants (compared to female participants), some intervention elements appeared to have some success in terms of increasing physical activity. These included:

- Being a member of a competitive team (Buis et al., 2009).
- Having the option of setting either individual or team-based physical activity goals (Buis et al., 2009; Leahey et al., 2010).
- Encouraging gradual increases in physical activity (Gilson et al., 2013).

### 2.2.5 Print-based interventions

Another method by which physical activity can be promoted is by using print-based materials. Printed materials can be relatively cost-effective to distribute, and have the potential to reach large numbers of participants, hence their wide-scale usage in health promotion initiatives. In large-scale initiatives, generic printed
materials are often developed to reach and appeal to broad populations, while smaller programs may utilise tailored materials to appeal to specific population groups, or individuals. The print-based physical activity intervention studies identified in the literature are summarised in Table 2.5.
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Swinburn et al. (1998)                    | • 456 sedentary adults (175 men)                                             | Face-to-face, Print-based           | Physical activity                 | **Intervention**  
  • Green Prescription  
  • Questionnaire  
  • Verbal advice from GP  
  • Written advice based on goals  

**Control group**  
• Questionnaire  
• Verbal advice on physical activity only (no written)  

**Main findings**  
• There was a significant increase in number of individuals in Green Prescription group participating in any recreational physical activity (p = 0.004).  
• Although not statistically significant, the number of individuals increasing their overall physical activity was higher in the Green Prescription group (78%) compared with the control group (65%).  
• A substantial increase in duration of physical activity was observed in both groups, and this increase was close to reaching significance in male participants. |
| The Writing Group for the Activity Counseling Trial Research Group (2001) | • 874 inactive primary care patients without clinical CVD (479 men)          | Print-based, Face-to-face           | VO$_{2max}$                      | **Advice group**  
  • Physician advice on physical activity  
  • Existing educational materials  
  • Limited advice on physical activity from health educator  

**Assistance group**  
• Same as advice group  
• Plus 30-40min counselling session, telephone call 1 week later, interactive mail, electronic step-counter  

**Counselling group**  
• Same as assistance group  
• Plus regular telephone counselling, weekly classes on behavioural skills  

**Main findings**  
• No significant between-group differences in either VO$_{2max}$ or self-reported total physical activity were observed for male participants. | 24 months |  

*Table 2.5 continued next page.*
Table 2.5 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harrison et al. (2005)</td>
<td>● 545 sedentary adults (182 men) with additional CHD risk factors</td>
<td>Print-based, Face-to-face</td>
<td>● Meeting physical activity target</td>
<td><strong>Physical activity intervention</strong>&lt;br&gt;- One 1-hour consultation with an exercise officer&lt;br&gt;- Tailored information provided&lt;br&gt;- Subsidised 12 week leisure pass to a local facility</td>
<td>12 weeks (with 6 and 12 month follow-up)</td>
<td>● There were no significant interactions observed for sex.&lt;br&gt;● A non-significant increase of 5% was observed in intervention group, compared to the written information group, for participation in ≥90 mins of moderate/vigorous physical activity/week (25.8% vs. 20.4%, p = 0.18) at 12-month follow-up.&lt;br&gt;● The intervention increased satisfaction with the information provided, but did not influence adherence with physical activity.</td>
</tr>
<tr>
<td></td>
<td>● ≥18 years&lt;br&gt;● United Kingdom</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Plotnikoff et al. (2007)</td>
<td>● 507 adults (136 men) Mean age approx. 43.4 (± 9 years) Canada</td>
<td>Print-based</td>
<td>● Levels of physical activity&lt;br&gt;Stages of change for physical activity</td>
<td><strong>Stage-matched materials intervention</strong>&lt;br&gt;- Five motivationally targeted stage-matched materials on physical activity&lt;br&gt;<strong>Standard intervention</strong>&lt;br&gt;- Two generic publications on physical activity&lt;br&gt;<strong>Control group</strong>&lt;br&gt;- No intervention materials provided)</td>
<td>12 months</td>
<td>From baseline, mean weekly MET mins of combined moderate and vigorous physical activity increased by 223 mins for stage-matched group, by 67 mins for the standard intervention group, and 78 mins for the control group.&lt;br&gt;There were no significant differences in weekly MET mins for male participants among the three treatment groups.</td>
</tr>
</tbody>
</table>
Three studies which have been discussed previously in this chapter also incorporated a print-based component (Harrison et al., 2005; Swinburn et al., 1998; The Writing Group for the Activity Counseling Trial Research Group, 2001). In the study by Harrison et al. (2005), participants in the intervention group received a one-hour individualised consultation with an exercise officer, a subsidised pass to a leisure centre and written information, while participants in the control group received written information only. No significant increases in physical activity were observed for male or female participants (Harrison et al., 2005). In the Green Prescription study (Swinburn et al., 1998), the intervention group received written material on their individualised goals in addition to verbal advice from their physician (Swinburn et al., 1998), while those allocated to the control group received verbal physician advice only. There was a significant increase in the number of participants in the intervention (Green Prescription) group participating in any recreational physical activity at six-week follow-up. A print-based component was also included in the Activity Counseling Trial, with all participants in the three intervention groups receiving existing printed material on physical activity (The Writing Group for the Activity Counseling Trial Research Group, 2001). No significant between-group differences were observed for physical activity outcomes (The Writing Group for the Activity Counseling Trial Research Group, 2001).

Plotnikoff et al. (2007) assessed the effectiveness of stage-matched printed materials (stage-matched intervention) based on the Transtheoretical Model (Prochaska & Velicer, 1997), compared with generic printed materials on physical activity (standard intervention) and a no treatment control group. A total of 507 participants (136 males) were randomly allocated to one of the three groups. The
stage-matched group received five motivationally targeted, stage-matched booklets on physical activity behaviours across three time-points (baseline, three-, and six-months). Stage of physical activity level change was assessed via self-administered questionnaire (Plotnikoff et al., 2007). Participants in the standard intervention group received a generic handbook developed by Health Canada, a brief guide on targets and advice for increasing physical activity, and an additional generic handbook (Plotnikoff et al., 2007). This print-based study did not include any face-to-face components as other studies with print-based components have (Harrison et al., 2005; Swinburn et al., 1998; The Writing Group for the Activity Counseling Trial Research Group, 2001). At 12-month follow-up, no significant differences were observed for weekly MET minutes of physical activity among males in any of the three groups in this study (Plotnikoff et al., 2007).

Of the studies discussed that used a print-based component, only the study by Swinburn et al. (1998) resulted in increases in physical activity. Seemingly effective intervention elements included in this study were:

- Providing physical activity advice from a trusted source (Swinburn et al., 1998).
- Offering advice in both a verbal and written format, as opposed to one or the other (Swinburn et al., 1998).
- Tailoring advice for each individual participant (Swinburn et al., 1998).
2.3 Intervention studies targeting both physical activity and nutrition behaviours

Although the focus of this literature review is on interventions targeting physical activity and sedentary behaviour, intervention studies often target multiple lifestyle behaviours. Two such behaviours that are commonly targeted concurrently are physical activity and nutrition behaviours. Interventions that have incorporated a physical activity element and have assessed changes in physical activity outcomes, in addition to nutritional behaviours, will be discussed in this section.

2.3.1 Face-to-face interventions

Only a small number of face-to-face physical activity and nutrition intervention studies have been identified in the literature and are summarised in Table 2.6.
### Table 2.6 Summary of face-to-face intervention studies targeting both physical activity and nutrition behaviours.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pritchard et al. (1997)</td>
<td>• 58 overweight men</td>
<td>Face-to-face, Print-based</td>
<td>• Body weight</td>
<td>Weight loss through diet group</td>
<td>12 months</td>
<td>• A significant between-group difference was observed for physical activity.</td>
</tr>
<tr>
<td></td>
<td>• Mean 43.4 (± 5.7 years)</td>
<td></td>
<td>• Total and regional fat mass and lean mass</td>
<td>• Personalised dietary plan</td>
<td></td>
<td>• There were no long-term improvements observed for weight maintenance.</td>
</tr>
<tr>
<td></td>
<td>• Australia</td>
<td></td>
<td>• Energy intake (kcal)</td>
<td>• Low-fat diet</td>
<td></td>
<td>• Adherence to the prescribed exercise frequency was relatively poor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Percentage dietary fat</td>
<td>• Printed material</td>
<td></td>
<td>• For the exercise group, the mean weight loss was 2.6 ± 3.0 kg, and 80% of the total weight loss was fat (limb lean tissue maintained).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Physical activity</td>
<td>• No change in physical activity</td>
<td></td>
<td>• For the diet group, the mean weight loss was 6.4 ± 3.3 kg, and 40% of the total weight loss was lean tissue.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Weight loss through exercise group</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• Individualised physical activity program</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• 3 sessions/week</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• 30 min sessions</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• No change in diet</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Control group</strong></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Monthly weight-monitoring sessions</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Followed usual pattern of physical activity and dietary intake</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bimonthly breakfast/lunch meetings available to all groups.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Guest speakers or health information provided</td>
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</tbody>
</table>

*Table 2.6 continued next page.*
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Arao et al. (2007) | 177 men with risk factors for chronic disease, 40-59 years, Japan | Face-to-face, Print-based                  | leisure time exercise energy expenditure (LEEE), VO₂max, Dietary habits, BMI, BP, Blood glucose, Lipid parameters | LiSM-PAN (Life Style Modification Program for Physical Activity and Diet) Intervention  | 6 months | - Participants in the intervention group experienced a significantly greater positive changes in LEEE.  
- The mean inter-group difference was 400.6 kcal/week, 95% CI: 126.1, 675.0 kcal/week.  
- No mean inter-group differences for dietary habits.  
- Significantly greater decreases in BMI, SBP, LDL in intervention participants compared with control participants. |

**Control group**  
- Written feedback and recommendations  
- Printed physical activity and nutrition materials  
- No counselling or environmental/social support
Rather than targeting physical activity and dietary behaviours in one combined intervention, Pritchard, Nowson, and Wark (1997) compared an exercise weight-loss program to a dietary weight-loss program in 58 overweight middle-aged Australian males. Participants assigned to the exercise group were asked to choose a physical activity program to be completed in leisure time, for at least three 30-minute sessions each week. Participants were instructed to exercise at 65-75% of their maximum heart rate, which had been determined prior to the intervention, and were asked not to change their food intake.

The diet group followed an individualised low-fat diet plan, were given a copy of a printed weight loss guide, were instructed not to increase their physical activity levels over the course of the intervention, and attended monthly weight monitoring sessions. The two intervention groups were compared to a control group, where participants were asked to maintain their physical activity and dietary behaviours and attended one weight monitoring session each month (Pritchard et al., 1997). Group breakfast or lunch meetings on physical activity, nutrition, and health were held bimonthly and participants from all three groups were invited to attend. For the duration of the intervention, participants kept food records and physical activity logs, and body composition was measured using a whole body x-ray densitometer. Both intervention groups decreased their body weight over the 12-month intervention, and although the diet group lost more weight (-6.4±3.3kg) than the exercise group (-2.6±3.0kg), the exercise group lost a greater proportion of fat than the diet group (Pritchard et al., 1997).

A face-to-face approach was, again, one of the most popular approaches to increasing physical activity and improving nutrition. Arao et al. (2007), for example, compared the Life Style Modification Program for Physical Activity and Diet
(LiSM-PAN) intervention group to a control group that received written physical activity and dietary advice only. This intervention targeted middle-aged male employees (n = 177) from two Japanese companies. The intervention group received five 10-minute sessions of individual counselling each month and advice on goal setting was based on the individual’s stage of change. In addition to the counselling component, environmental and social support components were also introduced to support behaviour change. Specifically for the physical activity aspect of the intervention, the environmental support component involved creating a walking course and installing exercise facilities at the participants’ workplaces. Strategies related to the dietary aspect of the intervention involved encouraging the cafeteria manager to offer more nutritious options and displaying the caloric content of items on the cafeteria menu (Arao et al., 2007).

The social support component focused on involving participants’ families. For example, intervention participants were encouraged to identify and discuss health problems and potential strategies for improvement with their families and select an exercise program that could be completed with their spouse or family members (Arao et al., 2007). The combination of individualised counselling, encouragement and support from participants’ families and employers produced positive results. Relative to the control group at the end of the 6-month intervention, the intervention group significantly increased their leisure-time exercise, energy expenditure and reduced their BMI. Unfortunately, Arao et al. (2007) did not conduct any further follow-up measurements, making it difficult to evaluate any longer term effects of this intervention.

Effective intervention elements implemented in these face-to-face interventions targeting both physical activity and nutrition include:
• Providing individualised counselling (Arao et al., 2007).
• Gaining support from participants’ employers for a workplace-based program (Arao et al., 2007).
• Encouraging participants to gain support from their families (Arao et al., 2007).
• Assigning a prescribed exercise intensity before the program (Pritchard et al., 1997).
• Allowing participants to choose their own physical activity program to follow (Pritchard et al., 1997).

2.3.2 Group-based interventions

As with interventions focusing on physical activity alone, group-based interventions that targeted both physical activity and nutrition interventions concurrently have been identified in the literature (Table 2.7).
### Table 2.7 Summary of group-based intervention studies targeting both physical activity and nutrition behaviours.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borg et al. (2002)</td>
<td>90 healthy, obese men, 35-50 years, Finland</td>
<td>Group-based</td>
<td>Body weight, Body composition, Body fat mass, WC, Waist-to-hip ratio</td>
<td><strong>Weight reduction intervention</strong>&lt;br&gt;• Two months, low-energy diet (LED) and very-low-energy diet (VLED)&lt;br&gt;• Small meetings led by a nutritionist&lt;br&gt;• Regular weighing&lt;br&gt;<strong>Weight maintenance phase</strong>&lt;br&gt;• Two exercise groups&lt;br&gt;• 45min sessions&lt;br&gt;• Held 3 times/week&lt;br&gt;• Supervised once/week by an exercise instructor</td>
<td>31 months (2 months intervention, 6 months weight maintenance, 23 months follow-up)</td>
<td>• Weight regain occurred during follow-up and at end of study.&lt;br&gt;• Exercise training did not improve short-term or long-term weight management, compared to control.&lt;br&gt;• Resistance training attenuated regain of body fat mass during weight management, but not during follow-up.&lt;br&gt;• Energy expenditure of 10.1 MJ/week was associated with maintaining weight after weight loss.&lt;br&gt;• Change in physical activity not an outcome for this study.</td>
</tr>
<tr>
<td>Aoun et al. (2009)</td>
<td>750 men from 23 Rotary clubs, Aged 39-87 years, Australia</td>
<td>Community-based, Group-based</td>
<td>Primary: Body weight, Waist circumference</td>
<td><strong>Intervention Level 1: Educational Presentations.</strong>&lt;br&gt;• Three educational presentations on nutrition, physical activity and healthy lifestyle&lt;br&gt;• Delivered during regular club meetings by specialists (e.g. health service dieticians, lecturers, physiotherapists).</td>
<td>12 months</td>
<td>• Approx. 30% of participants greatly increased awareness of foods high in fat and calories. 32% partly increased awareness.&lt;br&gt;• 50% were very much aware of how to lose weight with nutrition. 42% were partly aware.&lt;br&gt;• 50% of participants became greatly aware and 50% became partly aware of how physical activity could help.&lt;br&gt;• 43% of participants were very motivated to increase physical activity and 38% were aware of how to lose weight with physical activity.</td>
</tr>
</tbody>
</table>
### Table 2.7 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
|       |              |                     | • Cholesterol  
• BP  
• Glucose levels  
• Quality of life  
• Self-reported general health | • Presentations on: overview of the challenge, various aspects of nutrition and physical activity, and goal setting.  
**Intervention Level 2: BMI Monitoring/Competition. (Weight and height measured and recorded monthly, competition between Rotary clubs)**  
• Two volunteers recorded weight (kg) and height (cm) and recorded monthly  
• Club with highest reduction in BMI for month were awarded the ‘Waist Disposal’ trophy  
**Intervention Level 3: Telephone Lifestyle Coaching**  
• For participants with baseline BMI of ≥ 27  
• Four telephone calls  
• Individually-tailored weight loss program developed and coaching contract drawn up to increase ownership and commitment to reach goals.  
• Participants encouraged to | | | 53% of participants decreased their BMI later in BMI competition (34% earlier in competition).  
3% of participants had no change in BMI later in competition (23% earlier in competition).  
Approx. 40% of participants experienced a weight increase in both the earlier and later stages of the BMI competition.  

*Table 2.7 continued next page.*
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>visit a GP at the start and end of coaching to acquire cholesterol, BP and glucose measurements</td>
<td></td>
<td>No contact between coach and GP.</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>No control group</td>
</tr>
<tr>
<td>Gray et al. (2009)</td>
<td>105 men in weight management group</td>
<td>Group-based</td>
<td>Body weight, WC, BMI</td>
<td>Camelon model – men’s weight management</td>
<td>12 weeks</td>
<td>80 males completed the program, and recorded an average weight loss of 5.0kg at 12 weeks.</td>
</tr>
<tr>
<td></td>
<td>23-74 years</td>
<td></td>
<td></td>
<td>Men’s health clinic run by community nurses</td>
<td></td>
<td>Only 20 men attended final two post-program meetings (average 1-49 months post-intervention) with an average maintained weight loss of 3.7% (range = 32.6% loss to 25.6% gain).</td>
</tr>
<tr>
<td></td>
<td>Scotland</td>
<td></td>
<td></td>
<td>Pre-program assessment</td>
<td></td>
<td>Change in physical activity not an outcome for this study.</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Weight management program</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Optional postprogram meetings</td>
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</tr>
<tr>
<td>Morgan et al. (2010)</td>
<td>53 overweight/obese men and their school-aged children (n = 71)</td>
<td>Group-based</td>
<td>Primary: Weight, Secondary: WC, BMI, BP, Resting heart rate (HRrest)</td>
<td>Physical activity intervention</td>
<td>3 months</td>
<td>Significant between-group differences were observed for weight loss at 6-month follow-up.</td>
</tr>
<tr>
<td></td>
<td>40.6 ± 7.1 years</td>
<td></td>
<td></td>
<td>Healthy Dads, Healthy Kids – (HDHK)</td>
<td></td>
<td>ITT analysis showed that HDHK fathers lost more weight (-7.6 kg) than fathers in the control group (0.0kg).</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td></td>
<td></td>
<td>Face-to-face educational program</td>
<td></td>
<td>Significant treatment effects (p &lt;0.05) were observed for WC, BMI, SBP, HRrest, and physical activity.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>8 sessions held in total</td>
<td></td>
<td>No significant effects for dietary intake.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Children attended 3 sessions.</td>
<td></td>
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<tr>
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<td>Sessions were delivered by male researchers</td>
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<tr>
<td>Wait-list control group</td>
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</table>
Borg, Kukkonen-Harjula, Fogelholm, and Pasanen (2002) delivered another male-specific intervention to examine whether a walking program or a resistance training program improved weight maintenance after participation in a two-month diet program. In the first phase of this study, all participants were asked to consume a low-energy diet (1200kcal/day) for the first and last week in a two-month period, and to consume a very-low-energy diet (500kcal/day) for the remaining weeks in between (Borg et al., 2002). Small group meetings and weigh-ins were held weekly throughout the first phase of the intervention and these meetings were conducted by a nutritionist. The second phase of the intervention was a six-month weight maintenance phase, where participants were randomised into a walking group or a resistance training group, or a control group advised not to increase physical activity (Borg et al., 2002).

During the maintenance phase, both exercise groups were instructed to train three times each week, for 60 minutes (including 10 minutes warm-up and five minutes cool-down). One session was supervised by an exercise instructor each week for the duration of the maintenance phase, and participants were instructed to exercise at 60-70% of their maximum oxygen consumption which was pre-determined (Borg et al., 2002). Participants assigned to the exercise groups continued to attend weekly group meetings (one for the walking group and one for the resistance training group) over the maintenance phase and were given written educational material each month. Over the remaining 23 months, participants received no further information or supervision (Borg et al., 2002). Adherence to the prescribed exercise dose was relatively poor, particularly for the resistance training group (mean adherence 66%) and no improvements in long-term weight maintenance
were observed (Borg et al., 2002). The long-term follow-up was a particular strength of this study.

Aoun, Osseiran-Moissen, Collins, Newton, and Newton (2009) utilised a telephone-based lifestyle coaching element in a three-tier health intervention targeting males from Rotary (service) clubs in Australia. The first tier of this intervention involved up to three educational presentations based on physical activity, nutritional behaviours, and other healthy lifestyle behaviours, which were delivered during club meetings. The second tier was a club-versus-club BMI challenge, where participants had their BMI recorded each month by program champions. The telephone-based component was introduced in the third tier, targeting participants with a BMI of ≥27, with a lifestyle coaching program being delivered by trained lifestyle coaches at four time points (baseline, three months, six months, nine months). The intervention was designed to parallel the Transtheoretical Model through the different stages of behavioural change (Aoun et al., 2009). After attending the educational presentations, 50% of participants were greatly aware and 50% were partly aware of how physical activity could help them in general. In addition, 43% of participants were very motivated to increase physical activity and 38% were aware of how they could lose weight with physical activity. A total of 53% of participants decreased their BMI and the number of participants decreasing their BMI increased as the competition progressed – only 34% of participants had decreased BMI earlier in the competition (Aoun et al., 2009).

Based on feedback from the lifestyle coaches and program champions, it was suggested that the follow-up telephone calls needed to be more frequent. Frequent contact was deemed necessary at the initial stages of the program, to build
participants’ motivation level for change (Aoun et al., 2009). After this initial contact, it was thought that follow-up calls could be less frequent and used primarily to sustain motivation over a longer term. Aoun et al. (2009) reported that the number of telephone coaching sessions was limited to four due to budget limitations. Although feasible and promising, telephone-based interventions may be quite costly in larger population groups, given the number of phone calls and participants, as well as the cost associated with training the lifestyle coaches. Nevertheless, this program produced promising, longer-term results for BMI, and supports the implementation of team-based programs.

Gray et al. (2009) also used a gender-specific, group-based approach to weight maintenance in obese Scottish males from an economically disadvantaged area. The Camelon model was designed to be male-friendly; using humour, games and quizzes designed to appeal to males, delivering “masculine” advice related to participation in physical activity, and discussing issues such as alcohol consumption and portion sizes in a comfortable group setting. A total of 12 weekly meetings conducted by a community nurse were held over the three-month management program period, and each session ran for 60 minutes (Gray et al., 2009). The importance of making long-term, sustainable lifestyle changes was a key message delivered throughout the program. A total of 80 men completed the 12-week program (out of 105 participants) and program completers lost an average of 5.0 kg. Optional postprogram meetings were held quarterly for those who had completed the program, and 20 of the 80 program completers (25%) attended two postprogram meetings. Although these meetings were optional, the number of participants who returned to attend the meetings was quite low so longer-term follow-up data were only available
for a small proportion of participants. Compared to their baseline weight, participants for whom longer-term follow-up data were available maintained an average of 3.7% weight loss, with 14 participants still under their baseline weight (Gray et al., 2009).

When asked what they enjoyed about the male-specific program, participants discussed the use of humour and the support they received from other participants (Gray et al., 2009). On average, males who completed this 12-week group-based program experienced a reduction in their body weight and enjoyed participating in the program. The aspect of social support and the rapport the participants developed with the nurse and other males in the program appeared to enhance participants’ satisfaction with the program (Gray et al., 2009). Additionally, tailoring messages to appeal to men and emphasising the importance of setting long-term goals and changes in behaviour may be efficacious and similar approaches should be considered in interventions targeting males.

One group-based study targeting lifestyle behaviour change and weight loss incorporated a degree of social support by involving fathers and their school-aged children (Morgan et al., 2010). A total of 53 overweight or obese men participated in the three-month ‘Healthy Dads, Healthy Kids’ (HDHK) program, and were randomised to one of two groups – an intervention group which involved attending eight group-based educational sessions delivered by male researchers, and a wait-list control group. The educational sessions focused on specific topics such as weight loss, physical activity, and healthy eating, and introduced a range of techniques such as self-monitoring, goal setting, barrier identification, problem solving, social support, and identification as a role model, to encourage behaviour change (Morgan et al., 2010). Three of the eight sessions involved practical activities designed for
fathers and children to participate together and throughout the intervention; the importance of being a good role model for health behaviours was reinforced. In addition to the face-to-face sessions, the fathers also received additional materials including a program folder where they could read through educational session outlines and track their body weight, a handbook for physical activity, and a weight loss handbook specifically for males (Morgan et al., 2010).

In this study, a significant between-group difference in weight loss percentage at follow-up was found: fathers in the intervention group lost 6.4% body weight at three months and 7.4% body weight at six months, and those in the control group lost 0.3% body weight at three months and gained 0.2% body weight at six months. Significant treatment effects were also observed for weight loss, waist circumference, BMI, systolic blood pressure, resting heart rate, and physical activity in fathers (Morgan et al., 2010). Improvements were also observed for the children, with significant treatment effects observed for physical activity, resting heart rate, and dietary intake (Morgan et al., 2010).

Intervention elements that appeared to be effective in these group-based studies described above included:

- Delivering messages in supportive, male-friendly environments (Aoun et al., 2009; Gray et al., 2009; Morgan et al., 2010).
- Encouraging long-term, gradual lifestyle changes (Aoun et al., 2009; Gray et al., 2009; Morgan et al., 2010).
- Encouraging fathers to be good role models for their children (Morgan et al., 2010).
• Emphasising masculinity and tailoring intervention materials to appeal to male participants (Gray et al., 2009; Morgan et al., 2010).

• Having program champions within clubs (Aoun et al., 2009).

2.3.3 Internet-based interventions

A summary of studies utilising Internet technology to target physical activity and nutritional behaviours are summarised in Table 2.8.
Table 2.8  Summary of internet-based intervention studies targeting both physical activity and nutrition behaviour.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Veverka et al. (2003)  | 39 U.S. Air Force enlisted men      | Internet-based     | Primary:                                      | Website intervention                                                                                       | 6 months     | - There were no significant changes seen for \( V_{O2\text{max}} \).
|                        | 30–44 years                         |                    | • VO\(_{\text{max}}\)                         | • Required to log to website at least once per month                                                        |              | - Participants in the intervention group lost 2.2 kg of body weight, compared to control participants who gained 1 kg of body weight \( (p < .05) \).
|                        | United States                       |                    | • Secondary:                                  | • Tailored newsletter on physical activity or nutrition                                                    |              | - Intervention participants experienced reduced BMI of 0.7 kg/m\(^2\) and control participants experienced a gain of 0.3 kg/m\(^2\) \( (p < .05) \).
|                        |                                     |                    | • Body weight                                 | • Based on stage of change                                                                                   |              | - Participants in the intervention group decreased their body fat by 1.5% and participants in the control group gained 0.6% body fat \( (p < .001) \).
|                        |                                     |                    | • BMI                                         |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | • % body fat                                  |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | • Plasma cholesterol levels (total cholesterol, LDL, HDL and triglyceride levels)                        |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | Control group                                 |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | • No access to website                        |                                                                                                              |              |                                                                                                                                                |
| Morgan et al. (2009)   | 65 overweight or obese male         | Internet-based,    | Primary:                                      | SHED-IT (Self-Help, Exercise and Diet using Information Technology) intervention                           | 3 months     | - Males in the intervention group experienced a significant weight loss of 5.3 kg at 6 months (ITT analysis).
|                        | university staff (n = 37) and students (n = 28) | Print-based | • Body weight                                 | • One 75min face-to-face session delivered by male researcher                                               | plus 6 month | - Males in the control group experienced a significant weight loss of 3.5 kg at 6 months (ITT analysis).
|                        | 18-60 years                         |                    | • Secondary:                                  | • Dietary, exercise and weight data entered on website                                                     | follow-up     | - There was a significant group-by-time interaction for weight loss at 6 months                                                              |
|                        | Australia                           |                    | • BMI                                         | • Diaries kept                                                                                             |              | - Program compliers lost 9.1 kg, while non-compliers lost 2.7 kg, and the control group lost 4.2 kg.                                            |
|                        |                                     |                    | • WC                                          | • Feedback emailed based on diary entries                                                                    |              | - No significant between-group differences were observed for secondary outcomes.                                                              |
|                        |                                     |                    | • BP                                          |                                                                                                              |              | - Significant increase in physical activity at 6 month follow-up.                                                                                |
|                        |                                     |                    | • Level of physical activity                  |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | • Dietary intake                              |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | Control group                                 |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | • One 60min face-to-face session delivered by male researcher |                                                                                                              |              |                                                                                                                                                |
|                        |                                     |                    | • No internet component                       |                                                                                                              |              |                                                                                                                                                |
Table 2.8 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Duncan et al. (2012)   | • 317 males from regional Queensland  
• 35-54 years  
• Australia                           | Internet-based, Print-based  
  | Physical activity, Nutritional behaviours, Weight, Health literacy | **Internet-based intervention**  
• Access to ManUp website  
• Ability to set physical activity and healthy eating challenges  
• Tools to track progress  
• Social interaction features on website  
**Print-based group**  
• Hard copy booklet of educational materials and challenges – same as those given to internet-group | 3 months plus 9-month follow-up | • Participants significantly increased self-reported weekly MVPA over time  
• No significant between-group differences in self-reported MVPA were observed.  
• No significant effects for group or time were observed for self-reported leisure or occupational sitting time.  
• No significant changes were observed for weight, BMI, waist circumference, or for objectively measured sedentary time, light intensity physical activity (LPA), or MVPA. |
In an internet-based intervention targeting males specifically, Veverka, Anderson, Auld, Coulter, Kennedy, and Chapman (2003) used the Stages of Change model to increase fitness levels by improving nutrition and exercise habits in a sample of 39 male military personnel. The intervention group were given access to a website for six months, through which they received stage-matched messages on nutrition and exercise, based on a staging algorithm completed at first login. Participants in the control group received no intervention (Veverka et al., 2003). At the end of the six-month intervention period, no significant effects were observed for fitness levels, which were assessed using VO$_{2\text{max}}$ scores, however, significant between-group changes were observed for weight, BMI, body fat percentage, and waist-to-hip ratio (Veverka et al., 2003). Details of the intervention materials provided in this study were limited, so apart from suggesting that stage-matched materials delivered online can facilitate weight loss, it is unclear as to what other intervention elements may have been effective. Furthermore, participants were active military personnel aged between 30 and 44 years, so these findings may not necessarily be applicable to other male population groups.

Morgan, Lubans, Collins, Warren, and Callister (2009) assessed the efficacy of the Self-Help, Exercise and Diet using Information Technology (SHED-IT) program, a three-month program designed exclusively for males. Participants were 65 overweight or obese male staff and students from an Australian university, who were randomly allocated to either an internet group or a control group (Morgan et al., 2009). Those allocated to the internet group attended one face-to-face information session that was conducted by one of the male researchers. During the session, strategies to improve dietary intake and physical activity were discussed, and
included “self-monitoring, goal setting, and social support” (Morgan et al., 2009, p. 2026), related to Social Cognitive Theory. Participants were also introduced to the website they would be using for the duration of the three-month program and were given a male-oriented program booklet to assist with weight loss. Following this initial session, participants allocated to the internet group were given access to a publicly accessible website allowing them to keep track of their diet, physical activity, and weight, and were given three months of online support (Morgan et al., 2009). The research team facilitated behaviour change and weight loss by providing individualised feedback on seven occasions, based on diaries submitted throughout the intervention period, and by answering questions posted on an online discussion board (Morgan et al., 2009). The control group attended an information session similar to that conducted for internet group participants, although they did not receive access to the website, so information was only related to lifestyle modification and behaviour change strategies. The control group also received the program booklet, but no further intervention materials (Morgan et al., 2009).

Although this program contained an element of individualised feedback and support from researchers, this was limited to seven occasions for feedback on diaries, and weekly for responding to questions on the discussion board (Morgan et al., 2009), making this a feasible and relatively cost-effective approach to facilitating weight loss in males. Although there were no significant between-group differences, intention-to-treat (ITT) analysis demonstrated that males in both the internet and the control group significantly reduced their body weight at the six-month follow-up point, with losses of 5.3kg and 3.5kg, respectively (Morgan et al., 2009). A follow-up study reporting results at the 12-month time point reported that participants in the
intervention group maintained their 5.3kg weight loss and control group participants maintained a 3.1kg weight loss (Morgan, Lubans, Collins, Warren, & Callister, 2011). As such, researchers designing lifestyle modification interventions targeting males should consider tailoring their intervention materials and messages to appeal specifically to male participants in efforts to improve physical activity and dietary behaviours.

Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al. (2012) conducted the ManUp Study – a two-arm randomised controlled trial comparing an internet-and mobile phone-based intervention group to a group receiving printed materials on physical activity, nutrition, and health. This intervention study has been discussed briefly in Chapter 1, and was the intervention on which Study 3 of this thesis was based. A total of 317 Australian males aged between 35 and 54 years participated in the ManUp study and measurements were conducted at baseline, three- and nine-month time points (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012). Participants allocated to the internet-based intervention group received access to the ManUp website, where they could set physical activity challenges, self-monitor their physical activity and nutrition progress, and monitor their weight. Achievable physical activity and nutrition challenges were designed to increase gradually, and centred around six specific physical activities (walking, cycling, swimming, running, sport and recreation, and strengthening) and healthy eating. Each challenge had three different “strengths” (light-strength, mid-strength, and full-strength) that reflected a different challenge duration and volume of activity. Once participants had set one or more challenges (either individual challenges or group-based challenges), they could opt to “book” sessions in their online calendar.
and receive email reminders when they were scheduled to complete a portion of that challenge. The tracking tool used on the website generated an automated summary of participants’ progress toward their chosen activities. The website also featured an Information Centre that contained simple information on physical activity, nutrition, and health that was easy to understand. A social support element was incorporated into the internet-based intervention by allowing participants to find “mates”, compare their progress to that of their “mates”, and create groups with associated challenges (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012).

In addition to the website, participants in the internet-based group who owned a mobile phone that could connect to the internet were also able to access a mobile phone web application allowing them to access the self-monitoring tool from their phone. Data from each platform (website and mobile web application) were synchronised on a regular basis so participants’ profiles were kept up-to-date. Participants assigned to the print-based intervention arm did not receive access to the ManUp website, although they were provided with the same information given to the internet-based intervention group in a print-based booklet. These participants also received information on the physical activity and healthy eating challenges and log sheets to keep track of their progress (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012).

All participants provided self-reported data on demographic characteristics, perceived health, weight, height, waist circumference, physical activity, sitting time, nutritional behaviours, and health literacy at baseline, then at three- and nine-month follow-up sessions (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012). A subset of participants (n = 91) also attended in-person measurement
sessions where weight, height, waist circumference, physical activity, and sedentary time were objectively measured. Follow-up data for this study are yet to be published, however, participants in the ManUp Study significantly increased their self-reported weekly MVPA over time, although no significant between-group differences in self-reported MVPA were observed. Additionally, no significant effects for group or time were observed for self-reported leisure or occupational sitting time, and no significant changes were observed for weight, BMI, waist circumference, or for objectively measured sedentary time, LPA, or MVPA (Duncan, Vandelanotte, Rosenkranz, Caperchione, Connely, et al., 2012).

Successful intervention inclusions that were identified in the internet-based intervention studies described above included:

- Tailoring intervention materials to appeal to male participants (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012; Morgan et al., 2009).
- Incorporating messages that were male-specific (Morgan et al., 2009).
- Encouraging self-monitoring, social support, and goal setting (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012; Morgan et al., 2009).
- Providing individualised feedback (Morgan et al., 2009).
- Providing stage-matched materials on physical activity and nutrition (Veverka et al., 2003).
2.3.4 Print-based interventions

The print-based physical activity and nutrition intervention studies identified in the literature are summarised in Table 2.9.
Table 2.9  Summary of print-based intervention studies targeting both physical activity and nutrition behaviours.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Burke et al. (2003) | • 274 adults (137 men) • Men aged 20-61 years, women aged 18-62 years • Australia | • Print-based • Face-to-face | • Systolic blood pressure (SBP) • Diastolic blood pressure (DBP) • HR • BMI • HC • WC • Physical activity • Physical fitness (as Physical Work Capacity at 75% of HRmax) | **High-level intervention group** • Six modules on physical activity and nutrition • Delivered via print or by facilitators • Face-to-face delivery every 2 weeks<br>**Low-level intervention group** • One face-to-face contact with facilitator only • Then modules delivered print-based only | 16 weeks | • At post-intervention and follow-up, couples in the high-level intervention group showed improved fitness, decreased saturated fat intake and reduced LDL cholesterol.  
• Couples in the low-level intervention group also decreased saturated fat intake.  
• No significant between-group differences in moderate physical activity, number of days participating in physical activity, or BMI.  
• Fewer high-level participants became overweight or obese. |
| Arao et al. (2007) | • 177 men with risk factors for chronic disease • 40-59 years • Japan       | • Face-to-face • Print-based | • LEEE • VO2max • Dietary habits • BMI • BP • Blood glucose • Lipid parameters | **LiSM-PAN (Life Style Modification Program for Physical Activity and Diet)**  
**Intervention** • Individual counselling based on stages of change • Environmental and social support • Delivered by experienced research staff • Work- and home-based program | 6 months | • Participants in the intervention group experienced a significantly greater positive changes in leisure time exercise energy expenditure (LEEE).  
• The mean inter-group difference was 400.6 kcal/week, 95% CI: 126.1, 675.0 kcal/week.  
• No mean inter-group differences for dietary habits.  
• Significantly greater decreases in BMI, SBP, LDL in intervention participants compared with control participants. |
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Morgan et al. (2009) | 65 overweight or obese male university staff (n = 37) and students (n = 28) | Print-based Internet-based | Primary: | • Body weight  
• Secondary:  
• BMI  
• WC  
• BP  
• Level of physical activity  
• Dietary intake | SHED-IT (Self-Help, Exercise and Diet using Information Technology) intervention  
• One 75min face-to-face session delivered by male researcher  
• Dietary, exercise and weight data entered on website  
• Diaries kept  
• Feedback emailed based on diary entries | 3 months + 6 months follow-up | • Males in the intervention group experienced a significant weight loss of 5.3 kg at 6 months (ITT analysis).  
• Males in the control group experienced a significant weight loss of 3.5 kg at 6 months (ITT analysis).  
• There was a significant group-by-time interaction for weight loss at 6 months  
• Program compliers lost 9.1 kg, while non-compliers lost 2.7 kg, and the control group lost 4.2 kg.  
• No significant between-group differences were observed for secondary outcomes.  
• Significant increase in physical activity at 6 month follow-up. |
|               |                                                                               |                    | Control group                           | • Written feedback and recommendations  
• Printed physical activity and nutrition materials  
• No counselling or environmental/social support |                                                      |                                                      |
Table 2.9 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duncan et al. (2012)</td>
<td>• 317 males from regional Queensland&lt;br&gt;• 35-54 years&lt;br&gt;• Australia</td>
<td>Internet-based</td>
<td>Physical activity&lt;br&gt;Nutritional behaviours&lt;br&gt;Weight&lt;br&gt;Health literacy</td>
<td>Internet-based intervention&lt;br&gt;Access to ManUp website&lt;br&gt;Ability to set physical activity and healthy eating challenges&lt;br&gt;Tools to track progress&lt;br&gt;Social interaction features on website</td>
<td>3 months plus 9-month follow-up</td>
<td>• Participants significantly increased self-reported weekly MVPA over time&lt;br&gt;• No significant between-group differences in self-reported MVPA were observed.&lt;br&gt;• No significant effects for group or time were observed for self-reported leisure or occupational sitting time.&lt;br&gt;• No significant changes were observed for weight, BMI, waist circumference, or for objectively measured sedentary time, light intensity physical activity (LPA), or MVPA.</td>
</tr>
</tbody>
</table>
Burke, Giangjulio, Gillam, Beilin, and Houghton (2003) incorporated an element of social support by recruiting couples (including 137 males) to participate in a 16-week intervention targeting physical activity and nutritional behaviours. A high-level intervention group received six biweekly modules on physical activity – half of which were delivered in a printed format by postal mail, and half of which were delivered at interactive group sessions (Burke et al., 2003). A low-level intervention group attended only one group session at the beginning of the program, and then received the six modules by mail. Both of these groups were compared to a control group receiving no intervention (Burke et al., 2003). At the end of the 16-week intervention period, and at 12-month follow-up, participants in both intervention groups reduced their saturated fat intake, and those in the high-level intervention group also improved their fitness (physical work capacity at 75% of maximum heart rate), and reduced LDL cholesterol. There were no significant between-group differences observed for moderate physical activity, total number of days participating in physical activity, or BMI, although fewer participants in the high-level intervention group became overweight or obese over the 12-month period (Burke et al., 2003). These results suggest that a degree of face-to-face contact enhanced the effectiveness of a primarily print-based intervention.

In addition to this study by Burke et al. (2003), the studies by Arao et al. (2007), Morgan et al. (2009), and Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al. (2012), which have been discussed previously in this chapter, also incorporated a print-based component in their intervention. Arao et al. (2007) compared the LiSM-PAN intervention (individual counselling, environmental support, and social support for behaviour change) with a control group that received written feedback and printed materials. Compared with the control group that
received written advice only, those in the intervention group experienced significant improvements in all outcome measures (with the exception of dietary habits) at the end of the six-month intervention period (Arao et al., 2007). These findings suggest that counselling, social support and environmental changes were more effective in terms of improving health outcomes than printed material alone. Morgan et al. (2009) conducted a stand-alone face-to-face physical information session and provided a male-specific program booklet detailing key weight loss messages to participants in both the intervention and control group. Participants in both groups experienced a significant weight loss at six-month follow-up (Morgan et al., 2009). Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al. (2012) provided printed materials to one intervention arm in the ManUp Study. These materials included information on physical activity, healthy eating, and general health, and were designed to be simple and concise (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012). Participants in the ManUp Study significantly increased their self-reported weekly MVPA over time, however, there were no significant between-group differences in self-reported MVPA, no significant effects for group or time were observed for self-reported leisure or occupational sitting time, and no significant changes observed for weight, BMI, waist circumference, or for objectively measured sedentary time, LPA, or MVPA (Duncan, Vandelanotte, Rosenkranz, Caperchione, Connely, et al., 2012).

Effective inclusions within these above print-based intervention studies targeting physical activity and nutrition included:

- Tailoring printed materials to appeal to male participants (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012; Morgan et al., 2009).
• Incorporating elements of social support (Arao et al., 2007; Burke et al., 2003; Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012; Morgan et al., 2009).

2.4 Interventions targeting sedentary time

As epidemiological evidence continues to emerge on the potentially deleterious effects of sedentary time on health, a need for intervention studies targeting adults’ sedentary time has been identified (Wilmot et al., 2012). To date, much of the intervention work for reducing sedentary time has focused on youth (Biddle, O’Connell, & Braithwaite, 2011; Wilmot et al., 2012), although a growing number of intervention studies have more recently focused on adult populations. As intervention studies targeting sedentary time are relatively sparse, this section will summarise the literature on intervention studies to reduce sedentary time in the general adult population, rather than in males specifically.

2.4.1 Workplace-based interventions

Given that working adults spend up to one-third of their day sitting down (Jans, Proper, & Hildebrandt, 2007), targeting adults in the workplace setting has the potential to be efficacious. The workplace-based intervention studies targeting sedentary time are summarised in Table 2.10, and discussed below.
Table 2.10  Summary of workplace-based intervention studies targeting sedentary time.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkhajah et al. (2012)</td>
<td>● 32 employees (three males)</td>
<td>Workplace-based</td>
<td>● Sitting</td>
<td><strong>Intervention</strong></td>
<td>3 months</td>
<td>● Compared with the control group, the intervention group significantly reduced their sitting time and increased the number of sit-to-stand transitions during working hours at both follow-up time points.</td>
</tr>
<tr>
<td></td>
<td>● 20-65 years</td>
<td></td>
<td>● Standing</td>
<td><strong>Intervention</strong></td>
<td></td>
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<tr>
<td></td>
<td>● Australia</td>
<td></td>
<td>● Stepping</td>
<td><strong>Control group</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>● Sit-to-stand transitions</td>
<td><strong>Control group</strong></td>
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<td></td>
<td></td>
<td></td>
<td>● Weight</td>
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<td></td>
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<td>● BMI</td>
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<td>● WC</td>
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<td>● HC</td>
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<tr>
<td>Carr et al. (2012)</td>
<td>● 18 full-time employee (12% males)</td>
<td>Workplace-based</td>
<td>● Minutes of pedalling</td>
<td><strong>Intervention</strong></td>
<td>4 weeks</td>
<td>● Participants reported that, based on using the pedal machine, their sedentary time had decreased at work.</td>
</tr>
<tr>
<td></td>
<td>● 40.2±10.7 years</td>
<td></td>
<td>● Days of pedalling</td>
<td><strong>Intervention</strong></td>
<td></td>
<td>● Self-report data from the 7-day PAR questionnaire showed no significant reductions in sitting, standing, or walking.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Sedentary time</td>
<td><strong>Intervention</strong></td>
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<tr>
<td>Cooley &amp; Pedersen (2013)</td>
<td>● 46 employees (13 males)</td>
<td>Workplace-based</td>
<td>● Nonpurposeful movement</td>
<td><strong>Intervention</strong></td>
<td>26 weeks</td>
<td>● Participants were more likely to break up their sedentary time with nonpurposeful activity during the first phase of the intervention that utilised the automated prompts and software launch.</td>
</tr>
<tr>
<td></td>
<td>● 46.1±6.3 years (males)</td>
<td></td>
<td>during work day</td>
<td><strong>Intervention</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Australia</td>
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</tbody>
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Table 2.10 continued next page.
Table 2.10 continued.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td>computer screens disabled, prompted to participate in nonpurposeful movement and record data</td>
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<td></td>
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<td></td>
<td>• Active phase – no timed prompts, participants had to engage with materials on own</td>
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</table>
| Gilson et al. (2012)   | • 11 desk-based employees  
                          | Workplace-based | • Time spent sedentary  
                          | Interventions  
                          | 2 working weeks | • No significant changes in time spent sedentary, or in light or moderate intensity activity. |
|                        | • 46.9 ±9.8 years  
                          |                    | • LPA  
                          | • Shared access to four adjustable “hot” desks for five days  
                          |          |               |
|                        | • Australia    |                    | • Moderate physical activity  
                          | • Participants kept a record of their desk use during the five-day intervention period |          |               |
| Healy et al. (2013)    | • 43 office workers (19 males)  
                          | Workplace-based | • Workplace sitting time  
                          | Intervention group  
                          | 4 weeks | • Compared to the control group, intervention participants increased their standing time by more than two hours per day. |
|                        | • 26-62 years  
                          |                    | • Workplace standing time  
                          | • Organisational support  
                          |          | • Intervention participants also significantly reduced their daily sitting time, with a reduction of around one hour for prolonged sitting. |
|                        | • Australia    |                    | • Step counts  
                          | • One workshop led by researchers to discuss the intervention strategies, health impact of too much sitting  
                          |          | • The number of sit-stand transitions also increased by almost two per hour of sitting time. |
|                        |              |                    |          | • One employee acted as liaison between the intervention participants and the researchers  
                          |          |               |
|                        |              |                    |          | • Two emails per week to detail progress and to provide a tip to reduce daily sitting time  
                          |          |               |
| Control group          |              |                    |          | • No intervention – usual routine  
                          |          |               |
Several studies on workplace interventions have focused on the potential effectiveness of adjustable workstations or desks on levels of sedentary behaviour. One small workplace-based study, for example, examined the effectiveness of sit-stand workstations in an office-setting (Alkhajah et al., 2012). A total of 32 employees (three men and 29 women) participated in the two-arm quasi-experimental trial, and were allocated to either the intervention group (where participants had an adjustable sit-stand workstation installed), or the control group, which received no intervention. Participants wore an activPAL3 activity monitor for three seven-day assessment periods (at baseline, one-week and three-month follow-up) to record the number of sit-to-stand transitions and the time spent sitting, standing and stepping. Compared with the control group, the intervention group significantly reduced their sitting time and increased the number of sit-to-stand transitions during working hours at both follow-up time points (Alkhajah et al., 2012). The results of this study suggest that the implementation of individually assigned adjustable desks has the potential to significantly reduce sitting time in office workers. Adjustable workstations can be quite costly to purchase, so although promising, installing them for individual employees in larger office settings may not be feasible. The very small number of male participants in this study must be considered when interpreting the findings. Although this study demonstrated significant improvements in sitting time and other outcomes of interest, less than 10% of participants in the study were male, so findings may not necessarily be applicable to other males.

In another workplace-based program, Carr, Walaska, and Marcus (2012) examined the impact of portable pedal exercise machines on sedentary time in the
workplace. Eighteen adults (12% male) employed in sedentary occupations participated in the study and were given access to the machine and accompanying software for four weeks. The software was installed on the participants’ work computer and gave real-time feedback on the amount of pedalling completed, as well as the distance they had pedalled and the calories burnt (Carr et al., 2012). Daily sedentary time was self-reported using a modified version of the 7-day Physical Activity Recall (7-day PAR) questionnaire. Physical activity was also reported using this questionnaire, but this was in addition to the objectively measured data downloaded to the participants’ computers (Carr et al., 2012). Apart from the machine and the accompanying software, participants were not given any additional intervention materials to encourage behaviour change, which may have partly explained the gradual drop in compliance over the four-week intervention period.

After the study was completed, participants completed a feasibility questionnaire and the majority of employees reported that they would use the machines on a regular basis if their employer made them available. Participants also reported that, based on using the pedal machine, their sedentary time had decreased at work, but self-report data from the 7-day PAR questionnaire showed no significant reductions in sitting, standing, or walking. The authors acknowledged that a lack of additional intervention materials may have limited the impact of the intervention, suggesting that future studies utilising this equipment should also consider additional strategies to maintain use (Carr et al., 2012).

Cooley and Pedersen (2013) conducted a pilot study to test the feasibility of a workplace-based e-health intervention to reduce sitting time through nonpurposeful movement. A total of 46 participants (13 males) took part in the 26-week pilot study.
An induction session was held prior to the commencement of the study, where participants were given details of the study protocol. Baseline demographic data were collected, and then a brief educational session was held to discuss the negative impact of prolonged sitting time on health, to provide advice on the movement required to minimise the effects of prolonged sitting time, and to provide information on the e-health software being used in the study. The software was designed to provide timed prompts on the participants’ computer reminding them to engage in nonpurposeful movement, such as collecting photocopies, talking the stairs, and walking around the office (Cooley & Pedersen, 2013), and participants could select options that suited them.

The pilot intervention was divided into two phases – the first 13 weeks implemented a passive prompt condition, and the remaining 13 weeks implemented the active prompt condition. During the first phase, participants could not ignore the prompts, as their computer screens were deactivated and the e-health software interface launched after a giving them notice 45 minutes earlier. During this deactivation period, participants were prompted to select a nonpurposeful physical activity to participate in, and record their progress using the e-health software. After the data had been recorded, participants’ computer screens returned to normal, until the next hour when the interface launched again. The second phase of the research utilised the same software and activity options, but the interface no longer launched automatically every hour, and participant wishing to utilise the software were required to initiate use (Cooley & Pedersen, 2013). Results showed that participants were more likely to break up their sedentary time with nonpurposeful activity during the first phase of the intervention that utilised the automated prompts and software.
launch (Cooley & Pedersen, 2013). These findings were, however, based on self-report data, and may be impacted by bias. Research into similar, prompt-based interventions utilising both self-report and objective measures would help establish whether such an approach is effective in reducing workday sedentary time.

Gilson, Suppini, Ryde, Brown, and Brown (2012) examined the impact of standing “hot” desks on workers’ sedentary time. A total of 11 employees (four men and seven women) from an open-plan office in Australia were recruited to participate in the study, and unlike the study by Alkhajah et al. (2012), where participants in the intervention group were assigned individual stations, participants were given shared access to four adjustable “hot” desks for a five-day period. Study participants were asked to wear an armband accelerometer for two weeks (beginning one week prior to the introduction of the standing desks) and were asked to keep a record of their desk use during the five-day intervention period (Gilson et al., 2012). Results showed no significant changes in time spent sedentary, or in light or moderate intensity activity, and the amount of time participants spent using the desks varied. These finding must, however, be viewed in light of the small sample investigated.

In another Australian study, Healy et al. (2013) conducted a multicomponent intervention targeting sitting time in 43 Australian office workers (19 males) in one workplace. At the beginning of the intervention, researchers met with representatives from the intervention group and the organisation’s management team to discuss the importance of support from the organisation to ensure the success of the program. Participants taking part in the intervention were invited to a workshop led by researchers to discuss the intervention strategies, as well as the health impact of too much sitting. One employee acted as the liaison between the intervention participants
and the research team, and was responsible for sending two emails per week to detail progress and to provide a tip to reduce daily sitting time. In addition to the organisational element of this intervention, participants in the intervention group were given access to a sit-stand workstation for the four-week intervention period, and attended a 30-minute consultation session related to topics such as behaviour change and goal setting. This consultation session was delivered by two health coaches with a relevant Master’s level qualification. For the remaining three weeks, the health coaches who gave the consultation sessions telephoned participants to discuss any issues. Participants in the control group received no intervention and were instructed to maintain their usual routine. Physical activity and sitting time were objectively measured using the activPAL3 monitor, which was worn 24 hours per day during the intervention and work time was recorded in a log (Healy et al., 2013).

Compared to the control group, intervention participants increased their standing time by more than two hours per day, and also significantly reduced their daily sitting time, with a reduction of around one hour for prolonged sitting. The number of sit-stand transitions also increased by almost two per hour of sitting time (Healy et al., 2013). These findings suggest that a short-term, multicomponent, workplace-based intervention can significantly reduce sitting time during working hours. The key messages encouraging participants to “Stand Up, Sit Less, Move More” (Healy et al., 2013, p. 44) were simple, and the “Stand Up and “Sit Less” messages were seemingly effective. The authors recognised a lack of opportunities to be physically active in the workplace as a potential barrier for participants, suggesting that future studies consider strategies to improve this (Healy et al., 2013).
Most of these workplace-based intervention studies targeting sedentary time have been quite short in duration, so, as recognised by Healy et al. (2013), the longer-term impact of these interventions cannot be examined. Despite this, some intervention elements within these studies described above seemed to be effective:

- Gaining support from the organisation or company and senior staff (Healy et al., 2013).
- Implementing a multicomponent approach (Healy et al., 2013).
- Providing regular feedback and tips on reducing sedentary time (Healy et al., 2013).
- Giving participants a sit-stand workstation for exclusive use (Alkhajah et al., 2012).

While compliance rates in some studies dropped quite sharply (Carr et al., 2012; Gilson et al., 2012), this may have been due to the fact that these studies only implemented a stand-alone strategy for reducing sedentary time. Future studies should consider including additional intervention elements (e.g., supporting materials and prompts) in efforts to reduce sedentary time.

### 2.5 Studies targeting both physical activity and sedentary time

While the number of studies targeting sedentary time specifically is quite modest, there have been slightly more intervention studies targeting both physical activity and sedentary time, with changes in sedentary time often a secondary outcome to physical activity. These studies are still quite sparse, so this section will
also consider all studies in adult populations (where male participants are included) that have targeted both of these behaviours. As with previous sections, these studies will be presented by mode of delivery, beginning with studies using a face-to-face approach.

2.5.1 Face-to-face interventions

Only one face-to-face study targeting physical activity and sedentary time was identified in the literature, and this study is summarised in Table 2.11, below.
Table 2.11  Summary of face-to-face intervention studies targeting both physical activity and sedentary time.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Lakerveld et al. (2013)| 622 adults (41.6% males) 30-50 years  | Face-to-face       | Sedentary behaviour | Intervention group  
- Received up to six individual, face-to-face counselling sessions delivered by trained nurses in 12 general practices  
- Telephone-based counselling, once every three months  
Control group  
- Received printed materials containing information on physical activity and dietary habits, and smoking cessation if requested | 6 months plus 12 and 24-month follow-up |  
- At 12-month follow-up, compared with baseline measures, the intervention group significantly reduced sedentary behaviour by 27 minutes, and the control group significantly reduced sedentary behaviour by 19 minutes.  
- At the 24-month follow-up, the intervention group showed a reduction of 12 minutes for sedentary time, while the control group reduced sedentary time by 25 minutes from baseline.  
- Intention-to-treat analysis revealed no significant differences in overall sedentary behaviour, or domain-specific sedentary behaviour. |
Lakerveld, Bot, van der Ploeg, and Nijpels (2013) examined the effects of a lifestyle intervention on leisure-time sedentary behaviour in 490 adults (approximately 44% males) at risk of developing type 2 diabetes and cardiovascular disease. Participants were randomly allocated into either an intervention group or a control group for six months. Intervention participants received up to six individual, face-to-face counselling sessions delivered by trained nurses in 12 general practices, followed by telephone-based counselling, once every three months. Motivational interviewing and problem solving strategies were utilised, and intervention participants were able to select which lifestyle behaviours they wished to change, with options including physical activity, smoking and diet (Lakerveld et al., 2013).

The control group participants received printed materials containing information on physical activity and dietary habits, and smoking cessation if requested. Sedentary behaviour was assessed using a “subscale of the Activity Questionnaire for Adolescents and Adults” (Lakerveld, et al., 2013, p. 353), hence; self-report data were used to assess changes in sedentary behaviour.

At 12-month follow-up, compared with baseline measures, the intervention group significantly reduced sedentary behaviour by 27 minutes, and the control group significantly reduced sedentary behaviour by 19 minutes. At the 24-month follow-up, the intervention group showed a reduction of 12 minutes for sedentary time, while the control group reduced sedentary time by 25 minutes from baseline. Intention-to-treat analysis, however, revealed no significant differences in overall sedentary behaviour, or domain-specific sedentary behaviour. When data were stratified for sex, no significant intervention effects were observed. Reducing sedentary behaviour was not a major aim of this study, which targeted lifestyle
behaviours such as physical activity and nutrition, and results showed that the
counselling intervention was no more effective than providing printed materials for
reducing sedentary behaviour (Lakerveld et al., 2013). The long-term follow-up was
a positive inclusion in this study, although the self-report measures used for
sedentary time were not ideal. When designing future studies targeting multiple
lifestyle behaviours, providing information and intervention materials targeting
sedentary time specifically may be an effective inclusion.

2.5.2 Community-based interventions

Some community-based interventions targeting both physical activity and
sedentary time have been carried out, and are summarised below in Table 2.12.
Table 2.12  Summary of community-based intervention studies targeting both physical activity and sedentary time.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Mode/s of delivery</th>
<th>Outcomes</th>
<th>Intervention details</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| De Cocker et al. (2007)    | • 1,294 adults (605 men) • 25-75 years • Belgium                            | Community-based          | • Physical activity, including work, transportation, domestic, gardening and leisure-time physical activity (LTPA) | Physical activity intervention:  
  • Whole of community  
  • Ghent, intervention community  
  • Promoted 10,000 steps/day and meeting national physical activity guidelines  
 Control community:  
  • Aalst  
  • Received no intervention | 1 year                  | • At 12 months, participants in the intervention community reduced their daily sitting time by around 12 minutes per day.  
 • Participants in the intervention community that successfully increased their step counts also had a significant reduction of about 18 minutes in self-reported daily sitting time.  
 • Participants from the control community who successfully increased their step counts also increased their daily sitting time at follow-up |
| Gilson et al. (2009)       | • 179 “white-collar” university employees (38 males) • United Kingdom, Australia, and Spain | Community-based          | • Sitting time  
  • Step counts                                                                 | First intervention group:  
  • Instructed to participate in a minimum of ten minutes of route-based walking during breaks in the work day  
 Second intervention group:  
  • Encouraged to look for opportunities to increase incidental activity while carrying out normal work-related tasks  
 Control group:  
  • Maintained step counts that were determined at baseline (prior to randomisation) | 10 weeks                 | • Compared with the control group, both walking groups significantly increased their step counts at follow-up.  
 • Some reductions observed in sitting time for intervention participants, these reductions were not significant.  
 • Male participants were underrepresented, accounting for only 21% of the study population. |
The “10,000 Steps Ghent” study (De Cocker et al., 2007) has been discussed in a previous section in this chapter, and although this study did not necessarily target sedentary time, a secondary analysis was completed to assess whether this pedometer-based physical activity intervention also impacted upon participants’ sitting time (De Cocker, De Bourdeaudhuij, Brown, & Cardon, 2008). Daily sitting time was assessed using the International Physical Activity Questionnaire (IPAQ), which has demonstrated acceptable validity and reliability (Craig et al., 2003). After the 12-month intervention period, participants in the intervention community reduced their daily sitting time by around 12 minutes per day. When looking specifically at participants from the intervention community who successfully increased their daily step counts, a significant reduction of about 18 minutes in self-reported daily sitting time was observed. Conversely, participants from the control community who successfully increased their step counts also increased their daily sitting time at follow-up (De Cocker et al., 2008). There were no findings reported specifically for male participants, although, as reported earlier, male participants did significantly increase their step counts (De Cocker et al., 2007). Although this study relies on self-report data, the findings suggest that those in the community who received the “10,000 Steps” intervention may have replaced more of their sitting time with walking. Given this reduction in sitting time in the intervention community (De Cocker et al., 2008), including messages specifically related to reducing sedentary time to those already conveyed through the “10,000 Steps” intervention may further reduce daily sitting time.

