Motivational considerations of mass media messages used to promote more physical activity and less sedentary behaviour – what messages should be used?

by

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ABSTRACT

Physical activity guidelines have become a focal point of mass media messages promoting physical activity to the adult population. Messages regarding sedentary behaviour have also emerged. Further, Chapter 3 identified knowledge of just 18% within a large sample of highly educated and employed UK adults. Of concern is the further finding that knowledge is likely to be higher within this group than within the general population and many groups within society may therefore have even lower knowledge. As many individuals are seemingly not likely to know the current physical activity guidelines, disseminating messages to promote them appears to be a reasonable strategy. However, Chapter 1 of this thesis highlighted the lack of research investigating the efficacy of messages designed around physical activity guidelines. Chapters 4, 5 and 6 began to explore some of the possible motivational implications of messages prominent in mass media campaigns promoting physical activity guidelines. Chapter 4 describes a cross-sectional study which compared the effects of messages using the threshold of 150 minutes a week with a generic message on perceived benefits of physical activity. Messages were representative of those found in mass media campaigns. Those receiving a threshold message held significantly less positive views of the benefits of physical activity at durations below 150 minutes a week. While a threshold message may be motivationally damaging in certain contexts, they tend not to be provided in isolation. Intensity of physical activity i.e. moderate-to-vigorous (MVPA) is another key aspect of physical activity guidelines featured in mass media campaigns. Subsequently, Chapter 5 employed an online survey of highly educated adults to investigate associations between threshold and generic messages describing MVPA as either walking or using a physiological description, with motivational constructs. Interestingly, the message incorporating a threshold was motivationally advantageous when MVPA was described as walking. On the other hand, inactive adults tend to overestimate their physical activity with walking behaviour being serially overestimated. This could result in reduced motivation to engage in MVPA. The influence of regular walking speed on misperceptions was therefore investigated in Chapter 6. Further, accurate knowledge of physical activity requirements has been theorised to reduce misperceptions. Chapter 6 reports findings that 'regularly slow walkers' are more likely to overestimate their physical activity levels while knowledge of guidelines has no effect. This leaves a complex picture of the motivational qualities of messages

promoting physical activity guidelines. Finally, Chapter 7 describes a content analysis which broadens the investigation of mass media messages by scrutinising the introduction of messages promoting reductions in sedentary behaviour. Sticking closely to guidelines, combining messages on sedentary behaviour with those on physical activity, the relative omission of standing and the demonisation of sitting emerged as common themes. This thesis highlights the problem of low knowledge of physical activity guidelines within a sample of UK adults and points towards a lack of evidence-based messaging. With knowledge being low, the provision of a threshold is desirable on an informational level. The provision of walking as an exemplar appears to make the threshold more amenable, however, for inactive adults the use of this exemplar in messages may lead to overestimation of physical activity and decrease motivation. Clearly, the motivational implications of these messages are complex and require further investigation.

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ACSM	American College of Sports Medicine
COM	Canada on the Move
CON	no message control group
DH	Department of Health
EPPM	extended parallel process model
GEN	generic message group
GUADS	Get Up and Do Something
HEBS	Health Education Board Scotland
HSE	Health Survey for England
MDI	Index of Multiple Deprivation
MVPA	moderate-to-vigorous physical activity
NHS	National Health Service
PA	physical activity
PAPM	precaution adoption process model
PhysT	message using a physiological description of moderate-to-vigorous physical activity and a threshold
TPB	theory of planned behaviour
THR	threshold message group
THRm	threshold as a minimum group

WalkNT	message using walking as an exemplar of moderate-to-vigorous physical activity without a threshold
WalkT	message using walking as an exemplar of moderate-to-vigorous physical activity and a threshold
WHA	World Health Assembly

‘We do not cease to play because we grow old
we grow old because we cease to play.’

George Bernard Shaw

Introduction

PhD Background: Physical Activity Messaging

1. Introduction

1.1. Overview

Physical activity reduces the risk of morbidity and mortality from chronic disease and so has an important role to play in population health[1,2]. Objective data from accelerometers suggests low compliance with physical activity guidelines, at around five percent in British and American adults and 15% in Canadian adults[2,3,4]. Lack of physical activity is now recognised alongside tobacco use and an unhealthy diet as a key behaviour contributing to poor health[5]. Evidence supporting benefits of physical activity for health has informed the development of guidelines regarding the minimum duration, frequency and intensity of physical activity that should be engaged in for optimal health. From 2008 onwards, many countries around the world including the UK[6], US[7], Australia[8] and Canada[9], unified their guidelines, with Global guidelines also released in 2010[1]. Increasing population physical activity has therefore become a public health priority[1,2].

Mass media campaigns distribute information using a variety of modes such as, television, radio and print. They can reach large sections of the population and so have the potential to raise awareness of important issues[10]. For reasons that will be explored later in this chapter, mass media campaigns have been established as the major mode of dissemination of physical activity guidelines to the general adult population. Effective messaging strategies are imperative to the success of these campaigns[11]. A growing body of research has examined several features of message design[5,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32]. However, despite physical activity guidelines explicitly being at the forefront of the majority of physical activity campaigns, all of the messaging research predating the inception of this thesis has focused on physical activity generally and neglected to examine the construction of messages revolving around physical activity guidelines. This is almost unfathomable considering that physical activity guidelines are the product of more than four decades of dedicated research in the field. When you consider the hundreds of studies which have been conducted to inform physical activity guidelines and the

concerted effort of national, and more recently international task forces, to synthesise this research and regularly update the summary documents (every four to five years in recent years, see Figure 1), it is evident that physical activity guidelines have been a significant time investment. In addition, mass media campaigns promoting physical activity require significant financial investment. £89 million was spent on the UK campaign *Change4Life* between 2009 and 2012 alone[33,34]. It is difficult to estimate how much money has been spent globally, however an EU Sport and Health Working Group described EU physical activity expenditure as "considerable"[35]. With centrally funded campaigns also being delivered in Australia, Canada, New Zealand and the US, expenditure can be considered to be significant. However, exposure to commercial advertising from competing lifestyle influences (e.g. video games, junk food) is far greater[36,37,38,39,40]. With the budgets of major physical activity campaigns such as *Change4Life* in the UK now being cut, it has become even more crucial to ensure greater quality of messages.

Research into the role that too much sitting or time spent sedentary may have on health is growing steadily[41,42,43,44,45,46,47,48]. However, while the scientific base linking sedentary behaviour to health is emerging, research into the development of messages around sedentary behaviour has yet to be initiated. Despite this, health campaigns have already begun to release promotional messages cautioning against too much sedentary behaviour. For example, a *Change4Life* promotion shows a seated child playing video games with the tagline "Risk an early death, just do nothing". Growing media interest into sedentary behaviour research may open up further avenues to attract funding in support of activity/sedentary-related health. Thus, the current climate offers a prime opportunity to begin the examination of messages around sedentary behaviour and to fill some of the gaps in the research on messaging physical activity guidelines.

1.2. Terminology

It is important to operationally define and clarify important terms used by activity-related campaign messages which will appear throughout this thesis.

1.2.1. Exercise and physical activity

Exercise and physical activity are two distinctive terms which are often confused. Exercise is 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[49]. Physical activity includes exercise as well as other activities which involve bodily movement and are done as part of playing, working, active transportation, house chores and recreational activities. Early activity-related campaigns focused on exercise and not physical activity. For instance the first guidelines, released in 1975 by the American College of Sports Medicine (ACSM), were for exercise testing and prescription. More recently, messages have begun to focus on moderate-to-vigorous physical activity (MVPA) in reflection of the changing focus of guidelines.

1.2.2. Physical inactivity and sedentary behaviour

Two other terms which are also often misunderstood are inactivity and sedentary behaviour. Inactivity is a lack of physical activity[50], thus an individual who does not meet physical activity guidelines would be defined as inactive. Sedentary behaviour however, is not simply a lack of activity. It is a group of behaviours that occur whilst sitting or lying down and that require very low energy expenditure ($\leq$1.5 METS)[51]. Thus, an individual can meet physical activity guidelines but still be defined as sedentary if they also spend a large proportion of their time engaged in sedentary pursuits.

1.3. Development of activity-related guidelines for adults

Physical activity guidelines exist for four different age groups: children (under five years old), young people (5-17 years old), adults (18-64 years old) and older adults (65 years old and above). The present thesis relates only to guidelines for adults (18-64 years old) and so only these guidelines will be discussed.

1.3.1. Physical activity guidelines

In 1975 the first form of physical activity recommendations for adults were released in the United States by the ACSM[52]. From this point through to the early 1990's, recommendations focused on improving physical fitness through vigorous and structured forms of exercise. These early guidelines could therefore be referred to as exercise guidelines. By 1995, the link between physical inactivity and cardiovascular disease was becoming well-recognised prompting a paradigm shift in the focus of physical activity guidelines from structured exercise towards lifestyle physical activity[53]. At this stage American adults were advised to accumulate at least 30 minutes of MVPA, on preferably all days, each week[54]. In addition, the report introduced evidence that aerobic physical activity could also be accumulated in short bouts. From 1996, the Department of Health in England began following more closely the guidelines from the US (see Blair and colleagues for a thorough review of the development of US physical activity guidelines up until 2004[55]) and issued similar guidelines to the ACSM, recommending 30 minutes of MVPA on at least five days a week[56].

With physical activity now recognised as one of the important behaviours associated with health[57,58,59], there has been a shift within the UK and globally towards more uniform guidelines. This has been propelled by two major resolutions endorsed by the World Health Assembly (WHA). In 2004, member states of the WHA resolved to develop national physical activity action plans and policies[60]. Later in 2008, member states endorsed a global strategy (of which physical activity was a major part) for the prevention and control of non-communicable diseases[61]. In 2008, the first national physical activity guidelines for Americans to be issued by Federal government were published following a comprehensive review of the scientific data by experts in the field[7]. This in depth document was the first to state recommendations specifically as at least 150 minutes per week of MVPA. In addition, it is the first to provide detailed contextualised examples of physical activity and to foreground the concept that engaging in some physical activity is better than doing none but doing more achieves greater health benefits. Previously, guidelines in the UK had been disseminated separately by health agencies within each home country: the Department of Health in England, the Physical Activity Task Force in Scotland, the Welsh Assembly Government in Wales and the Public Health Agency in Northern Ireland. In 2010 the four UK Chief Medical Officers published the first UK-wide physical activity guidelines entitled "Start Active, Stay Active"[6]. This document followed the lead of the

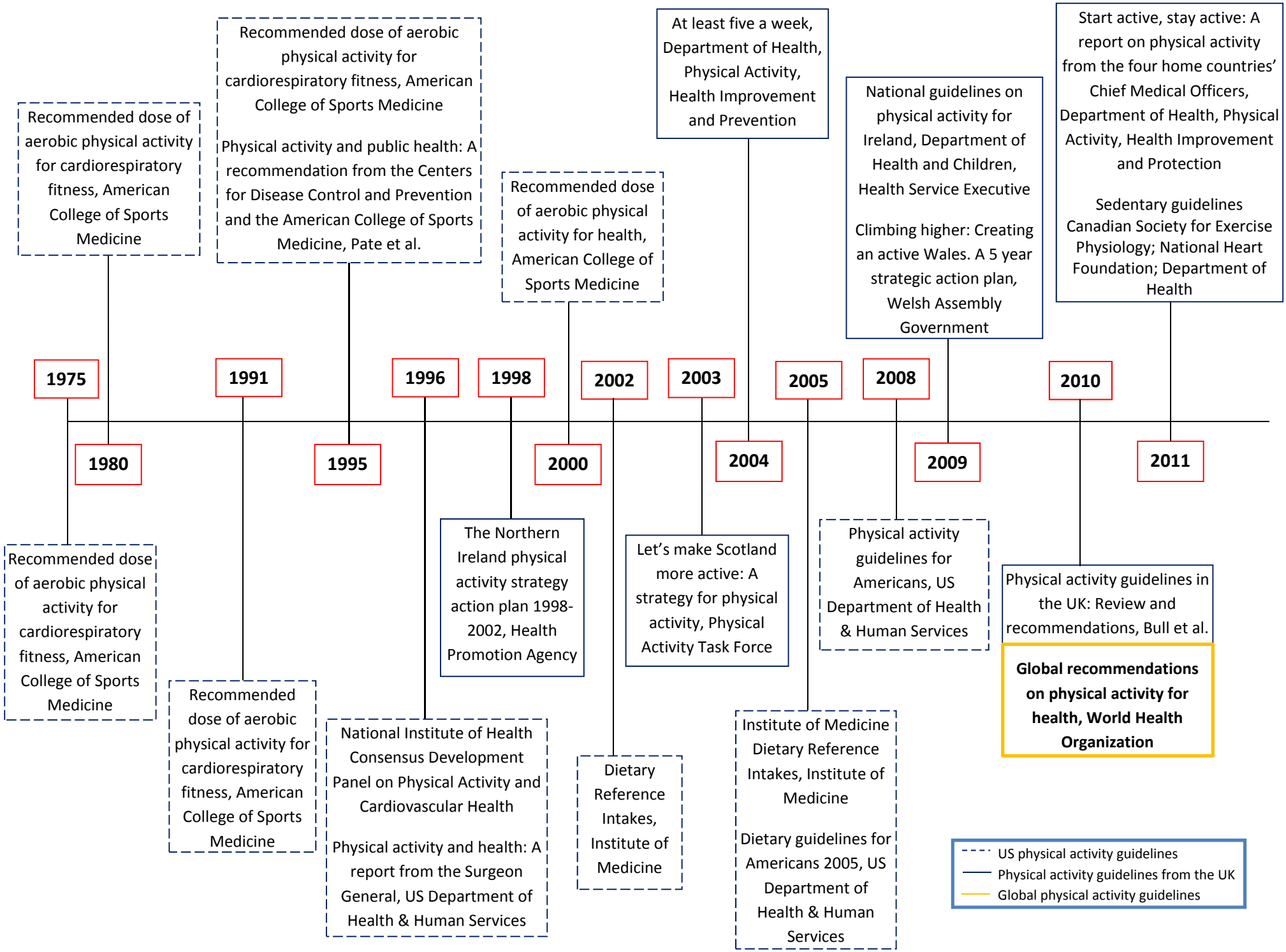

Figure 1.Timeline of major physical activity guidelines from the US and UK

US guidelines and reported the new adult guidelines of 150 minutes a week of MVPA. In comparison to the preceding 2008 US guidelines, which were designed to be more accessible for the general population and to motivate increased physical activity, the UK document focused more on elucidating changes to previous recommendations and updating the evidence. While the US physical activity guidelines are partly designed to facilitate a change in behaviour, at least for "interested members of the public", UK guidelines are not designed to be used as a motivational tool. Finally, global physical activity guidelines were issued by the World Health Organization (WHO) to reiterate the 150 minute a week message[1] to low and middle-income countries in which national physical activity guidelines are absent. It can be concluded that physical activity guidelines are currently more scientifically supported, comprehensive in content, consistent across countries and far-reaching than at any time previously. This presents a prime opportunity to inform similar assertions about the messages used to disseminate them.

1.3.2. Sedentary behaviour guidelines

The development of guidelines for sedentary behaviour is a more recent consideration in activity-related research. While there is evidence to support the impact of sedentary behaviour on health[44,48,50,62], little is known regarding the dose-response relationship[47]. Questions around the amount of time adults should spend sedentary, when/how often sedentary time should be broken up and the nature of the relationship between MVPA and sedentary behaviour cannot yet be answered[47,63]. Sedentary guidelines are therefore in the primitive stages and lack the detail characteristic of physical activity guidelines. The first systematic evidence-based sedentary behaviour guidelines for children and youth were released in Canada by the Canadian Society for Exercise Physiology in 2011 [CSEP][64]. However, the most advanced guidelines for adults come from the Australian Heart Foundation which released the document "Sitting less for adults"[65]. This document suggests adults should "aim to reduce the total amount of time they sit during the day (their overall sitting time)" and suggests ways in which such a reduction may be achieved. In the UK, basic guidelines on sedentary behaviour appear within the physical activity guideline document[6]. These state that all age groups "should minimise the amount of time spent being sedentary (e.g. sitting) for extended periods (except time spent sleeping)". Currently, sedentary behaviour research cannot inform global sedentary behaviour guidelines for multiple

populations[42,46], however, research interest continues[66] and some of the aforementioned critical questions are beginning to be addressed[63]. Thus, the coming years may see changes in the communication of sedentary behaviour through both formal guidelines and campaign messages. It is important to initiate research to inform these changes.

1.4. Mass media campaigns

1.4.1. Introduction to the promotion of physical activity through mass media

Mass media campaigns are currently used by health promoters to disseminate physical activity messages. Mass media health campaigns are developed and administered by various organisations, typically, government agencies and health associations. For instance, *Change4Life* is a campaign centrally-developed by government and disseminated through various health organisations such as the National Health Service (NHS) and a plethora of commercial sector organisations such as supermarkets (e.g. Asda, Sainsbury's)[33]. The main advertisments of the campaign were developed by the private advertising company M&C Saatchi. Partnering governmental organisations with private sectors is a popular framework for many campaigns around the world as it is a fruitful strategy to garner more financial backing for the campaign.

1.4.2. Social marketing

Social marketing is a process through which marketing principles are applied to the promotion of ideas and issues such as positive behavioural change to address social problems. Rather than promoting goods such as clothing or beauty products, social marketing sells better health through behaviours such as giving up smoking, improved diet and increased physical activity. It has been used to translate scientific knowledge into effective educational programs[67] and has been advocated by Kotler and Zaltman[68] as a promising framework for planning and implementing social change. Principles of social marketing include: researching the intended consumers of the intervention, understanding the environmental context in which it is hoped behaviour change will occur, applying segmentation (splitting a population into sub-populations of individuals with

common characteristics) and targeting (gathering information about specific segments to which intervention efforts will be focused), setting clear objectives and goals, the 4P's (product [e.g. physical activity], price [e.g. change in behaviour], place and promotion [e.g. messages]) and evaluating achievement of objectives.

1.4.3. *Change4Life*: An important campaign?

Change4Life is the UK's first national social marketing campaign to target reduced obesity through the promotion of a healthy diet and physical activity. It followed on from the *ACTIVE for LIFE* campaign which ran in the 1990's to improve awareness of physical activity[69]. Launched in January 2009 with a budget of £75 million for its first three years, using television, radio, the internet and print media, the *Change4Life* campaign promised to mark the most recognisable move towards a healthier lifestyle ever seen in the UK[70]. Indeed, 99% of families living in England reported being exposed to the campaign by the end of its first month and 413,466 families had joined by the end of the first year[70]. The project was designed to target specific groups within the population, beginning with children and families and moving on to adults. In its initial marketing strategy, *Change4Life* places messages at the very heart of the project to create awareness with a view to increasing intention's to change behaviour[33].

Unfortunately, although a promising campaign, *Change4Life* is fraught with limitations[71]. From the outset the campaign set what it considered to be an ambitious goal of 400,000 families attempting to change their behaviours[33]. This is based on the assumption that for every family that changes their behaviour through the program, another will do so independently, and was borne out of experience from the tobacco control programme. It is contentious whether this is indeed an ambitious enough goal for a campaign which aims to have a significant impact on the health of the population. Indeed, with around 18.2 million households recorded in the UK in 2012[72] it would require less than one percent of households to change their behaviour over a three-year period, in order to meet this goal. This is also short of the government's target for 70% of the UK population to meet physical activity guidelines by 2020[73]. However, considering the lack of progress made in increasing physical activity levels over the past decade[74,2,75] despite an increasing number of interventions[76], there is perhaps understandable justification for

seemingly modest ambitions. It is clearly very difficult to make targets which are both realistic and challenging for mass media physical activity campaigns.

1.4.4. Evaluation

The first year of *Change4Life* was reviewed in 2010 by the Department of Health[70]. The first phase of the campaign was reportedly successful in terms of people seeing, recalling, recognising and signing up to the campaign. In 2012, the initial marketing strategy for *Change4Life* came to an end. During this period a number of reviews of the campaign were published. The Department of Health issued a review at the end of 2011[34] which focused largely on the successes of the campaign including, the development of sub-brands, attracting commercial partnerships and recognition of the logo. The target of engaging more than 400,000 families is reported to have been met; however, only some qualitative indications of positive behavioural change within target families were reported, with robust evidence of changes to actual physical activity behaviour also lacking.

Independent reviews have been less positive regarding *Change4Life*. Piggin highlighted various inconsistencies between the research informing the campaign and the final product[71]. For instance, the campaign was developed using evidence that diet and physical activity messages should be promoted separately, yet the campaign consistently combined the two message types together. Even the main logo of the campaign, "Eat Well, Move More, Live Longer" combines the two behaviours. The logo is also inconsistent with contemporary issues in its use of the incentive "Live Longer". People are in fact already living longer[77] and so allusion to improvements in quality of life i.e. living healthier, would seem more appropriate. In addition the campaign appears to flit between self-determined actions of individuals and the obesogenic environment when apportioning blame for inactivity, resulting in inconsistent messaging.

One of the main factors which may have contributed to contradictions in *Change4Life* communications is likely to be the involvement of numerous stakeholders which ultimately makes brand management more difficult. With government funding cut by 44%, from £25 million a year to just £14 million for 2012[34], there will be an increased demand on stakeholders

to roll out the rest of the campaign, which is to have a greater focus on adults from 2012 onwards. Berry and Latimer-Cheung have previously discussed the problem of having multiple sources disseminating physical activity messages[78]. A greater linking of theory is required to develop a set of stringent instructions to ensure optimum efficiency and consistency of messages.

National campaigns are extremely difficult to evaluate, especially when the goal is to evaluate 'hard' outcomes such as changes to actual behaviour. Croker and colleagues reported that 96% of their sample of 1,419 families was aware of *Change4Life*[79]. However, only 6.5% of families within the population actively engaged with a "How are the Kids" questionnaire sent to them via *Change4Life*. While this appears low, this is just one small aspect of the whole campaign and in no way indicates its overall success. Indeed, earlier reports suggested that response to "How Are The Kids?" was relatively high[70]. It is possible that individuals became bored or that this particular aspect was disliked or not understood but other aspects of the campaign, which weren't evaluated, could have fared better. In addition, Croker and colleagues sent the pack to families for the purpose of their study. As the pack was intended to be requested as part of the *Change4Life* campaign this evaluation was not conducted within its intended audience. It is likely that individuals, who did request this pack via *Change4Life*, responded more positively to it. This paper is therefore a randomised trial of one motivational tool only, not the campaign, and should be treated as such.

1.4.5. Other campaigns

This section provides a chronological overview of some other mass media campaigns from around the world which have (or have had) a major physical activity component. Campaigns include: *Canada on the Move, Push Play, Find Thirty Everyday, Get A Life Get Active, Step it up, Move More* and *Get Up and do Something*. At the end of this chapter, Table 1 provides a summary of these campaigns.

Contrary to other countries with physical activity data, Canada has demonstrated a sustained trend towards small increases in physical activity levels[80]. The Department of Health report "Be

Active, Be Healthy" points to the Canadian campaign *ParticipACTION* as a contributor to this success and a model for future physical activity campaigns[81]. *ParticipACTION* was launched in the 1970´s in Canada by federal government and the major media players across the country. As one of the earliest national campaigns it provided a model for other countries and is one of the longest running communications campaigns to promote physical activity in the world. It is credited as having improved the fitness of Canadians and potentially saving the government millions of dollars in medical expenditure[82,83]. It is certainly one of the most recognised campaigns with 85% recognition more than one year after its final communication campaign[84]. *ParticipACTION* was initially stopped in 2001 but was re-commissioned in 2007. Humour was an important messaging tool throughout the whole campaign which was perhaps most famous for its "60 year old Swede" advertisement (in which the voiceover explains that an average 30 year old Canadian is as fit as an average 60 year old Swede and the two are shown jogging side-by-side) which sparked debate in parliament. In 2004, the Canadian Public Health Association published a supplement which reports numerous formative evaluations of the initial campaign[85]. Inability to target according to readiness to engage in more physical activity and the prominence of two distinct primary languages (French and English) between communities posed barriers to implementation, yet positive change is apparent during this 30 year period. Most notable results include: positive attitudes towards the campaign (M = 82.5% [N ~1,194]), an increase in the recall of physical activity guidelines (39.4% - 46.2% between 1998 and 2002 [N > 2,240]) and an increase in the number of Canadians 'regularly active' (three to five percent between 1971 and 1982 [N = 2,000]). Bauman and colleagues reported that *ParticipACTION* was a more memorable source of physical activity guidelines than Health Canada's physical activity guides[86]. However, unprompted recall was generally very low (around three percent), socio-economically deprived individuals had consistently lower recall, and recollection declined in the years following release of the guidelines. Two further studies reported higher levels of prompted awareness: 70% and 82% respectively, at the time of the second campaign[82,87]. However, there is still evidence of a knowledge gap, possibly compounded by increasing internet-based campaigns, with those of lower socioeconomic status and education being less aware[87]. Findings regarding the effectiveness of the messages are encouraging. Evidence suggests that sequential messaging (messages which tell a story over a series of adverts) contributed to changes in

population-level physical activity[88] and that awareness of *ParticipACTION* was associated with more leisure-time physical activity[87].

In 1995 a Scotland-wide mass media campaign was launched by *Health Education Board Scotland (HEBS)* to increase walking amongst inactive 30-55 year olds[89]. A 40 second television advertisement was launched to promote walking with the main message that "walking a mile uses exactly the same calories as running a mile…" Wimbush and colleagues found that around 70% of 30-55 year olds were aware of the main advertisement when it was on air with awareness dropping to 54% when the advertisement was no longer being aired[90]. However, the proportion of 30-55 year olds actively engaging with the program via its free direct telephone service (Fitline) increased by only 11%. This equated to an increase of 42 people (57 overall), though it should be noted that the sample was relatively small (N = 370) and this was just one component of the overall campaign. There were some positive results including a 22% increase in the proportion of people who reported that they wanted to be active. In addition, around 50% of the individuals engaging with *HEBS* reported being more physically active, however, the measure was highly subjective and it is unclear if physical activity increased within the overall population. The campaign was also unsuccessful in reaching its target population as the majority of Fitline callers were not aged between 30 and 55 and probably had physical activity levels which were not representative of the general population.

In 1999, $3,665,665 was allocated for health promotion and disease prevention programs in Hawaii. As a result, the *Healthy Hawaii Initiative* was developed[91]. The campaign is based on the social ecological model and consists of three main components: school, community and public education. Of these, mass media was a vital tool of the public education component and $1.65m was ear-marked over two years for social marketing. Radio advertisements, television advertisements and web-sites etc., targeted 35-55 year olds, different cultural groups and people with different levels of motivation via *Start.Living.Healthy,* launched in 2002. Maddock and colleagues report results from annual surveys given to around 4,555 adults between 2002 and 2004[92]. Findings were mixed with the number of inactive adults falling by 7.2%, but with no change in moderate physical activity or stage of change and with significant decreases in attitudes and subjective norms. Overweight and obesity decreased in Hawaii by only 0.2%,

however, considering that the rest of the US increased by three percent this could be considered a positive result. For five years of intervention, these are somewhat disappointing outcomes. From 2007 onwards messages began to focus on walking e.g. "Walking can be fun. 30 ways to get 30 minutes" (http://www.healthyhawaii.com/). Further, *Step It Up, Hawaii* was launched in 2007 for a period of ten weeks. Walking was the focus of this campaign which included a 30 second television advertisement to promote walking 30 minutes a day. Buchthal et al found that prompted recall of the message, "People should walk 30 minutes" was higher than that of more generic messages[93]. The campaign was recognised similarly by individuals with differing poverty status; however, those with a higher education level expressed greater trust in the messages.

In 1999 the Hilary Commission in New Zealand launched *Push Play*, with a three million dollar budget over four years, to promote 30 minutes of moderate exercise per day. The campaign was aimed towards both children and adults with the emphasis being on play. Examples of messages aimed towards adults include: "Kids Push Play for 60 minutes a day – that's twice as long as you guys!" and "Push Play 30 minutes a day." For adults play is operationalised as sport throughout this campaign. In a study conducted within just 69 adults aged 40 and above, only 32% reported being aware of the campaign and yet most self-reported meeting guidelines for physical activity[94]. Thus, sufficient physical activity did not appear to be related to the messages, suggesting that other informational or motivational sources were more important within this small sample. Using population sampling techniques in 26 of the main urban areas, Bauman and colleagues found that 83%, 88%, 61% and 84% of adults had seen at least one message during 1999, 2000, 2001 and 2002, respectively[95]. While this seems a reasonable achievement, awareness of another campaign; *10,000 Steps Rockhampton* (Queensland, Australia) was 92%[96]. Intention to be active also significantly increased from around two percent at baseline to ten percent during the three years of the campaign. Those aware of any of the campaign messages were more likely to have a positive intention to be active than those who could not recall any message. While this did not translate into behaviour change this needs to be considered within the context of declining physical activity levels elsewhere. During this time, physical activity levels in New Zealand increased only very slightly but data suggests declining levels in Australia and the UK, with no change in Canada and the US during the same period. Despite this, in 2009

a change in government threatened to reduce the emphasis on healthy active lifestyles and announced that; "Push Play and Mission On are less of a priority than they have been"[97].

In 2001 *Get Up And Do Something* (GUADS) was launched to promote physical activity among 18 to 30 year olds in Delaware using tenets of the theory of planned behaviour [TPB][98]. Messages aimed to highlight the fun of engaging in exercise (note exercise was a greater focus than physical activity or sport). Only minimal evaluation of *GUADS* has been conducted. Data from 500 interviews with the target audience, suggests that the slogan was successful in allowing freedom of choice but individuals desired more specific information[99]. Of the 500 individuals interviewed, 39.1% had seen *GUADS's* television advertisement in the previous month, of which 32.1% indicated an increased intention to be active. Of this same sample, 62.5% reported seeing either the television, or billboard advertisement, and 27.7% of these formed stronger intentions to be active. This translates to just 87 people, or 17% of the overall sample, increasing their intentions to be active. It is very difficult to predict what influence this may have on behaviour considering that intention is not always a strong predictor of physical activity behaviour[100]. Thus, it can only be concluded that the campaign had a motivationally favourable impact on attitudes, perceptions, and intention to be more active.

Canada on the Move (COM) was launched in December 2003 through a partnership between Canadian Institutes of Health Research and Kellogg Canada to provide a platform for evaluation and research related to physical activity in Canada[101]. Physical activity messages were introduced on cereal boxes and pedometers were given away with Kellogg's cereal. The aim of the campaign was to increase walking with messages such as "Add 2000 steps". It also targeted physical activity at population level via a website which encouraged visitors to "Donate your steps to health research", and enabled data to be collected from those engaging with the campaign. *COM* aimed to increase campaign and pedometer awareness and number of steps. Faulkner and Finlay discuss obstacles faced by the campaign as a result of its partnership with a private commercial company[102]. Such a partnership may be necessary to augment funding but, as previously discussed, can cloud messages about the purpose of the initiative. Despite initial problems, data collected from December 2003 and throughout 2004 from 7,217 adults, suggested that more people had become aware of the campaign and owned pedometers[103]. Evaluation in

2007 suggested that the prevalence of walking was higher amongst individuals who were aware of the campaign and cognisant of its brand and message[104]. Those who had not heard of *COM* failed to increase walking to sufficient levels. These results are promising and suggest that the pedometer could be a useful and feasible tool to sit alongside social marketing campaigns. However, the campaign generated lots of media interest because it was novel which may not be sustained. Continuing evaluation is necessary to evaluate the impact of such messages under conditions of reducing exposure. The campaign may well turn to more print media in the future. In addition, higher income families were 37 - 46% more likely to recall the *COM* message than lower income families, suggesting that the campaign failed to reach disadvantaged groups[103]. Despite calls in 2005 for the campaign to be expanded[105], little activity appears to have taken place and the website is no longer in commission.

Find Thirty Everyday is a state-wide initiative of the Heart Foundation launched in Western Australia in 2008[106]. The campaign was developed using a ten-step formative process which included focus groups during preliminary stages, and social marketing tools to develop strategies. Messages aimed to increase the proportion of people meeting physical activity guidelines and had a particular focus on lifestyle activity. Messages emphasised the fun of physical activity and the resulting benefits. For example, "I found I really enjoyed cycling and I even managed to fit into last year's jeans" and "You'll find all kind of rewards when you find 30 minutes of activity everyday". Impact evaluation consisted of 1,000 random pre- and post-cross-sectional Computer-Assisted Telephone Interviewing Surveys with 20-54 year olds[107]. Results suggested that the main message was well known and accepted. Self-efficacy, mental and social benefits, and overcoming barriers were highlighted as key focus areas. Eleven percent of respondents reported that they had taken action as a result of the campaign but it should be noted that this measure was highly subjective. The campaign did appear to have successfully reached minority groups with approximately 56% awareness across all categories of socioeconomic status. Many of the aforementioned campaigns have reported on awareness of campaign messages related to physical activity. This is based on the assumption that awareness of the health benefits of physical activity and physical activity requirements may be associated with increased engagement with physical activity. It is important to note that such evaluations are vulnerable to reverse causation whereby exposure to a campaign can increase knowledge of a

Table 1. Summary of different mass media campaigns from around the world

Campaign	Country	Main Message e.g.	Other Messages e.g.	Main Developer/Funder	Budget	Start	End
Change4Life	UK	Eat Well Move More Live Longer	Swap four wheels for me own two feet to get going for 150 minutes a week	Department of Health	£75m first three years. £14m in 2012	2009	N/A
Canada on the Move	Canada	Donate your steps to research/Step up Canada	Add 2,000 steps	Canadian Institute of Health/Research Kelloggs		2003	2007*
Find Thirty Everyday	Western Australia	Find Thirty Everyday	Find thirty, find a better you/It´s not a big exercise	Heart Foundation/Department of Health	$AU1.8m (2008-2010)	2008	2001*
Get A Life, Get Active	Northern Ireland	'Every Small Step is a Forward Step as a way to get 30mins…'	It all adds up	Public Health Agency	180,000 (1999)	1999	2012 (still active in TA & ACT)
Get Active America	US	Make the Move	Be physically active 5days per week for 30 minutes	Physical Activity Task Force/US Department of Health and Human Services	$US100m per yr for ten years from 2010	2010	N/A
Get Moving	Tasmania	30 minutes is all it takes to make a difference	30 minutes everyday can make all the difference to your health and well-being	Tasmania Premier´s Physical Activity Council		2011	N/A
Get Up and Do Something	Deleware, US	Get Up and Do Something today	No matter what your thing is just get up and do it all year round	Deleware Division of Public Health	$2.25 to $42.55 per person with intent to change or actual change	2003	N/A
Healthy Hawaii Initiative	Hawaii	Start. Living. Healthy	Easy steps to get 30 minutes	Hawaii State Department of Health	$1.65m (2002-2004)	2002	N/A
Health Education Board Scotland	Scotland	Walking. Take exercise in your stride	Walking a mile uses the same calories as running a mile	Health Scotland		1995	
Move More	UK	A short jog, or brisk walk can help	A little exercise is good for all of us	Macmillan Cancer Support	<6m (2011)	2011	
ParticipACTION	Canada	Run. Walk. Cycle. Let´s get Canada moving again	Walk a block a day everyday/Get active three times a week	Government of Canada	$0.07 per capita (1991)/$5m (2007)	1971/2007*	2001*
Push Play	New Zealand	Push play 30 minutes a day	Just 30 minutes a day for adults	Hilary Commission/SPARC/ Heart Foundation/Local Government NZ/Health Fund	$NZ 3m 1999-2002	1999	N/A

Table 1 cont. Campaign	(selected) Aims	Evaluated outcomes	Media	Targeted populations	Proximal results	Behavioural results
Change4Life	Change the behaviours & circumstances that lead to weight gain	Awareness/Recall/ Engagement	TV adverts/Radio/Print media/ Social media/Website (www.nhs.uk/change4life)	Children/ Families/Adults	96% awareness/6% engagement	N/A
Canada on the Move	↑awareness & pedometer ownership/usage	Brand & message awareness/Pedometer ownership/Walking prevalence	Press conferences/Cereal boxes/Website (www.canadaonthemove.ca)	Adults	↑awareness & ownership of pedometers	↑walking
Find Thirty Everyday	↑awareness of recommended PA/Benefits of PA/Help people overcome barriers	Awareness/ Comprehension/ Acceptance/ Intention/Action	Media releases/Competitions/ Website (www.findthirtyeveryday.au)	Adults	Message well recognised (56%) and accepted	11% persuaded to take ´action´
Get A Life, Get Active	↓people sedentary/↑people active	Knowledge/Beliefs/PA	Print media/TV adverts/Radio/ Website (www.getalifegetactive.com)	Young people/ Disadvantaged groups	10% ↑ awareness of health benefits/2% ↓ knowledge of guidelines	23% ↑PA once a week/10% ↑ daily PA (1999-2001)
Get Active America	↑national PA via education & resources/Promote PA guidelines	N/A	Print media/PALA challenge/ Social media/Website (www.ihrsa.org/getactiveamerica)	Children/ Adults	N/A	N/A
Get Moving	Value and support PA	N/A	Print media/Website (www.getmoving.tas.gov.au)	All Tasmanians	N/A	N/A
Get Up and Do Something	↑PA participation	Awareness/Attitudes/ Intention	Social media/TV adverts/Print media/Billboards/Website (www.getupanddosomething.org)	18-30 yr olds	↑awareness / ↑intention to be active	N/A
Healthy Hawaii Initiative	By 2010, ↑% meeting guidelines by 70%/↓ inactivity by 20%	Attitudes/PA (using BRFSS)	TV ads/Radio/Theatre previews/Mall ads/Website (www.healthyhawaii.com)	Adults/Cultural groups/Motivational levels	↑recall than generic comparison message	↓inactivity/no change in PA or obesity
Health Education Board Scotland	↑beliefs, motivation and walking behaviour	Awareness/Cognitive mediators e.g. intention/ Walking/PA behaviour	TV ad/Fitline/Information packs/Radio programmes	Inactive adults aged 30-55 yr	↑awareness/ ↑intention	↑self-reported PA
Move More	↑education of health benefits	N/A	TV adverts/Print media	Cancer patients/ survivors	N/A	N/A
Particip-ACTION	↑PA/Make PA & fitness more socially acceptable	Reach/Awareness/ Beliefs/Norms/Intention/ Behaviour	TV adverts/Social media/ Participarks/Print media/ Website (www.participaction.com)	Children/ Adults/ Parents	Awareness >80%/ ↑attitudes/↑ recall of guidelines	32% ↑PA (↑awareness ass. with ↑LTPA)
Push Play	↑awareness of the benefits of PA/Encourage people to ↑ PA	Awareness/Intention/ Achievement of guidelines	Billboards/TV adverts/Radio/ Magazine promotions/Website	All adults/Over 30´s	↑awareness (not related to PA)/↑ intention	No change in PA

PA = Physical activity

topic but knowledge of a topic can also result in increased exposure to a campaign. *Find Thirty Everyday* is still active in Tasmania and Capital Territory but is no longer active in Western Australia where the government is instead funding a new project called *LiveLighter*. This campaign aims to build on the messages used by *Find Thirty* but targets obesity more explicitly over physical activity[108].