In another intervention study designed to increase physical activity, Gilson, Puig-Ribera, McKenna, Brown, Burton, and Cooke (2009) implemented a
standardised 10-week intervention comparing two separate walking strategies in a workplace setting. The aim of this study was to examine the impact of these two strategies on objectively measured step counts, measured using pedometers, and self-reported sitting time, which was measured using a logbook. A total of 179 “white-collar” university employees (38 male) from three countries (United Kingdom, Australia, and Spain) participated in the study and were allocated to one of three groups. Over the 10-week intervention period, the first intervention group was instructed to participate in a minimum of ten minutes of route-based walking during breaks in the work day, while the second intervention group was encouraged to look for opportunities to increase incidental activity while carrying out normal work-related tasks. Participants in the control group maintained step counts that were determined at baseline (prior to randomisation) over the 10-week intervention period (Gilson et al., 2009). Compared with the control group, both walking groups significantly increased their step counts at follow-up, and although there were some reductions observed in sitting time for intervention participants, these reductions were not significant (Gilson et al., 2009). Participants assigned to the group encouraged to increase incidental activity showed the greatest reduction in self-reported sitting, suggesting that this strategy had some, albeit limited, impact on sedentary time (Gilson et al., 2009). Male participants were particularly underrepresented in this study, accounting for only 21% of the study population, so these findings cannot necessarily be generalised to male university staff.

It is important to note that neither the De Cocker et al. (2008) study, or the Gilson et al. (2009) study included an objective measure of sitting time, so self-reported sitting times may have been incorrectly reported, leading to an under or
overestimation of this behaviour. Although it appears that interventions targeting walking behaviours have the potential to impact sitting time, further research using objective measures of sitting time are required to accurately assess the true impact of such interventions.

2.6 Perceptions of physical activity and sedentary time

While the benefits of regular physical activity and the risks of inactivity are well known, the presence of perceived barriers is a strong and common correlate of physical inactivity (Trost, Owen, Bauman, Sallis & Brown, 2002). Barriers to, and motivators for, participating in regular physical activity vary within and between populations, and it is important to understand the impact of barriers and motivators on participation. Adults frequently identify work and family commitments, time constraints, associated costs, stress, lack of motivation, and a lack of convenient opportunities as barriers to participation in physical activity (Caperchione et al., 2012; Salmon, Owen, Crawford, Bauman & Sallis, 2003; Schwetschenau et al., 2008). Factors such as inadequate health, lack of motivation, and disability or injury have been cited as weight-related barriers (Ball, Crawford & Owen, 2000); while environmental factors and a lack of access to facilities have also been reported as barriers to participation in physical activity, particularly for those living in rural or in low socioeconomic areas (Australian Institute of Health and Welfare, 2010; Humpel, Owen & Leslie, 2002).

Caperchione et al. (2012) recruited middle-aged males living in a regional area of Queensland, Australia and conducted a series of focus groups to gain insight into physical activity and nutritional behaviours to inform the substantive ManUp Study
Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012). Six focus groups were held with a total of 30 male participants in the study. In this study, improving health, losing weight, enjoyment, and setting good examples for children were cited as motivating factors for being physically active. Caperchione et al. (2012) also reported that males in their study identified maintaining a good quality of life and being able to undertake daily tasks as motivators for being physically active, particularly as they got older.

Wandel and Roos (2006) explored perceptions of age and physical activity in a sample of male participants form three occupational groups. A series of semistructured interviews were conducted and participants discussed “everyday activities, thoughts and practices related to food, physical activity, smoking, health and work” (Wandel & Roos, 2006, p. 3026). Socialising, health, and maintaining strength were recognised as key benefits for physical activity, and participants reported that they became more aware of health and disease as they aged. Although some participants discussed becoming less active with age, others reported that they became more motivated to be physically active as they aged (Wandel & Roos, 2006).

Although motivators and barriers related to physical activity participation have been investigated in various population groups, there is much less research that has examined motivating factors and barriers related to sedentary time. Given that individuals working in office settings spend a large proportion of their workday sitting (Parry & Straker, 2013), it is equally important to understand factors related to sedentary time. Gilson, Burton, van Uffelen and Brown (2011) targeted men and women employed in a sedentary occupation to explore perceptions of health risks and potential intervention strategies related to workplace sedentary behaviours.
Gilson et al. (2011) found that participants welcomed the idea of implementing strategies to reduce sedentary behaviour and identified the need for future qualitative research into perceptions of sedentary behaviour in other employee groups. Participants in this study also suggested that senior employees such as team leaders needed to encourage the integration of strategies to reduce or break up sedentary time.

Prosser et al. (2007) conducted a focus group study in an academic setting to gain insights to inform a physical activity intervention in a workplace setting. A total of three focus groups were conducted, with 19 academic staff members. Only one participant was male, but given that this study was being conducted in an academic setting, some of the findings may be applicable to other populations in a similar workplace environment. Participants welcomed the idea of participating in physical activity during working hours as they believed they would have more free time at home after work. It was recognised, however, that opportunities for physical activity should not interfere with work duties or the needs of senior staff. Gaining support from supervisors was identified as being an important factor for participation in physical activity during working hours, and having a group or a partner to participate with was identified as a factor that may enhance motivation for physical activity participation, and help overcome barriers related to participation (Prosser et al., 2007).

Bennie, Timperio, Crawford, Dunstan, and Salmon (2011) investigated the associations between social ecological factors and short physical activity breaks taken during working hours, in a sample of Australian desk-based workers. Surveys were completed by 801 employees (274 males) that were primarily desk-based, and
assessed self-reported short physical activity breaks per work hour, and participants’ agreement with a range of statements on social ecological factors, in relation to taking short physical activity breaks (Bennie et al., 2011). Statements were related to factors such as, not having enough time, not having enough energy, being too stressed at work, having encouragement from company, and having recommendations from Occupational Health and Safety (OH&S). In male participants, a “lack of time” was significantly inversely associated with the frequency of the self-reported short physical activity breaks per work hour (Bennie et al., 2011). Although study participants were primarily female (65.8%), analyses were performed for males and females separately, allowing for sex-specific observations to be made, which is useful when developing interventions targeting male or female participants exclusively.

Overall, it appears that employees would be willing to make changes during working hours to increase physical activity and reduce sedentary time (Prosser et al., 2007; Gilson et al., 2011). Support, however, must be provided at an organisational level, and barriers need to be identified and overcome in order for changes to be implemented (Bennie et al., 2011; Prosser et al., 2007; Gilson et al., 2011).
Conclusion

Although a large number of intervention studies targeting physical activity and nutritional behaviours were identified in the literature, there were limited studies targeting male participants specifically, or analysing data separately for sex. Only three physical activity intervention studies (Bjograas et al., 2005; Coghil & Cooper, 2008; Kaukiainen et al., 2002) and nine physical activity and nutrition intervention studies (Aoun et al., 2009; Arao et al., 2007; Borg et al., 2002; Duncan et al., 2012; Gray et al., 2009; Morgan et al., 2009; Morgan et al., 2010; Pritchard et al., 2007; Veverka et al., 2003) included in this review targeted males exclusively. A number of intervention studies included in this literature review focused on changes in anthropometric measures such as body weight as a primary outcome measure, or implemented interventions in population groups with existing conditions. These studies do, however, provide an opportunity to gain further insight into intervention elements that could be used to increase levels of physical activity.

Some of the most commonly utilised modes of delivery for studies included in this literature review were face-to-face, group-based, or print-based approaches, and a number of studies used a combination of approaches to target lifestyle behaviours (Arao et al., 2007; Burke et al., 2003; Elliot et al., 2007; Harrison et al., 2005; Leahey et al., 2010; Morgan et al., 2009; Pritchard et al., 1997; Swinburn et al., 1998; The Writing Group for the Activity Counseling Trial Research Group, 2001). Providing tailored advice, and delivering male-specific materials appeared to be effective approaches implemented in several of the intervention studies discussed in this chapter (Arao et al., 2007; Bolognesi et al., 2006; Elliot et al., 2007; Gray et al., 2009; Morgan et al., 2009; Swinburn et al., 1998). In addition, interventions that
encouraged participants to set achievable goals, self-monitor their progress, and engage with others through social interaction also appeared to have a positive effect on lifestyle behaviours (Arao et al., 2007; Bolognesi et al., 2006; Morgan et al., 2010; Swinburn et al., 1998). The use of self-monitoring tools to track progress has the potential to increase and maintain motivation and adherence, and several common techniques used in several interventions that incorporated a counselling component included learning how to set goals and identify barriers related to behaviour change, and how to increase self-efficacy and motivation for participation in physical activity (Bolognesi et al., 2006; Swinburn et al., 1998). The importance of social support was tapped into by several studies that encouraged participants to seek support from their family (Arao et al., 2007; Morgan et al., 2010), incorporated a degree of friendly competition and camaraderie, and encouraged participants to engage with one another (Gray et al., 2009; Leahey et al., 2010). Of note also, are two particular studies that incorporated a degree of friendly competition (Buis et al., 2009; Leahey et al., 2010), which appeared to be a positive inclusion, so encouraging team-based activities may be advantageous.

By encouraging male participants to gain the support of their family or others in their social network, and by highlighting the importance of their health and wellbeing in relation to their families may enhance motivation for behaviour change. This aspect was tapped into by the Healthy Dads, Healthy Kids study (Morgan et al., 2010), that involved fathers and their school-aged children and used the notion of being healthy for their children as part of the motivation to improve activity levels and lose weight. Providing reliable advice from trustworthy sources (such as physicians) was another effective approach to improving lifestyle behaviours such as
physical activity and nutrition (Gray et al., 2009; Swinburn et al., 1998), and may indicate that if advice and information is to be taken into account, it needs to be seen as emanating from a reliable source.

The effects of the pedometer-based intervention studies produced mixed results in male participants, with findings by Leahey et al. (2010) and De Cocker et al. (2007) demonstrating increases in step counts. Contrary to these findings, however, results of a community-based pedometer intervention by Brown et al. (2006), that used a 10,000 steps recommendation, demonstrated that a walking or step-count challenge did not appeal to male participants (Brown et al., 2006). Giving male participants the option of setting their own unique physical activity goals or designing individualised programs based on their preferences, was a seemingly effective approach taken in several of the interventions discussed in this chapter (Bolognesi et al., 2006; Østerås & Hammer, 2006; Pritchard et al., 1997).

Encouraging males to incorporate physical activity as a part of their regular routine may also be an effective way to introduce physical activity without prescribing a specific program.

Despite a growing body of evidence on the potentially deleterious effects of sedentary time (Hamilton et al., 2008; Thorp, Owen, Neuhaus, & Dunstan, 2011), the number of intervention studies targeting sedentary behaviour was even more limited, with few intervention studies in this area targeting adults (Owen et al., 2011). Although there have been some promising results reported in the few studies targeting sedentary time, several of the studies that were identified and discussed in this chapter have included small sample sizes (Alkhajah et al., 2012; Carr et al., 2012; Gilson et al., 2012). Many of the intervention studies targeting sedentary time
in adult populations have been implemented in the workplace (Alkhajah et al., 2012; Carr et al., 2012; Gilson et al., 2012; Healy et al., 2013). The study by Healy et al. (2013) that obtained support from employers and senior staff members showed promising results, and this seems to be important for success.

Taking regular breaks during prolonged periods of sedentary time has been shown to have positive effects on health outcomes (Healy, Dunstan et al., 2008). A simple, cost-effective approach encouraging people to consider their sedentary time and look for opportunities to take breaks may be an efficacious approach to targeting sedentary time in adults. It is evident that further research, using valid and reliable measures in larger samples, is required to generate a strong body of literature on interventions targeting sedentary time.

The findings of this review have identified a number of effective methods of delivery and intervention elements with the potential to increase physical activity and reduce sedentary time in males. It is these findings, along with findings outlined in Chapter 3 and Chapter 4 that will assist in shaping the ManUp UWS intervention that will be tested in Chapter 5. In line with the recommendations by Waters et al. (2011), the findings of this review highlight the need for physical activity interventions to stratify results by sex to demonstrate intervention effects. In efforts to reach middle-aged males for the promotion of physical activity and the reduction of sedentary time, interventions must be designed in ways that appeal to male participants (George et al., 2012; Waters et al., 2011). It is evident that further research in male-specific population groups, targeting both physical activity and sedentary time, and using objective measurements are required.
2.7 Synopsis

This Chapter has presented a summary of the literature pertaining to physical activity and sedentary time in middle-aged males. A summary of intervention studies targeting physical activity alone, physical activity and nutrition, sedentary time alone, and physical activity and sedentary time have been discussed in detail, with particular attention paid to intervention elements that appeared to be successful and could be utilised in studies targeting male participants. Chapter 3 presents the findings of the first study conducted for this PhD – a cross sectional analysis of the associations between physical activity, sitting time, and chronic disease.
Chapter 3

Study 1 – The association between chronic disease, physical activity and sitting time: Cross-sectional analysis of the New South Wales 45 and Up Study

A peer-reviewed journal article based on findings from the study presented in Chapter 3 has been published in the International Journal of Behavioral Nutrition and Physical Activity (George, Rosenkranz, & Kolt, 2013, Appendix B).

Authorship details:

George (90%), Kolt (5%), Rosenkranz (5%).

Introduction

This analysis of existing cross-sectional data formed the first of three studies for this PhD. In order to develop an intervention to promote physical activity in middle-aged men, it was important to first consider demographic characteristics and underlying determinants of health. This analysis provides rich detail on these health and demographic variables for a sample of men aged between 45 and 64 years from across NSW, the most populous state in Australia. This chapter provides the background, describes the methods, and presents and discusses the findings of this cross-sectional study.

3.1 Background

Research into the area of male health is gaining momentum in countries across the world, and has been highlighted by the release of a range of male-specific health
reports and policies (Australian Institute of Health and Welfare, 2011b; Department of Health and Ageing, 2010b; Department of Health and Children, 2008; European Commission, 2011). As previously established in Chapters 1 and 2, Australian males experience higher rates of a range of chronic diseases such as type 2 diabetes mellitus and CVD, in comparison to their female counterparts (Department of Health and Ageing, 2010b). Australian data from 2007 showed that cancer and other tumours was the leading cause of death in both males and females aged between 45 and 64 years (Australian Institute of Health and Welfare, 2010), while CVD was the second highest cause of death in this age group (Australian Institute of Health and Welfare, 2010).

It has been well-established that regular participation in physical activity has the potential to reduce the risk of developing various chronic diseases (Physical Activity Guidelines Advisory Committee, 2008; World Health Organization, 2010a), however, less than half of Australian males are sufficiently active to confer health benefits (Australian Institute of Health and Welfare, 2010). Among middle-aged and older males, specifically, physical activity has been found to be inversely associated with a range of chronic diseases.

Haapanen, Miilunpalo, Vuori, Oja, & Pasanen (1997) found an inverse association between total physical activity and risk of coronary heart disease (CHD) and hypertension in middle-aged Finnish males. Sesso, Paffenbarger, and Lee (2000) also examined the association between physical activity and CHD in middle-aged and older males from the Harvard Alumni Study. Although no clear association between light and moderate physical activity and CHD risk was observed, results
demonstrated that both total physical activity and vigorous physical activity were inversely associated with CHD risk (Sesso, et al., 2000).

Physical activity has also been associated with reduced rates of type 2 diabetes, CVD mortality, and metabolic syndrome. Hu, Leitzmann, Stampfer, Colditz, Willett, and Rimm (2001) investigated the association between leisure time physical activity (LTPA) and diabetes in a cohort of middle-aged and older males and found that greater LTPA, namely moderate-intensity activities, were associated with reduced diabetes risk.

Further, physical activity has been associated with reduced type 2 diabetes risk (Hu et al., 2001), and higher levels of physical activity have also been associated with lower rates of CVD mortality (Warren, Barry, et al., 2010) and metabolic syndrome (Dunstan et al., 2005). High lifetime occupational physical activity has also been shown to be protective against colon and prostate cancer in adult males (Parent et al., 2011), and total daily physical activity was inversely associated with cancer mortality in middle-aged and older males (Orsini, Mantzoros, & Wolk, 2008).

Researchers have established that physical (in)activity and sedentary behaviour are two distinct risk factors that can independently affect health. While a number of studies have focused on specific domains of physical activity (e.g., LTPA) or sedentary behaviour (e.g., television viewing), few have examined overall time spent in these behaviours on the association with chronic disease. Sedentary behaviour is characterised by activities such as sitting or lying down, involving energy expenditure of 1.0-1.5 metabolic equivalents (Pate et al., 2008). Independent of LTPA, higher levels of daily sitting time – a form of sedentary behaviour – have been found to increase the risk of both CVD (Katzmarzyk et al., 2009) and all-cause
mortality in adults (Katzmarzyk et al., 2009; van der Ploeg, Chey, Korda, Banks, & Bauman, 2012). Specific sedentary behaviours such as television viewing have also been associated with higher CVD mortality risk in males (Warren, Barry, et al., 2010), increased likelihood of having metabolic syndrome (Dunstan et al., 2005), and increased type 2 diabetes risk (Hu et al., 2001). Time spent in sedentary behaviours has also been associated with clustered metabolic risk, independent of physical activity (Healy, Wijndaele, et al., 2008).

Current literature highlights the importance of participating in regular physical activity and limiting sedentary time for positive health outcomes. Although several studies have examined the association between these behaviours and specific chronic diseases, there is little evidence examining distinct associations between physical activity, sitting time, and a range of chronic diseases, particularly in middle-aged males.

### 3.2 Purpose of the study

The purpose of this study was to examine the independent association between chronic disease and two distinct and modifiable lifestyle behaviours – physical activity and sitting time – in a sample of middle-aged males. This study utilised a large sample of middle-aged Australian males – a relatively understudied population group, and statistically controlled for a range of associated covariates including age, BMI, and functional limitation.
3.3 Research questions

To address the gaps identified in the current literature and to inform the rationale for the subsequent studies in this PhD, this study addresses the following research questions, in relation to men aged 45 to 64 years.

1. Is there an association between chronic disease (combined chronic diseases, cancer, heart disease, diabetes, and high blood pressure) and physical activity in middle-aged Australian males?

2. Is there an association between chronic disease (combined chronic diseases, cancer, heart disease, diabetes, and high blood pressure) and sitting time in middle-aged Australian males?

Methods

3.4 The 45 and Up Study

The 45 and Up Study is a large-scale Australian cohort study of 267,153 individuals from across NSW, the most populous state in Australia. Data derived from The 45 and Up Study baseline questionnaire provides insight into an extensive range of health conditions and underlying determinants of health, and is the largest study of healthy ageing to be completed in the Southern Hemisphere, to date. The 45 and Up Study is longitudinal in nature, and data will be collected through the distribution of follow-up questionnaires at five-year time-points.

3.4.1 Sampling

Participants for the study were randomly sampled from the Medicare Australia database, which is Australia’s universal health care system. Participants
were eligible for inclusion into The 45 and Up Study if they were aged over 45 years and were living in NSW at the time of recruitment. They joined the study by completing a mailed, self-administered questionnaire (available at http://www.45andup.org.au) and providing consent for long-term follow-up.

3.4.2 Recruitment and response rate

A total of 267,153 participants were recruited to The 45 and Up Study between February 2006 and December 2009, representing approximately 10% of the eligible population in the 45 and over age group in NSW. The overall response rate to the mailed study invitation was estimated to be 17.9% (95% CI 17.8-18.1) (45 and Up Study Collaborators, 2008). In addition, people aged 45 years and over who were not sent a mailed study invitation could register their interest in the study by contacting the Coordinating Centre for the Study. Project staff checked all returned consent forms, and participants were excluded from the study if their consent forms were not completed correctly. Baseline data on 266,848 participants were available for the current study.

3.4.3 The 45 and Up Study baseline questionnaire

The 45 and Up Study baseline questionnaire captured information on a broad range of health (e.g., presence of chronic disease, health related quality of life, and self-rated health), demographic (e.g., income and employment status), and lifestyle-related variables (e.g., participation in physical activity and dietary habits). A separate questionnaire was developed for males and females (available from http://www.45andup.org.au/studymaterials.aspx?page=studymaterials, see Appendix
C and D) to ensure that sex-specific questions targeted only those to whom they were applicable.

3.4.4 Generalisability of The 45 and Up Study

A cohort study design is often a feasible, cost-effective approach that allows researchers to collect data across large-scale samples. Large-scale cohort studies such as the US Cancer Prevention Study and the British Doctors’ Study have contributed to the growing body of evidence on health and ageing, although cohort studies may also be affected by potential biases such as the healthy cohort effect, where participants in the sample are often healthier than the general population. Moreover, the response rate for cohort studies is often relatively low, and most cohort studies tend to recruit fewer than 50% of the eligible population (Mealing et al., 2010). For these reasons, The 45 and Up Study is not likely to be representative of the NSW population aged 45 years and over, although it was not designed to be a truly representative sample. This being said, The 45 and Up Study is expected to be one of the more representative cohort studies to be conducted globally (45 and Up Study Collaborators, 2009). The design of The 45 and Up Study allows for data-linkage and long-term follow-up, which will permit researchers to further monitor and investigate trends observed in the baseline data.

3.4.5 Data entry

A commercial data entry company was responsible for performing logic checks, recoding raw data where required, and entering the raw data obtained from each returned baseline questionnaire into the database. Any numeric responses that were recorded as a word were, where possible, converted to numeric form, to ensure
consistency in responses across the dataset. Written values that could not be translated to numeric form were deemed invalid, denoted by a coded value of ‘99999’. If a participant had recorded a numeric range when a single numeric response was required, the range was averaged to provide a single numeric response. Management staff at the Sax Institute completed additional data cleaning, checking and recoding once the commercial data entry company finished entering the data into the database.

### 3.5 Participants for the current study

Participants for the current study were a subset of males aged between 45 and 64 years of age from the total 267,153 males and females enrolled in The 45 and Up Study as of December 2009. A total of 123,799 study participants were male, and 70,416 of these were aged between 45 and 64 years (26.4% of the total sample). The final sample size for the current study was 63,048 males, after excluding those with missing or invalid data for two or more types of physical activity (walking, moderate physical activity and vigorous physical activity; n = 7,368).

### 3.6 Study design

The design for this study was a cross-sectional analysis of The 45 and Up Study baseline questionnaire data. A series of binary logistic regression analyses was conducted to investigate the association between the presence of chronic diseases, levels of physical activity, and time spent sitting.

### 3.7 Study variables
The exposure variables, outcome variables, and covariates examined in this study are listed with the corresponding 45 and Up Study baseline questionnaire item number in Table 3.1, and are outlined below.
Table 3.1  List of variables examined in Study 1.

<table>
<thead>
<tr>
<th>Research question 1</th>
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<tbody>
<tr>
<td><strong>Variable</strong></td>
<td><strong>Outcome</strong></td>
<td><strong>Exposure</strong></td>
<td><strong>Covariates</strong></td>
</tr>
<tr>
<td><strong>Chronic diseases (presence or absence)</strong></td>
<td><strong>24</strong></td>
<td><strong>Physical activity</strong> – measured using the Active Australia Survey (Australian Institute of Health and Welfare, 2003)</td>
<td>17</td>
</tr>
<tr>
<td><strong>Sitting time (hours/day)</strong></td>
<td>54</td>
<td><strong>Age</strong></td>
<td>1</td>
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<tr>
<td><strong>Pre-tax household income</strong></td>
<td>46</td>
<td><strong>Pre-tax household income</strong></td>
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<td><strong>Educational qualification</strong></td>
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<td><strong>Educational qualification</strong></td>
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<td><strong>Smoking status</strong></td>
<td>11</td>
<td><strong>Smoking status</strong></td>
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<tr>
<td><strong>BMI – self-reported height and weight data</strong></td>
<td>3, 4</td>
<td><strong>BMI – self-reported height and weight data</strong></td>
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</tr>
<tr>
<td><strong>Functional limitation – measured using the Medical Outcomes Study – Physical Functioning scale (MOS-PF) (Stewart &amp; Kamberg, 1992)</strong></td>
<td>28</td>
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<th>Research question 2</th>
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<tr>
<td><strong>Variable</strong></td>
<td><strong>Outcome</strong></td>
<td><strong>Exposure</strong></td>
<td><strong>Covariates</strong></td>
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<td>28</td>
</tr>
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</table>
3.7.1 Test instruments

This section describes the specific test instruments used to collect data on key variables of interest within The 45 and Up Study baseline questionnaire.

3.7.1.1 Chronic disease

Participants were asked to report whether they had ever been told by a doctor that they have a chronic disease or condition (question 24 of The 45 and Up Study baseline questionnaire). For the purpose of the current study, cancer (which included prostate cancer and other cancers, but did not include melanoma or non-melanoma skin cancer), heart disease, diabetes, and hypertension were used as primary outcome variables (binary presence or absence of each disease), as evidence suggests that time spent sedentary is associated with these, and other conditions (Dunstan et al., 2005; Healy, Wijndaele, et al., 2008; Hu et al., 2001; Katzmarzyk et al., 2009). In addition, an overall chronic disease variable combining the diseases listed above as computed (binary presence or absence of any chronic disease, among those listed) and analysed in a separate model.

3.7.1.2 Physical activity – the Active Australia Survey

Questions from the Active Australia Survey (AAS) (Australian Institute of Health and Welfare, 2003) were used to measure physical activity in The 45 and Up Study baseline questionnaire (see question 16 and 17 of The 45 and Up Study baseline questionnaire, Appendix C). The survey comprises a series of eight questions used to ascertain participation in different types and intensities of physical activity, with a reference period of one week (Australian Institute of Health and Welfare, 2003). Participants respond to survey questions by recording the total
number of times, total minutes, or total hours spent participating in a particular activity.

Participants completing The 45 and Up Study baseline questionnaire were asked to report their participation in three broad types of physical activity – walking continuously, for at least 10 minutes (for recreation or exercise or to get to or from places); vigorous physical activity (that made you breathe harder or puff and pant, like jogging, cycling, aerobics, competitive tennis, but not household chores or gardening); and moderate physical activity (like gentle swimming, social tennis, vigorous gardening or work around the house). Question 16 of The 45 and Up Study baseline questionnaire asked participants to record a numeric response to the question “How many TIMES did you do each of these activities LAST WEEK?”, while question 17 asked participants “If you add up all the time you spent doing each activity LAST WEEK, how much time did you spend ALTOGETHER doing each type of activity?”. For the current study, the data collected from question 17 were used to assess participants’ level of physical activity, with minutes of vigorous physical activity given double weighting (Australian Institute of Health and Welfare, 2003).

The test-retest reliability and validity of the AAS have been established, making it an acceptable tool for use in population health surveys (Brown, Trost, Bauman, Mummery, & Owen, 2004). Brown et al. (2004) assessed the psychometric properties of four different population-level physical activity measures, including the AAS, the short International Physical Activity Questionnaire, the Behavioural Risk Factor Surveillance System and the National Health Survey. The authors examined the test-retest reliability for physical activity status (active, insufficiently active, or sedentary) and for minutes of physical activity for each individual survey item, and
the test-retest reliability of the total minutes reported in each survey as a whole. It was acknowledged that the repeatability of each individual item was variable (ranging from fair to moderate), however, they concluded that each physical activity measure had “reasonable and acceptable reliability properties” (Brown et al., 2004, p. 211). When measured using each of these four tools, the recorded level of physical activity within the study population was found to be representative of the overall Australian population. As such, the AAS has been used as a physical activity measure in several national population health surveys, including the New South Wales population health survey (Centre for Epidemiology and Research, 2009).

According to the WHO (World Health Organization, 2010a), 150 minutes or more of moderate-intensity and/or vigorous-intensity physical activity in a one-week period is conducive to health benefits in adults aged between 18 and 64 years. For further health benefits, the WHO recommends that adults aged between 18 and 64 should participate in 300 minutes or more of moderate-intensity physical activity (World Health Organization, 2010a).

After reported minutes of vigorous physical activity were weighted by two (Australian Institute of Health and Welfare, 2003), total minutes of physical activity, including walking, moderate physical activity and vigorous physical activity, were calculated. The total minutes of overall physical activity were divided into five distinct categories: zero (no physical activity); 1 to 149 minutes of physical activity (insufficient levels); 150 to 299 minutes of physical activity (sufficient levels); 300 to 539 minutes (highly active); and ≥540 minutes of physical activity in the previous week. Given the high proportion of males in the current study that reported 150 minutes or more of physical activity in the previous week (~81%), further categories
were established to explore trends with higher levels of physical activity. Those males reporting 300 minutes or more of physical activity were categorised as highly active, however the proportion of males in this category was still quite high (>60%). Because of this high proportion, a filter was applied to remove participants reporting less than 150 minutes of physical activity, so a cut-point for two equal groups (from those reporting ≥150 minutes of physical activity) could be established. Of the 50,972 (~81%) of males reporting 150 minutes or more of physical activity, 50% reported a total of 540 minutes or more of physical activity.

There are potential limitations associated with self-report measures such as the AAS. The very high proportion of participants in this cohort who reported a sufficient amount of physical activity (i.e., 150 minutes or more per week) indicates that the AAS may be highly sensitive, though not particularly specific. The trends observed between the least active and the most active, however, remain the same.

3.7.1.3  Sitting time

Question 54 asked participants to record the number of hours in each 24-hour day they spent sitting. Total daily sitting time was divided into quartiles of zero to <4 hours, 4 to <6 hours, 6 to <8 hours, and ≥8 hours. This particular question has not been assessed for reliability and validity, although it is analogous to the sitting time assessment question used in the IPAQ. Participants completing the IPAQ are asked to report on the amount of time, in hours and minutes, they usually spend sitting on a daily basis, and this item used to assess sedentary time has been shown to have acceptable reliability and validity (Craig et al., 2003). Clemes, David, Zhao, Han, and Brown (2012) found that compared with accelerometer data, a single-item question assessing overall sitting time significantly underestimated sitting time,
while a multiple-question domain-specific questionnaire showed increased accuracy. Nevertheless, Atkin et al. (2012), support the use of single-item questionnaires in health-related epidemiological research, suggesting that such tools are appropriate when the primary requirements include usability and the capability to rank behaviours of interest. In comparison to the physical activity literature, research into sedentary time and its potential impact on associated health outcomes is still in the relatively early stages. As such, there is less information available on the validity and reliability of questions related to sedentary time. Although this is a concern, a number of studies have used similar, single-item questions to assess sedentary time (van der Ploeg, Chey, Korda, Banks, & Bauman, 2012; van Uffelen, Watson, Dobson, & Brown, 2011; Yates et al., 2012), and the available data are useful for analysing trends in chronic disease and other health outcomes of interest.

### 3.7.1.4 Pre-tax household income

Question 46 asked participants to select the most appropriate category for their usual yearly pre-tax household income from all sources, including benefits, pensions, and superannuation. Possible options were: less than $5,000 per year, $5,000-$9,999 per year, $10,000-$19,999 per year, $20,000-$29,999 per year, $30,000-$39,999 per year, $40,000-$49,999 per year, $50,000-$69,999 per year, $70,000 or more per year, and “I would rather not answer this question”. For the current study, these categories were combined to form five income categories (less than $10,000, $10,000-$29,999 per year, $30,000-$49,999 per year, $50,000-$69,999 per year, $70,000 or more per year). All other values were coded as missing.
3.7.1.5  

**Highest educational qualification**

Participants were asked to report the highest educational qualification they had completed, from the following options: no school certificate or other qualifications, school or intermediate certificate (or equivalent), higher school or leaving certificate (or equivalent), trade or apprenticeship (e.g. hairdresser, chef), certificate or diploma (e.g. child care, technician), and university degree or higher.

3.7.1.6  

**Smoking status**

For the current study, question 11 “*Have you ever been a regular smoker?*” was used to determine smoking status. Participants answered either “yes” or “no” to this question. Responses to this question were coded as either ‘ever’ when participants answered “yes” or ‘never’ when participants answered “no”.

3.7.1.7  

**BMI cut-points**

Self-reported height and weight measurements from the 45 and Up baseline questionnaire were used to determine participants’ BMI. BMI can be calculated by dividing an individual’s weight in kilograms (kg), by the square of their height in metres (kg/m²). Question 3 of The 45 and Up Study baseline questionnaire asked participants to give their height to the nearest centimetre or inch, with the question “How tall are you without shoes?”. The following question (4), asked “About how much do you weigh?” with participants recording their approximate weight in kilograms or stone and pounds. Cut-points developed by (WHO) were used to determine underweight (<18.50kg/m²), normal weight (18.50-24.99kg/m²),
overweight (25.00-29.99kg/m²) and obese (≥30.00kg/m²) BMI categories (World Health Organization, 2006).

3.7.1.8 Medical Outcomes Study – Physical Functioning Scale (MOS-PF)

The degree of limitation to physical function was assessed in question 28 of The 45 and Up Study baseline questionnaire, using the Medical Outcomes Study Physical Functioning Scale (Stewart & Kamberg, 1992). Survey respondents were asked “Does your health now LIMIT YOU in any of the following activities?” with reference to the following 10 daily activities: VIGOROUS ACTIVITIES (e.g. running, strenuous sports); MODERATE ACTIVITIES (e.g. pushing a vacuum cleaner, playing golf); lifting or carrying shopping; climbing several flights of stairs; climbing one flight of stairs; walking one kilometre; walking half a kilometre; walking 100 metres; bending, kneeling or stooping; bathing or dressing yourself (Stewart & Kamberg, 1992). By selecting 1 of 3 possible options to indicate the degree of limitation for each of the 10 activities listed above – yes, limited a lot; yes, limited a little; no, not limited at all. Each of these possible options were given a score of 0, 5 and 10, respectively, and the scores for all 10 variables were calculated to give an overall score out of 100 (Stewart & Kamberg, 1992).

An overall score of 100 indicates no functional limitation. Data for the remaining participants who reported some limitation were split into three equal groups to form minor (95-99), moderate (85-94) and severe (0-84) limitation categories. When more than 5 values (out of a possible 10) where missing or invalid, the MOS-PF score was coded as missing. If a participant was missing less than 5 values, an average score was calculated for this participant using SPSS. This tool has been shown to have
good test-retest reliability and content validity as a measure of physical functioning (Haley, McHorney, & Ware, 1994).

3.8 Data analysis

Data drawn from The 45 and Up Study baseline dataset were analysed using SPSS 18.0 statistical software (SPSS Inc. Chicago, IL USA). To explore the demographic characteristics of the study sample, frequencies were calculated for all outcome and exposure variables, and covariates. Binary logistic regression analyses were used to examine the odds of having each (and also any) chronic disease by categories of physical activity and sitting time, with partially adjusted models controlling for physical activity, sitting time, age group, educational qualification, pre-tax household income, smoking status, and BMI categories, and fully adjusted models also controlling for functional limitation. Results are presented as crude odds ratios (OR), and partially and fully adjusted odds ratios (AOR) and corresponding 95% confidence intervals (CI). Unless otherwise specified, results refer to the fully adjusted odds ratios (AOR). A significance level of alpha = 0.05 was used in all analyses.

3.9 Applying to access The 45 and Up Study baseline questionnaire data

In order to gain access to The 45 and Up Study baseline questionnaire data, researchers must first submit a detailed application to the 45 and Up Coordinating Centre, and supporting independent Access Committee (Banks, Jorm, & Wutzke, 2011). Permission to use the 45 and Up baseline dataset for the current study was
approved by the 45 and Up Coordinating Centre and Access Committee, in August 2010 (project number 10006, see Appendix E).

3.10 Ethical implications

The 45 and Up Study was granted prior ethics approval from the University of New South Wales Human Research Ethics Committee (approval number 05035) that covered analysis of the baseline questionnaire (Appendix F). The University of Western Sydney Human Research Ethics Committee granted reciprocal ethics approval for the current study on November 18, 2010 (UWS Protocol number H8793, see Appendix G).

3.10.1 Ensuring confidentiality

Before gaining access to the baseline data, all researchers listed on the application to use the data were required to sign confidentiality agreements detailing their responsibilities in handling, analysing and disseminating findings from the baseline data. Researchers agreed to maintain the confidentiality of Study participants; store data in a secure location; destroy any hard copy versions of the data appropriately; and provide a copy of articles containing data from The 45 and Up Study to the Sax Institute for technical review before being submitted for publication.

3.10.2 Data storage

In accordance with the requirements detailed in the confidentiality agreement and ethics approval, The 45 and Up Study baseline dataset was password protected and stored on a locked computer. All data analyses were conducted on campus and
the dataset was not copied onto any external devices or removed from the site. Analyses that were printed and used in hard copy format were stored in a secure location and disposed of accordingly.

Results

3.11 Initial descriptive analyses

The mean ± standard deviation (SD) age of participants included in the current study was 55.6 (± 5.4 years), and the mean ± SD BMI was 27.6 (± 4.3 kg/m²). The demographic information for the sample is presented in Table 3.2.
Table 3.2  Demographic characteristics of the sample for Study 1.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronic diseases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>37,013</td>
<td>58.7</td>
</tr>
<tr>
<td>One</td>
<td>19,550</td>
<td>31.0</td>
</tr>
<tr>
<td>Two or more</td>
<td>6,485</td>
<td>10.3</td>
</tr>
<tr>
<td>Cancer</td>
<td>3,528</td>
<td>5.6</td>
</tr>
<tr>
<td>Heart disease</td>
<td>5,447</td>
<td>8.6</td>
</tr>
<tr>
<td>Diabetes</td>
<td>4,872</td>
<td>7.7</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>19,753</td>
<td>31.3</td>
</tr>
<tr>
<td><strong>Sitting (hours/day)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to &lt;4</td>
<td>14,079</td>
<td>23.3</td>
</tr>
<tr>
<td>4 to &lt;6</td>
<td>15,369</td>
<td>25.4</td>
</tr>
<tr>
<td>6 to &lt;8</td>
<td>11,255</td>
<td>18.6</td>
</tr>
<tr>
<td>≥8</td>
<td>19,847</td>
<td>32.8</td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary (Zero)</td>
<td>2,571</td>
<td>4.1</td>
</tr>
<tr>
<td>Low active (1-149 mins)</td>
<td>9,505</td>
<td>15.1</td>
</tr>
<tr>
<td>Sufficiently active (150-299 mins)</td>
<td>10,712</td>
<td>17.0</td>
</tr>
<tr>
<td>Highly active (300-539 mins)</td>
<td>14,047</td>
<td>22.3</td>
</tr>
<tr>
<td>Very highly active (540+ mins)</td>
<td>26,213</td>
<td>41.6</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 to 49</td>
<td>12,427</td>
<td>19.7</td>
</tr>
<tr>
<td>50 to 54</td>
<td>16,142</td>
<td>25.6</td>
</tr>
<tr>
<td>55 to 59</td>
<td>17,940</td>
<td>28.5</td>
</tr>
<tr>
<td>60 to 64</td>
<td>16,539</td>
<td>26.2</td>
</tr>
<tr>
<td><strong>Pre-tax household income (AUD)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10k</td>
<td>1,890</td>
<td>3.4</td>
</tr>
<tr>
<td>10k to &lt;30k</td>
<td>7,494</td>
<td>13.5</td>
</tr>
<tr>
<td>30k to &lt;50k</td>
<td>9,549</td>
<td>17.2</td>
</tr>
<tr>
<td>50k to &lt;70k</td>
<td>9,183</td>
<td>16.5</td>
</tr>
<tr>
<td>70k +</td>
<td>27,378</td>
<td>49.3</td>
</tr>
<tr>
<td><strong>Educational qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>4,368</td>
<td>7.0</td>
</tr>
<tr>
<td>School Certificate</td>
<td>7,972</td>
<td>12.8</td>
</tr>
<tr>
<td>HSC</td>
<td>6,502</td>
<td>10.4</td>
</tr>
<tr>
<td>Trade/Apprenticeship</td>
<td>10,748</td>
<td>17.2</td>
</tr>
<tr>
<td>Certificate/Diploma</td>
<td>13,109</td>
<td>21.0</td>
</tr>
<tr>
<td>University degree</td>
<td>19,782</td>
<td>31.7</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>32,520</td>
<td>51.6</td>
</tr>
<tr>
<td>Ever</td>
<td>30,496</td>
<td>48.4</td>
</tr>
<tr>
<td><strong>Body Mass Index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>329</td>
<td>0.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>16,477</td>
<td>27.5</td>
</tr>
<tr>
<td>Overweight</td>
<td>28,574</td>
<td>47.8</td>
</tr>
<tr>
<td>Obese</td>
<td>14,447</td>
<td>24.1</td>
</tr>
<tr>
<td><strong>Functional limitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No limitation</td>
<td>26,442</td>
<td>44.5</td>
</tr>
<tr>
<td>Minor limitation</td>
<td>12,181</td>
<td>20.5</td>
</tr>
<tr>
<td>Moderate limitation</td>
<td>10,012</td>
<td>16.9</td>
</tr>
<tr>
<td>Severe limitation</td>
<td>10,731</td>
<td>18.1</td>
</tr>
</tbody>
</table>
3.11.1 Chronic disease

Of the 63,048 males included in the current study, 41.3% reported having at least one chronic disease, while 10.3% reported two or more.

3.11.2 Physical activity

Of the 63,048 males included in the current study, 80.9% reported participating in sufficient levels of physical activity, that is, at least 150 minutes per week (World Health Organization, 2010a). Within this 80.9%, 22.3% of men were highly active, reporting between 300 and 539 minutes of physical activity in the previous week, and 41.6% of men were very highly active, reporting 540 or more minutes of physical activity in the previous week. A total of 4.1% of men reported no physical activity, while 15.1% of men reported low levels of activity with 1 to 149 minutes of physical activity in the previous week.

3.11.3 Total hours spent sitting each day

A total of 25.4% of men reported spending 4 to less than 6 hours sitting each day, while 23.3% of men reported their total seated time as less than 4 hours. Six to less than 8 hours of sitting time per day was reported by 18.6% of men within the current sample, and 8 or more hours spent sitting was reported by 32.8% of participants within the current sample.

3.11.4 Pre-tax household income

Almost half of the males in the current study (49.3%) reported a pre-tax household income of $70,000 or more. A pre-tax income of less than $10,000 was reported by 3.4% of males, and an income of between $10,000 and $29,999 was
reported by 13.5% of males. A total of 17.2% of males reported a pre-tax household income of $30,000 to $49,999 and the remaining 16.5% reported an income of $50,000 to $69,999.

3.11.5 Highest educational qualification

A university degree or higher was reported by the highest proportion of males (31.7%), indicating that the sample is quite highly educated. A total of 21.0% listed a certificate or diploma as their highest qualification, and 17.2% of males in the current study had completed a trade or apprenticeship. The higher school certificate (HSC) was the highest educational qualification for 10.4% of males, and the school (or intermediate) certificate was the highest completed level of education for 12.8% of males within the current study. The remaining 7.0% of males held no educational qualification.

3.11.6 Smoking status

Smoking status was relatively evenly distributed, with 48.4% of males indicating that they had been a regular smoker at some point in their lives and 51.6% indicating that they had never been a regular smoker.

3.11.7 BMI

Less than 1% of males in the current study (0.5%) were classified as being underweight, while the highest proportion of men were classified as being overweight (47.8%). A total of 27.5% of males were within the normal weight category and the remaining 24.1% were classified as obese.

3.11.8 Functional limitation
A total of 44.5% of the sample reported no functional limitation, while 18.1% of participants reported severe functional limitation.

### 3.12 Binary logistic regression analyses

Results of the binary logistic regression analyses are presented in Table 3.3 and 3.4. These results are discussed in more detail below, and are presented separately for each chronic disease category: (1) combined chronic diseases, (2) cancer, (3) heart disease, (4) diabetes, and (5) high blood pressure.
### Table 3.3  Presence of chronic disease by categories of physical activity – results of binary logistic regression.

<table>
<thead>
<tr>
<th>Physical activity model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Any chronic disease</th>
<th>Cancer</th>
<th>Heart disease</th>
<th>Diabetes</th>
<th>High blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary (Zero)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Low active (1-149 mins)</td>
<td>0.88</td>
<td>0.81 - 0.96</td>
<td>0.87</td>
<td>0.73 - 1.03</td>
<td>0.80</td>
</tr>
<tr>
<td>Sufficiently active (150-299 mins)</td>
<td>0.83</td>
<td>0.76 - 0.90</td>
<td>0.79</td>
<td>0.66 - 0.94</td>
<td>0.79</td>
</tr>
<tr>
<td>Highly active (300-539 mins)</td>
<td>0.75</td>
<td>0.69 - 0.82</td>
<td>0.75</td>
<td>0.63 - 0.88</td>
<td>0.67</td>
</tr>
<tr>
<td>Very highly active (540+ mins)</td>
<td>0.72</td>
<td>0.67 - 0.79</td>
<td>0.76</td>
<td>0.65 - 0.89</td>
<td>0.69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical activity model 2&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Any chronic disease</th>
<th>Cancer</th>
<th>Heart disease</th>
<th>Diabetes</th>
<th>High blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary (Zero)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Low active (1-149 mins)</td>
<td>0.98</td>
<td>0.87 - 1.09</td>
<td>0.89</td>
<td>0.72 - 1.10</td>
<td>0.88</td>
</tr>
<tr>
<td>Sufficiently active (150-299 mins)</td>
<td>1.01</td>
<td>0.91 - 1.13</td>
<td>0.82</td>
<td>0.67 - 1.01</td>
<td>0.93</td>
</tr>
<tr>
<td>Highly active (300-539 mins)</td>
<td>0.94</td>
<td>0.84 - 1.04</td>
<td>0.76</td>
<td>0.62 - 0.93</td>
<td>0.81</td>
</tr>
<tr>
<td>Very highly active (540+ mins)</td>
<td>0.87</td>
<td>0.78 - 0.96</td>
<td>0.72</td>
<td>0.60 - 0.88</td>
<td>0.76</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical activity model 3&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Any chronic disease</th>
<th>Cancer</th>
<th>Heart disease</th>
<th>Diabetes</th>
<th>High blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary (Zero)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Low active (1-149 mins)</td>
<td>1.01</td>
<td>0.91 - 1.13</td>
<td>0.93</td>
<td>0.75 - 1.14</td>
<td>0.92</td>
</tr>
<tr>
<td>Sufficiently active (150-299 mins)</td>
<td>1.08</td>
<td>0.97 - 1.21</td>
<td>0.89</td>
<td>0.72 - 1.09</td>
<td>1.03</td>
</tr>
<tr>
<td>Highly active (300-539 mins)</td>
<td>1.03</td>
<td>0.92 - 1.15</td>
<td>0.83</td>
<td>0.68 - 1.02</td>
<td>0.93</td>
</tr>
<tr>
<td>Very highly active (540+ mins)</td>
<td>0.97</td>
<td>0.88 - 1.08</td>
<td>0.81</td>
<td>0.67 - 0.98</td>
<td>0.91</td>
</tr>
</tbody>
</table>

<sup>a</sup> Reference category
<sup>b</sup> Unadjusted odds for physical activity or sitting time alone.
<sup>c</sup> Adjusted for physical activity or sitting time (as appropriate), age, pre-tax household income, educational qualification, smoking status, and BMI.

* Adjusted for physical activity or sitting time (as appropriate), age, pre-tax household income, educational qualification, smoking status, BMI and functional limitation.
Table 3.1 Presence of chronic disease by categories of sitting time – results of binary logistic regression.

<table>
<thead>
<tr>
<th>Sitting time model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Any chronic disease</th>
<th>Cancer</th>
<th>Heart disease</th>
<th>Diabetes</th>
<th>High blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to &lt;4*</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>4 to &lt;6</td>
<td>1.09</td>
<td>1.04 - 1.14</td>
<td>1.07</td>
<td>0.97 - 1.18</td>
<td>1.07</td>
</tr>
<tr>
<td>6 to &lt;8</td>
<td>1.12</td>
<td>1.07 - 1.18</td>
<td>1.14</td>
<td>1.02 - 1.27</td>
<td>1.13</td>
</tr>
<tr>
<td>≥8</td>
<td>1.04</td>
<td>0.99 - 1.08</td>
<td>0.98</td>
<td>0.89 - 1.08</td>
<td>0.95</td>
</tr>
<tr>
<td>Sitting time model 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to &lt;4*</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>4 to &lt;6</td>
<td>1.07</td>
<td>1.01 - 1.13</td>
<td>1.03</td>
<td>0.92 - 1.16</td>
<td>1.03</td>
</tr>
<tr>
<td>6 to &lt;8</td>
<td>1.12</td>
<td>1.06 - 1.19</td>
<td>1.13</td>
<td>1.00 - 1.27</td>
<td>1.13</td>
</tr>
<tr>
<td>≥8</td>
<td>1.12</td>
<td>1.06 - 1.19</td>
<td>1.07</td>
<td>0.95 - 1.19</td>
<td>1.04</td>
</tr>
<tr>
<td>Sitting time model 3&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to &lt;4*</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>4 to &lt;6</td>
<td>1.06</td>
<td>1.00 - 1.12</td>
<td>1.02</td>
<td>0.91 - 1.15</td>
<td>1.01</td>
</tr>
<tr>
<td>6 to &lt;8</td>
<td>1.10</td>
<td>1.03 - 1.16</td>
<td>1.10</td>
<td>0.97 - 1.24</td>
<td>1.08</td>
</tr>
<tr>
<td>≥8</td>
<td>1.09</td>
<td>1.03 - 1.15</td>
<td>1.03</td>
<td>0.92 - 1.16</td>
<td>0.99</td>
</tr>
</tbody>
</table>

<sup>a</sup> Unadjusted odds for physical activity or sitting time alone.

<sup>b</sup> Adjusted for physical activity or sitting time (as appropriate), age, pre-tax household income, educational qualification, smoking status, and BMI.

<sup>c</sup> Adjusted for physical activity or sitting time (as appropriate), age, pre-tax household income, educational qualification, smoking status, BMI and functional limitation.
3.12.1 Combined chronic diseases

In the crude model, the likelihood of having a chronic disease decreased significantly with increasing levels of physical activity ($P_{trend} < .001$), and males reporting $\geq 540$ minutes of physical activity in the previous week were least likely to report having a chronic disease in comparison to the reference category of no physical activity (OR $0.72$, 95% CI $0.67 – 0.79$). Partially adjusting for covariates attenuated this association, and only males reporting the highest levels of physical activity were significantly less likely to report having a chronic disease (AOR $0.87$, 95% CI $0.78 – 0.96$). After adjusting for all covariates including functional limitation, the association between physical activity and chronic disease further diminished.

Males who reported sitting for 4 to $< 6$ and 6 to $< 8$ hours per day were significantly more likely to report having a chronic disease (OR $1.09$, 95% CI $1.04 – 1.14$; OR $1.12$, 95% CI $1.07 – 1.18$, respectively), while those who reported higher volumes of sitting ($\geq 8$ hours) were not significantly more likely to report having a chronic disease than those in the reference category of $< 4$ hours of sitting time (OR $1.04$, 95% CI $0.99 – 1.08$).

Partially adjusting for covariates strengthened the association between sitting time and chronic disease, and males in all sitting categories higher than the reference category were significantly more likely to report having a chronic disease ($P_{trend} = < .001$). Once functional limitation was added to the fully adjusted model, the odds of having a chronic disease were attenuated ($P_{trend} = .008$), although males reporting 4 to $< 6$, 6 to $< 8$, and $\geq 8$ hours of sitting per day were significantly more likely to report having a chronic disease than those sitting for $< 4$ hours per day.
(AOR 1.06, 95% CI 1.00 – 1.12; AOR 1.10, 95% CI 1.03 – 1.16, AOR 1.09, 95% CI 1.03 – 1.15, respectively).

3.12.2 Cancer

There was a significant linear trend between physical activity and cancer in the crude model ($P$ for trend = .001). Compared with those who reported no physical activity in the previous week, participants who were classified as very highly active were significantly less likely to report having cancer (OR 0.76, 95% CI 0.65 – 0.89). Partially adjusting for covariates resulted in some attenuation, although the linear trend remained significant ($P$ for trend <0.001) and the two highest physical activity categories were significantly associated with reduced odds of reporting cancer (AOR 0.76, 95% CI 0.62 – 0.93; AOR 0.72, 95% CI 0.60 – 0.88). The association observed in the crude model was attenuated further after adjusting for all covariates, including functional limitation ($P$ for trend = .068). Although the likelihood of having cancer appeared to be lower in all physical activity categories above the reference category, only participants reporting $\geq$540 minutes of physical activity were significantly less likely to report having cancer (AOR 0.81, 95% CI 0.67 – 0.98).

Sitting time was significantly associated with cancer ($P$ for trend = .015). In comparison to the reference group (<4 hours) participants reporting 6 to <8 hours of sitting per day were more likely to have cancer (OR 1.14, 95% CI 1.02 – 1.27). Adjusting for covariates impacted considerably on the association between sitting time and cancer ($P$ for trend = .216), and only participants reporting 6 to <8 hours of sitting time per day were more likely to report ever having cancer (AOR 1.13, 95% CI 1.00 – 1.27). Adding functional limitation to the final model further attenuated the association between sitting time and cancer ($P$ for trend = .485).
3.12.3 Heart disease

A significant crude inverse association between physical activity and heart disease was observed ($P$ for trend $< .001$), however, this association was attenuated after adjusting for covariates, particularly functional limitation. In the crude model, the odds of having heart disease were significantly reduced for participants in all physical activity categories above the reference category (no physical activity), and participants in the highest activity category were around 30% less likely to report having heart disease (OR 0.69, 95% CI 0.61 – 0.79). The association between physical activity and heart disease was attenuated slightly after partially adjusting for covariates ($P$ for trend $< .001$), although participants in the two highest physical activity categories were significantly less likely to report having heart disease (AOR 0.81, 95% CI 0.68 – 0.95; AOR 0.76, 95% CI 0.65 – 0.89). This association was significantly reduced once functional limitation was added in the fully adjusted model ($P$ for trend $= .088$), and physical activity levels were no longer significantly associated with heart disease.

There was a crude association between sitting time and heart disease ($P$ for trend $< .001$). In comparison to those reporting <4 hours of sitting time per day, participants who reported 6 to <8 hours of sitting time were significantly more likely to report having heart disease (OR 1.13, 95% CI 1.03 – 1.23). Higher volumes of sitting ($\geq$8 hours) were not significantly associated with having heart disease in the crude model. Once covariates including BMI were added to the model, the odds of having heart disease appeared to be slightly higher for participants in all sitting categories above the reference category ($P$ for trend $= .104$), although the only significant association observed was for those reporting 6 to <8 hours of sitting per
day (AOR 1.13, 95% CI 1.02 – 1.25). Adding functional limitation to the model attenuated the odds of having heart disease further ($P$ for trend = .259), and there were no significant associations observed for any sitting time categories.

### 3.12.4 Diabetes

A significant inverse monotonic relationship between physical activity and diabetes was seen in all three models. In the crude model, males participating in any physical activity in the previous week were less likely to report having diabetes, than those reporting no activity (reference category, $P$ for trend < .001). Participants in the highly active and very highly active categories were only half as likely to report having diabetes than those in the reference category (OR 0.50, 95% CI 0.44 – 0.57; OR 0.45, 95% CI 0.39 – 0.50, respectively). This association was weakened after partially adjusting for covariates ($P$ for trend < .001), although participants classified as sufficiently active, highly active, or very highly active were still significantly less likely to report having diabetes (AOR 0.81, 95% CI 0.69 – 0.96; AOR 0.74, 95% CI 0.63 – 0.87; AOR 0.63, 95% CI 0.54 – 0.74). This association was further attenuated once functional limitation was added to the final model ($P$ for trend < .001), although highly active and very highly active males were significantly less likely to report having diabetes (AOR 0.81, 95% CI 0.69 – 0.96; AOR 0.70, 95% CI 0.60 – 0.84, respectively).

The likelihood of having diabetes increased linearly with increasing sitting time across all three models. Compared with those reporting <4 hours of sitting time (reference category), participants reporting 4 to <6, 6 to <8, and ≥8 hours of sitting time per day were significantly more likely to report having diabetes (OR 1.12, 95% CI 1.03 – 1.23, OR 1.19, 95% CI 1.08 – 1.31, OR 1.15, 95% CI 1.06 – 1.25, $P$ for
In the partially adjusted model, a more pronounced linear increase in odds was observed between increasing sitting time and diabetes \((P \text{ for trend} < .001)\), and males reporting 6 to <8 and \(\geq 8\) hours of sitting time per day were significantly more likely to report having diabetes (AOR 1.18, 95% CI 1.05 – 1.32; AOR 1.25, 95% CI 1.13 – 1.38). The association between sitting and diabetes was attenuated slightly after functional limitation was added in the final model \((P \text{ for trend} < .001)\). Males reporting higher amounts of sitting (6 to <8 hours and \(\geq 8\) hours) were, however, significantly more likely to report having diabetes (AOR 1.15, 95% CI 1.03 – 1.28; AOR 1.21, 95% CI 1.09 – 1.33, respectively).

### 3.12.5 High blood pressure

Compared with those reporting no physical activity (reference category), participants reporting any physical activity in the previous week were significantly less likely to report having high blood pressure \((P \text{ for trend} < .001)\), and odds were lowest for those reporting \(\geq 540\) minutes (OR 0.73, 95% CI 0.67 – 0.79). Partially adjusting for covariates resulted in some attenuation in the odds of having high blood pressure \((P \text{ for trend} < .001)\), however, participants in the highest physical activity category were significantly less likely to report having high blood pressure than those reporting no activity (AOR 0.89, 95% CI 0.80 – 1.00). Adding functional limitation in the fully adjusted model attenuated the association between physical activity and high blood pressure \((P \text{ for trend} = .022)\), and the association observed in the previous models was diminished (AOR 0.98, 95% CI 0.88 – 1.09).

The likelihood of having high blood pressure was higher for participants in each sitting category above the reference category of <4 hours \((P \text{ for trend} = .008)\) and participants reporting 4 to <6 and 6 to <8 hours of sitting time per day were
significantly more likely to report having high blood pressure than those reporting <4 hours (OR 1.06, 95% CI 1.01 – 1.11, OR 1.10, 95% CI 1.04 – 1.16, respectively). After partially adjusting for covariates, the likelihood of having high blood pressure increased linearly with increasing hours of sitting time ($P$ for trend $= .026$), being highest for participants reporting ≥8 hours of sitting per day (AOR 1.09, 95% CI 1.03 – 1.15). Adding functional limitation in the fully adjusted model weakened the association ($P$ for trend $= .183$), but participants reporting ≥8 hours of sitting per day were significantly more likely to report having high blood pressure (AOR 1.06, 95% CI 1.00 – 1.12).

**Discussion**

There was a robust crude association between physical activity and all chronic diseases included in the analyses of this cross-sectional data (combined chronic diseases, heart disease, cancer, diabetes, and high blood pressure). These associations were attenuated when controlling for potential confounding variables, but being in the most physically active group was protective with regard to cancer and diabetes, relative to the least active group, in this cohort of middle-aged Australian men. The strongest association was observed between physical activity and diabetes, with males who reported 300 minutes or more of physical activity in the previous week being less than half as likely to report having diabetes as those reporting no physical activity.

These findings support previously published studies examining the association between physical activity and diabetes risk. Hu, Leitzmann, Stampfer, Colditz, Willett, and Rimm (2001) investigated the association between LTPA and
type 2 diabetes in a cohort of middle-aged and older males and found that greater LTPA, namely moderate-intensity activities, were associated with reduced diabetes risk. Although the focus of that study was on LTPA, rather than overall physical activity, their findings also suggest that participation in physical activity should be encouraged to reduce type 2 diabetes risk. In Japanese males aged between 35 and 60 years, participating in regular physical activity at least once a week, combined with vigorous activity performed at least once on weekends, was inversely associated with the risk of type 2 diabetes (Hu et al., 2001). This Japanese study categorised physical activity in terms of weekly sessions rather than total minutes per week, which were used in the current study (Hu et al., 2001). Both studies, however, demonstrated an inverse association between doing any physical activity and reporting diabetes. The protective effect of LTPA on the development of non-insulin dependent type 2 diabetes mellitus was examined in a prospective study by Helmrich, Ragland, Leung and Paffenbarger (1991). Independent of covariates, total energy expenditure from LTPA was inversely associated with the development of diabetes during the 14-year follow-up period, suggesting that LTPA was protective against diabetes in males (Helmrich et al., 1991).