1.4.6. Campaigns which have promoted reduced sedentary behaviour

Some recent activity-related campaigns have begun to introduce messages about sedentary behaviour despite the paucity of prescriptive detail in sedentary behaviour guidelines and the absence of research into messaging them. Many of the resulting messages have blurred the lines between messages aimed at increasing physical activity and messages aimed at reducing sedentary behaviour. Examples come from the Ministry of Health campaign in Portugal; "Sedentary people can't run away from diseases. Exercise", which shows images of people who have chairs for legs, the UEFA campaign *Get out of your Chair* which compels football fans to stand up and the Health Care System campaign in America; *Killer Sofa* which targets parents to help their children become more active. As of yet, no evaluation has been conducted on any campaign promoting sedentary behaviour.

1.4.7. Advantages and disadvantages of mass media campaigns

The UK Government recommends the use of social marketing to encourage healthful behaviour[109]. The National Social Marketing Strategy for Health, led by the National Consumer Council and the Department of Health, has been established to help realise the full potential of effective social marketing in contributing to national and local efforts to improve health and reduce health inequalities[110]. Mass media campaigns will therefore, continue to support health promotion efforts. The advantages and disadvantages of mass media campaigns will now be discussed.

1.4.7.1. Advantages

The main advantage of mass media campaigns is that they can reach a large bolus of people. A Cochrane review concluded that mass media campaigns induce uptake of health services through both planned campaigns and unplanned coverage[111]. The NHS Institute also highlights mass media campaigns as important contributors to the proliferation of health information[112]. The variety of formats which can be utilised to disseminate material may also allow different groups to be reached more effectively. For instance, analysis by MarketingCharts identified differences in media consumption between racial groups[113]. The combination of different formats could also elevate awareness and perceived importance of the topic being promoted.

The trend towards developing an online presence in addition to more traditional forms of print media, television and radio has increased the immediacy with which health information can now be accessed. The vast array of portable and/or online mediums also means that this information can be accessed almost anywhere; web pages provide access to information from many parts of the world, smart phones allow information to be viewed whilst commuting on public transport, tablets and portable devices enable visualisation or audio reception of information, and so on. Online information may appear less official or dictatorial whilst still providing copious information. The interactivity offered by such sites also provides another avenue for learning important information and enables a degree of personalisation or tailoring whilst being fun. In addition, Matsudo and colleagues identify the 'non-paid media approach' used in the highly successful *Agita Sao Paulo* campaign[114]. The authors discuss capitalising on 'mega-events' to garner media interest and secure free advertising through the media reports which result. Edwards also reports $289 million of unpaid media support over 29 years of *ParticipACTION*[115]. Though not explicitly discussed in *Change4Life* documents, *Change4Life* has gained 'non-paid media' through media responses to events (in February 2014 a search of 'Change4Life' on Google News identified 146 articles on the campaign). Examples of fast-growing non-paid media channels through which information can proliferate are discussion boards and social media such as Facebook or Twitter.

1.4.7.2. Disadvantages

As previously mentioned media campaigns will garner a large amount of non-paid media. While this can boost the circulation of messages, the content of these messages cannot normally be controlled. It has often been quoted in the media that "No publicity is bad publicity" and this may ring true when the aim is simply to gain maximum exposure. This is not necessarily true when the aim is to provide specific educational content that is capable of motivating certain populations. The content of 'non-paid media' cannot be controlled, which is problematic for health campaigns needing to communicate clear, consistent messages and to provide accurate information. Erroneous messages can also be spread through such media. For instance, a 2009 Sunday Telegraph headline read; "Health warning: exercise makes you fat"[116]. This was based on the results of just two trials (which themselves were reported out of context) and failed to reflect the overwhelming evidence to the contrary[117]. The headline message (and indeed the article which followed) favoured catching the attention of the reader instead of accurately representing the state of knowledge. One of the lead academic's whose research was presented, personally lambasted the article for detailing the research out of context and misrepresenting the science. While this is a rather extreme example of misinformation from mass media materials, favouring sensational information is a common and unfortunate trait of media campaigns. For instance headlines such as "Fatties R Us"[118] demonstrate the overemphasis of obesity campaigns on appearance rather than the health issues surrounding obesity. In these instances, more glamorous, eye-catching and consumerist information overshadows more important but potentially mundane information. The immediacy of online campaigns could also lead to some information becoming mainstream before it has been sufficiently empirically tested. Whilst mass media campaigns can improve health knowledge on a grand scale, they could alternatively result in misinformation on a grand scale if information is released that is inaccurate or of a low standard.

The budgets of competing commercial promotions e.g. junk food or video games, far outstrip those given to health campaigns[119]. For instance the UK-based company Cadbury's spent £584 million on advertising in 2008[120]. While companies not based in the UK but with a large influence on UK markets such as Coca Cola, McDonald's and video game manufacturers Electronic Arts Inc. spent $9.5 billion (2010-2012), $2.53 billion (2010-2012) and $873 million (2011-2013), respectively on advertising over a three year period[121,122,123]. This is compared to a

Department of Health budget of just £75 million for the first three years of *Change4Life*[70]. In addition, whilst the budgets of global commercial enterprises tend to increase year on year, the purse-strings of health campaigns are typically tightened after the first few years. Thus, for every item of material promoting physical activity there are several more promoting behaviours contrary to health such as, playing video games, eating junk food etc. Physical activity campaigns which tend to originate from non-profit organisations will often turn to the commercial sector for financial support to boost the exposure of their campaigns. Unfortunately, this can lead to messages which are not wholly consistent with the recommendations of the planning documents which could lead to reduced credibility of campaign messages and misinformation[124].

The budget and partnerships of a given campaign will have a powerful influence over the exposure it achieves. Another factor which could influence the effectiveness of mass media campaigns is actual intake of campaign messages by the target population. A mass media campaign will not be seen by all of its target population and only a proportion of those who see the message will consider it, internalise it and process it, with fewer still actually acting upon it. Further, as Dishman[125] discusses, physical activity interventions generally promote the adoption of physical activity with few promoting sustained or periodic physical activity. The result is that only a small fraction of the initial target population will ever see, process and react to mass media campaign messages promoting sustained guideline-fulfilling physical activity and experience improved health as a result. This makes it even more important that messages are on point.

1.4.8. A final note on mass marketing

The above review presents a mixed picture of mass media campaigns for physical activity in adults. The *VERB* campaign was launched by the Centre for Disease Control (CDC) in the US in 2001 following receipt of $125 million from Congress[126] to target physical activity levels of children. It reported positive effects on awareness and understanding[127], attitudes[128] and physical activity levels[129]. While the *VERB* campaign provides a framework for success for mass media campaigns targeted towards children[130], there does not appear to be an equivalent success story

for adults. One of the main reasons for this could be that the *VERB* campaign focused largely (though not exclusively) on modifying the school environment and using messages to encourage new ways of using this environment e.g. an advertisement showing children doing different activities in the school carries the voiceover "Shake! Swing! Explore! There are millions of verbs out there. It's what you do" (http://www.cdc.gov/youthcampaign/advertising/african.htm). The prevailing school environment provides a relatively consistent context in which large-scale campaigns can be introduced. While no two schools are the same it can be assumed that there is less variability between schools than between workplaces in terms of the physical environment and the timing of the day (i.e. most schools will run from 9 am to 3 pm whereas workplaces can have many different working hours). In addition, *VERB* targeted both children and parents as a strategy to increase children's physical activity[131]. Whilst campaigns such as *Change4Life* and *Push Play* have attempted to target adults physical activity levels by considering the family approach (e.g. *Change4Life* television advertisements often begin with a family sat on the sofa and show parents and children being active together), this is generally less prevalent in adult campaigns than campaigns developed for children. Finally, *VERB* had an explicit strategy for reaching minority groups[132]. Whilst campaigns such as *ParticiPACTION* successfully targeted minority groups, many of the aforementioned adult campaigns may have done so to a far lesser extent. This highlights three factors: the environment to which the intervention is introduced, consideration of individuals' closest normative influencers (i.e. husband/wife, children) and targeting of important sub-populations. While many mass media campaigns geared towards adults have considered at least one of these factors, they may have failed to consider all of them at once as comprehensively as reported by *VERB*.

While mass media campaigns are expensive, often cling only loosely to theory and have demonstrated limited effects on mediators of change or behaviour despite generally being highly recognised. A recent review by Abioye and colleagues is particularly discouraging, concluding that "mass media campaigns may promote walking but may not reduce sedentary behaviour or lead to achieving recommended levels of overall physical activity"[133]. On the other hand there are success stories, *ParticipACTION* being a good example. Outcomes need to be considered in relation to the challenges physical activity campaigns are up against. Firstly, it may be expecting

too much of these campaigns to convert populations towards meeting physical activity guidelines when the baseline level of physical activity is so low[3,134].

In addition, the media environment in which they are used presents a challenge. Competing forces (e.g. fast-food, sedentary pursuits, etc.), backed by large budgets, have been promoted fiercely in all areas of society for a prolonged period of time. In the 60's the inception of anti-smoking advertisements coincided with a sharp decline in smoking throughout the late 60's and 70's[135]. Health marketing campaigns can therefore be a success if they are intelligently developed and utilise the best empirical research to inform their messages. Ultimately, it is an extreme challenge to determine whether mass media campaigns have been, or will be successful in changing population health behaviours. Regardless, they are here to stay. In 2008, the Department of Health published a strategic framework entitled "Ambitions for Health"[136]. This document sets forth a plan to embed a social marketing approach to improve health and change behaviour. The 2008 Physical Activity Guidelines for Americans state that "The guidelines will be widely promoted through various communication strategies, such as material for the public, Web sites, and partnerships with organizations that promote physical activity"[7]. Messaging campaigns will clearly play a leading role in future promotional efforts to achieve physical activity targets and reduce sedentary behaviour on both sides of the Atlantic. Thus, further research into the messages which define these campaigns is urgently needed.

1.5. Theoretical underpinnings and aims of the present thesis

1.5.1. The theory of planned behaviour

Chapter 5 presents an examination of messages using two theoretical frameworks. The first, is the TPB[98]. The TPB suggests that an individual's behaviour is determined by their behavioural intentions. Individuals are more likely to enact a behaviour if they plan to do so. As illustrated in Figure 2, the formation of an intention is influenced by the individuals' perceptions of behavioural control, subjective norms and attitudes. Perceived behavioural control is influenced by factors such as the environment, facilities, time, ability etc. Subjective norms are shaped by individuals' perceptions of other people's behaviour and their beliefs regarding how others

perceive them in return. Attitudes concern whether an individual feels positively about the behaviour, believes it is likely to be beneficial and so on.

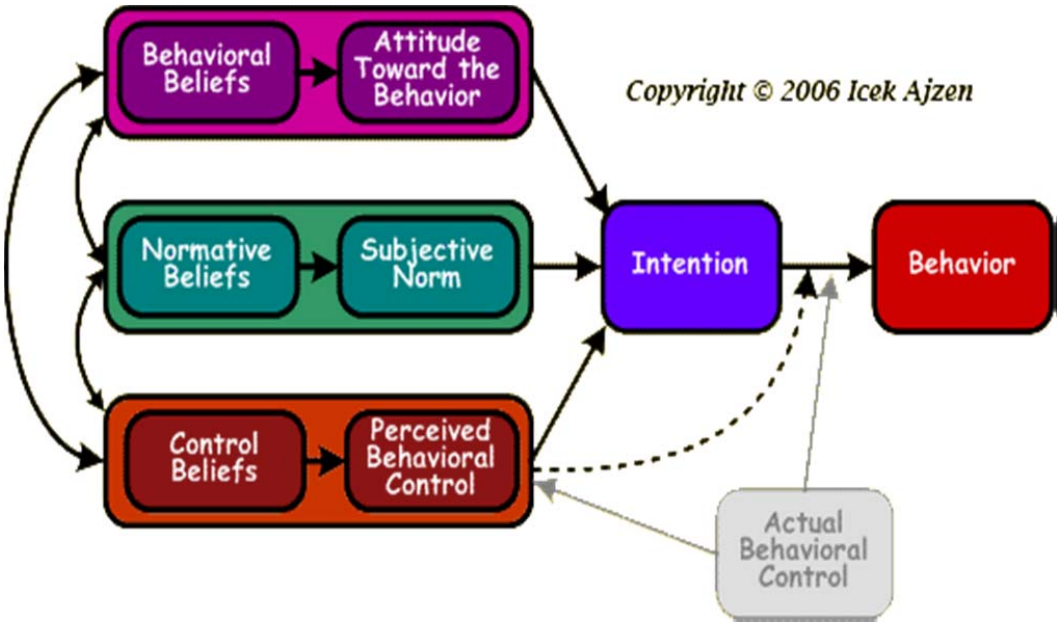

Figure 2. Diagram of theory of planned behaviour constructs and their relation with intention and behaviour

The research into TPB constructs and physical activity is substantial. While the influence of attitudes, perceived behavioural control and subjective norms on intention are now well-established for physical activity in general[137], lifestyle activity and exercise[138], and walking[139,140], the translation of intention to behaviour is more equivocal. Research conducted by Rhodes and Courneya has suggested that when TPB constructs are increased from low to medium levels, behaviour change is more likely than when TPB constructs are changed from medium to high levels[141]. Earlier work with 300 undergraduate students suggests behaviour is more likely to follow intention when the frequency of intended exercise days is lower, behavioural control is higher and attitudes are positive[142]. Indeed, TPB has been used by numerous interventions to develop messages promoting physical activity, with positive effects on intentions and behaviour[17,26,143,144].

1.5.2. The precaution adoption process model

Chapters 5 and 6 also present an examination of messages using the theoretical framework of the precaution adoption process model [PAPM][145]. The PAPM is a behaviour change model which suggests that individuals must move along a series of stages (shown in Figure 3) before they are likely to adopt a new behaviour. An individual is more likely to become engaged (stage 2-3) when they realise that the behaviour, in this case physical activity, is beneficial and important for health and that failing to engage in sufficient amounts could have severe negative consequences. In this instance, the individual may develop positive attitudes, perceptions of control and beliefs that the behaviour is socially desirable and supported. However, an individual is only likely to make the decision to act (stage 4-5) i.e. increase their physical activity, if they feel that they do not currently engage in sufficient physical activity and the aforementioned negative consequences pose a personal threat to them. If the perceived disadvantages of these consequences outweigh the perceived disadvantages of engaging in the new behaviour then the individual is likely to initiate attempts to enact the behaviour.

In relation to current attempts at increasing population physical activity, evidence suggests that people are becoming aware of the importance of physical activity[146]. However, numerous studies have shown that many inactive adults overestimate their physical activity levels and perceive themselves to engage in sufficient amounts of physical activity[147,148,149,150,151]. Inactive adults who believe they engage in enough physical activity to meet guidelines are unlikely to recognise

Figure 3. The stages described by the precaution adoption process model[153]. Each stage is characterised by increasing beliefs of susceptibility and severity

physical activity promoting messages as being relevant to them[147]. The TNS Segmentation study (reported by the Department of Health [33]) found that 93% of parents agreed that obesity was an issue of both importance and concern. However, only five percent agreed that it was 'their' issue (i.e. a problem for them). There was also routine underestimation of food intake and overestimation of activity levels within this sample. This trend was again prevalent in a later report[79] in which inactive individuals who overate considered themselves to be engaging in sufficient physical activity and eating a healthy diet. Indeed, less than three percent of participants from the 2007 Health Survey for England (HSE; $N > 4{,}800$; calculated from dataset) disagreed with the statements; "physical activity is good if only ten minutes" and "physical activity is good even if only moderate". These individuals have positive instrumental attitudes regarding physical activity and yet actual physical activity remains low. Anecdotally, it is commonly believed that the rise in media coverage, diet products and exercise facilities etc., in recent years has increased awareness making educational campaigns redundant. On the contrary, evidence suggests that people are still inept at judging their own behaviour and the trend in misperceptions is actually increasing[152].

The premise of the PAPM that people will not change their behaviour unless they feel vulnerable to maladaptive consequences[145,153] has garnered empirical support[148]. Indeed, this represents a different challenge to alternative health behaviours such as giving up smoking, in which individuals know conclusively that they are smokers. As a central tenet to large-scale behaviour change, *Change4Life*[33] recognises that for individuals to become more active they must recognise that they are at risk and take responsibility. Indeed, changing self-awareness of individuals to improve appraisal of behaviour was found as one of the most important factors for stimulating motivation when evaluating the early stages of *Change4Life* [34].

1.5.3. Theory to inform mass media campaigns

This section provides an overview of the use of theory in some of the major mass media physical activity campaigns. The planning documents of *Change4Life* discuss the creation of a hypothetical behaviour change model to inform marketing activities[33,34]. No theories are referred

to by name but the model does appear to have been informed by theoretical research and mainly the health belief model [154]. The theoretical model of *Change4Life* is shown in Figure 4:

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Figure 4: The theoretical model of *Change4Life* as printed in its 2009 planning document

The health belief model[154] suggests that the likelihood of changing behaviour, in this case engaging in more physical activity, is increased by feelings of susceptibility towards the negative consequences of not engaging in physical activity 1, presence of an apparent threat of not changing behaviour 2, overcoming barriers to physical activity, awareness of the costs and benefits of physical activity, increased self-efficacy 3, motivation to change behaviour 4 and cues to action 5. The numbers refer to the behaviour change model of *Change4Life* shown above and highlight its links to the health belief model. Despite its apparent use, the health belief model was designed to explain engagement or non-engagement with a behaviour and is not designed to predict behaviour change. A prevailing focus on the constructs of severity and susceptibility, as is consistent with both the health belief model and PAPM, is notable throughout the communication strategies of *Change4Life*. For instance, the *Change4Life* 2009 Marketing strategy states, "Before we can expect behaviour change on any significant scale people will need to be concerned that weight gain has health consequences and recognise that their families are at risk, and take responsibility for reducing that risk"[33]. The campaign is also reportedly designed to create positive social norms and a belief in one's ability to change as a precursor to increasing positive intentions for behaviour change. In this way, *Change4Life* also appears to be informed by the TPB. Goal setting theory and self-efficacy theory are also evident throughout the planning documents e.g. "people are encouraged to create their own goals" and "people need to believe that change is possible".

Other campaigns which report to be informed by psychological theories include Australia's *Find Thirty* informed by self-efficacy theory[155], *Get Active America*, *Get Moving Tasmania* and the

Healthy Hawaii Initiative informed by the socio-ecological model[7,156,157], *Get Active America* informed by theories of support[7], *Let's Make Scotland More Active* informed by TPB[158], and *ParticipACTION* informed by social cognitive theory, health belief model, TPB and the transtheoretical model[88,159].

1.6. Review of message characteristics

There is a wealth of research into aspects such as message framing[14], tailoring[5] and credibility[160] which informs the development of messages promoting the health benefits associated with physical activity. No research has examined messages promoting physical activity guidelines specifically. However, physical activity guidelines will ultimately be communicated within the grand scheme of a physically active and healthy lifestyle. Adults are advised to engage in at least 150 minutes a week of MVPA in addition to leading a generally active lifestyle[6]. Thus, specific messages on physical activity guidelines will sit alongside messages which elucidate the health links with physical activity more generally. For instance, in 2009 the UK launched its first national campaign for physical activity called *Change4Life*[33]. It's hallmark television advertisement entitled *Alfie,* promotes MVPA guidelines in the sentence "Get meself going for 150 minutes per week"; sandwiched between messages around physical activity and health e.g. "Instead of being nifty I'm knackered, it's harder getting up the stairs" and "To start to see the end of your middle". In the context of mass media campaigns, therefore, this research provides useful guidance on the formatting of many physical activity messages and will need to be applied synergistically with the research presented in the present thesis on physical activity guidelines.

1.6.1. Message framing

Health messages can be framed to highlight either the benefits of engaging in a particular behaviour (gain-frame) e.g. "Physical activity can help you lose weight", or the consequences of failing to engage in a particular behaviour (loss-frame) e.g. "Lack of physical activity can make you gain weight". Message framing has been examined extensively in health communication research. A recent meta-analysis conducted by Gallagher and Updegraff summarised findings

from 94 studies on the efficacy of gain and loss-framed messages in encouraging health protection behaviours[13]. The review concluded that gain-framed messages (i.e. messages which highlight the benefits of engaging in physical activity) were generally more effective than loss-framed messages (messages which warn about the consequences of not engaging in physical activity) at motivating health protective behaviours such as increased engagement in physical activity. Separate analysis of 23 studies using gain-framed messages to promote physical activity produced some of the strongest results ($r = 0.16$, $p < 0.01$). These results suggest only a small association between gain-framed messages and behaviour. However, the analysis pooled data for all the variables that were presented in the 23 studies including, attitudes, intentions, change in behaviour etc., and presented the mean effect size. Thus, any variables which were not influenced by the gain-framed messages will have diluted the overall statistic. The authors also noted that the greatest effects of gain-framed messages were mostly on behaviour rather than its motivational antecedents such as, intention. From this review, it is possible to conclude that gain-framing is preferable; however, this may not be mediated by belief and intentions which are typically thought to drive behaviour. Framed messages have also been examined alongside various potential moderators to improve understanding of how these messages may be conveyed in different contexts. For instance, a Gallagher and Updegraff study found that gain-framed messages were only effective in promoting physical activity when individuals were motivated by intrinsic outcomes, such as enjoyment or satisfaction[12]. This was also supported by Parrott and colleagues who found that gain-framed messages failed to increase motivation to be active for individuals with extremely negative perceptions of exercise enjoyment at baseline[143]. Thus, these messages may not be effective for the most hard to convince groups who are likely to be the least active. Also, Latimer et al found that some individuals are more oriented towards gain-framed messages and others towards loss-framed messages[19]. This suggests that two types of message may be differentially effective within a population depending upon the orientation of individuals within that population. Positive findings across studies for gain-framed messages may, therefore, be partially explained by a greater number of people within the population being gain-oriented, and not simply by the superiority of such messages. This would suggest that mass media campaigns should generally present messages which emphasise the gains associated with engaging in physical activity such as improved health, energy or mood, rather than messages which emphasise the losses associated with not participating.

1.6.2. Source credibility and specificity

A message which comes from sources perceived to have expertise in the topic such as, the government, health organisations and private marketers is likely to be considered to be more credible than those that do not[161]. Manipulation of the source credibility of messages has produced conclusively positive results in studies investigating the promotion of physical activity. In a study by Webb and Eves, adults (N = 1,200) were read the physical activity message; "regular stair-climbing helps to keep you healthy"[31]. Participants were randomised into two equal groups, with one group being told by the researchers that the message was true thereby validating the message. The other group was not given any additional information to influence the credibility of their message. The adults in the message validation group reported the message to be more persuasive than those who were not told that their message was true. Similarly, Jones and colleagues gave 192 students a pamphlet advocating physical activity[160]. Participants were randomly assigned into a Credible Source Group and a Non-credible Source Group. The Credible Source Group was told that this information had been provided by a medical doctor while the Non-credible Source Group was told that the information had been provided by a high-school science student. Those in the Credible Source Group reported more positive intentions towards physical activity, recalled more of the information in the pamphlet, and showed a greater intention to be active. Specific messages have also been found to be more effective than more general messages. For instance, Webb and Eves found that messages outlining specific consequences of stair-climbing (e.g. "stair-climbing keeps you fit") were more persuasive than general descriptions of stair-climbing (e.g. "stair-climbing is free exercise")[31]. Mass media campaigns may benefit from foregrounding their most credible supporters, such as, health organisations and governing bodies and providing specific information.

1.6.3. Fear appeals

Another feature to have been investigated in communications research is the use of fear appeals. Physical activity messages which use fear appeals emphasise the threat of not engaging in physical activity by referring to the likelihood of experiencing negative consequences and the

magnitude of these consequences[162]. An example of a message using a fear appeal could be; "If you don't engage in physical activity you risk heart disease." The extended parallel process model [EPPM] elucidates the mechanisms of fear appeals and describes the conditions in which they are likely to be adaptive[163]. Fear appeals manipulate the threat felt from not engaging in a particular behaviour, such as physical activity. They aim to scare individuals into doing what the message prescribes, by increasing the individuals' feelings of susceptibility to deleterious effects and elevating the perceived severity of these consequences.

Perceived susceptibility refers to an individual's estimation of the likelihood of experiencing the threat, whereas perceived severity refers to an individual's estimation of the magnitude of the threat[24]. For example, the link between physical activity and cardiovascular disease is now well recognised in academic circles and by health practitioners[164]. Thus, threat could be created by making inactive or insufficiently active individuals mindful that they are likely to suffer from cardiovascular disease and by outlining the problems associated with this outcome such as, time off work, missed time with family/friends, sickness/death etc. Such threats can exert powerful influences on the decision to change behaviour[165,166]. However, for this to occur, an individual must initially believe that they fail to engage in sufficient activity (i.e. susceptible to inactivity) and that this is related with severe consequences. In addition, the EPPM suggests that increasing perceived threat will only have adaptive outcomes such as planning to change behaviour, if the individual has high self-efficacy[28]. If, on the other hand, self-efficacy is low, then the individual is likely to employ maladaptive coping strategies such as avoiding the message, to reduce their fear. Cho and Salmon found that students in the pre-contemplation stage of change responded to threats negatively, whereas those in higher stages found them more motivational[28]. Threat appeals are therefore unsuitable for mass media campaigns for two reasons. Firstly, a large proportion of the population is currently not engaging in physical activity and report lacking the motivation to start[167]. The findings reported by Cho and Salmon suggest that threats would likely result in avoidance for these individuals, who are the very people physical activity campaigns most hope to inspire[28]. Secondly, the least active individuals who are most likely to be discouraged by threatening messages also tend to have the lowest socioeconomic status[168]. If such messages are less effective for individuals who are the least active and the most socially deprived they could widen existing health inequalities. In the physical activity literature, fear

appeals are often considered alongside framing where the targeted fear can be positively or negatively framed. For instance, a message can suggest that physical activity will reduce the risk of suffering a heart attack or it can warn that insufficient physical activity will increase the risk of a heart attack. In the literature fear appeals are often described as emphasising the negative consequences of not doing something[24]. This definition is very similar to that of negative framing and does not comprehensively describe fear appeals. In order for messages which combine fear appeals and framing to have desirable effects on physical activity behaviour it is necessary to understand which threats are important within the target audience. Studies often fail to do this, instead using general links between physical activity and disease to construct messages. For instance Brengman and colleagues reported no differential effects on intention to be active between individuals who received messages based on low ("lack of exercise leads to stress… individuals with increased stress are about seven days a year more ill", moderate ("lack of exercise leads to insomnia… individuals with insomnia are about 12 days more ill") and high ("lack of exercise leads to depression… individuals with depression are about 20 days more ill") fear appeals[24]. However, it is difficult to conclude that threat was indeed highest in the 'high' threat group as personal judgements of severity will be different for different conditions i.e. seven days of stress could be considered to be a greater threat than twelve days of insomnia. In summary, there is little support for the inclusion of fear appeals in physical activity promotion efforts.

1.6.4. Tailoring

Message tailoring fits messages to individual characteristics, such as personality factors like coping styles, or preferences for thinking extensively about choices. Studies investigating tailored, or individualised messages have produced equivocal results. Bull and colleagues reported comparable changes in physical activity for adult primary care patients receiving a standard or a tailored pamphlet on physical activity[169]. However, the standard pamphlet was developed using information on common benefits of and barriers to physical activity, while the tailored pamphlet was developed using information on benefits and barriers specific to the target population, thus the material in the two pamphlets was not appreciably different. Hageman and colleagues compared standard and tailored online newsletters in a study with 50-69 year old

females[170]. Both groups reported a similar reduction in barriers to physical activity. Langille and colleagues found that messages tailored to personal requirements for diet and physical activity (e.g. activity recommendations following fitness testing) produced more positive attitudes towards physical activity than non-tailored messages[171]. In addition, Quintiliani et al provided two groups of female college students with messages tailored according to stage of change[172]. While one group had been chosen by an expert panel to receive the tailored message based on their self-reported health behaviours, the other group had self-selected themselves to receive the tailored intervention. The messages increased vigorous physical activity and self-efficacy towards physical activity to a greater extent in the group chosen by experts. This suggests that the involvement of participants in message development and the backing of respected experts are both important. Recently, Latimer and colleagues systematically reviewed 12 studies which delivered interventions using tailored messages to participants[14]. Seven of the twelve studies favoured tailored materials over no message at all for improving physical activity stage of change. However, only one out of six studies reported tailored materials to be more effective than a generic comparison message.

Tailored materials appear to be as effective as, or better, than non-tailored materials when it comes to promoting physical activity. Currently, mass media campaigns tend to use a combination of tailored and non-tailored materials. For instance, *Change4Life* has a number of sub-campaigns such as *Walk4Life, Start4Life, Muck in4Life* and *Sport4Life* which are tailored towards specific sub-groups such as older adults, young families and children. More research is required to determine how messages should be tailored to maximise their impact.

1.6.5. Normative messaging

In comparison to tailored messaging, the influence of normative messaging in the physical activity domain is unclear. Descriptive norms concern individuals' perceptions of the prevalence of the behaviour of others i.e. "everyone else is active, so I should be too"[173]. Injunctive norms concern individuals' perceptions of others' approval of a given behaviour i.e. "everyone else thinks I should be active"[174]. While it is well established that normative social influences help determine individual behaviour, such influences on physical activity are not well understood.

Priebe and Spink found that messages including descriptive norms ("taking the stairs instead of the escalator - your co-workers popular choice") resulted in greater increases in stair-climbing behaviour in a workplace setting than messages focusing on health benefits, appearance or being active simply for its own sake[173]. However, this outcome was possibly dependent upon the availability of referents for others to follow and so may not be replicable with other types of physical activity behaviour and location. In other words, messages which encourage individuals to follow the active behaviour of others may only be effective in an environment where that active behaviour is clearly visible. In a mass media campaign, norm appeals rely on people initially enacting the behaviour early, after exposure to the normative message, and demonstrating the behaviour to others. The availability of referents is impossible to guarantee in this context.

1.6.6. Aspects of message content

Various aspects of message content including, affective/instrumental information, statistical/narrative information and images have also been investigated in the physical activity domain. Why and colleagues provided female undergraduates with a brochure containing either an affective message ("leisure walking energises, de-stresses and creates positive affect") or an instrumental message ("walking reduces one's risk of developing chronic disease, decreases body weight and promotes a longer and healthier life"), or a control brochure providing information on an unrelated topic[22]. The affective message was found to be associated with increased physical activity (number of steps measured with a pedometer), though the effect of the message in the absence of a pedometer is unknown. Another study investigated whether a brochure heavy in statistical content and a brochure heavy in narrative content had differential effects on control beliefs, attitudes and intentions regarding physical activity, and perceived message effectiveness of students[17]. No clear differences were found between message types for any of the outcomes. Finally, Gaston and Gammage investigated the effectiveness of brochures containing messages about the health benefits of postpartum exercise[175]. The health-based message greatly increased positive attitudes, perceived behavioural control and the intention to be active of participants. Image-based messages were also found to produce similar effects to health-based messages[176]. Mass media campaigns can make few firm conclusions from this

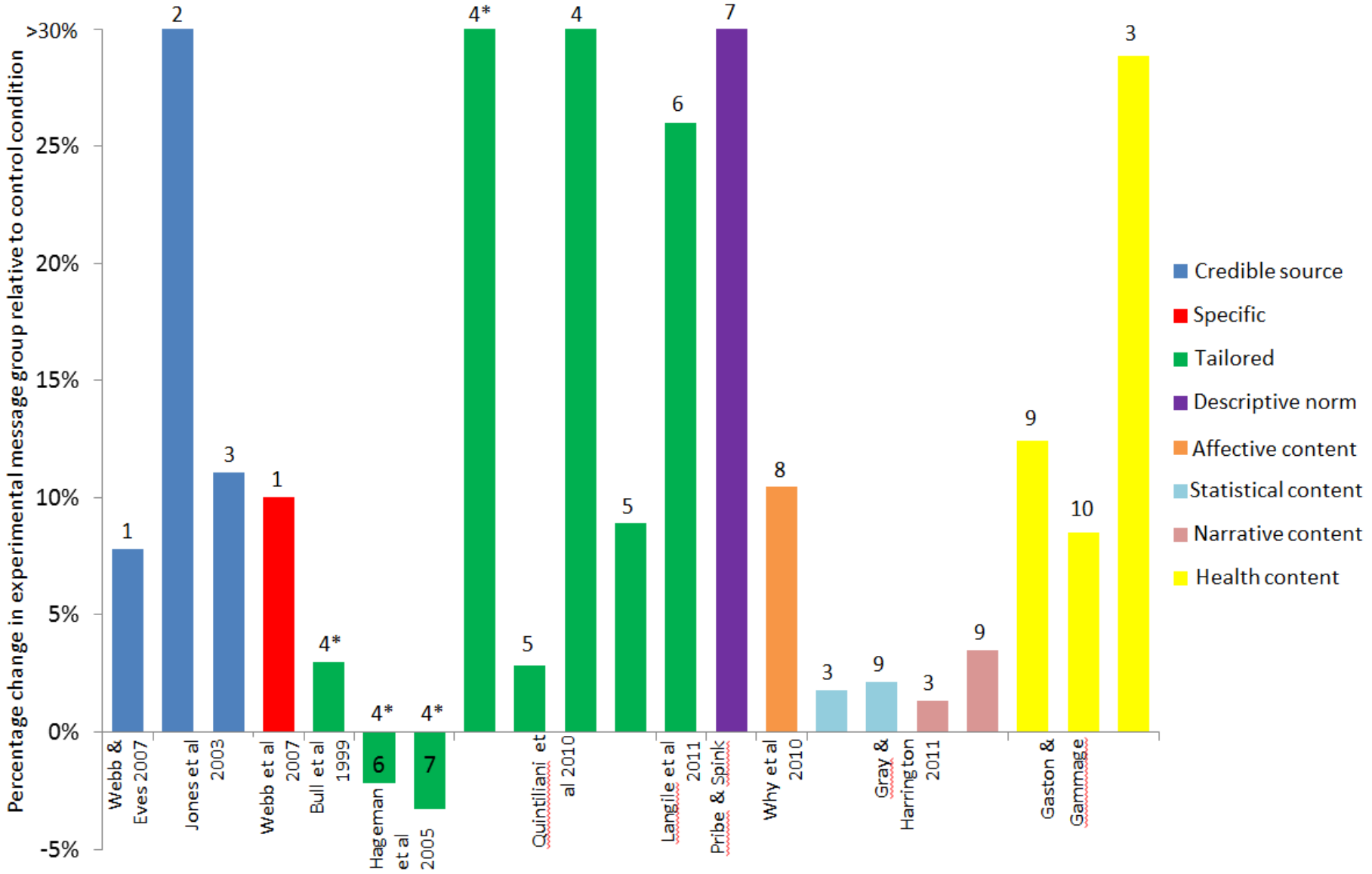

Figure 5. Percentage change in physical activity outcome variables relative to control message condition according to experimental message group. Outcome variable is numerically denoted. 1. Motivation. 2. Positive thoughts. 3. Intention. 4. Physical activity behaviour. 5. Self-efficacy. 6. Positive reaction. 7. Stair-climbing behaviour. 8. Pedometer steps. 9. Attitude. *Difference did not reach significance ($p<0.05$)

Table 2. An example of how the UK's largest physical activity mass media campaign, *Change4Life*, has used the empirical messaging literature to inform campaign messages

Message characteristics suggested by the literature	Consideration in campaign strategy?	Inclusion in *Change4Life*	Example from *Change4Life* media
Supportive messages (participating with others) may be better than challenge messages (criticise lack of participation). (Bailis et al, 2005)	*Understand what the person has to give to get the benefits proposed. Incentives, recognition, reward etc. (DH Health Improvement and Protection Directorate, 2009). Support change (DH, 2010). Coax people, remove guilt and shame (DH, 2011). Support people as they change (DH, 2009)*	*Group/family activities depicted in most adverts. Offers tools to help adults get active. Foregrounds environment as the main cause of inactivity. However, characters depicted as lazy in the beginning of adverts suggesting blame*	*"We've got loads more top tips to help you get more active" (Games4Life tips for subscribers, July 2012)* *"Life changed. In many ways it got easier" (Change4Life advert, 2009)* *"I can't imagine how it happened" [shows Alfie sitting on the sofa and eating chips] (Alfie advert, 2011)*
Clear consequences are more persuasive (Berry & Carson, 2010)		Simplifies and uses imagery to illustrate consequences such as CVD	"Not to mention what my middle is doing to my insides" (Alfie advert, 2011). "Move more. Live longer" (logo)
Threat appeals should be avoided for those with low efficacy. (Cho & Salmon, 2009)	*Increase the number of people who recognise their lifestyle choices threaten their health (DH, 2009)*	*Includes threat appeals, especially in adverts targeting families*	*"dangerous amounts of fat build up… more likely to get horrible things like heart disease, diabetes and cancer" (Change4Life advert, 2009)*
Gain-framed messages motivate health protection behaviour change better than loss-framed (Gallagher & Updegraff, 2012; Gray & Harrington, 2011)		*Mixes both gain and loss-framed messages*	*"get me going each day…to start to see the end of your middle" (Alfie advert, 2011)* *"Nobody had to run around for their food…dangerous amounts of fat"*

			(Change4Life advert, 2009)
Repeat exposure better than a single exposure (Latimer et al, 2010)	Public relations campaign, advertising, web-based tools, a partnership element. We will need sustained activity for years (DH, 2010). Remind people of the goals they set (DH, 2009). Our ambition will not be achieved in a single year but will require sustained pressure (DH, 2009)	Uses serial advertising and various media	"Get me going for 150 minutes each week" (Alfie advert, 2011). 'adults try to do 150 active minutes each week' (newsletter, August 2011)
Messages should increase self-efficacy in performing the behaviour (Noar et al, 2007)	*Minimise impact of competition from external influences (DH Health Improvement and Protection Directorate, 2009). Increase belief that change is possible (DH, 2010). Seek to inspire that change is possible (DH, 2009)*	*Attempts to show physical activity as achievable and compatible with every lifestyle but frames 150 mins/week as a 'must' which may compromise self-efficacy*	*"Swap it don't stop it" (Swap it don't stop it advice for adults, 2010) "You need to do at least 150 minutes of activity each week, but you don't have to do it all in one go - every 10 minutes counts!" (Games4Life tips – quick and easy, 2012)*
Messages should increase positive views towards the behaviour (Noar et al, 2007)	Show physical activity as possible and normal (DH, 2010). Reinforce belief in the impact of change (DH, 2011)	Heavy focus on enjoyment for kids but not included in adult campaign. Only the sub-campaign *Games4Life* makes physical activity seem fun	"So we can all stay healthy and have loads of fun doing it" (Wheelchair advert, 2012)
Frame in shorter terms (Peetz et al, 2011)	*Short-term changes are easier [to achieve] than long-term ones (DH, 2009)*	*>10 minute bout aspect only included in the small-print and in information sent to subscribers. 150 mins/week is foregrounded in most*	*"every 10 minutes counts! Here are our ideas for doing it in 10, 20 or 30 minute chunks" (Games4Life tips, August 2012) 'being active every*

		3communications	*day is essential for good health' (newsletter, September 2011)*
Messages should give an amount of physical activity but acknowledge that we are all different & we need to build up (Price et al, 2011)	*Recommend small but clinically significant changes (DH, 2011)*	*Information only included in the small-print but not in any major messages*	*"All adults need to be active every day, working up to their 150 active minutes in bursts of 10 minutes" (newsletter, September 2011, pg 2)*
Thresholds increase knowledge (Sugiyama et al, 2011).	"Specific, actionable and measurable behavioural goals" (DH Health Improvement and Protection Directorate, 2009)	Many communications include the thresholds of 150 minutes a week or 30 minutes on five days	"Get me going for 150 minutes a week" (Alfie advert, 2011)
Specific messages may be more motivational (Webb & Eves, 2007).	*"Use a developed segmentation approach not just targeting" (DH Health Improvement and Protection Directorate, 2009)*	*Specific information for duration and types of physical activity but intensity and context are relatively neglected with context only considered in the sub-campaign Walk4Life*	*"Walking is one… way to get… 150 active minutes" (newsletter, September 2011)*
Credible messages may be more motivational (Webb & Eves, 2007).	Build a coalition of partners and engage the local NHS (DH, 2010).	Backed by major UK health authorities, the Department of Health and the NHS	
Affective messages may be better than instrumental messages (Why et al, 2010).	*The logo is designed to be accessible and fun (DH, 2009).*	*Instrumental benefits of weight loss and health foregrounded. Any affective benefit is tied to the instrumental benefit i.e. lose weight feel better*	*"How to lose weight and feel healthy without giving up the things you love" "How would you feel if you lost a lost a bit of weight?" (Swap it don't stop it advice for adults, 2010)*
Health content may be better than image-based content	*Increase concern that weight gain could have health consequences. Reframe obesity from*	*Weight always mentioned in relation to health but other aspects of health not necessarily*	*"One day I was Jack the lad, the next moment I was Jack the porky middle-aged bloke" (Alfie*

	a cosmetic to a health issue (DH, 2010). Reframe the issue of obesity as not about appearance but about fat in the body (DH, 2009).	*associated with weight are neglected. Almost exclusive focus on weight may cloud the independent effect of physical activity*	*advert, 2011). "How to lose weight and feel healthy without giving up all the things you love" (Swap it don't stop it advice for adults, 2010)*

Where it appears that *Change4Life* has not been not consistent with evidence from the research literature the row is italicised.
DH – Department of Health. NHS – National Health Service

research informing the content of messages. The more robust evidence comes from literature examining the format of messages i.e. *how* information should be presented with glaringly little evidence to inform content i.e. *what* should be presented. It is also of note that the key statements in the physical activity guidelines such as "at least 150 minutes a week", "bouts of 10 minutes or more" etc.[6] have not been included in any of the messages under the research microscope. This should be an important area of focus for research informing mass media physical activity campaigns. Figure 5 at the end of this chapter summarises some of the key findings discussed in this chapter.

1.6.7. Limitations of current messaging research

Table 2 provides some examples of how research into the construction of physical activity messages has been applied to inform communications from the major mass media campaign *Change4Life*. While this body of research has therefore been somewhat useful, its applicability to the development of campaign messages promoting physical activity guidelines (examples from campaign messages promoting physical activity are shown in Figure 6) is limited for a number of reasons. Firstly, the messages included in current messaging research are often longer and more detailed than those typical of mass media campaigns[12,171,172]. Studies also tended to provide multiple messages to participants in a short time period[143] and personalised or delivered the message directly to the recipient in such a way that is not possible in mass media campaigns[19,171]. In addition, it is difficult to isolate the effects of the message from other

Figure 6: Threshold (left) and generic slogans and messages produced by mass media campaigns

intervention strategies which are often incorporated alongside the messages such as, fitness testing[170], feedback[171], provision of coach/exercise classes[24], motivational devices such as pedometers etc.[22]. In several studies it has also been difficult to identify the effects of message characteristics due to the similarity of messages used in control and intervention groups[22,160,177], while study samples have not always been representative of the wider adult population[160, 175,176]. In addition, many of the above studies relied on community leaders or local healthcare providers to disseminate messages. Despite the importance of physical activity for public health and its positioning on the health care agenda, the finding that an average of only 4.2 hours split over five years is currently spent on physical activity in UK medical schools, suggests that physical activity-related health is still not given the prominence it merits by many local health-care providers[178]. Indeed, the expertise and motivation to provide quality and uniform physical activity education to the population at the community level appears to be lacking. The bulk of responsibility for promoting physical activity to the general population currently falls on mass media campaigns and this is unlikely to change in the near future[179]. Such campaigns target the general population (though sub-groups can often be simultaneously targeted through pointed media, for instance, the *Change4Life* theme "How are the kids?", challenges parents to consider their children's health behaviour) and are reliant upon the messages themselves to 'recruit participants' to the campaign i.e. persuade further action from individuals such as visiting a webpage or attending a campaign event. Research into messages which are designed and delivered in a simple fashion and are more representative of the inception of mass media campaigns is required.

1.7. Aims of the present PhD

This thesis aims to draw on current physical activity messages prevalent in health promotion campaigns and to investigate their influence on the determinants of behaviour change. As discussed, current physical activity guidelines are the product of extensive research and debate amongst physical activity experts but no strategy has yet been developed to communicate these guidelines to adults, despite calls for one[180]. As a result, an abundance of campaigns from around the world have promoted these guidelines with little coherence or consistency and with little impulse as to the motivational implications of the messages for the public. Particular focus is on

the effect of the messages on constructs described by the TPB and the PAPM and the utility of these when predicting changes in behaviour.

The studies presented in this PhD thesis begin the examination of the messaging of physical activity and sedentary behaviour guidelines in mass media campaigns and has the following four aims:

1) To begin the examination of the current state of knowledge of physical activity guidelines within two separate samples of UK adults and assess the need for specific strategies to message physical activity guidelines to the adult population. Chapter 3 of this thesis explores knowledge of physical activity guidelines in UK adults in 2007 and 2013, and further examines demographic influences.

2) To explore the potential motivational impact of messaging physical activity guidelines to adults. Chapters 4 and 5 present cross-sectional studies which examine various ways in which duration and intensity of physical activity are messaged in mass media campaigns. The potential motivational repercussions of the different messages on self-selected adults are explored. In addition, Chapter 6 investigated the association between knowledge of physical activity guidelines and motivational determinants of physical activity. The aim of these chapters was to investigate whether the promotion of physical activity guidelines could increase motivation of some adults to engage in more MVPA.

3) To discuss promotional efforts aimed at reducing sedentary behaviour, which is a new challenge for health promotion. Chapter 7 presents a content analysis which discusses the development of messages around this topic and their integration into physical activity campaigns. The aim of this chapter was to highlight some of the main problems with messaging both increased physical activity and reduced sedentary behaviour in mass media campaigns and to identify key areas for future research.

General methodology

2. General methodology

2.1. Data collection

The data collection method selected will have a discernible impact on the reliability, validity and generalizability of the results. Self-report can be used to provide valuable information on many aspects of health research such as knowledge, attitudes, beliefs and behaviour, yet there is an identified lack of guidance from journals regarding the proper use of questionnaires[181]. The present thesis employed three main strategies for collecting data. The first was a structured street interview, the second was an online survey and the third was a directed content analysis. Each method will now be discussed in detail including both the reasons for selecting the method and the advantages and disadvantages of each. Methods for each individual study will also be briefly discussed in the relevant chapters. Ethical approval was granted for all studies by the ethics committee at Loughborough University.

2.1.1. Structured street interview

Chapter 4 reports data from short structured street interviews which were conducted to garner the perceptions held by adults of the health benefits associated with MVPA. Boynton and Greenhalgh stated; "anybody can write down a list of questions and photocopy it, but producing worthwhile and generalisable data from questionnaires needs careful planning and imaginative design"[182]. Two forms of questionnaires were utilised to collect data for this thesis. The first were researcher-assisted questionnaires or street interviews. The interviews were conducted between October and December 2011. In short, the interview schedule (see Appendix 2) was designed around five main questions (presented in order): "do you know what the current guidelines are for physical activity?", "Now that you know the guidelines (if participants had not known the correct MVPA guidelines in the first question they were informed) think of a typical adult. On the scale show what effect you think [insert duration] of physical activity would have on their health", "Do you currently engage in some physical activity for 30 minutes that makes you breathe heavily or sweat?" "Have there ever been periods in your life when you have been regularly active?" and "Rate the extent to which you trust the current physical activity guidelines". These questions were taken from previous literature but were delivered in the novel

context of a street interview[183,184]. This suited the exploratory and applied nature of the study. The interview schedule was piloted on one day in Loughborough town centre with 30 participants. Based on this experience the content of the schedule did not change but a strategy for concise questioning was made and interviewer delivery was formalised. The schedule was designed to guide the researcher during the short interviews and was only shown to participants when responding to question five (see Appendix 2). Interviews were initially conducted in Loughborough town centre; however, in response to consistently low footfall, the location was changed to Birmingham city centre after two weeks. During these first two weeks, data was collected from 186 participants (with an almost even split between groups [60, 46, 40, 40]) and separate analysis indicates that findings (discussed in later chapters) were not influenced by the location of data collection. All questions were short as this was deemed to be important for maximising adherence. Interviews generally lasted around five to ten minutes and were completed by 1,100 adults aged 18 and above.

While interviewer-assisted questionnaires impede privacy to participants, questions were not of a personal nature and it was also possible to deal with any concerns or uncertainties arising during the interview, which helped to ensure that participants remained interested and cooperative throughout. As answers were entered by the researcher, ineligible or 'creative' responses could also be avoided. Indeed, interviewer-assisted surveys have been shown to result in lower non-response than self-administered surveys and have been referred to as the 'gold standard' of surveys[185]. The strategies employed to optimise engagement with and completion of the survey, are detailed in Table 3. All interviews were conducted by the same researcher who made every effort to deliver uniform interviews and to avoid influencing the responses given by participants through non-verbal communications. Data were entered by the same researcher at the end of each data collection day.

The decision to recruit a convenience sample was a pragmatic choice made by the candidate borne out of pressures to conduct the research within a limited time-frame. While a large sample size was achieved it carries with it a number of limitations. One of the main disadvantages of this method of data collection is that the resultant study sample is self-selected and may hold views which are not shared by the majority of the population. Further, it may induce socially desirable

responding. Most responses were recorded on a closed scale and did not tackle topics of a sensitive nature in order to reduce the influence of this on results but the possibility of bias remains. Another disadvantage is that it was not possible to collect any meaningful data on non-response. Previous studies using similar data collection methods have systematised data collection, for instance by approaching the *n*th person in a shopping centre, and collected data on individuals who did not participate[186,187]. This method was not employed in this research for two main reasons. Firstly, research was conducted in a busy square with a high volume of people coming from all directions making it impossible to identify the *n*th person with any accuracy. Instead, the researcher consistently approached the closest person in the vicinity. Secondly, the majority of approached individuals refused to take part in the study. This was due to a reluctance to engage with an unknown individual in the street borne out of a large number of marketers, sales-people and charity collectors operating within the same area. As the vast majority of individuals refused to take part before listening to the reason for which they were being approached (only a handful of individuals declined after learning the purpose behind them being approached was for a research project), non-response data would not have been very meaningful.

2.1.2. Online survey

Chapters 3, 5 and 6 report data from an online survey. Data collection occurred in the order presented in this chapter i.e. the street surveys were conducted first, followed by dissemination of the online survey. Chapter 3 comments on data collected from the online survey (which also collected data for Chapters 5 and 6) before data from the street surveys is discussed in Chapter 4 in order to improve the flow of the present thesis. The purpose of the online survey was to collect data from UK adults on knowledge of physical activity guidelines, engagement in physical activity, awareness of physical activity behaviour, motivational constructs relating to TPB and PAPM, and demographics

Findings from Fricker and Schonlau show that most people choose to respond to surveys by mail rather than the internet when given the option[185]; however, responses to questions related with physical activity appear less affected by questionnaire format than other types of health behaviours[188]. The internet is a major component of current mass media campaigns. Most

messages are now delivered through campaign websites and so it is fair to assume that individuals who are reached by mass media physical activity campaigns are more likely than the general population to be computer literate. Addressing this probable imbalance is a separate albeit important issue that is beyond the scope of this thesis. An online survey was deemed an appropriate medium for a number of reasons. The survey was intended to be completed by a large sample of adults from the general population but this aim would have been cost-prohibitive for a postal survey. An online survey can reach a large sample cost-effectively and data is downloaded directly which reduces risk of human error. In addition, participants are able to access the survey at a convenient time and in a private environment that is comfortable to them (provided of course that there is access to a computer). The survey was developed from a number of validated items in the extant literature, many of which have also demonstrated reliability in internet surveys[189]. It was initially piloted amongst a small group of 15 adults recruited from the host institution and using the social network site Facebook. Whilst it is recognised that this is not an ideal sampling method for the piloting phase, as many steps as possible were taken to ensure reasonable piloting within the timescale available. At the very least, this phase was able to ensure that the survey would be understood, could be completed, wasn't boring or offensive and looked appealing[190].

Initial plans were to disseminate the survey through the British trade union, Unison. Unison has 1.3 million members across the UK. In early 2012, Unison agreed to disseminate the survey directly to their members via email provided that content was also included which covered the workplace environment and working pressures. Following almost 12 months of meetings between the candidate and Unison and development of the survey, it was eventually disseminated through Unison but rather than being sent directly to members, the survey was placed on a non-prominent page of the website. This garnered only seven responses (not included in any of the analyses reported in this thesis). This setback led to a reconsideration of the channel through which to deliver the survey. Unfortunately, time pressures dictated decisions surrounding sample selection. The final online survey was administered to UK adults in February and March 2013 through JISCMailing lists as this offered a large pool of UK adults to target. JISCMail has 178,729 users in the UK. The purpose of the list is to "support learning, teaching, research or professional support activities across UK education and research communities".

Topics range from microbiology to construction workers and from hard to reach groups such as minority ethnic groups and gay and lesbian groups. Thus, the list offers access to a large number of individuals from various socioeconomic backgrounds. In addition, email appeals have become so common they are likely to be ignored and the threat of viruses has resulted in distrust of emails from unknown senders. Posts through this list are generally seen as credible and trusted which increases the likelihood that individuals would consider following the link to the survey. Access was granted to 152 lists. A summary of the topic and number of subscribers to each list joined by the researcher is provided in Appendix 5. Based on the number of subscribers to these lists, the survey was sent to a potential 47, 950 UK email addresses. This sampling frame is likely inflated due to individuals being on multiple lists, email accounts being invalid or expired and the use of control settings such as directing mail to junk folders (evidence suggests emails are increasingly being considered as 'spam'[185]). With 2,332 adults responding to the survey this gives an estimated response rate of 4.9%, although this is likely an underestimate for the aforementioned reasons. JISCMail groups were divided into 16 different categories based on similarly themed topics. The number of respondents to the survey from each general topic is also shown in Appendix 5. Invitation letters were tailored to each particular group and can be viewed in Appendix 3. Recommendations stated by Parsons were followed when designing invitation letters[191]. This garnered 2,332 responses to the survey of which 1,774 completed all questions. Suggestions from a number of previous research studies of were followed to maximise engagement with the survey[190,191,192]. For instance, a clear design and simple layout was used, the aim of the study was explained on the opening page, contact details were provided to answer any queries and questions were concise. Closed questions were generally used, with open questions incorporated where appropriate, as has been previously suggested[193]. The survey was kept short due to evidence that long online surveys result in fatigue[194] and participants losing concentration and surfing other sites[185]. In addition design features, such as, putting one question at a time on a full-screen page, skip logic, response prompts and enforced answering were used to make the survey clear and concise and discourage non-response, while IP address and cookie tracking was used to prevent multiple responding. Specific strategies that were employed to improve both the quality of and adherence to both the street interview and the online survey are shown in Table 3.

Table 3. Strategies used when designing or delivering the structured street interviews and the online survey to overcome foreseen barriers

Barrier	Structured Street Interviews	Online Survey
Distrust of stranger/unknown sender	Wore university identification and developed rapport. The purpose, length and beneficiary of the study was initially explained. Personal information was not collected	Distributed through trusted mailing lists. A personalised invitation email introduced the purpose, length and benefits of the research. Welcome page of the survey included the University logo
Risk of socially desirable responding	For most questions it was not obvious what the socially desirable response would be. Developed rapport	Could be completed in a private environment
Distractions in the environment	Questions were short and researcher used verbal prompts	Survey was concise and questions were used sparingly on each page
Data entry	Questionnaires were entered by a single researcher at the end of each day	Data was directly downloaded
Non-response	Personal information was not collected. Verbal prompts	Automatic prompts
Missing values	Researcher completed the required information	Automatic prompts
Lack of clarity	Researcher was available to answer questions. Questions were unambiguous	The number of questions displayed on the screen at one time was limited. Conventional question formats were used
Illegible responses	Questions mostly required a single number response. Researcher wrote down responses	Most questions required responding on a scale with a limited number of response options
Loss of interest of participant	Interview was kept very short. Importance of the research was reiterated by the researcher	Was designed to be aesthetically pleasing and simple. Easiest and quickest questions were placed

		first. A range of tick boxes, linear scales and open boxes catered for a range of responses. Skip logic ensured that only questions relevant to each individual were viewed. A bar at the top of each section indicated the time remaining
Perceived burden	Participants were informed at the start that the interview would last five to ten minutes	Welcome page informed participants the survey would take around 15 minutes and a progress bar included at the end of each section emphasised progress
Heuristic responding	For questions requiring a recall of information participants were told the information if they couldn't remember	Questions regarding topics for which knowledge was presumed to be low were asked initially in open format and then given prompts
Lack motivation	Full details of the purpose and benefits of the study were explained by the researcher	Full details of the purpose and benefits of the study were provided on the welcome page.
Fatigue	Questions were short. Open-ended questions were used sparingly. Verbal progress indicators were given	Design features such as colour, text, layout were used to improve ease of reading and minimise strain. Line length was limited. Screens were used instead of scrolling. Open-ended questions used sparingly
Confusion	Researcher answered any questions.	All response options were visible. Drop-down boxes were avoided. Completion cues were provided. Researcher contact details were provided to answer any questions
Multiple responding	Researcher interviewed each individual only once	A final page informed individuals of submission. IP address and cookie tracking prevented multiple responding

Table 4. Comparison of demographic characteristics of the online survey sample and the Health Survey for England 2011 sample

	Online Survey		Health Survey for England 2011	
	%	N	%	N
Gender				
Male	31.1%	711	44.4%	3,732
Female	68.9%	1592	55.6%	4,679
Ethnicity				
White	92.7%	2162	89.7%	7,513
Mixed	1.5%	34	1.1%	93
Asian/Asian British	2.4%	57	4.6%	383
Black/Black British	.9%	22	2.5%	212
Chinese/Other ethnic group	2.4%	57	2.1%	173
Age (years)				
18-24	12.4%	286	7.8%	656
25-34	22%	507	15.1%	1,274
35-44	23.9%	549	18%	1,516
45-54	24.1%	554	17.7%	1,490
55+	17.6%	405	41.3%	3475
Employment Status				
Employed	83.2%	1879	54.7%	4,605
Unemployed	1.6%	37	4.2%	355
Retired	.8%	17	26.9%	2,265
Other economically inactive	14.4%	325	13.6%	1,148
Highest Education Level				
Degree	87.2%	1997	23.9%	2,008
Vocational/ technical	5.2%	120	11.2%	940
Some college/sixth form	5.5%	126	14.3%	1,206
Finished secondary school	1.8%	42	20.2%	1,699
Some secondary school	.2%	5	4.6%	388

A disadvantage of online surveys is that there will always be a sub-population that does not have access to computers or are computer-illiterate, thus it will not garner a sample that is fully representative of the general population. Internet use in the UK was at 86% in 2013[195] but with

only 33% use in the over 75's and with little evidence of the acceptability of this method to different cultural and ethnic groups. Demographic imbalances is a common problem also shared by postal surveys[196]. Demographic data from the online survey was compared to demographic data from the most recent, representative and freely available dataset in the UK, the 2011 HSE. As can be seen in Table 4, individuals who engaged with the online survey were indeed demographically different to the general population. The online survey sample was generally younger with fewer individuals aged 65 and over ($p < .001$); though it should be noted that the HSE reports (HSE, 2011) an oversampling of older adults, White British ($p < .001$), highly educated ($p < .001$) and females ($p < .001$) than the UK population[197]. This convenience sample evidences significant sample bias. Generalisability of the subsequent findings to other populations, therefore, cannot be assumed. Thus, the online survey is not representative of the general population, presenting less educational and socioeconomic diversity. In fact, the online survey captures a highly educated and largely employed segment of the UK population. All resultant findings can only be applied to this specific sample. Within the online survey dataset, analysis comparing completers (n = 1,774) and non-completers (n = 558) suggests that the latter were statistically more likely to be in the youngest age category (16-24; $p < .05$) and have lower self-rated health ($p < .005$) but were no different in terms of gender, ethnicity, education, employment status or physical activity behaviour. However, it is unknown whether individuals who didn't click on the survey invitation differed from those who did, thus the biases caused by differences in motivation, perceived social pressures, ulterior motives (e.g. concern over health) etc. are unknown. A counter argument to this is if the web survey allows greater population access then it is more externally valid and results are therefore more generalisable. Evans and Mathur[198] have identified reduced differences in industrialised countries between the characteristics of internet populations and the general population as more people around the world gain internet access. However, the authors highlight that attributes of internet populations are generally demographically skewed relative to the general population. They suggest using demographically balanced online panels as a form of quota sampling to achieve a demographically balanced sample. This method was not used due to the time pressures involved in collecting the data. The convenience sample offered an opportunity to reach a large number of people within a short period of time. Conclusions from this dataset can therefore only be assumed to apply to the sample from which they were drawn.

2.1.3. Secondary dataset

Chapter 3 refers to data taken from the HSE 2007 in addition to data collected from the online survey. Data from all versions of the HSE are freely available online. The datasets referred to in the present thesis were all acquired from the host website (http://www.hscic.gov.uk) and analysed independently. The HSE is conducted annually to collect information from a representative sample of the general population. In 2007, participants were asked about their knowledge and beliefs around physical activity. The methodology employed by HSE is fully detailed by Craig and Shelton in the HSE 2007 methodology report and will be summarised here[197]. The sampling method of the HSE involves a multi-stage stratified random probability sample of households using the Postcode Address File. The core sample comprised 7,200 addresses selected at random from 720 postcode sectors. HSE reports an 88% response rate in adults, resulting in a total of 6,882 adults being interviewed (7,504 children were also interviewed but the present thesis will only discuss the adult sample). During a home visit by a nurse, participants were provided with a self-completion booklet which questioned them on their knowledge of physical activity guidelines and attitudes towards physical activity. Specifically, participants were asked; "How many days a week do you think people of your age should do physical activity? Include all moderate physical activity, including physical activity as part of a job. By week we mean the whole week including weekends." This was followed by, "On each of the days someone of your age does moderate physical activity, how many minutes a day should they do it for it to be good for their health?" Those who gave an answer consistent with contemporary MVPA guidelines of 30 minutes a day on five days of the week were to be considered correct.

2.1.4 Content analysis

Chapter 7 reports on a content analysis conducted on mass media materials promoting reductions in sedentary behaviours. The majority of campaigns currently promoting reductions in sedentary behaviour were initially designed to promote physical activity but have now expanded their remit in recognition of this emerging (and activity-related) health topic. For this reason the review of

mass media campaigns presented in Chapter 1 provided the backdrop for this content analysis and so a directed method was employed. Campaigns for inclusion were selected based on the quantity of English-language material directed at sedentary behaviour attached to them. Messages within materials were selected based upon their prominence within the overall communication. For example; headlines on posters, titles on campaign websites (titles of both homepages and each subpage landed on after clicking individual links were used provided subpages were still within the campaign website), front page information on leaflets, logo´s and information contained within campaign and sub-campaign names themselves. The search for materials finished when no new headline messages could be found and ´message saturation´ was reached. Messages were tabulated alongside their respective campaigns and from this themes were identified. Messages were read and re-read with key words or phrases highlighted in order to develop themes. Two of the themes; clinging to guidelines and combining with the promotion of MVPA, were used to begin the analysis as these themes had been identified as being prevalent in messages promoting MVPA. A further two themes were added following further perusal of messages. An independent researcher later examined the tabulated messages in order to establish agreement regarding the selected themes.

The aim was to jointly analyse messages from campaigns around the world in order to increase the richness of information but also due to the fact that activity-related mass media campaigns from English-speaking countries tend to follow similar paths, as is the case with physical activity guidelines. However, due to being based in the UK, the researcher conducting the analysis had much greater access to information from the UK-based campaign. Thus, a summative interpretation of message content could not be used as it would have been biased towards messages borne out of the UK-based campaign. Thus, the frequency of message themes was not used to steer interpretation. Instead, themes are discussed within the context of current debate around sedentary behaviour and issues highlighted within the present thesis regarding the promotion of MVPA.

2.1.5. Final note on data collection

The three different methods discussed above provided the data at the heart of the present thesis. In "Research methods in health: Investigating health and health services", Bowling states; "There has been a tendency in research on health services to focus mainly on the experimental method. All methods have their problems and limitations, and the over-reliance on any one method, at the expense of using multiple research methods, to investigate the phenomenon of interest can lead to "a very ´limited tool box' and a limited understanding[199]". The present thesis provides studies amounting from data which was collected using a variety of techniques and thereby adds richness to the body of research to which it contributes.

2.2. Data analysis

Data analysis for each research question is discussed in more detail in the relevant section of each of the following chapters. The tests used and a brief overview of their suitability to the dataset is introduced here.

In Chapter 3 chi-squared analysis was performed to analyse demographic influences on knowledge within both the HSE 2007 dataset and the online survey. This test is used to identify whether the observed occurrences in a population differ from the expected occurrences and was selected because the data showed a non-normal distribution.

In Chapter 4 one way ANCOVA was used to examine differences in perception of the health effects associated with different durations of physical activity. Even though the data used was at the ordinal level and was non-parametric, this test was selected because it allows confounded variables to be controlled and it is ordinarily robust to non-normality, especially when the sample size is large[200].

Statistical mediation analysis described by Hayes and Preacher was employed in Chapter 5[201]. This analysis enabled estimation of and inference about direct, indirect, and total effects with a mediation hypothesis involving a multicategorical independent variable. Bootstrapped confidence intervals were also used to enable inference on the true error in the sample.

In Chapter 6 logistic regression analyses were performed to investigate the prediction of awareness of physical activity engagement from a number of measured variables (knowledge of guidelines, health status, subjective norms and regular walking pace) whilst controlling for demographic influences.

Finally, in Chapter 7 a directed content analysis was conducting following the methods described by Hsieh and Shannon[202]. Campaigns were examined from the US, UK, Australia and Canada as these countries had all released central physical activity documents since most recent physical activity guidelines were disseminated[6,8,9,203]. Themes from four leading campaigns were highlighted after extensively perusing campaign materials.

Establishing the need for research into the messaging of physical activity guidelines

3. Lack of knowledge of physical activity guidelines: A persistent failure of physical activity promotion campaigns

In response to the swell of physical activity campaigns and prevailing focus of messages on MVPA guidelines discussed in the preceding chapters, this chapter examines knowledge of MVPA guidelines within UK adults. Findings from this chapter were presented (short oral) at the European Congress for Sports Science in Barcelona, Spain 2013 and are published in *BMJ: Open* (see Appendix 1 for full reference).

3.1. Abstract

Physical activity guidelines state that at least 150 minutes a week of MVPA is necessary for optimal health benefits. This research study had two main aims. The first was to identify the prevalence of knowledge of current (since 2010) and prior physical activity guidelines within two large samples of UK adult's. The second was to investigate demographic disparities in knowledge of physical activity guidelines. The 2007 HSE provides data on knowledge of physical activity guidelines from 2,860 UK adults (56% female, 89% white, 63% under 45 years old). In 2013, an online survey collected data on knowledge of physical activity guidelines from 1,797 UK adults (70% female, 92% white, 57% under 45 years old). All adults were aged over 18 years old and were without illnesses/disorders likely to restrict physical activity. Chi-squared analysis and standardised residuals were used to examine demographic influences on knowledge of physical activity guidelines. Multiple logistic regression investigated differences in knowledge between the 2007 and 2013 samples. Of the 2013 sample, 18% accurately recalled current physical activity guidelines relative to 11% of the 2007 sample who accurately recalled the previous guidelines. Differences existed for marital status, gender, age, education and employment status within both 2007 and 2013 samples. Males with lower education and employment status and older adults were less likely to know physical activity guidelines. Knowledge of physical activity guidelines was only slightly higher in the 2013 sample despite this sample being significantly more educated and more employed than the 2007 sample. Disadvantaged population groups engage in less physical activity and have less knowledge of

physical activity guidelines. Efforts are needed to promote health information amongst these groups.

3.2. Introduction

Physical activity reduces the risk of morbidity and mortality from chronic diseases[204]. Increasing evidence of the importance of physical activity to health has led to the promotion of a "Physical activity is Medicine" agenda and calls for global physical activity policies[59, 205].

In 1975 the first form of physical activity recommendations for adults were released in the United States (US) by the American College of Sports Medicine[52]. By 1995, American adults were being advised to accumulate at least 30 minutes of MVPA, on preferably all days, each week[54]. In 2004 in England, the Department of Health followed similar guidelines to the ACSM and recommended 30 minutes of MVPA on at least five days per week[56]. Over the past few years, there has been a shift within the UK and globally towards more uniform guidelines. In 2008, the first physical activity guidelines for Americans to be issued by the Federal government were published following a comprehensive expert's review of scientific data. These guidelines were the first to state recommendations specifically as at least 150 minutes per week of MVPA[7]. Previously, guidelines in the UK had been disseminated separately by health agencies within each home country. In 2011 the four UK Chief Medical Officers published the first UK-wide physical activity guidelines[6]. This document followed the lead of the US guidelines and reported the new adult guidelines of 150 minutes a week of MVPA. This format was also used in global physical activity guidelines issued by the World Health Organisation [1].

Changes in the guidelines have also been reflected in the messages of the various coinciding campaigns e.g. "Every small step is… a way to get 30 minutes" (*Get A Life, Get Active* launched in Northern Ireland in 1999[206] and "Get going for 150 minutes a week" (*Change4Life* launched across the UK in 2009[207]). The purpose of these campaigns is to encourage adults to reach or exceed current physical activity guidelines.

In 2008, only approximately five percent of UK and US adults engaged in enough MVPA to meet recommendations[3,134]. Theories such as the PAPM and protection motivation theory suggest that individuals must be accurately aware of their current actions[153,208,209], such as through self-monitoring [210], in light of alternative and desired actions to be able to initiate change i.e. I *do* this amount of MVPA but this amount of MVPA is *recommended*. In addition, the Department of Health strategic framework "Ambitions for Health" details a strategy to embed informative social marketing campaigns within health behaviour change campaigns[136]. It would therefore be beneficial to investigate ***knowledge*** of MVPA guidelines within the broad UK adult population before and after the long-standing guidelines of 30 minutes on five days per week were updated with 150 minutes per week in 2011. Chaudhury and Shelton found that only five percent of UK adults aged 60-64 (N = 561) accurately recalled the general MVPA guideline in 2007[134]. Less than one percent of adults (N = 4,281) selected the correct guideline from a list of six options in a recent US survey[211]. Those with a lower educational level also demonstrated lesser knowledge of guidelines. This research, however, does not give an indication of unprompted knowledge which may be a stronger correlate with behaviour change[84].

The objectives for this study were 1) to identify knowledge of prior MVPA guidelines (2004 up until 2010) and of current UK MVPA guidelines (three years after their introduction in 2011) for adults using two large UK samples 2) to identify whether demographic characteristics such as, gender, age and socioeconomic status, are associated with knowledge of physical activity guidelines at either time-point.

3.3. Methods

3.3.1. Survey and analytical sample.

Data were analysed from the 2007 HSE and an online survey disseminated in 2013.

2007 Data (before dissemination of current physical activity guidelines). The HSE is an annual survey of non-institutionalised UK individuals[197]. A stratified, two-stage, random sample representative of the socio-demographic profile of the English population was recruited using a

Postcode Address File. 14,385 adults participated in the 2007 HSE. For the present research the HSE 2007 dataset was freely accessed on request from ESDS Government (http://www.esds.ac.uk/government/hse/). For this analysis individuals aged <18 years and adults with health conditions which restricted physical activity were excluded. This resulted in 4,491 eligible adults from which 2,860 had valid data for knowledge of contemporary (2004) physical activity guidelines.

2013 Data (after dissemination of current physical activity guidelines). The 2013 survey was developed using an online survey software and questionnaire tool (www.surveymonkey.com). The survey was disseminated through JISCMailing lists to staff from UK academic institutions. Unlike the HSE 2007 which provides nationally representative data, the 2013 survey provides data from a sub-population of adults who are, or have been, employed in some capacity by a UK university. A total of 152 mailing lists were joined providing a total of 178,729 members to whom the survey could have been sent. 2,332 adults responded giving a response rate of only 1.3%. This is likely to be an under-estimate as many emails from unknown senders are directed to junk folders or removed by spam filters before they are opened, adults could be members of more than one list and email addresses which are no longer active could still be associated to the lists. A final sample of 1,797 provided data for unprompted knowledge of current MVPA guidelines giving a completion rate of 77.1%. These individuals provided the research sample for this chapter; however, further questions were also included in this dataset which will be further discussed in Chapters 5 and 6. Approval for the study was received from the host university ethics committee.

3.3.2. Measures

The full 2013 survey is provided in Appendix 4.The following measures were included on both the 2007 HSE and 2013 survey:

Demographic characteristics. Gender, age, ethnic background, marital status (single, married/civil partnership, divorced/separated, widowed), education (highest level), employment

status (employed, unemployed, retired, student/other economically inactive) and self-reported health status were assessed.

The following measures were included in the 2007 HSE:

Knowledge. Participants were asked, "How many days a week do you think people of your age should do physical activity? Include all moderate physical activity, including physical activity as part of a job. By week we mean the whole week including weekends." Followed by, "On each of the days someone of your age does moderate physical activity, how many minutes a day should they do it for it to be good for their health?" Those who gave an answer consistent with contemporary physical activity guidelines of 30 minutes a day and five days a week were considered correct[56].

The following measures were included in the 2013 survey:

Knowledge. In line with previous research participants were first asked, "are you aware that there are physical activity guidelines available for adults?"[212] Those who indicated that they were aware were then asked the open-ended question, "What are the physical activity guidelines?" To enable comparison to HSE data, only information regarding duration of physical activity was included in the analysis. Those who gave the specific answer of 150 minutes a week exactly were considered correct[6].

3.3.3. Statistical analysis.

Prevalence rates for UK adults with correct knowledge of MVPA guidelines in 2007 and in 2013 were calculated. Associations with gender, age, ethnicity, marital status, education, employment status and self-reported health were assessed for each sample separately using chi-squared analysis and standardised residuals adjusted for multiple comparisons (Bonferroni).

3.4. Results

The 2007 HSE sample was: 56% female, 89% white and 63% under 45 years. 11% accurately recalled the MVPA recommendation, 46% overestimated and 43% underestimated. Differences were identified for marital status ($p < .05$), gender ($p < .005$), age ($p < .001$), education ($p < .05$) and employment status ($p < .05$) but not for ethnicity ($p = .21$) or self-reported health ($p = .32$). Standardised residuals suggested that younger (18-24 years), unmarried adults were more likely to overestimate. Adults with no economic activity (e.g. students/retired) and males were less likely to be accurate whereas those with a higher education (degree/equivalent) were more likely to have accurate knowledge of physical activity guidelines.

The 2013 survey sample was 70% female, 92% white and 57% under 45 years and is therefore not directly comparable to the HSE 2007 or to the general population. Further, the knowledge questions employed by each survey were different and so the data is not comparable. Without prompting, 18% accurately recalled the current physical activity recommendation. The provision of three prompts increased knowledge of guidelines by less than 1%. 82% did not know the guideline with 12% overestimating and 14% underestimating. Differences in unprompted knowledge were identified for gender ($p < .001$), age ($p < .05$), marital status ($p < .05$), employment status ($p < .05$), education ($p = 0.05$) and health status ($p < .005$), but not for ethnicity ($p = 0.3$). Standardised residuals suggested that older males with a lower education were more likely to report incorrectly. Younger adults (18-24 years), students and single adults were more likely to recount old guidelines (30 minutes five days a week). Knowledge of guidelines according to demographic characteristics is shown in Table 5. As the survey sample over-represents females, highly educated adults and those in full-time employment we can also conclude that the prevalence finding for knowledge is applicable only to an educated and mostly employed population and is likely to be lower within the general population. Only 66% of individuals who recalled MVPA guidelines accurately recalled the intensity of physical activity that is recommended. Of these, the most common descriptor was moderate or moderate-vigorous (40%). Inclusion of physiological parameters such as an elevated heart rate was the second most commonly used descriptor (23%). The remaining three percent referred to intensity necessary to increase fitness, effort/exertion or used walking as an exemplar.

Table 5. Proportion of adults who were aware of guidelines and had accurate knowledge of guidelines in the HSE 2007 and 2013 Survey, stratified according to demographic group

	HSE 2007		Survey 2013	
	Accurate Knowledge of guidelines		Accurate Knowledge of guidelines	
	%	N	%	N
Total	11%	2,860	18%	1797
Gender				
male	9.3%	1,239	15.2%	540
female	12.2%*	1,621	19.4%*	1250
Ethnicity				
White	10.7%	2,550	18.6%	1670
Mixed	16.7%	42	14.8%	27
Asian/Asian British	13.1%	153	18.2%	44
Black/Black British	13.8%	80	5.9%	17
Chinese/Other ethnic group	5.9%	34	5.1%	39
Age				
18-24	11.5%	349	21.2%	203
25-34	13.6%	633	17.6%	393
35-44	11%	789	20.7%	421
45-54	9.9%	616	17.5%	452
55+	8.2%	473	14%	322
Employment Status				
employed	11.9%*	2,210	17.7%	1483
unemployed	9.5%	137	11.5%	26
retired	8.1%	136	14.3%	14
other economically inactive	6.9%	376	22.1%	244
Highest Education Level				
degree	13.2%*	893	19.1%*	1569
vocational/ technical	9.5%	359	7.4%	94
some college/sixth form	11.7%	497	13.3%	98
finished secondary school	9.1%	776	12.5%	18
some secondary school	9.3%	332	50%	2
Marital Status				
single	11.6%	925	17.6%	665
married/civil partnership	10.5%	1,590	18.5%	932
divorced/separated	12.3%	302	14.7%	143
widowed	4.7%	43	34.8%	23
Self-rated health				
good	11.1%	1,284	20.3%	576
rather good	10.5%	1,251	20.0%	544
average	11.2%	303	14.5%	530
rather poor	27.8%	18	11.4%	123
poor	100%	2	33.3%	24

* standardised residual indicated greater probability of accurate awareness or knowledge of guidelines within this category.