Physical activity tends to decrease with age (Armstrong, Bauman, & Davies, 2000; Sallis, 2000) and the association between ageing and chronic disease has been well established at the population level (Anderson et al., 2009; Australian Bureau of Statistics, 2009). Our findings show that, even when age was held constant, higher levels of physical activity seemed to offer a degree of protection against diabetes, and cancer, and higher volumes of sitting were associated with increased odds of diabetes and overall chronic disease.
We controlled for several factors that could potentially confound the associations examined in this analysis – one of the more influential factors being functional limitation. Advancements in medical care and technology have resulted in improved treatment and earlier diagnosis of conditions, leading to a potential reduction in disease-related functional limitation (Jeune & Brønnum-Hansen, 2008; Parker & Thorslund, 2007). The presence of chronic disease, however, often brings with it some decline in functional limitation (Australian Institute of Health and Welfare, 2011a; Stahl & Patrick, 2011). Individuals who experience higher degrees of limitation may be less likely to participate in physical activity, and may consequently spend more time in sedentary behaviours such as sitting. Adding functional limitation in the final model allowed us to explore the unique contribution of this potentially confounding variable, while still controlling for additional covariates.

After partially adjusting for covariates including age and BMI, the associations between physical activity and each chronic disease were attenuated, although the patterns observed in the crude models remained statistically significant for diabetes and cancer. Once functional limitation was added to each model, there was further attenuation, although the decreasing linear trend observed for diabetes in the partially adjusted model remained significant.

There was a significant linear trend between sitting time and diabetes identified in this study. After partially adjusting for covariates, the association between sitting time and all chronic diseases included in this analysis was strengthened, and males reporting volumes of sitting above the reference category were more likely to report having these diseases. After adjusting for all covariates
including functional limitation, these associations were consistently attenuated, although higher quantities of sitting time were associated with significantly greater odds of having diabetes. These findings support those from a prospective cohort study by Hu et al. (2003), who found that sedentary behaviour was directly associated with type 2 diabetes risk, although this earlier study focused primarily on television viewing as a marker of sedentary behaviour. In our study, a linear trend between higher quantities of sitting and high blood pressure was observed, although in the fully adjusted model, only the highest category of sitting (≥8 hours) produced a significant association. Additionally, males reporting over 4 hours of sitting per day were significantly more likely to report having a chronic disease (overall chronic disease).

In response to the relatively limited body of evidence surrounding the health of Australian males, the National Male Health Policy specifically outlined a priority area for building a strong evidence base on male health (Department of Health and Ageing, 2010b). The findings of this study contribute to this body of evidence by highlighting the importance of considering both physical activity and sitting time as independent factors associated with diabetes in a sample of middle-aged Australian males.

Our findings suggest that there are independent relationships between physical activity and chronic disease, specifically for diabetes, and to a lesser extent, for cancer. The trends observed in our study also suggest that sitting time is significantly, and independently associated with diabetes and overall chronic disease. These findings build upon existing literature in which physical activity and aspects of sedentary time have been previously established as independent risk factors for
CVD, metabolic syndrome, and all-cause mortality (Dunstan et al., 2005; Healy, Wijndaele, et al., 2008; Katzmarzyk et al., 2009; van der Ploeg et al., 2012).

Being cross-sectional in nature, we cannot establish whether participation in physical activity or volume of sitting time led to the development of these chronic diseases, or whether the presence of these chronic diseases influenced participants’ physical activity levels and sitting time. Evidence from previous epidemiological studies, however, suggests that physical activity can offer protection from diabetes (Helmrich et al., 1991; Hu et al., 2001; Okada et al., 2000) and cancer (Orsini et al., 2008; Parent et al., 2011), and higher volumes of sitting time can present risk for diabetes (Grøntved & Hu, 2011; Hu et al., 2001).

When interpreting the findings of this study, potential limitations must be considered. First, being cross-sectional in nature, the findings of this study can only be used to establish associations between the outcome and exposure variables. Additional research in this particular population group is required to establish temporal sequence and further examine the potential dose-response relationships identified between physical activity, sitting time, and chronic diseases. Second, the self-report nature of measures used in The 45 and Up Study baseline questionnaire must be considered when interpreting the findings. Although self-report data can be affected by recall bias, or under- or over-reporting (Prince et al., 2008), self-report methods are often used in large-scale studies such as The 45 and Up Study due to the associated feasibility, cost-effectiveness and ability to collect data from large groups of people (Warren, Ekelund, et al., 2010). The 45 and Up Study has utilised valid and reliable measurement tools such as the Active Australia Survey (Australian Institute of Health and Welfare, 2003; Timperio, Salmon, Bull, & Rosenberg, 2002). The
third potential limitation is that the physical activity and sitting time variables do not delineate specific domains of physical activity or sitting time, and as such, the amount of time spent in specific domains of physical activity and sitting time (e.g., leisure, occupational, transportation) could not be established.

To examine the association between physical activity, sitting time, and chronic disease, several important and potentially confounding variables including BMI, age, and functional limitation were adjusted for in the analyses. It is however, possible that other factors that were not adjusted for may have influenced the associations observed within this study. In addition to physical inactivity and time spent sedentary, poor dietary behaviours form another risk factor for chronic disease (Robinson & Elliott, 2009; Slawson, Fitzgerald & Morgan, 2013). Adjustments were not made for dietary intake or quality in this study, which is another potential limitation to be taken into consideration.

As with many large-scale population health surveys, there is potential for selection bias. Combined with the 18% response rate obtained by the 45 and Up Study baseline questionnaire and the exclusion of 7,368 males (10.5%) from the available sample of males aged 45 to 64, the potential impact upon the external validity of the findings must be considered. Furthermore, the proportion of males who reported undertaking 150 minutes or more of physical activity in the previous week was higher than what has been reported in other population surveys. While the reason for this difference is not clear, it is possible that the physical activity data were influenced by social desirability bias (Adams et al., 2005). It could also be speculated that participants who responded to the 45 and Up Study baseline questionnaire were aware of the physical activity guidelines and benefits associated
with regular physical activity due to the launch of the nation-wide Active Australia initiative in 1996 (Bauman, Bellew, Vita, Brown & Owen, 2002). Since its launch, a number of associated mass-media campaigns including Active Australia Day and Walk to Work day have been introduced in Australia, and the importance of regular physical activity has been emphasised. Whether participants were actually engaging in these levels of physical activity is unknown, but it is possible that their increased awareness of the importance of physical activity may have influenced their responses to the physical activity questions and resulted in higher than expected levels of reported physical activity. While the characteristics of males included in the current study may not be truly representative of the middle-aged male population in NSW, strong and significant associations were observed, even after adjusting for potentially confounding factors such as age, BMI, and functional limitation. As previously noted, the 45 and Up Study is expected to be among the largest and most representative cohort studies conducted.

There are also several noteworthy strengths of this study, including the large sample size and the broad range of health-related variables on which data were collected. A total of 63,048 males from The 45 and Up Study baseline dataset were included in the analysis for the current study. Being that middle-aged males are a relatively understudied population group, the findings of his study will help to partially fill a current gap in the literature concerned with male health. This study is among the first to examine the associations between a range of chronic diseases, physical activity and sitting time in middle-aged Australian males, while statistically controlling for likely confounders. The 45 and Up Study will collect much-needed longitudinal data on middle-aged and older Australian adults over the coming years,
allowing researchers to monitor and investigate trends observed in this initial baseline data.

**Conclusion**

It has been established that physical activity and sedentary time can be independent factors that are associated with a range of health outcomes (Dunstan et al., 2005; Healy, Wijndaele, et al., 2008; Katzmarzyk et al., 2009; van der Ploeg et al., 2012; Warren, Barry, et al., 2010). The purpose of the current study was to concurrently examine the associations between each of these distinct behaviours and a range of chronic diseases, while controlling for a range of other covariates.

There were robust crude linear associations between physical activity and each chronic disease included in this analysis. Although controlling for potential confounders impacted upon these associations, physical activity was still significantly, and most strongly, associated with diabetes, independent of sitting time and other additional variables. Furthermore, independent of physical activity and additional covariates, sitting time was significantly associated with diabetes and overall chronic disease. At the association level, our findings suggest that there are distinct, independent relationships between physical activity and chronic disease, specifically for diabetes, and to a lesser extent, for cancer.

The findings of this cross-sectional study support and build upon previous findings while also shedding light on a relatively understudied population group in Australia. As the Australian population ages, and chronic diseases become more prevalent, it is imperative that health professionals and policy makers consider the underlying factors influencing these conditions. Self-report measures such as those
used in The 45 and Up Study provide estimates of time spent in specific behaviours. As recommended by Healy et al. (2008), however, prospective studies or well-designed intervention trials utilising objective measurement tools to assess physical activity and sedentary time are needed. Although there may be additional underlying factors influencing the development of chronic disease, as well as reported physical activity and sitting time, our findings suggest that physical activity and sitting are lifestyle factors that should be considered in efforts to decrease chronic disease in this particular population group. In line with suggestions from other researchers (Katzmarzyk et al., 2009; Warren, Barry, et al., 2010), health promotion initiatives should focus not only on encouraging people to lead physically active lifestyles, but also to be aware of the association between sitting time and health outcomes. Further research using valid and reliable measures into domain-specific physical activity and sitting time in middle-aged males is required to examine and explain the relationships suggested by these observed trends.

3.13 Synopsis

This Chapter has presented the findings of a cross-sectional analysis examining the independent associations between physical activity, sitting time, and chronic disease in a sample of middle-aged Australian males. Chapter 4 builds upon these initial findings, by presenting the results of a focus group study exploring perceptions of physical activity and sedentary time in middle-aged males.
Chapter 4

Study 2 – Male perceptions of physical activity and sedentary time in a university work environment

A peer-reviewed journal article based on the research presented in Chapter 2 has been published in the *American Journal of Men’s Health* (George, Kolt, Rosenkranz, & Guagliano, 2013, Appendix H).

Authorship details:
George (85%), Kolt (5%), Rosenkranz (5%), Guagliano (5%).

Introduction

This second study formed part of a larger body of research aimed at increasing physical activity and reducing time spent sedentary in male university employees. Findings from this study have been used to inform the final design of an internet-based intervention that has been tested (Study 3) in middle-aged males in a university work setting. The methods, results and implications of the intervention will be discussed in the following chapter.

4.1 Background

The benefits of regular physical activity have been well-established, and are often identified as key motivators for being active. As discussed in Chapter 2, regular participation in physical activity has been shown to improve overall health (Physical Activity Guidelines Advisory Committee, 2008), mental health (Blumenthal et al.,
2007; Dunn et al., 2005; Paluska & Schwenk, 2000), and is also associated with reduced chronic disease risk (Physical Activity Guidelines Advisory Committee, 2008; World Health Organization, 2010a). In addition to the evidence on the benefits of regular physical activity, an increasing body of evidence is also emerging on the potentially deleterious effects on health of sedentary time. Higher volumes of sedentary time have been shown to be associated with chronic diseases including diabetes (George, Rosenkranz et al., 2013; Hu et al., 2001; Hu et al., 2003), hypertension (Haapanen et al., 1997), heart disease (Haapanen et al., 1997; Katzmarzyk et al., 2009), and all-cause mortality (van der Ploeg et al., 2012). As evidence emerges demonstrating the independent risk of sedentary time on chronic diseases, it is increasingly important for health professionals to consider both physical activity and time spent sedentary in their efforts to promote healthy lifestyles.

Males form a particularly hard-to-reach population group for the promotion of healthy lifestyles (Department of Health and Ageing, 2010b; Morgan, Warren, et al., 2011). In addition to their lower life expectancy and increased rates of chronic diseases compared to their female counterparts (Department of Health and Ageing, 2010b), recruiting males to health promotion initiatives can be challenging (Department of Health and Ageing, 2010b; Morgan, Warren et al., 2011). Males are often underrepresented in health promotion research, and there is a need to understand the factors that impact upon males’ physical activity and sedentary time.

When promoting physically active lifestyles, it is important to consider the proportion of time adults spend at work, as this has the potential to negatively impact their opportunities for physical activity participation and foster a relatively sedentary
lifestyle. Sedentary time can be categorised into specific domains – in the workplace, while commuting, and during leisure time (Owen et al., 2009). Sedentary time in the workplace, or “occupational sitting”, has been shown to contribute to more than half of employees’ weekday sedentary time (Miller & Brown, 2004). Although university employees work in a range of roles including academic, technical, and administrative positions, individuals employed in such occupational settings may be likely to spend large amounts of time being sedentary – a risk factor for developing overweight or obesity, independent of levels of physical activity (Ching et al., 1996; Prosser et al., 2007; Salmon, Bauman, Crawford, Timperio, & Owen, 2000). According to Gilson, McKenna, Puig-Ribera, Brown, and Burton, “Universities are often amongst the largest employers of white-collar workers in cities throughout the world” (2008, p. 158), however, a limited number of studies have focused on university employees as a target population for the promotion of healthy lifestyle behaviours (Gilson, McKenna, Cooke, & Brown, 2007; Morgan et al., 2009; Prosser et al., 2007). As such, the need for more studies examining the potential to increase physical activity in academic and similar settings has been identified (Prosser et al., 2007).

The results of qualitative studies on perceptions of physical activity and sedentary time have been discussed in detail in Chapter 2. Based on the results of these previously discussed studies, commonly reported motivators related to regular participation in physical activity for male participants include health, enjoyment, being a good role model for their children, maintaining a good quality of life, maintaining strength for their occupation, socialising, and losing weight (Caperchione et al., 2012; Wandel & Roos, 2006). Despite these motivating factors, however, it has been reported in several studies that perceived barriers related to
participation in physical activity are often too difficult to overcome. Commonly reported barriers to participation in physical activity include work and family commitments, time constraints, lack of motivation, inadequate health, and lack of opportunities or access to facilities (Ball, Crawford, & Owen, 2000; Caperchione et al., 2012; Humpel, Owen, & Leslie, 2002).

Although several studies have examined perceptions of physical activity in a variety of settings and population groups, qualitative research examining perceptions of, and issues related to sedentary time is much more limited. Individuals that are employed in occupations that are largely sedentary (e.g., office settings) spend large proportions of their day seated (Parry & Straker, 2013). It is therefore equally important to understand factors related to sedentary time. Gilson, Burton, van Uffelen and Brown (2011) explored perceptions of health risks and intervention strategies that may help to reduce workplace sedentary time. The main findings of this study showed that participants would welcome the idea of implementing specific strategies to reduce sedentary time in the workplace, and that they felt it was important for senior employees to be on board with the strategies so employees were supported. Results of another qualitative study by Prosser et al. (2007), which was conducted in an academic setting, lend support to those from Gilson et al. (2011) by reporting that support from supervisors would be an important element in physical activity interventions.

4.2 Purpose of the study

As evidence emerges on the independent risk of chronic disease from both physical activity and sedentary time, understanding male perceptions of physical
activity and sedentary behaviour is important to inform the development of relevant interventions. The purpose of this study was to explore middle-aged men’s perceptions on a range of issues related to physical activity, sedentary time, and healthy lifestyles. More specifically, this study explored middle-aged men’s perceived benefits of leading a physically active lifestyle, motivators for physical activity, barriers related to participation in regular physical activity, issues related to sedentary time, and strategies to increase physical activity and reduce sedentary time. Insights and opinions obtained during the focus group sessions were used to help inform the final design and shaping of the physical activity intervention to be tested in this population, which will be presented in Chapter 5.

4.3 Research questions

To achieve the purpose of the study, a series of four main research questions were developed:

1. To what extent are middle-aged men aware of the benefits of a physically active lifestyle? What do they identify as the main benefits?
2. What are some of the main barriers to participating in physical activity?
3. What are some of the motivators and enablers for participating in physical activity?
4. What are some of the main reasons for sedentary time, and what do participants’ identify as some of the main issues related to high volumes of sedentary time?
Methods

4.4 Participants

A purposive sampling strategy was used to recruit male employees aged 35-64 years from a large multicampus Australian university (UWS), to partake in semistructured focus group sessions between November 2011 and May 2012. The primary aim of purposive sampling is to develop an “Understanding of an issue or topic in sufficient detail to provide information to design subsequent studies” (Vaughn, Schumm, & Sinagub, 1996, p. 58), and as such, is common to focus group research. Recruitment flyers (Appendix I) were distributed across two campuses and interested participants were asked to contact the primary researcher (ESG) by email.

4.4.1 University of Western Sydney

UWS is a large multicampus university situated in the Greater Western Sydney (GWS) region, in NSW, Australia. The five main university campuses are located in Penrith, Hawkesbury, Campbelltown, Parramatta, and Bankstown. The GWS region is demographically and culturally diverse, and is one of the largest and fastest growing areas in Australia. In 2011, the GWS population was estimated to be approximately 2.02 million, and based on population growth estimates, this number is estimated to rise to approximately 2.96 million by the year 2036 (New South Wales Government Premier and Cabinet, n.d.). The GWS region comprises some of the most disadvantaged Local Government Areas (LGAs) in NSW. The population experiences high rates of overweight and obesity and is overrepresented in a range of adverse health conditions (The Western Sydney Region of Organised Councils Ltd,
UWS has strong ties with the GWS community, and many of the staff and students reside in the region.

4.4.2 Eligibility criteria

Participants were deemed eligible if they were employed in an ongoing or fixed-term position at the University, were aged between 35 and 64 years, and were not highly active. To determine whether participants were highly active, they were asked to answer the question “As a rule, do you do at least half an hour of moderate to vigorous physical activity (such as walking or sport) on five or more days a week?”. Those who answered “no” were not deemed to be highly active and were therefore eligible. This question has been used in previous studies and has been shown to have a positive predictive value of 81% when identifying adults considered to be “less active” (Elley, Kerse, Arroll, & Robinson, 2003; Kolt, Schofield, Kerse, Garrett, Schluter, Ashton & Patel, 2009).

Eligible participants provided their focus group session scheduling preferences and were sent detailed study information (Appendix J) before attending the session. The study information was also given to participants again at the beginning of the session, before they gave their informed consent to participate in the study (Appendix K). Of the 15 staff members that participated in the study, 14 (93%) were employed in primarily desk-based roles (i.e., academic/faculty staff, school manager, liaison librarian).

4.5 Data collection

Once participants had the opportunity to ask questions and had given their informed consent to participate in the study, they completed a brief demographic
questionnaire (Appendix L). Participants were then informed that the focus groups would be digitally recorded to ensure none of the information they shared during the session was missed, and two digital recorders were used to record the audio data during each focus group session. The primary recorder was placed near the facilitator and the second recorder was placed towards the opposite end of the table, so all participants could be heard clearly. Any audio that was unclear on the recording from the primary recorder was played back on the recording from the secondary recorder. This secondary recorder was also used as a substitute, in the event of a failure to record or stoppage during the session.

Participation in the focus groups was voluntary, and all participants were informed that they could withdraw their participation at any time throughout the session without consequence. The primary researcher acted as the session facilitator, and was responsible for guiding the discussion and prompting when required; while a research assistant took notes and was responsible for the audio recording for each session. Each focus group session was held in a common room at one of the two targeted university campuses, and sessions ranged from 50 to 70 minutes in duration. Participants were not stratified into separate groups for BMI, age, level of physical activity or role at UWS, rather, each focus group included a range of participants with varying demographic characteristics.

4.5.1 Focus group questions

Questions asked during the focus group sessions were based on those from a similar study (Caperchione et al., 2012), and were guided by the study objectives. Each question was posed to the group as a whole and all participants were given the opportunity to share their thoughts and opinions. The same focus group schedule was
used for each session, meaning the same series of questions and prompts were applied. The questions were open-ended to encourage open conversation amongst participants, and prompts were used to promote further discussion on key themes, if required. Participants were encouraged to share their perceptions on the benefits of leading a physically active lifestyle, motivators for physical activity, barriers related to participation in regular physical activity, barriers related to sedentary time, and strategies to increase physical activity and reduce sedentary time. The content validity and appropriateness of the focus group questions were assessed through a process of pilot testing involving volunteers representative of the target population. All focus group questions and prompts are listed in the focus group schedule (Appendix M).

4.6 Data analysis

During each focus group session, the facilitator (ESG) and a research assistant noted emerging themes and took brief written notes on predeveloped forms to refer back to during the data analysis process. For each topic, several key themes identified in published literature and during pilot-testing were listed to permit the researchers to take brief notes during open conversation. Following each session, the primary researcher, transcribed the audio data verbatim. Using an inductive approach, thematic analysis was used to examine the data, and the methods used were similar to those used by Caperchione et al. (2012) and Braun and Clarke (2006). Two members of the research team (the primary researcher and the research assistant) independently and systematically read the transcripts several times to establish familiarisation. Once the researcher and the research assistant had read each transcript several times, they independently coded each transcript by highlighting
interesting portions of text and assigned a code to each portion of text. After each transcript had been independently coded, the research team compared transcripts and discussed codes so that all codes could be collated into one framework. Similar codes were then grouped together and categorised into theses to allow for identification of commonalities within the transcripts.

4.7 Ethics approval

The University of Western Sydney Human Research Ethics Committee granted ethics approval for this focus group study on 12 May 2011 (HREC H9087, Appendix N).

Results

4.8 Demographics

A total of 5 focus group sessions were conducted on 2 campuses at the University of Western Sydney, with a total of 15 participants. The number of participants in the focus groups ranged from 2 to 4 including a total of 9 academic staff (i.e., faculty) and 6 professional staff. The mean (±SD) age of participants was 46.1 (±8.0) years, and the demographic characteristics of the sample are reported in Table 4.1.
Table 4.1  Demographic characteristics for the sample in Study 2.

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<tr>
<td>40 to 44</td>
<td>4</td>
</tr>
<tr>
<td>%</td>
<td>26.7%</td>
</tr>
<tr>
<td>45 to 49</td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>6.7%</td>
</tr>
<tr>
<td>50 to 54</td>
<td>2</td>
</tr>
<tr>
<td>%</td>
<td>13.3%</td>
</tr>
<tr>
<td>55 to 59</td>
<td>4</td>
</tr>
<tr>
<td>%</td>
<td>26.7%</td>
</tr>
<tr>
<td><strong>Role at university</strong></td>
<td></td>
</tr>
<tr>
<td>Academic (faculty) staff</td>
<td>9</td>
</tr>
<tr>
<td>%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Professional staff</td>
<td>6</td>
</tr>
<tr>
<td>%</td>
<td>40.0%</td>
</tr>
<tr>
<td><strong>Highest educational qualification</strong></td>
<td></td>
</tr>
<tr>
<td>Higher School Certificate</td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Certificate/Diploma</td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>6.7%</td>
</tr>
<tr>
<td>University degree or higher</td>
<td>13</td>
</tr>
<tr>
<td>%</td>
<td>86.7%</td>
</tr>
<tr>
<td><strong>Household income</strong></td>
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</tr>
<tr>
<td>$60,000 to $79,000</td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>6.7%</td>
</tr>
<tr>
<td>$80,000 to $99,000</td>
<td>5</td>
</tr>
<tr>
<td>%</td>
<td>33.3%</td>
</tr>
<tr>
<td>$100,000 to $119,000</td>
<td>4</td>
</tr>
<tr>
<td>%</td>
<td>26.7%</td>
</tr>
<tr>
<td>$120,000 to $139,000</td>
<td>2</td>
</tr>
<tr>
<td>%</td>
<td>13.3%</td>
</tr>
<tr>
<td>$140,000+</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>20.0%</td>
</tr>
<tr>
<td><strong>Self-rating of current physical activity level</strong></td>
<td></td>
</tr>
<tr>
<td>Needs a lot of improvement</td>
<td>7</td>
</tr>
<tr>
<td>%</td>
<td>46.7%</td>
</tr>
<tr>
<td>Needs some improvement</td>
<td>5</td>
</tr>
<tr>
<td>%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Physically active on a regular basis</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>20.0%</td>
</tr>
</tbody>
</table>
4.9 Main findings

Although theoretical saturation was not used to determine the sample size for this study, there were marked consistencies observed amongst the responses in the focus group sessions. Findings are presented separately for each category under the sub-headings of (1) physical activity, (2) sedentary time, (3) strategies to increase physical activity and reduce sedentary time, and (4) intervention elements that may enhance motivation and aid in increasing physical activity and reducing sedentary time. A summary of the themes and example quotes for each category are presented in tables preceding each section.

4.9.1 Physical activity

A summary of the themes and selected example quotes related to questions on physical activity are provided in Table 4.2, and are discussed in further detail below.
Table 4.2  Summary of main themes and example quotes related to physical activity from focus groups in Study 2.

<table>
<thead>
<tr>
<th>Category</th>
<th>Themes</th>
<th>Sub-themes</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits of leading a physically active lifestyle</td>
<td>Health</td>
<td>• Improves general and mental health</td>
<td>“You feel better...you’re less likely to be struck down early with some lifestyle-related chronic disorder that’s going to stop you from doing any exercise ever again.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lowers chronic disease risk</td>
<td>“You’re more inclined to...be healthy...and not so susceptible to the sicknesses that other people get. And, and also, if you do get them, like colds and flu and stuff. I think you’re more able to cope with them and get over them.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduces susceptibility to illness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stress relief</td>
<td>• Relieves stress</td>
<td>“Physical activity can also reduce stress and stress-related diseases as well”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides an escape from work</td>
<td>“If you’ve got a lot going on at work, and a lot going through your mind, if you then go and do some physical activity which, for whatever reason...because of the nature of the physical activity, you’re concentrating on that activity and blotting everything else out”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides a change of scenery</td>
<td>“I look forward to doing things that, where I don’t think about work at all because it’s so totally consumed me for whatever reason that, you’d never ever think about work, or whatever other problems might be, and other challenges that we all have in our lives. So, and I think that’s quite vital actually.”</td>
</tr>
<tr>
<td></td>
<td>Weight loss and maintenance</td>
<td>• Can help reduce weight and waist circumference</td>
<td>“Keeping your weight down. I mean, all that sort of stuff that comes with exercise. Keeping the weight down, mobility.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Can assist with weight maintenance</td>
<td></td>
</tr>
<tr>
<td>Motivators for physical activity</td>
<td>Health and fitness</td>
<td>• Improving health</td>
<td>“For quite a bit of time I didn’t really do any sort of set exercises as such, and...then the weight piled on, and then the motivation came in.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maintaining fitness level</td>
<td>“I think the hardest part is getting fit, but once you are fit...you don’t want to lose it, and... I find, myself, that’s a real motivator.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Health and weight level became more of a motivator with age</td>
<td>“Yeah health for me is, it’s probably more of a long-term thing...I think I’m doing this now because I believe that I’ll reap benefits. Not only now, but I think more down the track, you know, as I get older.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“I’m well aware of it. My father lived to 100, but say, the last 15 years of his life, he was pretty immobile...so, it’s that whole thing, you’ve just got to keep doing it. So I’m really aware that I’ve just got to keep moving and doing stuff...cause I would say the quality of his life toward the end was pretty, pretty ordinary. So, I’m not looking forward to that.”</td>
</tr>
</tbody>
</table>

Table 4.2 continued next page.
<table>
<thead>
<tr>
<th>Family and children</th>
<th>• Being active/healthy for children</th>
<th>“My son...he’s big on the computer and you’re always wanting to get him out there all the time...and you’ve got to lead by example.”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Being a good role model for children</td>
<td></td>
</tr>
<tr>
<td>Social aspects</td>
<td>• Enjoyment</td>
<td>“I think the idea of the social arrangement where a firm booking can force you to get up early because you’ve got a meeting in place, whereas if there’s no meeting in place then you always have the option of having a long lie in and doing nothing.”</td>
</tr>
<tr>
<td></td>
<td>• Social interaction with others</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Belonging to a group or team and making a commitment to participate</td>
<td></td>
</tr>
<tr>
<td>Improving mood and wellbeing</td>
<td>• Avoiding guilty feeling for not being physically active</td>
<td>“One thing I find too, if I get really into the exercise pattern, if I don’t go, I feel guilt so I want to get rid of that, so...the motivator’s not to feel guilt...for not doing it.”</td>
</tr>
<tr>
<td></td>
<td>• Improving mood</td>
<td>“I know when I exercise I feel better. So if I haven’t...I know that I’m not at my best.”</td>
</tr>
<tr>
<td></td>
<td>• Enhancing productivity</td>
<td></td>
</tr>
<tr>
<td>Barriers related to participation in physical activity</td>
<td>Time</td>
<td>• Time constraints related to long working hours</td>
</tr>
<tr>
<td></td>
<td>• Family commitments</td>
<td>“I think for a lot of people...you work long hours at work and then drive home, and then it’s busy at home, family life, you know. They sort of veg out watching TV sometimes, and...don’t sort of, think they’ve got time to exercise. It’s just, life’s too hectic.”</td>
</tr>
<tr>
<td></td>
<td>Work</td>
<td>“For me, certainly, work is by far the most major impediment.”</td>
</tr>
<tr>
<td></td>
<td>• Demanding workload</td>
<td>“If you were paid to exercise and be healthy, you know, suddenly the balance is outweighed.. It’s sort of a hip pocket question, you know? You have to perform at work and meet your outcomes, but that’s why it [physical activity] can easily be displaced.”</td>
</tr>
<tr>
<td></td>
<td>• Long working hours and the need to work in evenings and on weekends</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• High expectations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of motivation or support</td>
<td>• Easier to cancel plans if you don’t have anyone to participate with</td>
</tr>
<tr>
<td></td>
<td>• More difficult to motivate yourself to be active</td>
<td>“That’s the thing, just getting motivated enough to get into a routine again, and maybe what I do has to change, you know, from season to season I think, or something. But for me, it’s just the motivation for getting up and off my backside.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I think if you...aren’t sort of part of a group or support exercising network...I think that can be a barrier.”</td>
</tr>
</tbody>
</table>
4.9.1.1 Benefits of a physically active lifestyle

Participants were asked to share their ideas on the main benefits of leading a physically active lifestyle. The majority of participants were aware of the benefits of leading an active lifestyle. Health-related benefits, including improved general health, reduced susceptibility to illness, and lower risk of developing chronic diseases were commonly identified benefits of regular physical activity. For some participants, the benefits related to physical activity were being realised later in life, and held more importance as they got older. One participant noted:

“You feel better…you’re less likely to be struck down early with some lifestyle-related chronic disorder that’s going to stop you from doing any exercise ever again.”

Some participants cited physical activity as a stress release or an escape from their work and schedules, and the mental health related benefits of physical activity were also frequently discussed. Weight maintenance was identified as a major benefit and many participants were also aware of the potential risks associated with being overweight. Some participants discussed health issues in their family that were related to being overweight, and reported that this had emphasised the benefits of leading a physically active lifestyle. Appearance, in relation to weight was also discussed, although not as often. Examples from participants were:

“That waistline is an important factor, especially for males because…an extra inch around your waist has a significant effect on your heart. So for me, the biggest motivation would be weight loss
“...inches off the waist...Mainly just ‘cause of the health benefits really.”

“In my 30s, I wasn’t really big, like hugely overweight, but I was putting on weight and I was having to go up sizes in clothes and I just thought, I don’t want to keep going on like this. And so that’s when I started exercising.”

4.9.1.2 Motivators for physical activity

Several participants mentioned maintaining and improving health as an important motivating factor for being physically active, particularly as they got older. Some participants explained that they were motivated to be active and healthy to increase their longevity and to be able to participate in physical activity with their children. Others aspired to be a good role model for their children in terms of leading a healthy, active lifestyle, as some participants reported that their children were not motivated to participate in physical activity and were more interested in playing on their computer or video games. For example:

“My son...he’s big on the computer and you’re always sort of wanting to get him out there all the time...and you’ve got to lead by example.”

“I’ve got two kids, 14 and 16...so I want to...be around for a long time and be in good shape for them as they grow older and yeah, so it is, it’s important to me.”

Physical activity was commonly referred to as being a stress reliever, with participants feeling a sense of escapism when they got away from work and were involved in an activity they enjoyed. Some participants also reported that they were
more active when they were on leave, as they were able to relax and escape their normally busy work schedule. Moreover, participants enjoyed the “change of scenery” when they left the work or home environment and participated in physical activities in a different setting. One participant reported:

“I would never, for example get an exercise bicycle, or some sort of garage gym because even though I’d be exercising, I’d still be within the same confines as what I’m either working or doing household work or things like that.”

Several participants identified guilt as somewhat of a reverse motivator, in the sense that they were physically active in order to avoid feeling guilty for being inactive. This was an interesting notion, as for some, physical activity became like a “chore” and something that had to be done to avoid that feeling of guilt. For example:

“Not exercising is actually a stressor to me, to be honest. If I know that I haven’t exercised, that actually creates anxiety that I haven’t done enough. Especially when I know I’ve got this family history of things that could have been affected by exercise.”

“If I get really into the exercise pattern, if I don’t go, I feel guilt...so I want to get rid of that, so, the motivator’s not to feel guilt...for not doing it.”

Although some saw physical activity as a chore and as something that had to be done, others enjoyed being physically active and said they participated in activities for fun. Belonging to a team or a social group, and being able to interact
with others who were interested in similar activities was another motivating factor. Among participants citing this as a motivator, one theme that resonated with them was the fact that they tended to feel more of a commitment toward participation in activity, and were less likely to displace activity if they felt they owed it to others in the group. One participant indicated that:

“It was good when I was involved in team sports because you had other people there to interact with and you had, they were there to motivate you and that as well.”

One of the more interesting ideas that was mentioned in several of the groups was that even though some participants felt that they were motivated enough to be active, they found it hard to overcome the impediments to being physically active.

For example:

“Knowing the fact that it’s good for you doesn’t necessarily make me change the fact that I don’t do enough – simple as that. So, I know all that stuff, but, well there’s motivators there, but then there’s other barriers that, I find difficult to overcome.”

“I think from my personal point of view I actually don’t need the motivators, what I need is to remove the impediments.”

“You can be well-intentioned and highly motivated, but unless there are a few more hours in the day, then it’s very hard to do.”

Also of interest was that many participants felt that their key motivators for being physically active changed over time. When they were younger, appearance and fitness were major factors for some, while others discussed competitiveness and
goals to succeed in their given sport or activity as a major motivator in their youth. Physical activity was said to “come naturally” to some in their youth, and few considered the health benefits in their choice to be active. Several participants identified a change in the physical activity “habits” of their children or younger family members, with many discussing how, unlike today, being physically active was part of their daily routine as a child. One participant noted that:

“As a kid you didn’t really think about it, you were just active anyway. It was just part of life – you came home, threw your school bag in the door and you were outside. So, you didn’t really think about you need to get out and do some exercise.”

When asked about how their motivators had changed over time, many explained that their family and their growing awareness of the health-related benefits of physical activity was now a major motivator, and the fact that they “weren’t getting any younger” pushed some to be active. Some participants had a “better late than never” mentality, deciding that they should start participating in some form of physical activity if they wanted to maintain or improve their health. For example:

“For quite a bit of time I didn’t really do any sort of set exercises as such, and...then the weight piled on, and then the motivation came in – alright, you really need to do something about this.”

4.9.1.3 Barriers related to regular participation in physical activity

The two most commonly discussed barriers to being physically active were, not surprisingly, time and work commitments. Most participants felt they did not
have the opportunity to be active during work hours and could not find the time to be active during the workday because of their workloads. With the exception of a few participants, most reported that they usually ate lunch at their desks, in front of their computer, and avoided taking breaks for fear that they would not complete their assigned work for the day. For example, one participant reported:

“For ever so many staff...the lunch hour is not a lunch hour, it’s a lunch 5 minutes – sitting in front of their computer, trying to catch up on the stuff that is about to avalanche over the top of them. So then the challenge becomes that if you do explicitly put more time aside during the day, then where does that time come from?”

Work pressures and time constraints were discussed as barriers in all focus group session, and participants tended to agree that physical activity was often an activity that was very easily displaced, particularly due to the nature of their jobs. For example:

“Because there’s the expectations from our careers. You know, you’ve got to be writing, you’ve got to be on the phone to people at silly hours when you’re in Australia and yeah, you just have to put so much time into teaching, setting up research collaborations, doing your writing.”

“The problem with exercise is that it’s so much more easily displaced than other things. Because even though you know it’s an imperative, it’s not an immediate imperative as such.”
While workload was cited as a barrier during the workday, some participants felt that their workload and job demands also impacted upon the amount of physical activity they undertook at home. Long commutes to and from work, and fitting in with the family’s schedule, were identified as barriers to regular physical activity, as was a lack of available facilities. For some participants, facilities were available (e.g., cycling trails) but they did not feel safe using them, while other participants felt that facilities were too far away from their home or workplace, or were too expensive to use (e.g., gym memberships). Some participants also identified ageing and a decline in general physical condition as barriers to being physically active. One participant indicated that:

“I’ve actually seen a big difference in me from when I was 45 to where I am now, that I’ve actually become more lazy...in terms of doing physical activity.”

This view, however, was not shared by all participants, with some explaining that they were more motivated to lead a physically active lifestyle at their current age, than they were in their youth. For example:

“I sort of stopped doing really much at all. Put on a bit of weight, and probably got back into it about six or seven years ago and haven’t looked back. So there was no sort of, driving force I think, back when I first started in my 20’s.”

Lack of motivation and laziness were cited by some as barriers to participation in physical activity, particularly with regards to physical activity during the working week. While some participants had good intentions of participating in
physical activity before or after work, many found they were too exhausted to do so.

In terms of bolstering motivation, some participants felt that they were more motivated to be regularly active when they had something to strive for. For example, several participants recalled how registering for an event like a “fun run” gave them the motivation to get into a routine because they felt that they would not be able to complete the challenge if they did not prepare. One participant in particular noted that:

“If it’s a bit aimless, then I just get stuck into a routine, and then I don’t think of it [physical activity], especially with the hours that many of us will work, and commuting and that. It becomes very easy not to find the time.”

Setting measurable and quantifiable goals was another factor that helped some participants stay motivated, as they were able to track their progress and work towards a goal. One participant reported:

“If I’m serious about it, I try and record what I’m doing so I can see that there’s progress.”

Not having a social network, which was identified as an important motivator, was also identified as a barrier, as some participants felt it was harder to get motivated on their own. For example:

“When you’ve only got yourself, it’s a lot harder to actually motivate yourself to actually do it, you know?”
4.9.2 Sedentary time

Participants discussed the domains in which they spent most of their sedentary time, perceived factors that influenced their sedentary time and issues related to reducing this. A summary of the main themes and example quotes related to sedentary time are presented in Table 4.3.

4.9.2.1 Most common sedentary pursuits.

Most participants agreed that they spent a lot of time sitting down during the day, and most of their daily sedentary time was related to work – for example, at their desk or computer; or transportation to and from work. Time spent in front of the computer was not limited to work hours, with many participants discussing the need to complete work outside of normal working hours (e.g., in the evenings or on weekends). Several participants employed in academic positions believed they were employed in a typically sedentary occupation. For example:

“If one’s mostly doing office work, it’s reasonably unavoidable to end up sitting at a desk. So if one is in academia, the only time one is not sitting at a desk is if one is teaching, otherwise, they’re sitting at a desk.”

“In academia, sedentary lifestyle is a given.”
### Table 4.3  Summary of main themes and example quotes related to sedentary time from focus groups in Study 2.

<table>
<thead>
<tr>
<th>Category</th>
<th>Themes</th>
<th>Sub-themes</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most common sedentary pursuits</strong></td>
<td>Work</td>
<td>● Most sedentary time was work-related – at desk and in front of computer</td>
<td>“If one’s mostly doing office work, it’s reasonably unavoidable to end up sitting at a desk.”</td>
</tr>
<tr>
<td></td>
<td>Commuting</td>
<td>● Driving or public transport, to and from work</td>
<td>“I’ve got a one-hour commute each way, so for me, that’s a lot of time behind the wheel of the car.”</td>
</tr>
<tr>
<td></td>
<td>Leisure</td>
<td>● Participating in sedentary hobbies and leisure activities</td>
<td>“I’m actually dropping some of these sedentary hobbies because I realise that they’re ultimately going to be bad for me.”</td>
</tr>
<tr>
<td><strong>Issues related to sedentary time</strong></td>
<td>Work</td>
<td>● Nature of work environment</td>
<td>“Our job at a university is one, primarily to use our abilities of cognition. That’s best used when you’re not moving around too much.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Sedentary time was unavoidable and a “by-product” of employment</td>
<td>“When I work, I have to concentrate, I have to focus, I have to have that lead in my mind and if I interrupt it, even for 5 minutes, it takes another 10 minutes to come back...My productivity would really fall.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Being seated perceived as being essential for productivity</td>
<td>“Even though we sit, it’s a by-product of the fact that we have to use our brains. It’s not as if it’s because we want to sit.”</td>
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<tr>
<td></td>
<td></td>
<td>● Demanding workload</td>
<td>“Now all of those lectures are podcast, so instead of standing up for an hour and doing what one does...I guess I sit down for an hour and record the podcast.”</td>
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<tr>
<td></td>
<td></td>
<td>● Shift in learning/teaching to be more online-based</td>
<td>“I think the main impediment is simply long periods stuck in front of the computer, sitting at the desk.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“If it’s [physical activity] going to be done in work time, then it has to be viewed as a legitimate activity in its own right.”</td>
</tr>
</tbody>
</table>

Table 4.3 continued next page.
<table>
<thead>
<tr>
<th>Leisure</th>
<th>Long hours and demanding workloads can result in higher volumes of sedentary time outside of working hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“After a long and intensive day, when I get home in the evening, there’s the choice – OK, am I going to go and do some physical activity now...or am I going to sit down with a glass of wine because you’re feeling a bit tired, and all of the rest of it.”</td>
</tr>
<tr>
<td></td>
<td>“I’m on my feet most of the time so it’s at home when I’m relaxing and that when I sit down most.”</td>
</tr>
<tr>
<td></td>
<td>“I’m only sitting down when I’m having lunch and checking my emails. But it’s mainly at home when it’s an issue, when I’m watching the telly or something like that.”</td>
</tr>
</tbody>
</table>
Some identified a shift in the delivery methods of lectures and tutorials (e.g. from face-to-face delivery to online delivery) as a cause of increasing sedentary time. This reflects a shift in the approach to teaching and student learning to incorporate technological advancements. Although this is a positive shift in terms of accessible learning, for many academic staff members, leaving the office to teach face-to-face classes provided an opportunity for physical activity. One participant indicated that:

“No all of those lectures are podcast, so instead of standing up for an hour and doing what one does... I guess I sit down for an hour and record the podcast. And the tutorials, instead of being interactive – physically interactive – tutorials, those tutorials are done electronically.”

Some focus group participants were conscious of their daily sedentary time, and made an effort to try and break up the long blocks of sitting, while others found it too difficult to find the time. For example:

“Just being conscious of sitting for too long, you just get into the habit... the lunch break, half an hour or something, is a good time to do some walking.”

4.9.2.2 Issues related to sedentary time

When participants were asked if there were barriers to overcome in terms of reducing high volumes of daily sedentary time, work and time were, again, commonly identified as factors that impacted upon their sedentary time. Participants discussed the need to sit at their desk or their computer to be able to do their work, and most of the participants in this study were employees who spent long stretches of
time at a desk, for example, preparing class work, marking, recording podcasts, or working in administration. For example:

“Our job at a university is one, primarily to use our abilities of cognition. That’s best used when you’re not moving around too much.”

While the main barriers preventing participants from reducing sitting time were primarily work-related, there was also discussion around sedentary hobbies such as reading and writing. One participant reported that:

“For me personally, something I’ve got to watch is that many of my hobbies also tend to be...passive...I used to write stories quite a bit. I’ve got unfinished work which I’m now no longer finishing because it’s just too much time in front of the computer at a desk. So in fact I’m actually dropping some of these sedentary hobbies because I realise that they’re ultimately going to be bad for me.”

4.9.3 Strategies to increase physical activity and reduce sedentary time

When asked about strategies that could be implemented to increase physical activity and reduce sedentary time, many participants discussed incorporating small changes and participating in habitual physical activity. These elements will be discussed in the next section that focuses specifically on intervention elements and inclusions for physical activity programs. At the University level, several strategies were identified to help employees increase physical activity and reduce sedentary
time while at work. These strategies are summarised in Table 4.4 and will be discussed below.
### Table 4.4

Summary of main themes and example quotes related to strategies to increase physical activity and reduce sedentary time from focus groups in Study 2.

<table>
<thead>
<tr>
<th>Category</th>
<th>Themes</th>
<th>Sub-themes</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategies to increase physical activity and reduce sedentary time</td>
<td>Changing University culture</td>
<td>Encouraging University-wide participation in physical activity</td>
<td>“Suddenly people realise that’s the culture of UWS. That everyone’s into doing stuff together on a casual basis, to stay fit, to stay healthy, to get out of their offices. It’s the culture that drives the activity, rather than a fixed program.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recognising physical activity as a legitimate activity during working hours</td>
<td>“It shouldn’t really be seen as exercise, you know? We happen to be a society which walks at lunchtime. We happen to be a society which parks our car further away. You know, lifestyle is what it’s about. It’s not about exercising and programs, and gyms and money…it’s sort of irrelevant. We just happen to be a society that’s active – that’s all it is.”</td>
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<tr>
<td></td>
<td></td>
<td>Gaining support from the University and senior staff</td>
<td>“People often think we need to give choice, but sometimes it’s that culture that drives them to be healthy.”</td>
</tr>
<tr>
<td>Changes to the work environment</td>
<td>Moving reserved parking spaces to a location further from buildings</td>
<td>Additional choices for parking</td>
<td>“There are small things that you can incorporate into the daily routine of the worker at the university, that can lead to enough change to improve health.”</td>
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<tr>
<td></td>
<td></td>
<td>Signs to encourage stair use</td>
<td>“I think, people are willing to do things, but sometimes you’ve kind of got to adjust the environment or the conditions as such that they’re forced to do it a little bit. You can’t give them too much choice. This is the way it is.”</td>
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<td></td>
<td></td>
<td></td>
<td>“If I drive into the car park here, I mean, I’ve got the option with the blue sticker of parking down quite close to the door, or I can quite happily park up the top of the hill and you get a bit of an extra walk. But then I guess my point then is if I get down here and get into it a bit quicker, then that’s 5 minutes earlier that I’m going to get things done and go home.”</td>
</tr>
</tbody>
</table>

Table 4.4 continued next page.
<table>
<thead>
<tr>
<th>Changing habits and building routines</th>
<th>“It’s creating that routine and being comfortable in a routine that you’re, you know you can maintain and sustain, over a period of time.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Encouraging small, achievable changes</td>
<td>“I don’t really need much motivation to actually get up, but it’s more about getting out of the house and actually doing the physical activity...and getting into that routine.”</td>
</tr>
<tr>
<td>• Building routines that include physical activity participation</td>
<td>“It doesn’t have to be a huge shift. I don’t think we’re beating down the wrong path, I just think it’s a slight adjustment of what we’re already doing.”</td>
</tr>
<tr>
<td>• Taking regular breaks from the desk</td>
<td></td>
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<tr>
<td>• Regular walks (e.g., to photocopier or colleagues’ offices)</td>
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</table>
Perceived barriers were a major issue in relation to physical activity participation, although participants were able to identify opportunities for change. Many liked the idea of changing habits and encouraging small changes that could be incorporated into their daily routine, as this was achievable. For example:

“It’s creating that routine and being comfortable in a routine that you’re, you know you can maintain and sustain, over a period of time.”

For example, parking the car further away from the building at work, taking the stairs instead of the lift, making a point of going for walks throughout the day, and trying to limit sedentary time after work or on weekends were commonly discussed as simple strategies that could be implemented to increase physical activity and reduce sedentary time. Participants reported:

“I know lots of staff members who never do the stairs, so...there are small things that you can incorporate into the daily routine of the worker at the university, that can lead to enough change to improve health.”

“I actually have a rule for myself not to touch my computer during the day on the weekends.”

Some participants were able to identify strategies to increase their physical activity and reduce their sedentary time during work hours, but they felt that they would lose productivity. For example:

“Even though we sit, it’s a by-product of the fact that we have to use our brains. It’s not as if it’s because we want to sit, if that makes
sense...So, unless you can find another way that we can run around making lecture slides and reading articles where we’ve got our heart rate up and improving our vascular flow to the muscles, I would happily swap that. But at the moment...I will be sitting to use my brain.”

“When I work, I have to concentrate, I have to focus, I have to have that lead in my mind and if I interrupt it, even for 5 minutes, it takes another 10 minutes to come back...My productivity would really fall.”

One of the more unique and interesting topics that came up in discussion across groups was that of changing the culture at the university and really encouraging staff and students to be more physically active. Some participants discussed the culture at previous workplaces as ones that supported social activities and active lifestyles, and they felt that the social culture among staff could be much stronger. It was also suggested that physical activity needed to be seen as a legitimate activity that should be supported and perhaps, even endorsed using a top-down approach. One participant reported:

“If it’s going to be done in work time, then it has to be viewed as a legitimate activity in its own right. I mean – would it ever get to the stage where they would allow an exercise component to be built into someone’s workload agreement? Because if not, then whilst you’re out there exercising, then you’re not doing the stuff that is in your workload agreement.”
### 4.9.4 Intervention elements that may enhance motivation and aid in increasing physical activity and reducing sedentary time

In order to maintain interest and motivation, and design an intervention that would appeal to male UWS staff, focus group participants were asked to consider potential intervention elements that they would like to see included in an intervention designed to increase physical activity and reduce sedentary time. A summary of these intervention elements is presented in Table 4.5 and discussed below.
Table 4.5 | Summary of main themes and example quotes from focus groups in Study 2 related to potential intervention elements for inclusion in Study 3.

<table>
<thead>
<tr>
<th>Category</th>
<th>Themes</th>
<th>Sub-themes</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention elements that may enhance motivation and aid in increasing physical activity and reducing sedentary time</td>
<td>Goal setting</td>
<td>Setting achievable goals</td>
<td>“I think the other thing for me is achieving goals...so you can actually set goals and achieve them and so that brings, apart from the wellbeing, it brings a sense of achievement.”</td>
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<tr>
<td></td>
<td></td>
<td>Goals should include gradual increases</td>
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<td></td>
<td></td>
<td>Must appeal to people of different experience levels</td>
<td>“We need to make sure there are activities that are going to appeal to...people who are essentially inactive. Because there’s such a range of different points that people will be starting from, I mean, okay, so we all need to do more activity, but some of us are doing more activity now than others, some are doing essentially none.”</td>
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<tr>
<td></td>
<td></td>
<td>Goals should be quantifiable</td>
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<tr>
<td></td>
<td></td>
<td>Giving people options for different goals and activities</td>
<td>“Because we’re able to choose what exercises that we’re going to do, then that would immediately give it appeal because obviously you’re going to choose an activity that is appealing.”</td>
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<tr>
<td></td>
<td></td>
<td>Flexibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Variety</td>
<td></td>
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<tr>
<td></td>
<td>Tracking progress</td>
<td>Being able to quantify physical activity</td>
<td>“It’s about perhaps finding appropriate levels, a broad range of appropriate intervention levels that actually provide the opportunity to achieve the kinds of goals that we would individually want to set for ourselves.”</td>
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<tr>
<td></td>
<td></td>
<td>Allowing people to keep track of their physical activity progress</td>
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<tr>
<td></td>
<td></td>
<td>Friendly reminders to track progress and increase motivation</td>
<td>“If people...put the bar too high, and...they find they can’t attain it, well they’ll give up. So I suppose it’s trying to, sort of gradually increase your fitness.”</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>“I like to be able to measure...if I was doing running, I’d actually be tracking, I’d time my runs. If it’s weights, I’d record...you know, if I’m serious about it, I try and record what I’m lifting so I can see that there’s progress.”</td>
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<td></td>
<td></td>
<td></td>
<td>“A little reminder that comes up once a month that says how are you going?”</td>
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Table 4.5 continued next page.
Table 4.5 continued.

<table>
<thead>
<tr>
<th>Enhancing knowledge</th>
<th>Social interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Providing resources to help people get started</td>
<td>• Discussion board element</td>
</tr>
<tr>
<td>• Providing links to other reliable sources of information</td>
<td>• Interaction with others</td>
</tr>
<tr>
<td></td>
<td>• Friendly competition</td>
</tr>
<tr>
<td></td>
<td>• Option to participate alone</td>
</tr>
<tr>
<td>“So either having that information or, or maybe links to maybe the sort of resources that people would find helpful.”</td>
<td>“If there was something like ‘ask an expert’ you know...where people could sort of post questions and there was some sort of web community, then that might be useful for people.”</td>
</tr>
<tr>
<td>“There might be a way...to put a link in there that allows you to go to YouTube and search things.”</td>
<td>“The 10,000 Steps idea is good...a number of us got into that at work over a period and that was a sort of a real...motivator. You could compare one another’s achievements, and try to better it.”</td>
</tr>
<tr>
<td></td>
<td>“I think the social networking is good, to be able to discuss things and be able to have a bit of fun and, but also, that competitive edge there too.”</td>
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</table>
Setting achievable goals and being able to quantify and track physical activity progress were commonly identified as important elements for inclusion. Many participants reported that they would be interested in being able to select from a variety of activities, with different levels of intensity, with some expressing the need to appeal to people at all levels of fitness and experience. For example:

“I think one of the things that is important is to make sure that there’s a ramp-up of expectations.”

“It needs to be made clear to people that, okay...we’re going to have a walking group at lunchtime. It’s not going to be some gung-ho, march, march, march, up the paddock...maybe there’s a group that wants to do that, but there will also be a group who effectively are going to go for, what might well actually be more described as a stroll through the bush out the back...instead of a march through the bush out the back. It needs to be clear to people what they are getting into, because I guess that...for some of the people who’ve not done much activity or any activity in recent times, they’re going to be put off by the thought of [participating].”

The importance achieving goals was also discussed as a motivating factor, and participants recognised that they needed to start with more reasonable goals that would allow them to see progress, before moving on to setting more difficult goals that would take more effort to achieve. One participant noted that:
“If people...put the bar too high, and...they find they can’t attain it, well they’ll give up. So I suppose it’s trying to, sort of gradually increase your fitness.”

Providing information or links to reliable, helpful resources was identified as a potentially motivating element, as was the inclusion of a discussion board or “ask the expert” type of element, where participants could interact with researchers. For example:

“If there was something like ‘ask an expert’ you know...where people could sort of post questions and there was some sort of web community, then that might be useful for people.”

Some participants liked the idea of developing an online community where participants could communicate with one another and for some, incorporating a degree of friendly competition and competing against others was identified as an element that would motivate them. This was not, however, unanimous, as others reported that they would prefer to participate on their own without a degree of social interaction. Some participants reported that:

“Clearly males are much more competitive in general than females so I think whatever you do needs to have some level of competitiveness in it, to some extent, even if it’s individual.”

“I think the social networking is good, to be able to discuss things and be able to have a bit of fun and, but also, that competitive edge there too.”
“I’d like it to be interactive so that I could put in, you know, what I’ve achieved, if there was some sort of tracking tool. But I sort of wouldn’t really be interested in interacting with other people.”

“For me...the whole social interaction thing is not particularly for me. I don’t see it as being particularly necessary. But then I’m not into Facebook or any of that kind of stuff either.”

Discussion

For each topic of discussion in this focus group study, several key themes emerged and resonated with men across the groups. When asked about the perceived benefits of being physically active on a regular basis, the men discussed a range of benefits, from improving general health and wellbeing, through to reduced risk of chronic diseases and improved mental health. Given the presence of high-profile health promotion campaigns and the popularity of television programs promoting weight loss and encouraging people to lead healthier lifestyles – for example, campaigns such as Measure Up (Department of Health and Ageing, 2010a), and television shows such as The Biggest Loser – it is not surprising that men in this study were aware of the benefits associated with regular physical activity and the risks associated with inactivity. It seems, however, that the issue is not so much about generating knowledge about the benefits of leading a physically active lifestyle, but educating people to enable them to identify and overcome the impediments related to nonparticipation.

Two prominent themes emerged from the discussion on barriers related to participation in physical activity – the impact of time constraints and work
commitments. These barriers were also identified in several other studies. For example, men in the Caperchione et al. (2012) study indicated that they lacked the time to participate in regular physical activity due to family and child care commitments. While the participants in the current study also mentioned family commitments, and fitting in with the family’s schedule outside of working hours, long working hours and excessive workloads were more commonly identified in relation to time constraints.

Incorporating a degree of competition into physical activity was suggested as a potential motivation strategy, with some, but not all, participants noting that they enjoyed a bit of friendly competition, and were more likely to push themselves if they knew they were competing against others. The desire for competition was not common among all participants, however, with some preferring to set personal goals and work individually. One participant shared his experiences relating to a social team he was once involved in, and explained that it was important for the competition to remain friendly and unthreatening, so as not to intimidate people. Older males in the study by Verdonk et al. (2010) held different opinions about workplace physical activity and competition in comparison to the younger males – their perceptions included feeling old around the younger men and feeling like they had to prove themselves if challenged.

Health was another major motivator for a lot of the men in this study, particularly as they were getting older. For many, the main motivators for being physically active shifted over time, compared to the motivating factors that they indicated influenced them in their youth. Some participants recalled seeing changes in their health or image when they reached their middle age, which prompted them to
start being physically active. Some, but not all participants saw age as a barrier to being physically active, but most agreed that they noticed quite a substantial difference in their fitness levels as they got older. Similar to the findings of Verdonk et al. (2010), in their youth, men felt that physical activity had more of a connotation with image and fitness, as health issues were not a major concern.

Wandel and Roos (2006) found that males in their study were also more aware of their health and the risk of disease as they aged, which was identified as a motivator for maintaining or undertaking physical activity for several participants in the present study. Although employed in a range of different occupations, participants in both our study, and the study by Wandel and Roos (2006), shared similar views on their levels of physical activity. Some participants discussed becoming less physically active as they got older, while others found the motivation to become active with age.

For most participants, high volumes of sedentary time were related to work and work-related tasks. Apart from small changes such as visiting a colleague rather than emailing them, or making several trips to the photocopier, participants – particularly those in academic or administrative roles – seemed to feel that opportunities to break up their sedentary time were limited. High volumes of sedentary time were accepted as somewhat of a by-product of their occupation and work environment, and a common idea held by participants was that sitting was essential for productivity. This notion also resonated with participants in the focus group study by Gilson et al. (2011). Although this was identified, in both studies, as a major barrier in relation to reducing daily sedentary time in the workplace; incorporating breaks in sedentary time can, in fact, enhance workplace productivity.
(Taylor, King et al., 2013). Stronger, more innovative efforts to overcome this misconception need to be considered. Encouraging regular breaks in sedentary time by incorporating small changes, such as those identified in these focus groups, may be efficacious for individuals employed in a university-based, or similar setting.

Changing the culture of the workplace to encourage physical activity emerges as a unique and interesting theme. In general, males who participated in our study were eager to see changes in workplace culture permitting more opportunities to participate in physical activity during the day. Participants felt that there was a lack of staff culture and social interaction conducive to physical activity participation within the workplace, although they were eager to see that change. It was also suggested that staff would need to have support and encouragement from supervisors and senior staff in order for physical activity during working hours to be acceptable and recognised as a legitimate activity, and the findings of Prosser et al. (2007) and Gilson et al. (2011) lend further support to this. Academic staff members in the Prosser et al. (2007) study suggested that having support from supervisors, and having a group or partner to be active with would help enhance and maintain motivation and overcome barriers for physical activity. Similarly, employees in the Gilson et al. (2011) study suggested that senior employees such as team leaders needed to encourage the integration of strategies to reduce or break up sedentary time. Although participants in both of these studies were predominantly female, some of the insights gained into workplace physical activity and sedentary time were reflected in our study. Participants in our study discussed the desire for greater staff engagement and promotion of social activities, and were in favour of seeing a change in culture using a top-down approach. This particular finding was taken into
consideration when designing and recruiting participants for the third study in this PhD (i.e., the intervention study to be tested in Chapter 5), and this will be discussed in greater detail in Chapter 5.

Although theoretical saturation was not used to determine sample size, the responses elicited across focus group sessions were similar. Recruiting men to participate in the study was challenging, although recruiting men to health promotion initiatives and research studies is notoriously difficult (Department of Health and Ageing, 2010b; Morgan, Warren et al., 2011). The focus group facilitator was female, and although the nature of the topics discussed during the focus group sessions were not particularly gender sensitive, female facilitation might have potentially influenced the responses of some participants.

Males in this sample were employed in a range of different positions, representing the varying roles often found within a university setting. For example, participants were employed in academic roles, management roles, and professional support positions. The majority of participants perceived their job to involve high volumes of sedentary time, so although the findings of this study are highly relevant to males employed in a university setting, they may not necessarily be applicable to other male populations, such as those employed in more labour-focused occupations.

A particular strength of this study was the insights that participants gave in relation to sedentary time. One particular notion that resonated with participants across groups was that sitting was necessary for their productivity, and taking regular breaks would significantly impact on their focus and productivity. It was suggested that it may not always be possible for employees to engage in physical activity during working hours. In addition to promoting regular physical activity both during
and outside of working hours, encouraging breaks in daily sedentary time during
working hours has been shown to be associated with positive health outcomes
(Healy, Dunstan, et al., 2008), and may be a more novel and achievable approach in
this type of setting.

**Conclusion**

The findings of this study demonstrate that promoting physical activity in
males working in particularly sedentary occupations can be challenging. Although a
variety of motivating factors were identified in this study, difficulties associated with
overcoming impediments for physical activity participation and reducing sedentary
time were a major concern for participants. Changing the workplace culture, gaining
support from employers and senior staff, and recognising physical activity as a
legitimate activity were identified as potential strategies to increase activity and
reduce sedentary time in a university-based setting. Future intervention research
targeting males in sedentary occupations should consider these strategies in efforts to
increase physical activity and reduce sedentary time.

**4.10 Synopsis**

This chapter has presented and discussed the findings of a focus group study
involving males that were employed in typically sedentary occupations. These
findings have addressed a gap in the literature by targeting middle-aged Australian
males and by providing much needed insights into barriers related to sedentary time
and strategies to overcome these barriers. The following chapter will discuss the
implications of this research on the final shaping and design of a 12-week
intervention designed to increase physical activity and reduce sedentary time in
middle-aged male university employees, the ManUp UWS Study.
Chapter 5

Study 3 – ManUp UWS: An intervention to increase physical activity and reduce sedentary time in middle-aged male university employees

Introduction

This chapter describes the methods, results and implications of the ManUp UWS Study – a randomised controlled trial testing the effectiveness of an internet-based intervention to increase physical activity and reduce sedentary time in middle-aged male university employees from an Australian university. The ManUp UWS study was largely based on the substantive ManUp Study (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012), and the final design of the intervention tested in the ManUp UWS study was based on findings from current literature (George et al., 2012) presented in Chapter 2, and the results of Study 2 (George, Kolt et al., 2013), presented in Chapter 4. This study has been registered as a clinical trial with the Australian New Zealand Clinical Trials Registry (ACTRN2612000450819), and is reported in accordance with the CONSORT statement for randomised controlled trials.

5.1 Background

As discussed in Chapter 2, there is great potential for improving physical activity and reducing sedentary time in workplaces, particularly those with large numbers of white-collar employees. It has been suggested that individuals who spend long periods of time seated while at work, should be a key focus for the promotion of
physical activity both during and outside of working hours (Miller & Brown, 2004). As outlined in Chapter 4, the university sector has been recognised as a large employer of white-collar employees, globally (Gilson et al., 2008), however, only a small number of studies have targeted university employees for the promotion of healthy lifestyles (Gilson et al., 2007; Morgan et al., 2009). Individuals employed in universities and similar occupational settings likely spend large amounts of time being sedentary, a risk factor for developing overweight or obesity, type 2 diabetes mellitus, metabolic syndrome, and CVD, independent of levels of physical activity (Ching et al., 1996; Dunstan et al., 2005; Hu et al., 2001; Katzmarzyk et al., 2009; Salmon et al., 2000).

The university-based study by Gilson et al. (2007) examined the effectiveness of two interventions to increase the work-day step counts and health of 64 university employees (six male and 58 female participants). A significant intervention effect for step counts was demonstrated ($p < .002$), and small, but nonsignificant decreases in waist circumference, blood pressure, and body fat percentage were observed (Gilson et al., 2007). More recently, Morgan et al. (2009) conducted a randomised controlled trial to examine the efficacy of an online weight-loss program for overweight or obese male university staff and students ($n = 65$). At six-month follow-up, intention-to-treat (ITT) analysis revealed significant decreases in weight for those in both the intervention (5.3kg) and control (3.5kg) groups (Morgan et al., 2009). Although the number of studies targeting employees in a university setting is quite limited, the results of these studies indicate that there is potential for the promotion of healthy lifestyle behaviours in university communities.
5.1.1 The ManUp Study

The substantive ManUp Study (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012) has been discussed in detail in Chapter 1 and Chapter 2. In summary, however, male participants aged between 35 and 54 years were chosen as the target group for this earlier study because they formed a hard-to-reach population group for the promotion of healthy lifestyles, have a lower life expectancy, and experience higher rates of a range of chronic diseases including diabetes and obesity, in comparison to females (Australian Bureau of Statistics, 2010; Department of Health and Ageing, 2010b). “ManUp” was chosen as the name for the study to “have men identify with the intervention and also to challenge men to take responsibility for their health” (Duncan, Vandelanotte, Rosenkranz, Caperchione, Connely, et al., 2012). Participants in the ManUp Study were primarily overweight or obese (44.5%), “professional” employees (55.9%), with a university degree (50.7%).

The results of the ManUp Study are presented in detail in Chapter 2, but briefly, Duncan, Vandelanotte, Rosenkranz, Caperchione, Connely, et al., (2012) found that participants significantly increased their self-reported weekly MVPA over time, however, no significant between-group differences in self-reported MVPA were observed. No significant effects for group or time were observed for self-reported leisure or occupational sitting time, and no significant changes were observed for weight, BMI, waist circumference, or for objectively measured sedentary time, light intensity physical activity (LPA), and MVPA. The lack of significant between-group effects may be attributed to the low engagement with the IT platform, or the possibility that both the IT-based intervention and the printed
resources approach worked equally well in modifying lifestyle behaviours in middle-aged males. Follow-up data were not yet available when the ManUp UWS Study was being designed and implemented, so many of the elements from the original ManUp Study were retained and revised. To test elements of the ManUp Study in a different population group (i.e., university employees), permission was sought from Queensland Health (the funding body for the larger ManUp Study) and approval was granted in May 2011. These elements are discussed in more detail in section 5.5.

5.1.2 Implications of focus group findings

As highlighted in Chapter 2, when designing intervention studies targeting lifestyle behaviours in specific population groups, particularly those that are considered hard-to-reach, it is important not only to identify intervention elements that have proven to be successful, but to consider the underlying factors associated with the lifestyle behaviours of interest. An extensive review of the literature, presented in Chapter 2 (George et al., 2012), indicated that there were limited physical activity intervention studies targeting males exclusively, and fewer that had considered ways to specifically reduce sedentary time in this population group. Additionally, in many intervention studies targeting physical activity and/or sedentary time in adult populations, males have tended to be underrepresented in comparison to their female counterparts (Waters et al., 2011). In efforts to increase the proportion of males participating in such interventions, it has been recommended that a gender-specific approach be taken to appeal specifically to males (Waters et al., 2011). By gaining insight into male perceptions of physical activity and sedentary time, and the types of intervention elements that males may find appealing, and by
embedding these elements and suggestions within male-specific interventions, males may be more likely to show interest and participate.

While the ManUp UWS Study used the more general ManUp intervention (see 5.1.1) as a starting point, prior to shaping the final design of the ManUp UWS intervention, a series of focus groups were conducted with males representative of the target population – low-active males aged between 35 and 64 years, employed in a university setting (see Chapter 4, George, Kolt et al., 2013). During these focus groups, male participants discussed their perceptions of physical activity and sedentary time, and intervention elements they would like in an internet-based physical activity program. Findings from the focus group study (discussed in Chapter 4) were used to help inform the final design of this 12-week internet-based intervention to increase physical activity and reduce sedentary time.

Many of the key barriers and motivators related to focus group participants’ regular participation in physical activity were included in the generic printed material distributed throughout the intervention period, and these will be discussed in more detail later in this chapter. In addition to these inclusions, there were several other findings that were more specifically related to the target population that helped to inform the study design. For example, most of the participants in the focus group study identified work and work-related tasks as a major source of daily sedentary time and a primary barrier to regularly participating in physical activity. Many participants employed in roles that required high volumes of sedentary time (such as academic and administrative staff) felt that they had limited opportunities to break up their sedentary time during working hours, and believed that being seated was essential for their productivity. Furthermore, participants often referred to sedentary
time as a “by-product” of their occupation and their work environment, seemingly accepting that they were expected to sit at their desks for prolonged periods.

Another interesting and unique notion that resonated across the focus groups (Chapter 4) was that of changing the culture of the workplace to encourage physical activity. Participants in the focus group study were eager to see changes in workplace culture permitting more opportunities to participate in physical activity during the day, as they felt that there was a lack of staff culture and social interaction conducive to physical activity participation within the workplace. Gaining support and encouragement from supervisors and senior staff was also identified as a necessity if physical activity was to be accepted and recognised as a legitimate activity during working hours.

Focus group participants were in favour of intervention elements that would allow them to set realistic, gradual goals and track their progress. Most participants reported that they would be interested in a program that was simple and quick, with various options for different types of physical activities. Some participants reported that they enjoyed an element of friendly competition and would like to participate in a program that incorporated this, while others reported that they preferred to work towards their own goals, at their own pace. All of these findings were taken into consideration when planning not only the final design of the ManUp UWS intervention, but also the recruitment strategies that would be implemented to appeal to as many male staff as possible.
5.2 Purpose of the study

As discussed in the literature review (Chapter 2), there is a need for physical activity interventions that are designed exclusively for males, utilising intervention elements that appeal to male participants. Using elements of the substantive ManUp Study in Gladstone, Queensland (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012), and guided by findings from an extensive literature review (Chapter 2, George et al., 2012) and focus group research (Chapter 4, George, Kolt et al., 2013), the purpose of this study was to adapt, implement, and evaluate an internet-based intervention designed to increase levels of physical activity and reduce sedentary time in male staff aged between 35 and 64 years, employed at UWS. As discussed in Chapter 2, the 35 to 64 year age range was selected as this was a broad definition of “middle-aged” to be inclusive and to reach as many potentially eligible participants as possible.

5.3 Research questions

The ManUp UWS Study was designed to answer three specific research questions.

1. Compared with males in a printed resources comparison group, did males in an internet-based intervention group experience any significantly greater increases in the percentage of time spent being physically active at 12-week and 24-week follow-up?

2. Compared with males in a printed resources comparison group, did males in an internet-based intervention group experience any significantly greater decreases in the percentage of sedentary time at 12-week and 24-week follow-up?
3. Compared with males in a printed resources comparison group, did males in an internet-based intervention group experience any significantly greater improvements in other health-related (secondary) outcomes – weight, BMI, waist circumference, and blood pressure at 12-week and 24-week follow-up?

Methods

5.4 Participants

Male employees aged 35-64 years from a large multicampus Australian university (UWS) were recruited to participate in the ManUp UWS Study – a two-arm randomised controlled trial comparing one group receiving a 12-week internet-based intervention aimed at increasing physical activity and reducing sedentary time with a comparison group receiving only generic printed materials on physical activity, sedentary time, and health.

Using baseline accelerometer data from the substantive ManUp Study, the study was powered to detect a 1.67% change in MVPA between groups. Based on 80% power and using a significance level of alpha = 0.05, it was calculated that 42 participants would be needed per group (i.e., a total of 84 participants). As attrition rates tend to be high in internet-based interventions (Eysenbach, 2005; Neve et al., 2010), a 40% attrition rate was assumed, and a total of 120 participants was required. In order to recruit as many male employees as possible, a range of recruitment strategies were utilised, each of which will be outlined below.

5.4.1 University of Western Sydney
The characteristics of UWS and the surrounding GWS region have been discussed in Chapter 4, but briefly, UWS is a large multicampus university situated in the GWS region, in NSW, Australia. There are five main university campuses, located in Penrith, Hawkesbury, Campbelltown, Parramatta, and Bankstown.

5.4.2 Recruitment strategies

A range of recruitment strategies were utilised in this study, each of which is described below.

5.4.2.1 Endorsement of program from UWS

Drawing upon one notable finding from the focus group research conducted prior to the final planning and shaping of the ManUp UWS intervention (Chapter 4), it was decided that the University needed to demonstrate support for staff wishing to become more active and wishing to participate in this study. Participants in the focus group sessions discussed the need for support from the University and from senior staff within their academic or other unit, in order for physical activity to be recognised as a legitimate, health promoting activity to be undertaken during working hours. As a result, our research team approached the University of Western Sydney Our People 2015 Steering Committee about the possibility of endorsing ManUp UWS. The Our People 2015 initiative is designed to work with activities that support staff within the organisation. This staffing strategy has five key goals – to become an employer of choice, to ensure workforce alignment, to maintain workforce continuity, to develop rewards and career progression, and to encourage and promote organisational and leadership culture.
The *Our People 2015* Steering Committee agreed that the objectives of the ManUp UWS Study reflected several of the goals behind the Strategy, and as such, endorsed the project as an initiative of the *Our People 2015* Staffing Strategy, with the support of the Vice-Chancellor and President of the University. Resulting from this endorsement and support, several strategies were used to promote the study across the University in order to attract participation. These strategies, outlined in further detail below, included an information page on the UWS website, participant recruitment flyers, participant recruitment emails across the University, presentations at staff events, advertising on the UWS website homepage, and exposure through the staff newsletter and social media site.

5.4.2.2 *ManUp UWS information page on University website*

The ManUp UWS information page ([www.uws.edu.au/manup](http://www.uws.edu.au/manup)) featured on the University website contained more detailed information on the project, including outlining the eligibility criteria, participation requirements (e.g., time commitment, requirements of measurement sessions) and contact details so potential participants could express their interest in the project (Appendix O).

5.4.2.3 *Participant recruitment flyers*

Participant recruitment flyers contained a brief summary of the project and eligibility criteria that were used (Appendix P). Male employees who were in the target age group, and who were interested in participating and becoming more active, were able to email the primary researcher (ESG) via a dedicated project email address ([ManUp@uws.edu.au](mailto:ManUp@uws.edu.au)) or visit the ManUp UWS information page, where they could find out more about the project. A total of 1,000 flyers were distributed.
around the five main University campuses and to administrative support employees who were asked to distribute to any staff members within their academic or other unit who may meet eligibility based on age and employment status. Flyers were also distributed at University-wide staff events.

5.4.2.4 Participant recruitment email

A very specific, predefined email list of all male staff aged between 35 and 64 years, who were employed in ongoing or fixed-term positions, was obtained from the Workplace Health and Safety unit (n = 845). Employees on this pre-defined list were sent one initial recruitment email on 30 July 2012, from the Vice-Chancellor, explaining the importance of health and wellbeing and inviting them to participate in the “ManUp UWS Challenge” (Appendix Q). Interested participants wishing to “take the challenge” or to find out more were directed to the ManUp UWS information page. A follow-up email was also sent to the same predefined email list in October 2012. Staff members were reminded that registration for the “ManUp UWS Challenge” was still open, and were directed to the study webpage to find out more about the project.

Units such as Information Technology Services, Capital Works and Facilities, Campus Safety and Security, and the Office of People and Culture were identified as those with high numbers of male staff members, and as such, were identified and targeted specifically for recruitment. An email was sent to the Head of each of these units asking them to promote the project to their male staff.
5.4.2.5  **Presentations at staff events**

The primary researcher introduced the ManUp UWS Study at several campus-based staff events, and staff from the Office of People and Culture also introduced and endorsed the project as an initiative of the *Our People 2015* Staffing Strategy at additional staff events. Recruitment flyers were placed on attendees’ chairs and at tables in common areas at these events.

5.4.2.6  **Advertisement on university website homepage and ManUp UWS promotional button**

The UWS website homepage featured a ManUp UWS Study banner (Appendix R), which was featured on the page for 2 weeks from the date of the project launch (July 30 to August 13, 2013) and participants were able to click on the ‘Find out more’ link, directing them to the ManUp UWS information page.

A ManUp UWS promotional button was also featured on a range of related web pages on the University website (Appendix S). Anyone who clicked on these promotional buttons was directed to the ManUp UWS information page. These buttons were featured throughout the University website until the end of the recruitment period in November 2012.

5.4.2.7  **Staff newsletter and social media**

In order to generate interest in the project and build upon initial interest generated through the recruitment email and website advertisements, a number of additional strategies utilising social media and staff-specific outlets were employed. An article on the ManUp UWS Study was featured in the *AroundUWS* staff newsletter in August 2012 (Appendix T). The article provided detail on the rationale
for the study, drawing particular attention to the importance of regular physical
activity to improve male health and wellbeing. By highlighting the fact that there was
a great deal of interest in the study and that many male staff members had already
commenced, it was anticipated that other staff members who had considered
registering their interest would be prompted to do so.

Announcements about ManUp UWS were also placed on the UWS e-update
system, which is a subscription-only update service, where subscribers receive a
daily email containing information on upcoming events, training and development
opportunities, and social events. Announcements and reminders about the project
were also placed on the University’s social media site, Yammer, to generate interest
in the project in a less-formal atmosphere. Interested and potentially eligible
participants were invited to visit the ManUp UWS information page to find out more.

5.4.3 Eligibility criteria

The eligibility criteria were detailed on the information page of the University
website, in efforts to decrease the number of ineligible participants contacting the
primary researcher. Potential participants who expressed their interest in the study by
emailing ManUp@uws.edu.au were thanked for their interest in the study and were
asked to answer five eligibility questions via return email (within 1 day of receipt of
expression of interest) (Appendix U). Potential participants were deemed eligible if
they were available for three short assessment sessions across 24 weeks, and were:

- Aged between 35 and 64 years (Eligibility question: Are you currently aged
  between 35 and 64 years?)
Employed at UWS in an ongoing or fixed-term position (Eligibility question: Are you employed at UWS in an ongoing or fixed-term position?)

Able to access a computer with email and internet capabilities at least once each week (Eligibility question: Do you have access to a computer with email and internet capabilities at least once each week?)

Not highly active (not participating in at least 30 minutes of moderate or vigorous physical activity on five or more days per week) (Eligibility question: As a rule, do you do at least half an hour of moderate or vigorous physical activity (such as walking or a sport) on five or more days a week?)

Not participating in other weight loss or physical activity programs during the study (Eligibility question: Are you currently participating in any other weight loss or physical activity programs?).

On receipt of email responses to these 5 eligibility questions, all respondents were advised whether they were eligible for participation or not. Eligible participants were sent a further email, confirming their eligibility and asking for their home campus (the campus where they spend most of their time, or where they would like to attend for measurements) and their session preferences for the ManUp UWS baseline measurement sessions to be held on the participant’s home campus. Once participants’ home campus and session preferences were recorded in a participant spread sheet, they were thanked again for their interest and were told that they would be informed via email once the next session was arranged at their home campus.

Ineligible participants were sent an email explaining why they were not eligible for participation at that point in time. As a courtesy, they were also directed to a website for the Australian Physical Activity Guidelines for Adults.

5.5 Internet-based intervention group

Participants allocated to the internet-based intervention group received exclusive access to the ManUp UWS website during the 12-week intervention period. The website was promoted as being designed for males who weren’t highly active, but were ready to “take the challenge” and become more active. The approach to be taken for this study was more problem-based, than theory-based (Bartholomew, Parcel, Kok, & Gottlieb, 2011). That is, rather than utilising one single theoretical framework, a broader, more holistic approach to promoting healthy lifestyle behaviours was adopted. The social ecological approach to health promotion is designed to provide an understanding of the “Interrelations among diverse personal and environmental factors in human health and illness” (Stokols, 1996, p. 283). This particular approach considers situational and personal attributes related to health, and focuses on characteristics of social and physical environments and diverse associations between environments and levels of involvement (Stokols, 1996). For example, the social ecological model considers factors related to the built environment, such as access to facilities for physical activity participation; factors related to policy, such as allowing for physical activity breaks during working hours; social factors such as the availability of support for participation in physical activity;
demographic factors such as a person’s socioeconomic status; and potential opportunities for physical activity.

The ManUp UWS website used the same platform as that used in the earlier ManUp Study based in Gladstone (discussed in detail in Chapter 1 and Chapter 2), with participants being able to select and complete personal physical activity challenges from a list of challenges, create groups with other participants, track their physical activity progress, and monitor their weight and BMI. The website also featured an Information Centre, where participants could find information related to physical activity, sedentary time, and health, as well as a Forum, where participants could ask questions, post tips and communicate with one another.

The earlier ManUp Study was designed to appeal specifically to middle-aged males living in rural Queensland, and as such, the ManUp website was framed in a different way. Compared with the original website which featured a maroon and gold colour scheme, the ManUp UWS website had a blue colour scheme to reflect the primary colour of the UWS logo. In addition to the aesthetic changes, a number of additional modifications were made to appeal to male staff members at UWS. One of the main elements of the original ManUp Study that was excluded from the ManUp UWS Study was the element using the mobile phone platform. Formative research conducted prior to the design and commencement of the original ManUp Study suggested that some males in this age category may not have been particularly interested in using their smartphones to access a mobile-based site. Although some focus group study participants expressed their interest in a mobile platform, other participants were “not particularly enthusiastic” about an intervention for physical activity and nutrition to be delivered in this way (Vandelanotte et al., 2013). These
mixed results, paired with the additional associated cost and expertise required to redevelop the mobile phone platform led to the exclusion of this particular element. The nutritional information and associated aspects and ManUp challenges were also omitted from the ManUp UWS Study. Although many studies have targeted both of these behaviours, it was decided that targeting physical activity and sedentary time would result in a more targeted intervention to fit within the scope of this PhD research. The larger ManUp Study also included a much larger research team including specialised researchers in the area of dietary behaviours.

Website elements that were retained and revised for the ManUp UWS Study included the Information Centre, the Forum, the weight and BMI tracking tool, and the physical activity challenges. While the vast majority of these elements were retained in their original format (with changes made to reflect the new colour scheme and overall look of the website), the main changes that were made were in the Information Centre. The same topic pages were retained, however, the information provided under each heading was different, with more area and campus-specific examples, and photographs of different UWS campuses to illustrate the availability of physical activity facilities, walking paths, and exercise equipment.

During the earlier focus group study (Chapter 4), participants were asked to provide suggestions for intervention elements to increase physical activity and reduce sedentary time. As almost all of these suggestions centred around finding opportunities to increase physical activity, it was decided that the challenges included in the intervention would focus on ways to increase physical activity. A portion of the information provided through the website and the printed materials was, however, focused on delivering messages on the importance of reducing
sedentary time. A list of the ManUp UWS website features is presented in Table 5.1 and a list of the physical activity challenges is presented in Appendix V.
<table>
<thead>
<tr>
<th>Table 5.1</th>
<th>Summary of ManUp UWS website features.</th>
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<tbody>
<tr>
<td><strong>Self-monitoring</strong></td>
<td></td>
</tr>
<tr>
<td>Ability to record progress towards completing physical activity challenges</td>
<td></td>
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<tr>
<td>Ability to record body weight, and calculate BMI</td>
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<tr>
<td>Automatically generated summary of all data recorded</td>
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<tr>
<td>Ability to schedule an activity and receive text or email reminder</td>
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<tr>
<td>Visual summary of progress towards completing ManUp UWS physical activity challenges</td>
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<tr>
<td><strong>Social support</strong></td>
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<tr>
<td>Ability to add a “mate”</td>
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<tr>
<td>Ability to view the progress of “mates”</td>
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<tr>
<td>Ability to comment on a the profile page of a “mate”</td>
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<tr>
<td>Ability to complete group-based challenges</td>
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<tr>
<td>ManUp UWS forum</td>
<td></td>
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<tr>
<td><strong>Information centre</strong></td>
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<tr>
<td>What is ManUp UWS?</td>
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<tr>
<td>Who is ManUp UWS?</td>
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<tr>
<td>What is Physical Activity?</td>
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<tr>
<td>List of Physical Activities</td>
<td></td>
</tr>
<tr>
<td>Being Active On and Around Campus</td>
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<tr>
<td>Sedentary Time</td>
<td></td>
</tr>
<tr>
<td>Barriers to Reducing Sedentary Time/ Strategies to Overcome Barriers to Reducing Sedentary Time</td>
<td></td>
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<tr>
<td>Benefits of Physical Activity</td>
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<tr>
<td>Tips for Being Active</td>
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<tr>
<td>Boosting Motivation for Physical Activity/ Common Barriers to Being Physically Active Strategies to Overcome Barriers to Being Physically Active</td>
<td></td>
</tr>
<tr>
<td>The ManUp UWS Physical Activity Challenges</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Duncan et al. (2012)
In addition to having access to the website for the duration of the 12-week intervention period, participants in the intervention group also received printed materials (Appendix V) on physical activity, sedentary time, and health in hard copy format at baseline (given to participants by the primary researcher when given their allocation letter, after all baseline data were collected and accelerometers returned), and via email at week 3, week 6, and week 9. Details of the printed materials are provided in section 5.7.7. The emails acted as friendly reminders for participants in the intervention group to log on to the ManUp UWS website and keep track of their physical activity progress. Participants were also given physical activity logs to track their progress in written format if they preferred. These logs were for the participants’ own reference and were not collected by the research team.

Participants returned for 2 follow-up measurement sessions; at the end of the intervention period (12 weeks) and a further 12 weeks after the intervention ended (i.e., 24 weeks from baseline). At the 12-week mark, they were asked to provide feedback on the ManUp UWS intervention by completing a process evaluation questionnaire (Appendix W). Participants could still access the ManUp UWS website once the intervention period had ended (i.e. after the 12-week time point), and they were informed that they could use the website as much or as little as they liked.

5.6 Printed resources comparison group

Participants allocated to the printed resources comparison group only received printed materials on physical activity, sedentary time, and health in hard copy format (printed in colour on standard white A4 size paper) at baseline (after all baseline data were collected and accelerometers returned), and via email at week 3, week 6, and
week 9 (the materials were the same as those received by the intervention group).

Email is the primary means of communication for University staff and all correspondence between the primary researcher and research participants related to attendance at measurement sessions and accelerometer collection dates was email-based. Email was therefore deemed to be the most convenient and timely method for delivery of printed resources. The emails acted as friendly reminders for participants to keep track of their physical activity progress using the physical activity logs provided. These logs were for the participants’ reference only, and were not collected by the research team. Participants in the printed resources comparison group did not have access to the ManUp UWS website during the 12-week intervention period or during the 24-week follow-up period. They were, however, given access to the website for a 6-week period after all follow-up data had been collected, as a token of appreciation for their participation in the study.

Participants in the printed resources comparison group also returned for two follow-up measurement sessions, one at the end of the intervention period (12 weeks) and a second, a further 12 weeks after the intervention ended (i.e., 24 weeks from baseline). At the 12-week point, they were asked to provide feedback on their experience in the study by completing a process evaluation questionnaire. This questionnaire included the same questions as those in the questionnaire given to the intervention participants, without those related specifically to the ManUp UWS website (Appendix X).
5.7 Baseline measurement sessions

Once a suitable date and time for a group of participants at the same campus was established, each participant was sent an individual email with preliminary details including the date, time, duration, and location of the “introductory” baseline session, as well as a brief summary of the measurements being taken during the session. Sessions were held across all 5 campuses and participants were invited to the next available session on their home campus. Sessions were held in a common room such as a research laboratory, or meeting space with adequate space to accommodate all equipment, with 2 researchers and at least 1 participant at a time. Some locations were large enough to split into 2 separate sections, so 1 participant could be having measurements taken, while another participant was completing participant documentation such as the demographic questionnaire and preexercise screening assessment.

Once participants confirmed that the session date and time was suitable, they were sent a meeting request via their University email, so the room location, time, additional details and reminders appeared in their University electronic calendar. Any participant who could no longer attend the session was invited to attend the next available session on their home campus. At the baseline measurement session, participants met the primary researcher and the trained male research assistant who took all anthropometric data measurements using the same instrument at each time point. The primary researcher attended all measurement sessions in order to build a rapport with participants, however, only the male research assistant took measurements and recorded results.
5.7.1 Informed consent

Participants were asked to read a detailed information sheet about the study (Appendix Y), which described participant requirements, ethical considerations, and who participants could contact if they had a complaint or concern about the project. Once participants read the information sheet, they were given an opportunity to ask any questions, and then indicated their informed consent to participate in the study by signing a written informed consent document (Appendix Z).

5.7.2 Preexercise screening assessment

After providing consent to participate in the study, participants were asked to complete the brief Sports Medicine Australia Preexercise Screening assessment (Norton, 2005). The primary researcher explained that the preexercise screening assessment was precautionary and its primary purpose was to identify participants who may be at high risk of any adverse events related to physical activity. One participant did not pass this preexercise screening assessment and did not obtain clearance from a medical professional, so no further data were collected and those data collected during the baseline session were excluded from all analyses. All other participants passed this preexercise screening assessment, and therefore did not need to obtain medical clearance.

5.7.3 Demographic questionnaire

A brief demographic questionnaire was administered during the baseline measurement session (Appendix AA) and participants were asked to select the most appropriate answer from the options given. To ensure consistencies across the three studies in this body of research, demographic questions 4 and 5 for Study 2 (Chapter
4, see Appendix L) and demographic questions 2 to 5 for the current study were based on demographic questions asked in The 45 and Up Study baseline questionnaire (Appendix C). Demographic questions are detailed below.

5.7.3.1 Current role at UWS

The first question asked participants to select from the options “Academic” (i.e. faculty), “General/Professional” (i.e., School Manager, Administrative Support, Technical staff) or “Other” to best describe their role at UWS. As only 5% of participants listed “other”, this variable was converted to a dichotomous variable with participants categorised as either “Academic”, or “Nonacademic”.

5.7.3.2 Highest educational qualification

In question 2, participants were asked to indicate the highest educational qualification they had completed from the options: “No school certificate or other qualifications”, “School or intermediate certificate (or equivalent)”, “Higher school or leaving certificate (or equivalent)”, “Trade/apprenticeship (e.g. hairdresser, chef)”, “Certificate/diploma (e.g. technician)”, or “University degree or higher”. The School Certificate is awarded to eligible NSW high school students after completing four years of secondary schooling from years/grades 7 to 10, while the Higher School Certificate is awarded to NSW high school students who successfully complete year/grade 11 and 12 (Board of Studies NSW, 2011). Equivalent qualifications are awarded in other Australian states and territories.

5.7.3.3 Pre-tax household income

The third demographic question asked participants to report their usual yearly household income before tax, from all sources. Income categories were: “less than
$20,000”; “$20,000 to $39,999”; “$40,000 to $59,999”; “$60,000 to $79,999”; “$80,000 to $99,999”; “$100,000 to $119,999”; “$120,000 to $139,999”; or “more than $140,000”, with one final option listed for participants who were not comfortable disclosing their income (“I would prefer not to answer this question”).

5.7.3.4 Self-rated health

Question 4 requested participants to report their level of self-rated general health, by selecting one of the following options: “Excellent”, “Very good”, “Good”, “Fair”, or “Poor” (Ware, Kosinski, & Keller, 1994). A similar question was also asked in The 45 and Up Study baseline questionnaire, which was used in Study 1 (Chapter 3), although the wording of that question was slightly different.

5.7.3.5 Self-rated quality of life

Quality of life was also assessed by asking participants to answer the question: “In general, how would you rate your quality of life?” with the five following options: “Excellent”, “Very good”, “Good”, “Fair”, or “Poor”. This question was the same as that asked in The 45 and Up Study baseline questionnaire, which was used in Study 1 (Chapter 3).

5.7.3.6 Perceived level of physical activity

To gain an initial idea of participants’ perceived level of physical activity, participants were asked “How would you rate your current physical activity level?” Options were “Needs a lot of improvement”, “Not bad, although I should probably do more”, and “Good, I am physically active on a regular basis”. These questions were also used in the demographic questionnaire in Study 2 (Chapter 4).
5.7.4 Primary outcome measure – physical activity

Participants’ physical activity was assessed using ActiGraph GT3X accelerometers. Once all anthropometric measurements had been taken at baseline, participants were given an accelerometer to wear for 7 consecutive days. Following the same procedure as used in the earlier and substantive ManUp Study (Duncan et al., 2012), prior to measurement sessions, accelerometers were fully charged and initialised to record steps, and acceleration counts using 10-second epochs in tri-axial mode.

Participants were instructed to wear the accelerometer from the moment they woke up, the day after their measurement session. The male research assistant explained the purpose of the accelerometer and demonstrated the correct way to fit the accelerometer. The lightweight device was fitted on an adjustable elastic belt with a clip to fasten. Participants were instructed to wear the accelerometer on their right hip, with the belt fastened to a point that the device did not move around when they were being physically active. The accelerometer number was recorded on a white label at the top of every device, and these labels were frequently replaced during the study period to ensure that they did not fall off while the participant had the accelerometer in their possession. Participants were instructed to place the accelerometer on their right hip with the white label facing up, every time they fitted it. They were also encouraged to wear the accelerometer for as long as possible over the 7-day recording period, being asked to wear the accelerometer from the time they woke up, to the time they went to bed in the evening, only removing it when they showered or bathed, or participated in any water-based activities. All participants were given an accelerometer information sheet (Appendix BB) containing details of
the device and all the instructions for wearing their device correctly over the 7-day wear period.

Wear time validation and data scoring were carried out using ActiLife software version 6.7.2 (ActiGraph, LLC, Pensacola, FL, USA). Periods of nonwear time were defined as 60 minutes of consecutive zero counts (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012; Troiano et al., 2008; Tudor-Locke, Camhi & Troiano, 2012), with no spike tolerance. Due to the compliance levels with regard to accelerometer wear time, a minimum of 10 hours per day of wear time on at least 3 days was required to be included in analysis. There were three occasions on which a particular accelerometer failed to collect valid data. One accelerometer malfunctioned during baseline data collection and recorded data prospectively for a period of 74 days. The participant agreed to wear a new accelerometer for a further 7 days, however, the data were excluded due to inadequate wear-time. Two accelerometers also failed to collect valid data during the 12-week follow-up sessions. Although data had been collected, an error occurred and the data could not be cleaned or coded. All accelerometers were initialised and checked by the primary researcher, and all three issues occurred at different measurement sessions (i.e., they were not initialised on the same day), so it is unclear as to why the devices failed. These three devices were not used again for the remainder of the study period. Excluding devices that failed to collect data, the proportion of participants with at least 3 days of valid wear time ranged from 48% to 85%. Although not an ideal representation of physical activity and sedentary time over a one-week period, increasing the number of days required for valid wear time would have substantially reduced the amount of valid wear time available for analysis. It was therefore
determined that including 3 days worth of valid wear time would provide a relatively reliable estimate of the participant’s physical activity for a 7-day period, a method that has been used in many other studies (Masse et al., 2005). Physical activity intensity (minutes and percentages) was categorised using cut-points developed by Troiano (2008). Physical activity was the primary outcome for this study, and of particular interest were the changes in light-intensity physical activity and moderate-to-vigorous intensity physical activity, each of which were examined separately. Light-intensity activity was classified as 100 to 2,019 counts per minute, and moderate-vigorous-intensity activity was classified as ≥2,020 to 5,998 counts per minute. Wear-time spent in moderate-intensity activity and vigorous-intensity activity alone was not examined.

Participants returned their accelerometer after wearing it for up to 7 consecutive days. The researcher returned to the participants’ home campus to collect their accelerometer, either meeting participants in a common room on campus, collecting it from them in their office, or collecting it from administrative support staff in their academic or other unit.

5.7.5 Secondary outcome measures

Several secondary outcome measures were included in this study. They included sedentary time, weight, BMI, waist circumference, and blood pressure.

5.7.5.1 Sedentary time

Minutes and percentages of sedentary time were also assessed using the ActiGraph GT3X accelerometer, using the same criteria as outlined above. Sedentary
time was classified using the same predeveloped cut-points (Troiano et al., 2008) and was represented by counts of 0 to 99 per minute.

5.7.5.2 **Height**

A trained male research assistant measured participants’ height to the nearest 0.1cm (without shoes), using a portable stadiometer (PE87 portable stadiometer, Mentone Educational, Victoria, Australia). Two height measurements were taken for each participant, and a third measurement was taken if the first 2 records varied by more than 0.5cm. The male research assistant was blinded to participants’ group allocation.

5.7.5.3 **Weight**

The same research assistant measured participants’ weight at all 3 measurement sessions. Participants were asked to remove their shoes and any bulky clothing before measurements were taken, and weight was measured to the nearest 0.1kg using a digital scale (EF 538 HealthStream digital scale; Aussie Fitness, Queensland, Australia). Two weight measurements were recorded for each participant, at each session, and a third measurement was taken if the first 2 varied by more than 0.5kg. The average weight measurement at each time point was used for analyses.

5.7.5.4 **BMI**

Participants’ BMI was calculated using the average of the height and weight values recorded by the trained research assistant at each session. Cut-points developed by the WHO (2006) were used to classify whether participants were of a
healthy weight (BMI of 18.50 to 24.99), underweight (BMI of <18.50), overweight (BMI of 25.00 to 29.99), or obese (BMI of ≥30).

5.7.5.5 Waist Circumference

Waist circumference was measured to the nearest 0.1 cm using a non-elastic tape measure (Myotape, Mentone Educational, Victoria, Australia) by the trained research assistant. After removing any bulky clothing, the participants were asked to stand up tall and the research assistant placed the retractable Myotape around the participants’ waist. Measurements were taken after exhalation, once the Myotape was fitted snugly around the midpoint. All measurements were taken on the right side of the participants’ body, on exhalation, by locating the midpoint, between the lowest rib and the iliac crest. Two waist circumference measurements were taken, with a third taken if the first 2 measurements varied by more than 0.5 cm. The average waist circumference measurement at each time point was used for analyses.

5.7.5.6 Blood Pressure

Participants’ systolic blood pressure (SBP) and diastolic blood pressure (DBP) was recorded using the Omron HEM-7211 automated upper arm blood pressure monitor (Omron Healthcare, Kyoto, Japan). SBP and DBP were measured at the end of the measurement session, while the participant was seated, using their right arm. Three blood pressure measurements were recorded for each participant at each measurement session, and an average of all 3 recordings was calculated for each of SBP and DBP.
5.7.6 Randomisation

Using an unblocked 1:1 allocation ratio, participants were randomly allocated to one of two groups – an internet-based intervention group, or a printed resources (comparison) group, using a randomisation list generated by a statistician using Microsoft Excel. The primary researcher randomly assigned a number to each participant when they arrived for their baseline measurement session. For example, a total of 9 participants attended the first measurement session, so these participants were randomly allocated a number between 1 and 9. A total of 7 participants attended the second baseline session, so these participants were randomly assigned a number between 10 and 16, and so on. Each individual participant’s name was recorded against the random number they were assigned, and this number was checked against the statistician-developed randomisation list, with each number in the list representing 1 participant. Once each of the baseline measurement sessions had concluded, the primary researcher randomly allocated participants to group A or group B – 1 of which represented the intervention, and 1 the comparison group, using the random number they had been assigned on arrival to the baseline session. The primary researcher was the only person with access to the list, and was not involved in taking or recording anthropometric measurement data.

After participants had worn their accelerometer for up to 7 consecutive days, the device was collected from them, and they were informed of their group allocation. Each participant was given an envelope with his name on the front. This envelope contained a personalised letter asking the participant to read the enclosed materials (the first series of generic materials on physical activity, sedentary time and health), explaining which group they had been assigned to (based on the random
number assigned to them in week 0), and what they could expect over the following 12-week intervention period. All participants received the generic printed materials. Participants were given the opportunity to ask any questions after they opened the envelope containing their allocation letter, and a contact email address was given at the bottom of the letter, in case participants had any questions at a later time.

In their allocation letter, participants assigned to the internet-based intervention group were asked to log on to the ManUp UWS website (http://manup.uws.edu.au/), enter their unique access code, which was provided in the allocation letter, and create their profile (Appendix CC). Participants assigned to the printed resources (comparison) group were told that they would be given access to the ManUp UWS website once they had completed their final 24-week measurement session (Appendix DD).

5.7.7 Printed materials

All participants received printed materials on physical activity, sedentary time, and health at baseline, and across the intervention period. The first batch of materials were given to participants as a hard copy when they received their allocation letter (after all baseline measurements had been collected), while the remaining materials were sent to the participants’ staff email addresses, once every 3 weeks (Appendix V). Table 5.2 provides a summary of the topics and the week they were distributed to participants.
Table 5.2  Summary of ManUp UWS printed resources.

<table>
<thead>
<tr>
<th>Printed resources - topic</th>
<th>Time point</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>What is ManUp UWS?</td>
<td>✓</td>
</tr>
<tr>
<td>Who is ManUp UWS?</td>
<td>✓</td>
</tr>
<tr>
<td>What is Physical Activity?</td>
<td>✓</td>
</tr>
<tr>
<td>List of Physical Activities</td>
<td>✓</td>
</tr>
<tr>
<td>Being Active On and Around Campus</td>
<td>✓</td>
</tr>
<tr>
<td>Sedentary Time</td>
<td>✓</td>
</tr>
<tr>
<td>Barriers to Reducing Sedentary Time/ Strategies to Overcome Barriers to Reducing Sedentary Time</td>
<td>✓</td>
</tr>
<tr>
<td>Benefits of Physical Activity</td>
<td>✓</td>
</tr>
<tr>
<td>Tips for Being Active</td>
<td>✓</td>
</tr>
<tr>
<td>Boosting Motivation for Physical Activity/ Common Barriers to Being Physically Active</td>
<td>✓</td>
</tr>
<tr>
<td>Strategies to Overcome Barriers to Being Physically Active</td>
<td>✓</td>
</tr>
<tr>
<td>The ManUp UWS Physical Activity Challenges</td>
<td>✓</td>
</tr>
<tr>
<td>My Physical Activity – Week x Progress</td>
<td>✓</td>
</tr>
</tbody>
</table>

5.7.8  Follow-up measurement sessions

Participants were contacted by email with preliminary details for follow-up measurement sessions at the 12-week and 24-week mark. A date and time was proposed and participants were asked whether they would be available to attend, and if possible, to provide a preferred session time. Once more than 1 participant confirmed their availability, a location was booked and participants were sent a meeting request via their staff email address with all session details. The follow-up sessions took approximately 15 minutes to complete and session times were flexible, to fit in with participants’ schedules.
When participants arrived for their 12-week follow-up measurement session, they were asked to complete a process evaluation questionnaire (Appendices W and X), which will be discussed in more detail in section 5.7.9, below. Participants then had their height, weight, waist circumference, and blood pressure measured by the same trained research assistant who took all measurements across every time point. Each participant was also given an accelerometer to wear for 7 consecutive days, and was instructed to wear the accelerometer according to the protocol described above, in section 5.4.3.4. The primary researcher sent each participant an email either the day before, or on the day that the accelerometer stopped collecting data, to inform them that they were no longer required to wear it past that point. They were given a date and time for accelerometer collection and were asked to nominate a suitable time for the primary researcher to collect the device. All participants were also given the option to be able to leave the device for the primary researcher to collect from a colleague or administrative staff member.

The 24-week follow-up measurement sessions were organised using the same approach taken for the 12-week follow-up measurement sessions. When participants arrived for their final measurement session, they had their weight, waist circumference, and blood pressure measured by the same trained research assistant. Participants were asked to wear an ActiGraph accelerometer for one final 7-day period, which was collected by the primary researcher. Once the participant’s accelerometer was collected after the final 24-week data collection phase, they were given a personalised thank you letter (Appendices EE and FF) and a ManUp UWS Certificate of Achievement (Appendix GG) to show that they had successfully completed the program. Those in the comparison group were also given access to the
ManUp UWS website for a 6-week period, to thank them for their participation in the study.

5.7.9 Process evaluation questionnaire

At the beginning of the 12-week follow-up session (at the end of the formal intervention period), participants were asked to provide their subjective evaluation of the ManUp UWS intervention by completing a process evaluation questionnaire (Appendices W and X). A separate questionnaire was administered to participants in the intervention and comparison groups as some of the intervention elements were different for each group. Participants were asked to answer a series of questions related to specific elements of the intervention (e.g., the importance of the printed materials, the ability to set challenges, and the tool allowing them to track their progress), and perceived changes in physical activity and sedentary time, and were given the opportunity to provide further feedback or evaluation, especially in relation to areas for improvement. The process evaluation was administered at the 12-week follow-up session as this marked the end of the formal intervention period, when participants no longer received any email contact or printed materials. The next face-to-face follow-up was held a further 12 weeks after the end of the formal intervention (i.e., 24 weeks from baseline), and by this time, participants may not have been able to provide detailed, subjective feedback on their involvement in the formal intervention. Results of the process evaluation questionnaire will be presented later in this chapter.
5.7.10 Website usage

To examine the degree to which participants engaged with the ManUp UWS website, several website usage statistics were collected over the 12-week intervention period – the number of logins, number of challenges set, and total data entries were recorded. These results will be discussed later in this chapter.

5.8 Data analysis

All data were entered into a single dataset and were analysed using SPSS 21.0 statistical software (SPSS Inc. Chicago, IL, USA). To explore the demographic characteristics of the study sample, frequencies were calculated for baseline demographic and anthropometric data. Independent t tests were conducted to establish whether there were any significant differences in continuous variables between groups at baseline, and chi-square tests were conducted for categorical variables. A series of linear mixed models were conducted to examine the impact of group (internet-based intervention versus print-based comparison), time (baseline, 12 weeks and 24 weeks), and group by time interaction, adjusting for covariates (wear time, age, and participants’ role at UWS). Group, time, and group-by-time interaction were included in the models as fixed effects, and participant ID, wear time, and participants’ role at UWS were included as random effects. Linear mixed models were selected for analyses because they have been shown to provide better control of type I and type II errors, and are more robust to the biases of missing data in comparison to last-observation-carried-forward analysis of variance (Mallinckrodt, Watkin, Molenberghs, & Carroll, 2004). Assumptions of the linear mixed model, such as normality, linearity, and independent observations (Jaeger, Graff, Croft, & Pontillo, 2011) were met, and no influential outliers were present. Potential
clustering was not accounted for in the analysis. Results for the main analyses will be reported as difference of means and corresponding 95% confidence intervals. A significance level of alpha = 0.05 was used in all analyses. All randomised participants with baseline data were analysed for primary and secondary outcomes at 12 weeks and 24 weeks.

### 5.9 Ethics approval and trial registration

The University of Western Sydney Human Research Ethics Committee granted ethics approval for this study on 12 October 2011 (HREC H9339, see Appendix HH). This study has been registered as a clinical trial with the Australian New Zealand Clinical Trials Registry (ACTRN2612000450819, Appendix II).

### Results

#### 5.10 Participant flow

Figure 5.1 illustrates the flow of participants through the trial. A total of 79 participants registered their interest in ManUp UWS by emailing the primary researcher. Of these 79 potential participants, 64 males were eligible for inclusion, however, 8 were not randomised as they did not respond to follow-up emails (n = 4), were no longer interested in participating (n = 2), did not obtain medical clearance after failing to pass a preexercise screening assessment (n = 1), or for personal reasons (n = 1). A total of 56 males were randomised – 31 participants were randomly allocated to the internet-based intervention group, and 25 were randomly allocated to the printed resources comparison group.
A total of 47 participants (83.9%) attended 12-week follow-up and 44 participants (78.6%) attended 24-week follow-up; however, valid accelerometer data were not available for all participants retained at follow-up. A total of 21 participants (67.7%) in the intervention group, and 14 (56.0%) in the comparison group had valid accelerometer data at baseline. There were no significant differences in baseline characteristics (age, role at UWS, weight, BMI, waist circumference, SBP, or DBP) between participants lost to follow-up and those remaining in the study at the 24-week follow-up. There was also no difference between follow-up rates between the intervention and comparison group at 12-week follow-up ($\chi^2 = .56$, $df = 1$, $p = .46$), or at 24-week follow-up ($\chi^2 = .79$, $df = 1$, $p = .37$).
Figure 5.1 Flow of participants through the ManUp UWS Study (Study 3).

Assessed for eligibility (n = 79)
- Excluded (n = 15)
  - Too active (n = 9)
  - Wrong age (n = 2)
  - No response to email (n = 4)
- Eligible (n = 64)
- Excluded (n = 6)
  - No response to email (n = 4)
  - No longer interested (n = 2)
- Attended baseline (n = 58)
- Excluded (n = 2)
  - Did not obtain GP clearance (n = 1)
  - Personal reasons (n = 1)
- Randomised (n = 56)

Internet-based intervention group (n = 31)
- Lost to 12-week follow-up (n = 6)
  - 1 No longer working at UWS
  - 1 Workload
  - 1 No time to participate
  - 2 No response to follow-up emails
  - 1 No longer interested

Printed resources comparison group (n = 25)
- Lost to 12-week follow-up (n = 3)
  - 1 No longer interested
  - 2 No response to follow-up emails
- Lost to 24-week follow-up (n = 4)
  - 1 No longer interested
  - 2 No response to follow-up emails
  - 1 Medical condition limiting participation

Analysed for physical activity and sedentary time
(n = 21)
Analysed for other secondary outcomes
(n = 31)

Analysed for physical activity and sedentary time
(n = 14)
Analysed for other secondary outcomes
(n = 25)
5.11 Demographic characteristics

The demographic characteristics of the sample are presented in Table 5.3, for all participants, and for each group separately. The mean (± SD) age of participants in the sample was 48.2 years (± 7.1), and the mean BMI was 30.8 kg/m² (± 5.2). Participants’ mean weight was 97.3 kg (± 18.0) and waist circumference was 107.4 cm (± 13.9). A total of 66.1% of participants were Nonacademic (General or Professional) staff, 76.8% held a University degree or higher, and 37.5% reported a household income of ≥$140,000.
Table 5.3  Demographic characteristics of the sample for the ManUp UWS Study (Study 3).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Intervention group (n = 31)</th>
<th>Comparison group (n = 25)</th>
<th>Total sample (n = 56)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
</tr>
<tr>
<td>Age</td>
<td>47.8 ± 6.9</td>
<td>48.7 ± 7.4</td>
<td>48.2 ± 7.1</td>
</tr>
<tr>
<td>Weight</td>
<td>99.6 ± 17.5</td>
<td>94.5 ± 18.6</td>
<td>97.3 ± 18.0</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31.2 ± 4.9</td>
<td>30.3 ± 5.5</td>
<td>30.8 ± 5.2</td>
</tr>
<tr>
<td>BMI category, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy weight</td>
<td>3 (9.7)</td>
<td>6 (24.0)</td>
<td>9 (16.1)</td>
</tr>
<tr>
<td>Overweight</td>
<td>12 (38.7)</td>
<td>3 (12.0)</td>
<td>15 (26.8)</td>
</tr>
<tr>
<td>Obese</td>
<td>16 (51.6)</td>
<td>16 (64.0)</td>
<td>15 (26.8)</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>107.9 ± 13.8</td>
<td>106.7 ± 14.2</td>
<td>107.4 ± 13.9</td>
</tr>
<tr>
<td>SBP</td>
<td>139.1 ± 15.6</td>
<td>138.2 ± 18.8</td>
<td>138.7 ± 16.9</td>
</tr>
<tr>
<td>DBP</td>
<td>86.5 ± 11.6</td>
<td>84.7 ± 12.4</td>
<td>85.7 ± 11.9</td>
</tr>
<tr>
<td>Role at UWS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>10 (32.3)</td>
<td>9 (36.0)</td>
<td>19 (33.9)</td>
</tr>
<tr>
<td>Nonacademic</td>
<td>21 (67.7)</td>
<td>16 (64.0)</td>
<td>37 (66.1)</td>
</tr>
<tr>
<td>Highest educational qualification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School certificate</td>
<td>0 (0)</td>
<td>2 (8.0)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>Trade/Apprenticeship</td>
<td>0 (0)</td>
<td>1 (4.0)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Certificate/Diploma</td>
<td>6 (19.4)</td>
<td>4 (16.0)</td>
<td>10 (17.9)</td>
</tr>
<tr>
<td>University Degree or higher</td>
<td>25 (80.6)</td>
<td>18 (72.0)</td>
<td>43 (76.8)</td>
</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤$59,999</td>
<td>2 (3.6)</td>
<td>1 (4.0)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>$60,000 to $79,999</td>
<td>2 (3.6)</td>
<td>1 (4.0)</td>
<td>2 (3.6)</td>
</tr>
<tr>
<td>$80,000 to $99,999</td>
<td>14 (25.0)</td>
<td>9 (36.0)</td>
<td>14 (25.0)</td>
</tr>
<tr>
<td>$100,000 to $119,999</td>
<td>8 (14.3)</td>
<td>4 (16.0)</td>
<td>8 (14.3)</td>
</tr>
<tr>
<td>$120,000 to $139,999</td>
<td>5 (8.9)</td>
<td>4 (16.0)</td>
<td>5 (8.9)</td>
</tr>
<tr>
<td>≥$140,000</td>
<td>21 (37.5)</td>
<td>5 (20.0)</td>
<td>21 (37.5)</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>4 (7.1)</td>
<td>1 (4.0)</td>
<td>4 (7.1)</td>
</tr>
</tbody>
</table>
5.12 Results of linear mixed models

To account for differences in the amount of valid wear time between participants, the percentages of time spent in physical activity and sedentary time were used for analyses, and wear time, age, and participants’ role at UWS were included in the models as a covariates. Changes in outcome variables are presented in Table 5.4.
Table 5.4  Results of linear mixed models showing change in outcome variables for the ManUp UWS Study (Study 3).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Time point</th>
<th>Intervention (n = 31)</th>
<th>Comparison (n = 25)</th>
<th>Mean difference between groups (95% CI)</th>
<th>Group-by-time interaction (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% wear-time in LPA</td>
<td>12-week</td>
<td>-0.41 (-2.26 , 1.44)</td>
<td>-1.48 (-2.77 , -0.19)</td>
<td>-1.07 (-3.47 , 1.67)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>-0.74 (-1.65 , 0.18)</td>
<td>-0.72 (-2.58 , 1.13)</td>
<td>0.55 (-2.15 , 3.25)</td>
<td>0.89</td>
</tr>
<tr>
<td>% wear-time in MVPA</td>
<td>12-week</td>
<td>-0.24 (-1.20 , 0.72)</td>
<td>0.18 (-5.20 , 0.88)</td>
<td>0.42 (-0.83 , 1.33)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>0.21 (-1.11 , 1.53)</td>
<td>-0.35 (-1.26 , 0.57)</td>
<td>-0.56 (-2.03 , 0.92)</td>
<td>0.07</td>
</tr>
<tr>
<td>% wear-time in Sedentary time</td>
<td>12-week</td>
<td>0.65 (-1.70 , 3.01)</td>
<td>1.31 (-0.43 , 3.05)</td>
<td>0.66 (-2.43 , 3.74)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>0.53 (-1.14 , 2.20)</td>
<td>1.08 (-1.13 , 3.29)</td>
<td>0.01 (-2.07 , 2.09)</td>
<td>0.73</td>
</tr>
<tr>
<td>Step counts</td>
<td>12-week</td>
<td>-1154 (-8754 , 6447)</td>
<td>-429 (-5546 , 4688)</td>
<td>725 (-9076 , 10526)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>-384 (-7258 , 6491)</td>
<td>325 (-5734 , 6385)</td>
<td>709 (-7890 , 9308)</td>
<td>0.09</td>
</tr>
<tr>
<td>Weight</td>
<td>12-week</td>
<td>-0.25 (-1.47 , 0.97)</td>
<td>-0.52 (-1.60 , 0.55)</td>
<td>-0.27 (-1.87 , 1.33)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>-0.20 (-1.92 , 1.51)</td>
<td>-1.55 (-3.89 , 0.80)</td>
<td>-1.34 (-4.13 , 1.44)</td>
<td>0.27</td>
</tr>
<tr>
<td>BMI</td>
<td>12-week</td>
<td>-0.09 (-0.47 , 0.29)</td>
<td>-0.17 (-0.52 , 0.18)</td>
<td>-0.08 (-0.59 , 0.43)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>-0.08 (-0.62 , 0.46)</td>
<td>-0.52 (-1.29 , 0.24)</td>
<td>-0.45 (-1.34 , 0.45)</td>
<td>0.29</td>
</tr>
<tr>
<td>WC</td>
<td>12-week</td>
<td>-1.51 (-2.74 , -0.28)</td>
<td>-1.36 (-2.42 , -0.31)</td>
<td>0.14 (-1.45 , 1.74)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>-2.05 (-4.37 , 0.27)</td>
<td>-2.96 (-5.08 , -0.84)</td>
<td>-0.91 (-3.98 , 2.16)</td>
<td>0.09</td>
</tr>
<tr>
<td>SBP</td>
<td>12-week</td>
<td>-0.68 (-3.48 , 2.12)</td>
<td>2.32 (-3.55 , 8.19)</td>
<td>3.00 (-3.07 , 9.07)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>1.91 (-2.24 , 6.06)</td>
<td>-1.95 (-8.51 , 4.60)</td>
<td>-3.87 (-11.25 , 3.52)</td>
<td>0.13</td>
</tr>
<tr>
<td>DBP</td>
<td>12-week</td>
<td>-3.00 (-6.32 , 0.32)</td>
<td>1.27 (-1.76 , 4.30)</td>
<td>4.27 (-0.15 , 8.69)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24-week</td>
<td>-0.48 (-3.89 , 2.92)</td>
<td>-2.10 (-5.45 , 1.26)</td>
<td>-1.62 (-6.27 , 3.04)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Note: a = 95% Confidence interval. b = A negative value in the Mean change from baseline columns reflects a decrease in the value from baseline to 12 weeks, or baseline to 24 weeks. c = A negative value in the Mean difference between groups column reflects a reduction in the value for the intervention group, compared with the comparison group (reference category). d = p value of <0.05 indicates statistical significance.
5.12.1 Primary outcome - physical activity

5.12.1.1 Light-intensity physical activity

Using objectively measured accelerometer data, the mean percentage of valid wear time spent in LPA was 17.1% (95% CI 14.8 – 19.4) at baseline for participants allocated to the intervention group, and 16.6% (95% CI 14.7 – 18.5) for participants in the comparison group. At 12-week follow-up the mean percentage of LPA was 17.3% (95% CI 15.0 – 19.7) for the intervention group and 16.5% (95% CI 15.0 – 18.0) for the comparison group. At 24-week follow-up, the mean percentage of LPA was 16.8% (95% CI 14.1 – 19.4) in the intervention group and 15.9% (95% CI 14.5 – 17.3) in the comparison group. There were no significant group ($F = .13$, $df = 41.55$, $p = .72$), time ($F = 2.05$, $df = 51.87$, $p = .14$) or group-by-time ($F = .11$, $df = 51.16$, $p = .89$) effects for LPA.

5.12.1.2 MVPA

The percentage of valid wear time spent in MVPA was 5.0% (95% CI 4.2 – 5.8) at baseline for participants allocated to the intervention group, and 4.3% (95% CI 3.0 – 5.6) for participants in the comparison group. At 12-week follow-up, the percentage of MVPA was 4.8% (95% CI 3.9 – 5.8) in the intervention group and 5.3% (95% CI 4.1 – 6.6) in the comparison group. At 24-week follow-up, the mean percentage of time spent in MVPA was 4.9% (95% CI 3.4 – 6.4) in the intervention group, and 4.2% (95% CI 3.5 – 5.0) in the comparison group. No group ($F = .15$, $df = 40.64$, $p = .70$), time ($F = .58$, $df = 54.25$, $p = .56$) or group-by-time ($F = 2.75$, $df = 54.25$, $p = .07$) effects were observed for MVPA.
5.12.1.3 Step counts

At baseline, adjusted accelerometer-derived mean step counts were 46,586 (95% CI 40,383 – 52,789) in the intervention group and 44,030 (95% CI 35,133 – 52,926) in the comparison group, across the wear-time period (i.e., at least 3 days of valid wear time over the 7-day observation period). At the end of the 12-week intervention, mean step counts were 45,298 (95% CI 37,933 – 52,663) for intervention participants, and 51,111 (95% CI 43,638 – 58,585) for comparison participants. At the 24-week time point, participants in the intervention group had a mean step count of 43,887 (95% CI 32,908 – 54,867) and participants in the comparison group had a mean step count of 43,704 (95% CI 37,458 – 49,954). There were no significant group (F = .06, df = 40.05, p = .81), time (F = .74, df = 53.33, p = .48) or group-by-time (F = 2.48, df = 54.83, p = .09) effects for step counts.

5.12.2 Secondary outcomes

5.12.2.1 Sedentary time

The percentage of valid wear time spent sedentary was 77.9% (95% CI 75.2 – 80.6) in the intervention group and 79.1% (95% CI 77.1 – 81.1) in the comparison group. The mean percentage of sedentary time remained stable in both groups at 12-week follow-up, with a value of 77.8% (95% CI 75.0 – 80.6) in the intervention group, and 78.2 (95% CI 76.4 – 80.0) in the comparison group. At 24-week follow-up, the mean percentage of sedentary time was 78.3 (95% CI 75.2 – 81.5) in the intervention group, and 79.8% (95% CI 78.0 – 81.7) in the comparison group. No significant effects for group (F = .18, df = 40.79, p = .67), time (F = 1.54, df = 52.61, p = .23), or group-by-time (F = .31, df = 49.66, p = .73) were observed.
5.12.2.2 Weight

At baseline, the mean weight for participants in the intervention group was 99.6 kg (95% CI 93.16 – 106.0) and 94.5 kg (95% CI 86.9 – 102.2) in the comparison group. At 12-week follow-up, the intervention participants’ mean weight was 98.9 kg (95% CI 92.3 – 105.5) and weight change ranged from -5.6kg to +7.3kg. In the comparison group, the mean weight was 92.8 kg (95% CI 84.4 – 101.2) at 12-week follow-up, and participants’ weight change ranged from -9.1kg to +2.3kg. At 24-week follow-up, weight change for participants in the intervention group ranged from -9.4kg to +7.6kg from baseline, with a mean weight of 99.5 kg (95% CI 92.1 – 106.9). Weight change for participants in the comparison group ranged from -21.7kg to +2.7kg with a mean weight of 91.7 kg (95% CI 83.2 – 100.1). No significant group \((F = 4.23, df = 41.10, p = .05)\), or group-by-time \((F = 1.36, df = 47.99, p = .27)\) effects were observed for weight, however, a significant effect was observed for time \((F = 6.08, df = 47.00, p < .05)\).