3.5. Discussion

Results identified low knowledge of physical activity guidelines in a 2007 sample of nationally representative UK adults (11%) and in a separate sample of adults collected in 2013 (18%). Adults in the 2013 survey sample were significantly more educated and more likely to be employed than adults from the HSE 2007 sample. As these characteristics are associated with better knowledge of physical activity guidelines generally, it would be expected that knowledge would be higher within this sample relative to the general population. While this was the case, only 18% of this sample accurately recounted recommendations (when only duration was considered). This drops to 11% when only the adults who provided an appropriate description of intensity are considered. The finding of low knowledge in this sample is, therefore, even more concerning. While knowledge alone is unlikely to stimulate behaviour change, awareness of the required behaviour is a determinant of behaviour change[213]. The PAPM suggests that individuals are unlikely to change their behaviour unless they become aware that their behaviour is not optimal[145]. Compared with 2007, adults in 2013 do not appear to be better educated regarding MVPA recommendations. Similarly, Hillsdon and colleagues, found no evidence that a national campaign conducted in the 1990's in England had succeeded in raising knowledge[69].

Mass media campaigns are currently used to improve the provision of health information to the general public. The release of the most recent guidelines in 2011 was promoted by the Department of Health campaign *Change4Life*. *Change4Life* had a £75 million budget for social marketing to promote five key health behaviours, one of which was physical activity[33]. Early publications from this campaign suggest it achieved high visibility and recall of its messages within target populations[34,70]. Few adults were able to accurately report the recommended duration of MVPA. Better results were expected in light of the promotional efforts which have supported current guidelines. Inconsistency of messaging from *Change4Life* and other campaigns may create confusion and lead to inaccurate responses. Piggin has previously identified contradictory messages presented by different *Change4Life* informational materials[71]. Indeed, a search of physical activity campaign messages released since 2011 uncover various messages which could be perceived as inconsistent. For example, a *Change4Life* newsletter released in November 2011 stated; "Get going every day for 10, 20 or 30 minutes". For World Physical Activity Day 2011, a Coca Cola sponsored advertisement read; "all this [health

benefits] with just 30 minutes of physical activity every day." Some campaigns have also failed to update their messages in line with the update in recommendations. The *Get A Life, Get Active* campaign website homepage has not updated its message since 2009 and still states, "30 minutes on most days for adults". Indeed, nine percent of adults from the 2013 sample reported the old guideline (2004-2010) when asked to recall the current guideline (2011). While the aforementioned messages are not necessarily incorrect, campaigns need to become more coherent if the strategy is to improve knowledge of guidelines. Indeed, the unification of US, UK and global physical activity guidelines will be undermined if the messages which follow are isolated and random[1,6,7]. The failure of physical activity campaigns to disseminate consistent messages, both between each other and between various arms within their own campaigns, may have led to misinformation and confusion for many adults.

In addition to the evidence of low education pertaining to the guidelines in a nationally representative sample of UK adults from 2007 and a sample of highly educated UK adults (2013), the present research highlights two areas of concern. Firstly, disparities in health knowledge continue to be evident. In both the 2007 and 2013 samples those with lower education, lower employment status and older adults were less likely to know physical activity guidelines. The Chief Medical Officers voiced concerns regarding the disproportionately low involvement in physical activity of disadvantaged groups in society[6]. Improved provision of information and opportunities for these groups to engage in physical activity was a target of the government backed campaigns *Change4Life* and *HealthyPeople*[33,73]. Despite these pledges, physical activity campaigns appear to have been less successful in reaching these groups. Strategies to educate and reach disadvantaged groups within society, especially those with a low education or socioeconomic status, are urgently required. Secondly, adults generally consider only the duration component of physical activity recommendations. While the 2007 HSE sample were asked specifically for the recommended duration of physical activity, the 2013 survey sample was asked an open question which allowed them to include any aspects of the guidelines of which they were aware. Despite this, only 11% of adults included an appropriate descriptor of intensity. Even when adults were prompted to provide a descriptor of intensity, only and additional two percent did so. Only two percent provided a physiological parameter which could be practically used to monitor intensity.

In recent years there has been a rise in the number of campaigns promoting lifestyle activities, especially walking, as a proxy for MVPA. While walking is undoubtedly an accessible and appropriate form of physical activity, the intensity of walking varies greatly within the population. Brisk walking is promoted by many physical activity campaigns as an example of MVPA, but in actuality, the walking performed by many is less than brisk[214,215]. While such campaigns may increase the perceived accessibility of physical activity and cater to adults' physical activity preferences[216], they often fail to educate individuals about the necessity for physical activity to be effortful in order to induce health benefits. It is possible that a lack of knowledge regarding intensity requirements may result in adults engaging in more physical activity of low intensity but not sufficient physical activity to meet guidelines. In addition, adults may struggle to see the difference between their own current behaviours and the behaviours being promoted. The PAPM suggests that individuals need to be aware that their actual behaviour is different from the desired behaviour and that this may put their health at risk[145]. Awareness of personal risk behaviour is especially important to proceed from pre-contemplation to contemplating behaviour change. Based on the PAPM, it can be expected that people may only proceed to contemplation when they become aware that they engage in too little physical activity or that their physical activity is not of a sufficient intensity. With the emergence of alternative strategies to improve health, such as by breaking up sedentary time or increasing light activity, the difference between actual and desired behaviour becomes less obvious. The benefits of engaging in more light activity and of reducing or breaking up sedentary time are evident[47,63,217]. Guidelines regarding sedentary behaviour have already been developed in Canada and Australia and current UK physical activity guidelines recommend developing sedentary behaviour guidelines as a priority[6, 65,218]. The various discourses surrounding physical activity and health may cloud directives to the lay population (i.e. "is desirable behaviour to be less sedentary, or to be more active, or to do more MVPA?"). While research across the intensity continuum of physical activity is rapidly increasing, transmitting such knowledge to the general population may require more complex messages but understanding of how to effectively develop such messages lags behind.

Knowledge of guidelines was low in the present study (i.e. only 18% and 11% of adults knew the duration component of MVPA guidelines); however, this is more than reported for American adults, where less than 1% knew physical activity guidelines when surveyed in 2009 (N = 4,281)[211]. This may be at least partly explained by the greater affluence of our sample. There are two further possible reasons why knowledge was higher in the present study. Firstly, in this study, the physical activity guideline had been consistent for at least three years prior to both samples completing their respective surveys. In the American study, only ten months separated dissemination of a changed guideline and completion of the survey. Indeed, 33.3% of American adults selected the old 30 minutes on five days of the week guideline relative to nine percent in the present study[211]. In addition, the American survey employed a closed question with six response options. Two of these were correct according to old guidelines. Prompting from these response options may have triggered more incorrect responses.

The present findings should be interpreted with caution due to the following limitations. Firstly, the 2013 survey sample reflects the level of knowledge of more highly educated adult groups and cannot be used as an indication of knowledge within the general population. Future efforts should gage knowledge within more representative samples. Secondly, neither the HSE 2007, nor the 2013 survey, used a validated measure of knowledge of physical activity guidelines. In addition, differences between participants interpretations of the questions on knowledge of physical activity guidelines could also have influenced findings. For instance, adults who gave answers of amounts greater than 150 minutes per week would have been described as not knowing physical activity guidelines even though this answer is not technically incorrect (guidelines state "*at least* 150 minutes a week"). Future studies should attempt to validate measures of knowledge within diverse populations to improve the robustness of data.

3.5.2. Conclusions

The present study identified knowledge of physical activity recommendations in two large UK adult samples from 2007 and 2013. Results indicate that knowledge of guidelines is slightly higher in an educated and employed sample but is still low. This study has implications for future promotional campaigns. Messages need to be developed to target individuals with lower

education and employment status but accurate knowledge of physical activity guidelines cannot be assumed within highly educated populations. In addition, further research is needed to develop an effective strategy for promoting more comprehensive educational messages relating to physical activity guidelines. Campaigns need to straddle the thin line between messages which capture awareness, and are informational and motivational. In the present study, only two percent of adults acknowledged that physical activity should be effortful. Intensity is an important aspect of health-enhancing physical activity and should not be neglected by physical activity campaigns. Increasing understanding of the intensity continuum will likely result in a broader range of physical activity being included in media campaigns. Messages from these campaigns need to work in synergy to ensure effective communication of the benefits of the various forms of accumulating physical activity.

Using threshold messages to promote physical activity: Implications for public perceptions of health effects

4. Using threshold messages to promote physical activity: Implications for public perceptions of health effects

Chapter 1 outlined the predilection of physical activity campaigns to root their messages in MVPA guidelines. Chapter 3 then presented findings to suggest that knowledge of physical activity guidelines is low, even in a highly educated sample, despite concerted promotional efforts over recent years. The following chapter presents research which begins the examination of particular messages used to promote MVPA guidelines in physical activity campaigns. It examines the motivational implications of providing different descriptions of physical activity *duration.* Findings from this chapter were presented (oral) at the European Congress of Sport Science in Bruges, Belgium in 2012 and are published in the *European Journal of Public Health* (see Appendix 2 for full reference).

4.1. Abstract

The promotion of physical activity guidelines to the general public is an important issue that lacks empirical investigation. Physical activity campaigns often feature participation thresholds that cite physical activity guidelines verbatim (e.g. 150 minutes a week of MVPA). Some campaigns instead prefer to use generic physical activity messages (e.g. do as much MVPA as possible). 'Thresholds' may disrupt understanding of the health benefits of modest physical activity participation. This study examined the perception of health benefits of physical activity after exposure to physical activity messages that did and did not contain a duration threshold. Brief structured interviews were conducted with a convenience sample of adults (N = 1,100). Participants received a threshold message (THR; 150 minutes a week MVPA), a message that presented the threshold as a minimum (THRm), a generic message (GEN) or no message (CON). Participants rated perceived health effects of seven physical activity durations. One-way analyses of variance with post hoc tests for group differences were used to assess raw perception ratings for each duration of physical activity. Recipients of all three messages held more positive perceptions of more than 150 minutes a week of MVPA relative to those not receiving any message. For MVPA durations amounting to less than 150 minutes a week, the generic physical activity message group perceived the greatest health benefits. Those receiving the threshold

message tended to have the least positive perceptions of durations amounting to less than 150 minutes a week. Threshold messages were associated with lower perceived health benefits for modest physical activity durations. Campaigns based on threshold messages may be limited when promoting small increases in physical activity at a population level.

4.2. Introduction

Physical activity reduces risk of morbidity and mortality from chronic diseases[1,2]. Approximately 65% of Western adults self-report insufficient levels of physical activity[2,219]. Studies using objective measurements show lower compliance with physical activity guidelines, at five percent in adults[3,134]. Increasing population physical activity therefore is a public health priority[1,2]. Mass media campaigns reach large sections of the population[10]. To optimise effects, researchers have examined how message characteristics influence their persuasive appeal. Investigators have explored descriptive versus injunctive norms[220], fear appeals[221], tailoring[14], gain/loss framing[14,160], source credibility[160] and specificity[31]. One issue yet to be examined in the physical activity messaging field is the impact of 'threshold' information.

In behavioural domains, threshold messages implore individuals to attain a specified volume of behaviour (e.g. five fruit/vegetable portions a day). Many physical activity campaigns feature thresholds. For instance, the UK's *Change4Life* campaign and Singapore's *Physical Activity Programme* encourage 150 minutes of MVPA per week[222,223]. Similarly, earlier campaigns promoted 30 minutes of MVPA per day, e.g. *Get Active America* in the US, *Get a Life, Get Active* in Northern Ireland and *Find Your Thirty* in Australia[203,206,224]. Essentially, these campaigns directly cited physical activity guidelines of the day [(e.g. "Swap four wheels for me own two feet to get me going for 150 minutes a week" (*Change4Life*); "30 minutes of regular activity a day is good for your health" (*Get a Life, Get Active*)].

Guidelines provide essential information on the minimum level of physical activity needed for health benefits. Consequently, they are invaluable for surveillance, planning interventions and policy. However, physical activity guidelines were not made to motivate individuals to adhere to being active. Brawley and Latimer discuss the importance of packaging the guidelines into

messages that (i) offer specific content, (ii) are based on scientific recommendations and (iii) encourage specific targeted groups to meet the guidelines[225]. The current popular approach of presenting the 150 minute threshold in mass media campaigns achieves these first two aims. Promoting 150 minutes a week of physical activity is instructive and based on scientific evidence for good health. However, it could also be argued that messages encouraging lower levels of physical activity also meet these criteria. Scientific evidence, based on a simple dose–response curve, suggests that participation in less than 150 minutes a week of physical activity also carries health benefits, but likely at lower levels of potency[226]. This is especially true for those who are very inactive[227]. Uncertainty surrounds the success of messages that contain a threshold in motivating improved physical activity behaviour. Goal theory proposes that for a goal to be motivational it must be specific, measurable, attainable, realistic and time-managed[228]. With the average adult engaging in just 42–77 minutes per week of MVPA[2,3], an increase to 150 minutes each week is likely to be considered unrealistic for many[139]. Goal theory suggests that a goal closer to 90 minutes a week would, in this context, be more beneficial from a motivation perspective. Brawley and Latimer, state in their final principle for message development that the message should help the individual strive towards the recommendations[225]. An increase from, for instance, 42 to 90 minutes a week still represents a move towards the recommendations and is more attainable than the 150 minutes often cited verbatim from the guidelines. The guidelines are clearly important for physical activity promotion, but perhaps a more gradual messaging strategy may be beneficial in moving individuals towards this optimum level. At present, the association between threshold (with regard to physical activity duration) messages and perceptions of health benefits associated with physical activity has not been studied.

The aim of the present study, therefore, is to examine the association between different types of physical activity messages (two different threshold messages and a generic physical activity message) and perceptions of the health benefits of seven different durations of physical activity, relative to a no-message 'control' group.

4.3. Method

From October 2011 to December 2011, a convenience sample of pedestrians were approached in a UK town centre and asked to participate in a short interview. In total, 1,100 interviews were completed after gaining written consent. No individual was interviewed more than once. The length of the interview was dictated by the participant and was usually five to ten minutes. The study was approved by the host university's ethics committee.

Data were collected in the following order:

Participants were asked to recount current physical activity guidelines. Marks out of ten were awarded for accuracy, with the same points awarded for synonymous answers (i.e. "150 minutes a week" and "30 minutes, five days a week"). To differentiate between individuals with some knowledge regarding physical activity and individuals with no knowledge, participants were awarded points if they were within a set range of the correct response. Eight points were awarded for answers amounting to 150 minutes a week. Six and four points, respectively, were awarded for answers within a 30 and 60 minute range of this. In addition, two points were awarded for the answer 'moderate-to-vigorous' and one point for separate answers of 'moderate' or 'vigorous'.

Participants were equally divided between four groups (n = 275). Individuals were assigned to groups in blocks of 20 (i.e. the first 20 participants interviewed were assigned to Group 1, the next 20 were assigned to Group 2 and so on, until 275 participants were in each group). Group 1 (threshold message group; THR) received a message based on current campaigns: "Regular physical activity, such as brisk walking, protects your health. Each week adults should accumulate 150 minutes of physical activity[229]." Group 2 (threshold presented as a minimum; THRm) received a slightly altered message: "Regular physical activity, like brisk walking, protects your health. Each week adults should accumulate at least 150 minutes of physical activity". This message sought to examine if framing the threshold as a minimum differentially influenced perceived health benefits of accruing amounts equating to less than 150 minute a week. The phraseology corresponds with existing campaigns[230]. Group 3 (generic message group; GEN) received a comparison message containing no threshold: "Regular physical activity, like brisk walking, protects your health. Each week adults should engage in physical

activity as regularly as possible". Efforts were made to match messages in length and complexity. All participants were shown the message while it was read aloud to them. The interview continued after participants provided verbal confirmation that they understood their message. Group 4 (no message control group; CON) received no message, providing a control condition.

Participants were then asked: "Think of a typical (fe)male, using the scale provided, what effect do you think 10 minutes a week of physical activity, such as brisk walking, would have on their health?" The 15-point scale was anchored by 'strong negative effect' (-7) and 'strong positive effect' (+7) to accommodate varied beliefs and avoid the assumption that appraisals would be universally positive[231].

Reference to a hypothetical scenario helped reduce confounding effects of individual-level factors (e.g. fitness level[232], attitudes towards exercise[231,233], optimistic bias[234] and current health status[232] and has been used previously when assessing responses to health messages[152]. For instance, if asked about personal effects, individuals with arthritis may provide negative assessments, despite holding positive general attitudes about physical activity. Brisk walking was specified to clarify what constitutes physical activity. This question was piloted for readability with 15 adults before data collection. With each participant, the question was repeated for six other physical activity durations: 70, 130, 150, 170, 230 and 290 minutes a week. Seven durations were used to match the 15-point belief scale (above) and enable participants to place each duration incrementally on either a negative or positive arm. This was to reduce the cognitive load on participants and was based on research suggesting that a 15-point scale provides the optimal balance between time effort and participant engagement with the scale[235]. Twenty-four different interview schedules were used to present durations in counterbalanced order.

Motivational readiness[232] influence perceptions of physical activity. Consequently, participants' stage of change was identified using a validated item[236]. Stages are: pre-contemplation (not considering change), contemplation (considering change), preparation (planning for change), action (engaging in physical activity but for less than six months) or maintenance (engaging in

physical activity for six months or more). Previous experience of a behaviour has been shown to influence risk/benefit judgements[152]. The stage of change model identifies those who are currently active; however, it cannot separate those who have never been active from those who have previously been highly active but have recently stopped. Thus, participants were asked to estimate the number of life years in which they had been regularly active to identify individuals who had been previously active from those who had never been active. Trust in a message can also moderate perceptions of behaviour[152]. Thus, participants rated their trust in the given message, from +1 (complete distrust) to +7 (complete trust). This item was adapted from items widely used in research examining messages[237,238].

Finally, demographic variables were collected. Participants were asked for their postcode from which the multiple deprivation index (IMD) was later calculated using the GeoConvert online tool (http://geoconvert.mimas.ac.uk/). The investigator then visually coded gender, weight status and broad age category (<65 or >65 years) from extensively used[32,187,239] and validated[32,239], protocols. A second investigator simultaneously coded a subsample (n = 100), generating Kappa scores for gender (1.00), weight status (0.76) and age (0.86).

4.3.2. Statistics analysis

Statistical analysis was performed using SPSS 19.0 for Windows with alpha set at 0.05. One-way analyses of variance with post hoc were conducted to analyse group differences in knowledge of guidelines, stage of change, physical activity experience, trust and demographics. Analysis was performed using one-way analysis of covariance with the independent variable of group (GEN, THR, THRm and CON), dependent variable of perceived health effects and the covariates gender, knowledge, trust, age and multiple-deprivation index. Post hoc tests assessed the group differences in raw perception ratings of each physical activity duration. Sidak correction was used to control the error resulting from conducting multiple comparisons.

4.4. Results

Power analysis using G*Power data analysis software suggested that 237 adults should be recruited to each group to achieve a power of 0.8. The survey was completed by 1,100 adults suggesting that the study has good power. A record of the number of individuals who came into contact with the researcher was not kept as it was not feasible for the candidate to do this due to the large number of individuals, however, of those adults who were contacted and given full study information, only four declined to participate. Data collection occurred in two geographic locations: Loughborough and Birmingham. Data for 186 of the 1,100 adults was collected in Loughborough with the remaining data collected in Birmingham. Individuals were approached by the candidate who was wearing University accreditation and invited to participate in a short survey for a research project. Those who agreed were verbally informed of the purpose and requirements of the study and were interviewed. The overall sample was 50% female, 28% aged over 65 years and 41% were over-weight. Chi-squared analysis did not find any significant demographic differences between the two samples (Loughborough: 57% female, 23% aged over 65 years and 34% overweight; Birmingham: 48% female, 31% aged over 65 years and 41% over-weight). Demographic variables were observed in an effort to increase completion of the survey; however, this limits the generalisability of the findings. Median results for additional variables for the overall sample were: knowledge, 0 (range = 0–10); estimated life years of physical activity, five years (range = 0–60 years) and trust, six (range = 1–7). The most frequently reported stage of change was 'maintenance' (412/1,100). These results were not different when data collected in Loughborough and Birmingham were examined separately. There was no significant difference in any demographic variables (age, gender or weight status) between groups. Knowledge of physical activity guidelines was the only additional variable to differ between groups ($p < 0.005$). Post hoc tests revealed that THR ($\overline{x} = 2.5$, SD = 2.9) had higher knowledge than THRm ($\overline{x} = 1.7$, SD = 2.6). No other pairwise comparisons were significant, suggesting knowledge was similar between all other groups and comparisons. There was also a significant between-group difference in trust ($p < 0.001$). THRm ($\overline{x} = 4.6$, SD = 1.7) expressed lower trust in their message than THR ($\overline{x} = 5.1$, SD = 1.5, $p < 0.05$) and GEN ($\overline{x} = 5.2$, SD = 1.4, $p < 0.005$). All other pairwise comparisons were non-significant.

Analysis of covariance revealed significantly different ratings of perceived health benefits between the four groups at 10 ($p < 0.05$), 70 ($p < 0.01$), 130 ($p< 0.01$), 150 ($p < 0.001$), 170 ($p <$

0.01) and 230 ($p < 0.05$) minutes. Between-group differences are shown in Table 6. Post hoc tests identified lower perceptions of health benefits in THR relative to GEN at 10 ($p < 0.01$), 70 ($p < 0.001$) and 130 ($p < 0.01$) minutes. This indicates that GEN had more positive perceptions of the health benefits of modest durations of physical activity than THR recipients. Importantly, for durations more than the 150 minute threshold, there were no significant differences between these two groups. When we compare message groups with those not receiving any message, significant differences only emerge after the 150 minute threshold [THR v CON at 150 ($p < 0.005$) and 170 minute ($p < 0.05$), THRm v CON at 150 ($p < 0.005$), 170 ($p < 0.005$) and 230 minutes ($p < 0.05$) and GEN v CON at 230 minutes ($p < 0.05$)].

Table 6. Average perception rating provided by group for each of the seven durations of physical activity and the overall univariate statistic adjusted for age, gender, MDI, trust and knowledge of physical activity guidelines

	Group				
Duration (mins)	GEN	THR	THRm	CON	F-statistic
10	-.09*	-.91*	-.47	-.41	**4.55**
70	2.53*	1.69*	2.04	2.15	**5.85**
130	3.76*	3.22*	3.49	3.28	**7.60**
150	3.98	4.32**	4.33$^{\#}$	3.69$^{**\#}$	**8.51**
170	4.34	4.62**	4.48	3.84**	**5.19**
230	5.06^{+}	4.89	4.99$^{\#}$	4.45$^{\#+}$	**2.14**
290	5.32	5.18	5.21	4.72	1.33

Significant F-statistic (p<.05) highlighted in bold. *Post hoc significant between GEN and THR **Post hoc significant between THR and CON $^{\#}$Post hoc significant between THRm and CON $^{+}$Post hoc significant between GEN and CON

4.5. Discussion

This study examined the association between different threshold physical activity messages and individuals' perceptions of the health benefits of different durations of physical activity. Worryingly, at durations lower than the 150 minute threshold, the message representative of those most often used by current mass media campaigns (THR) tended to be associated with more negative perceptions (significantly more negative relative to GEN). Messages were only associated with more positive perceptions of physical activity relative to CON when the duration of physical activity was relatively long (more than 150 minutes). The GEN message showed a similar relationship with health benefits to the THR and THRm messages. Thus, the absence of a stated threshold does not appear detrimental to individuals' understanding that longer regimens bestow the most benefit. Essentially, the findings indicate that messages currently prevalent in mass media campaigns may be ineffective in informing individuals' understanding that "even a little is good, but more is better"[217]. There is some evidence to support a greater focus on non-threshold/generic messages used by campaigns such as *Do-Groove* (US), e.g. "groove your body every day"[240].

These findings could have implications for efforts to change behaviour. The TPB[98] posits that behaviour is typically preceded by an intention to act, with intentions most strongly predicted by our attitudes toward the target behaviour[241]. Mass media campaigns target the belief (instrumental) component of our attitudes. In the current study, those receiving the generic message believed that modest durations of physical activity would result in greater health benefits than recipients of the threshold physical activity message. These individuals are therefore likely to form a positive attitude towards small, but meaningful, changes. Consequently, these individuals may be more likely to form intentions for small behavioural adjustments, which could serve as useful 'stepping stones' towards attainment of 150 minutes a week of MVPA. Primary guidance documents recognise that facilitating participation in 'suboptimal' levels of physical activity is better than nothing[1,2], mass media campaigns should therefore reflect this in their messages. It is also interesting that the results were not influenced by differences in previous physical activity behaviour or motivational readiness. Thus, the messages themselves appeared to be the main influence on perceptions of the health benefits of

different durations of physical activity. However, these factors are still likely to influence future motivation.

Despite obvious challenges in realising universal compliance with the 150 minute a week threshold, it remains the optimal outcome for health benefits. Arguably, campaigns must continue to be driven towards this target. The findings from this study do not suggest that threshold messages are problematic per se, only that a high threshold may be off-putting for individuals with low levels of physical activity. Thresholds may still have a role to play in physical activity promotion, but thresholds that are likely to be perceived as high may not be optimal for those who are engaging in low levels of physical activity. Indeed, according to goal setting theory, having a 'specific' and 'measurable' goal, that is a threshold, should be motivational[228]. However, goals must be 'attainable'. Goal research in the context of physical activity generally targets 40% improvement in either maximum difficulty but attainable conditions or unattainable conditions[242,243]. For the average adult in the US[219] and UK[2], the 150 minute a week message translates to an increase of 100–400%. Such messages may need to be augmented with additional information to motivate compliance, such as encouraging small steps towards the final goal. It is also possible that more generic messages enable individuals to set personalised goals appropriate to their current status. Qualitative research approaches could help explore potential mechanisms.

Only THR showed suppressed perceptions of health benefits of physical activity durations less than 150 minutes a week. The effect was not prevalent for THRm. This finding appears counterintuitive, considering that THRm group's message presented the threshold as a minimum ("at least 150 minutes a week"). The findings may reflect a moderating effect of trust. In stressing 150 minutes a week as a minimum, it is possible that the THRm message was seen as more controlling. Miller and colleagues found that demanding messages were trusted less[244]. Importantly, such messages did not impair attitudes towards physical activity, possibly because they were disregarded for being less trustworthy. THRm reported significantly lower trust in their message compared with the other message groups. Consequently, they may have been less compelled by the sentiment of their message, that physical activity totalling less than 150 minutes a week lacks value. The lack of association between perception data and other variables

(e.g. experience of physical activity, stage of change, etc.) was also initially surprising. These findings could, however, be explained by the weak measures employed to measure these variables resulting in a general lack of variance in these factors, consistently low knowledge of guidelines, high trust in the messages, little previous experience of physical activity and many individuals placing themselves in the 'maintenance' stage. More rigid measures of additional variables such as ethnicity and social class could have provided more useful information regarding factors influencing the way in which messages are perceived.

This study is a novel line of research, as no study has yet examined messages prevalent in major physical activity campaigns from a motivational perspective. Thus, the article has practical application for current and past promotional efforts. Strengths of this study include a large sample size and the inclusion of three physical activity message groups and one control group. In addition, the study responds to calls for more field research in social psychology and health-related fields[238].

The aim of this research was to investigate the influence of mass media messages in their simplest form; however, the practical nature of the study precluded a detailed measurement of constructs, such as motivation. Furthermore, this limited the collection of demographic information, and the subjective reporting of age and gender may have introduced error. Some measures such as trust and physical activity experience are yet to be validated. Weaknesses in these measures could therefore have contributed to the lack of influence of these variables on our results. The study was conducted in a busy town centre. Individuals were only judged as refusing to participate if they engaged with the researcher but declined to provide consent. This occurred with less than one percent of individuals, thus no real inference can be made regarding characteristics between those who did and did not participate. In addition, it is possible that self-reported responses were subject to social desirability bias. However, given that knowledge of physical activity guidelines was low and durations of physical activity were presented in a counterbalanced order, we believe that social desirability did not have an impact on our results, as individuals cannot give desirable answers when they do not know what answer is expected.

4.5.2. Conclusions

The 150 minutes a week threshold is an expert-derived guideline for the minimum volume of physical activity required for good health. Evidence-based 'position stands' like this are vital for researchers and practitioners. Nonetheless, the current findings raise questions about citing these guidelines verbatim as the central tenet of promotional campaigns. A non-threshold alternative was similarly effective in evoking high perceived benefits of longer physical activity durations and more effective in promoting shorter physical activity durations, which could be beneficial for selected health outcomes. Future research should investigate the use of generic physical activity messages and of messages using lower thresholds that may be more motivationally beneficial.

Messages to promote physical activity: Are descriptors of required duration and intensity related to intentions to be more active?

5. Messages to promote physical activity: Are descriptors of required duration and intensity related to intentions to be more active?

The research presented in this chapter builds on the findings presented in Chapter 4 by examining the communication of *intensity* of MVPA alongside *duration* as an additional feature of physical activity messages. In addition, two theoretical frameworks were applied to enable a more detailed examination of motivation. The findings from this chapter were presented (poster) at the International Society for Behavioural Nutrition and Physical Activity Annual Conference, San Diego, USA in 2014 and have been accepted for publication at the *Journal of Education and Health Promotion.*

5.1. Abstract

Mass media campaigns such as, *Change4Life* in the UK and *Get Active America* in the US, promote physical activity recommendations of at least 150 minutes a week of MVPA. We investigated whether different messages used in MVPA campaigns were associated with intention to engage in more MVPA. The TPB constructs; subjective norms, affective attitudes, instrumental attitudes and perceived behavioural control were applied to explain the associations between campaign messages and intentions to engage in more MVPA. 1,412 UK adults completed an online survey on MVPA and TPB. The sample was 70% female and 93% white with 23% reporting meeting physical activity guidelines. Participants received one of three messages: a walking message either with or without the 150 minute a week threshold (WalkT; WalkNT); a physiological description of MVPA with the 150 minute a week threshold (PhysT). ANCOVA examined group differences in intention. Path analysis evaluated mediation by TPB variables. ANCOVA identified lower intentions to increase MVPA in Group PhysT relative to WalkT and WalkNT ($p < .001$). Perceived behavioural control mediated this relationship in WalkT ($\beta = .014$, 95% CI = .004 to .028) whereas affective attitudes mediated this relationship in WalkNT ($\beta = .059$, 95% CI = .006 to .113). Campaigns promoting MVPA guidelines need to choose their messages carefully. Messages which exemplified MVPA through walking were associated with higher intentions to increase MVPA than messages using a physiological description. Further, perceived behavioural control was enhanced when the 150 minute a week threshold was promoted alongside the walking exemplar. Future exemplars should be investigated to inform adults how to meet MVPA guidelines.

5.2. Introduction

Physical activity guidelines for the four UK home countries unified in 2010[1]. Dissemination plans have begun in countries such as the US[203] and Canada[180] but a strategy of messaging these guidelines to the general public has yet to be developed in the UK. Mass media messages in the UK and abroad centre on MVPA guidelines e.g. 'just 150 minutes a week is all you need to get yourself going…'[222]. While this correctly reports current physical activity recommendations[1] it is unknown whether communicating this duration and intensity will provide the motivational impetus required for behavioural change.

MVPA can be illustrated through physiological descriptions e.g. raised heart rate, breathlessness[1]. Physical activity campaign messages have tended to steer away from connotations of sweat and exertion associated with earlier exercise guidelines[55] as such messages may be motivationally dissuading[146]. More moderate activities such as walking[89] have instead been used by campaigns promoting MVPA; "It's important to do 150 active minutes each week. Can you find 10 minutes to squeeze in a brisk walk today?"[229] Walking has become especially prominent due to its accessibility and association with health benefits[245].

The TPB[98] is useful for predicting whether physical activity messages are likely to be successful. TPB proposes three primary determinants of behavioural intention: attitude, subjective norms, and perceived behavioural control. Self-efficacy can also be considered as part of the model[5] According to TPB, believing in positive outcomes (e.g. improved health), perceived validation from important others (e.g. spouse, friend) and belief in one's own power over change, will result in a greater intention to be active. This has been supported in the literature[241,246].

Stage theories help us to predict how an individual is likely to respond to messages, depending on their stage in the behaviour change process. The PAPM suggests that individuals will not change their behaviour unless they are aware that their current behaviour is sub-optimal and makes them susceptible to severe negative outcomes[145]. Thus, an individual who is not meeting MVPA guidelines may hold positive attitudes towards MVPA, feel supported and in control, but

have no plans to engage in more MVPA because they believe they already do enough and so do not feel imminent risk to their health. This is also supported in the literature[150,247,248]. Combining both theories should therefore provide greater insight into the motivational implications of messages promoting MVPA.

Using tenets of TPB, walking requires little technical skill and can be performed almost anywhere. In this way walking messages may increase self-efficacy and perceived behavioural control. However, for many individuals walking is an incidental activity already engaged in regularly, even if normally at a low intensity[214,215,249]. Messages promoting walking may therefore be less likely than messages promoting less incidental activities, such as jogging, to help those individuals who are not meeting MVPA guidelines realise that their physical activity levels are inadequate. As suggested by the PAPM, these individuals may subsequently be less likely to feel susceptible to severe negative consequences and intend to engage in more MVPA.

The study reported in Chapter 4 suggests that MVPA messages which use a threshold of 150 minutes a week may not be motivationally optimal. The present study builds on this research by investigating the communication of guidelines through both duration and intensity aspects of MVPA. The primary purpose of this paper was to investigate the association between MVPA messages with different descriptions of intensity and duration, and intentions to increase MVPA. Further, this study explored whether relationships could be partly explained using TPB and PAPM constructs.

5.3. Methods

Ethical approval in accordance with the Declaration of Helsinki was granted by the host university. An online survey was developed using an online survey software and questionnaire tool (www.surveymonkey.com). This chapter reports on further data collected in the same online survey previously introduced in Chapter 3. The survey was disseminated via JISC mailing lists to UK adults (aged 18 and above) in February and March 2013. Subscribers to 152 lists which ranged in topic from societal lists e.g. minority ethnic groups to occupational e.g. masonry, were sent an email inviting them to complete a survey of measures from the extant literature. In order

to join a JISC mailing list, individuals are required to possess a university email address. Disseminating research surveys through these lists is therefore a useful strategy for targeting a sub-population of adults who are likely to be educated and employed. Adults responding to the survey were assigned to one of three experimental message groups. Each group received a different message adapted from existing MVPA campaigns. Measures are reported below in the order in which they were completed by participants.

5.3.1. Measures

Demographic factors. Participants reported their age, gender, ethnicity, health status, marital status, employment status and education level.

Current physical activity. A single validated item was used; "In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to raise your breathing rate? This may include sport, exercise and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job". [250,251]

Physical activity messages. Group WalkT received a walking threshold message; "Regular physical activity, such as walking, protects your health. Each week, adults should accumulate 150 minutes of physical activity". Group PhysT received a physiological threshold message; "Regular physical activity that makes you feel warmer, breathe harder and makes your heart beat faster protects your health. Each week, adults should accumulate 150 minutes of physical activity". Group WalkNT received a walking message without a threshold; "Regular physical activity, such as walking, protects your health. Each week, adults should accumulate as much physical activity as possible".

<u>PAPM measures.</u>

Awareness. Participants rated on a five-point scale (very low-very high) the statement; "My level of physical activity is ___ ."[149] This was considered alongside self-reported physical activity to

determine whether individuals over-estimated, correctly estimated or under-estimated their personal physical activity behaviour relative to physical activity guidelines.

Severity. Participants rated on a nine-point likert scale (definitely not necessary-definitely necessary); "To what extent do you feel that you need to engage in more moderate-to-vigorous physical activity in the next six months?"

Susceptibility. Participants rated on a nine-point likert scale (extremely unlikely-extremely likely); "How likely do you think you are to experience or develop the following (heart disease, cancer, ill health and weight gain) at some time in the future, because of the amount of physical activity you do?"[252]

TPB measures.

Guidelines of Ajzen were followed when selecting items[253]. All items were answered on a seven-point Likert scale (completely agree-completely disagree).

Intention. Three items which have previously shown good reliability and validity assessed intention to engage in more MVPA e.g. "I am motivated to regularly engage in more moderate-to-vigorous physical activity" [139,140,254,255].

Subjective norms. A composite measure combining three items which assessed approval of and engagement in MVPA by important others and participants' 'motivation to comply' was used e.g. "Most of the people who are important to me engage in sufficient moderate-to-vigorous physical activity themselves"[253].

Attitudes. Three items each with the stem "Engaging in more MVPA each week would be…" assessed instrumental (e.g. useless) and affective attitudes (e.g. enjoyable) [138,255,256].

Perceived behavioural control. A single-item was used: "Whether or not I regularly engage in more moderate-to-vigorous physical activity is completely up to me"[256].

Self-efficacy. A single-item was used: "If it were entirely up to me, I am confident I would be able to engage in more moderate-to-vigorous physical activity"[18].

The mix of single-component and multi-component measures employed in the present study was informed by previous research. Rhodes et al[257] clarified the best operational constructions of TPB constructs. The authors provided evidence which supported the use of affective and instrumental attitude as distinct constructs. On the other hand, injunctive and descriptive norms did not evidence distinct predictive influence and so a combined measure is appropriate. In addition, Ajzen[258] has previously discussed the application of perceived behavioural control and self-efficacy both in combination as a single unitary factor and as separate indices. The author's conclusions support the use of two separate indices in answering the present research question.

Other measures.

Knowledge of physical activity guidelines. An open-response textbox accompanied the question; "What are the physical activity guidelines?" to garner unprompted knowledge[94].

Manipulation check items. Five items assessed the extent to which PA messages were read, believed, interesting, informative and liked[18]. Additional items assessed the extent to which they were remembered and relevant.

5.3.2.Analysis

ANCOVA analysis was performed using SPSS 20.0 to identify group differences in intention to engage in more MVPA. Path analysis using M*Plus* software was then employed to evaluate whether TPB variables explained (i.e. mediated) the relationships among messages and intentions[259]. First, a model was constructed examining the TPB variables as predictors of intentions. Then, a full indirect associations model was constructed which included two binary

Table 7. Descriptive statistics for demographic, TPB and PAPM variables stratified by group. Mean and standard deviation reported unless stated otherwise

	WalkT	PhysT	WalkNT
N	493	449	470
Demographics/Other			
Age (% under 45)	54%	58%	63%
Gender (% female)	74%	68%	67%
Ethnicity (% White)	94%	92%	92%
Education (% with a university degree)	90%	86%	88%
Employment (% employed)	89%	78%	81%
Marital status (% married)	57%	54%	47%
Current Health[1]	3.7 ± 1	3.9 ± 1	3.8 ± 1
Days doing 30 minutes of PA	3.7 ± 2.1	3.8 ± 2.1	3.7 ± 2.1
Manipulation check[2]	3.5 ± 1	3.5 ± 1	3.2 ± 1
Environment[3]	5.3 ± 1.5	5.2 ± 1.4	5.2 ± 1.4
TPB constructs			
Intention	5.3 ± .1	4.5 ± .1	5.3 ±.1
Subjective norm	2.5 ± .1	2.4 ± .1	2.4 ± .1
Affective attitude	5.4 ± .1	5.2 ± .1	5.3 ± .1
Instrumental attitude	6.3	6.2 ± .1	6.2 ± .1
Perceived behavioural control	5.5 ± .1	5.6 ± .1	5.8 ± .1
Self-efficacy	4.7 ± .1	4.9 ± .1	3.9 ± .1
PAPM constructs			
Susceptibility	5.2 ± 2	5 ± 2.1	4.8 ± 2
Severity	6.8 ± 2.1	6.7 ± 2.3	6.8 ± 2.1
Awareness (% accurate)	64%	70%	65%

WalkT – Walking used as an exemplar of MVPA and 150 minute/week threshold included; PhysT – physiological parameters used to describe MVPA and 150 minute/week threshold included; WalkNT – Walking used as an exemplar of MVPA and no threshold used in message

PA – physical activity

1. Self-reported current health status
2. Manipulation check was a composite score of five items which assessed the extent to which the message was trusted, interesting, informative, remembered and liked.
3. Composite of self-reported proximity to amenities, proximity of facilities for physical activity and perceived attractiveness of the local environment

categorical variables comparing the effects of the WalkT message and WalkNT message to the reference message (i.e., PhysT; see results section for the rationale for this approach), respectively. Potential mediation of these associations by the significant TPB variables was

tested using the procedures outlined by Hayes and Preacher for establishing mediation with categorical predictors and for calculating 95% bias-corrected bootstrap confidence intervals[201]. Model fit for this full model was assessed using the confirmatory fit index (CFI), root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMR) to assess model fit.

Finally, potential moderation of the direct associations among message groups and TPB constructs by the PAPM variables was tested by constructing path models which included the categorical message variables, a main effect of the respective PAPM variable on intentions, and a PAPM variable x message interaction term. The moderating influence of each PAPM variable on each message (relative to the reference message) was assessed in separate models.

5.4. Results

All subscales showed acceptable reliability (> .70). Data from this online survey have been reported in Chapter 3. There were 178,729 subscribers to the joined JISC mailing lists from which 1,861 adults responded to the survey questions pertaining to the research question in this chapter. This gives a potential response rate of 1%, though this is likely underestimated due to factors discussed earlier such as individuals being subscribers to multiple mailing lists. Completion rate was 76% with 1,412 adults providing complete datasets for analysis. The sample was 70% female, 43% under 45 years of age and 93% white with 23% reporting meeting physical activity guidelines. The sample over-represents females, the highly educated and the employed relative to the general population and so findings need to be interpreted in the context of a highly educated sample. Full descriptive statistics are provided in Table 7. Preliminary analysis of demographic variables revealed that knowledge of physical activity guidelines significantly differed between message groups ($p < .05$), thus these were included as covariates in the ANCOVA analysis. ANCOVA revealed a lower intention in group PhysT relative to the other two groups ($p < .001$). Group PhysT was therefore selected as the reference group in the subsequent path analysis.

The path model exploring the pattern of relationships among TPB variables and intentions revealed significant perceived behavioural control-intention (β = .06, $p < .01$), affective attitude-intention (β = .48, $p < .001$) and subjective norm-intention (β = .08, $p < .001$) relationships. Instrumental attitudes (β = .02, $p = .78$) and self-efficacy (β = .04, $p = .71$) did not significantly predict intentions and so were removed from further analysis. A full model (see Figure 7) was then examined testing the indirect associations of the two messages (i.e., WalkT and WalkNT compared to PhysT) on intentions via the three significant TPB constructs. This overall model demonstrated acceptable fit to the data: SRMR = .03; CFI = .91; RMSEA = .08 (CI = .06-.10). Further, significant positive associations were observed between WalkT and perceived behavioural control (β = .23, $p < .01$), and WalkNT and affective attitude (β = .12, $p < .05$), indicating that the participants receiving these messages reported higher perceived behavioural control and affective attitudes, respectively, compared to participants receiving the PhysT message. Subjective norms did not demonstrate any associations. In turn, all three TPB constructs were positively associated with intentions (perceived behavioural control: β = .06, $p = .005$; affective attitudes: β = .49, $p < .001$; subjective norms: β = .09, $p < .001$). Employing Hayes and Preacher's procedures, a small but significant indirect relationship was identified between WalkT and intentions via perceived behavioural control (β = .014, $p < .05$, 95% CI = .004 to .028), and between WalkNT and intentions via affective attitudes (β = .059, $p < .05$, 95% CI = .006 to .113)[201].

A series of path models then tested whether PAPM variables moderated the direct effects of the two walking-based messages on intentions (relative to the PhysT comparison group). Severity did not moderate any of the associations; however, susceptibility and awareness were found to moderate the relationship between WalkNT (relative to PhysT) and intentions (susceptibility × WalkNT: β = .16, $p < .002$; awareness × WalkNT: β = -.11, $p < .05$). Further inspection of the interaction terms revealed that the association between WalkNT (relative to PhysT) and intentions was greater for those with higher susceptibility and awareness.

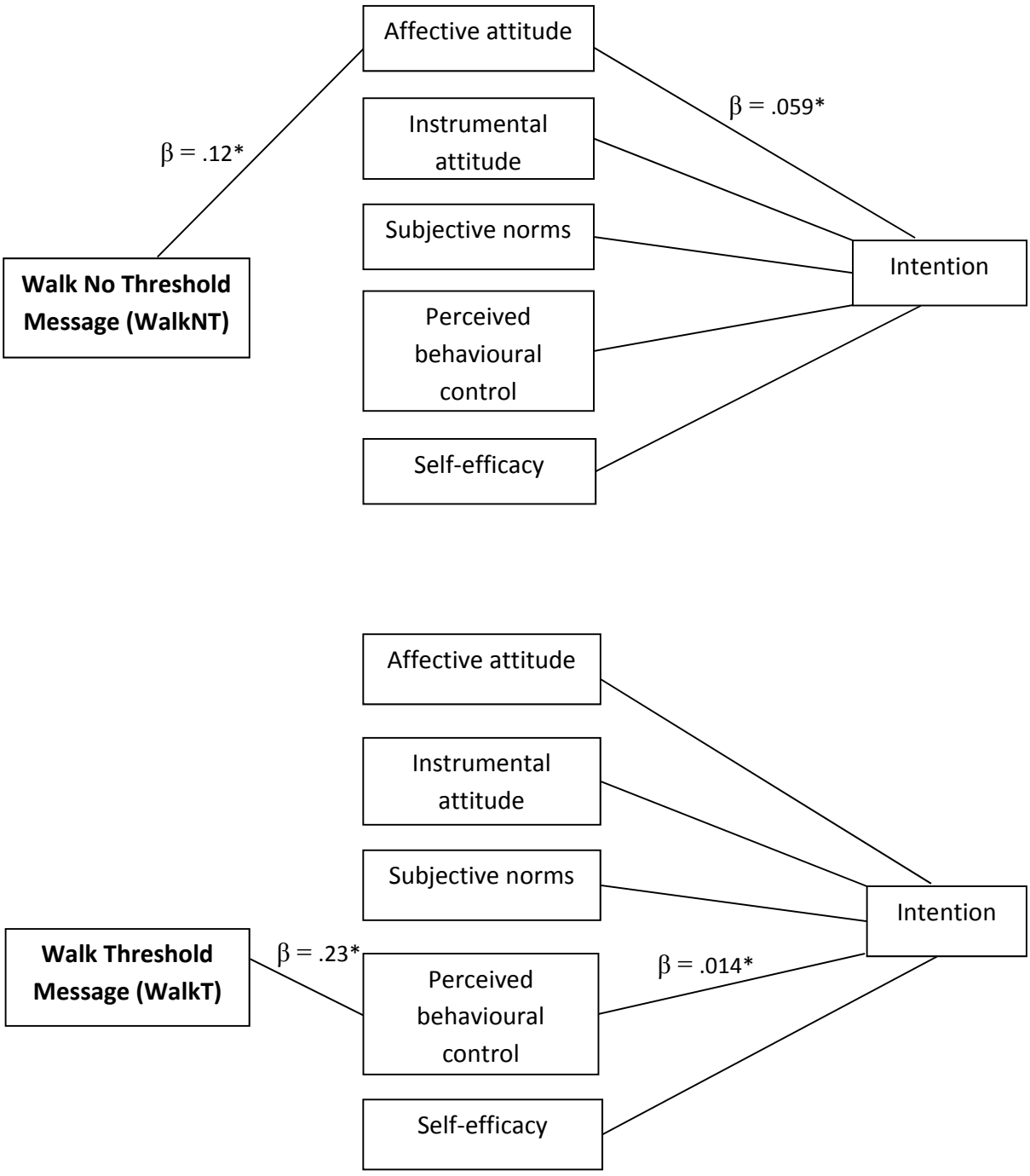

Figure 7. Path analysis of the effect of two walking-based physical activity messages relative to a physiological threshold message on intention via theory of planned behaviour constructs *$p < .05$

5.5. Discussion

Present findings suggest that messages which use walking to exemplify MVPA are associated with greater intentions to do more MVPA when compared with messages which use physiological parameters, such as heart rate or sweating within a sample of highly educated and employed adults. This finding provides some preliminary evidence to support the use of walking exemplars which are currently prominent in mass media physical activity campaigns (e.g. the Healthy Hawaii Initiative *Step It Up, Walk4Life* [sub-campaign of *Change4Life*] and *STEPtember* [sub-campaign of *America on the Move*]), as a useful tactic to increase engagement of educated adults in MVPA.

On the other hand, the message which described MVPA most closely from MVPA guidelines (PhysT) was associated with a lower intention to engage in more MVPA than the other two messages within this sample[1]. This is in line with the findings reported in Chapter 4 from a different sample, that the physical activity message which most closely described UK guidelines was related to less positive perceptions of the health benefits associated with physical activity. However, Chapter 4 investigated communication of the *duration* aspect of physical activity guidelines, focusing on the use of the 150 minute a week threshold. The present study extended this research by investigating both *duration* and *intensity* aspects of physical activity guidelines. In the present study the 150 minute a week threshold was only negatively associated with intentions to be more active when it was paired with a physiological description of MVPA. Unfortunately, the degree of similarity between the samples used in Chapters 4 and the present chapter is unclear as only limited demographic data was collected.

The higher intention in the two groups receiving MVPA messages based around walking (Group's WalkT and WalkNT) was mediated by perceived behavioural control and affective attitudes. Affective attitudes mediated the relationship between Group WalkNT and intentions. Effects were generally small which is normal for mediation effects associated with theoretical constructs, however, the direct effects identified were much larger. The *Walk Missouri* physical activity campaign similarly found improvements in affective attitudes in response to walking messages[260]. *Walk Missouri* used generic messages such as "I do it for my health. Why do you walk?" Individuals probably like messages which do not stipulate a duration of MVPA because

they allow ideas of smaller behavioural change to be entertained. However, while such messages may be motivational, they do not provide information on the duration of MVPA required for optimum health. As knowledge of MVPA guidelines was shown to be low in Chapter 3, it is preferable for messages to be both motivational and informative.

Group WalkT's higher intention relative to Group PhysT was related to their greater perceived behavioural control. Unlike the WalkNT message, the WalkT message provided accurate information on the duration of MVPA recommended for adults. According to goal theory, specific, measurable, attainable and time-framed goals can motivate increased physical activity[261]. The threshold of 150 minutes a week may fulfill some of these criteria. As suggested in Chapter 4, this 150 minute a week threshold may have negative impacts on motivation when used in campaign messages because it is not a realistic target for most of the adult population. In the present study, the WalkT message incorporated the same 150 minute a week threshold as used in the study reported in Chapter 4 but added the exemplar walking and motivations were not negatively affected. Indeed, it has previously been highlighted that to successfully encourage individuals to meet physical activity guidelines, messages must tell them *how* to achieve them, not only *what* they are[14]. The present findings support this, providing evidence that positioning exemplars such as walking alongside duration thresholds may improve intention by increasing perceived behavioural control over achieving 150 minutes a week of MVPA. Scott and colleagues found that adults considered MVPA to be under greater personal control than vigorous-intensity physical activity[255]. Possibly, adults in Group PhysT associated the physiological description of MVPA with more intense physical activity than the walking message group and subsequently perceived the message to be recommending vigorous-intensity physical activity, rather than MVPA. As one of the most popular activities in the UK[2], walking may be an especially good exemplar as it is likely considered more accessible than other types of MVPA such as jogging, which could be deemed to be too intense.

Instrumental attitudes and subjective norms did not mediate the relationships between messages and intention to be more active. The MVPA messages in the present study did not target subjective norms, while instrumental attitudes appear to be more strongly related to intention to engage in more vigorous physical activity than MVPA[255].

Impaired awareness of physical activity behaviour has been associated with reduced intentions to be active[150,247,248]. In the present study, awareness of current MVPA behaviour and perceived susceptibility to health risks moderated the relationship between WalkNT and intentions. Adults receiving the WalkNT message who were accurately aware of the MVPA they engaged in and who felt susceptible to health problems had a greater intention to increase MVPA, compared to those who were not aware and did not feel susceptible. According to the PAPM, adults who overestimate their current physical activity level and the ensuing health effects will feel less susceptible to adverse health outcomes and will resultantly hold a lower intention to be more active. This was supported in the present study but only for adults receiving the WalkNT message. This is a possible weakness of the WalkNT message as individuals typically overestimate their physical activity level and these individuals may subsequently not find this message motivational[147,149,150,151,247,248,262]. The WalkNT message did not tell readers how much MVPA they should engage in, making it more difficult to rate their physical activity relative to MVPA guidelines. Messages containing a threshold may be more effective for adults who misperceive their current physical activity behaviour i.e. the majority of inactive adults. As a result, campaigns using messages without thresholds, similar to the WalkNT message in the present study, may fail to persuade the very inactive individuals they were conceived to target.

The present study is cross-sectional and so investigation of behaviour change and of cause and effect is not possible. The TPB predicts change in behaviour from intention and we therefore assume that the higher intention in the Group's WalkT and WalkNT will translate to improved MVPA behaviour[263]. However, a large amount of variance in behaviour is not accounted for by intentions[22]. Further studies are therefore needed which objectively measure change in MVPA behaviour (e.g. using accelerometers). It is also not possible to remark on differences between adult's completing the survey and those not, due to the data collection method employed. However, comparisons with freely available demographic data from the HSE 2011 suggest the adults in the present study are more educated and more likely to be in employment than the general population. Despite these limitations, the provision of different physical activity mass media campaign messages to a large, albeit self-selected, sample is novel and could have important applications for health promotion. Future studies should attempt to confirm the

findings with representative samples. It would also be useful to examine other exemplars of MVPA, such as cycling or gardening. This is especially important considering that walking is often performed at a below moderate intensity. Messages to promote physical activity guidelines should be further investigated in consideration of message design literature and different behaviour change and health behaviour theories. For instance, Peetz and colleagues found messages framed the threshold in daily terms using a 30 minutes a day threshold resulted in greater intention to be active than a 150 minute a week threshold[29]. The efficacy of using different duration thresholds could be further examined.

The present research investigated motivational implications of messages used to promote MVPA guidelines within a self-selected sample of educated adults. An appropriate description of MVPA intensity, which avoids physiological descriptions, alongside the 150 minute a week threshold is crucial to consider when developing messages targeting intentions to increase MVPA.

Knowledge of physical activity guidelines does not prevent overestimation of physical activity engagement in adults

6. Knowledge of physical activity guidelines does not prevent overestimation of physical activity engagement in adults.

The research presented in the following chapter furthers the motivational exploration of the effects of messages on MVPA. This chapter examines whether inactive adults who know the correct physical activity guidelines are more likely to accurately perceive their own level of MVPA i.e. know that they are inactive. In addition, the inclusion of walking as a suitable exemplar of MVPA is further explored. Findings presented in this chapter are under review at *Health Promotion Practice.*

6.1. Abstract

Adults may be less likely to increase their engagement in MVPA if they inaccurately perceive that they already meet MVPA guidelines. Mass media campaigns, such as *Change4Life*, inform the general public of MVPA guidelines. Correct knowledge of MVPA guidelines may help to inform adult's accurate perceptions of their own MVPA level. Subjective norms and health status may also influence the way in which adults perceive their own behaviour. The primary purpose of this paper was to investigate the relative effects that knowledge of MVPA guidelines, subjective norms and health status had on adults' awareness of their MVPA level. An online survey including items on minutes spent in MVPA, MVPA awareness, subjective norms, knowledge of guidelines, health status and demographics, was completed by 1,724 UK adults. Logistic regression analyses with awareness of MVPA entered as the dependent variable identified associations with both high subjective norms (OR = 1.84, $p < .005$) and average or below average health status (OR = -.337, $p < .05$) and accurate MVPA awareness. Reporting a usual walking pace of moderate-to-vigorous intensity was also associated with accurate awareness of MVPA relative to light intensity (OR = 1.31, $p < .05$). In contrast, knowledge of MVPA guidelines was not associated with accurate awareness of personal MVPA behaviour. Campaigns which promote MVPA guidelines may be failing to improve awareness of MVPA engagement among adults. Campaign messages may be more influential targeting social norms instead of knowledge, thereby raising awareness of personal engagement with MVPA amongst inactive adults and increasing motivation to engage in more MVPA.

6.2. Introduction

Engagement in regular physical activity is associated with numerous health benefits including improved cardiovascular health and quality of life[264,265]. Efforts have been made to unify physical activity recommendations between countries (for example, Canada[9], United States[7], United Kingdom[6], Australia[8]), as well as with the World Health Organization[1]. This has resulted in the recommendation that adults engage in at least 150 minutes of MVPA each week. Only around five percent of adults from the UK[134] and US[3] and 15% from Canada[4] achieve enough MVPA to meet national guidelines.

An accurate awareness that one does not engage in sufficient MVPA can increase motivation to engage in more physical activity[150,247,248]. Evidence suggests that many adults misjudge themselves as being more active than they are in reality, with many believing themselves to be active when in fact they do not meet MVPA guidelines[147,149,150,151,247,248,262]. This could be a major factor contributing to a lack of engagement in MVPA. Judgements around the adequacy of an individual's level of engagement with MVPA are informed by perceptions of how much MVPA one *should* engage in, relative to how much MVPA one *does* engage in. Previous studies have found that subjective indicators of health such as having a normal weight status can contribute towards the fallacy that one does not need to engage in physical activity and thus result in misperceptions of current MVPA engagement[148,149]. Physical activity campaigns around the world such as *Change4Life* in the UK, *Fulfil a Lifetime* in New Zealand and *Be Active* in Australia, promote MVPA guidelines in order to increase knowledge of the amount of MVPA required for good health for all adults within the general population. This knowledge can be used to inform more accurate judgements of personal MVPA and motivate increased engagement. However, subjective norms could be a competing influence on judgements regarding how much MVPA one should engage in and subsequently the manner in which an individual rates their own level of physical activity[149]. For instance, an individual who engages in below recommended levels of MVPA may perceive themselves to be active if their family and friends do not engage in any at all. From a health promotion standpoint it is important to know whether educating the

population about the required level of MVPA is likely to influence awareness of personal levels of MVPA despite the presence of preeminent subjective norms.

Physical activity campaigns can also create norms through the activities promoted in their messages. For instance, campaigns often specifically promote walking as MVPA, despite evidence suggesting that walking is often performed at an insufficient intensity to meet MVPA guidelines[214,215,249]. This could lead to misperceptions of personal MVPA amongst those who engage in low intensity walking; however, this has yet to be empirically tested.

The aim of this study was to examine the hypothesis that greater knowledge of MVPA guidelines and greater subjective norms and lower self-reported health status are associated with accurate awareness of MVPA engagement within the same self-selected sample of UK adults used in Chapters 3 and 5. In addition, the intensity with which individuals typically walked was investigated as an additional predictor of accurate awareness of physical activity engagement.

6.3. Methods

Ethical approval was granted by the ethics committee at the host institution. An online survey was developed using a commercially available software tool (www.surveymonkey.com). Chapters 3 and 5 also report on data from this survey. As discussed in these earlier chapters, the survey was sent to a large sample of adults who were members of at least one JISC mailing list in February and March 2013. There were a maximum of 178,729 subscribers to these mailing lists, which means the survey was sent to a potential 178,729 individuals. From this, 2,332 UK adults responded to the survey giving a potential response rate of 1.3%.

6.3.1. Measures

Participants answered the following measures:

Demographics. Participants self-reported gender, age, ethnic background, marital status, highest level of education and level of employment (full-time, part-time, unemployed, retired or student).

Health status. Participants responded to the sentence; "I would say that my health currently is", on a five-point scale from poor to good. This item was adapted and has been used reliably in physical activity research[266,267].

Knowledge of MVPA guidelines. Participants were asked; "What are the physical activity guidelines?" An open text box enabled participants to respond with any information they felt was appropriate. Individuals who stated 150 minutes a week were labelled as having accurate knowledge regardless of whether or not an appropriate description of intensity was included.

Awareness. Awareness of personal MVPA behaviour was calculated by first asking participants; "In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to raise your breathing rate? This may include sport, exercise and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job". Response options from one to seven were provided. Next, participants responded to the statement; "My level of physical activity is…" on a five-point scale from very low to very high[149]. Individuals were labelled as being accurate if their responses to these two items matched i.e. they reported engaging in MVPA on less than five days and described their activity as being less than sufficient. Individuals were labelled as inaccurate if their responses to the two items did not match i.e. they engaged in MVPA on less than five days but described their activity as being sufficient or better.

Subjective norms. The stem *"*Most of the people who are important to me…." was followed by the following three items "think I should engage in more MVPA"; "engage in sufficient MVPA themselves"; "influence my decisions regarding MVPA". These questions were answered on a seven-point scale from strongly agree to strongly disagree and were selected based on guidance for constructing TPB questionnaires[253].

Intensity of walking. In addition participants were asked; 'What effort would you associate with walking?' This was answered on a 15-point scale ranging from no exertion at all to maximal exertion[268]. Responses 1-7 were labelled as below moderate and 8-15 as moderate-to-vigorous.

6.3.2. Analysis

All statistical analyses were performed using IBM SPSS Statistics Package 21.0. Descriptive statistics were performed to characterise the demographic variables and chi-square analyses for non-parametric data examined differences between adults with accurate and inaccurate awareness of personal MVPA engagement. Logistic regression models were developed to examine the hypotheses with α set at .05. Variables were dichotomised for entry into logistic regression models. The first model included awareness of personal physical activity (accurate versus inaccurate) as the dependent variable and knowledge of MVPA guidelines, subjective norms and self-rated health entered as predictor variables. In the second model the variable describing the perception of effort associated with the participants normal walking pace was entered as a predictor of awareness. Both models controlled for all measured demographic variables. Following the logistic regression analysis, the inaccurate awareness variable was divided into those who overestimated and those who underestimated their MVPA. Chi-squared analysis was then used to further explore results.

6.4. Results

The completion rate was 73.9% with 1,724 adults responded to all questions. The sample was 70% female, 57% aged under 45, 93% White and 69% in full-time employment. This is over-representative of females, highly educated and full-time employed adults relative to the general population and so results must be considered in the context of an educated sample. 62% reported their health to be above average, while 62% demonstrated accurate awareness of their own physical activity level, only 18% accurately reported the MVPA guidelines and 51% reported high subjective norms towards MVPA. Table 8 reports group characteristics for adults with accurate and inaccurate awareness of their MVPA level. Results from chi-square analysis examining significant differences between groups are also reported in Table 8. Amongst adults

with accurate awareness of their own MVPA engagement there is a greater percentage of adults aged under 45, married and reporting above average health, high subjective norms and a regular walking pace of moderate or vigorous relative to adults with inaccurate awareness.

Table 9 reports results from the logistic regression models. Model one tested the hypothesised associations between awareness, knowledge, health status and subjective norms, controlling for demographic variables. Results revealed that adults with a high subjective norm were 84% more likely than adults with low subjective norms to have an accurate awareness of their MVPA level ($p < .005$). Individuals who self-reported their health as being sufficient or less than sufficient were 29% more likely than those reporting good health to have accurate awareness of their MVPA level ($p < .05$). Model two examined associations between awareness and the novel variable normal walking intensity, whilst controlling for demographic variables. Results showed that, relative to adults who reported their walking as normally being of a light intensity, adults who typically performed walking at a moderate-to-vigorous intensity were 31% more likely to have accurate awareness ($p < .05$). In addition, chi-square analysis identified a significantly higher proportion of overestimators amongst those who reported usually walking at a light intensity relative to those who reported usually walking at a moderate-to-vigorous intensity ($p < .05$).

6.5. Discussion

Many mass media physical activity campaigns place physical activity guidelines at the heart of their messages in a bid to motivate more adults to engage in 150 minutes a week of MVPA. For instance, the marketing strategy of the UK's leading national health campaign *Change4Life*, states that: "before we can expect behaviour change on any significant scale, people will need to know what they need to do to change"[33]. Thus, for inactive individuals to be motivated to engage in more MVPA they may need to know how much is recommended and how their behaviour deviates from this. The present research found that accurate knowledge of MVPA guidelines was not related to adults' awareness of their own physical activity behaviour within a sample of educated adults. This is a pertinent finding as it suggests that some individuals may not necessarily need to know the amount and intensity of physical activity recommended for health

in order to perceive accurately whether they are themselves sufficiently active. It supports previous suggestions that individuals with misperceptions about their physical activity behaviour do not pay attention to health messages about physical activity because they do not believe these messages to be relevant to them[151]. Knowledge of physical activity guidelines for this sample is reported in Chapter 3 and was found to be low (only 18% knew MVPA guidelines). These findings suggest concern when considered in the context of recent promotional efforts endorsing physical activity guidelines. Awareness of campaign messages was not measured precluding firm conclusions regarding messaging guidelines, knowledge and awareness. However, the finding that knowledge of guidelines did not influence awareness suggests that the provision of information on physical activity recommendations may fail to improve adults' awareness of their current engagement with physical activity within some samples. Messaging strategies which

Table 8. Descriptive statistics stratified according to awareness of personal MVPA engagement. Significant differences between groups identified using chi-squared analysis

	Accurate awareness (n = 1,083)	**Inaccurate awareness (n = 641)**	**Chi-square p value**
Male	29.8%	32.6%	.14
Aged under 45	55.3%	61.7%	<.005
White ethnicity	92.4%	92.7%	.34
Married	54.7%	49.2%	<.05
Higher education	93%	92.7%	.47
Full-time employment	68.9%	67.2%	.23
Above average health	55.2%	72.1%	<.001
Accurate knowledge of guidelines	18.1%	18.1%	.51
High subjective norm	52.7%	47.5%	<.05
Moderate walking pace	29.7%	27%	<.005

Table 9. Logistic regression predicting accurate awareness of engagement with MVPA from subjective norms, knowledge of MVPA guidelines, normal walking intensity and demographics (N = 1,724). Reference group is given in brackets. * indicates a significant difference at the $p < .05$ level

Predictor	B	Standard error	Wald	Odds ratio	Lower 95% CI limit	Upper 95% CI limit
Model 1: Hypothetical predictors of accurate awareness of engagement with MVPA						
Gender (male)	.124	.111	1.263	1.133	.912	1.407
Age (45 and over)	.157	.109	2.076	1.17	.945	1.448
Ethnicity (white)	-.092	.197	.218	.912	.62	1.342
Marital status (married)	.142	.107	1.746	1.152	.934	1.422
Education (low education i.e. highest level of education is completing secondary school)	.077	.203	.143	1.08	.725	1.608
Employment (part-time or unemployed)	-.006	.112	.003	.994	.799	1.237
Knowledge (accurate)	.061	.132	.216	1.063	.82	1.378
Subjective norms* (high)	.611	.181	11.435	1.843	1.293	2.626
Health* (above average)	-.337	.155	4.737	.714	.527	.967
Model 2: Exploratory predictor of accurate awareness of engagement with MVPA						
Age* (45 and over)	.225	.107	4.449	1.253	1.016	1.388
Gender (male)	.114	.109	1.098	1.121	.905	1.544
Ethnicity (white)	-.046	.193	.058	.955	.655	1.392
Marital status (married)	.15	.105	2.038	1.162	.946	1.427

Education (low education i.e. highest level of education is completing secondary school)	.053	.2	.07	1.054	.712	1.561
Employment (part-time or unemployed)	-.022	.11	.041	.978	.788	1.213
Walking intensity* (moderate or vigorous)	.269	.111	5.893	1.308	1.053	1.625

focus on creating knowledge of physical activity guidelines to motivate increased engagement in MVPA are therefore unlikely to be effective.

The present study did find that subjective norms which favoured MVPA were associated with more accurate perceptions of MVPA engagement. These subjective norms may be shaped through adult's perceptions that their significant others (friends/family) believe they should engage in more MVPA or through having significant others who are themselves active. Previous findings found that individuals who misperceived their physical activity level used social referents who were inactive or low active[149]. Active peers may improve awareness by providing a tangible means of comparing ones behaviour to the ideal. While government sponsored information on guidelines given through campaigns may be dismissed by many as not being personally applicable, the sight of an active friend or coercion from a family member to engage in MVPA may alternatively be relatable and informative. Indeed, the three-year social marketing plan for *Change4Life* states: "we are more likely to adopt a habit or behaviours if we feel that it is how 'people like me' normally behave"[34]. Future campaign strategies may be more successful by highlighting how individuals have achieved physical activity guidelines using examples from within society and individual communities. Such a benchmark was included in a 2009 marketing strategy for *Change4Life* ("use mass media to bring the results to life and to tell people where they and their neighbours stand in relation to the nation"[33]; however, this focus has yet to emerge in the main campaign advertisements to date. Individuals with lower socioeconomic status are less likely to engage in physical activity and to have supportive subjective norms than those with

a higher socioeconomic status[269]. Given the higher socioeconomic status of the present sample, research is needed to support the generalisability of these findings.

Previous studies have found a normal weight status to be associated with the overestimation of physical activity level[147,270]. The present study investigated health status more generally and found that educated adults who perceive themselves to be healthy tend to overestimate their engagement in physical activity. Vähäsarja and colleagues found subjective markers of health such as weight status and fitness had a stronger association with adults' perceived need to increase physical activity than objective health markers[271]. Those who believed themselves to be overweight or unfit being more likely to believe that they engaged in insufficient physical activity and that they needed to engage in more physical activity. Adults' perceptions of their own health therefore seem important as a motivational driver for physical activity. Future campaigns may need to educate adults on the importance of physical activity for all and not just for those who are overweight or in poor health.

Finally, adults whose usual walking pace was described as being of at least a moderate intensity were more likely to accurately perceive their level of engagement with MVPA. Many MVPA campaigns provide walking as an exemplar despite evidence that walking is usually performed at a light intensity[214,215,249]. The present study found that adults who reported their usual walking pace to be light were more likely to overestimate their engagement in MVPA. Adults who typically walk slowly may erroneously believe they meet MVPA guidelines, especially if they believe that all walking is guideline-fulfilling. Campaigns such as *Change4Life* which promote messages such as; "Swap four wheels for my own two feet when I go to the shops… to get me going for 150 minutes a week [advertisement 2011]", may contribute to misperceptions among 'slow walkers' and resultantly fail to motivate improved behaviour. This is problematic as many campaigns with the goal of promoting MVPA foreground walking in their messages but, as is apparent in the above message, fail to mention intensity. Campaigns which do promote walking as MVPA should therefore, emphasise the intensity that is required for walking to be health-enhancing and avoid general or vague messages to promote walking.

The present study reports cross-sectional data so conclusions regarding causality cannot be made. Adults' awareness of their MVPA level was calculated using self-reported engagement with MVPA. Thus, inaccurate reporting of MVPA may also contribute to adults inaccurate perceptions of their MVPA engagement. Future studies should use objective measures of MVPA. On the other hand, the sample size was large and demographically representative of the UK population (based on comparisons with freely available 2008 HSE data). This is the first research to explore associations between prominent physical activity campaign messages, knowledge of physical activity guidelines and adults' awareness of their MVPA engagement. Further study could explore different methods of questionnaire delivery e.g. pen and paper. The motivational implications of the findings and behavioural outcomes should also be further explored.

We found high subjective norms and below average health status to be associated with adult's perceptions of their own MVPA engagement within an educated sample of UK adults. Unexpectedly, knowledge of MVPA guidelines was not associated with accurate awareness of engagement in MVPA. This suggests that the promotion of MVPA through campaign messages centred on MVPA health guidelines may not be an effective strategy for improving adult's knowledge of recommended MVPA or awareness of their own engagement in MVPA. This could negatively influence motivation and further involvement in MVPA. These findings have substantial applied relevance for future MVPA campaigns. While the ultimate aim is for adults to achieve at least 150 minutes a week of MVPA this goal is a long way from being reached and simple transmission of this goal to the public via campaign messages is unlikely to improve behaviour. Cohesion is needed between academics, campaign developers and health promoters to develop evidence-based messaging strategies which effectively promote increased MVPA and surreptitiously move adults towards meeting recommendations.

Accounting for sitting and moving: An analysis of sedentary behaviour in mass media campaigns

7. Accounting for sitting and moving: An analysis of sedentary behaviour in mass media campaigns

The following chapter presents an analysis of the content of mass media campaigns with emphasis on messages employed to promote reducing sedentary behaviour. Messages promoting reductions in sedentary behaviour have begun to materialise in mass media campaigns which were initially developed to encourage physical activity. Key emergent themes are discussed and future directions are suggested to direct research for developing messages for these two important health behaviours. Findings from this chapter are In Press in the *Journal of Physical Activity and Health.*

7.1. Abstract

The erosion of lifestyle-embedded activity has seen sedentary behaviour rise to levels which endanger the health of many individuals. The relevance of sedentary behaviour to public health has propelled it to feature prominently in activity-related health campaigns across the world, many of which were initially developed to promote MVPA. There is, however, an absence of research informing how messages can successfully curb sedentary behaviours. This research aims to understand more about the use of messages regarding sedentary behaviour in health campaigns within the context of current debates surrounding the association between sedentary behaviour and health, and messaging strategies to promote MVPA. Specifically, this article provides results from a directed content analysis of major campaigns in four countries to analyse the inclusion of messages regarding sedentary behaviour in health campaigns and identify key areas for future research. The analysis reveals four themes from the campaigns: clinging to guidelines, advocating reducing sedentary behaviour as a first step on the activity continuum, complicating the promotion of MVPA and the demonization of sedentary behaviour. Recommendations are offered for both researchers and health promoters to develop strategies for managing sedentary behaviour as a complicating factor in health promotion. Using lessons learned from previous health communication campaigns, future directions are suggested to stimulate research to inform messaging strategies.

7.2. Introduction

Sedentary behaviour poses a health risk to adults which appears to be largely independent of the effects of MVPA[44,272], although findings for children are less clear[273]. Debate around what constitutes sedentary behaviour[274,275] led the Sedentary Behaviour Research Network (SBRN) to define it as; "any waking behaviour characterised by an energy expenditure ≤1.5 METs while in a sitting or reclining posture"[276]. This is distinct from being physically inactive which is defined as not meeting physical activity guidelines (or an equivalent agreed criterion). It is therefore possible for an individual to be both active and sedentary although evidence suggests that those who are active are less likely to be sedentary[277]. With many individuals failing to meet physical activity guidelines for MVPA[6] the problem of inactivity and the problem of a sedentary lifestyle inflict a potential 'double blow' to health[277].

The proportion of the day spent being sedentary is increasing for many people[41, 272]. Many urban environments contribute to this trend. For instance, city workplaces are office-based and school children sit at desks for most of the day. UK adults are spending increasingly more time on computers and less time actively commuting (teleworking increased by 46% between 2006 and 2011[278,279]. Similar trends are seen in children. For example, between 2011 and 2012, children aged 12-15 spent an additional 2.2 hours per week on the computer and the number owning smartphones/tablets increased by more than eight percent[280]. Active commuting amongst children has also decreased by 12% since 2005[281]. The threat of an increasingly sedentary lifestyle is a global problem[282,283].

The proven inverse relationship between sedentary behaviour and health have generated growing media interest in recent years (e.g. "Sitting for long periods is 'bad for your health'"[284]; "Exercise: How to keep fit at your desk"[285]). Evidence of distinct health benefits with reducing or breaking up sedentary time has provided health promoters with a cluster of new health behaviours to target[50]. Indeed, health promoters have begun to pick up on the sedentary message with an increasing number of initiatives targeting specific sedentary behaviours[286,287,288]. Examples include, activity report cards to monitor children's sitting behaviour[289] and standing meetings advised in books such as "Up the Organization"[290]. It follows that reducing sedentary time should be another goal of health promotion campaigns and that existing mass media

campaigns, which already promote physical activity and so benefit from having an existing infrastructure and brand profile, will take the lead. This research aims to understand more about the use of messages regarding sedentary behaviour in health campaigns within the context of current debates surrounding the association between sedentary behaviour and health, and messaging strategies to promote MVPA. The unique challenges presented by this emerging public health issue are explored.

7.3. Methods

Chapter 1 of this thesis introduced a number of campaigns which were developed to promote physical activity. Chapters 4 (street surveys), 5 and 6 (online survey) investigated a number of messages which were representative of these campaigns and highlighted the tendency of messages to specifically state the physical activity guidelines. As sedentary behaviour is a topic of growing interest around the world a preliminary search of campaigns was conducted to uncover the scope for conducting a content analysis of sedentary behaviour-based promotions. This study employed a directed content analyses[202] which was initially geared towards investigating whether sedentary behaviour messages were as closely associated to guidelines as physical activity messages. First, a variety of existing English-language mass media campaigns from four countries were examined. The four countries and their campaigns were: United Kingdom (*Change4Life*), Canada (*ParticipACTION*), USA (*5210*) and Australia (Heart Foundation campaigns; *Be Active, Measure Up, Swap it Don't Stop It* and *Shape Up*). These four countries were selected because they were all identified to have released important government sponsored physical activity documents since the global physical activity guidelines were disseminated and were therefore deemed likely to have conducted concerted promotional efforts in recent years[6,203,9,8]. Non-English speaking countries were not included.