5.12.2.3 BMI

Participants in the intervention group had a mean BMI of 31.2 kg/m\(^2\) (95% CI 29.4 – 33.0) and participants in the comparison group had a mean BMI of 30.3 kg/m\(^2\) (95% CI 28.0 – 32.6) at baseline. At 12-week follow-up, the mean BMI values were 30.6 kg/m\(^2\) (95% CI 28.7 – 32.4), and 29.7 kg/m\(^2\) (95% CI 27.2 – 32.1), for the intervention and comparison group, respectively. At the 24-week follow-up session, participants in the intervention group had a BMI of 30.6 kg/m\(^2\) (95% CI 28.5 – 32.7), and participants in the comparison group had a BMI of 29.3 kg/m\(^2\) (95% CI 26.9 – 31.7). No significant group \((F = 1.22, df = 41.13, p = .28)\), or group-by-time \((F = \)
1.27, \( df = 48.01, p = .29 \) effects were observed, although there was a significant time effect \( (F = 6.34, df = 47.01, p < .05) \).

### 5.12.2.4 Waist circumference

Waist circumference decreased linearly across all 3 time points for participants in both groups. At baseline, intervention participants’ mean (±SD) waist circumference was 107.9 cm (102.8 – 113.0) while comparison participants’ waist circumference was 106.7 cm (95% CI 100.9 – 112.6). At 12-week follow-up, waist circumference decreased to 105.6 cm (95% CI 100.4 – 110.9) and 104.3 cm (95% CI 98.2 – 110.4) for intervention, and comparison group participants, respectively. At 24 weeks, waist circumference was 105.3 cm (95% CI 99.3 – 111.2) in the intervention group, while in the comparison group, the mean waist circumference at the 24-week mark decreased to 102.6 cm (95% CI 96.5 – 108.7). Despite these decreases, there was no significant group \( (F = .98, df = 40.21, p = .33 \) or group-by-time effect for waist circumference \( (F = 2.49, df = 45.58, p = .09 \). There was, however, a significant effect for time \( (F = 15.45, df = 47.39, p < .001) \).

### 5.12.2.5 Blood pressure

At baseline, mean SBP was 139.1 mmHg (95% CI 133.3 – 144.8) for intervention participants and 138.2 mmHg (95% CI 130.4 – 145.9) for comparison participants. At 12 weeks, SBP in the intervention group decreased slightly to 136.6 mmHg (95% CI 131.1 – 142.1), and remained stable in the comparison group at 140.0 mmHg (95% CI 132.1 – 147.8) At 24 weeks, the slight reduction for SBP in the intervention group was no longer observed, and SBP was 139.9 mmHg (95% CI 132.1 – 147.6). SBP for participants in the comparison group, however, decreased at
24 weeks to 136.2 mmHg (95% CI 127.7 – 144.7). There were no significant group 
\((F = .004, df = 42.29, p = .95)\), time \((F = 2.34, df = 53.81, p = .11)\), or group-by-
time \((F = 2.09, df = 53.89, p = .13)\) effects observed for SBP.

DBP was 86.5 mmHg (95% CI 82.3 – 90.8) at baseline for the intervention 
group and 84.7 mmHg (95% CI 79.6 – 89.8) for the comparison group. At the 12-week time point, there was a slight decrease in DBP in the intervention group to 82.6 
mmHg (95% CI 78.4 – 86.8), and a slight increase in the comparison group to 86.0 
mmHg (95% CI 80.3 – 91.8). At 24 weeks, the mean DBP increased in the 
intervention group to 85.2 mmHg (95% CI 80.3 – 90.1), although this average was 
still slightly lower than the baseline average. DBP for participants in the comparison 
group decreased to 82.7 mmHg (95% CI 77.2 – 88.2). There were no significant 
effects observed for group \((F = .02, df = 42.28, p = .90)\), time \((F = 1.42, df = 52.31, 
p = .25)\), or group-by-time interaction \((F = 2.48, df = 52.39, p = .09)\).

### 5.13 Results of the ManUp UWS process evaluation

A total of 47 participants completed the process evaluation at the 12-week 
follow-up session, and a summary of these results is presented in Table 5.5. The 
main reasons participants had for joining the study were:

- To increase physical activity (80.9%)
- To motivate themselves to change their lifestyle (57.4%)
- To lose weight (51.1%)

When asked how much of the printed material they read, 25.5% of participants 
reported that they read all the material, and 4.3% reported reading no material. Most
participants that reported reading at least some of the printed material said they learnt either “a little” (45.5%) or “a moderate amount” (47.7%) from reading the material, and almost half of the participants that reported reading the material indicated that the material only motivated them “a little” (47.7%) to become more physically active, while 31.8% reported that they experienced “a moderate amount” of motivation from reading the printed materials.

When rating the importance of each topic from the printed resources in relation to their participation in the study, 62.8% of participants rated the information on physical activity as being “important”, and 20.9% rated it as being “moderately important” to their participation in the ManUp UWS Study. In relation to the information on sedentary time, 34.9% rated the information as being “important”, and 44.2% of participants rated it as being “moderately important” to their participation in the Study. The material on overcoming barriers related to physical activity and sedentary time was considered to be “important” by 46.5% of participants, while information on boosting motivation for participation in physical activity was considered to be “important” to their participation in the ManUp UWS Study by 44.2% of participants. Interestingly, 41.9% of participants considered the physical activity logs to be “of little importance” in relation to their participation in the study.

When asked whether their physical activity had changed since beginning the ManUp UWS challenge, 68.0% of participants in the intervention group and 77.3% of participants in the comparison group reported that their physical activity had “increased” while only 16.0% of intervention participants and 22.7% of comparison participants reported that their physical activity levels had “remained unchanged”
since beginning the ManUp UWS challenge. In relation to sedentary time, 48.0% or participants in the intervention group reported that their sedentary time had “decreased” and 36.0% reported that their sedentary time had “remained unchanged.” A total of 40.9% of participants in the comparison group reported that their sedentary time had “decreased” and 40.9% reported that their sedentary time had “remained unchanged” since beginning the ManUp UWS challenge.
Table 5.5 Results of the ManUp UWS process evaluation delivered at the end of the formal intervention period for Study 3.

<table>
<thead>
<tr>
<th>Process Evaluation Question</th>
<th>Intervention (n = 25)</th>
<th>Comparison (n = 22)</th>
<th>Total (n = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Why did you join the ManUp UWS program?</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>To increase physical activity</td>
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<td>88.0</td>
<td>16</td>
</tr>
<tr>
<td>To lose weight</td>
<td>14</td>
<td>56.0</td>
<td>10</td>
</tr>
<tr>
<td>For health reasons</td>
<td>13</td>
<td>52.0</td>
<td>8</td>
</tr>
<tr>
<td>To reduce sedentary time</td>
<td>7</td>
<td>28.0</td>
<td>5</td>
</tr>
<tr>
<td>To get motivated to improve lifestyle</td>
<td>15</td>
<td>60.0</td>
<td>12</td>
</tr>
<tr>
<td>How much of the printed material did you read?</td>
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</tr>
<tr>
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<tr>
<td>Less than half</td>
<td>7</td>
<td>28.0</td>
<td>2</td>
</tr>
<tr>
<td>About half</td>
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<td>All material</td>
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<td>7</td>
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<tr>
<td>A moderate amount</td>
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<tr>
<td>A lot</td>
<td>1</td>
<td>4.2</td>
<td>1</td>
</tr>
<tr>
<td>How much did the information provided in the printed materials encourage or motivate you to become more physically active?</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>12.5</td>
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<tr>
<td>A little</td>
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<td>A moderate amount</td>
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<tr>
<td>A lot</td>
<td>2</td>
<td>8.3</td>
<td>2</td>
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</tbody>
</table>

The printed materials covered a range of topics related to physical activity and health. Please rate the importance/relevance of each of the following topics in relation to your participation in the ManUp program.

**Physical activity**

- Of little importance | 2 | 8.7 | 2 | 10.0 | 4 | 9.3 |
- Moderately important | 4 | 17.4 | 5 | 25.0 | 9 | 20.9 |
- Important           | 14 | 60.9 | 13 | 65.0 | 27 | 62.8 |
- Very important      | 3 | 13.0 | 0 | 0.0 | 3 | 7.0 |

**Sedentary time**

- Unimportant | 0 | 0.0 | 1 | 5.0 | 1 | 2.3 |
- Of little importance | 1 | 4.3 | 2 | 10.0 | 3 | 7.0 |
- Moderately important | 12 | 52.2 | 7 | 35.0 | 19 | 44.2 |
- Important | 7 | 30.4 | 8 | 40.0 | 15 | 34.9 |
- Very important      | 3 | 13.0 | 2 | 10.0 | 5 | 11.6 |

Table 5.5 continued next page.
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<th>Being active on and around your campus</th>
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<th></th>
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<th></th>
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<td>Since beginning the ManUp UWS challenge, would you say your physical activity levels have</td>
<td></td>
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<tr>
<td>Increased</td>
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<td>68.0</td>
<td>17</td>
<td>77.3</td>
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<td>0</td>
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<td>3</td>
</tr>
<tr>
<td>Since beginning the ManUp UWS challenge, would you say the amount of time you spend sitting or being sedentary has</td>
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<tr>
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<td>0.0</td>
<td>1</td>
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<tr>
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<tr>
<td>Greatly increased</td>
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<td>How often did you set physical activity challenges during the 12-week challenge period?</td>
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<td>9.1</td>
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<td>6</td>
<td>27.3</td>
<td>10</td>
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<td>At least fortnightly</td>
<td>5</td>
<td>20.8</td>
<td>6</td>
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</table>

*Table 5.5 continued next page.*
### Table 5.5 continued.

**To what degree did setting physical activity challenges motivate or encourage you to become and remain physically active?**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>4</td>
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</tr>
<tr>
<td>A little</td>
<td>7</td>
<td>29.2</td>
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<tr>
<td>A moderate amount</td>
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<td>25.0</td>
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<tr>
<td>A lot</td>
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<td>20.8</td>
</tr>
<tr>
<td>A great deal</td>
<td>2</td>
<td>8.3</td>
</tr>
</tbody>
</table>

**How often did you track your physical activity progress during the 12-week challenge period?**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least daily</td>
<td>3</td>
<td>12.5</td>
</tr>
<tr>
<td>At least weekly</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>At least fortnightly</td>
<td>5</td>
<td>20.8</td>
</tr>
<tr>
<td>At least monthly</td>
<td>6</td>
<td>25.0</td>
</tr>
<tr>
<td>Never</td>
<td>6</td>
<td>25.0</td>
</tr>
</tbody>
</table>

**To what degree did the physical activity tool motivate or encourage you to become and remain physically active?**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>9</td>
<td>36.0</td>
</tr>
<tr>
<td>A little</td>
<td>7</td>
<td>28.0</td>
</tr>
<tr>
<td>A moderate amount</td>
<td>4</td>
<td>16.0</td>
</tr>
<tr>
<td>A lot</td>
<td>3</td>
<td>12.0</td>
</tr>
<tr>
<td>A great deal</td>
<td>2</td>
<td>8.0</td>
</tr>
</tbody>
</table>

**How often did you use the body weight/BMI tracker during the 12-week challenge period?**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least daily</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>At least weekly</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>At least fortnightly</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>At least monthly</td>
<td>3</td>
<td>12.0</td>
</tr>
<tr>
<td>Never</td>
<td>21</td>
<td>84.0</td>
</tr>
</tbody>
</table>

**To what extent did the BMI tracking tool motivate you to keep track of your weight?**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>20</td>
<td>80.0</td>
</tr>
<tr>
<td>A little</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>A moderate amount</td>
<td>3</td>
<td>12.0</td>
</tr>
<tr>
<td>A lot</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>A great deal</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**How often do you use social networking sites (e.g. Facebook, Twitter)?**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least daily</td>
<td>9</td>
<td>36.0</td>
</tr>
<tr>
<td>At least weekly</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>At least fortnightly</td>
<td>2</td>
<td>8.0</td>
</tr>
<tr>
<td>At least monthly</td>
<td>2</td>
<td>8.0</td>
</tr>
<tr>
<td>Never</td>
<td>11</td>
<td>44.0</td>
</tr>
</tbody>
</table>

**Which physical activities in the list of ManUp UWS physical activity challenges were most relevant to you?**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>4</td>
<td>16.0</td>
</tr>
<tr>
<td>Walking</td>
<td>20</td>
<td>80.0</td>
</tr>
<tr>
<td>Swimming</td>
<td>7</td>
<td>28.0</td>
</tr>
<tr>
<td>Cycling</td>
<td>8</td>
<td>32.0</td>
</tr>
<tr>
<td>Strengthening</td>
<td>9</td>
<td>36.0</td>
</tr>
<tr>
<td>Sport and Recreation</td>
<td>9</td>
<td>36.0</td>
</tr>
</tbody>
</table>
5.13.1 Elements of ManUp UWS that participants enjoyed most

Participants were asked to indicate the aspects of the study that they enjoyed most, allowing them to respond in a free text box. Several participants reported that participating in the study simply gave them the motivation to become more active.

“I always fool myself that I can get in the shape I want with a couple of months of good health behaviours, but never do so. This was a chance to see if I could actually be motivated to put in that effort. Thanks.” (Nonacademic Staff, 41 years)

“Just receiving the material itself was a motivator. I liked the feeling that ‘somebody’ was taking an interest in my health and wellbeing and motivating me to be active.” (Academic Staff, 45 years)

“It made me think more about increasing my walking around campus and at home.” (Academic Staff, 60 years)

“The before and after comparison is useful. It helped motivate me when I might not have done some exercise at times.” (Nonacademic Staff, 50 years)

“Helped keep front of mind the need for physical activity. For example, initial monitoring, the email reminders.” (Nonacademic Staff, 60 years)

“Committing to the program is the first step in improving my health and wellbeing.” (Nonacademic Staff, 51 years)
Participants also reported that they enjoyed the simplicity and ease of the intervention and the information provided. For example,

“[The study] presented me with various options...support was there if I needed it. It gave me some realistic ideas to incorporate exercise.”  
(Nonacademic Staff, 48 years)

“It provided simple solutions to issues we all face about exercise. It was quick and easy to understand and provided some options to follow.”  
(Nonacademic Staff, 46 years)

“The program itself is quite simple and easy to follow.”  
(Nonacademic Staff, 51 years)

“The information provided was interesting and sometimes thought-provoking.”  
(Nonacademic Staff, 51 years)

“I enjoyed pushing myself to meet the targets I had made for myself.”  
(Nonacademic Staff, 42 years)

Several participants reported that they most enjoyed being able to discuss the study with other members of staff,

“Hearing others talk about their experience and having a constant reminder to actively engage in activities.”  
(Nonacademic Staff, 46 years)

“Encouraging other members of my department to participate and discussing it with them.”  
(Nonacademic Staff, 50 years)
Other participants reported that they enjoyed being involved in something that was relevant and important for the health of people in their age group.

“Any assistance is good as I rate male health of people my age critical, given work and pressure, family needs and lifestyle hopes and expectations.” (Nonacademic Staff, 48 years)

“Belonging to a study group/like-minded people and knowing this program will be beneficial to this age group” (Nonacademic Staff, 50 years)

Attending individual measurement sessions was also noted as an enjoyable aspect of the study. One participant in particular noted that:

“The most beneficial part of the program for me was that it highlighted a medical condition (high BP) that I was not aware of. This led to a check up with my GP which also revealed type 2 diabetes mellitus.” (Nonacademic Staff, 44 years)

Although not a key message of ManUp UWS, several participants also reported that they had become motivated to change other lifestyle behaviours, such as their dietary habits. For example, participants reported

“Getting motivated to go out there and move about. Getting motivated to cut down on crappy foods.” (Nonacademic Staff, 57 years)

“Having motivation to keep going – it was in the back of my mind. Also was more aware of what I was eating. For example, no sugar in coffee/tea now.” (Nonacademic Staff, 58 years)
“I didn't go through the material but saw the program as a ‘kick in the arse’ and started eating better and getting back into walking. I went back to drinking water only and dropping snacks and sweets, and walking regularly.” (Nonacademic Staff, 37 years)

“Just getting out and being more active. I struggled initially to find an activity that I enjoyed and could sustain. I really enjoyed the 35min/4km daily walk I was doing. It was a great way to get moving and also unwind after work.” (Nonacademic Staff, 41 years)

5.13.2 Elements of ManUp UWS that participants liked least

Participants were also asked to give details of the aspects of the study they liked least. Reflecting on the notion that there is no “one-size-fits-all” approach to promoting physical activity, the responses elicited were varied. While some participants reported that they would have liked more face-to-face contact, others reported that they would have preferred less face-to-face meetings. Several participants assigned to the printed resources comparison group reported that they would have preferred more options for contact with other participants.

“Perhaps linking and networking with other staff outside my unit - didn’t know who they were.” (Nonacademic Staff, 48 years)

While another participant in the internet-based group reported that he preferred individualised goals:

“I was less interested in partnerships/social aspects – I prefer to manage health alone.” (Academic Staff, 42 years)
Some participants who were allocated to the printed resources comparison group reported that they would have preferred having access to the website, while some participants that were assigned to the internet-based intervention group reported that they would have preferred being assigned to the printed resources group. For example,

“*I was assigned to the ‘web’ group. Whilst I use computers all the time for my work, I didn't see the web interface as a motivating factor in itself. I feel that progress could have been tracked just as easily on paper.*” (Academic Staff, 44 years)

While most participants approved of the overall concept of the study, one participant noted:

“*It felt a bit contradictory to be logging on to a website for a program that was trying to decrease sitting/sedentary time.*” (Academic Staff, 47 years)

For many participants, the printed material became “just another thing to read” and they reported that they did not have the time to read all of it.

“*Timing is a challenge but that reflects the situation I always face.*”

(Nonacademic Staff, 48 years)

Suggestions for improvements to the study included gaining support from the University gym and offering a discounted pass for participants, establishing the study as an ongoing program for staff rather than just “ad hoc research”, using podcasts rather than printed resources, and having more frequent face-to-face measurement
sessions. It was also suggested by one participant that the program was not implemented at an ideal time, because it coincided with the holiday break and many people often break their usual routines over this period. Although no measurement sessions were held across this period, some participants mentioned in their follow-up sessions that they felt they had lost momentum in terms of being physically active.

5.14 Website Usage

Of the 31 participants randomly allocated to the internet-based intervention group, 20 (64.5%) created a profile on the ManUp UWS website. The mean (±SD) number of logins was 11.67 (±29.60), with the highest number of website logins being 156. The mean (±SD) number of challenges set was 1.47 (±2.48), and 56.7% of participants did not set any physical activity challenges. The mean (±SD) number of data entries (tracking progress toward physical activity goals, tracking weight, etc.) was 12.50 (±30.76).

Discussion

This study compared two approaches to increasing physical activity and reducing sedentary time in middle-aged male university employees. Both the intervention and comparison group received printed resources on physical activity, sedentary time, and health, with the internet-based intervention group also receiving access to the ManUp UWS website. The website and associated intervention materials were designed to appeal specifically to male participants, and were informed by a robust review of the literature (Chapter 2, George et al., 2012), the earlier substantive ManUp Study (Duncan Vandelanotte, Rosenkranz, Caperchione, Ding et al., 2012), and formative focus group research (Chapter 4, George, Kolt et
al., 2013) with males representative of the target population. Despite employing a large number of robust strategies to recruit participants, including sending a direct email to 845 potentially eligible staff members, advertising the study on the University webpage, speaking at staff events, and featuring the study in the University newsletter, less than 10% of these potentially eligible participants (n = 79) contacted the primary researcher to express their interest in the study, and from this, only 56 participants were enrolled into the study. Attempts to recruit participants were exhaustive, although male employees were still reluctant to participate. The difficulty in recruiting middle-aged males for this study lends support to the notion that this is a hard-to-reach population group (Department of Health and Ageing, 2010b; Morgan, Warren, et al., 2011).

Valid data on weight, BMI, waist circumference, and blood pressure were available, and included in analyses for all 56 participants that were recruited at baseline, although only 35 participants had valid data available for the percentage of LPA, MVPA, step counts and sedentary time due to the poor compliance with wearing the accelerometers. Linear mixed models produced no significant group-by-time effects for any of the primary or secondary outcomes, although significant time effects were observed for weight ($p < .05$), BMI ($p < .05$), and waist circumference ($p < .001$). At baseline, 26.8% of participants were classified as overweight, and 57.1% of participants were classified as obese and 51.1% or participants reported that they joined the study to lose weight. Although not all participants experienced positive changes in their weight, BMI, or waist circumference, some experienced quite substantial improvements, with one participant in particular losing 21.7 kg of body weight and 18.0 cm from their waist circumference in the 24-week period. The
significant effects observed for these measurements across time suggest that, although not a primary outcome for this study, both approaches were somewhat successful in terms of improving weight and weight-related outcomes. Based on qualitative feedback obtained through the process evaluation questionnaires, it appears that participants became more cognisant of their lifestyle behaviours (including eating habits), and self-monitoring was an *a priori* component of the intervention design, so this may have accounted for some of the improvements seen for these outcomes.

These results should, however, be interpreted with caution due to the smaller-than-targeted sample size. The randomised controlled trial design, while a strength of the study, did not account for potential contamination or clustering effects. A number of specific work units with high proportions of male employees (e.g., IT services, capital works, and campus safety and security) were targeted for recruitment, so in some cases, there was more than one staff member from a particular work unit enrolled in the study. Participants were randomly allocated to either the internet-based intervention group or the printed resources comparison group using the method described in section 5.7.6. Although each intervention participant was given a unique code to access the ManUp UWS website, it is possible that participants in the internet-based intervention group may have discussed elements of the intervention arm with participants who were allocated to the printed-resources comparison group. Although unlikely, based on the website usage statistics and website engagement, it is possible that this may have had an impact on the between-group results of the study.
The inclusion of a “comparison” group rather than a true control group may partially explain why no significant group-by-time interactions were observed. Participants in both groups received the same printed resources on physical activity, sedentary time, and health, and although only 25.5% of participants reported reading all of the material that was sent to them, the internet-based approach was no more successful than the printed resources approach to increasing physical activity and reducing sedentary time. Furthermore, as so few participants engaged with the website component of the internet-based intervention, it is not surprising that there were no significant differences between groups. The selection of a printed resources comparison group, rather than a no-treatment or wait-list control group reflects a recent shift in physical activity behaviour change research, calling for researchers to compare interventions to positive intervention controls, with established efficacy (Courneya, 2010). As discussed in Chapter 2, utilising printed resources can be efficacious as they are cost-effective to distribute, and have the potential to reach large numbers of participants, hence their wide-scale usage in health promotion initiatives, and several print-based studies have shown positive results (Bolognesi et al., 2006; Swinburn et al., 1998). Additionally, recruiting participants for this study was extremely difficult, and if the intervention was tested against a true control group that received no treatment, recruitment may have been limited further, and attrition rates in the control group may have been higher.

The internet-based SHED-IT trial conducted by Morgan et al. (2009) demonstrated that a male-specific intervention targeting weight loss in overweight males can significantly improve weight. In that study, intervention materials were designed specifically for males, and masculinity was emphasised throughout the
program. The ManUp UWS intervention materials were designed to appeal to males, although the intervention was slightly less intensive compared with that provided by Morgan et al. (2009), where participants attended a face-to-face information session and received individualised feedback. As highlighted in the process evaluation findings from the ManUp UWS Study, some participants reported that they would have liked more face-to-face contact, and the opportunity to meet other participants within the study. Including some of the more innovative, interactive elements of the SHED-IT trial, although slightly beyond the scope of this PhD research, may have increased social interaction and subsequently resulted in improved health outcomes.

Another internet-based study that was successful was the study by Leahey et al. (2010). As with ManUp UWS, participants in that study were able to set physical activity challenges to complete on their own, or in a group or team. This study did not target male participants specifically, and only 16% of participants were male, however, male participants significantly increased their step counts, suggesting that a pedometer-based intervention can be appealing to male participants.

Two intervention studies that targeted physical activity and nutritional behaviours also incorporated a degree of social support, particularly through the involvement of participants’ families. The HDHK study (Morgan et al., 2010) involved fathers and their school-aged children. Throughout this study, messages on physical activity, eating habits, being a role model, and leading a healthy lifestyle were delivered in interactive, male-oriented group-based sessions. At 6-month follow-up, significant between-group differences were observed for weight, and treatment effects were seen for other outcome variables including BMI and waist circumference. Fathers in the intervention group who attended the group-based
educational program meetings lost more weight than fathers in the control group, suggesting that incorporating social support and involvement of family members is an innovative and efficacious approach to improving health and reducing body weight (Morgan et al., 2010). Social interaction on the ManUp UWS Study website was extremely low, and although several participants reported that they enjoyed discussing the study with their colleagues, there were no specific activities or meetings arranged for participants to meet one another and tap into the element of social support between participants. Arao et al. (2007) also incorporated social support, not only from participants’ families, but also from the participants’ workplaces. Results from this study showed that the intervention group significantly increased their leisure-time exercise, energy expenditure and reduced their BMI.

Although UWS endorsed the ManUp UWS Study, and this probably increased the number of participants recruited, several participants reported through the process evaluation questionnaire, that they would like to see more support for staff in terms of social interaction, and providing opportunities to increase physical activity and improve health. Perhaps implementing changes within the work environment (e.g., building more accessible facilities for physical activity, arranging more staff social events), similar to those implemented by Arao et al. (2007), greater increases in health-related outcomes may have been observed. The initial recruitment email was sent to potential participants from the Vice-Chancellor, and the heads of departments including Capital Works and Facilities, IT services, and Campus Safety and Security were approached to endorse the Study and encourage participation from the male staff within their work unit. The level of involvement from the University level after this initial recruitment period was, however, very low. By using a top-down approach and gaining further support from the University, participants in the ManUp UWS
Study may have felt more supported to participate in physical activity both during and outside of working hours.

Reducing sedentary time was a secondary outcome in the ManUp UWS Study, with some of the intervention materials designed to deliver messages related to reducing sedentary time. There were, however, no significant changes observed for objectively measured sedentary time. Healy et al. (2013) found that a short-term, multicomponent workplace intervention has the potential to reduce sedentary time in sedentary office workers. Support for that study, like the study by Arao et al. (2007) was gained from the organisation, to aid with participation and adherence, and although the sample size for that study was only small, the study produced promising results.

Although several participants reported (through the process evaluation questionnaire) that they would have enjoyed more face-to-face and social interaction with other participants and researchers, others reported that they would have preferred less face-to-face interaction. This intervention was designed to involve very little researcher interaction to determine whether a simple website with little maintenance could increase physical activity and reduce sedentary time in male university employees. Perhaps giving participants the option to receive more frequent, individualised feedback, and attend face-to-face meetings would have been efficacious.

One of the strengths of this study was that it was designed to specifically target middle-aged males – a population group that is typically underrepresented in health promotion initiatives. The substantive ManUp Study (Duncan et al., 2012)
was designed to target physical activity and nutrition behaviours in middle-aged males living in rural Queensland, Australia. This population group was identified as being hard-to-reach, and at-risk of a range of chronic diseases related to lifestyle factors such as physical inactivity and poor nutrition (Australian Bureau of Statistics, 2010; Department of Health and Ageing, 2010b). To appeal to male participants in the substantive ManUp Study, intervention materials emphasised masculinity and simplicity. For example, the physical activity and healthy eating challenges progressed in “strength”, from light to full strength, and a range of different activity options were included as they were identified as having more appeal to males (Duncan, Vandelanotte, Rosenkranz, Caperchione, Connely, et al., 2012). In addition, this study utilised elements of a previously tested intervention (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012) and adapted them to appeal to male employees in a university setting, as the university work environment has been identified as an area requiring further research (Prosser et al., 2007). The randomised design and the inclusion of two follow-up measurements, one at the end of the formal intervention, and one a further 12 weeks later, were also strengths of this study.

Compliance with wearing the accelerometers for the requested period of seven days was low, and as such, substantial proportions of accelerometer data were not valid and could not be included in analyses. This is likely to have impacted upon the results. Although many studies have used as little as one valid day worth of accelerometer data in analyses (Masse et al., 2005), and including all participants with at least one valid day of data would have increased the sample size used for the physical activity analyses, we did not feel that this would have been an accurate
representation of a 7-day period. When asked about their experience wearing the accelerometer after each measurement session, several participants complained that it was uncomfortable and that they did not like wearing it. Some claimed that the device would dig into their hip, while others stated that the device would move due to the belt on their trousers and caused irritation. Although some participants complained about having to wear the device, when asked whether they had worn it for the full week, most would respond by saying that they had only missed wearing it on one day, or on one particular morning. When the accelerometer data were downloaded, however, the number of days with a valid amount of wear-time was substantially lower compared to participant reports. The discrepancies observed between participants’ perceived wear-time and the actual accelerometer-recorded wear-time is of interest, however, the reason behind the largely unknown.

Perhaps asking participants to keep a log of their accelerometer wear time may have helped with data processing and may have increased compliance rates. Participants were asked to remove the accelerometer when they slept, bathed, or participated in any water-based activities. The fact that the accelerometer was not waterproof meant that time spent in water-based physical activities such as swimming, surfing, and kayaking was not captured. Alternatively, utilising another device that participants can wear on the wrist or ankle, that is waterproof and that does not have to be removed, may have resulted in increased compliance and overall wear time (Vanhelst et al., 2012). Although accelerometer wear time compliance was less than ideal, the use of an objective measurement of physical activity (and sedentary time) was a particular strength of this study, and the subjective measure of
whether participants had changed their physical activity and sedentary time across the 12-week intervention period provided an interesting comparison.

The intervention website was designed to appeal to male participants, and findings from formative focus group research were used to inform the final design of the website (George et al., 2012; George, Kolt et al., 2013; Vandelanotte et al., 2013). Participants, however, did not engage with the social support aspects of the ManUp UWS website. The ManUp UWS website was designed to be user-friendly and simple to navigate, however, the social networking element of the website may not have been interactive or intuitive enough to elicit participation from research participants. Several participants posted messages on their profile stream (on their individual profile page), although only one participant added a “mate” and posted a comment on the ManUp UWS Forum. Although there was an option for other participants to comment on these profile stream posts, this did not occur. Apart from posting a few introductory messages on the forum and the example ManUp UWS profile, the researchers did not get involved in commenting on participants’ profile posts so as not to influence participant involvement and interaction with the website. It may have been efficacious for one member of the research team to monitor the website and provide encouraging messages of support, or responses to profile posts to ensure that those participants who were interacting with the site continued to do so. Future studies should consider ways to increase online social support as a means of increasing the effectiveness of internet-based interventions. Had the sample size been larger, the social interaction between participants may have been greater. In order to develop a strong social support element through the online forum, a larger online “community” where participants interact with one another, was likely
required. This being said, even with 317 participants, a similar result was observed in the earlier substantive ManUp Study, with few participants engaging with the online social support elements (Duncan, vandelanotte, Rosenkranz, Caperchione, Connely, et al., 2012).

No spike tolerance (i.e., not allowing for any accelerometer counts during the non-wear time classification period of 60 minutes of consecutive zeros) was used when validating the accelerometer wear time, as it is possible that many of these participants could be spending more than 60 consecutive minutes being sedentary, with very little movement. Even without allowing for any spike tolerance, however, the total amount of sedentary time in this sample may still have been underestimated due to the non-wear time classification used. The proportion of time spent sedentary is, however, quite high in comparison to other studies. Most participants were employed in positions that were primarily desk-based (e.g., academic/faculty staff, IT services staff), so it is possible that these participants spent the majority of their day seated at their desk, in meetings, or while travelling (to and from work, or between campuses). As previously mentioned, it may have been advantageous to ask participants to complete a log to record their physical activity and sedentary time over the 7-day period while wearing their accelerometers. While not wanting to unnecessarily increase the level of participant burden, this may provide more of an insight into the specific activities in which participants are engaging during their waking hours, and may help explain differences in the proportion of wear-time in sedentary time and physical activity intensities across similar studies.

Of particular interest, was that 72.3% of all participants reported (in the process evaluation questionnaire) that their physical activity levels had increased
over the 12-week intervention period, and 44.7% reported that their sedentary/sitting time had decreased over the 12-week intervention period. The objectively measured accelerometer data, however, did not reflect these perceptions, with only 28.6% of participants showing any increase in physical activity and only 14.3% of participants showing any reduction in sedentary time. Self-reported data may be affected by social desirability bias (Adams et al., 2005) and this may partially explain why participants perceived changes in physical activity and sedentary time were not reflected in the objectively measured accelerometer data. Many participants reported feeling “healthier” and “fitter” when they attended follow-up measurement sessions, with some of them having lost weight. Findings from the process evaluation questionnaire delivered at the end of the 12-week formal intervention revealed that some participants had become more aware of their poor dietary behaviours and had changed their diet as a result of their involvement in the study. It is possible that some of this weight loss and subsequent improvements in health were a result of dietary changes, more so than changes in physical activity levels. Conversely, due to the poor compliance with wearing the accelerometers, and high proportions of missing accelerometer-derived data, it is possible that the 7-day wear-time period did not adequately capture periods during the intervention period when participants were most active, and therefore may have produced invalid estimates of physical activity.

A vast range of strategies were implemented in an attempt to recruit male university staff to participate in ManUp UWS, however, the small sample size achieved in this study highlights the fact that middle-aged males are a hard-to-reach population group (Department of Health and Ageing, 2010b). Although a range of recruitment strategies were implemented, less than half of the required sample was
recruited. This being said, however, these findings contribute to a much-needed body of research on male health in Australia. Researchers designing interventions for males should consider implementing more innovative and robust approaches (e.g., offering incentives for participation) to bolster the number of participants recruited.

Most participants reported several positive aspects associated with their involvement in the Study, and many reported (in the process evaluation) that they felt they had increased their physical activity and reduced their sedentary time over the 12-week intervention period. The fact that this was not reflected in the results of the linear mixed models using objective accelerometer data is interesting, and may warrant further research in future studies. There appears to be somewhat of a contradiction between the perceptions of behaviour change and the objectively measured changes of these behaviours. While other internet-based intervention studies have demonstrated positive results (Leahey et al., 2010; Morgan et al., 2009), the results of this study showed that the internet-based intervention was no more successful than the printed resources approach. The lack of engagement with the website, however, may partially explain why there were no discernible differences between the two groups. Despite the fact that all participants worked at the same university (albeit, across five campuses), there was very little social interaction on the website. In the process evaluation, several participants reported that they enjoyed discussing the study with their colleagues, and it may have been that participants in the same unit or school may have interacted outside of the website instead.
Researchers utilising internet-based approaches in male populations may wish to consider introducing more social aspects early on in their intervention to potentially increase social interaction.
Conclusion

Although no significant group-by-time effects were observed for any of the outcomes of interest, qualitative feedback obtained through the process evaluation questionnaires suggest that participants enjoyed being involved in the study, and most of them had a positive experience within the study. Modest changes in weight, BMI, and waist circumference were observed, which is beneficial for health, particularly as over half of participants were classified as being obese. The findings of this study highlight the need for intervention studies to be designed in ways that appeal to male participants, in efforts to bolster the number of males participating in health promotion interventions.

5.15 Synopsis

This Chapter has presented the findings of the ManUp UWS Study – a 12-week intervention designed to increase physical activity and reduce sedentary time in middle-aged male university employees, as well as the results of a process evaluation, undertaken to explore perceptions of the ManUp UWS intervention. The sixth, and final Chapter synthesises the information presented in this PhD thesis in its entirety (i.e., all studies), and will discuss considerations and implications for future research, and the development of health promotion initiatives and policy.
Chapter 6

Discussion and conclusions

Introduction

This final chapter presents an overview of the thesis in its entirety, drawing conclusions from each individual study (Chapters 3 to 5), discussing the strengths and limitations of each study, and considering implications for future research.

6.1 Thesis overview

The primary aim of the body of research presented in this PhD thesis was to improve male health through developing and rigorously testing an intervention to increase levels of physical activity and reduce sedentary time, and by encouraging healthy behaviour change in middle-aged (35-64 years) males employed in a university setting (UWS). The secondary aims for this PhD research were to determine whether physical activity and sitting time are associated with chronic disease, and to understand male perceptions of physical activity and sedentary time in a university-based setting. To achieve these aims, a series of three distinct, yet associated, studies were conducted.

The first study, which was presented in Chapter 3 (George, Rosenkranz et al., 2013), utilised baseline data drawn from The 45 and Up Study to examine the independent association between chronic disease and two distinct and modifiable lifestyle behaviours – physical activity and sitting time – in a large sample of 63,048 Australian males aged between 45 and 64 years. As literature pertaining to this particular population group is limited, especially in an Australian context, this study
was conducted to provide specific background information to inform the rationale for this body of intervention research.

Building upon this initial research, the second study was presented in Chapter 4 (George, Kolt et al., 2013). This qualitative study was conducted to gain more in-depth insights into middle-aged men’s perceptions on a range of issues including the perceived benefits of leading a physically active lifestyle, motivators for physical activity, barriers related to participation in regular physical activity, issues related to sedentary time, and strategies to increase physical activity and reduce sedentary time. A total of 15 male employees from UWS participated in five semistructured focus group sessions to understand these important issues.

The third major study conducted as part of this PhD was based on the substantive ManUp Study in Gladstone, Queensland (Duncan, Vandelanotte, Rosenkranz, Caperchione, Ding, et al., 2012), and informed by findings from Study 1 (Chapter 3, George, Rosenkranz et al., 2013) and Study 2 (Chapter 4, George, Kolt et al., 2013), and the extensive literature review presented in Chapter 2 (George et al., 2012). This two-arm randomised controlled trial, presented in Chapter 5, tested the effectiveness of two approaches (an internet-based intervention, and a printed resources comparison) to increase physical activity and reduce sedentary time in middle-aged male employees of a university.

**Results**

The results of this PhD research help to address a gap in the current literature related to the health and physical activity of middle-aged Australian males. The association between physical activity and chronic disease has been well-established
(Physical Activity Guidelines Advisory Committee, 2008; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010), although findings that are specifically related to Australian males are sparse. Evidence on the association between sitting or sedentary time and chronic disease is continually emerging, and physical inactivity and sedentary time have been established as distinct risk factors that can have a detrimental impact on health (Owen et al., 2009; Owen, Healy, Matthews, & Dunstan, 2010). Findings from the first study demonstrated that, independent of sitting time and additional covariates such as age, BMI, and functional limitation, physical activity was significantly associated with diabetes. Sitting time was also significantly associated with diabetes and overall chronic disease (i.e., a combined category of all chronic diseases included in the analysis – cancer, heart disease, diabetes, high blood pressure), independent of physical activity and other covariates.

The second study explored male perceptions of physical activity and sedentary time and helped to inform the final design of the ManUp UWS Study. In this focus group study, participants reported that health and family were motivators for physical activity, whereas time constraints and work commitments were major barriers to physical activity participation. Sedentary time was perceived, by many participants, as a “by-product” of university employment, as a substantial proportion of their days were spent sitting, primarily at a computer. Participants in this focus group study reported that physical activity needed to be recognised as a legitimate activity at work, and that it should be “embedded” within the university culture and endorsed by the University and by senior staff.

The third and final study examined the effectiveness of two approaches to increase physical activity and reduce sedentary time in middle-aged male UWS
employees. There were no significant group-by-time effects observed for any of the primary or secondary outcomes, however, modest improvements in weight, BMI, and waist circumference were observed across time for both groups. The null findings for physical activity and sedentary time may have been due to a range of factors. It is possible that both the internet-based intervention and the printed resources comparison were equally effective in terms of eliciting small changes in outcome measures. It is also possible that the Study was not adequately powered to detect significant changes in physical activity, sedentary time, and other secondary outcomes, and it is also possible that neither the internet-based intervention nor the printed resources comparison treatment were effective. Results of the process evaluation showed that just over half of participants retained at 12-week follow-up reported losing weight as one of their main reasons for joining the ManUp UWS Study. Although no significant effects were seen for physical activity or sedentary time, the modest changes in body composition for some participants demonstrates that the intervention had some, albeit limited, health promotion success. It may be possible that these changes in body weight were associated with other factors, such as eating more healthfully, as several participants reported that their involvement in the study had made them more aware of their dietary habits. Through the process evaluation questionnaire implemented at the end of the formal intervention, participants reported many positive aspects of their involvement in the study. It appears that participants enjoyed being involved in the study and would be supportive of the implementation of a university-based program for staff members in the future.
6.2 Strengths and limitations of this PhD thesis

The strengths and limitations of these studies must be considered when interpreting the results presented in this thesis. Recruiting males to health promotion initiatives can be challenging (Department of Health and Ageing, 2010b; Morgan et al., 2011), and the sample size obtained for Study 2 and Study 3 reflect this recruitment challenge. Aside from Study 1, where existing cross-sectional data were used, recruiting male participants to partake in focus groups (Study 2) and a randomised controlled trial (Study 3) was extremely difficult. To recruit male UWS staff in Study 2, a conservative recruitment strategy (distributing flyers around two campuses) was used, and only 15 participants were recruited. Based on the difficulties experienced while recruiting for Study 2, it was decided that a broader approach would be taken to recruit males for the third and final study. As discussed in Chapter 5, a very comprehensive range of resourceful and innovative strategies (such as sending a specific email to a list of 845 potentially eligible staff members, advertising the study on the UWS webpage, and introducing the study at staff events across the university) was used, however, the target number of participants identified through the reported power analysis was not achieved.

Focusing specifically on middle-aged males, however, was a particular strength of this body of research. Australian males experience higher age-specific rates of a range of chronic diseases and have a lower life expectancy compared to their female counterparts (Department of Health and Ageing, 2010b). Males are also often underrepresented in health promotion research, have been identified as a group that is hard-to-reach, and compared to females, are less likely to undertake positive health measures such as seeking advice from health professionals, or attending health.
education sessions (Deeks, Lombard, Michelmore, & Teede, 2009). In line with previous findings (Waters et al., 2011), an extensive review of the literature pertaining to this population group also revealed that intervention studies designed to target males exclusively are limited (George et al., 2012).

The large sample size (n = 63,048) included in Study 1 was a particular strength of that study. The 45 and Up Study, from which these data were drawn, is the largest study of healthy ageing in the Southern Hemisphere, and will collect longitudinal data allowing researchers to monitor and investigate trends observed in the initial baseline data. To our knowledge, this study is among the first to examine the associations between a range of chronic diseases, physical activity and sitting time in middle-aged Australian males, while statistically controlling for numerous possible confounders.

Findings from this cross-sectional analysis provide a rationale for studies designed to target middle-aged Australian males, as they demonstrate that physical activity and sitting time are significantly (and independently) associated with diabetes. Significant associations were also observed for physical activity and cancer, and sitting time and overall chronic disease. Being cross-sectional in nature, however, the findings of Study 1 can only be used to establish associations between the outcome and exposure variables. Additional research in this particular population group is required to establish temporal sequence and further examine the potential dose-response relationships identified between physical activity, sitting time, and chronic diseases.

The use of self-reported measures can be problematic, as self-report data can be affected by recall bias, or under- or over-reporting (Prince et al., 2008). This being...
said, self-report measures are often used in large-scale population-level studies such as The 45 and Up Study, as they are feasible and cost-effective, and they allow researchers to collect data from large samples (Warren, Ekelund, et al., 2010). Additionally, a number of the measurement tools used in The 45 and Up Study, including the Active Australia survey have been shown to be reliable and valid (Australian Institute of Health and Welfare, 2003; Timperio et al., 2002). Finally, the amount of domain-specific physical activity and sitting time could not be established, as the questions asked in The 45 and Up Study baseline questionnaire did not allow for the delineation of specific domains of physical activity or sitting time.

A particular strength of Study 2 was the responses and insights participants gave in relation to sedentary time, particularly in their work environment. One finding that was of particular interest was that participants reported that being seated was essential for their productivity, and that taking regular breaks would significantly affect their focus and efficiency. Similarly, Bennie et al. (2011) reported that desk-based employees in an Australian study had a perceived “lack of time” to take short breaks, while Healy et al. (2008) found that taking regular breaks from being sedentary is associated with positive health outcomes. As recommended by Bennie et al. (2011), implementing strategies encouraging desk-based employees to take short breaks may be efficacious, and could be implemented in the workplace.

As discussed, the main limitation to be considered when interpreting the results of this study is the small sample size. Ideally, a larger number of male UWS staff would have participated, and as a result, each focus group session would have included more participants, possibly eliciting further discussion between participants. Theoretical saturation was not used to determine the sample size for this study,
although the responses that were obtained across the five sessions were similar, and it was therefore deemed that robust data were obtained, and that enough information was obtained to inform the intervention within the same population group. Another potential limitation of Study 2 was that the focus group facilitator was female. Although the topics for discussion were quite broad and not particularly gender-sensitive, it is possible that the presence of a female facilitator may have influenced the responses shared by some of the participants (Pini, 2005). That said, however, the data obtained through this study did not provide any indication that the participants were reticent to discuss these matters with a female facilitator.

Study 3 had a number of strengths, including the randomised design and the inclusion of two follow-up measurements, at the end of the 12-week formal intervention, and again, a further 12 weeks later. Furthermore, the ManUp UWS intervention was implemented in a real-world setting, where competing demands, workload pressures, and additional priorities were experienced. The main strengths of this study, however, were that the intervention itself was based on a previously tested intervention (Duncan et al., 2012), was informed and shaped by further formative research (George et al., 2012), and was designed specifically for male participants. Findings from the process evaluation questionnaire were also promising, and participants seemed to enjoy being involved in the study.

There were several limitations of Study 3. Firstly, despite implementing numerous robust recruitment strategies, only 56 participants were randomised at baseline and the study was subsequently underpowered. Secondly, compliance with wearing the accelerometers was low, and as such, a substantial proportion of the accelerometer data obtained was deemed invalid and could not be used in the
analyses. This is likely to have impacted on the results and may have led to invalid estimates of true levels of physical activity and sedentary time. Thirdly, for the intervention group, engagement with the website was limited, and participants did not optimally utilise the social support elements.

**Conclusion**

Two of the six priority areas for action outlined in the National Male Health Policy call for “a focus on preventive health for males” and “building a strong evidence base on male health” (Department of Health and Ageing, 2010b, p. 8). This research has added to a growing body of literature on the health and physical activity of Australian males, and has helped to address these two action areas to improve the health and wellbeing of Australian males. Findings from Study 1 lend support to previous findings in other populations, while also addressing a gap in the literature by shedding light on an understudied and underrepresented population group. Research into the potentially deleterious effects of prolonged sitting or sedentary time on health outcomes is mounting, and the findings related to sitting time in particular, contribute to this important body of evidence. Findings from the focus group research conducted for Study 2 provided insights into influences on physical activity and sedentary time in a sample of male university employees. The findings of Study 2 demonstrated that promoting physical activity in males working in particularly sedentary occupations can be challenging. These findings can be used as a platform for designing interventions targeting males in particularly sedentary occupations.
Study 3 further demonstrated that males are a hard-to-reach population group. Although a range of recruitment strategies were implemented, less than half of the required sample was able to be recruited. Researchers designing interventions for males should consider implementing more innovative and robust approaches to bolster the number of participants recruited. For example, researchers should consider designing interventions that are male-friendly and involve aspects of social support (from family, friends, colleagues, or other research participants). Where possible, researchers should also consider providing incentives such as discounted gym memberships or arranging events such as regular face-to-face meetings for potential research participants.

Most participants reported several positive aspects associated with their involvement in the Study, and many reported (in the process evaluation) that they felt they had increased their physical activity and reduced their sedentary time over the 12-week intervention period. The fact that this was not reflected in the results of the linear mixed models using objective accelerometer data is interesting, and may warrant further research in future studies. There appears to be somewhat of a contradiction between the perceptions of behaviour change and the objectively measured changes of these behaviours. While other internet-based intervention studies have demonstrated positive results (Leahey et al., 2010; Morgan et al., 2009), the results of Study 3 showed that the internet-based intervention was no more successful than the printed resources approach. The lack of engagement with the website, however, may partially explain why there were no discernible differences between the two groups. Despite the fact that all participants worked at the university (albeit, across five campuses), there was very little social interaction on the website.
In the process evaluation, several participants reported that they enjoyed discussing the study with their colleagues, and it may have been that participants in the same unit or school may have interacted outside of the website instead. Researchers utilising internet-based approaches in male populations may wish to consider introducing more social aspects early on in their intervention to potentially increase social interaction.

A number of studies have recorded physical activity or sedentary time using both objective (e.g., accelerometers or pedometers) and subjective measures (e.g., diaries or logs). Researchers working with male participants may wish to implement a self-report measure of physical activity, sedentary time, or device wear-time, in addition to asking participants to simply wear a device for a given period. The poor adherence with wearing the accelerometer observed in Study 3 resulted in a significant loss of data, and potentially inaccurate estimations of physical activity and sedentary time. Researchers may wish to consider utilising devices that can be worn on the wrist or ankle as this may increase adherence (Vanhelst et al., 2012).

In summary, this body of research has contributed to the current literature on male health, physical activity, and sedentary time. Study 1 has provided evidence suggesting that interventions to improve health and reduce chronic disease risk in males should not only focus on promoting physical activity, but also reducing sitting time. Study 2 has provided important information on male perceptions of physical activity and sedentary time, which can be used to help inform future intervention studies. Although the results of Study 3 were modest, the findings of the randomised controlled trial and the supplementary process evaluation suggest that male university employees may benefit from a short-term, simple intervention, whether
print-based or internet-based. Additional research is still required to build a stronger evidence base for male health, and to improve the physical activity, health, and wellbeing of Australian males.
References


Anderson, L. M., Quinn, T. A., Glanz, K., Ramirez, G., Kahwati, L. C., Johnson, D.
physical activity interventions for controlling employee overweight and
obesity: A systematic review. *American Journal of Preventive Medicine*,
37(4), 340-357.

self-management concept for men at the community level: The ‘Waist’
Disposal Challenge. *Journal of Health Psychology*, 14(5), 663-674. doi:
10.1177/1359105309104910

Arao, T., Oida, Y., Maruyama, C., Mutou, T., Sawada, S., Matsuzuki, H., &
Nakanishi, Y. (2007). Impact of lifestyle intervention on physical activity and

Armstrong, T., Bauman, A., & Davies, J. (2000). *Physical activity patterns of
Australian adults. Results of the 1999 National Physical Activity Survey.*
Canberra: AIHW.

Biddle, S. J. (2012). Methods of measurement in epidemiology: Sedentary
behaviour. *International Journal of Epidemiology*, 41, 1460-1471. doi:
10.1093/ije/dys118

2007-2008*. Cat no. 4364.0. Canberra: ABS. Retrieved from


Caperchione, C. M., Vandelanotte, C., Kolt, G. S., Duncan, M. J., Ellison, M., George, E. S., & Mummery, W. K. (2012). What a man wants:


Duncan, M. J., Vandelanotte, C., Rosenkranz, R. R., Caperchione, C. M., Connely, K., Ding, H., . . . Mummery, W. K. (2012). *Final report: HPQ Research Project 10/022 - To undertake a comprehensive research project which demonstrates the effectiveness of strategies (including information technology) to support lifestyle risk modification in men (aged 35-54 years) in relation to nutrition and physical activity in an urban or rural setting in Queensland.*


common chronic diseases during a 10-year period. *Archives of Internal Medicine, 161*, 1581-1586. doi:10.1001/archinte.161.13.1581


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Masse, L. C., Fuemmeler, B. F., Anderson, C. B., Matthews, C. E., Trost, S. G.,
comparison of four reduction algorithms on select outcome variables.
doi:10.1249/01.mss.0000185674.09066.8a

McTiernan, A., Sorensen, B., Irwin, M., Morgan, A., Yasui, Y., Rudolph, R., . . .
*Obesity, 15*, 1496-1512. doi: 10.1038/oby.2007.178

Investigation of relative risk estimates from studies of the same population
with contrasting response rates and designs. *BMC Medical Research
Methodology, 10*. doi: 10.1186/1471-2288-10-26

*International Journal of Behavioral Medicine, 11*, 219-224. doi:
10.1207/s15327558ijbm1104_5

Morgan, P., Lubans, D., Callister, R., Okely, A., Burrows, T., Fletcher, R., &
Collins, C. (2010). The ‘Healthy Dads, Healthy Kids’ randomized controlled
trial: Efficacy of a healthy lifestyle program for overweight fathers and their
children. *International Journal of Obesity, 35*, 436-447. doi:
10.1038/ijo.2010.151

The SHED-IT randomized controlled trial: Evaluation of an internet-based
weight-loss program for men. *Obesity, 17*, 2025-2032. doi:
10.1038/oby.2009.85


and dietary behavior change. *American Journal of Preventive Medicine, 33*, 336-345. doi: 10.1016/j.amepre.2007.05.007


American Journal of Preventive Medicine, 41, 189-196. doi:
http://dx.doi.org/10.1016/j.amepre.2011.05.013


Appendices
A Review of the Effectiveness of Physical Activity Interventions for Adult Males

Emma S. George,1 Gregory S. Kolt,1 Mitch J. Duncan,2 Cristina M. Capechione,3 W. Kerry Mummery,4 Corniel Vandelanotte,2 Penne Taylor5 and Manny Noakes5

1 University of Western Sydney, Sydney, NSW, Australia
2 Central Queensland University, Rockhampton, QLD, Australia
3 University of British Columbia, Kelowna, BC, Canada
4 University of Alberta, Edmonton, AB, Canada
5 CSIRO Food and Nutritional Sciences, Adelaide, SA, Australia

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Abstract

Physical inactivity is one of the main modifiable risk factors for a range of noncommunicable diseases. Of particular interest are adult males, a hard-to-reach population group for health promotion interventions. The purpose of this review is to provide a critical evaluation of the published health-related physical activity interventions that have targeted adult males.

A comprehensive search of MEDLINE, CINAHL®, ScienceDirect, Web of Science, PsyCINFO, the Cochrane Library, and SPORTDiscus™ was conducted for intervention studies published in English, between January 1990 and August 2010. Studies including community-dwelling adult men (≥18 years), or including both males and females where data on male participants could be extracted and examined, were included in this review. Studies assessing changes in levels of physical activity, physical fitness or changes in
biomarkers of disease risk relevant to physical activity (e.g. body weight, waist circumference, lipids, blood pressure) were the primary focus.

A total of 14 studies focusing on physical activity only and nine combined physical activity and nutrition studies were also included in this review. Ten of the 14 physical activity only studies and four of the nine combined physical activity and nutrition studies demonstrated significant increases in physical activity outcomes. Face-to-face, group-based and print-based methods were most commonly employed in these interventions. Within each mode of delivery, a number of elements including regular feedback, access to self-monitoring tools, elements of social support, variety in activities and a degree of friendly competition, were revealed as positive inclusions for this population group.

Males are generally under-represented in health-promotion interventions and should therefore be targeted specifically, and while results of the included studies are encouraging, there is a lack of intervention studies targeting adult males. Further research into this population group is therefore required.

1. Introduction

On average, males have a shorter life expectancy[11] and experience higher mortality rates attributable to chronic diseases than their female counterparts.[2,3] Despite this, adult males are often less likely to access health services or utilize preventive healthcare services including cancer screening and lifestyle modification programmes.[4–8] As mainstream public health interventions often fail to reach these particular individuals, it has been recommended that health promotion and prevention programmes take on a tailored and culturally appropriate approach to reach males across all population groups.[23] High blood pressure, high body mass, physical inactivity and low fruit and vegetable intake are the main modifiable risk factors that contribute to poor health and the burden of disease in males.[6,9] Such risk factors are often targeted in health promotion initiatives; however, physical activity, for example, is still one of the leading contributors to the global burden of disease and is one of the three leading risks of mortality worldwide.[9]

Research shows that sufficient physical activity is associated with a lower risk of developing non-communicable diseases, such as cardiovascular disease, diabetes mellitus, osteoporosis and some forms of cancer.[12–14] Regular physical activity has also been positively associated with higher levels of mental health and well-being.[12–14] Despite an abundance of strong evidence surrounding physical activity and its associated health benefits, an alarming proportion of adults continue to lead sedentary or low-activity lifestyles. In the period between 2007 and 2008, for example, less than half (48.5%) of Australian males reported participating in sufficient levels of physical activity, that is, 150 minutes or more of moderate and/or vigorous physical activity in a 1-week period.[9]

Low levels of sufficient physical activity and the subsequent potential effects on the health of adult males warrant concern. As indicated in the literature, males are a particularly hard-to-reach population group, who experience a range of health inequities. These inequities are magnified in non-metropolitan areas that often have lower access to medical services, as such implementing preventive health initiatives targeting men can be challenging.[15] A recently published review by Waters et al.[16] found that few physical activity intervention studies reported intervention effects by sex, and indicated that there was a need for authors to do so. The findings of their review also emphasized the need for interventions designed
to appeal to male participants, with fewer than 35% of participants in the 32 included studies being male.\textsuperscript{16}

While a large number of reviews on the effectiveness of physical activity interventions have been published,\textsuperscript{17-24} to our knowledge there are currently no reviews that focus on male participants. The purpose of this review is, therefore, to provide a critical evaluation of the effectiveness of physical activity interventions in adult males.

2. Methods

Studies for this review were retrieved by one of the authors (ESG) via individualized literature searches from the following databases: MEDLINE, CINAHL\textsuperscript{59}, ScienceDirect, Web of Science, PsycINFO, the Cochrane Library and SPORTDiscus\textsuperscript{TM}. The search was restricted to full-text articles published in English between January 1990 and March 2010. The reference lists of retrieved articles and other relevant published systematic reviews were also reviewed. Search terms used included ‘physical activity’, ‘exercise’, ‘sport’, ‘fitness’, ‘intervention’, ‘program’, ‘trial’, ‘men’, ‘male’ and ‘adult’.

To identify the most effective strategies for increasing levels of physical activity and supporting lifestyle risk modification in adult males, this review considers a range of studies that report changes in physical activity or changes in biomarkers of disease risk, as either a primary or secondary outcome. Study designs include, but are not limited to, randomized controlled trials, non-randomized controlled trials, and pre-, post-test designs.

Publications were selected for this review if they met the following criteria: (i) published in the English language; (ii) included either adult males aged ≥18 years, or both males and females where data on male participants was reported separately; (iii) assessed changes in physical activity, physical fitness or changes in biomarkers of disease risk related to physical activity (e.g. body weight, waist circumference, lipids, blood pressure), or both. It has been demonstrated that physical activity is significantly associated with changes in a range of biomarkers including body weight, lipids, blood pressure and waist circumference,\textsuperscript{27,28} which are associated with chronic diseases including type 2 diabetes and obesity.\textsuperscript{15,29} Changes in such biomarkers were therefore included as an outcome of interest in this review.

Studies testing interventions in participants aged ≥65 years only were excluded, as older males were not the focus of this review and likely have different intervention requirements, compared with the younger cohort. If multiple publications presented data from the same population in the same intervention study, only the most relevant publication was included for review. As many studies have investigated interventions that combine physical activity and nutrition components, such studies have also been reviewed. Any discrepancy in interpretation of findings was resolved through discussion among authors.

Study features reported in this review, and detailed in tables 1 and 11, include the (i) participant characteristics (including age, gender, specific health characteristics); (ii) country in which the study was conducted; (iii) intervention delivery (including mode of delivery, details of intervention and control group if applicable, intervention duration); (iv) outcome measures; and (v) results of intervention.