The specific campaigns were selected following an internet search of existing mass media campaigns associated with physical activity and sedentary behaviour conducted between January and February 2014. The search terms were; "physical activity campaign/promotion/messages", "sedentary behaviour campaign/promotion/messages", "health campaign/promotion/messages" and their related words. The seven campaigns named above were selected based on the amount

of media communications related to them which suggested they had received more publicity than other campaigns in their host nations and so were the most influential. All media associated with the campaigns was considered including websites, television advertisements, newsletters and posters. Messages within materials were selected based upon their prominence within the overall communication. For example; headlines on posters, titles on campaign websites (titles of both homepages and each subpage landed on after clicking individual links were used provided subpages were still within the campaign website), front page information on leaflets, logo´s and information contained within campaign and sub-campaign names themselves. The search for materials finished when no new headline messages could be found and ´message saturation´ was reached. Campaign messages were read and critically re-read in order to develop themes about the promotional techniques which are being utilised by physical activity promoters. Messages were tabulated and an independent researcher verified themes in order to minimise bias.

After a period of familiarisation with the materials of the selected campaigns, campaign messages with the aim of reducing sedentary behaviour were identified and communications were categorised thematically. This enabled four key themes to be developed. Some of the challenges faced by health promoters producing messages targeting the reduction of sedentary behaviour, and the partnering of messages on sedentary behaviour and messages on physical activity within comprehensive over-arching campaigns are discussed throughout. Therefore, rather than analysing the various campaigns individually, the campaigns were compiled and analysed collectively in order to develop key themes. As the researcher is based in the UK it would have been possible to access more materials for the UK-based campaign *Change4Life*. For instance, as a local (i.e. from the same country in which the campaign is based) postcode is required to sign up to the campaigns, the researcher would be able to join *Change4Life* and would subsequently receive all materials sent to members. Further, the researcher was simply more likely to be exposed to posters for *Change4Life* by virtue of living in the UK. Only material found on the internet (posters, leaflets and other print materials were all downloaded from the internet) was included in this content analysis in order to standardise the material that could be included from the campaigns in each country. While most materials can be reasonably expected to be discovered using the internet, the data is indicative of the campaign messages associated

with these campaigns but may not be fully representative as some materials may have been missed.

7.4. Results

7.4.1. Theme one: Clinging to guidelines

The content analysis identified a tendency for messages to rely on the sedentary behaviour guidelines to provide content on how much sedentary behaviour individuals should engage in. Health campaigns have adopted messages with directives which follow the exact wording of guidelines e.g. "engage in no more than two hours of recreational screen time" ("*5210 Lets Go! Maine*)[291], "setting a limit of two hours max of screen time each day helps make sure kids are active" (*Change4Life*[292]), and "limit that [screen time] to two hours a day" (*ParticipACTION)*. Through its sub-campaign *Up & About*[293], *Change4Life* expressly targets sedentary behaviour of children after school, the area of the day highlighted by guidelines, using messages such as "get up after eating" and "two hours [screen time] max".

7.4.2. Theme two: Reducing sedentary behaviour as a gateway to more active lifestyles

The content analysis identified a predilection of campaigns towards combining messages around sedentary behaviour with messages on physical activity. The focus of messages is on achieving additional physical activity by replacing sedentary behaviours. Messages do not tend to focus on simply breaking up sedentary behaviour. For instance, *ParticipACTION* messages suggest "Limit that [screen time] to two hours a day and they'll have more time for physical activity!", "Turn off the screens. Turn up the play", and "unplug and play" (http://www.participaction.com/). The Australian campaign *Swap it Don't Stop it* urges individuals to "swap sitting for moving" and have released a series of advertisements suggesting a number of swaps for sedentary behaviours e.g. "swap a close park [of your car] for a short walk", "swap your stop and walk part of the way" and "swap a feed for a lead"[294].

Other messages identify that aiming to reduce sedentary behaviours offers a large proportion of the day to target but fail to capitalise on the entirety of the day. *ParticipACTION* posters present the messages "The average Canadian kid watches up to eight hours of screens every day. Ninety two percent would rather play. Unplug and go out for some good old fashioned fun" and "63% of Canadian kids free time after school and on weekends is spent being sedentary. We need to get our kids moving!" (http://www.participaction.com/get-moving/unplug-play/). Similarly, *5210* published a series of advertisements all of which emphasised a variety of different forms of physical activity such as, running, jumping, skipping etc (https://www.facebook.com/5210nwfl). Despite the sedentary message being inherent to the logo and to the campaign aim (http://www.letsgo.org/) moving from sitting to less intense activities such as standing, are not featured in any of the *5210* advertisements.

7.4.3. Theme three: Complicating the promotion of MVPA

A number of identified campaign messages intimate that replacing sedentary behaviour with other activities will accumulate guideline-fulfilling MVPA. In *Change4Life*'s hallmark television advertisement *Alfie*; Alfie suggests "[to] swap four wheels for my own two feet to get me going for 150 minutes a week" (http://www.youtube.com/watch?v=XYKltGcJDRY). The advertisement shows Alfie substituting a common sedentary behaviour (in this case driving) for an active one, thereby becoming less sedentary and more active in the process. Further messages employed in the *Up & About* sub-campaign state "setting a limit of two hours max of screen time each day helps make sure kids are active"[292]. Many of the campaigns frequently mention activities such as 'taking the stairs' or 'parking further away' as ways of achieving physical activity guidelines. For instance, *LiveLighter,* a *Be Active* campaign states "if you work in an office make your default printer the one furthest away from your desk and force yourself to walk that little bit further to collect your paperwork" (https://livelighter.com.au/).

7.4.4. Theme four: Demonization of sedentary behaviour

When advertisements of the campaigns portray sedentary behaviour the images are consistently negative. One *Change4Life* poster reads "Risk an early death just do nothing". The word 'death' is bolded in black so as to stand out whilst the image on the poster is of a bored vacant-looking child sat holding a games controller. Another message in the *Change4Life* supporter's guide reads "how to limit 'vegging out'"[292]. A *5210* television advert shows children kicking a computer screen (https://www.youtube.com/watch?v=TluNJeM6HAI). The *ParticipACTION* advertisement "Crisis in Canada" contrasts a number of bored vacant-looking individuals on their computers, watching televisions and playing video games, with happy and engaged individuals engaged in physical activity (http://www.youtube.com/watch?v=VNs0gqCn0bg). Negative terms such as "Couch potato" are used. The Australian *Swap it, Don't Stop it* campaign mascot Eric is a generally cheerful balloon man, except when he is sat in a sofa or car and his smile becomes a frown (http://www.youtube.com/watch?v=AFWM97GelPc).

7.4.5. Discussion

The content analysis identified four themes of messages promoting reduced sedentary behaviour within mass media campaigns: clinging to guidelines, reducing sedentary behaviour as a gateway to more active lifestyles, complicating the promotion of MVPA and demonization of sedentary behaviour.

Health promotion messages are largely shaped around the guidelines at the time. The first identified theme found this trend in messages regarding sedentary behaviour. While guidelines regarding sedentary behaviour are available they lack the prescriptive detail found in guidelines for physical activity[6], diet[295] and alcohol[296]. UK and Australian guidelines for sedentary behaviour currently provide general advice to; "minimise the amount of time spent being sedentary for extended periods (except time spent sleeping)"[6]. Canadian guidelines for sedentary behaviour more specifically recommend that recreational screen time be limited to two hours per day[297]. However, dose-response has yet to be identified[298]. It is uncertain whether a longer total sedentary time that is broken up regularly (e.g. an adult or child who sits at a desk all day but gets up for five minutes every hour) is preferable to a shorter total sedentary time that is rarely broken up (e.g. an individual who is only sedentary in the evening but for four hours

continuously). Sedentary behaviour guidelines do not prescribe a maximum duration of daily or weekly sedentary time or the specific types of behaviours to limit (e.g. television watching, passive commuting, restraining toddlers in a high chair, etc.) due to the lack of precise evidence to guide such parameters. Latimer-Cheung and colleagues recently called for a strategy to disseminate physical activity guidelines[180]. The emergence of the sedentary behaviour topic within physical activity campaigns suggests that a strategy to develop messages targeting sedentary behaviour is also required.

The promotion of sedentary behaviour offers a gateway to more active lifestyles but current messages are not capitalising on the full activity spectrum. Theme two shows a persistent focus on swapping sedentary behaviour for physical activities instead of less intense activities such as standing. Consequently, a lack of awareness regarding the independent benefits of limiting sitting time could make it more difficult to convince the general population that swapping sedentary behaviours for activity that is only marginally more active (i.e. sitting for standing) and does not constitute MVPA, holds value[41,46,48]. Anecdotal evidence from internet discussions and public responses to news items regarding sedentary behaviour suggests that portions of the general public are aware that too much sitting is bad for their health but do not recognise that modifications as small as standing during the commercial break of a television programme can improve health (e.g. “It's not that these scientific edicts aren't correct it's the whole 'state the bleeding obviousness' of it I can live without”; “There's nothing that we can do other than installing treadmills behind every school and office desk” [comments posted in response to the BBC News article “Sitting for long periods is ‘bad for your health’”[284]). Further, individuals are sedentary for around six hours a day[277]. Intuitively, it seems unlikely that individuals will be persuaded to change all of this behaviour into physical activity such as running, bicycling etc. With adults currently engaging in almost no physical activity, such ambitious messages could be motivationally deleterious[134,232]. Messaging campaigns targeting large (or entire) populations may benefit from being realistic rather than idealistic. As discussed by Hamilton and colleagues the proportion of the day taken up with ‘nonexercise’ activity, also referred to as NEAT, far exceeds that taken up by exercise (i.e. MVPA)[299]. By neglecting low intensity behaviours such as standing, a large ‘window of opportunity’ is being lost in terms of accumulating health benefits over the course of an entire day. Offering greater flexibility in the time of day at which lifestyle

changes can occur and encouraging smaller steps towards an active lifestyle may be more realistic and therefore effective in motivating positive behavioural change[242,298]. Positively-framed messages around sedentary behaviour offer more achievable small steps towards generally more active lifestyles. Reducing sedentary behaviour may be seen as a first step on the physical activity continuum and presents a more attainable option for most individuals[47]. Messages which encourage reduced sedentary behaviour may resultantly have the potential for greater population health gains than messages which only promote MVPA due to a greater likelihood of compliance[300].

The third identified theme is the possibility that messages regarding sedentary behaviour could confuse perceptions around MVPA and even detract from its perceived importance. Reducing sedentary behaviour requires increased engagement with active alternatives but it does not necessarily follow that these alternatives will result in the accumulation of more MVPA. Some research suggests it is more likely that sedentary time will be replaced with light forms of physical activity rather than guideline-fulfilling MVPA[301]. Many advertisements recommend substituting sedentary behaviours with activities such as taking the stairs instead of the lift and walking from the car to the supermarket, and suggest such adjustments will contribute towards individuals meeting MVPA guidelines. However, these activities were never intended to be promoted as guideline-fulfilling MVPA but to be reinforced as part of the regular 'active lifestyle' routine[46]. These messages could contribute to misperceptions regarding MVPA engagement in adults and lead to a devaluation of engaging in true MVPA[147,149,150,151,247,248,262]. While reducing sedentary behaviour in itself can result in some health gains[50], it is important that this is not seen as an alternative to increasing MVPA. Indeed, engaging in more intense forms of physical activity is still likely to provide the greatest health returns[302], notwithstanding the difficulty (perceived and/or actual) of achieving such levels. In addition, the 150 minute a week MVPA guideline is based on the assumption that people already engage in regular lifestyle activity. Those who engage in little lifestyle activity may need to do more MVPA for good health, while those with very active daily lives can probably do less. Health promotion experts need to account for an increasingly heterogeneous range of behaviours outside of an 'active-sedentary' dichotomy. It is important that the current media interest in sedentary behaviour does not result in messages regarding MVPA being lost.

The fourth identified theme is the demonization of sedentary behaviour. A recent campaign launched in the UK entitled *Move1hour* carries a logo which depicts a chair with a skull as the back-rest, alongside the slogan "Sitting is the new enemy". (https://www.facebook.com/MOVE1HOUR). The messages examined in the present study were similarly negative with regards to sedentary behaviours, although perhaps less extreme. Such aggressive messaging approaches seem unwise in light of the lack of evidence to support their efficacy, especially considering findings that fear appeals and negative framing may not be motivational[28,13,14]. Some sedentary behaviour is essential and even valuable. Cars enable individuals to travel longer distances, family meal times are spent sat at the table and for many computers are a necessary part of the working day. The *Change4Life* poster "Risk an early death, just do nothing", inflamed some individuals and societal groups to the extent that an alternative poster was independently printed carrying the same message but alongside a picture of a child sat reading. Clearly, a more thorough consideration of the contribution of sedentary behaviour and its place in society is needed before messages castigating it are disseminated.

7.4.6. Future directions

We suggest three areas to focus future research. First, it is important to investigate whether messages on sedentary behaviour and physical activity can and should be presented together. Researchers need to consider the repercussions of presenting the two types of messages together on comprehension and motivation, and reflect on this when pilot-testing campaigns. This requires an investigation into the effects of one type of message on the other and vice versa. So far, research has only focused on the effect of physical activity messages on understanding of physical activity behaviours[5,12,13,14,17,19,22,24,28,31,143,160,169,170,171,172,173,174,175,176]. However, we posit that physical activity messages will influence understanding of sedentary behaviours and, in the same way, messages regarding sedentary behaviour will influence perceptions of physical activity. Research into the implications of this symbiotic relationship is needed to align these two important areas of research through messages which compliment rather than contradict. In addition, the contexts and populations in which each type of message is presented will be influential. For instance, messages regarding sedentary behaviour are likely to have a very

different influence on perceptions when presented in a workplace or school environment relative to a gym or a leisure centre.

Second, different strategies of combining messages should be explored. Health campaigns could emphasise the reduction of sedentary behaviour, as exemplified by the *5210* campaign which targets "two hours or less recreational screen time", or the introduction of more light activity as seen in the tips section of the *Change4Life* website; "The furthest parking space could be good for you". These subtle differences may influence the way in which campaigns are perceived. Messages around changing lifestyle to improve both health behaviours should be a focus of future research. Brawley and Latimer have previously discussed the need for messages on MVPA guidelines to inform individuals how more MVPA may be engaged[225]. We agree with these sentiments and suggest that such information should also be present in sedentary behaviour guidelines from the outset. Viable strategies for replacing sedentary behaviour with both light activity and MVPA should be investigated.

Finally, if theories typically used to understand physical activity behaviour such as the TPB[98] are also to be applied to understanding sedentary behaviour, work is required to see how appropriate they are and whether modifications are needed or new approaches should be adopted[303].

7.4.7. Conclusion

Wareham and Brage have called for caution when delivering public health messages and suggested changes should only be made when the evidence is robust[304]. Excessive sedentary time presents a major health threat[42,62] causing some health campaigns to introduce sedentary messages despite lacking evidence to inform them. This analysis of major activity-related campaigns in four countries identified four themes associated with messaging sedentary behaviour: clinging to guidelines, sedentary behaviour as a first step on the physical activity continuum, complicating the promotion of MVPA and the demonization of sedentary behaviour. A consortium of academics, policy-makers and marketing experts from the realms of physical activity and sedentary behaviour should be brought together to synthesise existing research and

stimulate new research to inform further development of guidelines, more expansive shaping of health campaigns and successful execution of activity-related messages.

Discussion

8. Discussion

This thesis has presented five studies which each contribute novel and important elements to the evidence informing the development of messages to communicate physical activity guidelines to UK adults. The research presented in this thesis shone the spotlight on the use of physical activity guidelines in mass media campaign messages and examined the promotion of physical activity guidelines from both an educational and a motivational perspective. In addition messages aimed at reducing sedentary behaviour were considered. In this chapter, findings are discussed with reference to the broader challenge of increasing population levels of physical activity. A brief summary of each study, including key findings, strengths and limitations, is provided in Table 10. General conclusions and opportunities for further research are presented.

8.1. Chapter 3: Key findings

A handful of studies have previously reported knowledge of physical activity guidelines within specific populations[211,305,306,307,308,309,310]. Chapter 3 presented the first study to collect knowledge of the most recent physical activity guidelines in the UK. While Kay and colleagues and DeBastiani and colleagues have presented data on knowledge of current physical activity guidelines in the US, they both employed the same closed question format and so unprompted knowledge is likely to be overestimated[211,309]. The data presented in Chapter 3 is the most up-to-date information available on knowledge of guidelines in UK adults and is also the first study to employ an open-question format (in the 2013 survey sample). These results therefore provide more accurate information on unprompted knowledge. In addition, the study examined knowledge of guidelines within a second sample collected in 2007. This provides a snapshot of the state of knowledge at two time-points between which time physical activity guidelines changed[6,56] and a seminal mass media campaign (*Change4Life*) was launched[33]. On the one hand, the 2007 dataset shows the state of knowledge within the UK general population before guidelines changed and *Change4Life* was launched. On the other hand, the 2013 survey shows the state of knowledge within a large educated and mostly employed sample of UK adults after the change in guidelines and the launch of *Change4Life.* The major finding is that knowledge of physical activity guidelines is low in both the nationally representative sample and in the sample

of highly educated adults, with only 18% and 11% respectively, of the adults sampled accurately recounting the MVPA guideline of the time. In addition, knowledge of guidelines is influenced by demographic factors such as education and employment. Adults with lower education and less employment in both the nationally representative 2007 sample and in the more highly educated 2013 sample were least likely to know MVPA guidelines. Knowledge therefore could reasonably have been expected to be much higher in the 2013 sample on account of the study sample and in the context of the physical activity movement occurring at that time. These are concerning findings given the concerted effort to promote physical activity guidelines during this period and the UK national objective to reduce health inequalities. Research conducted by Cameron et al[212] found that the Canadian Physical Activity Guides had not been well disseminated to the target population and had failed to significantly increase knowledge of recommendations amongst Canadian adults. It is possible that information around guidelines is not being disseminated through channels which can reach the target population. While knowledge of the most recent physical activity guidelines within the general UK population is unknown, the evidence of reducing knowledge with reducing education and employment status suggests that it is likely to be lower than 18%. Current messaging strategies employed by mass media physical activity campaigns may need to be reviewed and approaches for messaging physical activity guidelines to adults from various demographic backgrounds are needed.

8.2. Chapters 4 and 5: Key findings

A large number of studies have been conducted to inform the development of messages to promote physical activity[5,12,13,14,17,19,22,24,28,31,78,143,160,169,170,171,172,173,174,175,176]; however, none of this existing literature examined messages directly relating to physical activity guidelines. As physical activity guidelines constitute a dominant focus of current physical activity campaign messages it is important to examine messages which specifically pertain to the guidelines. In addition, Latimer-Cheung and colleagues called for a strategy to disseminate physical activity guidelines[180]. The research presented in Chapters 4 and 5 answers this call by beginning the examination of prominent messages in current mass media campaigns promoting physical activity guidelines.

Two key apects of physical activity guidleines are: the duration of physical activity (i.e. 150 minutes a week) and the intensity of physical activity (i.e moderate-to-vigorous) that is suggested to achieve health benefits[1]. The manner in which campaign messages communicate these two key aspects of physical activity guidelines may have important motivational repercussions for the consumer. Chapter 4 compared messages giving three different pieces of information regarding the duration of physical activity which adults should engage in: 1) "adults should engage in 150 minutes a week of physical activity", 2)"adults should engage in at least 150 minutes a week of physical activity" and 3) "adults should engage in as much physical activity as possible". The key finding from this study was that the two messages which most closely followed the wording of physical activity guidelines (i.e. contained the 150 minute a week threshold) and which are more commonly seen in physical activity campaign messages, were associated with more negative perceptions of the health benefits of physical activity durations below 150 minutes a week.

Chapter 5 developed this research by comparing messages which used different descriptions of the duration and intensity of recommended physical activity. Two motivational theories, the TPB[98] and the PAPM[145], were also applied to further the examination of the motivational implications of these messages. The research presented in Chapter 5 repeated the messages used in Chapter 4 which compared threshold and non-threshold messages as a manner of describing duration with a different sample of UK adults. As an additional element, clauses related to intensity were also incorporated. The intensity of recommended physical activity is moderate-to-vigorous but this can be communicated in a number of ways for instance using physiological parameters such as heart rate or sweat rate, or using exemplars such as walking. The key finding from this study was that the two messages which included the exemplar walking to describe intensity were positively associated with the intention to engage in physical activity via TPB constructs. This was the case for the message which incorporated the 150 minute a week threshold and the message which did not.

Chapters 4 and 5 provide the first evidence to inform the development of messages around physical activity guidelines. . The findings presented in Chapters 4 and 5 suggest that caution is required when relaying physical activity guidelines to UK adults verbatim. While these findings

are tentative, goal theory supports their face validity[311]. The motivational implications of urging adults to engage in 150 minutes a week of physical activity appear to be dependent upon the accompanying contextual information. Exemplars such as walking may be an effective way of describing MVPA and thus warrant further investigation. The task of developing effective messages that succesfully inform and motivate adults towards MVPA is complex and clearly will not be achieved on the back of this research alone. Mass media campaigns produce messages for the general population as a whole but also target various sub-groups through tailored messages. The evidence presented in Chapters 4 and 5 was generated using two convenience samples and so is subject to self-selection bias. While the survey sample was highly educated and employed, demographic details of the interview sample are largely unknown. As a result, the evidence can only shed light on the possible motivational implications of mass media messages for a tiny fragment of their potential audience and suggest that further research is required to confirm these findings in other populations. In addition, the measures employed were brief and lacked robustness. The findings should be interpreted in light of these weaknesses. A much deeper examination of the messages used by campaigns is needed before firm conclusions can be made regarding their efficacy. It is hoped that these findings have highlighted the need for a thorough investigation into the development of messages communicating physical activity guidelines and will stimulate concentrated research using more rigorous study designs into this area which can be used to better inform future campaigns.

8.3. Chapter 6: Key findings

A main purpose of the messages used in *Change4Life* and other physical activity campaigns is to inform and educate the target audience on physical activity guidelines. As stated in its planning document; *Change4Life* aims to create the "appropriate preconditions for behaviour change by (amongst other things) educating people on what they need to do to change and benchmarking their behaviour against others"[33]. This approach is theoretically supported by the PAPM[145] which posits that individuals who fail to meet physical activity guidelines need to be aware of both the health benefits of physical activity and of their own failure to engage in sufficient levels of physical activity before they will consider increasing their engagement in physical activity. It has been identified that inactive adults tend to overestimate their engagement in physical

activity[147,149,150,151,247,248,262]. It has also been shown that these adults do not perceive health information as being intended for them[151] and may use social referents who are less active than themselves[149].

Physical activity campaign messages are often centered on physical activity guidelines e.g. "get me going for 150 minutes a week" (*Change4Life);* "Push play for 150 minutes a week" (*Push Play*). For an individual to know whether they are sufficiently active they need to know how much physical activity they should be doing, yet, the influence of adults' knowledge of physical activity guidelines on awareness of their personal MVPA involvement has not been tested. Chapter 6 sought to find whether knowledge of physical activity guidelines predicted awareness of personal physical activity behaviour within the same sample of highly educated and employed adults used in Chapters 3 and 5. The key finding was that adults' knowledge of physical activity guidelines did not predict awareness of their physical activity while subjective norms and intensity of regular walking did. This supports the findings of Lechner and colleagues and further suggests that social influences may have a greater impact on awareness than knowledge of guidelines[149]. As identified by Bolman and colleagues, inactive individuals who perceive themselves to meet physical activity guidelines may know what the guidelines are but dismiss them as not being relevant to them[151]. Visual standards for comparison (i.e. active peers) may, be more powerful than the provision of verbal standards of comparisons in helping some adults realise when they do not engage in enough MVPA. This should be further explored using more rigid study designs and nationally representative samples. The nature of the present sample (self-selected and highly educated) is not reflective of many other groups in society. The present adults are more likely to be motivated towards health behaviours and more likely to have supportive social norms[312]. Previous research by Lockwood et al[312] has suggested that individuals are more influenced by social norms which are congruent with their motivations. Thus, the present sample may be more strongly influnced by their social norms than other demographic groups. These findings could have important implications for the development of messages in future campaigns, suggesting that alternative messages may be required to raise awareness of physical activity behaviour within some adults. Further work is required using nationally representative samples to inform the use of subjective norms in campaign messages promoting physical activity guidelines on a grand scale. Chapter 6 also adds further weight to

findings from Chapters 4 and 5 that contextual information is important to consider when presenting physical activity guidelines to UK adults.

8.4. Chapter 7: Key findings

There has been an emergence of research in recent years into the influence of sedentary behaviour on health[48,62,286,287,288], culminating in the release of guidelines targeting reduced sedentary behaviour[297]. Mass media campaigns have already begun to release messages promoting reductions in sedentary behaviour. The aim of Chapter 7 was to examine campaign communications regarding sedentary behaviour using internet searches of print literature and websites. This investigation highlighted a proclivity within campaigns to combine messages on reducing sedentary behaviour with messages promoting physical activity. There are many potential problems associated with this approach, such as, creating confusion, having to cater to different motivational and environmental demands, and detracting from the MVPA message. The chapter is an urge for caution and a call for further research into the mixed messaging of increased physical activity and reduced sedentary behaviour.

8.5. General discussion

Since their inception by the ACSM in 1975[52], physical activity guidelines have been issued and updated with little coordination between the various organisations in charge of dissemination both within and between countries. More than 30 years later, physical activity guidelines are becoming increasingly standardised across countries and governments within countries are taking ownership over compiling and promoting physical activity guidelines[1,6,7,8,61,218]. Guideline documents are now almost exclusively published by government health agencies as opposed to organisations (often sport organisations) such as the ACSM[1,6,7,8, 218]. During this period there has also been a rise in the promotion of physical activity through mass media campaigns of which many are also now backed by national governments (e.g. the UK's *Change4Life*). This can therefore be seen as an important period for the promotion of physical activity and a great opportunity to make significant gains in public health.

Table 10. Summary of key findings from the present thesis

Chapter	Purpose	Method	Findings	Strengths	Limitations
3	1. Identify knowledge of physical activity guidelines amongst UK adults 2. Compare the change in knowledge of physical activity guidelines between 2007 and 2013 3. Examine demographic dosparities in knowledge	Compared data between two cross-sectional surveys (one pre-collected and one online survey) 2007. n = 2,860, 44% male, 63% under 45 years old 2013. n = 1,797, 30% male, 57% under 45 years old Stepwise multiple logistic regression	Knowledge has increased by ~7% but this was not significant and was partially due to the more educated second sample. Health disparities remain with lower education, less employment and older age still associated with lower knowledge	Large sample sizes Use of both open and closed question formats in the 2013 sample	Closed question format in 2007 sample Two different samples
4	1. Examine the association between threshold messages (150 mins/wk) and perceptions of the health benefits associated with different durations of physical activity	Cross-sectional street interviews n = 1,100, 50% male, 72% uder 65 years old One-way ANCOVA with sidak corrected post-hoc	Thrshold message group had significantly less positive perceptions of the health benefits of durations of physical activity below 150 minutes.	Larg e sample size Perceptions measured for multiple durations of physical activity Novel	Characteristics of those who did not participate not collected Limited demographic data collected
5	1. Investigate the association between MVPA messages with different descriptions of intensity and duration, and intentions to engage in more MVPA	Cross-sectional online survey n = 1,412, 30% male, 43% under 45 years old ANCOVA. Structural equation	WalkT messages associated with greater intentions via greater perceived behavioural control WalkNT message associated with greater	Large sample size Combined duration and intensity components of	Sample was not randomly selected Cross-sectional so can not infer causality Did not measure

	2. explore whether relationships could be partly explained using TPB and PAPM	modelling with bootstrapped confidence intervals	intentions via greater affective attitude, moderated by awareness and susceptibility	MVPA guidelines Bootstrapping increased rigour of analysis Novel	behaviour change
6	1. Examine whether greater knowledge of MVPA guidelines, greater subjective norms, normal walking intensity and lower self-reported health status are associated with accurate awareness of MVPA engagement within a sample of UK adults	Cross-sectional online survey n = 1,724, 30% male, 43% under 45years old Logistic regression models	Greater knowledge of MVPA guidelines was not associated with awareness of personal MVPA engagement High subjective norms, below average health status and a regular walking intensity of moderate-to-vigorous was associated with accurate awareness	Large sample and demographically comparable to UK population	Cross-sectional so can not infer causality Self-reported physical activity measure
7	1. Explore the unique challenges to messaging of sedentary behaviour and physical activity guidelines 2. Discuss the potential of mass media messaging campaigns as a strategy for population improvements in sedentary behaviour	Qualitative content analysis using web-based search methods to identify campaign print and internet literature Major campaigns in four countries	Messages around reducing sedentary behaviour have emerged in health promotion campaigns and messages are often combined with those on physical activity Sedentary behaviour is portrayed as an exclusively bad behaviour Messages may create confusion and there is no evidence of their efficacy	Covered the most prominent campaigns in five different countries Important current topic with the release of sedentary guidelines	Content is mostly online and so is highly dynamic Literature is more easy to acquire from home country Non-English speaking campaigns excluded

MVPA – moderate-to-vigorous physical activity, TPB – Theory of planned behaviour, PAPM – precaution adoption process model

The purpose of mass media campaigns is to raise awareness and knowledge within a target population with a view to inspiring change[313]. Noar stated that mass media campaigns are "compelling health communication tool[s] that potentially can address health attitude and behavioural change across numerous health problems and in numerous audiences"[11]. As highlighted in Chapter 1, the bedrock of many current physical activity campaigns is physical activity guidelines. A wealth of research has been conducted to inform the development of messages to motivate increased physical activity[5,12,13,14,17,19,22,24,28,31,143,160,169,170,171,172,173,174,175,176]. However, no study has yet investigated whether short messages based on physical activity guidelines will significantly impact knowledge and whether these messages are likely to be motivational. Snyder (2007) highlighted a lack of evidence demonstrating effects on knowledge as a common and collective failure of physical activity campaigns. While reports for campaigns such as *Change4Life* ordinarily report awareness of campaign features, influences on knowledge have not been studied[70]. Indeed, *Change4Life* reported high awareness of its campaign messages in 2010 but did not measure knowledge[70]. The findings presented in Chapter 3 suggest that knowledge of physical activity guidelines is low despite concerted physical activity promotion. Further, knowledge was low within a sample of adults who were more highly educated and more employed than the general UK population. It is expected that knowledge of guidelines is likely to be higher within this sample than in the general population. Thus, these findings likely overestimate knowledge of MVPA guidelines. This suggests that campaign messages may not have been effective at educating UK adults, albeit, awareness of the *Change4Life* campaign itself was not measured in any of the studies constituting the present thesis.

Another motive for physical activity campaigns to present messages based on guidelines could be to increase realisation within inactive adults that they do not engage in sufficient physical activity for optimum health. Indeed, benchmarking behaviour and recognising the risks of behaviour are discussed in the aims of the *Change4Life* 2009 Marketing strategy[33]. A plethora of studies have shown that the majority of inactive adults perceive themselves to engage in sufficient physical activity or rate themselves as active[147,149,150,151,247,248,262]. Lechner and colleagues suggested that adults who overestimate their physical activity level are likely to compare themselves to other individuals who are less active than themselves[149]. In this way, an

adult's social norms are likely to influence their awareness. The provision of information on recommended levels of physical activity could also influence ones norms regarding physical activity. Further, Chaudhury and Shelton found that inactive adults who perceived themselves to be active were generally not knowledgeable about physical activity guidelines[314]. Surprisingly, the study reported in Chapter 6 found that knowledge of physical activity guidelines was not associated with adults' awareness of their physical activity engagement. On the other hand, the findings of Lechner et al. were supported as subjective norms did influence awareness[149]. As previously mentioned, one goal of physical activity campaigns is to increase knowledge of physical activity guidelines but perhaps the focus should be on facilitating adults' ability to assess their need for physical activity. The wider context in which physical activity messages are presented should therefore be carefully considered. This context will vary for different sub-populations of adults and so the relationships between knowledge, subjective norms, walking and awareness are also likely to vary. For the majority of inactive adults with little intention to be active, a supportive social norm is more likely to be ignored as this would not be congruent with these adults' regulatory focus[312].

Messages used in the previous literature reflect early thinking by way of promoting physical activity. For instance, work on message framing sought to answer questions around whether messages should inform adults that exercise is good for them or that not exercising is bad for them using messages such as "Physical activity can help you lose weight" [12,13,19,143]. While such simple messages may still be evident in smaller-scale interventions or community campaigns comparable to those used in the majority of the conducted studies such as the study reported by Gaston and Gammage, and Smeets and colleagues[21,175], these messages are not reflective of those used by large-scale mass media campaigns (reviewed in Chapter 1). A common theme of the messages used in prior research is that they tend to focus solely on the outcome associated with physical activity, for example "Physical activity can help you lose weight or "leisure walking energises, de-stresses, and creates positive affect"[13,22]. On the other hand, messages in the physical activity mass media campaigns of today tend to focus on how much physical activtiy should be engaged in and the types of physical activity that can be perfomed e.g. "just 150 minutes a week is enough to get me going" (*Change4Life*). This may be partly due to greater acceptance within the general population that physical activity is associated with benefits and a

need for more prescriptive detail regarding what constitutes health enhancing physical activity[315]. Only one previous study has examined messages which include the what, how and why of physical activity[16]. The messages provided by Cheval and colleagues were long and detailed and comparable to the type of information one might read in a leaflet instead of a poster or short advertisement[16]. The studies presented in this thesis are the first to examine 'headline' messages that are already being employed in numerous physical activity campaigns. In addition, the work of Cheval et al does not allow aspects of the message to be examined separately, whereas the studies presented in this thesis enable scrutiny of separate aspects of messages such as duration and intensity.

Noar discussed a number of principles which should be followed by mass media campaigns to increase the possibility of stimulating positive change[11]. These principles include, conducting formative research pretesting messages with the target audience, using theory, and using a targeted message design approach that is likely to be effective within its intended audience. Thus, mass media campaigns are accountable for disseminating messages which have not been formatively tested within the target audience as the messages used in research studies and those eventually seen in campaigns are dissimilar. The studies presented in Chapters 4, 5 and 6 were the first to examine messages which were selected from existing mass media physical activity campaigns and so give a true reflection of the information UK adults could be naturally exposed to. Further, the present thesis discusses the first attempt at using theory-driven approaches to formatively test actual mass media messages, albeit the samples under the microscope need to be drastically diversified before the findings can be applied to the target audiences of mass media campaigns. Chapter 4 found that individuals who were exposed to a physical activity message which included the guidelines threshold of either "adults should engage in 150 minutes a week of physical activity" or "adults should engage in at least 150 minutes a week of physical activity…", devalued the health benefits of weekly physical activity durations amounting to less than the stated 150 minutes a week, relative to adults receiving a message lacking this threshold. Previously, Heinrich and colleagues found that almost half of Hawaiian adults (N = 3,607) believed that more than 30 minutes a day of physical activity was required to gain health benefits[315]. Although the optimal outcome remains for all adults to be meeting or exceeding guideline levels of MVPA, there are huge potential health gains to be made from making small

steps towards physical activity guidelines at population level[217]. It is therefore important that adults recognise the health gains that can be achieved with any increase in physical activity so as not to be deterred from making achievable modifications. Of course, the sample interviewed in Chapter 4 was self-selected and the results are subject to bias. Individuals receiving either of the threshold-based messages may have been responding in the way they believed they should by saying that lower levels of physical activity lacked benefit. Further studies should be conducted with a more robust study design to confirm these findings.

Chapter 5 found that the message which most closely resembled the wording of physical activity guidelines and provided the 150 minute a week threshold alongside a physiological description of intensity, resulted in significantly lower intentions to be active than a message which promoted 150 minutes a week of walking. This observation is similar to findings from Cheval et al (2014) that messages which described not only what individuals should do but also why and how they should/could engage in a given behaviour more effectively increased intentions to be active. As discussed by Lee and Buchner, walking could be valuable to public health due to its popularity and potential as a moderate-intensity activity[316]. Attempts have even been made to translate physical activity guidelines into step goals[317]. In a recent review by Abioye and colleagues, it was concluded that mass media campaigns may be effective at increasing walking but not at achieving recommended levels of physical activity or at reducing sedentary behaviour[133]. Previous studies have also shown that walking pace is highly variable and rarely constitutes MVPA[318,319,320]. The study reported in Chapter 6 revealed that individuals whose regular walking pace was reported as moderate or above were more likely to demonstrate accurate awareness of their physical activity than those who normally walked at a slower pace. Walking was examined in this thesis because it appears to be the most prominent activity in physical activity campaigns. It is also an activity which is accessible to most able-bodied adults regardless of demographic. Messages promoting walking as a route to achieving physical activity guidelines appear motivational but may be misleading if walking is at a low intensity and may contribute to persistent misperceptions within segments of the population regarding what constitutes guideline-fulfilling MVPA. These findings now need to be replicated in other segments of the population. Data came from a sample which was more highly educated and employed than the general UK population. Findings should therefore be replicated within other

samples and using more rigorous study designs. Nonetheless, walking may not be the best activity to promote if achieving MVPA guidelines is the ultimate aim. Until these relationships are better understood, campaigns should be cautious when promoting walking and physical activity guidelines together.

This thesis has presented evidence from four studies regarding the implications of focusing on physical activity guidelines in physical activity mass media campaigns. While only a small number of messages were investigated they are the messages most serially used by campaigns and so findings are informative. The findings give cause for concern and elucidate the potential pitfalls of basing national health campaigns on untested messages. While findings are only preliminary and further work is clearly needed, the current strategy of embedding physical activity guidelines at the heart of promotional materials cannot be supported by the present thesis with regards to increasing knowledge or positive motivation. These issues need to be resolved as a matter of priority before further investment is made into these campaigns. Berry and Latimer-Cheung have suggested that a critical challenge to the promotion of physical activity messages is making public health messages heard in an environment dominated by commercial advertising[78]. Concerns over making messages heard are valid; however, promotion of untested messages with unknown effects is an even greater concern. Commitment of campaigns to promoting guidelines has yet to be justified. An important first step would be to enable informed judgement on whether campaigns should persist with the strategy of messaging guidelines specifically, or elect for alternative strategies of physical activity promotion such as promoting progressive physical activity goals. A fifth study also analysed mass media material promoting reductions in sedentary behaviour. As highlighted in Chapter 7, sedentary behaviour has emerged as a topic within physical activity campaigns. A number of high profile campaigns have already begun to disseminate messages regarding reductions in sedentary behaviour despite lacking evidence to inform them. The practice of combining sedentary-directed messages with MVPA-directed messages is also apparent. Thus, not only are mass media campaigns facing a new challenge in messaging reductions in sedentary behaviour but in doing so, the landscape of messaging MVPA is changing. This makes the present a crucial moment to develop evidence-based messaging strategies before mistakes of campaigns are repeated.

8.6. Future directions

The following section acknowledges some of the limitations of the studies which constitute this thesis and also outlines recommendations for future work. A major limitation of the work presented in the present thesis pertain to study design weaknesses of the two collected datasets. Both the street interviews and the online survey were designed with the aim of canvassing as many reponses as possible within a constrained timeline. Time pressures on data collection meant that more rigorous methods were not employed. The resulting samples are both large but the findings cannot be generalised to the wider population as little demographic information was collected from the street interview sample and the survey sample is not demographically comparable to the general popultation. The online survey sample was more highly educated and more likely to be in full-time employment. Results are therefore not generalisable but are powerful as knowledge would be expected to be higher in this sub-population than in less educated sub-populations[211]. The methods employed for data collection also precluded collection of information on individuals who did not respond to the street surveys or the online survey, respectively. It is therefore not possible to estimate the bias caused by the data collection methods employed. Future studies should seek to replicate the findings presented here using more rigorous research designs and more demographically diverse samples. Studies should also strive to employ alternative methods of data collection which enable the characteristics of non-responders to be estimated.

Secondly, the findings of this work pertain solely to a handful of self-reported motivational precursors to physical activity. This is a useful first step, however, subsequent work should investigate further motivational antecedents such as self-regulation and social cognitive theories which are evidenced to influence physical activity behaviour[321]. More rigorous methods than self-report should also be applied, one such method is objective monitoring of physical activity. There is a large variance in behaviour which is not accounted for by intentions[22]. Future study should investigate changes in physical activity in response to prolonged exposure to campaign messages whilst also seeking to uncover the psychological constructs which are most amenable to change to enable powerful messages to be developed. An important next step should also be to uncover the influences of the messages used in Chapters 4 and 5 on objectively measured physical activity. Objective monitoring of physical activity using accelerometers offers more

reliable measurement of physical activity[322]. Accelerometry offers a more sensitive assessment of MVPA than self-report and so associations with intention may be easier to uncover. Unfortunatly, accelerometers cannot provide any information regarding the context of physical activity making further investigation of exemplars complicated. Using log books or diaries when wearing devices is one method of capturing context, though this strategy is flawed by subjectivity. Future research should consider new and rigorous methods of capturing this information

Thirdly, the measures of knowledge taken in Chapter 3 occurred at only two specific time-points. It is possible that knowledge fluctuates, for instance knowledge could have been higher in the months which immediately followed the release of major *Change4Life* advertisements, or around the time of the Olympics when physical activity may have powerfully entered the consciousness of many. While the strength of the study is that it compares knowledge between two important time points, collecting data at multiple time-points throughout this period would have been more informative. It is not yet known whether *Change4Life* will continue into 2015[34], but media campaigns will likely continue to promote physical activity[323]. Future studies should collect data on; knowledge of guidelines, awareness of messages from physical activity campaigns targeted towards the population and behaviour change, at multiple time-points during one or more years of a physical activity campaign.

Finally, the messages used in Chapters 4 and 5 were selected as they appeared the most in physical activity campaigns. However, many alternative campaign messages have yet to be examined. Aspects of message format which could be explored include; alternative ways of framing the 150 minute a week duration threshold i.e. daily versus weekly, further investigating exemplars to describe MVPA (e.g. walking, cycling, fitness classes), communicating the recommended intensity of physical activity versus persuading adults that physical activity can be easily accommodated into the existing lifestyle, communicating continuity of recommended physical activity versus the accumulation of small (ten minute) bouts and so on. Further exploration of different forms of presenting physical activity guidelines will contribute to the development of more effective mass media campaigns.

8.7. Final comments

The question still remains; how influential can mass media campaigns such as *Change4Life* be? In terms of change in population levels of physical activity, the answer is largely unknown as campaign evaluations are largely limited to internal reports of brand awareness and recognition[103,70,94,]. Statistics on changes in overall physical activity engagement suggest little improvement has been made[324]. Campaign developers and behaviour change advocates may be guilty of expecting too much from these campaigns if they are anticipated to produce significant and timely increases in population MVPA. Even global corporations backed by huge budgets and public goodwill require a long time to become established. For instance, it took around 30 years of advertising before Cadbury's chocolate began to establish itself in the UK as the national icon it is today. *Change4Life* is the biggest campaign to ever promote physical activity in the UK but it has been running a mere five years. A great deal can be learnt from the development and evaluation of *Change4Life* and other national campaigns. The present thesis is important as it presents the first 'guideline-centric' examination of messages from existing influential campaigns. The lessons learned from these campaigns can contribute towards the development of more effective campaign messages in the future.

References

References

1. World Health Organization. *Global recommendations on physical activity for health*. (WHO Press, 2010).

2. The NHS Information Centre. *Health Survey for England 2008. Volume 1. Physical activity and fitness*. **1,** (The Health and Social Care Information Centre, 2009).

3. Troiano, R. P. *et al.* Physical activity in the United States measured by accelerometer. *Med. Sci. Sports Exerc.* **40,** 181–188 (2008).

4. Colley, R. C. *et al.* Physical activity of Canadian adults: Accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. *Health.Reports* **22,** 7–14 (2011).

5. Noar, S. M., Benac, C. N. & Harris, M. S. Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychol. Bull.* **133,** 673–693 (2007).

6. Department of Health Physical Activity Health Improvement and Protection. *Start Active, Stay Active: A report on physical activity for health from the four home countries' Chief Medical Officers*. (Department of Health, 2011).

7. US Department of Health and Human Services. *2008 physical activity guidelines for Americans*. (Centers for Disease Control, 2008).

8. Australian Government Department of Health. *Make your move – Sit less Be active for life!* (2014).

9. Tremblay, M. S. *et al.* New Canadian physical activity guidelines. *Appl. Physiol. Nutr. Metab.* **36,** 36–58 (2011).

10. Richman, W. L., Kiesler, S., Weisband, S. & Drasgow, F. A Meta-Analytic study of Social Desirability Distortion in Computer- Administered Questionnaires, Traditional Questionnaires, and Interviews. *J. Appl. Psychol.* **84,** 754–775 (1999).

11. Noar, S. M. A 10-year retrospective of research in health mass media campaigns: Where do we go from here? *J. Health Commun.* **11,** 21–42 (2006).

12. Gallagher, K. M. & Updegraff, J. A. When "fit" leads to fit, and when "fit" leads to fat: How message framing and intrinsic vs. extrinsic exercise outcomes interact in promoting physical activity. *Psychol. Health.***26,** 819–834 (2011).

13. Gallagher, K. M. & Updegraff, J. A. Health message framing effects on attitudes, intentions, and behavior: A meta-analytic review. *Ann. Behav. Med.* **43,** 101–116 (2012).

14. Latimer, A. E., Brawley, L. R. & Bassett, R. L. A systematic review of three approaches for constructing physical activity messages: What messages work and what improvements are needed? *Int. J. Behav. Nutr. Phys. Act.* **7,** 36–52 (2010).

15. Witte, K. & Allen, M. A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health.Educ. Behav.* **27,** 591–615 (2000).

16. Cheval, B., Sarrazin, P., Isoar-Gautheur, S., Radel, R. & Friese, M. Reflective and impulsive processes explain (in)effectiveness of messages promoting physical activity: A randomized controlled trial. *Health.Psychol.* 1–36 (2014).

17. Gray, J. B. & Harrington, N. G. Narrative and framing: A test of an integrated message strategy in the exercise context. *J. Health Commun.* **16,** 264–281 (2011).

18. Latimer, A. E. *et al.* A field experiment testing the utility of regulatory fit messages for promoting physical activity. *J. Exp. Soc. Psychol.* **44,** 826–832 (2008).

19. Latimer, A. E., Salovey, P. & Rothman, A. J. The effectiveness of gain-framed messages for encouraging disease prevention behavior: Is all hope lost? *J. Health Commun.* **12,** 645–649 (2007).

20. Pal, S., Cheng, C. & Ho, S. The effect of two different health messages on physical activity levels and health in sedentary overweight, middle-aged women. *BMC Public Health* **11,** 204–212 (2011).

21. Smeets, T., Brug, J. & de Vries, H. Effects of tailoring health messages on physical activity. *Health Educ. Res.* **23,** 402–413 (2008).

22. Why, Y. P., Huang, R. Z. & Sandhu, P. K. Affective messages increase leisure walking only among conscientious individuals. *Pers. Individ. Dif.* **48,** 752–756 (2010).

23. Berry, T. R. & Carson, V. Ease of imagination, message framing, and physical activity messages. *Br. J. Health Psychol.* **15,** 197–211 (2010).

24. Brengman, M., Wauters, B., Macharis, C. & Mairesse, O. Functional effectiveness of threat appeals in exercise promotion messages. *Psicologica* **31,** 577–604 (2010).

25. Eves, F. F., Olander, E. K., Webb, O. J., Griffin, C. & Chambers, J. Likening stairs in buildings to climbing a mountain: Self-reports of expected effects on stair climbing and objective measures of effectiveness. *Psychol. Sport Exerc.* **13,** 170–176 (2012).

26. Jung, T. & Heald, G. R. The effects of discriminate message interventions on behavioural intentions to engage in physical activities. *J. Am. Coll. Health.***57,** 527–535 (2009).

27. Berry, T. R., Jones, K. E., McLeod, N. C. & Spence, J. C. The relationship between implicit and explicit believability of exercise-related messages and intentions. *Health.Psychol.* **30,** 746–752 (2011).

28. Cho, H. & Salmon, C. T. Fear appeals for individuals in different stages of change: Intended and unintended effects and implications on public health campaigns. *Health Commun.* **20,** 91–99 (2006).

29. Peetz, J., Buehler, R. & Britten, K. Only minutes a day: Reframing Exercise duration affects exercise intentions and behavior. *Basic Appl. Soc. Psych.* **33,** 118–127 (2011).

30. Sugiyama, S. *et al.* Association between visual message and health knowledge in a 4-month follow-up study at worksites. *J. Occup. Health* **53,** 465–472 (2011).

31. Webb, O. J. & Eves, F. F. Promoting stair climbing: Effects of message specificity and validation. *Health Educ. Res.* **22,** 49–57 (2007).

32. Kerr, J., Eves, F. F. & Carroll, D. Getting more people on the stairs: The impact of a new message format. *J. Health Psychol.* **6,** 495–500 (2001).

33. Department of Health. *Change4Life marketing strategy*. (2009).

34. Department of Health. *Change4Life three year social marketing strategy*. (2011).

35. EU Expert Working Group "Sport & Health."*EU physical activity guidelines: Recommended policy actions in support of health-enhancing physical activity*. 1–38

36. Thomas, L. Viewers watch 47 television ads every day... up a fifth from five years ago. *Mail Online* (2011). at <http://www.dailymail.co.uk/tvshowbiz/article-2025513/Viewers-watch-47-television-ads-day--fifth-years-ago.html>

37. University of Liverpool. Family TV programmes saturated with junk food adverts. *Univeristy Liverpool News* (2014). at <http://news.liv.ac.uk/2014/03/21/family-tv-saturated-with-junk-food-adverts/>

38. The BBC. Ban TV junk food ads until 21:00, say campaigners. *BBC News Health.*(2014). at <http://www.bbc.co.uk/news/health-26665952>

39. Marketing Charts. Average hour-long TV show is 36% commercials. (2009). at <http://www.marketingcharts.com/wp/television/average-hour-long-show-is-36-commercials-9002/>

40. Ofcom. *Trends in advertising activity - gambling*. 1–215 (2013).

41. Staiano, A. E., Harrington, D. M., Barreira, T. V & Katzmarzyk, P. T. Sitting time and cardiometabolic risk in US adults: Associations by sex, race, socioeconomic status and activity level. *Br. J. Sports Med.* **48,** 213–219 (2014).

42. Ekelund, U. Commentary: Too much sitting - a public health threat? *Int. J. Epidemiol.* **41,** 1353–1355 (2012).

43. Costigan, S. A., Barnett, L., Plotnikoff, R. C. & Lubans, D. R. The health indicators associated with screen-based sedentary behavior among adolescent girls: A systematic review. *J. Adolesc. Health.***52,** 382–392 (2013).

44. Wilmot, E. G. *et al.* Sedentary time in adults and the association with diabetes, cardiovascular disease and death: Systematic review and meta-analysis. *Diabetologia* **55,** 2895–2905 (2012).

45. De Rezende, L. F. M., Rey-López, J. P., Matsudo, V. K. R. & do Carmo Luiz, O. Sedentary behavior and health outcomes among older adults: A systematic review. *BMC Public Health* **14,** 333–341 (2014).

46. Dunstan, D. W. *et al.* Breaking up prolonged sitting reduces postprandial glucose and insulin responses. *Diabetes Care* **35,** 976–983 (2012).

47. Owen, N., Healy, G. N., Matthews, C. & Dunstan, D. W. Too much sitting: The population-health science of sedentary behavior. *Exerc. Sport Sci. Rev.* **38,** 105–113 (2010).

48. Dunstan, D. W., Thorp, A. A. & Healy, G. N. Prolonged sitting: Is it a distinct coronary heart disease risk factor? *Curr. Opin. Cardiol.* **26,** 412–419 (2011).

49. Caspersen, C. J., Powell, K. E. & Christenson, G. M. Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Rep.* **100,** 126–31 (1985).

50. Hamilton, M. T., Healy, G. N., Dunstan, D. W., Theodore, W. & Owen, N. Too little exercise and too much sitting: Inactivity physiology and the need for new recommendations on sedentary behavior. *Curr. Cardiovasc. Risk Rep.* **2,** 292–298 (2008).

51. Sedentary Behaviour Research Network. Standardized use of the terms "sedentary" and "sedentary behaviours. *Appl. Physiol. Nutr. Metab.* **37,** 540–542 (2012).

52. American College of Sports Medicine. *Guidelines for graded exercise testing and exercise prescription*. (Lea & Febiger, 1975).

53. Haskell, W. L. Health consequences of physical activity: Understanding and challenges regarding dose-response. *Med. Sci. Sports Exerc.* **26,** 649–660 (1994).

54. Pate, R. R. *et al.* Physical Activity and Public Health A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine. *J. Am. Med. Assoc.* **273,** 1995 (1995).

55. Blair, S. N., LaMonte, M. J. & Nichaman, M. Z. The evolution of physical activity recommendations: How much is enough? *Am. J. Clin. Nutr.* **79,** S913–S920 (2004).

56. Department of Health. *At least five a week: Evidence on the impact of physical activity and its relationship to health*. (2004).

57. World Health Organization. *The world health report: Reducing risks, promoting healthy life*. (2002).

58. World Health Organization. *Global strategy on diet, physical activity and health*. **2002,** (2004).

59. Kohl, H. W. *et al.* The pandemic of physical inactivity: Global action for public health. *Lancet* **380,** 294–305 (2012).

60. in *Fifty- seventh World Health.Assem. Geneva, 17–22 May 2004. Resolut. Decis. Annex.* **95,** 38–55 (World Health Organization, 2004).

61. World Health Organization. *2008-2013 action plan for the global strategy for the prevention and control of noncommunicable diseases*. (2008).

62. Dunstan, D. W., Howard, B., Healy, G. N. & Owen, N. Too much sitting - a health hazard. *Diabetes Res. Clin. Pract.* **97,** 368–376 (2012).

63. Healy, G. N. *et al.* Breaks in sedentary time: Beneficial associations with metabolic risk. *Diabetes Care* **31,** 661–666 (2008).

64. Canadian Society for Exercise Physiology. *Canadian sedentary behaviour guidelines*. (2011).

65. National Heart Foundation of Australia. *Sit less, move more*. 1–4 (2011).

66. Saunders, T. J., Chaput, J.-P. & Tremblay, M. S. Sedentary behaviour as an emerging risk factor for cardiometabolic diseases in children and youth. *Can. J. Diabetes* **38,** 53–61 (2014).

67. Lefebvre, C. R. & Flora, J. A. Social marketing and public health intervention. *Health Educ. Q.* **15,** 299–315 (1988).

68. Kotler, P. & Zaltman, G. Social marketing: An approach to planned social change. *J. Mark.* **35,** 3–12 (1971).

69. Hillsdon, M., Cavill, N., Nanchahal, K., Diamond, A. & White, I. R. National level promotion of physical activity: Results from England's ACTIVE for LIFE campaign. *J. Epidemiol. Community Health* **55,** 755–761 (2001).

70. Department of Health. *Change4Life one year on*. (2010).

71. Piggin, J. Turning health research into health promotion: A study of causality and "critical insights" in a United Kingdom health campaign. *Health Policy (New. York).* **107,** 296–303 (2012).

72. Office for National Statistics. *Statistical Bulletin: Families and Households, 2012*. 1–16 (2012).

73. DCMS/Strategy Unit. *Game Plan : A strategy for delivering Government's sport and physical activity objectives*. (2002).

74. The NHS Information Centre Lifestyle Statistics. *Statistics on obesity, physical activity and diet: England, 2012*. **1,** (The Health and Social Care Information Centre, 2012).

75. The NHS Information Centre. *Statistics on obesity, physical activity and diet : England, 2006*. (2006).

76. Heath, G. W. *et al.* Evidence-based intervention in physical activity: lessons from around the world. *Lancet* **380,** 272–81 (2012).

77. World Health Organization. Life expectancy: Life expectancy - Data by country. *Glob. Health.Obs. Data Repos.* (2013). at <http://apps.who.int/gho/data/node.main.688>

78. Berry, T. R. & Latimer-Cheung, A. E. Overcoming challenges to build strong physical activity promotion messages. *Am. J. Lifestyle Med.* **7,** 371–378 (2013).

79. Croker, H., Lucas, R. & Wardle, J. Cluster-randomised trial to evaluate the "Change for Life" mass media/social marketing campaign in the UK. *BMC Public Health* **12,** 404–429 (2012).

80. Craig, C. L., Russell, S. J., Cameron, C. & Bauman, A. Twenty-year trends in physical activity among Canadian adults. *Can. J. Public Health.***95,** 59–63 (2004).

81. Department of Health leading in partnership with OGDs. *Be active, be healthy: A plan for getting the nation moving*. (2009).

82. Bauman, A., Cavill, N. & Brawley, L. R. ParticipACTION: The future challenges for physical activity promotion in Canada. *Int. J. Behav. Nutr. Phys. Act.* **6,** 89–93 (2009).

83. Lagarde, F. The mouse under the microscope: Keys to ParticipACTION's success. *Can. J. Public Health.***95,** S20–S24 (2004).

84. Bauman, A., Madill, J. & Craig, C. L. ParticipACTION: This mouse roared, but did it get the cheese? *Can. J. Public Health.***95,** S14–S19 (2004).

85. Canadian Public Health Association. ParticipACTION: The mouse that roared: A marketing and health communications success story. *Can. J. Public Health.***95,** S1–S46 (2004).

86. Bauman, A., Craig, C. L. & Cameron, C. Low levels of recall among adult Canadians of the CSEP/Health Canada physical activity guidelines. *Can. J. Appl. Physiol.* **30,** 246–252 (2005).

87. Spence, J. C. *et al.* ParticipACTION: Awareness of the participACTION campaign among Canadian adults - examining the knowledge gap hypothesis and a hierarchy-of-effects model. *Int. J. Behav. Nutr. Phys. Act.* **6,** 85–93 (2009).

88. Craig, C. L., Bauman, A. & Reger-Nash, B. Testing the hierarchy of effects model: ParticipACTION's serial mass communication campaigns on physical activity in Canada. *Health Promot. Int.* **25,** 14–23 (2009).

89. Wimbush, E. A moderate approach to promoting physical activity: The evidence and implications. *Health Educ. J.* **53,** 322–336 (1994).

90. Wimbush, E., Macgregor, A. & Fraser, E. Impacts of a national mass media campaign on walking in Scotland. *Health Promot. Int.* **13,** 45–53 (1997).

91. Pateman, B., Irvin, L. H., Shoji, L. & Serna, K. Building school health programs through public health initiatives: the first three years of the Healthy Hawaii Initiative partnership for school health. *Prev. Chronic Dis.* **1,** A10 (2004).

92. Maddock, J. E. *et al.* Evaluation of a statewide program to reduce chronic disease: The Healthy Hawaii Initiative, 2000–2004. *Eval. Program Plann.* **29,** 293–300 (2006).

93. Buchthal, O. V. *et al.* Avoiding a knowledge gap in a multiethnic statewide social marketing campaign: Is cultural tailoring sufficient? *J. Health Commun.* **16,** 314–327 (2011).

94. Green, J. H. & Boyle, F. E. Lack of awareness of public health promotion messages among a group of adult New Zealanders who meet national guidelines for food intake and physical activity. *Asia Pac. J. Clin. Nutr.* **10,** 17–20 (2001).

95. Bauman, A. *et al.* Evaluation of the national "Push Play" campaign in New Zealand - creating population awareness of physical activity. *N. Z. Med. J.* **116,** 1–11 (2003).

96. Schofield, G. Push Play: what's under the umbrella? *N. Z. Med. J.* **116,** 1–3 (2003).

97. Ford, G. Push Play era over as National set new path. *Sunday Star Times* (2009).

98. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **50,** 179–211 (1991).

99. Peterson, M., Abraham, A. & Waterfield, A. Marketing physical activity: lessons learned from a statewide media campaign. *Health Promot. Pract.* **6,** 437–46 (2005).

100. Rhodes, R. E. & de Bruijn, G.-J. How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. *Br. J. Health Psychol.* **18,** 296–309 (2013).

101. Dietz, W. H. Canada on the Move: A novel effort to increase physical activity among Canadians. *Can. J. Public Health.***S3,** S3–S4 (2004).

102. Faulkner, G. & Finlay, S.-J. Canada on the Move: An intensive media analysis from inception to reception. *Can. J. Public Health.***97,** S16–S19 (2006).

103. Craig, C. L., Cragg, S. E., Tudor-locke, C. & Bauman, A. Proximal impact of Canada on the Move: The relationship of campaign awareness to pedometer ownership and use. *Can. J. Public Health.***97,** S21–S27 (2006).

104. Craig, C. L., Tudor-Locke, C. & Bauman, A. Twelve-month effects of Canada on the Move: A population-wide campaign to promote pedometer use and walking. *Health Educ. Res.* **22,** 406–413 (2007).

105. Tudor-Locke, C. Canada on the Move : Research , Evaluation , and Partnership - Walk this Way: At the Intersection of Information and Promotion. *WellSpring* **16,** (2005).

106. Tasmanian Government. Find Thirty every day® overview. *Find Thirty every day* (2011). at <http://www.findthirty.tas.gov.au/campaign/find_thirty_every_day_overview>

107. Maitland, C., James, N. & Shilton, T. Regional considerations for state-wide social marketing campaigns - some lessons learned. in *11th Natl. Rural Health.Conf.* 1–5 (2011).

108. Heart Foundation. *LiveLighter – A world first campaign to tackle obesity LiveLighter Facts*. 24–25 (2012).

109. Department Of Health/DCMS. *Choosing Health? Choosing Activity: A Consultation on how to Increase Physical Activity*. (2004).

110. National Social Marketing Centre. *It's our health! Realising the potential of effective social marketing: Summary*. (2006).

111. Grilli, R., Ramsay, C. & Minozzi, S. Mass media interventions: effects on health services utilisation. *Cochrane Database Syst. Rev.* (2002). doi:10.1002/14651858.CD000389

112. NHS Institute for Innovation and Improvement. Mass Media. at <http://www.institute.nhs.uk/building_capability/technology_and_product_innovation/mass_media.html>

113. MarketingCharts. Differences in media consumption among racial groups. *BIGresearch* (2008). at <http://www.marketingcharts.com/television/differences-in-media-consumption-among-racial-groups-4590/>

114. Matsudo, V. *et al.* Promotion of physical activity in a developing country: The Agita São Paulo experience. *Public Health Nutr.* **5,** 253–261 (2002).

115. Edwards, P. No country mouse: Thirty years of effective marketing and health communications. *Can. J. Public Health.***95,** S6–S13 (2004).

116. Gray, R. Obesity why fat itself may be the answer. *Telegr.* (2009). at <http://www.telegraph.co.uk/science/6083234/Obesity-why-fat-itself-may-be-the-answer.html>

117. Shaw, K., Gennat, H., O'Rourke, P. & Del Mar, C. Exercise for overweight or obesity. *Cochrane Libr.* (2006).

118. Ho, V. Fatties R Us: Washington obesity rate nearly doubles. *SeattlePi* (2011). at <http://www.seattlepi.com/local/article/Fatties-R-us-Washington-obesity-rate-nearly-1456393.php>

119. Randolph, W. & Viswanath, K. Lessons Learned from Public Health Mass Media Campaigns: Marketing Health in a Crowded Media World. *Annu. Rev. Public Health* **25,** 419–437 (2004).

120. Cadbury. *Focused on performance: Delivering against our plan. Annual report & accounts 2008*. (2008).

121. United States Securities and Exchange Commision. *The Coca-Cola Company. 2012 Form 10-K Annual Report*. **15,** 1–176 (2013).

122. McDonald's Corporation. *2012 financial report*. *2012 Annu. Rep.* 1–54 (2013).

123. Electronic Arts Inc. *Electronic Arts Inc. Fiscal year 2013 proxy statement and annual report*. (2013).

124. Smith, K., Jones, S. C. & Algie, J. Measuring source credibility with generation Y: An application to messages about smoking and alcohol consumption. in *Proc. Soc. Entrep. Soc. Chang. Sustain.* 77–82 (2007).

125. Dishman, R. K. The problem of exercise adherence: Fighting sloth in nations with market economies. *Quest* **53,** 279–294 (2001).

126. Collins, J. L. & Wechsler, H. The VERB campaign. *Am. J. Prev. Med.* **34,** S171–S172 (2008).

127. Huhman, M., Bauman, A. & Bowles, H. R. Initial outcomes of the VERB campaign: Tweens' awareness and understanding of campaign messages. *Am. J. Prev. Med.* **34,** S241–248 (2008).

128. Berkowitz, J. M., Huhman, M. & Nolin, M. J. Did augmenting the VERB campaign advertising in select communities have an effect on awareness, attitudes, and physical activity? *Am. J. Prev. Med.* **34,** S257–S266 (2008).

129. Huhman, M. E. *et al.* The influence of the VERB campaign on children's physical activity in 2002 to 2006. *Am. J. Public Health* **100,** 638–645 (2010).

130. Cavill, N. & Maibach, E. W. VERB: Demonstrating a viable national option for promoting physical activity among our children. *Am. J. Prev. Med.* **34,** S173–S174 (2008).

131. Price, S. M., Huhman, M. & Potter, L. D. Influencing the parents of children aged 9-13 years: findings from the VERB campaign. *Am. J. Prev. Med.* **34,** S267–S274 (2008).

132. Huhman, M. *et al.* The VERB campaign's strategy for reaching African-American, Hispanic, Asian, and American Indian children and parents. *Am. J. Prev. Med.* **34,** S194–209 (2008).

133. Abioye, A. I., Hajifathalian, K. & Danaei, G. Do mass media campaigns improve physical activity? A systematic review and meta-analysis. *Arch. Public Health.* **71,** 20–29 (2013).

134. Chaudhury, M. & Esliger, D. in *Health. Surv. Engl. 2008 Vol. 1 Phys. Act. Fit.* (Craig, R., Mindell, J. & Hirani, V.) **1,** (The Health and Social Care Information Centre, 2009).

135. Warner, K. E. The effects of the anti-smoking campaign on cigarette consumption. *Am. J. Public Health* **67,** 645–650 (1977).

136. Department Of Health, HIP & Social Marketing and health Related Behaviour Health. *Ambitions for health*. (2008).

137. Rhodes, R. E. & Nigg, C. R. Advancing physical activity theory: a review and future directions. *Exerc. Sport Sci. Rev.* **39,** 113–119 (2011).

138. Bellows-Riecken, K. H., Rhodes, R. E. & Hoffert, K. M. Motives for lifestyle and exercise activities: A comparison using the theory of planned behaviour. *Eur. J. Sport Sci.* **8,** 305–313 (2008).

139. Rhodes, R. E., Blanchard, C. M., Courneya, K. S. & Plotnikoff, R. C. Identifying belief-based targets for the promotion of leisure-time walking. *Health. Educ. Behav.* **36,** 381–393 (2009).

140. Rhodes, R. E., Brown, S. G. & McIntyre, C. A. Integrating the perceived neighborhood environment and the theory of planned behavior when predicting walking in a Canadian adult sample. *Am. J. Health. Promot.* **21,** 110–118 (2006).

141. Rhodes, R. E. & Courneya, K. S. Threshold assessment of attitude, subjective norm, and perceived behavioral control for predicting exercise intention and behavior. *Psychol. Sport Exerc.* **6,** 349–361 (2005).

142. Rhodes, R. E. Translating exercise intentions into behavior: Personality and social cognitive correlates. *J. Health Psychol.* **8,** 447–458 (2003).

143. Parrott, M. W., Tennant, L. K., Olejnik, S. & Poudevigne, M. S. Theory of planned behavior: Implications for an email-based physical activity intervention. *Psychol. Sport Exerc.* **9,** 511–526 (2008).

144. Conner, M., Rhodes, R. E., Morris, B., McEachan, R. & Lawton, R. Changing exercise through targeting affective or cognitive attitudes. *Psychol. Health.* **26,** 133–149 (2011).

145. Weinstein, N. D. The precaution adoption process. *Health. Psychol.* **7,** 355–386 (1988).

146. Lovell, G. P., El Ansari, W. & Parker, J. K. Perceived exercise benefits and barriers of non-exercising female university students in the United Kingdom. *Int. J. Environ. Res. Public Health* **7,** 784–798 (2010).

147. Watkinson, C. *et al.* Overestimation of physical activity level is associated with lower BMI: A cross-sectional analysis. *Int. J. Behav. Nutr. Phys.* **7,** 68–76 (2010).

148. Vandelanotte, C., Duncan, M. J., Hanley, C. & Mummery, W. K. Identifying population subgroups at risk for underestimating weight health risks and overestimating physical activity health benefits. *J. Health Psychol.* **16,** 760–769 (2011).

149. Lechner, L., Bolman, C. & Van Dijke, M. Factors related to misperception of physical activity in the Netherlands and implications for health promotion programmes. *Health Promot. Int.* **21,** 104–112 (2006).

150. Van Sluijs, E. M. F., Griffin, S. J. & van Poppel, M. N. M. A cross-sectional study of awareness of physical activity: Associations with personal , behavioral and psychosocial factors. *Int. J. Behav. Nutr. Phys. Act.* **4,** 53–61 (2007).

151. Bolman, C., Lechner, L. & Dijke, M. Van. Question order in the assessment of misperception of physical activity. *Int. J. Behav. Nutr. Phys. Act.* **4,** 42–52 (2007).

152. Johnson, B. B. Public views on drinking water standards as risk indicators. *Risk Anal.* **28,** 1515–1530 (2008).

153. Weinstein, N. D. & Sandman, P. M. A model of the precaution adoption process: Evidence from home radon testing. *Health. Psychol.* **11,** 170–180 (1992).

154. Hochbaum, G. Public participation in medical screening programs: A sociopsychological study. PHS publication no. 572. (1958). doi:10.4135/9781412953948.n195

155. Maitland, C. *Statewide Physical Activity Campaign Campaign Brief - Substantiation of Objectives January 2008*. 1–5 (2008).

156. Physical Activity Council. *Tasmania's plan for physical activity*. 1–13 (2011).

157. Nigg, C. *et al.* The Healthy Hawaii Initiative: A social ecological approach promoting healthy communities. *Health. Promot. Community Des.* **19,** 310–314 (2005).

158. Physical Activity Task Force. *Let's make scotland more active: A strategy for physical activity*. 1–66 (Crown, 2003).

159. Powell, K. E., Kreuter, M. W., Stephens, T., Marti, B. & Heinemann, L. The dimensions of health promotion applied to physical activity. *J. Public Health Policy* **12,** 492–509 (1991).

160. Jones, L. W., Sinclair, R. C. & Courneya, K. S. The effects of source credibility and message framing on exercise intentions, behaviors, and attitudes: An integration of the elaboration likelihood model and prospect theory. *J. Appl. Soc. Psychol.* **33,** 179–196 (2003).

161. Slater, M. D. & Rouner, D. How message evaluation and source attributes may influence credibility assessment and belief change. *Journal. Mass Commun. Q.* **73,** 974–991 (1996).

162. Roskos-Ewoldsen, D. R., Yu, J. H. & Rhodes, N. Fear appeal messages affect accessibility of attitudes toward the threat and adaptive behaviors. *Commun. Monogr.* **71,** 49–69 (2004).

163. Witte, K. Putting the fear back into fear appeals: The extended parallel process model. *Commun. Monogr.* **59,** 329–349 (1992).

164. Nocon, M. *et al.* Association of physical activity with all-cause and cardiovascular mortality: a systematic review and meta-analysis. *Eur. J. Cardiovasc. Prev. Rehabil.* **15,** 239–46 (2008).

165. Zambroski, C. H. & Kentucky, L. Qualitative analysis of living with heart failure. *Hear. Lung* **32,** 32–40 (2003).

166. Uppal, N., Shahab, L., Britton, J. & Ratschen, E. The forgotten smoker: A qualitative study of attitudes towards smoking, quitting, and tobacco control policies among continuing smokers. *BMC Public Health* **13,** 432 (2013).

167. National Obesity Observatory. *Knowledge and attitudes towards healthy eating and physical activity: What the data tell us*. (2011).

168. De Cocker, K. *et al.* Can differences in physical activity by socio-economic status in European adolescents be explained by differences in psychosocial correlates? A mediation analysis within the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study. *Public Health Nutr.* **15,** 2100–9 (2012).

169. Bull, F. C., Kreuter, M. W. & Scharff, D. P. Effects of tailored, personalized and general health messages on physical activity. *Patient Educ. Couns.* **36,** 181–92 (1999).

170. Hageman, P. A., Walker, S. N. & Pullen, C. H. Tailored versus standard internet-delivered interventions to promote physical activity in older women. *J. Geriatr. Phys. Ther.* **28,** 28–33 (2005).

171. Langille, J.-L. D. *et al.* Strength of messaging in changing attitudes in a workplace wellness program. *Health Promot. Pract.* **12,** 303–311 (2011).

172. Quintiliani, L. M. *et al.* Results of a randomized trial testing messages tailored to participant-selected topics among female college students: Physical activity outcomes. *J. Phys. Act. Health.* **7,** 517–526 (2010).

173. Priebe, C. S. & Spink, K. S. Using messages promoting descriptive norms to increase physical activity. *Health Commun.* **27,** 284–91 (2012).

174. Park, H. S. & Smith, S. W. Distinctiveness and Influence of Subjective Norms, Personal Descriptive and Injunctive Norms, and Societal Descriptive and Injunctive Norms on Behavioral Intent: A Case of Two Behaviors Critical to Organ Donation. *Hum. Commun. Res.* **33,** 194–218 (2007).

175. Gaston, A. & Gammage, K. L. The effectiveness of a health-based message on pregnant women's intentions to exercise postpartum. *J. Reprod. Infant Psychol.* **29,** 162–169 (2011).

176. Gaston, A. & Gammage, K. L. Health versus appearance messages, self-monitoring and pregnant women's intentions to exercise postpartum. *J. Reprod. Infant Psychol.* **28,** 345–358 (2010).

177. Bull, F. C., Jamrozik, K. & Blanksby, B. a. Tailored advice on exercise - does it make a difference? *Am. J. Prev. Med.* **16,** 230–239 (1999).

178. Weiler, R., Chew, S., Coombs, N., Hamer, M. & Stamatakis, E. Physical activity education in the undergraduate curricula of all UK medical schools: Are tomorrow's doctors equipped to follow clinical guidelines? *Br. J. Sports Med.* **46,** 1024–1026 (2012).

179. National Social Marketing Centre for DH/HIP/Social Marketing & Health Related Behaviour. *Review of Social Marketing within Public Health Regional Settings November 2008-January 2009*. (2009).

180. Latimer-Cheung, A. E. *et al.* Evidence-informed recommendations for constructing and disseminating messages supplementing the new Canadian Physical Activity Guidelines. *BMC Public Health.* **13,** 419–431 (2013).

181. Bennett, C. *et al.* Reporting guidelines for survey research: an analysis of published guidance and reporting practices. *PLoS Med.* **8,** e1001069 (2010).

182. Boynton, P. M. & Greenhalgh, T. Hands-on guide to questionnaire research: Selecting, designing, and developing your questionnaire. *BMJ* **328,** 1312–1315 (2004).

183. Sims, J., Smith, F., Duffy, A. & Hilton, S. The vagaries of self-reports of physical activity: A problem revisited and addressed in a study of exercise promotion in the over 65s in general practice. *Fam. Pract.* **16,** 152–157 (1999).

184. Eiser, J. R., Miles, S. & Frewer, L. J. Trust, perceived risk, and attitudes toward food technologies. *J. Appl. Soc. Psychol.* **32,** 2423–2433 (2002).

185. Fricker, R. D. & Schonlau, M. Advantages and disadvantages of internet research surveys: Evidence from the literature. *Field methods* **14,** 347–367 (2002).

186. Webb, O. J. & Eves, F. F. Promoting stair climbing: Intervention effects generalize to a subsequent stair ascent. *Am. J. Health. Promot.* **22,** 114–119 (2007).

187. Webb, O. J. & Eves, F. F. Effects of environmental changes in a stair climbing intervention: Generalization to stair descent. *Am. J. Health.Promot.* **22,** 38–44 (2007).

188. Kann, L., Brener, N. D., Warren, C. W., Collins, J. L. & Giovino, G. a. An assessment of the effect of data collection setting on the prevalence of health risk behaviors among adolescents. *J. Adolesc. Health* **31,** 327–35 (2002).

189. Hansen, T., Møller Jensen, J. & Stubbe Solgaard, H. Predicting online grocery buying intention: A comparison of the theory of reasoned action and the theory of planned behavior. *Int. J. Inf. Manage.* **24,** 539–550 (2004).

190. Boynton, P. M. Hands-on guide to questionnaire research: Administering, analysing, and reporting your questionnaire. *BMJ* **328,** 1372–1375 (2004).

191. Parsons, C. Web-based surveys: Best practices based on the research literature. *Visit. Stud.* **10,** 13–33 (2007).

192. Vicente, P. & Reis, E. Using questionnaire design to fight nonresponse bias in web surveys. *Soc. Sci. Comput. Rev.* **28,** 251–267 (2010).

193. Griffith, L. E., Cook, D. J., Guyatt, G. H. & Charles, C. A. Comparison of open and closed questionnaire formats in obtaining demographic information from Canadian general internists. *J. Clin. Epidemiol.* **52,** 997–1005 (1999).

194. Hardré, P. L., Crowson, H. M., Xie, K. & Ly, C. Testing differential effects of computer-based, web-based and paper-based administration of questionnaire research instruments. *Br. J. Educ. Technol.* **38,** 5–22 (2007).

195. Office for National Statistics. Internet Access Quarterly Update, Q3 2013. *Stat. Bull.* 1–15 (2013).

196. Parker, C., Michael, D. & Group, the T. S. Assessing research outcomes by postal questionnaire with telephone follow-up. *Int. J. Epidemiol.* **29,** 1065–1069 (2000).

197. The NHS Information Centre. *Health Survey for England 2007: Volume 2. Methodology and documentation*. **2,** (The Health and Social Care Information Centre, 2008).