3. Results

The database searches resulted in a total of 2845 hits. Publications were excluded if they did not meet the specified inclusion criteria, based on the title and abstract. A total of 132 physical activity intervention studies, 61 combined physical activity and nutrition intervention studies, and 22 review papers were deemed to be potentially eligible for inclusion in this review and were retained for further consideration. The majority of these studies included both male and female participants and did not allow data to be extracted and analysed for male participants, exclusively. Hence, a total of 14 studies focusing on physical activity only, and nine combined physical activity and nutrition studies were included in this review. Ten of the 14 physical activity only studies and four of the nine combined physical activity and nutrition studies were able to show increases in physical activity in male participants. Further findings are presented separately for
<table>
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<th>Study (y)</th>
<th>Participants*</th>
<th>Mode of delivery</th>
<th>Outcomes</th>
<th>Intervention</th>
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<tr>
<td>Leashey et al. (2013)</td>
<td>5303 adults (65% men) ≥18 y US</td>
<td>Internet-based Community-based</td>
<td>Step count</td>
<td>Physical activity (Shape Up Rhode Island – 16 wk, web-based, online competition) No control group (results compared with baseline)</td>
<td>16 wk</td>
<td>Physical activity increased for completers (average 3065 steps/day) and average 2594 steps/day for all (ITT analysis) Participants who were sedentary, low active or somewhat active at baseline decreased from 64% to 61% Participants considered active increased from 16% to 40% Step change was greater for male participants (p = 0.02), for less overweight individuals (p = 0.00) and those whose company paid for enrollment into the programme (p = 0.09)</td>
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<tr>
<td>Buist et al. (2010)</td>
<td>7483 adults (1853 men) P = maturity 18–59 y (4% aged &gt;60) US</td>
<td>Internet-based</td>
<td>Health status BMI Weekly physical activity</td>
<td>Physical Active (active U = 8 wk, internet-based physical activity programme, during winter, free of change. Weekly newsletters delivered via email – content derived by health promotion experts) No control group (results compared with baseline and between those who joined teams and those who did not)</td>
<td>8 wk</td>
<td>Women more likely to sign up to website (75% of total participant population) and to join a competitive team (72% vs 63%) vs men Proportion of participants meeting physical activity goals significantly higher in those in competitive teams (p &lt; 0.001) Gender not a significant predictor of meeting physical activity goals Participation decreased after third week of programme</td>
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<td>De Cock et al. (2007)</td>
<td>1294 randomly selected adults (605 men) 25–75 y Belgium</td>
<td>Community-based</td>
<td>Physical activity, including work, transportation, domestic, gardening and LTPA Step count Awareness of project</td>
<td>Physical activity (intervention community of Ghent, Belgium, promoting 10000 steps/day + physical activity levels meeting national guidelines) Control community (Aalst, Belgium, no intervention)</td>
<td>1 y</td>
<td>48% of intervention participants increased steps/day by min. 800 vs a decrease of approximately 135 steps/day in controls Average step increase significantly in men (p = 0.001) and women (p = 0.001) and in the 25–45 y (p = 0.006), 45–65 y (p = 0.009) and 65–75 y age groups (p = 0.003) Higher proportion of intervention community (62%) vs 10% of control) and women (compared with men) were aware of intervention</td>
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<td>McTiernan et al. (2007)</td>
<td>202 sedentary unfit men (n = 102) women (n = 100) 40-75 years US</td>
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<td>Moderate/vigorous recreational physical activity</td>
<td>Physical activity (moderate-vigorous intensity aerobic exercise, 60 min/day, 6 days/wk; supervised by a dietitian specialist at 1 of 4 locations); Control group (no change in exercise or diet, physical activity interviews)</td>
<td>12 mo</td>
<td>Significant increase in mean moderate-vigorous physical activity in men and women $\bar{VO}_{2max}$ increased in men in intervention (11%) and decreased in controls 62.3% of men in intervention met ≥80% of goal (360 min/wk), 27.5% of men in intervention met or exceeded goal Men in intervention completed 370 ± 86 min/wk of physical activity Body weight: 1.8 kg loss in intervention men vs 0.1 kg loss in controls BMI: Intervention men lost 0.2 kg/m², no change in controls WC decreased by 3.3 cm in intervention men vs loss of 0.4 cm in controls Total fat mass decreased by 3.0 kg in intervention men vs gain of 0.2 kg in controls</td>
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<tr>
<td>Plotnikoff et al. (2006)</td>
<td>507 adults (136 men) approximately 44±4 yr Canada</td>
<td>Print-based</td>
<td>Levels of physical activity Stages of change for physical activity</td>
<td>Stage-matched materials (five motivationally targeted stage-matched materials on physical activity); Standard (two generic publications on physical activity); Control group (no materials provided)</td>
<td>12 mo</td>
<td>Mean weekly MET min for combined moderate and vigorous activity increased from baseline by 223 (stage-matched), 97 (standard) and 76 (control); Differences not significant (p &gt; 0.05) No significant differences in weekly MET min for men among the three groups</td>
</tr>
<tr>
<td>Bolognesi et al. (2006)</td>
<td>96 overweight or obese adults 18-70 y Italy</td>
<td>Face-to-face</td>
<td>BMI Abdominal girth (WC) Stage of change of physical activity Self-efficacy</td>
<td>Physical activity (PACE assessment, GP delivered counseling based on stage of readiness for physical activity, individualized physical activity programs); Control group (usual care-no PACE assessment)</td>
<td>5–6 mo</td>
<td>Men in intervention group experienced a decrease in BMI and abdominal girth at follow-up (vs baseline) &gt;50% of non-active participants progressed to a more advanced stage of readiness for physical activity Self-efficacy increased significantly in the intervention group, and the effect was stronger in men</td>
</tr>
<tr>
<td>Study (y)</td>
<td>Participants</td>
<td>Mode of delivery</td>
<td>Outcomes</td>
<td>Intervention</td>
<td>Duration</td>
<td>Main findings</td>
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<tr>
<td>Brown et al. (2006)</td>
<td>Whole of community - (1255 men) ≥18 y Australia</td>
<td>Community-based</td>
<td>Level of physical activity</td>
<td>Physical activity (10,000 steps/day, Queensland, Australia). Use of pedometers to increase steps/day, social marketing, physical activity advice from health professionals, and environmental support strategies used as intervention strategies</td>
<td>2y</td>
<td>Women: early adopters, with an increase in active participants of 5%. Men: 4% decrease in active participants in intervention vs. 8.9% decrease in active participants in control. It appears that the 10,000 steps intervention did not appeal to men.</td>
</tr>
<tr>
<td>Østergaard and Hamers (2006)</td>
<td>131 healthy adults in secondary work (50 men) 41.2 ± 9.4 y Norway</td>
<td>Face-to-face</td>
<td>Primary cardiorespiratory capacity (VO₂ max/physical activity level) Secondary: BMI</td>
<td>Physical activity (30 min interview to identify obstacles and develop plan for individualized physical activity programme, follow-up counselling offered). No control group (results compared with average population)</td>
<td>6mo</td>
<td>Significant increase in VO₂ max observed (men p &lt; 0.001). Experimental group: significant increase in levels of physical activity (days/week p &lt; 0.001). No change in days/week with at least 10 min walking. No significant change in BMI.</td>
</tr>
<tr>
<td>Bjorngås et al. (2006)</td>
<td>28 overweight Caucasian men with type 2 diabetes mellitus 50-70 y Norway</td>
<td>Group-based</td>
<td>Step count VO₂ max body weight HbA₁c</td>
<td>Physical activity (1.5 h exercise sessions, twice weekly, supervised by physiotherapist). Control group (no physical activity recommendations)</td>
<td>12 weeks</td>
<td>Exercise group significantly increased pedometer activity and VO₂ max, significantly decreased weight and HbA₁c.</td>
</tr>
<tr>
<td>Harrison et al. (2006)</td>
<td>545 sedentary adults (182 men with additional CHD risk factors ≥18 y UK</td>
<td>Face-to-face</td>
<td>Meeting physical activity target</td>
<td>Physical activity (one 1 h consultation with exercise officer, tailored information, supervised 12 wk leisure pass). Control group (written information only)</td>
<td>12 wk (with 6 and 12 mo follow-up)</td>
<td>No significant interactions observed for sex. At 12 mo, no group differences in 5% of individuals in intervention vs. control groups. Participation in 220 min of moderate/vigorous physical activity/wk (25.8% vs. 20.4%, p = 0.18). Intervention increased satisfaction with information but did not influence adherence with physical activity.</td>
</tr>
<tr>
<td>Kaukiainen et al. (2002)</td>
<td>76 unemployed male construction workers</td>
<td>Group-based</td>
<td>Musculoskeletal symptoms LTPA</td>
<td>Physical activity (two smaller groups, identical exercise programmes 90 min/session, twice/wk. Supervised by GT)</td>
<td>14 wk</td>
<td>Statistically significant increase in LTPA, muscular fitness of back and upper extremities, and balance in...</td>
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<table>
<thead>
<tr>
<th>Study (y)</th>
<th>Participants*</th>
<th>Mode of delivery</th>
<th>Outcomes</th>
<th>Intervention</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Winti Group for the Activity Research</td>
<td>874 inactive primary care patients without clinical (CVD: 479 men)</td>
<td>Face-to-face; Print-based</td>
<td>Perceived work ability; Physical capacity; Aerobic capacity</td>
<td>Control group (no change in physical activity level for duration of intervention; Two meetings, no physical activity guidance)</td>
<td>24 mo</td>
<td>Intervention group vs control group No significant change in perceived work ability</td>
</tr>
<tr>
<td>Dunn et al. (1999)</td>
<td>235 healthy sedentary adults (116 men)</td>
<td>Group-based</td>
<td>Primary; Physical activity; VO2max; Secondary; Plasma lipid and lipoprotein; cholesterol concentrations; BP; body composition</td>
<td>Structured exercise (traditional exercise prescription, supervised, offered 5 d/wk for 6 mo at fitness facility, free membership; minimum 3 sessions/wk)</td>
<td>24 mo (6 mo intensive intervention + 18 mo maintenance)</td>
<td>6 mo results: significant increase in EE and cardiorespiratory fitness (structured and lifestyle). Men in lifestyle group participated in over double the number of sessions of moderate intensity activities vs men in structured exercise group. Men in structured group participated in almost three times more hard activity vs men in lifestyle group. Men in structured group had significantly higher VO2max (vs men in lifestyle group) 24 month results: significant increase in EE for both structured (p &lt; 0.001) and lifestyle (p = 0.002) groups. Cardiorespiratory fibre decreased in both groups between 6-24 mo. Similar increases in physical activity at 6 mo, and similar decreases from 6-24 mo for both groups. Greater increases in fitness and in total and vigorous physical activity seen in men, though not significant</td>
</tr>
<tr>
<td>Study (y)</td>
<td>Participants*</td>
<td>Mode of delivery</td>
<td>Outcome measure</td>
<td>Intervention (Green Prescription: questionnaire, verbal advice from GP, written advice based on goals)</td>
<td>Duration</td>
<td>Main findings</td>
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<tr>
<td>Swahn et al. (2016)</td>
<td>450 secondary adults (175 men)</td>
<td>Face-to-face</td>
<td>Physical activity</td>
<td>Intervention (Green Prescription: questionnaire, verbal advice from GP, written advice based on goals)</td>
<td>6 wks</td>
<td>Significant increase in number of individuals in Green Prescription group participating in any recreational physical activity (p = 0.004). Although not statistically significant, the number of individuals increasing their overall physical activity was higher in the Green Prescription group (76% vs. 66%). A substantial increase in duration of physical activity was seen in both groups. This increase was not statistically significant, but was close to reaching significance in male participants.</td>
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* Data for age are presented as approximate or in ranges or means ± standard deviations.

BP = blood pressure; BMI = body mass index; CHD = coronary heart disease; CVD = cardiovascular disease; EE = energy expenditure; GP = general practitioner; HbA1c = haemoglobin A1c; HC = hip circumference; ITT = intent to treat; LTPA = leisure time physical activity; MET = metabolic equivalent; OT = occupational therapist; PACE = Patient-Centred Assessment and Counselling for Exercise; QLD = Queensland; VO2max = maximal oxygen consumption; VO2peak = peak oxygen consumption; WC = waist circumference.
<table>
<thead>
<tr>
<th>Study (y)</th>
<th>Participants</th>
<th>Mode of delivery</th>
<th>Outcomes</th>
<th>Intervention</th>
<th>Duration</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morgan et al.(2011)</td>
<td>105 men</td>
<td>Group-based</td>
<td>Body weight, WC, BMI</td>
<td>Camino model - men's weight management (men's health clinic run by community nurses. Pre-programme assessment, weight-management programme, post-programme meetings)</td>
<td>12 wk</td>
<td>Short term results: 80 men completed programme, with an average weight loss of 4.9 kg. Long term: 20 men attended final two post-programme meetings (average 1-49 mo post-intervention) with an average maintenance weight loss of 3.7% (range 1-22 kg) loss to 25.6% gain. Change in physical activity not an outcome for this study.</td>
</tr>
<tr>
<td>Morgan et al.(2009)</td>
<td>55 overweight or obese male university staff and students (n=52)</td>
<td>Print-based</td>
<td>Body weight, WC, BMI</td>
<td>SHEDE-IT (one 75 min face-to-face session delivered by male researcher, 60 min exercise and 60 min weight data entered on website, diaries, feedback emailed)</td>
<td>3 mo + 6 mo follow-up</td>
<td>Intervention group: significant weight loss of 5.3 kg at 6 mo (ITT analysis) Significant weight loss of 5.3 kg in control group (ITT analysis). Significant group-by-time interaction for weight loss: at 6 mo, completers lost 9.3 kg vs non-completers (2.7 kg loss) and control group (4.2 kg loss). No significant between-group differences for secondary outcomes. Significant increase in physical activity at 6 mo follow-up.</td>
</tr>
<tr>
<td>Aso et al.(2007)</td>
<td>177 men with risk factors for chronic disease 40-59 years</td>
<td>Face-to-face, Print-based</td>
<td>LEEE, BD, Dietary habits</td>
<td>LIGM group (individual counselling based on stages of change and environmental and social support, delivered by expertised research staff, work- and home-based)</td>
<td>6 mo</td>
<td>LIGM group: significantly greater positive changes in LEEE (mean intergroup difference: 400.6 kcal/wk, 95% Cl: 126.1, 875.9 kcal/wk)</td>
</tr>
<tr>
<td>Study (y)</td>
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<tr>
<td>Borg et al (2002)</td>
<td>50 healthy, obese men, 35-50 y, Finland</td>
<td>Group-based</td>
<td>Body weight, Body composition, Body fat mass, WC, Waist-to-hip ratio</td>
<td>Weight reduction (2 mo. LED and VLED, small meals led by nutritionist, regular weighing) Weight maintenance (two exercise groups, 45 min sessions, 3 x/w, supervised on weekends by exercise instructor) Control group (no increase in physical activity)</td>
<td>31 mo (3 months intervention, 6 mo weight maintenance, 23 mo follow-up)</td>
<td>Weight regain occurred during follow-up and at end of study. Exercise training did not improve short- or long-term weight management, compared with control. Resistance training resulted in a greater gain of body fat mass during weight management, but not during follow-up. Energy expenditure of 10.1 MJ/wk was associated with maintaining weight after weight loss. Change in physical activity over time was not assessed.</td>
</tr>
<tr>
<td>Birchard et al (1997)</td>
<td>50 overweight men, (43.4 ± 5.7 y), Australia</td>
<td>Face-to-face, Print-based</td>
<td>Body weight, Total and regional fat mass and lean mass, Energy intake (kcal), Percentage dietary fat, Physical activity</td>
<td>Weight loss through diet group (personalized dietary plan, low-fat diet plan, no change in physical activity) Weight loss through exercise group (individualized physical activity program, 3 sessions/wk, 30 min/session, no change in diet) Control group (monthly weight-monitoring sessions, followed usual pattern of physical activity and dietary intake) Bi-monthly feedback and lunch meetings available to all groups. Guest speakers or health information provided.</td>
<td>12 mo</td>
<td>No improvements in long-term weight maintenance were seen, and adherence to the prescribed exercise frequency was relatively poor. Exercise: mean weight loss was 2.0±1.0 kg, 50% of total weight loss was fat (light lean tissue maintained) Diet: mean weight loss was 6.4±3.3 kg, 40% of total weight loss was lean tissue. Mean activity levels for exercise groups were significantly different from baseline and other groups at 12 mo.</td>
</tr>
</tbody>
</table>

*Data for age are presented in ranges or means and standard deviations.

BP = blood pressure; BMI = body mass index; DBP = diastolic blood pressure; HC = hip circumference; HDL = high-density lipoprotein; HR = heart rate; HRmax = maximum HR; HRrest = resting HR; ITT = intent to treat; LDL = low-density lipoprotein; LED = low-energy diet; LEEE = leisure time exercise energy expenditure; LSM = Life Style Modification group; MI = motivational interviewing; RDI = recommended dietary intake; RM = repetition maximum; SBP = systolic blood pressure; SHED-IT = Self-Help Exercise and Diet using Information Technology; VLED = very low energy diet; VO2max = maximal oxygen consumption; VO2peak = peak VO2; WC = waist circumference.
tivity for the Green Prescription group. Participation in overall physical activity was greater in the Green Prescription group, although the increase was not statistically significant. An increase in the duration of physical activity was seen in both groups, and was almost statistically significant for male participants.

Harrison et al. compared a physical activity intervention (written physician advice on physical activity in addition to a single counselling session delivered by an exercise officer and a subsidized leisure pass) with a control group (written physician advice only), and no significant increases in self-reported physical activity were seen. The study conducted by the Writing Group for the Activity Counseling Trial Research Group compared three intervention groups (advice: printed materials plus physician advice; assistance: printed materials, physician counselling, interactive mail and behavioural counselling; and counselling: printed materials, physician counselling, interactive mail, behavioural counselling, regular telephone counselling and behavioural classes). This study incorporated regular telephone counselling as a component of their counselling intervention, and this was the only included study to do so. The authors reported no significant between-group differences in VO_{2max} or self-reported physical activity for male participants.

A counselling or advice component was included in three of the five face-to-face interventions. The study by Bolognesi et al. suggested that the counselling methods used by general practitioners helped participants increase their stage of motivational readiness for physical activity and significantly increased self-efficacy for participating in, and maintaining adequate levels of, physical activity. Counselling for physical activity was also utilized to help participants make lifestyle changes by identifying and overcoming barriers and learning to set achievable goals.

### 3.1.2 Group-Based Interventions

The four intervention studies with a group-based component presented in table I, were all effective in increasing physical activity levels in males. All of the four group-based interventions involved structured physical activity programmes, supervised by professionals. Of these four studies, one compared the results of the structured exercise intervention with a lifestyle group, and one compared the intervention group with a control group receiving usual care and two compared results with a control group who received no intervention.

McTiernan et al. assessed the effectiveness of a physical activity intervention (moderate-vigorous aerobic activity, supervised by an exercise specialist at one of four locations, 6 days per week) in comparison with a control group who only participated in quarterly physical activity interviews. Self-reported physical activity and objectively measured step counts were used to measure physical activity elements. A total of 82.3% of male participants in the intervention group met the physical activity goal of 350 minutes per week over the 12-month intervention period, and body mass index (BMI), waist circumference and hip circumference values all decreased significantly in male intervention participants. The study by Bjorgas et al. compared a physical activity intervention (1.5 hour exercise sessions supervised by physiotherapist, twice per week) with a no-treatment control group. Participants in the exercise group significantly increased objectively measured pedometer activity and VO_{2max}, and significantly decreased body weight and haemoglobin A_{1C}. Kauklaainen et al. assessed the effect of a physical activity intervention (90 minute exercise sessions supervised by an occupational therapist, held twice weekly) against a control group who attended two meetings only and did not receive any physical activity guidance. Men in the intervention group reported significant increases in self-reported leisure time physical activity, muscular fitness and balance.

Another group-based study assigned participants to a structured exercise programme and then allowed them to develop an individualized session, and compared this with a lifestyle physical activity group. Participant input into the development of the structured exercise group may have influenced the increase in levels of physical activity during the 6-month intervention stage. At 6-months, both the structured and the lifestyle intervention groups significantly increased self-reported energy expenditure and objectively measured cardiorespi-
ratory fitness; however, there was a decrease in these levels between the 6- and 24-month assessment points. This may have been due to a considerable decrease in face-to-face or group contact during the 18-month maintenance phase of the intervention.[62]

3.1.3 Internet-Based Interventions

Although 12 studies were identified that used some form of internet-based intervention, only two met the inclusion criteria for this review.[30,31] The Active U intervention was an 8-week online physical activity programme where participants could register individually, but also had the option of joining a competitive team.[31] Participants had only individual goals and team rankings were based on the proportion of team members meeting individual goals.[31] All sessions of physical activity were self-reported through the website, where participants could choose to participate in 27 different activities to meet their goal. Participants received weekly emails containing team rankings, information on physical activity and health (developed by health promotion experts) and friendly reminders to log their physical activity sessions online.[12] Results from this study were compared with baseline measures and between those who joined teams and those who did not. It was found that physical activity levels increased initially, but then decreased after week 3 of the programme. Participant sex was not associated with likelihood of achieving weekly physical activity goals, although it was found that participants who were members of competitive teams were significantly more likely to meet their physical activity goals. This study reported a large dropout rate, particularly in male participants.[31]

The second internet-based intervention included in this review assessed the effectiveness of Shape Up Rhode Island, Providence, RI, USA—a 16-week, team-based online intervention utilizing a pre-, post-test design.[63] This intervention took a similar approach to the Active U intervention,[31] whereby participants joined competitive teams; however, team captains were responsible for setting goals for their team.[31] The 16-week competition included eight separate rounds lasting for 2 weeks each, and participants were required to record their total objectively measured step count at the end of each 2-week period. Feedback on performance in relation to their personal and team goals was then provided through the online system.[38] The results of the Shape Up Rhode Island intervention were compared with baseline measurements, rather than a control group. A significant increase in steps per day was seen in male participants, and was higher in comparison to female participants; however, in line with other pedometer-based interventions, only a small proportion of participants (16%) were male.[30]

3.1.4 Community-Based Interventions

Of the three community-based physical activity interventions presented in table I, two were effective in increasing levels of physical activity.[30,32] One of the three community-based studies used an online approach,[39] and the other two used a 10,000 steps-per-day recommendation embedded in a multiple strategy approach,[22,30] as a means of increasing daily physical activity, and objectively measured steps using a pedometer. One of the studies promoting the 10,000 steps recommendation reported a significant increase in steps per day in males,[33] while the other reported a decrease (although not significant) in steps per day in male participants.[30]

3.1.5 Print-Based Interventions

Four studies included in table I incorporated a print-based component.[34,39,41,43] Potmickoff et al.[34] assessed the effectiveness of materials matched to each stage of the Transtheoretical Model[53] (stage-matched intervention), compared with generic printed materials on physical activity (standard intervention) and a no treatment control group. This was the only print-based study that did not include a face-to-face component. No significant differences were observed for self-reported weekly metabolic equivalent minutes of physical activity among males in any of the three groups in this study.[34]

The three remaining studies with a print-based component also included a face-to-face component.[39,41,43] One study[34] assessed the effectiveness of a physical activity intervention (one face-to-face consultation with an exercise officer, plus tailored information and a subsidized leisure activities.)
pass) compared with a control group who received only written information. This study did not result in any significant increases in self-reported physical activity. All participants in the three groups in the Activity Counseling Trial received existing educational material on physical activity. Swinburn et al. assessed the effectiveness of verbal advice with additional written materials on the goals the participant had developed during the face-to-face session (Green Prescription), in comparison to verbal advice only. Male participants in the Green Prescription group had a significantly greater increase in recreational physical activity levels than men in the verbal advice only group.

3.2 Combined Physical Activity and Nutrition Studies

Nine combined physical activity and nutrition studies met the inclusion criteria and were included in this review. Sample sizes ranged from 39 to 599, with a total of 1323 male participants. The intervention duration ranged from 3 to 31 months. Five of the nine included physical activity and nutrition intervention studies assessed a physical activity element (level of physical activity, step count, stage of change for participation in physical activity) as a primary or major outcome, and two included a physical activity element as a secondary outcome. Two of the included studies utilized both physical activity and nutrition intervention components; however, they focused on anthropometric measures/biomarkers for disease risk (e.g. body weight, waist circumference), and did not include physical activity as an outcome measure. Seven of the nine combined studies recruited males only, with three of these studies designing interventions specifically for men. Table II provides an overview of the physical activity interventions identified for this review.

3.2.1 Face-to-Face Interventions

Four studies summarized in Table II included face-to-face components and three of these were delivered in a workplace setting. The study by Arao et al. provided participants in the Life Style Modification Program for Physical Activity and Diet (LiSM-PAN) intervention group with individual counseling delivered by experienced researchers and based on the stages of change, as well as environmental and social support, and compared results with a control group (written physical activity advice only). Arao et al. found that the intervention group experienced significantly greater positive changes in a range of outcome measures, including self-reported leisure-time exercise, energy expenditure and BMI. The study by Elliot et al. utilized a team-centred approach compared with one-on-one motivational interviewing with trained counselors. In this study, participants in both the team-centred and motivational interview groups reported a significant increase in the number of sit-ups performed in 1 minute; however, there was no significant impact on peak oxygen consumption for either group. The face-to-face intervention by Prichard et al. examined the effectiveness of an exercise weight-loss programme in comparison to a diet weight-loss programme. There was a significant between-group difference for the self-reported physical activity index scores (type, duration and frequency), and both the exercise and diet groups decreased their body weight by a standard deviation of 2.6 ± 3.0 kg and 6.4 ± 3.3 kg, respectively.

The final face-to-face physical activity and nutrition study by Burke et al. compared a high-level intervention (alternating between face-to-face, facilitator delivered and print-delivered modules on physical activity and nutrition) with a low-level intervention (primarily print-based modules) and a no-treatment control group. Participants in the high-level intervention showed greater improvements in a range of outcomes including fitness (physical work capacity at 7.5% of maximum heart rate). No significant between-group differences were observed for moderate physical activity, days spent participating in physical activity or BMI.
group sessions and one included a team-centred component.

One group-based study involved overweight fathers and their children in an educational programme. The ‘Healthy Dads, Healthy Kids’ programme ran for 3 months and fathers attended eight face-to-face group-based sessions delivered by male researchers, designed to facilitate weight loss. Being physically active and eating healthily were the key messages delivered during the sessions, and the authors found that targeting the fathers also improved health behaviours in their children. Significant treatment effects were seen for waist circumference, BMI, systolic blood pressure, resting heart rate and objectively measured physical activity.

Borg et al. compared the effectiveness of walking or resistance training against a control group in weight maintenance after a 2-month very low energy diet programme. Small group meetings led by nutritionists were held weekly, and participants were given written educational material each month. During the maintenance phase, the intervention group participated in three 45-minute exercise sessions per week, with one session supervised by an exercise instructor. No improvements in long-term weight maintenance were seen, and adherence to the prescribed exercise frequency was relatively poor.

Gray and colleagues assessed the effectiveness of the Camelon model, a gender-specific, group-based weight management programme for obese males. The model consisted of four components including a men’s health clinic run by community nurses, pre-programme assessment, weight management programme and post-programme meetings. The model was designed to be ‘male-friendly’ by using humour, games and quizzes; giving ‘masculine’ advice about exercise; and devoting time to issues, such as alcohol consumption and portion sizes. Body weight decreased amongst study completers; however, long-term results were not reported. This intervention was designed to help males make long-term lifestyle changes, and this message was emphasized throughout the programme.

Another study that took a group-based approach was conducted by Elliot et al. This intervention included a team-centred component where one group member was nominated as a group leader and given a curriculum for leading group sessions. This study encouraged a degree of friendly competition, which may have been an additional motivating factor for some participants.

### 3.2.3 Internet-Based Interventions

Two internet-based interventions were included in Table II, both of which targeted males exclusively. The Self-Help, Exercise and Diet using Information Technology (SHED-IT) programme by Morgan et al. involved one face-to-face information session with a male researcher, plus 3 months of online support, where participants were given access to a publicly accessible website allowing them to log data on their levels of physical activity, dietary habits and body weight, compared with a single face-to-face information session (control group). The programme was designed to promote healthy lifestyles and facilitate weight loss. The research team gave individualized advice based on diaries submitted throughout the intervention period to the online intervention group. The programme required little interaction between researchers and participants, making it relatively cost effective and a feasible option for weight-loss initiatives. Intent-to-treat analysis revealed significant weight loss in both the internet group and the information-only control group at 6-month follow-up, and this weight loss was sustained for both groups at 12 months, as recorded in a follow-up study.

The second internet-based intervention by Vervoort et al. aimed to increase fitness levels in males by providing individually tailored information on physical activity and nutrition based on the stages of change of the transtheoretical model in comparison with a no-treatment control group. While no significant effects were seen for fitness levels (VO2max), significant effects for weight, BMI and body-fat percentage were observed.

### 3.2.4 Print-Based Interventions

Three combined physical activity and nutrition studies included a print-based component.
One study held a stand-alone face-to-face information session and also gave a gender-specific printed programme booklet on key weight-loss messages to males in both the intervention and the control groups. Intent-to-treat analysis revealed a significant weight loss in both groups. Another study compared the effectiveness of the LiSM-PAN programme with a control group receiving written feedback and print-based material. Changes in all outcome measures (leisure time energy expenditure, BMI, systolic blood pressure [SBP] and low-density lipoprotein [LDL]) were significantly greater in the intervention group, with the exception of dietary habits.

The third study by Burke et al. evaluated a high-level intervention, where a total of six modules on physical activity and nutrition were delivered fortnightly, either in printed format or through face-to-face contact sessions against a low-level intervention, where modules were mailed out to participants in printed format after a single face-to-face session, and a control group that received no intervention. Greater positive effects for objectively measured fitness and reductions in saturated fat intake and LDL cholesterol were seen in participants in the high-level intervention group, suggesting that the face-to-face sessions enhanced the effectiveness of the printed modules.

4. Implications and Conclusions

Although the literature search initially yielded large numbers of physical activity intervention studies, only a small number targeted males specifically, or presented results separately for sex. In line with findings by Waters et al., a relatively limited number of studies where results were presented separately for sex were identified. Ten of the 14 physical activity only intervention studies and four of the nine combined physical activity and nutrition intervention studies included in this review demonstrated significant increases in physical activity outcomes.

Physical activity was included as a primary or major outcome in all of the 14 included physical activity only interventions. Several combined physical activity and nutrition intervention studies focused on anthropometric measures, such as body weight and waist circumference as primary outcome measures; however, five of these also assessed a physical activity element as a major outcome. Although two of the combined studies did not assess physical activity as an outcome at all, these studies do, nevertheless, provide an opportunity to gain further insight into intervention elements that could also be used to increase levels of physical activity.

All five modes of delivery identified in this review had some success in increasing physical activity in males. From the studies included in this review, interventions delivered using face-to-face, group or print-based methods are the most common, and a number of studies used a combination of approaches.

Findings from interventions using face-to-face methods suggest that tailored advice given at face-to-face sessions was effective in facilitating both physical activity and dietary changes for positive health outcomes. Keifer et al. found that males tended to manage their weight with exercise, and the group-based study by Gray et al. encouraged regular physical activity as the key to maintaining weight loss. Masculinity was emphasized throughout the programme, as it is believed to be associated with strength and competitiveness.

The findings of the internet-based interventions included in this review suggest that interventions using the internet to promote healthy lifestyle behaviours have the potential to facilitate changes. In addition, the inclusion of self-monitoring tools and social interaction may further improve outcome measures by allowing participants to track their progress and find support in other participants. The positive change in steps per day for male participants in the internet-based study by Leahy et al. suggests that a team-centred, pedometer-based approach to increasing physical activity may be effective in a male population. Contrary to these findings, results of a community-based intervention by Brown et al. that used a 10,000 steps recommendation, showed that although female participants significantly increased their steps per
day, a walking or step-count challenge did not have much appeal to male participants.[36]

As part of the 10,000 steps project, an evaluation to investigate the reactions of middle-aged males to the strategies used in the intervention was carried out.[39] This evaluation identified perceived benefits (e.g., weight and stress management) and barriers (e.g., lack of time, low motivation and cost) to physical activity, as well as potential approaches to promote physical activity to middle-aged males.[37] While some males found wearing a pedometer motivated them to increase their steps, the majority of men rejected the idea of wearing a pedometer for longer than a few weeks.[30] Team spirit and social interactions were recognized as ways to possibly reduce disinterest and increase motivation.[37]

Also of note, are the two studies that incorporated a degree of friendly competition.[60, 11] Although one of these studies only increased physical activity until week 3 of the intervention,[51] one of the major findings of this study was that those who joined competitive teams were significantly more likely to meet their physical activity goals. Encouraging team-based activities may have the potential to increase adherence and enhance motivation among male participants.

Physical activity was measured using a range of different instruments including self-report questionnaires,[34, 35, 37, 39, 41, 43, 46, 49] physical activity logs or diaries,[14, 47, 52] or pedometers.[36, 38, 44, 46] Several physical activity intervention studies used both objective and subjective tools to measure physical activity.[32, 33, 39, 42] Eight studies also measured aspects of physical fitness, such as VO2max, using objective measures.[33, 37, 38, 41, 42, 45, 49, 50]

Subjective measures of physical activity, such as recall questionnaires, are often used in large-scale studies because of their feasibility and cost-effectiveness.[58] Although the reliability and validity of several self-reported physical activity questionnaires, such as the Active Australia Survey[99] or the International Physical Activity Questionnaire,[99] has been demonstrated, bias surrounding recall or social desirability can lead to under- or over-reporting of such behaviours.[99] Objective measurement instruments, such as pedometers or accelerometers, obtain more reliable results; however, such instruments can be expensive and are not always feasible, particularly in larger-scale studies.[98]

Rather than prescribing a 'one-size-fits-all' programme, encouraging ownership by allowing males to set unique physical activity goals or design individualized programmes based on their preferences, as seen in several of the reviewed interventions,[35, 37, 52] may be of benefit. Encouraging males to make physical activity a part of their regular daily or weekly routine may also be a positive way to introduce regular physical activity without giving a prescription. It has been suggested that men do not find lectures on health and lifestyle choices to be beneficial,[15] so perhaps encouraging the development of a more individualized programme would be advantageous. A common component was included in a number of the physical activity interventions,[35, 41, 43] and appeared to be an effective inclusion. Goal setting and identifying, and overcoming barriers to physical activity were common behavioural themes in the counseling sessions, as were motivational readiness for participation, the stages of change and increasing self-efficacy.[35, 41, 43, 44] Recognizing successes, even small ones, such as meeting a goal for the first time, may be a good motivator and may form a source of encouragement. Additionally, males need to see and understand how poor lifestyle choices such as being inactive, may affect their health or their families. This aspect was tapped into by the Healthy Dads, Healthy Kids study[40] that involved both male parents and their children and used the notion of being healthy for their children as part of the motivation to improve activity levels and lose weight. Also, the frequent use of health professional advice to men and its success in changing behaviours,[93, 48] may indicate that if advice and information is to be respected and taken into account by men, it needs to be seen as emanating from a reliable source.

The findings of this review have identified a number of effective methods of delivery and intervention elements with the potential to increase physical activity in males. In line with the recommendations by Waters et al.,[92] the findings of this review highlight the need for physical activity interventions to stratify results by sex to demonstrate
intervention effects. In order to amplify the proportion of male participants, improve retention and increase overall success, there is a need for interventions to be designed in ways that appeal only to males. While results of the studies included in this review are promising, it is evident that further research is required to examine the utility of innovative approaches for use in male populations before they are widely promoted.

Acknowledgements

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References

37. Ochs R, Hammeier S. The effectiveness of a pragmatic worksite physical activity program on maximal oxygen consumption and physical activity level in healthy people. J Bodyw Mov Ther 2006; 10 (1) 51-7
42. Dunn AL, Marcus BH, Kampert JB, et al. Comparison of lifestyle and structured interventions to increase physical activity and cardiovascular fitness: a randomised trial. JAMA 1999; 281 (4) 327-34
57. Burton N, Walsh A, Brown W. It just doesn’t speak to me: mid-aged men’s reactions to ‘10,000 steps a day’. Health Promot J Aust 2008; 19 (1) 52-9

Correspondence: Miss Emma S. George, School of Science and Health, University of Western Sydney, Locked Bag 1997, Penrith, NSW 2751, Australia.
E-mail: e.george@uws.edu.au
physical activity has been shown to be protective against colon and prostate cancer in adult males [13].

Researchers have established that physical (in)activity and sedentary behaviour are two distinct risk factors that can independently affect health. Sedentary behaviour is characterised by activities such as sitting or lying down, involving energy expenditure of 1.0-1.5 metabolic equivalents [14]. Independent of LTPA, higher levels of daily sitting time have been found to increase the risk of both CVD [15] and all-cause mortality in adults [15,16]. Specific (presumably) sedentary behaviours such as television viewing have also been associated with higher CVD mortality risk in males [11], increased likelihood of having the metabolic syndrome [17] and increased diabetes risk [12].

Time spent in sedentary behaviours has also been associated with clustered metabolic risk, independent of physical activity [18]. In addition to these findings that have demonstrated associations between sedentary time and health outcomes, other prospective studies have provided evidence of reverse causality, whereby specific health indicators such as body mass index (BMI) have been shown to predict sedentary time [19,20].

Current literature highlights the importance of participating in regular physical activity and limiting sedentary time for positive health outcomes. A number of studies have focused on specific domains of sedentary behaviour (e.g., television viewing), however, it has been demonstrated that television viewing time is not necessarily representative of overall sedentary time [21,22]. Furthermore, although several studies have examined the association between sedentary time and specific chronic diseases, few have examined overall time spent sitting on the association with a range of chronic diseases, particularly in middle aged males.

The aim of this study was to build upon an existing and growing body of literature on sitting time – and the association of this modifiable lifestyle behaviour – with a range of chronic diseases. This study utilised a large sample of middle-aged Australian males – a relatively understudied population group – and statistically controlled for a range of associated covariates, including age, BMI, and functional limitation.

Methods

The 45 and Up Study

The 45 and Up Study has been described in detail elsewhere [23]. Briefly, the 45 and Up Study is a large-scale Australian cohort study of 267,153 individuals from across New South Wales (NSW), the most populous state in Australia. Data derived from the 45 and Up Study baseline questionnaire [24] provide insight into an extensive range of health conditions and underlying determinants of health. Participants were randomly sampled from the Medicare Australia (national health insurance) database between February 2006 and December 2008. All adults who were aged 45 years and over and who were currently residing in NSW at the time of recruitment were eligible for inclusion in the study. Participants were included in the Study if they completed a mailed baseline questionnaire and provided their signed consent for participation in the baseline questionnaire and long-term follow-up [25].

Ethics approval for the 45 and Up Study and analysis of the baseline questionnaire data was granted by the University of NSW Human Research Ethics Committee (approval number 08/035). The University of Western Sydney Human Research Ethics Committee granted reciprocal ethics approval for use of the baseline questionnaire data in the current study (UNSW Protocol number H18/93).

Participants

Participants were a subset of males aged between 45 and 64 years of age from the total 267,153 males and females enrolled in the 45 and Up Study as of December 2009 (78% response rate). A total of 123,799 study participants were male, and 70,416 of these were aged between 45 and 64 years (26.4% of the total sample). The final sample size for the current study was 63,048 males, after excluding those with missing or invalid data for two or more types of physical activity (walking, moderate physical activity, and vigorous physical activity; n = 7,368).

Data

Data on all variables included in this analysis were derived from self-report measures from the 45 and Up Study baseline questionnaire.

Participants were asked to report whether they had ever been told by a doctor that they have a chronic disease or condition (question 24 of the 45 and Up Study baseline questionnaire). For the purpose of the current study, cancer (which included prostate cancer and other cancers, but did not include melanoma or non-melanoma skin cancer), heart disease, diabetes, and hypertension were used as primary outcome variables (binary presence or absence of each disease), as evidence suggests that time spent sedentary is associated with these, and other conditions [12,15,17,18]. In addition, an overall chronic disease variable combining the diseases listed above was computed (binary presence or absence of any chronic disease, among those listed) and analysed in a separate model.

Total sitting time was determined by asking participants to record the total amount of time, in hours, they usually spent sitting per day, and values were divided into quartiles of 0 to <4 hours, 4 to <6 hours, 6 to <8 hours, and ≥8 hours of sitting time per day. This particular question has not been assessed for reliability and validity, although it is analogous to the sitting time assessment question used in the International Physical
Activity Questionnaire (IPAQ). Participants completing the IPAQ are asked to report on the amount of time, in hours and minutes, they usually spend sitting on a daily basis, and this item used to assess sedentary time has been shown to have acceptable reliability and validity [25]. Clemens, Davi, Zhao, Han, and Brown [26] found that compared with accelerometer data, a single-item question assessing overall sitting time significantly underestimated sitting time, while a multiple-question domain-specific questionnaire showed increased accuracy. Nevertheless, Atkin et al. [27] support the use of single-item questionnaires in health-related epidemiological research, suggesting that such tools are appropriate when the primary requirements include usability and the capability to rank behaviours of interest.

The Active Australia Survey (AAS) [28], which has been shown to have acceptable test-retest reliability [29] and validity [30], was used to measure physical activity in the 45 and Up Study baseline questionnaire. Participants were asked to report on their participation in three types of physical activity, with a reference period of the previous week (questions 16 and 17 of the 45 and Up Study baseline questionnaire) – “walking continuously, for at least 10 minutes (for recreation or exercise or to get to or from places)”; “vigorous physical activity (that made you breathe harder or puff and pant, like jogging, cycling, aerobics, competitive tennis, but not household chores or gardening)”; and “moderate physical activity (like gentle swimming, social tennis, vigorous gardening or work around the house)” – by recording the total duration and the total number of times they participated in each (28). For the current study, the total time spent in these activities was used to determine participants’ physical activity levels, with minutes of vigorous physical activity given double weighting [28].

According to the World Health Organization (WHO) [6], 150 minutes or more of moderate-intensity and/or vigorous-intensity physical activity on a weekly basis is conducive to gaining health benefits in adults aged between 18 and 64 years. A total of five distinct physical activity categories were established for this study: 0 (no physical activity); 1 to 149 minutes of physical activity (insufficient levels); 150 to 299 minutes of physical activity (sufficient levels); 300 to 539 minutes (highly active); and ≥540 minutes (very highly active) of physical activity in the previous week.

Highest educational qualification was self-reported, with options including no qualifications, school or higher school certificate, trade or apprenticeship, certificate or diploma, and university degree. Participants also selected the most appropriate of nine categories for their pre-tax household income. For this study, these categories were combined to form five income categories (less than $10,000; $10,000-$29,999 per year; $30,000-$49,999 per year; $50,000-$69,999 per year; $70,000 or more per year). All other values were coded as missing. Questionnaire respondents indicated whether they had been a regular smoker in the past, and smoking status was categorised as ‘ever’ or ‘never’.

BMI (kg/m²) was calculated from participants’ self-reported height and weight measurements, and cut-points developed by the WHO were used to determine underweight (<18.50kg/m²), normal weight (18.50–24.99kg/m²), overweight (25.00–29.99kg/m²), and obese (≥30.00kg/m²) categories [31]. Functional limitation was measured using the Medical Outcomes Study Physical Functioning (MOS-PF) scale, which assesses the extent to which an individual’s health limits their ability to perform daily activities [32]. Functional limitation scores (out of 100) were divided into 4 categories: no limitation (100), minor limitation (95–99), moderate limitation (85–94) and severe limitation (0–84). The MOS-PF has been shown to have good test-retest reliability and content validity as a measure of physical functioning [33].

Statistical methods
Data drawn from the 45 and Up Study baseline dataset were analysed using SPSS 18.0 statistical software (SPSS Inc., Chicago, IL, USA). To explore the demographic characteristics of the study sample, frequencies were calculated for all outcome and exposure variables, and crossovers. Binary logistic regression analyses were used to examine the odds of having one (and also any) chronic disease by categories of sitting time, with partially adjusted models controlling for physical activity, age group, educational qualification, pre-tax household income, smoking status, and BMI categories, and fully adjusted models also controlling for functional limitation. Results are presented as crude odds ratios (OR), and partially and fully adjusted odds ratios (AOR) and corresponding 95% confidence intervals (CI). Unless otherwise specified, results refer to the fully adjusted odds ratios (AOR). A significance level of alpha = 0.05 was used in all analyses.

Results
The mean ± standard deviation (SD) age of participants included in the current study was 55.6 (± 5.4) years, and the mean ± SD BMI was 27.6 (± 4.3 kg/m²). The demographic information for the sample is presented in Table 1. Of the 63,998 males included in this analysis, 41.3% reported ever having at least one chronic disease, 55.5% reported ever having cancer, 8.6% reported ever having heart disease, 7.2% reported ever having diabetes, and 31.3% reported ever having high blood pressure. A total of 60.9% of males reported participating in at least 150 minutes of physical activity in the previous week, while a total of 4.1% of males reported no physical
Table 1 Demographic characteristics of the sample

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic disease</td>
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<td></td>
</tr>
<tr>
<td>None</td>
<td>37,213</td>
<td>58.7</td>
</tr>
<tr>
<td>One</td>
<td>16,010</td>
<td>24.6</td>
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<tr>
<td>Two or more</td>
<td>6,895</td>
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<td>Cancer</td>
<td>3,028</td>
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<tr>
<td>Heart disease</td>
<td>5,457</td>
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<td>Diabetes</td>
<td>4,972</td>
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<td>High blood pressure</td>
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<tr>
<td>Siting (hours/day)</td>
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<td></td>
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<tr>
<td>0 to &lt;4</td>
<td>14,257</td>
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<tr>
<td>4 to &lt;8</td>
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<td>27.4</td>
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<tr>
<td>6 to &lt;8</td>
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<td>10,467</td>
<td>18.8</td>
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<td>Sedentary (2hrs)</td>
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<tr>
<td>Low active (2+14 hrs)</td>
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<td>Sufficiently active (155+ hrs)</td>
<td>10,779</td>
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<tr>
<td>Highly active (600-859 hrs)</td>
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<td>Very highly active (540+ hrs)</td>
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<td>Age</td>
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<tr>
<td>45 to 59</td>
<td>12,477</td>
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<td>60 to 74</td>
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<td>75 to 84</td>
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<td>85+</td>
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<tr>
<td>&lt;10k</td>
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<td>10k to &lt;20k</td>
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<td>30k to &lt;40k</td>
<td>11,460</td>
<td>20.3</td>
</tr>
<tr>
<td>40k to &lt;70k</td>
<td>5,183</td>
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<tr>
<td>70k+</td>
<td>2,778</td>
<td>4.93</td>
</tr>
<tr>
<td>Educational qualification</td>
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<td>4,386</td>
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<tr>
<td>School Certificate</td>
<td>7,097</td>
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<td>HSC</td>
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<tr>
<td>Trade/Apprenticeship</td>
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<td>Certificate/Diploma</td>
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<td>University degree</td>
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<td>32.17</td>
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<tr>
<td>Smoking status</td>
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<td></td>
</tr>
<tr>
<td>Never</td>
<td>52,970</td>
<td>51.6</td>
</tr>
<tr>
<td>Ever</td>
<td>30,466</td>
<td>29.4</td>
</tr>
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</table>

Table 1 Demographic characteristics of the sample (Continued)

<table>
<thead>
<tr>
<th>Functional limitation</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No limitation</td>
<td>26,442</td>
<td>44.5</td>
</tr>
<tr>
<td>Minor limitation</td>
<td>12,181</td>
<td>20.5</td>
</tr>
<tr>
<td>Moderate limitation</td>
<td>19,472</td>
<td>32.0</td>
</tr>
<tr>
<td>Severe limitation</td>
<td>10,741</td>
<td>17.6</td>
</tr>
</tbody>
</table>

Combined chronic diseases
Males who reported sitting for 4 to <6 (OR 1.09, 95% CI 1.04 – 1.14, p <0.001) and 6 to <8 hours per day (OR 1.12, 95% CI 1.07 – 1.18, p <0.001) significantly more likely to report ever having a chronic disease (Table 2), while those in the highest quartile (>8 hours per day) were not significantly more likely to report ever having a chronic disease than those in the reference category (<4 hours of sitting time (OR 1.04, 95% CI 0.99 – 1.08). Across quartiles, there was a significant trend between sitting time and chronic disease (P for trend <0.001). Partial adjustment for covariates strengthened the association between sitting time and chronic disease, and males in all sitting categories higher than the reference category were significantly more likely to report ever having a chronic disease (P for trend <0.001). Once functional limitation was added to the fully adjusted model, the odds of having a chronic disease were attenuated, but remained significant (P for trend = 0.008), and males in each quartile above the reference category were significantly more likely to report ever having a chronic disease than those sitting for <4 hours per day (AOR 1.06, 95% CI 1.00 – 1.12, p = 0.050; AOR 1.10, 95% CI 1.03 – 1.16, p = 0.003; AOR 1.09, 95% CI 1.03 – 1.15, p = 0.002 respectively).

Cancer
Sitting time was significantly associated with cancer (P for trend = 0.015) in the crude model. In comparison to the reference group (<4 hours) participants reporting 6 to <8 hours of sitting per day were more likely to report ever having cancer (OR 1.14, 95% CI 1.02 – 1.27, p = 0.018). Adjusting for covariates impacted considerably on the association between sitting time and cancer (P for trend = 0.216), and adding functional limitation to
Table 2 Presence of chronic disease by categories of sitting time

<table>
<thead>
<tr>
<th>Sitting time model 1*</th>
<th>Odds (95% CI) of having a chronic disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any chronic disease</td>
<td>OAR 1.00 (1.00 - 1.00)</td>
</tr>
<tr>
<td>Cancer</td>
<td>1.00 (1.00 - 1.00)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>1.00 (1.00 - 1.00)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.00 (1.00 - 1.00)</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>1.00 (1.00 - 1.00)</td>
</tr>
</tbody>
</table>

Sitting time model 2*:

| Any chronic disease   | OAR 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| Cancer                | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| Heart disease         | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| Diabetes              | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| High blood pressure   | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |

Sitting time model 3*:

| Any chronic disease   | OAR 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| Cancer                | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| Heart disease         | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| Diabetes              | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |
| High blood pressure   | 1.00 (1.00 - 1.00)  | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) | 1.00 (1.00 - 1.00) |

*Reference category.
* Adjusted for physical activity, age, pre-tax household income, educational attainment, smoking status, BMIs.
* Adjusted for physical activity, age, pre-tax household income, educational attainment, smoking status, BMIs at functional limitations.

the final model further attenuated the association between sitting time and cancer (P for trend = 0.485).

Heart disease

There was a crude association between sitting time and heart disease (P for trend = 0.001). In comparison to those reporting <4 hours of sitting time per day, participants who reported 6 to <8 hours of sitting time were significantly more likely to report ever having heart disease (OR 1.13, 95% CI 1.03 – 1.23, p = 0.007). Once covariates including BMI were added to the model, the association was attenuated and the odds of ever having heart disease appeared to be slightly higher for participants in all sitting categories above the reference category (P for trend = 0.016), with those reporting 6 to <8 hours of sitting per day being significantly more likely to report ever having heart disease (AOR 1.13, 95% CI 1.02 – 1.25, p = 0.017). Adding functional limitation to the model attenuated the odds of ever having heart disease further (P for trend = 0.259), and there were no significant associations observed for any sitting time categories.

Diabetes

The likelihood of reporting diabetes increased with increasing sitting time across all three models. Compared with those reporting <4 hours of sitting time per day, participants reporting 6 to <8 (OR 1.19, 95% CI 1.08 – 1.31, p = 0.001), 6 to <8 (OR 1.19, 95% CI 1.08 – 1.31, p = 0.001) and 28 hours of sitting time per day (OR 1.15, 95% CI 1.06 – 1.25, p = 0.001) were significantly more likely to report ever having diabetes (P for trend = 0.002). In the partially adjusted model, a linear increase in odds was observed between increasing sitting time and diabetes (P for trend = 0.001), and males in the two highest quartiles of sitting time were significantly more likely to report ever having diabetes (AOR 1.18, 95% CI 1.05 – 1.32, p = 0.004; AOR 1.25, 95% CI 1.13 – 1.38, p <0.001). The association between sitting and diabetes was attenuated slightly after functional limitation was added in the final model (P for trend <0.001). Males reporting higher amount of sitting (6 to <8 hours and ≥8 hours) were, however, significantly more likely to report ever having diabetes (AOR 1.15, 95% CI 1.03 – 1.28, p = 0.016; AOR 1.21, 95% CI 1.09 – 1.33, p <0.001, respectively).

High blood pressure

The likelihood of having high blood pressure was higher, albeit slightly, for participants in each sitting category above the reference category of <4 hours (P for trend = 0.008) and participants reporting 4 to <6 (OR 1.06, 95% CI 1.01 – 1.11, p = 0.027) and 6 to <8 hours of sitting (OR 1.10, 95% CI 1.04 – 1.16, p = 0.001) were significantly more likely to report ever having high blood pressure than those reporting <4 hours. After partial adjustment for covariates, the likelihood of reporting high blood pressure increased linearly with increasing hours of sitting time (P for trend = 0.026) being highest for participants reporting ≥8 hours of sitting per day (AOR 1.09, 95% CI 1.03 – 1.15, p = 0.005). Adding functional limitation in the fully adjusted model weakened
the association ($P$ for trend = 0.183), but participants reporting 28 hours of sitting per day were significantly more likely to report ever having high blood pressure (OR: 1.96, 95% CI 1.00 – 1.12; $p = 0.046$).

**Discussion**

Physical activity tends to decrease with age [34,35] while sitting time tends to increase [36], and the association between ageing and chronic disease has been well established at the population level [37,38]. Our findings show that, even when age was held constant, higher volumes of sitting were associated with increased odds of diabetes and overall chronic disease.

We controlled for several factors that could potentially confound the associations examined in this analysis – one of the more influential factors being functional limitation. Advancements in medical care and technology have resulted in improved treatment and earlier diagnosis of conditions, leading to a potential reduction in disease-related functional limitation [39,40]. The presence of chronic disease, however, often brings with it some decline in functional limitation [41,42]. Individuals who experience higher degrees of limitation may be less likely to participate in physical activity, and may consequently spend more time in sedentary behaviours such as sitting. Adding functional limitation in the final model allowed us to explore the unique contribution of this potentially confounding variable, while still controlling for additional covariates.

After partially adjusting for covariates including age and BMI, the associations between sitting time and most chronic disease variables included in this analysis were attenuated, with the exception of overall chronic disease and diabetes, where the associations were strengthened. After adjusting for all covariates including functional limitation, these associations were consistently attenuated, although higher quantities of sitting time were associated with significantly greater odds of having diabetes. These findings support those from a prospective cohort study by Hu et al. [12] who found that sedentary behaviour was directly associated with diabetes risk, although this earlier study focused primarily on television viewing as a marker of sedentary behaviour. Additionally, males in all sitting time categories above the reference category were significantly more likely to report ever having a chronic disease (overall chronic disease).

In response to the relatively limited body of evidence surrounding the health of Australian males, the National Male Health Policy specifically outlined a priority area for building a strong evidence base on male health [1]. The findings of this study contribute to this body of evidence by highlighting the importance of considering both physical activity and sitting time as independent factors associated with diabetes in a sample of middle-aged Australian males. Our findings suggest that sitting time is significantly associated with diabetes and overall chronic disease, independent of physical activity, building upon existing literature in which physical activity and aspects of sedentary time have been previously established as independent risk factors for CVD, metabolic syndrome, and all-cause mortality [15-18].

When interpreting the findings of this study, potential limitations must be considered. Being cross-sectional in nature, we cannot establish whether the volume of sitting time led to the development of these chronic diseases, or whether the presence of these chronic diseases influenced participants' sitting time. Evidence from previous epidemiological studies, however, suggests that higher volumes of sitting time can present risk for diabetes [12,43]. Additional research in this particular population group is required to establish temporal sequence and further examine the potential dose-response relationships identified between sitting time and chronic diseases in the male population. Second, the self-report nature of measures used in the 45 and Up Study baseline questionnaire must be considered when interpreting the findings. Although self-report data can be affected by recall bias, or under- or over-reporting [44], self-report methods are often used in large-scale studies such as the 45 and Up Study due to the associated feasibility, cost-effectiveness, and ability to collect data from large groups of people [45].

The potential for misclassification of the variables used in this analysis must be acknowledged. It is possible that some participants may have incorrectly reported (or failed to report) having a chronic disease, while others may have under- or over-reported their daily sitting time. While these potential misclassifications may have impacted upon the strength of the observed associations, even after adjusting for a range of covariates, sitting time was still strongly and significantly associated with diabetes. In addition, while other studies on the association between sedentary time and health outcomes have adjusted for potential confounders including light intensity activity or overall energy expenditure [46-47], only data on overall time spent in physical activity in the previous week were included in this study. It is also possible that a proportion of the moderate intensity activity reported in the 45 and Up Study baseline questionnaire was actually light intensity, which may have led to an overestimation of moderate intensity physical activity. The third potential limitation is that the sitting time variables did not delineate specific domains of sitting time, such as office work, driving, other passive travel, and sitting during leisure time.

Given the potential for selection bias, as well as the 18% response rate pertaining to the 45 and Up Study...
and the fact that we further excluded males for whom certain data were not available, the potential impact upon the external validity of these findings should be considered. Although the characteristics of the 63,048 males included in this analysis may not be truly representative of the NSW middle-aged male population, sitting time, within this large sample of males, was strongly and significantly associated with diabetes, and to a lesser extent, overall chronic disease. Furthermore, the 45 and Up Study is the largest study of healthy ageing to be carried out in the Southern Hemisphere, and is likely to be one of the more representative large-scale cohort studies conducted globally [48].

There are several other noteworthy strengths of this study, including the large sample size and the broad range of health-related variables on which data were collected. A total of 63,048 males from the 45 and Up Study baseline dataset were included in the analysis for the current study. Being that middle-aged males are a relatively understudied population group, the findings of his study will help to partially fill a current gap in the literature concerned with male health. This study is among the first to examine the associations between a range of chronic diseases and sitting time in middle-aged Australian males, while statistically controlling for likely confounders. The 45 and Up Study will collect much-needed longitudinal data on middle-aged and older Australian adults over the coming years, allowing researchers to monitor and investigate trends observed in this initial baseline data.

Conclusion
It has been established that physical activity and sedentary time can be independent factors that are associated with a range of health outcomes [11,15-18]. The purpose of this study was to examine the association between sitting time and a range of chronic diseases in a sample of middle-aged Australian males, while controlling for a range of covariates.

Independent of physical activity, BMI and additional covariates, sitting time was significantly associated with diabetes and overall chronic disease in this sample of Australian males. The findings of this cross-sectional study support and build upon previous findings while also shedding light on a relatively understudied population group in Australia. As the Australian population ages, and chronic diseases become more prevalent, it is imperative that health professionals and policy makers consider the underlying factors influencing these conditions. Self-report measures such as those used in the 45 and Up Study provide estimates of time spent in specific behaviours, such as physical activity and sedentary time. In accordance with recommendations by Healy et al. [18], however, prospective studies or well-designed intervention trials utilising objective measurement tools to assess these behaviours are needed to more clearly understand the strength, direction and temporal sequence in the association with chronic disease. Although there may be additional underlying factors influencing the development of chronic disease, as well as reported sitting time and physical activity, our findings suggest that sitting time is a distinct lifestyle factor that may be considered in efforts to decrease chronic disease in middle-aged Australian males. In addition to promoting physically active lifestyles, health promotion initiatives targeting males should also consider encouraging reductions in daily sitting time.

Abbreviations
OR: Odds ratio; AOR: Adjusted odds ratio; CI: Confidence interval;
CVD: Cardiovascular disease; CHD: Coronary heart disease; IPAQ: International physical activity questionnaire;
BMI: Body mass index; NWA: New South Wales;
UNSW: University of New South Wales; AD: Active Australia Survey; WHO: World Health Organization; NCEP-III: National Cholesterol Education Program.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
ECB conceived of the study, participated in the design and coordination of the study, performed the statistical analyses and drafted the manuscript. RMB participated in the design and coordination of the study, assisted with the statistical analyses and contributed to the preparation of the manuscript. CK conceived of the study, participated in the design and coordination of the study and contributed to the preparation of the manuscript. All authors read and approved the final manuscript.

Acknowledgements
The Sax Institute, UNSW Australia and the Sydney School of Public Health collaborated on the Longitudinal Study of Australian Adults. The authors acknowledge the contributions of the participants to this study. In accordance with the terms of the study, the University of New South Wales is the owner of the data and has the responsibility of ensuring the data is kept secure. The procedures of the Longitudinal Study of Australian Adults have been approved by the University of New South Wales Human Ethics Committee. The Sax Institute and UNSW Australia have no proprietary interest in the study. The funders had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript. The Sax Institute, UNSW Australia and the Sydney School of Public Health contributed funds to support the development of the Longitudinal Study of Australian Adults.

Author details
1 School of Science and Health, University of Western Sydney, Sydney, Australia; 2Department of Human Nutrition, Kansas State University, Manhattan, KS, USA.

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References
Appendix C. 45 and Up Study baseline questionnaire for men.
24. Has a doctor EVER told you that you have:

- [ ] cancer (not melanoma)
- [ ] melanoma
- [ ] prostate cancer
- [ ] other cancer

**Type of cancer (please describe):**

- [ ] heart disease
- [ ] type of heart disease (please describe)

- [ ] high blood pressure
- [ ] stroke
- [ ] diabetes
- [ ] blood clot (thrombosis)
- [ ] enlarged prostate
- [ ] asthma
- [ ] lupus
- [ ] depression
- [ ] arthritis
- [ ] Parkinson's disease
- [ ] none of these

25. In the last month have you been treated for:

- [ ] cancer
- [ ] heart attack or angina
- [ ] other heart disease
- [ ] high blood pressure
- [ ] high blood cholesterol
- [ ] blood clotting problems
- [ ] asthma
- [ ] osteoarthritis
- [ ] thyroid problems
- [ ] osteoporosis or low bone density
- [ ] arthritis
- [ ] none of these

**Age when condition was first found:**

- [ ] age

26. Are you NOW suffering from any other important illness?

- [ ] Yes
- [ ] No

**Please describe this illness and its treatment:**

27. Do you regularly need help with daily tasks because of long-term illness or disability?

- [ ] Yes
- [ ] No

**If yes, list a lot:**

- [ ] personal care, getting around, preparing meals

28. Does your health now LIMIT YOU in any of the following activities?

- [ ] Yes
- [ ] No

**If yes, limited a lot:**

- [ ] VIGOROUS activities
- [ ] MODERATE activities
- [ ] lifting or carrying
- [ ] climbing several flights of stairs
- [ ] climbing one flight of stairs
- [ ] walking a kilometre
- [ ] walking 100 metres
- [ ] bending, kneeling or stooping
- [ ] bathing or dressing yourself

29. Have you ever had any of the following operations?

- [ ] removal of skin cancer
- [ ] mastectomy
- [ ] part of prostate removed
- [ ] whole prostate removed
- [ ] knee replacement
- [ ] hip replacement
- [ ] gallbladder removed
- [ ] heart or coronary bypass surgery

**Age when operation:**

- [ ] age

**Describe any other operations you have had in the last 10 years, with your age when you had them:**
30. Do you regularly care for a sick or disabled family member or friend?  
[ ] Yes  [ ] No

If yes, about how much time each week do you usually spend caring for this person?  
[ ] 0-1 hours/week  [ ] 2-5 hours/week  [ ] 6-12 hours/week  [ ] 13 or more hours/week

31. In general, how would you rate your:  
[ ] Good  [ ] Fair  [ ] Poor  [ ] Not at all well

Quality of life?  
[ ] Good  [ ] Fair  [ ] Poor  [ ] Not at all well

Eye sight? (with glasses or contact lenses, if you wear them)  
[ ] Good  [ ] Fair  [ ] Poor  [ ] Not at all well

Mouth health?  
[ ] Good  [ ] Fair  [ ] Poor  [ ] Not at all well

Teeth and gums?  
[ ] Good  [ ] Fair  [ ] Poor  [ ] Not at all well

32. Do you feel you have a hearing loss?  
[ ] Yes  [ ] No

33. How many of your teeth do you have left?  
[ ] None - all of my teeth are missing  [ ] 1-9 teeth left  [ ] 10-19 teeth left  [ ] 20 or more teeth left

34. During the past 12 months, how many times have you fallen to the floor or ground?  
[ ] 0 times  [ ] 1-2 times  [ ] 3-4 times  [ ] 5 or more times

35. Have you had a broken/fractured bone in the last 5 years?  
[ ] Yes  [ ] No

If yes, which bones were broken?  
[ ] Neck  [ ] Arm  [ ] Hip  [ ] Ankle  [ ] Other

How old were you when it happened?  
[ ] Under 1 year  [ ] 1-5 years old  [ ] 6-10 years old  [ ] 11 years old or more

36. About how many times a week are you usually troubled by leaking urine?  
[ ] Never  [ ] Once a week or less  [ ] 2-3 times a week  [ ] 4-5 times a week  [ ] Every day

37. How often are you able to get and keep an erection that is firm enough for satisfactory sexual activity?  
[ ] Always  [ ] Usually  [ ] Sometimes  [ ] Never  [ ] Doctor does not answer this question

38. Have you ever had a blood test ordered by your doctor to check for prostate cancer?  
[ ] Yes  [ ] No

If yes, what year did you have your last PSA test?  

How many times have you had a PSA test altogether?  
[ ] 1 time  [ ] 2 times  [ ] 3 times  [ ] 4 times  [ ] 5 times  [ ] 6 times  [ ] 7 times  [ ] 8 times  [ ] 9 times  [ ] 10 times  [ ] More than 10 times

39. Have you ever been screened for colorectal (bowel) cancer?  
[ ] Yes  [ ] No

If yes, please indicate which test(s) you had:  
[ ] Local occult blood test (check for blood in the stool/feces)  [ ] Colonoscopy (a tube is used to examine the large bowel)  [ ] Other test(s) (please specify)

If any of these tests were done in a doctor's office only without pain relief?  
[ ] Yes  [ ] No

If yes (or no) is it usually done in a doctor's office only without pain relief?  
[ ] Yes  [ ] No

Do you know the average age at which colorectal cancer is usually diagnosed?  
[ ] Before age 40  [ ] 40-50  [ ] 50-60  [ ] 60-70  [ ] 70 or more

How old were you when you had your last test?  
[ ] Under 1 year  [ ] 1-5 years old  [ ] 6-10 years old  [ ] 11 years old or more

40. Questions about your diet

40. About how many times each week do you eat:  
[ ] Beef, lamb, or pork  [ ] Chicken, turkey, or duck  [ ] Fish or shellfish  [ ] Processed meat  
[ ] Slices or pieces of brown/whole wheat bread each week  [ ] Bananas  [ ] Carrots  [ ] Cheese  
[ ] Cereals  [ ] Other bread or rolls  

41. How many of the following do you usually eat?  
[ ] Tuna  [ ] Oatmeal  [ ] Other cereals  [ ] Other bread or rolls  

42. Which type of milk do you mostly have?  
[ ] Whole milk  [ ] Skim milk  [ ] 2% milk  

43. How many servings of vegetables do you usually eat each day?  
[ ] Less than 1 serving  [ ] 1 serving  [ ] 2 servings  [ ] 3 servings  [ ] 4 or more servings

44. How many servings of fruit or glasses of fruit juice do you usually have each day?  
[ ] 0 servings  [ ] 1 serving  [ ] 2 servings  [ ] 3 servings  [ ] 4 servings  [ ] 5 or more servings

45. Please put a cross in the box if you NEVER eat:  
[ ] Red meat  [ ] Chicken  [ ] Dairy products  [ ] Fish  

46. Questions about time and work

46. What is your usual yearly household income before tax, from all sources?  
[ ] Less than $5,000 per year  [ ] $5,000-$9,999 per year  [ ] $10,000-$19,999 per year  [ ] $20,000-$29,999 per year  [ ] $30,000-$39,999 per year  [ ] $40,000-$49,999 per year  [ ] $50,000-$59,999 per year  [ ] $60,000-$69,999 per year  [ ] $70,000-$79,999 per year  [ ] $80,000-$89,999 per year  [ ] $90,000-$99,999 per year  [ ] $100,000-$124,999 per year  [ ] $125,000-$149,999 per year  [ ] $150,000-$174,999 per year  [ ] $175,000-$199,999 per year  [ ] $200,000-$249,999 per year  [ ] $250,000-$299,999 per year  [ ] $300,000-$399,999 per year  [ ] $400,000-$499,999 per year  [ ] $500,000-$599,999 per year  [ ] $600,000-$699,999 per year  [ ] $700,000-$799,999 per year  [ ] $800,000-$999,999 per year  [ ] $1,000,000 or more per year

47. Would you rather not answer this question?  
[ ] Yes  [ ] No
Consent form

The 45 and Up Study relies on the willingness of people in New South Wales to share information about their lives and experiences and to have their health followed over time. By signing this form, you are agreeing to take part in the 45 and Up Study and for the Study team to follow your health over time. Participation is completely voluntary, and you are free to ask questions or to withdraw from the Study at any time by calling the Study helpline on 1300 45 11 45. More information on the Study can be found at www.45andup.org.au

I agree to have my health followed over time through:
the 45 and Up Study team following health and other records relating to me, including NSW hospital records, cancer records, death records and other health-related records, as outlined in the Study leaflet: The 45 and Up Study: Information for participants;
Medicare Australia releasing to the 45 and Up Study my enrolment details, including Medicare number, and information concerning services provided to me under Medicare, the Department of Veterans’ Affairs, the Pharmaceutical Benefits Scheme and the Repatriation Pharmaceutical Benefits Scheme, including past information, until the end of the Study or for the duration of my involvement in the Study;
being contacted in the future to provide information on changes to my health and lifestyle. I may also be asked to provide further information including questionnaire responses or biological samples; my participation in any of these would be completely voluntary.

I have been provided with information about the 45 and Up Study, including how it will gather, store, use and disclose information about me, in the Study leaflet. I have been given an opportunity to ask questions and have been fully informed about the Study.

Name (Print):__________________________
Signature:__________________________ Date today:______/______/______

Extra contact details

It would be very helpful and reduce Study costs if we could contact you in future by e-mail. If you are happy for us to do this, please write your email address here:

Email address:____________________________________________________________"

Sometimes we find that people have moved when we try to contact them again. It would be very helpful if you could give us your mobile phone number and/or the contact details of someone close to you (such as a relative or friend) who would be happy for us to contact them if we are unable to reach you. We would only get in touch with that person if we were unable to contact you directly and we would need to tell them our reason for contacting you. Please leave this section blank if you do not wish to provide these extra contact details.

Your home phone number:__________________________ Your mobile phone number:__________________________

First name of contact person:__________________________ Phone number of contact person:__________________________

If you have any questions about the Study, please ring the Study helpline on 1300 45 11 45.
You can also write to or send your questionnaire (no stamp required) directly to:

Associate Professor Emily Banks, Scientific Director,

Thank you very much for taking part.

SAMPLE ONLY

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Appendix D. 45 and Up Study baseline questionnaire for women.
Questions about your health

20. About how many hours a week are you exposed to someone else’s tobacco smoke?

hours per week at home

hours per week in other places (in a week, going out, etc.)

21. Have you ever used the pill or other hormonal contraceptives? (e.g. the contraceptive pill, minipill, contraceptive implant or injection)

Yes □ No

If yes, for how long altogether have you used hormonal contraceptives? (please write 'O' if you used them for less than a year or '0' if you are still using them)

years

If yes, how old were you when you last used hormonal contraceptives? (please write your current age if you are still using them)

age

Which type of pill or other contraceptive did you use MOST RECENTLY?

- “the pill” (completed pill, e.g. Microgynon, Levlen)
- progesterone-only pill (‘mini pill’, e.g. Micronor, Norlutal, Norplant)
- Depo-Provera
- contraceptives by injection (e.g. Implanon, Norplant)
- oestrogen-only (e.g. estradiol, estradiol valerate)
- do not know

22. Have you ever used hormone replacement therapy (HRT)?

Yes □ No

If yes, for how long altogether have you used HRT? (please write ‘0’ if you used HRT for less than a year or ‘0’)

years

Are you currently taking HRT?

Yes □ No

If no, at what age did you stop?

age

23. Have you taken any medications, vitamins or supplements for most of the last 4 weeks, including HRT and the pill?

Yes □ No

If yes, name it: □ multivitamins + minerals □ multivitamins alone □ fish oil □ glucosamine □ green tea

- paracetamol
- aspirin for the heart
- aspirin for other reasons
- Lipo-B (known as Apenix, Novo-Cin, Lipo-Cell, Course);
- Fenofibrate
- Cenofibrate (known as Zetia, Zetia-Plus)
- statins (e.g. Lipitor, Zocor, Pravachol, Lescol).
- folic acid
- hydroxycitric acid
- flaxseed
- St. John’s wort
- ginkgo biloba
- coenzyme Q10
- ashwagandha
- L-arginine
- vitamin D
- melatonin
- probiotics
- omega-3 fatty acids
- choline
- glucosamine
- Schiff)
- genistein
- chromium
- ginger
- protease
- green tea
- coenzyme Q10
- nigella

Please list any other regular medications or supplements here:

- 339

Questions about your family

18. Have your mother, father, brother(s), or sister(s) ever had (please make only please put a cross in the appropriate box)

- Heart disease
- high blood pressure
- stroke
- diabetes mellitus
- dementia/Alzheimer's disease
- Parkinson's disease
- severe depression
- severe arthritis
- do not know

19. How many children have you given birth to?

(children)

Please list all the time you spent breastfeeding all of your children, out of “0” if you never breastfed
24. Has a doctor EVER told you that you have:

<table>
<thead>
<tr>
<th>Illness</th>
<th>Age when condition was first found</th>
</tr>
</thead>
<tbody>
<tr>
<td>skin cancer (not melanoma)</td>
<td></td>
</tr>
<tr>
<td>melanoma</td>
<td></td>
</tr>
<tr>
<td>breast cancer</td>
<td></td>
</tr>
<tr>
<td>other cancer</td>
<td></td>
</tr>
<tr>
<td>type of cancer (please describe)</td>
<td></td>
</tr>
<tr>
<td>heart disease</td>
<td></td>
</tr>
<tr>
<td>type of heart disease (please describe)</td>
<td></td>
</tr>
<tr>
<td>high blood pressure – when pregnant</td>
<td></td>
</tr>
<tr>
<td>high blood pressure – when not pregnant</td>
<td></td>
</tr>
<tr>
<td>stroke</td>
<td></td>
</tr>
<tr>
<td>diabetes</td>
<td></td>
</tr>
<tr>
<td>blood clot (thrombosis)</td>
<td></td>
</tr>
<tr>
<td>asthma</td>
<td></td>
</tr>
<tr>
<td>hayfever</td>
<td></td>
</tr>
<tr>
<td>depression</td>
<td></td>
</tr>
<tr>
<td>anxiety</td>
<td></td>
</tr>
<tr>
<td>Parkinson's disease</td>
<td></td>
</tr>
<tr>
<td>none of these</td>
<td></td>
</tr>
</tbody>
</table>

26. Are you NOW suffering from any other important illnesses?

- Yes
- No

27. Do you regularly need help with daily tasks because of long-term illness or disability?

- Yes
- No

28. Does your health now LIMIT YOU in any of the following activities?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes, limited a lot</th>
<th>Yes, limited a little</th>
<th>No, not limited at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigorous activities (e.g., running, swimming)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate activities (e.g., lifting a wees, carrying groceries)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climbing several stairs of stairs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climbing one flight of stairs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking one kilometre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking had a disability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking 100 metres</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bending, kneeling or stooping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bathing or dressing yourself</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None of these</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

29. Have you ever had any of the following operations?

- Yes
- Age when operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Yes</th>
<th>Age when operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of skin cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herniorrhaphy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both ovaries removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterilisation (tubes tied)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair of prolapsed uterus, bladder or bowel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallbladder removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart or coronary bypass surgery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other please describe any other operations you have had in the last 10 years, with your age when you had them.
Questions about your diet

40. About how many times each week do you eat: (please count all meals and snacks, put 0 if never eaten or eaten less than once a week)

- beef, lamb or pork
- chicken, turkey or duck
- processed meat (include bacon, sausages, salami, frankfurters, hamburgers, etc)
- fish or seafood
- cheese

How many times each week?

41. About how many of the following do you usually eat:

- slices or pieces of (corn/homemade) bread each week (also include muffins, bagels, etc.)
- bowls of breakfast cereal each week
- If you eat breakfast cereal it is usually (please circle)
  - bran cereal
  - all-bran
  - breakfast cereal (average)
  - shredded wheat
  - other (please specify)
- cut cereal, porridge, etc.

42. Which type of milk do you mostly have?

- whole milk
- reduced fat milk
- skim milk
- soy milk
- other milk
- I don’t drink milk

43. About how many servings of vegetables do you usually eat each day? A serving is half a cup of cooked vegetables or one cup of salad. (Please include potatoes and 1/2 cup of beans less than once a day)

- number of servings of cooked vegetables each day
- number of servings of raw vegetables each day (e.g. salad)
- I don’t eat vegetables

44. About how many servings of fruit or glasses of fruit juice do you usually have each day? A serving is 1 medium piece or 2 small pieces or 1 cup of dried or fresh fruit (please put 0 if you eat less than once a day)

- number of servings of fruit each day
- number of glasses of fruit juice each day
- I don’t eat fruit

45. Please put a cross in the box if you NEVER eat:

- red meat
- chicken/poultry
- fish/seafood
- dairy products
- eggs
- bread
- wheat products
- nuts
- cheese

Questions about time and work

46. What is your annual household income before tax, from all sources? (Please includes benefits, pensions, superintendent, etc.)

- less than $5,000 per year
- $5,000-$9,999 per year
- $10,000-$19,999 per year
- $20,000-$29,999 per year
- $30,000-$39,999 per year
- $40,000-$49,999 per year
- $50,000-$69,999 per year
- $70,000 or more per year
- I would rather not answer this question

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Consent form

The 45 and Up Study relies on the willingness of people in New South Wales to share information about their lives and experiences and to have their health followed over time. By signing this form you are agreeing to take part in the 45 and Up Study and for the Study team to follow your health over time. Participation is completely voluntary, and you are free to ask questions or to withdraw from the Study at any time, by calling the Study helpline on 1300 45 11 45.

More information on the Study can be found at www.45andup.org.au

I agree to have my health followed over time through:

the 45 and Up Study team following health and other records relating to me, including NSW hospital records, cancer records, death records and other health-related records, as outlined in the Study leaflet The 45 and Up Study: Information for participants;

Medicare Australia releasing to the 45 and Up Study any enrolment details, including Medicare number, and information concerning services provided to me under Medicare, the Department of Veterans' Affairs, the Pharmaceutical Benefits Scheme and the Repatriation Pharmaceutical Benefits Scheme, including past information, until the end of the Study or for the duration of my involvement in the Study;

being contacted in the future to provide information on changes to my health and lifestyle. I may also be asked to provide further information including questionnaire responses or biological samples. My participation in any of these would be completely voluntary.

I have been provided with information about the 45 and Up Study including how it will gather, store, use and disclose information about me, in the Study leaflet. I have been given an opportunity to ask questions and have been fully informed about the Study.

I give my consent on the understanding that:

my information will only be used for the purposes outlined in the Study leaflet entitled The 45 and Up Study: Information for participants, of which I have a copy;

my information will be kept strictly confidential and will be used for health research only;

reports and publications from the Study will be based on de-identified information and will not identify any individual taking part;

my participation in this Study is entirely voluntary and my consent will continue to be valid following death or disability unless withdrawn by my next of kin or other person responsible. I am free to withdraw from the Study at any time by calling the Study helpline on 1300 45 11 45;

my decision on whether or not to take part in the Study or in any additional research will not disadvantage me or affect my future health care in any way.

Name (First): ____________________________  Signature: ____________________________  Date today: __/__/20

Extra contact details

It would be very helpful and reduce Study costs if we could contact you in future by email. If you are happy for us to do this, please write your email address here:

Email address: ____________________________

Sometimes we find that people have moved when we try to contact them again. It would be very helpful if you could give us your mobile phone number and/or the contact details of someone close to you (such as a relative or friend) who would be happy for us to contact them if we are unable to reach you. We would only get in touch with that person if we were unable to contact you directly and we would need to tell them our reason for contacting you. Please leave this section blank if you do not wish to provide these extra contact details.

Your home phone number: ____________________________  Your mobile phone number: ____________________________

Full name of contact person: ____________________________

Phone number of contact person: ____________________________

If you have any questions about the Study, please ring the Study helpline on 1300 45 11 45. You can also write to or send your questionnaire (no stamp required) directly to:

Associate Professor Emily Banks, Scientific Director,

Thank you very much for taking part
Appendix E. Approval to use The 45 and Up Study baseline questionnaire data.

From: Alicia Nimmo [mailto:Alicia.Nimmo@saxinstitute.org.au]
Sent: Wednesday, August 25, 2010 10:25 AM
To: Gregory Kolt
Subject: Amendment approval - Project 10006

Dear Gregory,

Thank you for submitting this application to amend an approved project.

I am pleased to advise that the amendment has been approved, and attach an individual confidentiality undertaking for Miss George’s signature. Could you please ask her to sign on the last page then return this document to me at her earliest convenience. Upon receipt of the signed undertaking, Miss George has approval to access The 45 and Up Study dataset. (An emailed PDF or faxed copy is fine in the first instance, with the original to follow.)

Please do not hesitate to contact me if I can provide you with any further information or assistance.

Regards,

Alicia

Alicia Nimmo
Project Officer, Data Access
The 45 and Up Study: The Sax Institute

P + 61 2 9514 5958  E alicia.nimmo@saxinstitute.org.au  W www.saxinstitute.org.au  W www.45andup.org.au

F + 61 2 9514 5952  A UTS Building 10 Level 8, 235 Jones Street, Ultimo 2007  P PO Box 123 Broadway, NSW 2007 Australia
Appendix F. University of NSW Human Research Ethics Committee (HREC) Approval for The 45 and Up Study.
25 July 2005

Dr Emily Banks
Building 82 M Block
National Centre for Epidemiology & Population Health
Australian National University
CANBERRA ACT 0200

Dear Dr Banks

The 45 and UP Study: Research to improve health and well being
(HREC 05035)

At its meeting held on 19 July 2005 the Executive of the Human Research Ethics Committee (HREC) ratified my executive approval 30 June 2005.

In accordance with the guidelines set out in the National Statement on Ethical Conduct in Research Involving Humans* (NS) and exercising the authority delegated to me by the UNSW Council, I give permission for this project to proceed.

Would you please note:

* approval is valid for five years (from the date of this letter);
* you will be required to provide annual reports on the study’s progress and any adverse events to the HREC, as recommended by the National Statement on Ethical Conduct in Research Involving Humans;
* (NS 2.37) An HREC shall, as a condition of approval of each protocol, require that researchers immediately report anything which might warrant review of the ethical approval of the protocol, including:

(a) serious or unexpected adverse effects on participants
(b) proposed changes in the protocol; and
(c) unforeseen events that might affect continued ethical acceptability of the project.

... 2 ...

UNSW SYDNEY NSW 2052
AUSTRALIA
Telephone: +61 (2) 9385 4234
Facsimile: +61 (2) 9385 6468
Email: ethics.sed@unsw.edu.au
Location: Robert Myers Building
C/o Research Office / Ethics,
Garrick 14, Darke Street Kensington
ABN 57 195 873 179
Consent Forms are to be retained within the archives of the Centre and made available to the Committee upon request.

Yours sincerely

[Signature]

Professor Andrew Lloyd
President, Member
HREC

*http://www.nhmrc.gov.au
Notification of UWS approval for a project with external approval

Email on behalf of the UWS Human Research Ethics Committee

Dear Gregory and Emma

I'm writing to advise you that the University of Western Sydney Human Research Ethics Committee has agreed to provide reciprocal approval for the following project.

Title: The 45 and Up Study: Research to improve health and well-being: Physical activity and health: Studies of older adults and middle-aged men

Pis: Professor Gregory Kolt, Professor Louisa Jorm, Dr Richard Rosenkranz
PhD candidate: Miss Emma George, Supervisor: Professor Gregory Kolt

Condition: Following the confirmation of the candidate's research protocol during the CoC process, an amendment or a separate ethics application may be required, if there is a substantial modification in the PhD research project.

Approved by: University of New South Wales, 25/8/2010, 10006

The UWS Protocol Number for this project is H8793. Please ensure that this number is quoted in all relevant correspondence and on all information sheets, consent forms and other project documentation.

Please note the following:
1) The approval will expire on 1/12/2011. If you require an extension of approval beyond this period, please ensure that you notify the Human Ethics Officer (humanethics@uws.edu.au) prior to this date.

2) Please ensure that you notify the Human Ethics Officer of any future change to the research methodology, recruitment procedure, set of participants or research team.

3) If anything unexpected should occur while carrying out the research, please submit an Adverse Event Form to the Human Ethics Officer. This can be found at http://www.uws.edu.au/research/ors/ethics/human_ethics

4) Once the project has been completed, a report on its ethical aspects must be submitted to the Human Ethics Officer. This can also be found at http://www.uws.edu.au/research/ors/ethics/human_ethics

Finally, please contact the Human Ethics Officer, Kay Buckley on (02) 4736 0883 or at k.buckley@uws.edu.au if you require any further information.

The Committee wishes you well with your research.

Yours sincerely

Associate Professor Janette Perz
Chair
UWS Human Research Ethics Committee

Kay Buckley
Human Ethics Officer
University of Western Sydney
Locked Bag 1797, Penrith Sth DC NSW 1797
Tel: 02 47 360 883

Physical Activity and Sedentary Time: Male Perceptions in a University Work Environment

Emma S. George, BHS(Hons)¹, Gregory S. Kolt, PhD¹, Richard R. Rosenkranz, PhD¹, and Justin M. Guagliano, BA(Hons)¹

Abstract

Promoting physical activity and reducing sedentary time in males can be challenging, and interventions tailored specifically for males are limited. Understanding male perceptions of physical activity and sedentary behavior is important to inform development of relevant interventions, especially for males working in an office setting. As part of a larger intervention study to increase physical activity and reduce sedentary time, male university employees aged 35 to 64 years were invited to partake in focus groups to discuss benefits, motivators, and barriers related to physical activity and sedentary time. Five semi-structured focus group sessions, ranging from 50 to 70 minutes in duration, were conducted on two campuses at an Australian university. A total of 15 participants (9 academic/faculty staff and 6 professional staff), with a mean (±SD) age of 46.1 (±8.0) years took part in the study. Health and family were commonly discussed motivators for physical activity, whereas time constraints and work commitments were major barriers to physical activity participation. Sedentary time was a perceived “by-product” of participants’ university employment, as a substantial proportion of their days were spent sitting, primarily at a computer. Participants believed that physical activity should be recognized as a legitimate activity at work, embedded within the university culture and endorsed using a top-down approach. It is important to encourage breaks in sedentary time and recognize physical activity as a legitimate health-promoting activity that is supported and encouraged during working hours. These findings can be used as a platform from which to develop targeted strategies to promote physical activity in male university employees.

Keywords

physical activity, sedentary time, focus groups, middle-aged men, workplace health promotion

Introduction

The benefits of regular physical activity have been well-established, and are often identified as key motivators for being active. Regular participation in physical activity has been shown to improve overall health (Physical Activity Guidelines Advisory Committee, 2008), mental health (Blumenthal et al., 2007; Dunn, Tevedt, Kampert, Clark, & Chambless, 2005; Palatka & Schwenk, 2003), and is also associated with reduced chronic disease risk (Physical Activity Guidelines Advisory Committee, 2008; World Health Organization, 2010). In addition to the evidence on the benefits of regular physical activity, an increasing body of evidence exists also emerging on the potentially deleterious health effects of sedentary time. Higher volumes of sedentary time have been shown to be associated with chronic diseases, including diabetes (George, Rosenkranz, & Kolt, 2013; Hu et al., 2001; Hu, Li, Colditz, Willett, & Manson, 2003), hypertension (Haspanan, Miltunpalo, Vuori, Oja, & Pasanen, 1997), heart disease (Haspanan et al., 1997; Kazinmirezy, Cherich, Craig, & Bouchard, 2009), and all-cause mortality (van der Ploeg, Chey, Kuysa, Banks, & Bauman, 2012). As evidence emerges demonstrating the independent risk of sedentary time on chronic diseases, it is increasingly important for health professionals to consider both physical activity and time spent sedentary in their efforts to promote healthy lifestyles.

Males form a particularly hard-to-reach population group for the promotion of healthy lifestyles (Department of Health, 2006). The Moving to Action campaign (2008) promotes healthy lifestyles for men, and has been adopted by several states and territories in Australia. The campaign focuses on five evidence-based lifestyle changes: maintaining a healthy weight; increasing physical activity; smoking cessation; reducing alcohol use; and reducing the intake of unhealthy foods (Department of Health, 2006).ghts; and reducing the intake of unhealthy foods (Department of Health, 2006).
of Health and Ageing, 2010; Morgan, Warren, Lubans, Collins, & Callister, 2011). Australian males have a lower life expectancy and increased rates of chronic disease compared with their female counterparts (Department of Health and Ageing, 2010), although recruiting males to health promotion initiatives that have the potential to affect these inequalities, can be challenging (Department of Health and Ageing, 2010; Morgan et al., 2011). Males are often underrepresented in health promotion research (Glasgow et al., 2007; Waters, Gallois, Owen & Enkin, 2011), and a need for male-targeted interventions and initiatives to increase male participation has been identified (Waters et al., 2011). Males are also less likely than women to undertake positive health measures such as seeking advice from health professionals or attending health education sessions (Deeks, Lombard, Michelmore, & Teede, 2008). These discrepancies highlight a need to understand the factors that affect males' physical activity and sedentary time.

When promoting physically active lifestyles, it is important to consider the proportion of time adults spend at work, as this has the potential to negatively affect their opportunities for physical activity participation and foster a relatively sedentary lifestyle. University employees, for example, may be likely to spend large amounts of time being sedentary—a risk factor for developing overweight or obesity, independent of levels of physical activity (Chung et al., 1996; Prosser, Thomas, & Darling-Fisher, 2007; Salmon, Bauman, Crawford, Timperio, & Owen, 2000). Few studies have focused on university employees as a target population for the promotion of healthy lifestyle behaviors (Gilson, McKenna, Cooke, & Brown, 2007; Morgan, Lubans, Collins, Warren, & Callister, 2009; Prosser et al., 2007), and the need for more studies examining the potential to increase physical activity in academic and similar settings has been identified (Prosser et al., 2007).

Although the benefits of regular physical activity and the risks of inactivity are well known, the presence of perceived barriers is a strong and common correlate of physical activity nonparticipation (Trost, Owen, Bauman, Sallis, & Brown, 2002). Barriers to, and motivators for, participating in regular physical activity vary within and between populations, and it is important to understand the impact of barriers and motivators on participation. Adults frequently identify work and family commitments, time constraints, associated costs, stress, lack of motivation, and a lack of convenient opportunities as barriers to participation in physical activity (Capernichio et al., 2012; Salmon, Owen, Crawford, Bauman, & Sallis, 2003; Schuursman et al., 2008). Factors such as inadequate health, lack of motivation, laziness, and disability or injury have been cited as weight-related barriers (Ball, Crawford, & Owen, 2000). while environmental factors and a lack of access to facilities have also been reported as barriers to participation in physical activity, particularly for those living in rural or low socioeconomic areas (Australian Institute of Health and Welfare, 2010; Hampel, Owen, & Leslie, 2002). Although motivators and barriers related to physical activity participation have been investigated in various population groups, there is a lack of research examining motivating factors and barriers related to sedentary time. Given that individuals working in office settings spend a large proportion of their weekday sitting (Parry & Straker, 2013), it is equally important to understand factors related to sedentary time.

Caperichino et al. (2012) recruited middle-aged males living in a regional area of Queensland, Australia and conducted a series of focus groups to gain insight into physical activity and nutritional behaviors. In that study, improving health, losing weight, enjoyment, and setting good examples for children were cited as motivating factors for being physically active (Caperichino et al., 2012). Caperichino et al. also reported that males in their study identified maintaining a good quality of life and being able to undertake daily tasks as motivators for being physically active, particularly as they got older. In a similar population group, socializing and maintaining strength were recognized as key benefits for physical activity (Wanddl & Roos, 2006). Not all participants in that study placed as much importance on regular physical activity though, as some believed that it was acceptable to allow the aging process to occur naturally (Wanddl & Roos, 2006).

Although motivators and barriers related to physical activity participation have been investigated in various population groups, there is much less research that has examined motivating factors and barriers related to sedentary time. Given that individuals working in office settings spend a large proportion of their weekday sitting (Parry & Straker, 2013), it is equally important to understand factors related to sedentary time. Gilson, Barron, van Uffelen, and Brown (2011) targeted men and women employed in a sedentary occupation to explore perceptions of health risks and potential intervention strategies related to workplace sedentary behaviors. Gilson et al. found that participants welcomed the idea of implementing strategies to reduce sedentary behavior and identified the need for future qualitative research into perceptions of sedentary behavior in other employee groups.

As evidence emerges on the independent risk of chronic disease from both physical activity and sedentary time, understanding male perceptions of physical activity and sedentary behavior is important to inform the development of relevant interventions, especially for males who work in sedentary occupations. The purpose of this study was to explore middle-aged men's perceptions on a
range of issues related to physical activity and sedentary time. More specifically, this study explored middle-aged men’s perceived benefits of leading a physically active lifestyle, motivators for physical activity, barriers related to participation in regular physical activity, barriers related to sedentary time, and strategies to increase physical activity and reduce sedentary time. This study formed part of the substantive ManUp UWS project, aimed at increasing physical activity and reducing time spent sedentary in male university employees. Insights and opinions obtained during these focus groups were used to help inform the final design and shaping of the ManUp UWS intervention, a 12-week Internet-based physical activity intervention for this population.

Method

A purposive sampling strategy was used to recruit male employees aged 35 to 64 years from a large multi-campus Australian university, to partake in focus group sessions between November 2011 and May 2012. The primary aim of purposive sampling is to develop an “understanding of an issue or topic in sufficient detail to provide information to design subsequent studies” (Vaughn, Schumm, & Sinagub, 1996, p. 58), and as such, is common to focus group research. Recruitment flyers were distributed across two campuses and interested participants were asked to contact the primary researcher (ESG) by e-mail. Participants were deemed eligible if they were employed in an ongoing or fixed-term position at the university, were aged between 35 and 64 years, and were not highly active (i.e., as a rule, they were not participating in at least 30 minutes of moderate to vigorous physical activity—such as walking or sport—on 5 or more days per week). Eligible participants provided their focus group session scheduling preferences and were sent detailed study information before attending the session. The study information was also given to participants again at the beginning of the session before they gave their informed consent to participate in the study. At this time, participants were also asked to complete a brief demographic questionnaire (Table 1).

Participants were informed that the focus groups would be digitally recorded to ensure none of the information they shared during the session was missed, and two digital recorders were used to record the audio data during each focus group session. Participation in the focus groups was completely voluntary, and all participants were informed that they could withdraw their participation at anytime throughout the session without consequence. The primary researcher (ESG) acted as the session facilitator, and was responsible for guiding the discussion and prompting when required while another member of the research team (JMG) took notes and was responsible for the audio recording for each session. Each focus group session was held in a common room at one of the two campuses, and sessions ranged from 50 to 70 minutes in duration.

Questions asked during the focus group sessions were based on those from a similar focus group study (Caperchione et al., 2012) and were guided by the study objectives. Unlike the Caperchione et al. (2012) study, participants were asked questions not only related to physical activity but also about sedentary time. The questions were open-ended to encourage open conversation among participants, and prompts were used to promote further discussion on key themes, if required. Participants were encouraged to share their perceptions on the benefits of leading a physically active lifestyle, motivators for physical activity, barriers related to participation in regular physical activity, barriers related to sedentary time, and strategies to increase physical activity and reduce sedentary time. The content validity and appropriateness of the focus group questions were assessed through a process of pilot-testing involving volunteers representative of the target population. All focus group questions and prompts are listed in the focus group schedule (see the appendix).

Table 1. Demographic Characteristics of Focus Group Participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age-group (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td>4</td>
<td>26.7</td>
</tr>
<tr>
<td>40-44</td>
<td>4</td>
<td>26.7</td>
</tr>
<tr>
<td>45-49</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td>50-54</td>
<td>2</td>
<td>12.2</td>
</tr>
<tr>
<td>55-59</td>
<td>4</td>
<td>26.7</td>
</tr>
<tr>
<td>Role at university</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic (faculty) staff</td>
<td>9</td>
<td>60.0</td>
</tr>
<tr>
<td>Professional staff</td>
<td>6</td>
<td>40.0</td>
</tr>
<tr>
<td>Highest educational qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher school certificate</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td>Certificate/diploma</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td>University degree or higher</td>
<td>13</td>
<td>86.7</td>
</tr>
<tr>
<td>Household income ($)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60,000-79,999</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td>80,000-99,999</td>
<td>5</td>
<td>31.3</td>
</tr>
<tr>
<td>100,000-119,999</td>
<td>4</td>
<td>26.7</td>
</tr>
<tr>
<td>120,000-139,999</td>
<td>2</td>
<td>13.3</td>
</tr>
<tr>
<td>140,000+</td>
<td>3</td>
<td>20.0</td>
</tr>
<tr>
<td>Self-rating of current physical activity level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs a lot of improvement</td>
<td>7</td>
<td>46.7</td>
</tr>
<tr>
<td>Needs some improvement</td>
<td>5</td>
<td>33.3</td>
</tr>
<tr>
<td>Physically active on a regular basis</td>
<td>3</td>
<td>20.0</td>
</tr>
</tbody>
</table>
During each focus group session, the facilitator (ESG) and another member of the research team (JMG) noted emerging themes and took brief written notes on predeveloped forms to refer back to during the data analysis process. For each topic, several key themes identified in published literature and during pilot-testing were listed to permit the researchers to take brief notes during open conversation. Following each session, the primary researcher (ESG) transcribed the audio data verbatim. Using an inductive approach, thematic analysis was used to examine the data. Two members of the research team (ESG and JMG) independently and systematically read the transcripts several times for familiarization purposes. The authors independently coded each transcript by highlighting interesting segments of text and assigning a label to each segment. After independently coding, both authors compared and discussed codes from each transcript for the purpose of collapsing codes into one framework. Similar codes were grouped and categorized into themes to allow for identification of commonalities within the transcripts. The process used for our thematic analysis was similar to a guide provided by Braun and Clarke (2006). Ethics approval for the focus group study was granted by the University of Western Sydney Human Research Ethics Committee.

Results
A total of five focus group sessions were conducted on two campuses at the University of Western Sydney, with a total of 15 participants. The number of participants in the focus groups ranged from 2 to 5, including a total of 9 academic staff (i.e., faculty) and 6 professional staff. The mean (±SD) age of participants was 46.1 (±8.0) years, and the demographic characteristics of the sample are reported in Table 1. Although theoretical saturation was not used to determine the sample size for this study, there were marked consistencies observed among the responses in the focus group sessions. Findings are presented separately for physical activity, sedentary time, and strategies to improve physical activity and reduce sedentary time.

Physical Activity
Benefits of a Physically Active Lifestyle. The majority of participants were aware of the benefits of leading an active lifestyle. Health-related benefits, including improved general health, reduced susceptibility to illness, improved mental health, and lower risk of developing chronic diseases were commonly identified benefits of regular physical activity.

You feel better, you’re less likely to be struck down early with some lifestyle-related chronic disorder that’s going to stop you from doing any exercise ever again.

Weight maintenance was identified as a major benefit and many participants were also aware of the potential risks associated with being overweight. Appearance, in relation to weight was also discussed, although not as often.

That waistline is an important factor, especially for males because . . . an extra inch around your waist has a significant effect on your heart. So for me, the biggest motivation would be weight loss and you know . . . inches off the waist . . . Mainly just cause of the health benefits really.

In my 20s, I wasn’t really big, like hugely overweight, but I was putting on weight and I was having to go up sizes in clothes and I just thought, I don’t want to keep going on like this. And so that’s when I started exercising.

Motivators for Physical Activity. Maintaining and improving health was mentioned by several participants as an important motivating factor for being physically active, particularly as they got older. Some participants explained that they were motivated to be active and healthy to increase their longevity and to be able to participate in physical activity with their children. Others aspired to be a good role model for their children in terms of leading a healthy, active lifestyle and discussed the need to “lead by example.”

I’ve got two kids, 14 and 16. . . . so I want to . . . be around for a long time and be in good shape for them as they grow older and yeah, so it is, it’s important to me.

Physical activity was commonly referred to as being a stress reliever, with participants feeling a sense of escapism when they got away from work and were involved in an activity they enjoyed. Moreover, participants enjoyed the “change of scenery” when they left their work or home environment and participated in physical activities in a different setting.

I would never, for example get an exercise bicycle, or some sort of garage gym because even though I’d be exercising, I’d still be within the same confines as what I’m either working or doing household work or things like that.

On the other hand, several participants identified guilt as somewhat of a reverse motivator, in the sense that they were physically active in order to avoid feeling guilty for being inactive.

Not exercising is actually a stressor to me, to be honest. If I know that I haven’t exercised, that actually creates anxiety that I haven’t done enough. Especially when I know I’ve got this family history of things that would have been affected by exercise.
If I get really into the exercise pattern, if I don’t go, I feel guilty... so I want to get rid of that, so the motivator’s not to feel guilty... for not doing it.

Although some saw physical activity as a chore and as something that had to be done, others enjoyed being physically active and said they participated in activities for fun. Belonging to a team or a social group and being able to interact with others who were interested in similar activities was another motivating factor. Among participants citing this as a motivator, one theme that resonated with them was the fact that they tended to feel more of a commitment toward participation in activity and were less likely to displace activity if they felt they owed it to others in the group.

It was good when I was involved in team sports because you had other people there to interact with and you had, they were there to motivate you and that as well.

Also of interest was that many participants felt that their key motivators for being physically active changed over time. Appearance and fitness were major factors for some, while others discussed competitiveness and goals to succeed in their given sport or activity as a major motivator in their youth. Physical activity was said to “come naturally” to some in their youth, and few considered the health benefits in their choice to be active.

As a kid you didn’t really think about it, you were just active anyway. It was just part of life—you came home, threw your school bag in the door and you were outside. So, you didn’t really think about you need to get out and do some exercise.

When asked about how their motivators had changed over time, many explained that their family and their growing awareness of the health-related benefits of physical activity was now a big motivator, and the fact that they “weren’t getting any younger” pushed some to be active. Some participants also explained that they were more motivated to lead a physically active lifestyle at their current age than they were in their youth.

For quite a bit of time I didn’t really do any sort of set exercises as such, and... then the weight piled on, and then the motivation came in—ah, you really need to do something about this.

I sort of stopped doing really much at all. Put on a bit of weight, and probably got back into it about six or seven years ago and haven’t looked back. So there was no sort of, driving force I think, back when I first started in my 20’s.

A particularly interesting notion that was mentioned in several of the groups was that even though some participants felt that they were motivated enough to be active, they found it hard to overcome the impediments to being physically active. For example,

Knowing the fact that it’s good for you doesn’t necessarily make it change the fact that I don’t do enough—simple as that. So, I know all that stuff, but, well there’s motivations there, but then there’s other barriers that I find difficult to overcome.

You can be well intentioned and highly motivated, but unless there are a few more hours in the day, then it’s very hard to do.

**Barriers Related to Participation in Regular Physical Activity**

The two most commonly discussed barriers to being physically active were, not surprisingly, time and work constraints. Most participants felt they did not have the opportunity to be active during work hours and could not find the time to be active during the workday because of their workloads. For example,

For ever so many staff, yeah, the lunch hour is not a lunch hour, it’s a lunch 5 minutes—sitting in front of their computer, trying to catch up on the stuff that is about to avalanche over the top of them. So then the challenge becomes that if you do explicitly put more time aside during the day, then where does that time come from?

Work pressures and time constraints were discussed as barriers in all focus group sessions, and participants tended to agree that physical activity was often an activity that was very easily displaced, particularly because of the nature of their jobs.

Because there’s the expectations from our careers. You know, you’ve got to be writing, you’ve got to be on the phone to people at silly hours when you’re in Australia and yeah, you just have to put so much time into teaching, setting up research collaborations, doing your writing.

The problem with exercise is that it’s so much more easily displaced than other things. Because even though you know it’s an imperative, it’s not an immediate imperative as such.

While workload was cited as a barrier during the workday, some participants felt that their workload and job dynamics also affected the amount of physical activity they undertook at home. Long commutes to and from work and fitting in with the family’s schedule were identified as barriers to regular physical activity, as was a lack of available facilities. For some participants, facilities were available (e.g., cycling trails) but they did not feel
sage using them, while other participants felt that facilities were too far away from their home or workplace or were too expensive to use (e.g., gym memberships). Ageing and a decline in general physical condition were also identified by some participants as barriers to being physically active.

I've actually seen a big difference in me from when I was 45 to where I am now, that I've actually become more lazy... in terms of doing physical activity.

Lack of motivation and laziness were cited by some as barriers to participation in physical activity, particularly with regard to physical activity during the working week. While some participants had good intentions of participating in physical activity before or after work, many found they were too exhausted to do so. In terms of bolstering motivation, some participants felt that they were more motivated to be regularly active when they had something to strive for. For example, several participants recalled how registering for an event like a “fun run” gave them the motivation to get into a routine because they felt that they would not be able to complete the challenge if they did not prepare.

If it’s a lot smaller, then I just get stuck in a routine, and then I don’t think of it physically actively, especially with the hours that many of us will work, and commuting and that. It becomes very easy not to find the time.

Setting measurable and quantifiable goals was another factor that helped some participants stay motivated, as they were able to track their progress, observe improvements, and work toward a goal. Not having a social network, which was identified as an important motivator, was also identified as a barrier, as some participants felt it was harder to get motivated on their own.

When you’ve only got yourself, it’s a lot harder to actually motivate yourself to actually do it, you know?

Sedentary Time

Most Common Sedentary Pursuits. Most participants agreed that they spent a lot of time sitting down during the day, and most of their daily sedentary time was related to work—for example, at their desk or computer, or transportation. Time spent in front of the computer was not limited to work hours, with many participants discussing the need to complete work outside of normal working hours. Several participants employed in academic positions believed they were employed in a typically sedentary occupation, identifying sedentary time as “a given.”

Here’s mostly doing office work, it’s reasonably unavoidable to end up sitting at a desk. So if one is in academia, the only time one is not sitting at a desk is if one is teaching, otherwise, they’re sitting at a desk.

Some identified a shift in the delivery of lectures and tutorials as a cause of increasing sedentary time. This reflects a shift in the approach to teaching and student learning to incorporate technological advancements.

Now all of these lectures are podcasts, so instead of standing up for an hour and doing what one does...I guess I sit down for an hour and record the podcast. And the tutorials, instead of being interactive—physically interactive—tutorials, those tutorials are done electronically.

Some focus group participants were conscious of their daily sedentary time and made an effort to try and break up the long blocks of sitting while others found it too difficult to find the time.

Just being conscious of sitting for too long, you just get into the habit...the lunch break, half an hour or something, is a good time to do some walking.

Barriers Related to Sedentary Time. When participants were asked if there were barriers to overcome in terms of reducing high volumes of daily sedentary time, work and time were again, commonly identified. Participants discussed the need to sit at their desk or their computer to be able to do their work, and most of the participants in this study were employees who spent long stretches of time at a desk, for example, preparing class work, marking, recording podcasts, or working in administration.

Our job at a university is one, primarily to use our abilities of cognition. That’s best used when you’re not moving around too much.

While the main barriers preventing participants from reducing sitting time were primarily work-related, there was also discussion around sedentary hobbies, such as reading and writing.

Strategies and Goals to Increase Physical Activity and Reduce Sedentary Time

Perceived barriers were a major issue in relation to physical activity participation, although participants were able to identify opportunities for change. Many liked the idea of changing habits and encouraging small changes that could be incorporated into their daily routine.
George et al.

It's creating that routine and being comfortable in a routine that you're, you know you can maintain and sustain, over a period of time.

For example, parking the car further away from the building at work, taking the stairs instead of the lift, and making a point of going for walks throughout the day and trying to limit sitting time after work or on weekends were commonly discussed.

I know lots of staff members who never do the stairs, so...there are small things that you can incorporate into the daily routine of the worker at the university, that can lead to enough change to improve health.

On the other hand, some participants were able to identify strategies to increase their physical activity and reduce their sedentary time during work hours, but they felt that they would lose productivity.

Even though we sit, it's a by-product of the fact that we have to use our brains. It's not as if it's because we want to sit, if that makes sense...So, unless you can find another way that we can run around making lecture slides and reading articles where we've got our hand near up and improving our vascular flow to the muscles, I would happily swap that. But at the moment...I will be sitting to use my brain.

When I work, I have to concentrate, I have to focus, I have to have that lead in my mind and if I interrupt it, even for 5 minutes, it takes another 10 minutes to come back...My productivity would really fall.

One of the more distinctive themes that came up in discussions across groups was that of changing the culture at the university and really encouraging staff and students to be more physically active. Some participants discussed the culture at previous workplaces as ones that supported social activities and active lifestyles, and they felt that the social culture among staff could be much stronger. It was also suggested that physical activity needed to be seen as a legitimate activity that should be supported and perhaps even endorsed using a top-down approach.

If it's going to be done in work time, then it has to be viewed as a legitimate activity in its own right. I mean—would it ever get to the stage where they would allow an exercise component to be built into someone's workload agreement? Because if not, then whilst you're out there running, then you're not doing the stuff that is in your workload agreement.

Discussion

For each topic of discussion in this focus group study, several key themes emerged and resonated with men across the groups. When asked about the perceived benefits of being physically active on a regular basis, the men discussed a range of benefits, from improving general health and well-being, through to reduced risk of chronic diseases and improved mental health. Given the presence of high-profile health promotion campaigns and the popularity of television programs promoting weight loss and encouraging people to lead healthier lifestyles, it is not surprising that men in this study were aware of the benefits associated with regular physical activity and the risks associated with inactivity. It seems, however, that the issue is not so much about generating knowledge about these benefits, but educating people to enable them to identify and overcome the impediments related to participation in physical activity.

Two prominent themes emerged from the discussion on barriers related to participation in physical activity—the impact of time constraints and work commitments. These barriers were also identified in several other studies. For example, men in the Caprino et al. (2012) study indicated that they lacked the time to participate in regular physical activity because of family and child care commitments. While the participants in the current study also mentioned family commitments and fitting in with the family's schedule outside of working hours, long working hours and excessive workloads were more commonly identified in relation to time constraints.

Incorporating a degree of competition into physical activity was suggested as a potential motivation strategy, with some, but not all, participants noting that they enjoyed a bit of friendly competition and were more likely to push themselves if they knew they were competing against others. The desire for competition was not common among all participants, however, with some preferring to set personal goals and work individually. One participant shared his experiences relating to a social team he was once involved in and explained that it was important for the competition to remain friendly and unthreatening, so as not to intimidate people. Older males in the study by Verdun et al. (2010) held different opinions about workplace physical activity and competition in comparison with the younger males—their perceptions included feeling old around the younger men and feeling like they had to prove themselves if challenged.

Health was another major motivator for a lot of the men in our study, particularly as they were getting older. For many, the main motivators for being physically active shifted over time, compared with the motivating factors that influenced them in their youth. Some participants recalled seeing changes in their health or image when they reached their middle age, which prompted them to start being physically active. Some, but not all participants were age as a barrier to being physically active, but most agreed that they noticed quite a substantial difference in their fitness levels as they got older. Similar to the findings of
Vendovk et al. (2010), in their youth, men felt that physical activity had more of a connection with image and fitness as health issues were not a major concern.

Wandel and Roos (2006) reported that males in their study were also more aware of their health and the risk of disease as they aged, which was identified as a motivator for maintaining or undertaking physical activity for several participants in our study. Although employed in a range of different occupations, participants in both our study and the study by Wandel and Roos shared similar views on their levels of physical activity. Some participants discussed becoming less physically active as they got older while others found the motivation to become active with age.

For most participants, high volumes of sedentary time were related to work and work-related tasks. Apart from small changes, such as visiting a colleague rather than e-mailing them, or making several trips to the photocopier, participants—particularly those in academic or administrative roles—seemed to feel that opportunities to break up their sedentary time were limited. High volumes of sedentary time were accepted as somewhat of a by-product of their occupation and work environment, and a common idea held by participants was that sitting was essential for productivity. This was identified as a major barrier in relation to reducing daily sedentary time in the workplace; however, incorporating breaks in sedentary time can, in fact, enhance workplace productivity (Taylor et al., 2013). Stronger, more innovative efforts to overcome this misconception need to be considered.

Encouraging regular breaks in sedentary time by incorporating small changes, such as those identified in these focus groups, may be efficacious for individuals employed in a university-based, or similar, setting.

Changing the culture of the workplace to encourage physical activity emerges as a unique and interesting theme. In general, males who participated in our study were eager to see changes in workplace culture permitting more opportunities to participate in physical activity during the day. Participants felt that there was a lack of staff culture and social interaction within the workplace, although they were eager to see that change. It was also suggested that staff would need to have support and encouragement from supervisors and senior staff in order for physical activity during working hours to be acceptable and recognized as a legitimate activity, and the findings of Presser et al. (2007) lend further support to this. Academic staff members in the study by Presser et al. suggested that having support from supervisors and having a group or partner to be active with would help enhance and maintain motivation and overcome barriers for physical activity. The desire for greater staff engagement and promotion of social activities was discussed by participants in our study, who were in favor of seeing a change in culture using a top-down approach.

Males in this sample were employed in a range of different positions, representing the varying roles often found within a university setting. For example, participants were employed in academic roles, management roles, and professional support positions. The majority of participants perceived their job to involve high volumes of sedentary time, so although the findings of this study are highly relevant to males employed in a university setting, they may not necessarily be applicable to other male populations, such as those employed in more labor-focused occupations.

A particular strength of this study was the insights that participants gave in relation to sedentary time. One particular notion that resonated with participants across groups was that sitting was necessary for their productivity, and taking regular breaks would significantly affect their focus and productivity. It was suggested that it may not always be possible for employees to engage in physical activity during working hours. In addition to promoting regular physical activity both during and outside of working hours, encouraging breaks in daily sedentary time during working hours has been shown to be associated with positive health outcomes (Healy et al., 2008) and may be a more novel and achievable approach in this type of setting.

The results of this study should also be viewed in light of some potential limitations. Although this study has provided important insight into male perceptions of physical activity and sedentary time, the small number of participants in the focus group sessions was not ideal. Recruiting men to participate in the study was challenging, although recruiting men to health promotion initiatives and research studies is notoriously difficult (Department of Health and Ageing, 2010; Morgan et al., 2011). Ideally, each focus group session would have included more participants, resulting in a larger sample size and possibly eliciting further discussion among participants. Although the data were not used to determine sample size, the responses elicited across focus group sessions were similar. As such, it was determined that robust data were obtained. The focus group facilitator was female, and although the nature of the topics discussed during the focus group sessions were not particularly gender sensitive, female facilitator might have potentially influenced the responses of some participants (Pini, 2005).

The findings of this study demonstrate that promoting physical activity in males working in particularly sedentary occupations can be challenging. Although a variety of motivating factors were identified in this study, difficulties associated with overcoming impediments for physical activity participation and reducing sedentary time were a major concern for participants. Changing the workplace culture, gaining support from employers and senior staff, and recognizing physical activity as a legitimate activity were identified as potential strategies to increase activity and reduce sedentary time in a university-based setting.

Future intervention research targeting males in sedentary
occupations should consider these strategies in efforts to increase physical activity and reduce sedentary time.

Appendix

Focus Group Schedule

1. Physical Activity

1.1. Benefits of a physically active lifestyle. We all know that we are supposed to be physically active on a regular basis, but what do you think are the main benefits of leading a physically active lifestyle?

PROMPTS:
- Mainly health-related or physical benefits
- For general health
- To lose weight or maintain healthy body weight
- Body image—to feel good about yourself
- To maintain strength, stamina, et cetera, with age

1.2. Motivators for physical activity. What would motivate or encourage you to be more physically active?

PROMPTS:
- Health
- Family—i.e., to keep up with kids or to set an example
- Body weight or image
- Stress management/mood
- For work—perhaps your occupation requires you to be physically fit
- Enjoyment
- Competition
- Guilt

1.3. Barriers related to participation in regular physical activity. What are some of the barriers you have encountered that prevent you from being more physically active, or as active as you would like to be?

PROMPTS:
- That is, what is stopping you now or what has stopped you in the past?

- Time/work constraints
- Yourself—i.e., lack of motivation, laziness, too much effort
- Health issues or injury
- Weather
- Cost (gym membership, team registration fees, etc.)
- Other priorities
- Access to facilities

Can you think of some instances where you decided you wanted to become more physically active? What have you done or are you trying to do?

PROMPTS:
- For example, joined a gym, started walking or jogging, joined a team

What are some of the factors that motivated you to be physically active when you were younger—i.e., in your adolescence? How have these factors changed over the years?

PROMPTS:
- More aware of health or benefits of regular physical activity

2. Sedentary Time

2.1. Most common sedentary pursuits. Where would you say you spend most of your time sitting?

PROMPTS:
- Work
- Home (Leisure)
- Commuting

2.2. Barriers related to sedentary time. What are some of the barriers that prevent you from reducing this sedentary time on a usual day?

PROMPTS:
- Travel time
- Work commitments
- Time spent at computer

3. Strategies and Goals to Increase Physical Activity and Reduce Sedentary Time. Can you identify any ways you could reduce the amount of time you spend sitting on an average day?

PROMPTS:
- Catching public transport
- Taking the stairs instead of the lift
- Active e-mails—walking to colleagues’ offices instead of e-mailing
- Walking meetings
- Leaving your desk at lunch
- Standing up and stretching
If you were going to consciously try to be more physically active and reduce the amount of time you spend sitting or being sedentary, what kind of physical activity goals would you choose to include?

**PROMPTS:**
- For example, participating in team sports?
- Joining a gym? Walking? A variety of activities?
- What other activity are of interest to you that may not have been mentioned?
- How motivated would you be to reach such goals?

Can you identify any other elements that we could possibly incorporate into a program to boost and maintain your interest and motivation?

**PROMPTS:**
- Social interaction
- Friendly competition
- Physical activity tracking
- Perhaps consider websites/forums/social networking sites you have previously visited—any ideas from there?

**Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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**References**


Appendix I. Participant recruitment flyer for Study 2.

Are you a male UWS staff member aged between 35 and 64?
Are you interested in helping shape the design of a physical activity programme specifically for men?

Male academic and general staff (ongoing and fixed-term) at the UWS Campbelltown and Penrith Campus who are aged between 35 and 64 years are invited to participate in a study titled Men's perceptions of physical activity: Barriers, motivators, and benefits.

This study is being carried out by Emma George from the School of Science and Health, as part of a PhD project being supervised by Professor Gregory Kolt and Dr Ric Rosenkranz.

Participants will be invited to take part in one focus group session, where they will discuss issues related to physical activity. Topics of discussion will include:
- Barriers and motivators for being physically active
- Benefits and risks associated with levels of physical activity
- The design of an internet-based physical activity programme for men

The information gathered through these focus groups will help to inform the final design of the programme to be implemented at UWS.

Focus group sessions will be conducted on campus, and will run for approximately 60 minutes. Light refreshments will be provided during the sessions.

If you are interested in participating, or finding out more about this research project please contact Emma via email.

Emma George  
PhD Candidate  
School of Science and Health  
Email: e.george@uws.edu.au

UWS HREC approval number H9087
Appendix J. Participant information sheet for Study 2.

Participant Information Sheet (General)

Project title: Men's perceptions of physical activity: Barriers, motivators, and benefits.

Who is carrying out the study?

You are invited to participate in a study conducted by Miss Emma George, PhD Candidate in the School of Biomedical and Health Sciences at the University of Western Sydney.

Supervisors:
Prof Gregory Kolt
Head of School
School of Biomedical and Health Sciences
University of Western Sydney

Dr Ric Rosenkranz
Lecturer/Research Fellow
School of Biomedical and Health Sciences
University of Western Sydney

What is the study about?

Our research team is currently developing an internet-based intervention designed to increase levels of physical activity and decrease time spent sedentary for middle-aged (35-64 years) male university employees - 'ManUp UWS'. The purpose of this initial study is to explore middle-aged men's perceptions on a range of issues related to physical activity and healthy lifestyles, to help inform the final design and shaping of the ManUp UWS internet-based physical activity intervention, for middle-aged male university employees.

What does the study involve?

The study involves the completion of a short questionnaire on demographic characteristics and participation in one focus group. Barriers, enablers and motivators for physical activity, as well as current guidelines, benefits, and examples of physical activity will be discussed in a series of focus groups. Insights and suggestions obtained during these focus groups will help to inform the final design and shaping of the ManUp UWS internet-based physical activity intervention, for middle-aged male university employees. The topics for discussion will be facilitated by the UWS project staff and will relate specifically to physical activity and the development of the ManUp UWS physical activity intervention. The focus group will be digitally audio-taped to ensure that none of the important information you share with us is missed.
How much time will the study take?

The short questionnaire will take approximately 5 minutes to complete, and the focus group session will run for 60 minutes.

Will the study benefit me?

While you will not experience any immediate benefits, your participation in this study will allow you to share your insights and opinions into the development of effective strategies to improve the health of male university employees.

Will the study involve any discomfort to me?

The study will not involve any discomfort for you, however, should you feel uncomfortable or distressed at any time during the focus groups, you are free to withdraw from the study at any time without penalty or prejudice. In this case, any information given prior to your withdrawal will be retained in the study.

How is this study being paid for?

The study is being sponsored by the College of Health and Science - School of Biomedical and Health Sciences at the University of Western Sydney.

Will anyone else know the results? How will the results be disseminated?

All aspects of the study, including results, will be confidential and only the researchers will have access to information on participants. Outcomes of this study and subsequent process evaluation will be published as part of the student’s PhD thesis and in peer-reviewed journals and other scientific publications or presentations.

Can I withdraw from the study?

Participation is entirely voluntary: you are not obliged to be involved and - if you do participate - you can withdraw at any time without giving any reason and without any consequences.

Can I tell other people about the study?

Yes, you can tell other people about the study by providing them with the chief investigator’s contact details (Emma George). They can contact the chief investigator to discuss their participation in the research project and obtain an information sheet.
What if I require further information?

When you have read this information, Emma George will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact:

Miss Emma George  
PhD Candidate  
Email: e.george@uws.edu.au

This study has been approved by the University of Western Sydney Human Research Ethics Committee. The Approval number is H9087.

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through the Office of Research Services on Tel 02-4736 0883 Fax 02-4736 0013 or email humanethics@uws.edu.au

Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you may be asked to sign the Participant Consent Form.
Appendix K. Informed consent form for Study 2.

Participant Consent Form

This is a project specific consent form. It restricts the use of the data collected to the named project by the named investigators.

Note: If not all of the text in the row is visible please 'click your cursor' anywhere on the page to expand the row. To view guidance on what is required in each section 'hover your cursor' over the bold text.

Project Title:  Barriers, motivators, and benefits: Middle-aged men's perceptions of physical activity

I, ........................................, consent to participate in the research project titled 'Barriers, motivators, and benefits: Middle-aged men's perceptions of physical activity'.

I acknowledge that:

I have read the participant information sheet and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

I consent to participating in a focus group session to discuss physical activity and related issues. I understand that all focus group sessions will be audio-taped.

I understand that my involvement is confidential and that the information gained during the study may be published but no information about me will be used in any way that reveals my identity.

I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher/s now or in the future.

Signed:

Name:

Date:

Return Address:
Appendix L. Demographic questionnaire for Study 2.

Men’s perceptions of physical activity: Barriers, motivators, and benefits

Focus group demographic questionnaire

The details you provide on this questionnaire will be used to describe the overall demographic characteristics of the focus group participants. Please fill in the blanks as clearly as possible or check the most appropriate box for the following questions.

1. Your name: ________________________________

2. Your age: ____________________

3. Today’s date: ________/_______/_______
4. **Role at UWS (please tick):**

- [ ] Academic
- [ ] General/Professional
- [ ] Other – please give details: __________________________

5. **What is the highest qualification you have completed?**

- [ ] No school certificate or other qualifications
- [ ] School of intermediate certificate (or equivalent)
- [ ] Higher school or leaving certificate (or equivalent)
- [ ] Trade/apprenticeship (e.g. hairdresser, chef)
- [ ] Certificate/diploma (e.g. technician)
- [ ] University degree or higher

6. **What is your usual yearly household income before tax, from all sources?**

- [ ] Less than $20,000
- [ ] $20,000 to $39,999
- [ ] $40,000 to $59,999
- [ ] $60,000 to $79,999
- [ ] $80,000 to $99,999
- [ ] $100,000 to $119,999
- [ ] $120,000 to $139,999
- [ ] More than $140,000
- [ ] I would prefer not to answer this question
7. **How would you rate your current physical activity level?**

- [ ] Needs a lot of improvement
- [ ] Not bad, although I should probably do more
- [ ] Good, I am physically active on a regular basis

Comments on your current physical activity level:

________________________________________________________________________

________________________________________________________________________

Thank you for participating. Please return your completed questionnaire to the researcher.
Appendix M. Focus group schedule for Study 2.

I. Physical activity

1.1 Benefits of a physically active lifestyle

We all know that we are supposed to be physically active on a regular basis, but what do you think are the main benefits of leading a physically active lifestyle?

PROMPTS:
- Mainly health-related or physical benefits
- For general health
- To lose weight or maintain healthy body weight
- Body image – to feel good about yourself
- To maintain strength, stamina etc. with age

1.2 Motivators for physical activity

What would motivate or encourage you to be more physically active?

PROMPTS:
- Health
- Family – i.e., to keep up with kids or to set an example
- Body weight or image
- Stress management/mood
- For work – perhaps your occupation requires you to be physically fit
- Enjoyment
- Competition
- Guilt
1.3 Barriers related to participation in regular physical activity

What are some of the barriers you have encountered that prevent you from being more physically active, or as active as you would like to be?

- I.e. what is stopping you now or what has stopped you in the past?

**PROMPTS:**
- Time/work constraints
- Yourself – i.e., lack of motivation, laziness, too much effort
- Health issues or injury
- Weather
- Cost (gym membership, team registration fees etc.)
- Other priorities
- Access to facilities

Can you think of some instances where you decided you wanted to become more physically active? What have you done or are you trying to do?

**PROMPTS:**
- E.g., joined a gym, started walking or jogging, joined a team

What are some of the factors that motivated you to be physically active when you were younger – i.e. in your adolescence? How have these factors changed over the

**PROMPTS:**
- More aware of health or benefits of regular physical activity?
2. Sedentary time

2.1 Most common sedentary pursuits

Where would you say you spend most of your time sitting?

**PROMPTS:**
- Work
- Home (leisure)
- Commuting

What are some of the barriers that prevent you from reducing this sedentary time on a usual day?

**PROMPTS:**
- Travel time
- Work commitments
- Time spent at computer

3. Strategies and goals to increase physical activity and reduces sedentary time

Can you identify any ways you could reduce the amount of time you spend sitting on an average day?

**PROMPTS:**
- Catching public transport
- Taking the stairs instead of the lift
- Active emails – walking to colleagues’ offices instead of emailing
- Walking meetings
- Leaving your desk at lunch
- Standing up and stretching
If you were going to consciously try to be more physically active and reduce the amount of time you spend sitting or being sedentary, what kind of physical activity goals would you choose to include?

**PROMPTS:**
- E.g., participating in team sports? Joining a gym? Walking? A variety of activities?
- What other activities are of interest to you that may not have been mentioned?
- How motivated would you be to reach such goals?

Can you identify any other elements that we could possibly incorporate into a program to boost and maintain your interest and motivation?

**PROMPTS:**
- Social interaction
- Friendly competition
- Physical activity tracking
- Perhaps consider websites/forums/social networking sites you have previously visited – any ideas from there?
Appendix N. UWS HREC approval for Study 2.

UWS HUMAN RESEARCH ETHICS COMMITTEE

12 May 2011

Professor Gregory Kolt
School of Biomedical and Health Sciences

Dear Gregory and Emma,

I wish to formally advise you that the Human Research Ethics Committee has approved your research proposal H9087 “Barriers, motivators, and benefits: Middle-aged men’s perceptions of physical activity”, until 30 October 2011 with the provision of a progress report annually and a final report on completion.

Please quote the project number and title as indicated above on all correspondence related to this project.

Yours sincerely

Dr Janette Perz
Chair, UWS Human Research Ethics Committee
Appendix O. ManUp UWS information page contents for the UWS website.

ManUp UWS
An internet-based physical activity intervention for male UWS staff aged 35-64 years.

What is ManUp UWS about?

The purpose of the ManUp UWS initiative is to implement and evaluate an internet-based intervention designed to increase levels of physical activity and reduce sedentary time in males aged between 35 and 64 years, employed at the University of Western Sydney.

Just briefly, ManUp UWS participants will:

- Be randomly allocated to either the ManUp UWS internet-based group or a group that receives a range of print-based material to encourage physical activity
- Participate in a 12-week intervention designed to increase physical activity and reduce sedentary time
- Have their physical activity, height, weight, waist circumference, and blood pressure measured at three time points

Participants will be able to work alone – tracking their physical activity progress as they go, or choose to set group challenges and compete against a mate.

Who is carrying out the study?

The project is being carried out with both a program focus and research focus by Emma George, PhD Candidate in the School of Science and Health at the University of Western Sydney. ManUp UWS is endorsed by the Office of People and Culture as an initiative of the Our People 2015 Staffing Strategy.

The research is supervised by Professor Gregory Kolt and Dr Ric Rosenkranz.
Am I eligible to participate in ManUp UWS?

✓ Are you a male UWS staff member (ongoing or fixed-term) aged between 35 and 64 years?

✓ Is your current physical activity level low and needs improvement?

✓ Are you interested in becoming more active?

If you answered YES to these questions, you may be eligible to participate! Email ManUp@uws.edu.au now to find out more now!

Do you know of anyone else who might be interested? There’s nothing better than teamwork and a bit of friendly competition to boost motivation – encourage them to ManUp too!

How much time will the program take?

The program will last for 12 weeks, with one extra follow-up session a further 12 weeks later. During this time, participants will be able to utilise elements of the program at any time and at their own pace. There is no limit to the time participants must spend using the program – it is entirely up to them.

How will participation in the study benefit me?

Participation in regular physical activity is associated with a range of health benefits, including weight reduction, reduced risk of chronic disease and improved mental health. Many of these benefits are long-term, so although participants may not see any substantial immediate benefits (apart from feeling good), adherence to the program will help to improve overall health and well-being.

What if I require further information or would like to get involved?

If you would like to know more at any stage or if you would like to get involved in ManUp UWS, please contact:

Emma George

Email: ManUp@uws.edu.au

This project has been approved by the UWS Human Research Ethics Committee (approval number H9339).
Appendix P. Recruitment flyers for Study 3.
Are you a male UWS staff member aged between 35 and 64?

Would you like to become more physically active?

ManUp and take the challenge today!

All ongoing and fixed-term male UWS staff aged between 35 and 64 years are invited to participate in ManUp UWS.

An initiative of the Our People 2015 Staffing Strategy, ManUp UWS is a 12-week internet-based physical activity intervention developed especially for men just like you.

We know it can be difficult to fit in regular physical activity, so we have developed a flexible program where you can set your own goals and choose your own activities – you just have to ManUp and take the challenge!

Visit [www.uws.edu.au/manup](http://www.uws.edu.au/manup) or email ManUp@uws.edu.au to get started.
Appendix Q. Recruitment email from Vice-Chancellor.

Dear (participant),

We recognise the importance of the health and wellbeing of our staff.

Men are known to have a higher risk of certain diseases and a lower life expectancy than women. Participation in regular physical activity is associated with a range of health benefits, including reduced risk of chronic diseases, weight reduction, and improved mental health.

I am pleased to invite you to participate in the ManUp UWS challenge. An initiative of the Our People 2015 Staffing Strategy, ManUp UWS is a 12-week program led by the School of Science and Health. ManUp UWS has been designed specifically for men who are not highly active but would like to increase their levels of physical activity.

The ManUp program is flexible – you set your own goals, choose your activities, and track your progress online. You can choose to work individually or to set group challenges.

All ongoing and fixed-term male staff between the ages of 35 and 64 are invited to participate.

To take up the challenge or find out more, visit http://www.uws.edu.au/manup.

Regards
Rhonda Hawkins

Acting Vice-Chancellor
Appendix R. ManUp UWS Study banner featured on UWS website homepage.
Appendix S. ManUp UWS promotional button featured on UWS website.
Appendix T. Content of the article featured in the *AroundUWS* newsletter.

Get active and ManUp

It’s a fact: Australian men have a lower life expectancy than women and it’s time to do something about it. Getting active has more health benefits than just losing weight; getting physical also reduces the risk of developing chronic diseases that can lead to premature death and has been proven to boost mental health; after all, what’s better than a walk or some other activity to clear the head?

“Research shows that Australian men experience higher rates of certain chronic diseases and have a lower life expectancy than females,” says Emma George, a PhD candidate in the School of Science and Health. “Increasing physical activity is one way to reduce the risk of developing chronic diseases and improve overall health, although there aren’t a lot of physical activity programs tailored specifically for men.”

ManUp UWS is endorsed by the Office of People and Culture as an initiative of the Our People 2015 Staffing Strategy. The ManUp UWS program, which will run for 12 weeks, has been developed to implement and evaluate both an internet-based intervention and a print resources intervention designed to improve activity levels and reduce sedentary time for participants. ManUp UWS participants will be randomly allocated to either the ManUp UWS internet-based group or another group which receives a range of print-based material encouraging physical activity. Participants will have their physical activity, height, waist circumference, weight and blood pressure measured three times while undertaking the program.

ManUp UWS is flexible in its application: you can work alone, tracking your progress as you go, or set up group challenges and compete with friends. There’s also no limit on how much time participants need to spend using the program — it’s entirely up to them.

“We have had a lot of interest in the program so far,” says Emma. “The initial response has been very positive and it’s great to see so many male staff members wanting to increase their physical activity. There are already many staff who have commenced in the program and we are still looking for other male staff who are ready to ManUp.”

Do you want to ManUp?

Emma George, a PhD candidate from the School of Science and Health, is still recruiting male UWS staff members who want to get involved. To find out more information, visit the [ManUp webpage](#) or email Emma.
Appendix U. Emails sent to (1) potential, (2) eligible, and (3) ineligible participants.

1. Potential participants – expression of interest

Dear (insert name),

Thank you for expressing interest in ManUp UWS!

Before we send you any further information on the ManUp UWS program, please answer the following four questions via return email so we can ensure you are eligible for participation in the study.

Please note that this program is targeted towards men who are not currently doing enough physical activity, but would like to do more.

1. Are you currently aged between 35 and 64 years?

2. Are you currently employed at UWS in an ongoing or fixed-term position?

3. Do you have access to a computer with email and internet capabilities at least once each week?

4. Are you currently participating in any other weight loss or physical activity programs?

5. As a rule, do you do at least half an hour of moderate or vigorous physical activity (such as walking or sport) on five or more days a week?

We look forward to hearing back from you soon.

Kind regards

Emma George

2. Eligible participants

Dear (insert name),

Thank you for your email and your interest in the ManUp UWS program. Based on your responses, you are eligible to participate in the program.

Your participation will involve:

- Being randomly allocated to either the ManUp UWS internet-based group or a group that receives a range of print-based material to encourage physical activity
- Participating in a 12-week intervention designed to increase physical activity and reduce sedentary time
- Having physical activity, height, weight, waist circumference, and blood pressure measured on campus at three time points

The next step in taking up the ManUp UWS challenge will involve coming in for a brief introductory session on your home campus. At this session you will meet members of the research team, complete a brief demographic questionnaire, have health-related measurements taken, and be fitted with an accelerometer (a small, lightweight device to measure physical activity).

To assist with our planning, could you please list your home campus and indicate two preferences based on the session options below:

**Monday sessions:**
- Morning (between 10am and 12pm)
- Midday (between 12pm and 3pm)
- Afternoon (between 3pm and 5pm)

**Tuesday sessions:**
- Morning (between 10am and 12pm)
- Midday (between 12pm and 3pm)
- Afternoon (between 3pm and 5pm)

**Thursday sessions:**
- Morning (between 10am and 12pm)
- Midday (between 12pm and 3pm)
- Afternoon (between 3pm and 5pm)

We look forward to hearing from you.

Kind regards

Emma

**3. Ineligible participants**

Dear (insert name),

Thank you for your email and your interest in the ManUp UWS program.

As indicated earlier, this program is targeted towards men who are not currently doing enough physical activity, but would like to do more. Based on your answer to question 4, you have indicated that you do participate in at least half an hour of moderate or vigorous physical activity (such as walking or a sport) on five or more days a week. Unfortunately, you are therefore not eligible to participate in this program at this stage.
Although you aren’t eligible for this program, we still encourage you to increase your current levels of physical activity to improve your health! You may find the following information helpful:

Australian physical activity guidelines for adults:

Get Healthy Information and Coaching Service:
http://www.uws.edu.au/wellbeing_mentalhealth/get_healthy_information_and_coaching_service

We thank you again for your time and for registering your interest in ManUp UWS, and keep up the good work!

Kind regards

Emma
Appendix V. ManUp UWS printed resources and physical activity challenges.
What is ManUp UWS?

ManUp UWS is a physical activity program designed by a collaborative research team just for men aged between 35 and 64 years.

UWS is a great place to work, but as we all know, sometimes our jobs can keep us glued to our seats, which is not good for our health. It can be difficult to get started, but with the help of ManUp UWS, you CAN become more active and lead a healthier life.

So, what are you waiting for?

GetUp!

Did you know that prolonged amounts of sitting on a daily basis can increase your risk of developing chronic diseases such as type 2 diabetes and cardiovascular disease?[1-3]

Make a point of getting up and breaking up your seated time during the day. Stand up and have a stretch, walk to the photocopier, walk to a colleague’s office, go for a walk around campus at lunch - anything to get you up and moving!

AimUp!

Set yourself some achievable goals, and select a range of activities you enjoy. Tailor your goals to suit your preferences - you will be more likely to achieve these goals.

If you prefer playing a sport over going to the gym, try to organise a friendly game with family or friends. Being active doesn't have to feel like a chore! Start off small and then aim for those bigger, more challenging goals.

JoinUp!

Why not look into joining a gym, or a social team or competition? Lots of sporting clubs offer social competitions on different days during the week.

Jump online to check out what’s available in your local area!

ManUp!

Take responsibility for your health and well-being. By following these simple tips and using ManUp UWS, you’re well on your way to becoming more active and improving your health!

ManUp and take the challenge!
References


Who is ManUp UWS?

You are ManUp UWS! This project has been designed with the input of men just like you so you can get the most out of it!

The project is for men from UWS who want to become more active, improve their health and are not afraid of a challenge.

The original ManUp project was funded by Queensland Health and developed by researchers from four different organisations:

- Centre for Physical Activity Studies @ CQUniversity
- University of Western Sydney
- Australian e-Health Centre @ CSIRO in Brisbane
- Food and Nutritional Sciences @ CSIRO in Adelaide

ManUp UWS is endorsed by the Office of People and Culture at UWS as an initiative of the Our People 2015 Staffing Strategy.

For any enquiries, your main point of contact is Emma George
Email: ManUp@uws.edu.au
Why UWS?

Being a part of the UWS community ourselves, we are keen to help improve the health and well-being of our peers and co-workers.

We know from previous research and our own experience that many UWS staff members spend a lot of time sitting at work, so we want to try and reduce that!

Whether it is going for a walk around our beautiful campuses at lunchtime, before work, or after work; or incorporating regular physical activity into your daily routine, we want you to ManUp and get active!

The risk of many chronic diseases increases with age, and participation in regular physical activity is one way to reduce this risk. It's never too late to make a change and become more active!

The UWS Our People 2015 Staffing Strategy has a strong focus on the health and well-being of UWS staff. The ManUp UWS project will play a significant role in the promotion of regular physical activity – an important factor for a healthy lifestyle.
What is Physical Activity?

Many people think that being physically active is just about going to the gym and doing high intensity exercise, but physical activity can include any type of movement where your body uses energy.\(^4\)

This can include sports (e.g. cricket, football, soccer), structured exercise (e.g. going to the gym or jogging) or everyday activities like gardening, walking for transportation and some household chores such as mowing the lawn...although ride-on mowers don't count!

When you consider all the ways you can be physically active, it does not have to seem like a chore! The National Physical Activity Guidelines for adults\(^5\) are outlined below, and are made up of four easy steps.

Step 1 and step 2 are recommended ways to help you find opportunities to be active every day, and step 3 represents the minimum amount of physical activity for health benefits. Once you have successfully introduced physical activity into your everyday routine, step 4 introduces more intense activity, which can lead to greater improvements in health and well-being.

**Step 1. Think of movement as an opportunity, not an inconvenience!**
**Step 2. Be active every day in as many ways as you can (e.g. walk or cycle instead of driving for transportation).**
**Step 3. Put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days (achieving 30 minutes per day through shorter, 10 to 15 minute sessions, is OK).**
**Step 4. If you can, also enjoy some regular, vigorous activity for extra health and fitness benefits.**

What is the difference between moderate and vigorous physical activity?

**Moderate physical activity** raises your heart and breathing rate, but you should still be able to have a conversation with the people around you.\(^5\)

**Vigorous physical activity** increases your heart and breathing rate to the point that you can no longer hold a conversation and start to build up a sweat.\(^5\) **ManUp** and participate in vigorous activity on a regular basis for maximum health benefits!
References


List of Physical Activities

We know there is no one-size-fits-all approach to physical activity, so we have included a range of activities to suit everyone!

Swimming
A low-impact activity for any fitness level. Swimming is great for your joints and works your major muscle groups.

Walking
Anywhere, any time...walking can be incorporated into your daily routine, whether it is for transport or leisure.

Cycling
Another low-impact activity that works the legs and helps improve cardiovascular health.

Running
Can be done anywhere, at any intensity and is great for weight loss and bone health. For an extra challenge, try running on sand or up an incline.

Sport and Recreation
Participating in any sport or leisure activity can help improve your health. Why not join an organised team, or just get some mates together for a game of footy or cricket at the park or beach? This physical activity category can include just about anything, so be creative!

Strengthening
Resistance training is great for bone health and building and maintaining muscle tone.

What are you waiting for? Give one of these great activities a go today!
Benefits of Physical Activity

There are countless, well-established health-related benefits of being physically active.[6-9] You may already be aware of some of them, but here’s a reminder of some of the key benefits to help get you motivated.

Regular physical activity helps you:

- Improve your overall physical and mental health
- Keep mobile for when you’re older
- Reduce your risk of developing cardiovascular disease and diabetes
- Prevent weight gain and helps to lose those extra centimetres around your waist
- Live a longer, healthier life
- Reduce your risk of developing some forms of cancer
- Increase your fitness to make other activities easier
- Concentrate at work

In addition to these physical and psychological benefits, have you considered the social benefits of being physically active?

Or perhaps the economic and environmental benefits?

Social benefits - Being physically active is a great way to meet new people! You might consider joining a local sporting team, participating in group classes at the gym, or just visiting local parks and facilities where other like-minded people exercise. You can also encourage your friends and family to get active with you, which can be a lot more fun!

Economic benefits - Physical activity improves your health which means you end up spending less money on medical bills. You can also save cash on fuel if you walk or cycle instead of driving to where you need to go. Keep in mind, you do not have to spend a lot to be active...utilise local facilities and open areas like parks or lakes.

Environmental benefits - You might not think it is a big deal, but if you walk or cycle instead of taking the car you can reduce air and noise pollution as well as reduce your use of fossil fuels.
Research shows that some of the main benefits men associate with physical activity include:

General physical and mental health – including general health, reduced susceptibility to illness, and lower risk of developing chronic diseases
Stress relief – including escaping from hectic schedules
Weight – reducing the health risks associated with being overweight, and improving appearance.

References


Being Active On and Around Campus

There are many places that you can be active for little or no cost on or around your campus. Here are some ideas:

- Walking trails
- Cycleways
- Ovals
- Local parks
- Botanic gardens
- Rivers and lakes
- Swimming pools
- Sports courts and clubs

UWS Bankstown campus

Recreation areas on and around the Bankstown campus:

- UWS Bankstown campus - in addition to the campus gym, you can get active on the tennis courts, get a friendly game together on the sports oval, have a hit in the cricket nets, or go for a walk or jog on the designated paths and athletics track on campus.
- Action Indoor Sports Bankstown offer a range of competitions form indoor sports such as cricket, netball and soccer. [Google Map](http://www1.bankstown.nsw.gov.au/Cycleways/default.aspx)
- For athletics competitions for all ages and abilities, check out Bankstown Sports Senior Athletic Club. [Google Map](http://www1.bankstown.nsw.gov.au/Cycleways/default.aspx)
- Visit one of the many golf courses in the Bankstown area. [Google Map](http://www1.bankstown.nsw.gov.au/Cycleways/default.aspx)

Gyms in and around the Bankstown area:

UWS Campbelltown campus

Recreation areas on and around the **Campbelltown** campus:

- UWS Campbelltown campus - in addition to the campus gym, you can get active on the basketball or tennis courts, get a friendly game together on the sports oval, or go for a walk or jog on the designated paths around campus.
- Camden Squash Courts - try something different! [Google Map](#)
- Camden Tennis Club - a range of competitions to suit all skill levels. [Google Map](#)
- Camden War Memorial Pool - featuring heated pools and personal training programs, the newly-renovated centre is ideal. [Google Map](#)
- Minto Indoor Sports Centre - for basketball, volleyball, futsal and martial arts. [Google Map](#)
- Cycleways in the Campbelltown region include Eschol Park Sports Complex, Macquarie Fields Bike Track, Raby Cycleway.

Gyms in and around the **Campbelltown** area:


UWS Hawkesbury campus

Recreation areas on and around the **Hawkesbury** campus:

- UWS Hawkesbury campus - in addition to the campus gym, Hawkesbury campus features an indoor basketball court, tennis courts and a pool. Get some volunteers together for a friendly game of soccer or footy on the sports oval, or set up a game of cricket.
- Visit Hawkesbury District Tennis Association - a range of competitions to suit all skill levels. [Google Map](#)
- YMCA Hawkesbury Indoor Stadium offer indoor competitions for a range of sports including touch football, soccer, futsal, and netball. [Google Map](#)
- Go for a swim at Hawkesbury Oasis [Google Map](#) or Richmond Pool [Google Map](#)
- Visit one of the golf courses located in the Hawkesbury region. [Google Map](#)
Gyms in and around the Hawkesbury area:

- Hawkesbury Oasis (YMCA) http://www.ymcasydney.org/centre/oasis/
- For something a little different, try Hawkesbury Outdoor Fitness http://www.hawkesburyoutdoorfitness.com.au/
UWS Parramatta campus

Recreation areas on and around the Parramatta campus:

- UWS Parramatta campus - get active on the tennis court, get a friendly game together on the sports oval, or go for a walk, jog or bike ride on the designated paths around campus.
- Take a trip to Parramatta Park - jog, cycle, or enjoy a leisurely walk along the banks of the Parramatta River. [Google Map](#)
- Visit serene Lake Parramatta Reserve for a quick jog, a leisurely walk, or a bike ride. [Google Map](#)
- Visit one of the many golf courses in the Parramatta area. [Google Map](#)

Gyms in and around the Parramatta area:

UWS Penrith campus

Recreation areas on and around the Penrith campus:

- UWS Kingswood campus - in addition to the newly-refurbished gym, the Kingswood campus features basketball and tennis courts, a sports oval and walking/bicycle trails.
- UWS Werrington South and Werrington North campuses - walking/bicycle trails.
- The Great River walk - jog, cycle, or enjoy a leisurely walk along the banks of the Nepean River. [Google Map](#)
- Jamison Park - a popular spot for team sports, group exercise, and walking the dog, with a newly developed off-leash dog park for man's best friend. [Google Map](#)
- Sydney International Regatta Centre - built for the 2000 Sydney Olympics, this venue is great for walking, cycling or jogging. You can also try kayaking! [Google Map](#)
- Ripples Leisure Centre, St Marys - hit the gym or swim a few laps in the indoor and outdoor swimming pools. [Google Map](#)
- The Kingsway playing fields, Werrington - a great open space for a friendly game of soccer, football or cricket. [Google Map](#)
- Penrith Valley Regional Sports Centre - home to several team sports including basketball, volleyball, futsal and badminton. [Google Map](#)

Gyms in and around the Penrith area:

**Other options:**

Have you ever thought about giving 'active transport' a go? Visit this link for different transport options for your campus:

http://www.uws.edu.au/campuses_structure/cas/campuses/getting_to_uni

Alternatively, here you will find maps and guides for cycling to and from campus, plus bicycle parking options and showers on campus:

http://www.uws.edu.au/campus_safety_and_security/security/transport_and_accessibility/cycling@uws

Not everyone lives close to their main campus, so here are some suggested websites to help you find a location or venue where you can get active in the wider Sydney area:

For walking, jogging and cycling trails, check out:
- http://www.stepwhere.com/listpaths

For public swimming pools, take a look at:

For an extensive list of sports and contact information for local sporting clubs, visit:
Sedentary Time

We know that physical activity is good for us (if you aren’t aware of the benefits, maybe you should check out the Benefits of physical activity page), and most of us know that we should probably make an effort to do more.

But what about the other end of the spectrum? How often do you think about the time you spend sitting each day?

Although physical activity is known to reduce the risk of developing some chronic diseases, even people who are active every day are at risk of these diseases if they spend a lot of time sitting.

Independent of physical activity levels, research shows that people who spend more time sitting increase their risk of being overweight or obese,\textsuperscript{[10]} or of developing the metabolic syndrome.\textsuperscript{[11,12]} Furthermore, higher levels of daily sitting have been found to increase the risk of mortality from both cardiovascular disease and from all-causes.\textsuperscript{[3,13]}

For a lot of men, especially those working in sedentary jobs, the main contributors to daily sitting time include:

- **Sitting at work**: usually sitting at a desk
- **Being in front of the computer**: mostly for work-related tasks
- **Daily commuting**: typically to and from work each day

Although some people are conscious of their daily sitting time and make an effort to try and break up long blocks of sitting, it can often be quite difficult to find the time. It is important to take notice of, and try to limit the amount of time you spend sitting each day.

For some, high volumes of sitting time may be seen as a by-product of working in a university environment, but it is important to take notice of, and try to limit the amount of time you spend sitting each day.

\textsuperscript{\textsuperscript{*} Metabolic syndrome: A group of risk factors including central obesity (extra weight around the waist), high blood pressure, and insulin resistance, which can significantly increase risk of developing type 2 diabetes and cardiovascular disease.\textsuperscript{[14]}}
References


Barriers to Reducing Sedentary Time

Some of the most common barriers preventing people from reducing their sedentary time include:

- **Having to sit at a desk or computer to work** - sometimes it can be hard to find time to leave your desk, especially when the work you are doing requires you to be at your computer.

- **Having a high workload and pressure to deliver** - knowing you have a deadline or a backlog of work can make it much more tempting to stay at your desk.

- **Enjoying sedentary hobbies such as reading, writing or playing instruments** - if the activities you are doing while sitting are enjoyable, it can be harder to find the motivation to get up and be active.

Strategies to Overcome Barriers to Reducing Sedentary Time

Here are some commonly suggested strategies to overcome these barriers:

- **Walking to a Colleague's office, rather than emailing them**

- **Taking regular walks throughout the day**

- **Taking the stairs instead of the lift**

- **Avoiding computer on weekends or after work if possible**
Tips for being active

Get your gear
You don’t need a lot of equipment to increase your physical activity, in fact, for a lot of activities; all you need is some comfortable clothing and a pair of sports shoes suitable for the activity you’re going to participate in. They don’t have to be expensive, just appropriate for that activity.

Warm up – Stretch – Cool down
Before you get started, it’s a good idea to warm-up and get your muscles ready for physical activity. A short walk or jog followed by some light stretches will help reduce the risk of muscle soreness and injury, and will help you get the most out of your workout. Also remember to cool down with some light activity and some light stretching to aid recovery and reduce soreness.

Don’t overdo it
Improving your fitness levels and health takes time, so you need to make sure you are committed to progressively increasing your activity levels and sticking to your goals and challenges. There is no need to rush, and you are more likely to maintain and improve your physical activity levels if you take it easy and allow enough time to get into a routine.

Be sun smart
The Australian sun can be very damaging, so always remember to cover up before being active outdoors. Make sure you wear a hat and protective clothing and apply (and re-apply) plenty of sunscreen. If you are being active outdoors, it is also a good idea to take regular breaks in the shade.

Stay hydrated
Make sure you drink plenty of water before, during, and after your physical activity session. It can be easy to become dehydrated, particularly in the summer months, so don’t wait until you are thirsty! Remember to carry a water bottle with you at all times so you can stay hydrated.
**Boosting Motivation for Physical Activity**

Common motivators for being physically active include:

Health – including general health, and maintaining health with age.

Family – for example, being a good role model for kids.

Enjoyment – some people just love being active, and see that as a motivator.

Social aspects, like being part of a team – enjoying the company of others and sharing the experience with people in a club or team can be a rewarding experience.

While the motivators for physical activity are usually pretty clear, a lot of men tend to find it hard to overcome barriers to being physically active.

**Common Barriers to Being Physically Active**

The main barriers that often stop men from being as active as they could be include:

Time – finding time to be active can sometimes be difficult, especially for those with busy schedules.

Work – a lot of people work long hours or take work home with them, which often limits the time they have to be active.

Age – for those who remain inactive, it may become more and more difficult to break old habits as general physical function tends to decrease, and aches and pains seem to increase!

Lack of motivation – a lot of people struggle with motivation and it’s often easier to talk yourself out of being active than it is to talk yourself into it!

No social network to belong to – it can be hard to motivate yourself to be active, but when you are part of a group or team, you can’t back out as easily.
Strategies to Overcome Barriers to Being Physically Active

There are a number of strategies to overcome these barriers, and these can be as easy as changing daily habits and encouraging small changes, for example, parking the car further away from the building at work. Other strategies to overcome barriers include:

Building physical activity into daily routines – which can include simple things like taking the stairs instead of the lift, or parking the car further away from the office or the shops.

Organising social teams or finding others to be active – having that network of friends or teammates can make a big difference! Belonging to a social group can boost motivation and encourage a bit of friendly competition.

Providing a range of activities for people at a range of skill and fitness levels – there is no one-size-fits-all approach to physical activity, and everyone has different interests and skill levels so it’s important to find what works for you.

Boosting motivation – deciding on individual goals and sticking to a regular routine is important – keeping these goals in mind can act as a pretty strong motivator. Again, it’s important to find what works for you.
The ManUp UWS Physical Activity Challenges

Here are some different types of activities you might like to try. To help improve your physical activity levels, we have developed a range of challenges for each activity. You might want to start off with one of the 3 week challenges and work your way up – it is up to you.

Walking challenges

<table>
<thead>
<tr>
<th>Minutes of walking</th>
<th>270 minutes over 3 weeks</th>
<th>900 minutes over 6 weeks</th>
<th>2,520 minutes over 12 weeks</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Number of steps</th>
<th>157,500 steps over 3 weeks</th>
<th>420,000 steps over 6 weeks</th>
<th>1,000,000 steps over 12 weeks</th>
</tr>
</thead>
</table>

Swimming challenges

<table>
<thead>
<tr>
<th>Total metres of swimming</th>
<th>3,000 metres over 3 weeks</th>
<th>12,000 metres over 6 weeks</th>
<th>36,000 metres over 12 weeks</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Minutes of swimming</th>
<th>90 minutes over 3 weeks</th>
<th>360 minutes over 6 weeks</th>
<th>1,080 minutes over 12 weeks</th>
</tr>
</thead>
</table>
## Cycling challenges

<table>
<thead>
<tr>
<th>Total metres of cycling</th>
<th>75,000 metres over 3 weeks</th>
<th>300,000 metres over 6 weeks</th>
<th>1,200,000 metres over 12 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes of cycling</td>
<td>180 minutes over 3 weeks</td>
<td>720 minutes over 6 weeks</td>
<td>2,880 minutes over 12 weeks</td>
</tr>
</tbody>
</table>

## Running challenges

<table>
<thead>
<tr>
<th>Total metres of running</th>
<th>15,000 metres over 3 weeks</th>
<th>60,000 metres over 6 weeks</th>
<th>240,000 metres over 12 weeks</th>
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<tbody>
<tr>
<td>Minutes of running</td>
<td>90 minutes over 3 weeks</td>
<td>360 minutes over 6 weeks</td>
<td>1,440 minutes over 12 weeks</td>
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## Sport and recreation challenges

| Minutes of sport and recreation                           | 90 minutes over 3 weeks     | 260 minutes over 6 weeks    | 1,080 minutes over 12 weeks   |
Strengthening challenges

<table>
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<tr>
<th>Total repetitions</th>
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<tr>
<td>480 repetitions over 3 weeks</td>
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<tr>
<td>1,920 repetitions over 6 weeks</td>
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<tr>
<td>5,760 repetitions over 12 weeks</td>
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We have provided some weekly physical activity logs for you to record your activity progress. These logs are for your own reference, and the research team will not be collecting them.

Select one or more goal/s from the list above and record it in the ‘Overall goal’ box, then break the goal down into several, more achievable parts in the ‘Week X goal’ box. Record the amount of activity you do each day, add the total amount of activity in the ‘Total’ box, and see if you can tick off these challenges as you go.
### My Physical Activity – Week 1 Progress

#### Challenges for week 1

<table>
<thead>
<tr>
<th>Activity</th>
<th>Walking</th>
<th>Cycling</th>
<th>Swimming</th>
<th>Running</th>
<th>Sport &amp; Rec</th>
<th>Strengthening</th>
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<tr>
<td>Overall goal</td>
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<tr>
<td>Week 1 goal</td>
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<td>Monday</td>
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<td><strong>Challenge completed?</strong></td>
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</tbody>
</table>

* Logs were provided for week 1-12.
Appendix W. Process evaluation questionnaire for internet-based intervention.

ManUp UWS
Program evaluation questionnaire

The details you provide on this questionnaire will be used to help our understanding of how you rate the specific components of the ManUp UWS program. Once you have completed the questionnaire, this cover sheet will be removed.

Please fill in the blanks as clearly as possible or circle/check the most appropriate response for the following questions.

Participant name: ..........................................................................................................

Today’s date: ..............................................................


1. Why did you join the ManUp UWS program? Please select as many as are relevant.

- To increase physical activity
- To reduce sedentary time
- To lose weight
- To meet like-minded people
- For health reasons
- To get motivated to improve my lifestyle

Other reasons not listed above:

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2. How much of the printed material did you read?

No material | Less than half | About half | More than half | All material
-------------|---------------|------------|----------------|-----------------|
1            | 2             | 3          | 4              | 5               |

If you did not read **any** of the printed material, please proceed to question 6.

3. How much did you learn by reading the printed material?

Nothing at all | A little | A moderate amount | A lot | A great deal
----------------|---------|------------------|-------|-----------------|
1               | 2       | 3                | 4     | 5               |

4. How much did the information provided in the printed materials encourage or motivate you to become more physically active?

Not at all | A little | A moderate amount | A lot | A great deal
-----------|---------|------------------|-------|-----------------|
1          | 2       | 3                | 4     | 5               |
5. The printed materials covered a range of topics related to physical activity and health. Please rate the importance/relevance of each of the following topics in relation to your participation in the ManUp program.

   a. Physical activity

<table>
<thead>
<tr>
<th>Importance</th>
<th>Unimportant</th>
<th>Of little importance</th>
<th>Moderately important</th>
<th>Important</th>
<th>Very important</th>
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<td>3</td>
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<td></td>
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</tbody>
</table>

   b. Sedentary time

<table>
<thead>
<tr>
<th>Importance</th>
<th>Unimportant</th>
<th>Of little importance</th>
<th>Moderately important</th>
<th>Important</th>
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</thead>
<tbody>
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<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
<td></td>
</tr>
</tbody>
</table>

   c. Being active on and around your campus

<table>
<thead>
<tr>
<th>Importance</th>
<th>Unimportant</th>
<th>Of little importance</th>
<th>Moderately important</th>
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<td>2</td>
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</tbody>
</table>

   d. Overcoming barriers related to physical activity and sedentary time

<table>
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<tr>
<th>Importance</th>
<th>Unimportant</th>
<th>Of little importance</th>
<th>Moderately important</th>
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</table>

   e. Boosting motivation for physical activity

<table>
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<th>Importance</th>
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</table>
f. Physical activity challenges and logs

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Additional comments on any of the material (optional)

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6. What did you enjoy most about the ManUp UWS program? Please give details.

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7. **What did you like least about the ManUp UWS program? Please give details.**

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8. **Since beginning the ManUp UWS challenge, would you say your physical activity levels have:**

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<th>Greatly decreased</th>
<th>Decreased</th>
<th>Remained unchanged</th>
<th>Increased</th>
<th>Greatly increased</th>
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</table>

9. **Since beginning the ManUp UWS challenge, would you say the amount of time you spend sitting or being sedentary has:**

<table>
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<th></th>
<th>Greatly decreased</th>
<th>Decreased</th>
<th>Remained unchanged</th>
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</table>
10. **How often did you login to the ManUp UWS website during the 12-week challenge period?**

<table>
<thead>
<tr>
<th>At least daily</th>
<th>At least weekly</th>
<th>At least fortnightly</th>
<th>At least monthly</th>
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</table>

11. **How often did you set physical activity challenges during the 12-week challenge period?**

<table>
<thead>
<tr>
<th>At least daily</th>
<th>At least weekly</th>
<th>At least fortnightly</th>
<th>At least monthly</th>
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</table>

12. **To what degree did setting physical activity challenges motivate or encourage you to become and remain physically active?**

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>A moderate amount</th>
<th>A lot</th>
<th>A great deal</th>
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13. **How often did you track your physical activity progress during the 12-week challenge period?**

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<th>At least daily</th>
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14. **To what degree did the physical activity tracking tool motivate or encourage you to become and remain physically active?**

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<tr>
<th>Not at all</th>
<th>A little</th>
<th>A moderate amount</th>
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15. How often did you use the body weight/body mass index (BMI) tracker during the 12-week challenge period?

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<tr>
<th>At least daily</th>
<th>At least weekly</th>
<th>At least fortnightly</th>
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16. To what extent did the BMI tracking tool motivate you to keep track of your weight?

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<tr>
<th>Not at all</th>
<th>A little</th>
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17. How often do you use social networking sites (e.g. Facebook, Twitter)?

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18. Which physical activities in the list of ManUp UWS physical activity challenges were most relevant to you? Please select as many as are relevant.

- [ ] Running
- [ ] Cycling
- [ ] Walking
- [ ] Strengthening
- [ ] Swimming
- [ ] Sport and Recreation
Comments on the physical activities included in the ManUp UWS program (optional):

19. Do you have any other suggestions for improvements or changes to be made to the ManUp UWS program?
Appendix X. Process evaluation questionnaire for printed resources comparison group.

ManUp UWS

Program evaluation questionnaire

The details you provide on this questionnaire will be used to help our understanding of how you rate the specific components of the ManUp UWS program. Once you have completed the questionnaire, this cover sheet will be removed.

Please fill in the blanks as clearly as possible or circle/check the most appropriate response for the following questions.

Participant name: ................................................................................................

Today’s date: ......................................................................................
1. Why did you join the ManUp UWS program? Please select as many as are relevant.

- [ ] To increase physical activity
- [ ] To reduce sedentary time
- [ ] To lose weight
- [ ] To meet like-minded people
- [ ] For health reasons
- [ ] To get motivated to improve my lifestyle

Other reasons not listed above:

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2. How much of the printed material did you read?

<table>
<thead>
<tr>
<th>No material</th>
<th>Less than half</th>
<th>About half</th>
<th>More than half</th>
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</table>

If you did not read any of the printed material, please proceed to question 6.

3. How much did you learn by reading the printed material?

<table>
<thead>
<tr>
<th>Nothing at all</th>
<th>A little</th>
<th>A moderate amount</th>
<th>A lot</th>
<th>A great deal</th>
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4. How much did the information provided in the printed materials encourage or motivate you to become more physically active?

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</table>
5. The printed materials covered a range of topics related to physical activity and health. Please rate the importance/relevance of each of the following topics in relation to your participation in the ManUp program.

   a. Physical activity

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   b. Sedentary time

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</table>

   c. Being active on and around your campus

<table>
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   d. Overcoming barriers related to physical activity and sedentary time

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   e. Boosting motivation for physical activity

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### Physical activity challenges and logs

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**Additional comments on any of the material (optional)**

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**6. What did you enjoy most about the ManUp UWS program? Please give details.**

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7. What did you like least about the ManUp UWS program? Please give details.

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8. Since beginning the ManUp UWS challenge, would you say your physical activity levels have:

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<thead>
<tr>
<th>Greatly decreased</th>
<th>Decreased</th>
<th>Remained unchanged</th>
<th>Increased</th>
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</table>

9. Since beginning the ManUp UWS challenge, would you say the amount of time you spend sitting or being sedentary has:

<table>
<thead>
<tr>
<th>Greatly decreased</th>
<th>Decreased</th>
<th>Remained unchanged</th>
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</table>

10. How often did you set physical activity challenges during the 12-week challenge period?

<table>
<thead>
<tr>
<th>At least daily</th>
<th>At least weekly</th>
<th>At least fortnightly</th>
<th>At least monthly</th>
<th>Never</th>
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11. To what degree did setting physical activity challenges motivate or encourage you to become and remain physically active?

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</table>

12. How often did you track your physical activity progress during the 12-week challenge period?

<table>
<thead>
<tr>
<th>At least daily</th>
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<th>At least fortnightly</th>
<th>At least monthly</th>
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</table>

13. Which physical activities in the list of ManUp UWS physical activity challenges were most relevant to you? Please select as many as are relevant.

- Running
- Cycling
- Walking
- Strengthening
- Swimming
- Sport and Recreation

Comments on the physical activities included in the ManUp UWS program (optional):

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14. Do you have any other suggestions for improvements or changes to be made to the ManUp UWS program?
Appendix Y. Participant information sheet for Study 3.

Participant Information Sheet (General)

An information sheet, which is tailored in format and language appropriate for the category of participant - adult, child, young adult, should be developed.

Notes: Not all of the text in this form is visible, please click your cursor anywhere on the page to expand the row. To view guidance on what is required in each section, hover your cursor over the bold text. Further instructions are on the last page of this form.

Project Title: ManUp UWS: Internet-based physical activity intervention for middle-aged men

Who is carrying out the study?
You are invited to participate in a study conducted by Miss Emma George, PhD Candidate in the School of Science and Health at the University of Western Sydney.

Supervisors:
Prof Gregory Kolt
Dean, School of Science and Health
University of Western Sydney

Dr Ric Rosenkranz
Assistant Professor
Co-director Youth Health Behavior Research Lab Department of Human Nutrition
Kansas State University

What is the study about?
The purpose of this study is to develop, implement, and evaluate an internet-based intervention designed to increase levels of physical activity (and reduce sedentary behaviours) in men aged between 35 and 64 years, employed at the University of Western Sydney.

What does the study involve?
The study will involve the completion of a short questionnaire on demographic characteristics and lifestyle behaviours, plus participation in a 12-week physical activity intervention designed for men aged between 35 and 64 years. Outcome measures including physical activity, sedentary time (time spent sitting), height, weight, waist circumference, blood pressure, and health-related quality of life will be obtained at several time points. Measurements will be taken at baseline and will be taken again at three months (12 weeks - end of formal intervention) and six months (24 weeks - post-baseline follow-up) time points from the beginning of the intervention. Participants may be requested to interact with a free internet-based program, allowing them to keep track of their physical activity progress. Participants will also be given printed materials on physical activity and health. At the completion of the program (week 12), participants will be given the opportunity to provide valuable feedback on the program through an evaluation.

How much time will the study take?
The intervention period will last for 12 weeks and during this time, participants will be able to utilise elements of the program at any time and at their own pace. Participants will be encouraged to spend as
much or as little time using the program as they feel is needed. A further follow-up session will be held at week 24 (12 weeks after the intervention has been completed). The demographic questionnaire will take approximately 5 minutes to complete and the measurement sessions (at weeks 0, 12, and 24) will take approximately 10-20 minutes. An evaluation of the program will be carried out at the end of the formal intervention (week 12) and this evaluation will take approximately 10-15 minutes to complete.

Will the study benefit me?
Participation in regular physical activity is associated with a range of health benefits, including weight reduction, improved mental health, and reduced risk of chronic disease. Many of these benefits are long-term, so although you may not see any substantial immediate benefits, adherence to the program will help to improve your overall health and well-being.

Will the study involve any discomfort for me?
The study will not involve any discomfort for you, however, should you feel uncomfortable or distressed at any time during the study period, you are free to withdraw from the study at any time without penalty or prejudice. In this case, any information given prior to your withdrawal will be retained (in non-identifiable format) in the study.

How is this study being paid for?
The study is being sponsored by the School of Science and Health at the University of Western Sydney.

Will anyone else know the results? How will the results be disseminated?
All aspects of the study, including results, will be confidential and only the researchers will have access to information on participants. Outcomes of this study and subsequent process evaluation will be published as part of the student's PhD thesis and in peer-reviewed journals and other scientific publications or presentations.

Can I withdraw from the study?
Participation is entirely voluntary: you are not obliged to be involved and - if you do participate - you can withdraw at any time without giving any reason and without any consequences.

Can I tell other people about the study?
Yes, you can tell other people about the study by providing them with the chief investigator's contact details. They can contact the chief investigator to discuss their participation in the research project and obtain an information sheet.

What if I require further information?
When you have read this information, Emma George will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact:

Miss Emma George
PhD Candidate
Email: ManUp@uws.edu.au

What if I have a complaint?
This study has been approved by the University of Western Sydney Human Research Ethics Committee. The Approval number is H5339.
If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through the Office of Research Services on Tel +61 2 4736 0229 Fax +61 2 4736 0013 or email humanethics@nsws.edu.au.

Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you may be asked to sign the Participant Consent Form.
Appendix Z. Informed consent form for Study 3.

Participant Consent Form

This is a project specific consent form. It restricts the use of the data collected to the named project by the named investigators.

Note: If not all of the text in the row is visible please ‘click your cursor’ anywhere on the page to expand the row. To view guidance on what is required in each section ‘hover your cursor’ over the bold text.

Project Title: ManUp UWS: Internet-based physical activity intervention for middle-aged men

I,....................................................................................., consent to participate in the research project titled ManUp UWS: Internet-based physical activity intervention for middle-aged men.

I acknowledge that:

I have read the participant information sheet and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

I consent to completing a demographic questionnaire and participating in a 12-week physical activity intervention, where I may be requested to interact with an online program. I consent to having outcome measures including height, weight, waist circumference, blood pressure, and health-related quality of life, taken at three time points (baseline, week 12, week 24). I also consent to completing a program evaluation at the conclusion of the 12-week program.

I understand that my involvement is confidential and that the information gained during the study may be published but no information about me will be used in any way that reveals my identity.

I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher/s now or in the future.

Signed: __________________________________________

Name: ____________________________________________

Date: _____________________________________________

Return Address: Emma George
                School of Science & Health
                University of Western Sydney
                Locked Bag 1797
                Penrith South DC NSW 2751

This study has been approved by the University of Western Sydney Human Research Ethics Committee.

The Approval number is H339
If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through the Office of Research Services on Tel +61 2 4736 3229 Fax +61 2 4736 0613 or email humanethics@unsw.edu.au. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
Appendix AA. Demographic questionnaire for Study 3.

ManUp UWS

Participant demographic questionnaire

The details you provide on this questionnaire will be used to describe the overall demographic characteristics of ManUp UWS participants. Please fill in the blanks as clearly as possible or check the most appropriate box for the following questions.

Your name: ______________________________________________________

Your age: _____________  Today’s date: _____/_____/___________

Campus: __________________  Office location: __________________

Ext: _______________  Mobile (or alternate): ____________________
Role at UWS (please tick):

- [ ] Academic
- [ ] General/Professional
- [ ] Other – please give details: ______________________________

What is the highest qualification you have completed?

- [ ] No school certificate or other qualifications
- [ ] School of intermediate certificate (or equivalent)
- [ ] Higher school or leaving certificate (or equivalent)
- [ ] Trade/apprenticeship (e.g. hairdresser, chef)
- [ ] Certificate/diploma (e.g. technician)
- [ ] University degree or higher

What is your usual yearly household income before tax, from all sources?

- [ ] Less than $20,000
- [ ] $20,000 to $39,999
- [ ] $40,000 to $59,999
- [ ] $60,000 to $79,999
- [ ] $80,000 to $99,999
- [ ] $100,000 to $119,999
- [ ] $120,000 to $139,999
- [ ] More than $140,000
- [ ] I would prefer not to answer this question
In general, would you say your health is:

- Excellent
- Very good
- Good
- Fair
- Poor

In general, how would you rate your quality of life?

- Excellent
- Very good
- Good
- Fair
- Poor

How would you rate your current physical activity level?

- Needs a lot of improvement
- Not bad, although I should probably do more
- Good, I am physically active on a regular basis

Comments on your current physical activity level:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Thank you for participating. Please return your completed questionnaire to the researcher.
Appendix BB. Accelerometer information sheet given to participants in Study 3.

Accelerometer information for ManUp UWS participants

How do I wear the accelerometer?
- The accelerometer is attached to an elastic belt that should be fitted securely, just above your right hipbone – the way it was fitted when you came in for your introductory session.
- The number (beginning with ‘S’ on the white sticker) should be facing up.
- You can wear the belt underneath or on top of your clothing, just make sure it does not move while you are being active.
- You can adjust the belt by pulling the end of the strap (to tighten) or pushing the strap through the loop (to loosen).
- Please do not let anyone else wear the accelerometer.

When do I wear the accelerometer?
- Please start wearing the accelerometer as soon as you receive it, and continue to wear it during waking hours for the next seven days.
- Please put the accelerometer on as soon as you wake up, or straight after you shower/bathe in the morning – it is very important that you wear the accelerometer during all waking hours over the next seven days.
- Please make sure you do not submerge the accelerometer in water (while swimming, bathing etc.), and remove the accelerometer when showering.
- The accelerometer must be taken off right before going to bed, but make sure you keep it in a place where you will remember to put it on the following morning (e.g. next to your alarm clock or mobile phone).

What does the accelerometer do?
- The accelerometer is a physical activity monitor that will record your movement throughout the day. Don’t worry, it is not a tracking device, and we won’t be able to tell exactly what type of activity you are doing. We will only be able to see how active you have been while you have been wearing the accelerometer.
- We will also be able to measure the intensity of your activity, so we will be able to determine the amount of time you spend being sedentary, and the time you spend in light, moderate, or vigorous activity.
Why have I been asked to wear the accelerometer?
- The accelerometer data we collect will allow us to determine your overall physical activity and sedentary time over a typical seven day period.

Can I see how much activity I have done?
- No, you will not be able to see how much activity you have done while wearing the accelerometer.
- The data needs to be downloaded using a specific program, so only the research team will be able to see how much activity you have done. This data will not be shared with anyone else.

Is there a power switch?
- No, there is no power switch for you to worry about. The accelerometer runs on a battery, so it will run continually without having to be switched on or off.
- Please do not try to open the accelerometer.

What if I forget to wear the accelerometer?
- It is very important that you wear the accelerometer for the entire seven days.
- If you forget to put it on when you first wake up, please make sure you put the accelerometer on as soon as you realise you have forgotten, and continue to wear it until you go to bed (remembering to remove it to swim or shower).

When/how do I return the accelerometer?
- You will return the accelerometer after wearing it for seven full days. The ManUp team will contact you by email with a return time and location. This will have been discussed at your introductory session.
- For our research to run smoothly, we need to collect all accelerometers on the specified day.
- If you are unable to return the accelerometer on the specified day, we ask that you let us know as soon as possible, so we can try to make alternate arrangements.

Why did the light on the accelerometer stop flashing?
- The light on the accelerometer has been set to stop flashing once it starts collecting physical activity data. The light should stop flashing at midnight, the day you collect it, and it should not flash again.
- If the light does start flashing again in the next seven days, please report this to the ManUp team at ManUp@uws.edu.au.

What if I have any further questions?
- If you have any questions that have not been answered here, please contact us at ManUp@uws.edu.au.
Appendix CC. Allocation letter given to participants assigned to the internet-based intervention group.

Dear (Insert participant name here)

Congratulations on making the decision to ManUp and become more active!

You have been allocated to the ManUp UWS internet-based group.

Over the next 12 weeks, you will have exclusive access to the ManUp UWS website, which has been designed especially for men who aren’t highly active, but are ready to take the challenge and become more active. You will be able to set personal physical activity challenges, create groups with group challenges, keep track of your physical activity progress, and monitor your weight.

Along the way, you will receive a range of printed resources on physical activity and health, and you will also receive a few emails from our research team. We know it can be difficult to fit physical activity into your day, so these will act as friendly reminders to log on and keep up with your challenges.

You have already worn an accelerometer for one week, allowing us to measure your physical activity levels over a typical week. We have also taken a few health-related measurements to track during and after the ManUp UWS program. Once you have reached the end of the 12-week program, we will ask you to return for a measurement session on campus so we can take these measurements again. At this point, we will also ask you to wear an accelerometer for seven days, and to give us some feedback on the website through a brief questionnaire.

Although the program will officially end after 12 weeks, you will still have access to the ManUp UWS site for a period of time once the 12 weeks is up. We will also ask you to come back for one last measurement session a further 12 weeks later, where we will take the last series of measurements and ask you to wear an accelerometer for a further seven days.

Please follow these steps to get started:
2. Register by entering your unique access code: zxc123
3. Create your profile and start to ManUp!

If you have any questions about ManUp UWS, either now, or at any time, please don’t hesitate to contact us at ManUp@uws.edu.au. Thank you again for your participation. Good luck!

Kind regards
The ManUp Team
Appendix DD. Allocation letter given to participants assigned to the printed resources comparison group.

Dear (Insert participant name here)

Congratulations on making the decision to ManUp and become more active!

You have been allocated to the ManUp UWS printed resources group.

Over the next 12 weeks, you will receive a range of printed resources on physical activity and health which have been designed to help you get motivated and undertake more physical activity! The resources will cover a range of topics related to physical activity, sedentary time, and health and will provide some great ideas for getting active on and around your home campus. You will also receive a few emails from our research team along the way.

You have already worn an accelerometer for one week, allowing us to measure your physical activity levels over a typical week. We have also taken a few health-related measurements to track during and after the ManUp UWS program. Once you have reached the end of the 12-week program, we will ask you to return for a further measurement session on campus so we can take these measurements again. At this point, we will also ask you to wear an accelerometer for seven days.

We will also ask you to come back for one last measurement session a further 12 weeks later, where we will take the last series of measurements and ask you to wear an accelerometer for seven days.

We are testing two different approaches for increasing physical activity, one of which includes access to the ManUp UWS website. To thank you for your participation, after the final measurement session at the 24-week point, you will be given access to the ManUp UWS website. You will be able to utilise the program as much or as little as you like.

If you have any questions about ManUp UWS, either now, or at any time, please don’t hesitate to contact us at ManUp@uws.edu.au. Thank you again for your participation. Good luck!

Kind regards
The ManUp Team
Appendix EE. Thank you letter given to participants in the internet-based intervention group.

Dear (Insert participant name here),

Thank you for your participation in the ManUp UWS program!

As a small token of our thanks, we would like to offer the enclosed certificate to express our appreciation of the time and effort you took to make the ManUp UWS program a success.

There are no further measurement sessions and you will no longer be receiving any emails from the ManUp UWS team, but you are welcome to continue using the ManUp UWS website. As always, you can email us at ManUp@uws.edu.au over the next few months if you have any questions or queries about the website. In addition, if you would like a copy of your weight, waist circumference and blood pressure measurement records from the three sessions, please email us.

Kind regards

Emma George and the ManUp UWS team
Appendix FF. Thank you letter given to participants in the printed resources comparison group.

To (Insert participant name here),

Thank you for your participation in the ManUp UWS program!

At the beginning of the program, all participants were randomly allocated to one of two groups – one group where participants received a range of printed resources on physical activity and health and also had access to the ManUp UWS website; and another group – where participants received only the printed resources on physical activity and health.

To thank you for your participation, we would like to offer you access to the ManUp UWS website for the next six weeks. The website has been designed especially for men who aren’t highly active, but are ready to take the challenge and become more active. You will be able to set personal physical activity challenges, create groups with group challenges, keep track of your physical activity progress, and monitor your weight. You are welcome to utilise the program as much or as little as you like.

Please follow these steps to get started:

2. Register by entering your unique access code: zxc123
3. Create your profile and start to ManUp!

As a small token of our thanks, we would like to offer the enclosed certificate to express our appreciation of the time and effort you took to make the ManUp UWS program a success.

There are no further measurement sessions and you will no longer be receiving any emails from the ManUp UWS team, but you are more than welcome to email us at ManUp@uws.edu.au over the next few months if you have any questions or queries about the website. In addition, if you would like a copy of your weight, waist circumference and blood pressure measurement records from the three sessions, please email us.

Kind regards

Emma George and the ManUp UWS team
Appendix GG. Certificate of achievement given to participants at the conclusion of Study 3.
Appendix HH. UWS HREC approval for Study 3.

UWS HUMAN RESEARCH ETHICS COMMITTEE

12 October 2011

Professor Gregory Kolt,
School of Biomedical and Health Sciences

Dear Gregory and Emma,

I wish to formally advise you that the Human Research Ethics Committee has approved your research proposal H9339 “ManUp UWS: Internet-based physical activity intervention for middle-aged men”, until 31 March 2013 with the provision of a progress report annually and a final report on completion.

Please quote the project number and title as indicated above on all correspondence related to this project.

This protocol covers the following researchers:

Gregory Kolt, Emma George.

Yours sincerely

Dr Anne Abraham

Chair, UWS Human Research Ethics Committee
Appendix II. Registration of ManUp UWS with the ANZCTR

From: info@actr.org.au
Sent: Friday, 20 April 2012 4:36 PM
To: Emma George
Subject: Your ACTRN (registration number): ACTRN12612000450819

Dear Emma,

Re: Comparing the ManUp UWS internet-based physical activity intervention for middle-aged male university employees, with a control group receiving only generic printed material on physical activity and health.

Thank you for submitting the above trial for inclusion in the Australian New Zealand Clinical Trials Registry (ANZCTR).

Your trial has now been successfully registered and allocated the ACTRN: ACTRN12612000450819

Date submitted: 18/04/2012 11:53:50 AM
Date registered: 20/04/2012 4:35:28 PM
Registered by: Emma George

If you have already obtained Ethics approval for your trial, could you please send the ANZCTR a copy of at least one Ethics Committee approval letter? A copy of the letter can be sent to info@actr.org.au (by email) OR (61 2) 9565 1863, attention to ANZCTR (by fax).

Please be reminded that the quality and accuracy of the trial information submitted for registration is the responsibility of the trial's Primary Sponsor or their representative (the Registrant). The ANZCTR allows you to update trial data, but please note that the original data lodged at the time of trial registration and the tracked history of any changes made will remain publicly available.

The ANZCTR is recognised as an ICMJE acceptable registry (http://www.icmje.org/faq.pdf) and a Primary Registry in the WHO registry network (http://www.who.int/ictrp/network/primary/en/index.html).

If you have any enquiries please send a message to info@actr.org.au or telephone +61 2 9562 5333.

Kind regards,
ANZCTR Staff
T: +61 2 9562 5333
F: +61 2 9565 1863
E: info@actr.org.au
W: www.ANZCTR.org.au