198. Evans, J. R. & Mathur, A. The value of online surveys. *Internet Res.* **15,** 195–219 (2005).

199. Bowling, A. *Research methods in health: Investigating health and health services*. 1–29 (Open Universiy Press, 2002).

200. Schmider, E., Ziegler, M., Danay, E., Beyer, L. & Bühner, M. Is it really robust? Reinvestigating the robustness of ANOVA against violations of the normal distribution assumption. *Methodology* **6,** 147–151 (2010).

201. Hayes, A. F. & Preacher, K. J. Statistical mediation analysis with a multicategorical independent variable. *Br. J. Math. Stat. Psychol.* **E-pub ahea,** (2013).

202. Hsieh, H.-F. & Shannon, S. E. Three approaches to qualitative content analysis. *Qual. Health Res.* **15,** 1277–1288 (2005).

203. National Coalition for Promoting Physical Activity. *National Physical Activity Plan for the United States*. (2010).

204. Lee, I. M. *et al.* Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* **380,** 219–29 (2012).

205. Sallis, R. E. Exercise is medicine and physicians need to prescribe it! *Br. J. Sports Med.* **43,** 3–4 (2009).

206. Public Health Agency. Get a Life, Get Active. 60 (2011). at <http://www.getalifegetactive.com/>

207. NHS. Change4life. (2013). at <www.nhs.uk/change4life>

208. Plotnikoff, R. C. & Trinh, L. Protection motivation theory: Is this a worthwhile theory for physical activity promotion? *Exerc. Sport Sci. Rev.* **38,** 91–98 (2010).

209. Prentice-Dunn, S. & Rogers, R. W. Protection motivation yheory and preventive health: Beyond the health belief model. *Health Educ. Res.* **1,** 153–161 (1986).

210. Michie, S., Abraham, C., Whittington, C., McAteer, J. & Gupta, S. Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health. Psychol.* **28,** 690–701 (2009).

211. Kay, M., Carroll, D. D., Carlson, S. A. & Fulton, J. Awareness and knowledge of the 2008 Physical Activity Guidelines for Americans. *J. Phys. Act. Health.* **11,** 693–698 (2014).

212. Cameron, C., Craig, C. L., Bull, F. C. & Bauman, A. Canada's physical activity guides: Has their release had an impact? *Appl. Physiol. Nutr. Metab.* **32,** S161–169 (2007).

213. Snyder, L. B. Health communication campaigns and their impact on behavior. *J. Nutr. Educ. Behav.* **39,** S32–40 (2007).

214. Dawson, J., Boller, I., Foster, C. & Hillsdon, M. *Evaluation of changes to physical activity amongst people who attend the walking the way to health initiative (WHI)*. (The Countryside Agency, 2006).

215. O'Dougherty, M., Arikawa, A., Kaufman, B. C., Kurzer, M. S. & Schmitz, K. H. Purposeful exercise and lifestyle physical activity in the lives of young adult women: Findings from a diary study. *Women Health* **49,** 642–661 (2010).

216. Williams, D. M., Matthews, C., Rutt, C., Napolitano, M. A. & Marcus, B. H. Interventions to increase walking behavior. *Med. Sci. Sports Exerc.* **40,** 567–573 (2008).

217. Lee, I. M. Dose-response relation between physical activity and health: Even a little is good, more is better. *J. Am. Med. Assoc.* **297,** 2137–2139 (2007).

218. Canadian Society of Exercise Physiology. *Canadian physical activity and sedentary behaviour guidelines*. CSEP: Canada. 1–30 (2012).

219. Pleis, J. R., Ward, B. W. & Lucas, J. W. *Summary health statistics for U.S. adults: National Health Interview Survey, 2009*. *Vital Health.Stat. 10, Data from Natl. Health.Surv.* 1–207 (US Department of Health and Human Services, 2010). at <http://www.ncbi.nlm.nih.gov/pubmed/21905346>

220. Slaunwhite, J. M., Smith, S. M., Fleming, M. T. & Fabrigar, L. R. Using normative messages to increase healthy behaviours. *Int. J. Work. Health. Manag.* **2,** 231–244 (2009).

221. Wurtele, S. K. & Maddux, J. E. Relative contributions of Protection in Motivation Theory components predicting exercise intentions behavior. *Health. Psychol.* **6,** 453–466 (1987).

222. National Health Services. Change4Life. *http//www.nhs.uk/Change4Life/Pages/ Exerc.* (2013).

223. Health Promotion Board. Singapore's Physical Activity Programme. (2009). at <http://www.hpb.gov.sg/physicalactivity/article.aspx?id= 103463>

224. Department of Health. Find your thirty. at <http://www.findthirtyeveryday.com.au/ default.aspx? MenuID=4>

225. Brawley, L. R. & Latimer, A. E. Physical activity guides for Canadians: Messaging strategies, realistic expectations for change, and evaluation. *Appl. Physiol. Nutr. Metab.* **32,** S170–S184 (2007).

226. Garber, C. E. *et al.* American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med. Sci. Sports Exerc.* **43,** 1334–59 (2011).

227. Church, T. S., Earnest, C. P., Skinner, J. S. & Blair, S. N. Effects of Different Doses of Physical Activity on Cardiorespiratory Fitness Among Sedentary , Overweight or Obese Postmenopausal. **297,** 2081–2091 (2007).

228. Cullen, K. W., Baranowski, T. & Smith, S. P. Using goal setting as a strategy for dietary behaviour change. *J. Am. Diet. Assoc.* **101,** 562–566 (2001).

229. National Health Services. This week's top tips from Change4Life! (2012).

230. Public Health Agency. Get a Life, Get Active. *http://www.getalifegetactive.com/ adults/how-much-activity-do-adults-need/how-much-activity-do-adults-need4*

231. Sallis, J. F. & Hovell, M. F. in *Exercise Determinants,* 307–330 (1990).

232. Trost, S. G., Owen, N., Bauman, A., Sallis, J. F. & Brown, W. Correlates of adults' participation in physical activity: Review and update. *Med. Sci. Sports Exerc.* **34,** 1996–2001 (2002).

233. Rejeski, W. J. & Mihalko, S. L. Physical activity and quality of life in older adults. *Journals Gerontol.* **56A,** 23–35 (2001).

234. Weinstein, N. D. & Lyon, J. E. Mindset , optimistic bias about personal risk and health-protective behaviour. *Br. J. Health Psychol.* **4,** 289–300 (1999).

235. Matell, M. S. & Jacoby, J. Is there an optimal number of alternatives for likert-scale items? Effects of testing time and scale properties. *J. Appl. Psychol.* **56,** 506–509 (1972).

236. Cardinal, B. J. Construct validity of stages of change for exercise behavior. *Am. J. Health.Promot.* **12,** 68–74 (1997).

237. Latimer, A. E. *et al.* Promoting participation in physical activity using framed messages: An application of prospect theory. *Br. J. Health Psychol.* **13,** 659–681 (2008).

238. Salovey, P. & Williams-Piehota, P. Field experiments in social psychology: Message framing and the promotion of health protective behaviors. *Am. Behav. Sci.* **47,** 488–505 (2004).

239. Mueller, W. H., Joos, S. K. & Schull, W. J. Alternative measurements of obesity: Accuracy of body silhouettes and reported weights and heights in a Mexican American sample. *Int. J. Obes.* **9,** 193–200 (1985).

240. Blue Cross and Blue Shield of Minnesota. Do-groove. (2007). at <http://www.do-groove.com/ tv-ads/commercials>

241. Hagger, M. S., Chatzisarantis, N. L. D. & Biddle, S. J. H. A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *J. Sport Exerc. Psychol.* **24,** 3–32 (2002).

242. Bar-Eli, M., Tenenbaum, G., Pie, J. S., Btesh, Y. & Almog, A. Effect of goal difficulty , goal specificity and duration of practice time intervals on muscular endurance performance. *J. Sports Sci.* **15,** 125–135 (1997).

243. Smith, J., Hauenstein, M. & Buchanan, L. Goal setting and exercise performance. *Hum. Perform.* **92,** 141–154 (1996).

244. Miller, C. H., Lane, L. T., Deatrick, L. M., Young, A. M. & Potts, K. A. Psychological reactance and promotional health messages: The effects of controlling language, lexical concreteness, and the restoration of freedom. *Hum. Commun. Res.* **33,** 219–240 (2007).

245. Kelly, P., Murphy, M., Oja, P., Murtagh, E. M. & Foster, C. Estimates of the number of people in England who attain or exceed vigorous intensity exercise by walking at 3 mph. *J. Sports Sci.* **29,** 1629–1634 (2011).

246. Gardner, R. E. & Hausenblas, H. A. Exercise and diet determinants of overweight women participating in an exercise and diet program: A prospective examination of the theory of planned behavior. *Women Health* **42,** 37–62 (2006).

247. Ronda, G., Van Assema, P. & Brug, J. Stages of change, psychological factors and awareness of physical activity levels in The Netherlands. *Health Promot. Int.* **16,** 305–314 (2001).

248. Van Stralen, M. M., de Vries, H., Mudde, A. N., Bolman, C. & Lechner, L. The long-term efficacy of two computer-tailored physical activity interventions for older adults: Main effects and mediators. *Health.Psychol.* **30,** 442–452 (2011).

249. Oja, P., Vuori, I. & Paronen, O. Daily walking and cycling to work: Their utility as health-enhancing physical activity. *Patient Educ. Couns.* **33,** S87–S94 (1998).

250. Milton, K., Bull, F. C. & Bauman, A. Reliability and validity testing of a single-item physical activity measure. *Br. J. Sports Med.* **45,** 203–208 (2011).

251. Harris, S. S., Caspersen, C. J., DeFriese, G. H. & Estes, H. E. Physical activity counseling for healthy adults as a primary preventive intervention in the clinical setting: Report for the US Preventive Serivces Task Force. *J. Am. Med. Assoc.* **261,** 3588–3598 (1989).

252. Raats, M. M., Sparks, P., Geekie, M. A. & Shepherd, R. The effects of providing personalized dietary feedback. A semi-computerized approach. *Patient Educ. Couns.* **37,** 177–189 (1999).

253. Ajzen, I. Constructing a theory of planned behavior questionnaire. *TPB Quest. Constr.* 1–7 (2011). at <http://people.umass.edu/aizen/pdf/tpb.measurement.pdf>

254. Rhodes, R. E., Courneya, K. S., Blanchard, C. M. & Plotnikoff, R. C. Prediction of leisure-time walking: An integration of social cognitive, perceived environmental, and personality factors. *Int. J. Behav. Nutr. Phys. Act.* **4,** 51–61 (2007).

255. Scott, F., Rhodes, R. E. & Symons Downs, D. Does physical activity intensity moderate cognition and behavior relationships? *J. Am. Coll. Health.***58,** 213–222 (2009).

256. Jones, L. W., Sinclair, R. C., Rhodes, R. E. & Courneya, K. S. Promoting exercise behaviour: An integration of persuasion theories and the theory of planned behaviour. *Br. J. Health Psychol.* **9,** 505–521 (2004).

257. Rhodes, R. E., Blanchard, C. M. & Matheson, D. H. A multicomponent model of the theory of planned behaviour. *Br. J. Health Psychol.* **11,** 119–37 (2006).

258. Ajzen, I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *J. Appl. Soc. Psychol.* **32,** 665–683 (2002).

259. Muthén, L. K. & Muthén, B. O. *Mplus: Statistical analysis with latent variables - user's guide*. 1–752 (Muthén & Muthén).

260. Wray, R. J., Jupka, K. & Ludwig-bell, C. A community-wide media campaign to promote walking in a Missouri town. *Prev. Chronic Dis. Public Health.Res. Pract. Policy* **2,** 1–17 (2005).

261. Latham, G. P. & Locke, E. A. Self-regulation through goal setting. *Organ. Behav. Hum. Decis. Process.* **50,** 212–247 (1991).

262. Vandelanotte, C. & Mummery, W. K. Qualitative and quantitative research into the development and feasibility of a video-tailored physical activity intervention. *Int. J. Behav. Nutr. Phys. Act.* **8,** 70–80 (2011).

263. Webb, T. L. & Sheeran, P. Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychol. Bull.* **132,** 249–268 (2006).

264. Glazer, N. L. *et al.* Sustained and shorter bouts of physical activity are related to cardiovascular health. *Med. Sci. Sports Exerc.* **45,** 109–115 (2013).

265. Gill, D. L. *et al.* Physical activity and quality of life. *J. Prev. Med. Public Health.***46,** S28–S34 (2013).

266. Miilunpalo, S., Vuori, I., Oja, P., Pasanen, M. & Urponen, H. Self-rated health status as a health measure: The predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *J. Clin. Epidemiol.* **50,** 517–528 (1997).

267. Malmberg, J., Miilunpalo, S., Pasanen, M., Vuori, I. & Oja, P. Characteristics of leisure time physical activity associated with risk of decline in perceived health - a 10-year follow-up of middle-aged and elderly men and women. *Prev. Med. (Baltim).* **41,** 141–150 (2005).

268. Borg, G. Borg-RPE Scale. (1998).

269. Mansfield, E. D., Ducharme, N. & Koski, K. G. Individual, social and environmental factors influencing physical activity levels and behaviours of multiethnic socio-economically disadvantaged urban mothers in Canada: A mixed methods approach. *Int. J. Behav. Nutr. Phys. Act.* **9,** 42–57 (2012).

270. Jackson-Elmoore, C. Self-perceived weight status and exercise adequacy. *Health Educ. Res.* **22,** 588–598 (2007).

271. Vähäsarja, K. *et al.* Perceived need to increase physical activity levels among adults at high risk of type 2 diabetes. A cross-sectional analysis within a community-based diabetes prevention project FIN-D2D. *BMC Public Health.***12,** 514–523 (2012).

272. Townsend, N. *et al. Physical activity statistics 2012*. 1–131 (2012).

273. Carson, V. & Janssen, I. Volume, patterns, and types of sedentary behavior and cardio-metabolic health in children and adolescents: A cross-sectional study. *BMC Public Health* **11,** 274 (2011).

274. Yates, T. *et al.* Sedentary behavior: What's in a definition? *Am. J. Prev. Med.* **40,** e33–e34 (2011).

275. Proper, K. I., Singh, A. S., van Mechelen, W. & Chinapaw, M. J. Sedentary behavior: What's in a definition? *Am. J. Prev. Med.* **40,** e34 (2011).

276. Sedentary Behaviour Research Network. Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours."*Appl. Physiol. Nutr. Metab.* **542,** 540–542 (2012).

277. Bauman, A. *et al.* The descriptive epidemiology of sitting. A 20-country comparison using the International Physical Activity Questionnaire (IPAQ). *Am. J. Prev. Med.* **41,** 228–235 (2011).

278. Nash, H. *Navigating choppy waters: CBI/Harvey Nash employment trends survey 2011*. 1–44 (CBI, 2011).

279. Leveson Gower, T. & Analysis and Disemmination. *2011 Census analysis - method of travel to work in England and Wales report*. 1–28 (Crown, 2013).

280. Ofcom. *Children and parents: Media use and attitudes report*. 1–205 (2012).

281. Department for Transport. *National Travel Survey 2010*. 1–9 (2011).

282. George, E. S., Rosenkranz, R. R. & Kolt, G. S. Chronic disease and sitting time in middle-aged Australian males: Findings from the 45 and Up Study. *Int. J. Behav. Nutr. Phys. Act.* **10,** 20–27 (2013).

283. Patel, A. V *et al.* Leisure time spent sitting in relation to total mortality in a prospective cohort of US adults. *Am. J. Epidemiol.* **172,** 419–429 (2010).

284. Sitting for long periods "is bad for your health."*BBC News Health.*(2012). at <http://www.bbc.co.uk/news/health-19910888>

285. Exercise: How to keep fit at your desk. *Huffingt. Post UK* (2013). at <http://www.huffingtonpost.co.uk/2013/09/12/how-to-keep-fit-at-your-desk_n_3912496.html>

286. Healy, G. N. *et al.* Reducing sitting time in office workers: Short-term efficacy of a multicomponent intervention. *Prev. Med. (Baltim).* **57,** 43–48 (2013).

287. Carr, L. J., Karvinen, K., Peavler, M., Smith, R. & Cangelosi, K. Multicomponent intervention to reduce daily sedentary time: A randomised controlled trial. *BMJ Open* **3,** 1–10 (2013).

288. Parry, S., Straker, L., Gilson, N. D. & Smith, A. J. Participatory workplace interventions can reduce sedentary time for office workers - a randomised controlled trial. *PLoS One* **8,** 1–10 (2013).

289. *A report of the UP4FUN project to reduce sedentary behaviour among children, with recommendations for implementing similar projects across Europe*. 1–59 (ENERGY-project Consortium, 2012).

290. Townsend, R. C. & Bennis, W. *Up the organization: How to stop the corporation from stifling people and strangling profits*. 1–208 (Wiley, 2007).

291. 5210 Let's Go! Maine. (2012). at <http://www.letsgo.org/>

292. Department of Health. *Change4Life local supporter's guide*. (2010).

293. Change4Life. *Up & about: Why kids shouldn't veg out and how to get them up and about*. (2010).

294. Australian Government. Swap It Don't Stop It. (2011).

295. National Health Services. Food and diet. *NHS Choices* at <http://www.nhs.uk/livewell/goodfood/Pages/Goodfoodhome.aspx>

296. Drinkaware. Daily Unit Guidelines. (2013). at <https://www.drinkaware.co.uk/check-the-facts/what-is-alcohol/daily-guidelines>

297. Canadian Society for Exercise Physiology. *Canadian sedentary behaviour guidelines*. 3–5 (2013).

298. Manns, P. J., Dunstan, D. W., Owen, N. & Healy, G. N. Addressing the nonexercise part of the activity continuum: A more realistic and achievable approach to activity programming for adults with mobility disability? *Phys. Ther.* **92,** 614–625 (2012).

299. Hamilton, M. T., Hamilton, D. G. & Zderic, T. W. Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease. *Perspect. Diabetes* **56,** 2655–2667 (2007).

300. Katzmarzyk, P. T. & Mason, C. The physical activity transition. *J. Phys. Act. Health.***6,** 269–280 (2009).

301. Healy, G. N. *et al.* Objectively measured light-intensity associated with 2-h plasma glucose. *Diabetes Care* **30,** 1384–1389 (2007).

302. Warburton, D. E. R., Nicol, C. W. & Bredin, S. S. D. Health benefits of physical activity: The evidence. *Can. Med. Assoc. J.* **174,** 801–809 (2006).

303. Biddle, S. Fit or sit? Is there a psychology of sedentary behaviour? *Sport Exerc. Psychol. Rev.* **7,** 5–10 (2011).

304. Wareham, N. J. & Brage, S. Commentary: Physical activity and obesity; scientific uncertainty and the art of public health messaging. *Int. J. Epidemiol.* **42,** 1843–1845 (2013).

305. Pronk, N. P. *et al.* Knowledge of energy balance guidelines and associated clinical care practices: The U.S. National Survey of Energy Balance Related Care among Primary Care Physicians. *Prev. Med. (Baltim).* **55,** 28–33 (2012).

306. Moore, L. V, Fulton, J., Kruger, J. & McDivitt, J. Knowledge of physical activity guidelines among adults in the United States, HealthStyles 2003-2005. *J. Phys. Act. Health.***7,** 141–149 (2010).

307. Marshall, A. L., Hunt, J. & Jenkins, D. Knowledge of and preferred sources of assistance for physical activity in a sample of urban Indigenous Australians. *Int. J. Behav. Nutr. Phys. Act.* **5,** 22–28 (2008).

308. Dunlop, M. & Murray, A. D. Major limitations in knowledge of physical activity guidelines among UK medical students revealed: Implications for the undergraduate medical curriculum. *Br. J. Sports Med.* **47,** 718–720 (2013).

309. DeBastiani, S. D., Carroll, D. D., Cunningham, M., Lee, S. & Fulton, J. Awareness and knowledge of the youth 2008 Physical Activity Guidelines for Americans. *J. Phys. Act. Health.***11,** 495–501 (2014).

310. Bennett, G. G., Wolin, K. Y., Puleo, E. M., Mâsse, L. C. & Atienza, A. a. Awareness of national physical activity recommendations for health promotion among US adults. *Med. Sci. Sports Exerc.* **41,** 1849–1855 (2009).

311. Elston, T. & Ginis, K. A. M. The effects of self-set versus assigned goals on exercisers' self-efficacy for an unfamiliar task. *J. Sport Exerc. Psychol.* **26,** 500–504 (2004).

312. Lockwood, P., Jordan, C. H. & Kunda, Z. Motivation by positive or negative role models: Regulatory focus determines who will best inspire us. *J. Pers. Soc. Psychol.* **83,** 854–864 (2002).

313. Bauman, A. & Chau, J. The role of media in promoting physical activity. *J. Phys. Act. Health* **6 Suppl 2,** S196–210 (2009).

314. Chaudhury, M. & Shelton, N. Physical activity among 60-69-year-olds in England: Knowledge, perception, behaviour and risk factors. *Ageing Soc.* **30,** 1343–1355 (2010).

315. Heinrich, K. M., Maddock, J. E. & Bauman, A. Exploring the relationship between physical activity knowledge, health outcomes expectancies, and behavior. *J. Phys. Act. Health.***8,** 404–409 (2011).

316. Lee, I. M. & Buchner, D. M. The importance of walking to public health. *Med. Sci. Sports Exerc.* **40,** S512–S518 (2008).

317. Marshall, S. J. *et al.* Translating physical activity recommendations into a pedometer-based step goal: 3000 steps in 30 minutes. *Am. J. Prev. Med.* **36,** 410–415 (2009).

318. Himann, J. E., Cunningham, D. A., Rechnitzer, P. A. & Paterson, D. H. Age-related changes in speed of walking. *Med. Sci. Sports Exerc.* **20,** 161–166 (1988).

319. Morabia, A. & Costanza, M. C. Does walking 15 minutes per day keep the obesity epidemic away? Simulation of the efficacy of a populationwide campaign. *Am. J. Public Health* **94,** 437–440 (2004).

320. Rafferty, A. P., Reeves, M. J., McGee, H. B. & Pivarnik, J. M. Physical activity patterns among walkers and compliance with public health recommendations. *Med. Sci. Sports Exerc.* **34,** 1255–1261 (2002).

321. Rhodes, R. E. & Pfaeffli, L. a. Mediators of physical activity behaviour change among adult non-clinical populations: A review update. *Int. J. Behav. Nutr. Phys. Act.* **7,** 37–47 (2010).

322. Bouten, C. V, Koekkoek, K. T., Verduin, M., Kodde, R. & Janssen, J. D. A triaxial accelerometer and portable data processing unit for the assessment of daily physical activity. *IEEE Trans. Biomed. Eng.* **44,** 136–147 (1997).

323. Department of Health. *Let's get moving: Commisioning guidance - a physical activity care pathway*. (2012).

324. TNS Opinion & Social. *Special Eurobarometer 412: Sport and physical activity*. (2014).

Appendices

Appendices

Appendix 1	Full publications list and copies of published articles
Appendix 2	Survey items used in Chapter 4
Appendix 3	Example of an invitation letter to complete the online survey used in Chapters 3, 5 and 6
Appendix 4	Survey items used in Chapters 3, 5 and 6
Appendix 5	JISC mailing list subscribers to which the online survey in Chapters 3, 5 and 6 was deployed

Appendix

1

Journal publications and conference presentations relating to the present thesis

Journal articles

Knox, ECL., Piggin, J., Biddle, SJH & Sherar, LB. Accounting for sitting and moving: An analysis of sedentary behaviour in mass media campaigns. *Journal of Physical Activity and Health,* In Press.

Knox, ECL., Webb, OJ., Esliger, DW., Biddle, SJH. & Sherar, LB. (2014). Using threshold messages to promote physical activity: Implications for public perceptions of health effects. *European Journal of Public Health, 24:* 195-199.

Knox, ECL., Esliger, DW., Biddle, SJH. & Sherar, LB. (2013). Lack of knowledge of physical activity guidelines: can physical activity promotion campaigns do better? *BMJ: Open, 3*:

Papers under review

Knox ECL., Biddle, SJH., Taylor, IM., Latimer-Cheung, A., Webb, OJ. & Sherar, LB. Messages to promote physical activity: Are descriptors of required duration and intensity related to intentions to be more active? *Journal of Education and Health Promotion,* under review.

Knox, ECL., Taylor, IM., Biddle, SJH. & Sherar, LB. Knowledge of physical activity guidelines does not prevent overestimation of physical activity engagement in adults. *Health Promotion Practice,* under review.

Conference presentations

Effects of exemplars of moderate-to-vigorous physical activity on cardiometabolic health: Implications for media campaigns (Mini-oral). The International 22nd Puijo Symposium, Kuopio, 24th – 28th June, 2014.

Messages to promote physical activity: Are descriptors of required duration and intensity related to intentions to be more active? (Poster). 2014 Annual Meeting of the International Society for Behavioural Nutrition and Physical Activity, San Diego, 21st – 24th May, 2014.

Messages to promote physical activity: Are descriptors of required duration and intensity related to intentions to be more active? (Oral). Health & Wellbeing Research Conference, Loughborough, 17th February, 2014. Awarded second best oral presentation.

Is knowledge of physical activity guidelines motivationally beneficial for behaviour change? Results from a national survey (Mini-oral). 18th Annual Congress of the European College of Sport Science, Barcelona, 26th – 29th June, 2013.

Are optimistic perceptions of physical activity behaviour a problem in physical activity promotion? Results from a national survey (Mini-oral). 18th Annual Congress of the European College of Sport Science, Barcelona, 26th – 29th June, 2013.

Socio-demographic influences on knowledge of physical activity guidelines (Poster). 2013 Annual Meeting of the International Society for Behavioural Nutrition and Physical Activity, Ghent. 22nd – 25th May, 2013.

Impact of threshold messages on the perceived relationship between physical activity and health (Poster). British Society for Population Studies annual conference 2012, University of Nottingham, 10th – 12th September, 2012.

Impact of threshold messages on the perceived relationship between physical activity and health (Oral). 17th Annual Congress of the European College of Sport Science, Bruges, 4th – 7th July, 2012.

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JPAH In Press

Accounting for Sitting and Moving: An Analysis of Sedentary Behaviour in Mass Media Campaigns

Section: Original Research

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Abstract

Background: Mass media campaigns are an important tool for promoting health-related physical activity. The relevance of sedentary behaviour to public health has propelled it to feature prominently in health campaigns across the world. This study explored the use of messages regarding sedentary behaviour in health campaigns within the context of current debates surrounding the association between sedentary behaviour and health, and messaging strategies to promote moderate-to-vigorous physical activity (MVPA). **Methods**: A web-based search of major campaigns in the UK, US, Canada and Australia was performed to identify the main campaign from each country. A directed content analysis was then conducted to analyse the inclusion of messages regarding sedentary behaviour in health campaigns and to elucidate key themes. Important areas for future research were illustrated. **Results**: Four key themes from the campaigns emerged: clinging to sedentary behaviour guidelines, advocating reducing sedentary behaviour as a first step on the activity continuum and the importance of light activity, confusing the promotion of MVPA and the demonization of sedentary behaviour. **Conclusions**: Strategies for managing sedentary behaviour as an additional complicating factor in health promotion are urgently required. Lessons learned from previous health communication campaigns should stimulate research to inform future messaging strategies.

Keywords: Health promotion, messages, physical activity

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Using threshold messages to promote physical activity: implications for public perceptions of health effects

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Background: The promotion of physical activity (PA) guidelines to the general public is an important issue that lacks empirical investigation. PA campaigns often feature participation thresholds that cite PA guidelines verbatim [e.g. 150 min/week moderate-to-vigorous physical activity (MVPA)]. Some campaigns instead prefer to use generic PA messages (e.g. do as much MVPA as possible). 'Thresholds' may disrupt understanding of the health benefits of modest PA participation. This study examined the perception of health benefits of PA after exposure to PA messages that did and did not contain a duration threshold. Methods: Brief structured interviews were conducted with a convenience sample of adults (n = 1100). Participants received a threshold message (150 min/ week MVPA), a message that presented the threshold as a minimum; a generic message or no message. Participants rated perceived health effects of seven PA durations. One-way analyses of variance with post hoc tests for group differences were used to assess raw perception ratings for each duration of lts: Recipients of all three messages held more positive perceptions of >150 min/week of MVPA relative to those not receiving any message. For MVPA durations <150 min/week, the generic PA message group perceived the greatest health benefits. Those receiving the threshold message tended to have the least positive perceptions of durations
<150 min/week. Conclusion: Threshold messages were associated with lower perceived health benefits for modest PA durations. Campaigns based on threshold messages may be limited when promoting small PA increases at a population level.

Introduction

Physical activity (PA) reduces risk of morbidity and mortality from chronic diseases.[1,2] Approximately 65% of Western adults self-report insufficient levels of PA.[1,3] Studies using objective measurements show lower compliance with PA guidelines, at ""5% in adults.[1,4] Increasing population PA therefore is a public health priority.[1,2] Mass-media campaigns reach large sections of the population.[5] To optimize effects, researchers have examined how message characteristics influence their persuasive appeal. Investigators have explored descriptive versus injunctive norms,[6] fear appeals,[7] tailoring,[8] gain/loss framing,[8,9] source credibility[9] and specificity.[10] One issue yet to be examined in the PA messaging field is the impact of 'threshold' information.

In behavioural domains, threshold messages implore individuals to attain a specified volume of behaviour (e.g. five fruit/vegetable portions a day). Many PA campaigns feature thresholds. For instance, the UK's 'Change4Life' campaign[11] and Singapore's 'Physical Activity Programme[12]' encourage 150 min of moderate-to-vigorous physical activity (MVPA) per week. Similarly, earlier campaigns promoted 30 min of MVPA per day, e.g. 'Get Active America' (US)[13], 'Get a Life, Get Active' (Northern Ireland)[14] and 'Find Your Thirty' (Australia).[15] Essentially, these campaigns directly cited PA guidelines of the day [(e.g. 'Swap 4 wheels for me own 2 feet to get me going for 150 minutes a week' (Change4Life); '30 min of regular activity a day is good for your health' (Get a Life, Get Active)].

Guidelines provide essential information on the minimum level of PA needed for health benefits. Consequently, they are invaluable for surveillance, planning interventions and policy. However, PA guidelines were not made to motivate individuals to adhere to being active. Brawley and Latimer[16] discuss the importance of packaging the guidelines into messages that (i) offer specific content, (ii) are based on scientific recommendations and (iii) encourage specific targeted groups to meet the guidelines. The current popular approach of presenting the 150-min threshold in mass-media campaigns achieves these first two aims. Promoting 150 min/week of PA is instructive and optimally beneficial to health. However, it could also be argued that messages encouraging lower levels of PA also meet these criteria. Scientific evidence, based on a simple dose–response curve, suggests that participation in <150 min/week of PA also carries health benefits, but likely at lower levels of potency.[17] This is especially true for those who are very inactive.[18] Uncertainty surrounds the success of messages that contain a threshold in motivating improved PA behaviour. Goal Theory proposes that for a goal to be motivational it must be specific, measurable, attainable, realistic and time-managed.[19] With the average adult engaging in just 42–77 min/week of MVPA.[1,4] an increase to 150 min/week is likely to be considered unrealistic for many.[20] Goal Theory suggests that a goal closer to 90 min/week would, in this context, be more beneficial from a motivation perspective. Brawley and Latimer[16] state in their final principle for message development that the message should help the individual strive towards the recommendations. An increase from, for instance, 42 to 90 min/week still represents a move

BMJ Open

Lack of knowledge of physical activity guidelines: can physical activity promotion campaigns do better?

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ABSTRACT

Objectives: To identify the prevalence of knowledge of the current UK physical activity guidelines which were introduced in 2011 and prior physical activity guidelines (30 min on 5 days each week) within two large samples of UK adult's. To investigate whether knowledge of physical activity guidelines differs according to demographics such as ethnicity, age, education and employment status.

Design: Descriptive cross-sectional study comparing two distinctive adult samples.

Setting: National survey and online-administered survey conducted in England.

Participants: The 2007 Health Survey for England provides data on knowledge of physical activity guidelines from 2860 UK adults (56% women, 89% white, 63% under 45 years old). In 2013, an online survey was disseminated and data were collected from 1797 UK adults on knowledge of the most recent physical activity guidelines. The 2013 sample was 70% women, 92% white and 57% under 45 years old. All adults in both samples were >18 years old and without illnesses/disorders likely to restrict physical activity.

Main outcomes: Knowledge of physical activity guidelines in 2007 and 2013. Demographic correlates of knowledge of moderate-to-vigorous physical activity guidelines.

Results: 18% of the 2013 sample accurately recalled the current physical activity guidelines compared with 11% of the 2007 sample who accurately recalled the previous guidelines. The differences in knowledge of physical activity guidelines existed for marital status, gender, age, education and employment status within both 2007 and 2013 samples ($p<0.05$). Men with lower education and employment status (unemployed including student and retired) and older adults were less likely to know physical activity guidelines ($p<0.05$). Knowledge of physical activity guidelines remained higher in the 2013 sample after controlling for demographic differences ($p<0.05$).

Conclusions: Disadvantaged population groups are less knowledgeable about physical activity guidelines. Although knowledge of physical activity guidelines appears to have increased in recent years demographic disparities are still evident. Efforts are needed to promote health information among these

Strengths and limitations of this study

- The present study is limited because of differences between the two surveys. Health Survey for England 2007 was delivered via face-to-face interviews whereas the 2013 survey was deliv- ered online.
- Furthermore, convenience sampling was used for the 2013 survey with an over-representation of females and employed adults.
- Strengths of the study are that demographic variables, including ethnicity and age, were similar between the surveys, while employment status and age were statistically controlled for and did not influence our outcomes. We therefore believe that comparisons between both surveys are valid. In addition, the large sample size strength- ens the present research.

BACKGROUND

Physical activity (PA) reduces the risk of morbidity and mortality from chronic diseases.[1] Increasing evidence of the importance of PA to health has led to the promotion of a 'PA is Medicine' agenda and calls for global PA policies.[2 3]

In 1975, the first form of PA recommendations for adults were released in the USA by the American College of Sports Medicine.[4] By 1995, American adults were being advised to accumulate at least 30 min of moderate-to-vigorous PA (MVPA), on preferably all days, each week.[5] In 1996 in England, the Department of Health followed similar guidelines from the ACSM and recommended 30 min of MVPA on at least 5 days/week.[6] Over the past few years, there has been a shift within the UK and globally towards more uniform guidelines. In 2008, the first PA guidelines for Americans to be issued by the Federal government were published following a comprehensive expert's review of scientific data. These guidelines were the first to state recommendations specifically as 150 min/week of MVPA.[7] Previously, guidelines in the UK had

Appendix

2

Interview schedule used in Chapter 4

1) Do you know what current guidelines are for getting physical activity? **C150**

90	120	150	180	210

OR:

	25	30	35
Less 5d	Most	5d	All

AND:

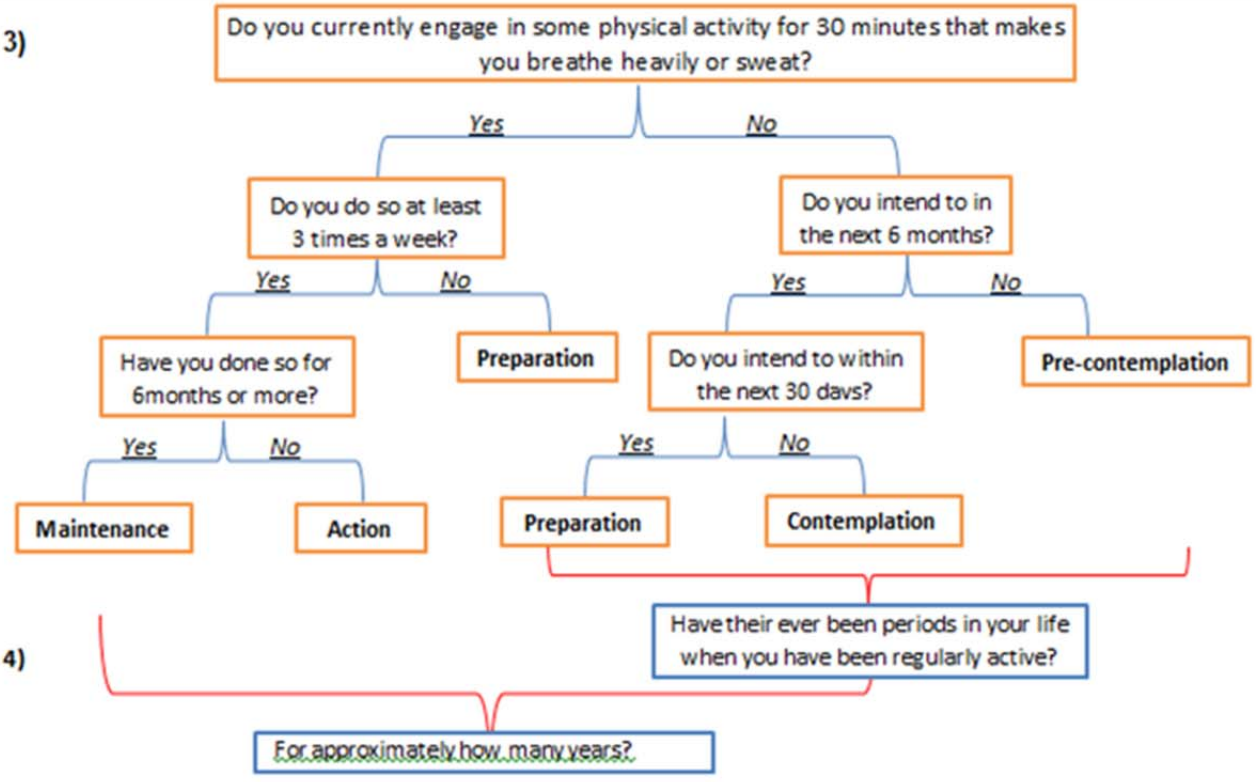
Light	Moderate	Vigorous

'Regular physical activity, such as brisk walking, protects your health. Each week, adults should accumulate 150 minutes of physical activity'

2) Now that you know the guidelines think of a typical (fe)male. Use the scale below to show what effect you think 70 mins of PA would have on their health?

	Strong Negative Effect							No Effect							Strong Positive Effect
70 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
10 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
230 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
130 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
150 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
290 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
170 mins	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7

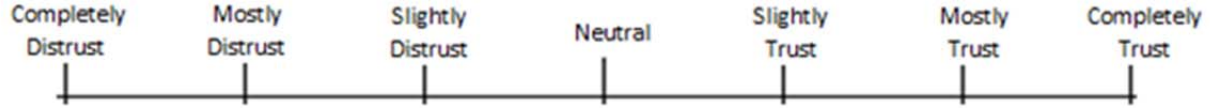
3)



4) Have their ever been periods in your life when you have been regularly active?

For approximately how many years?

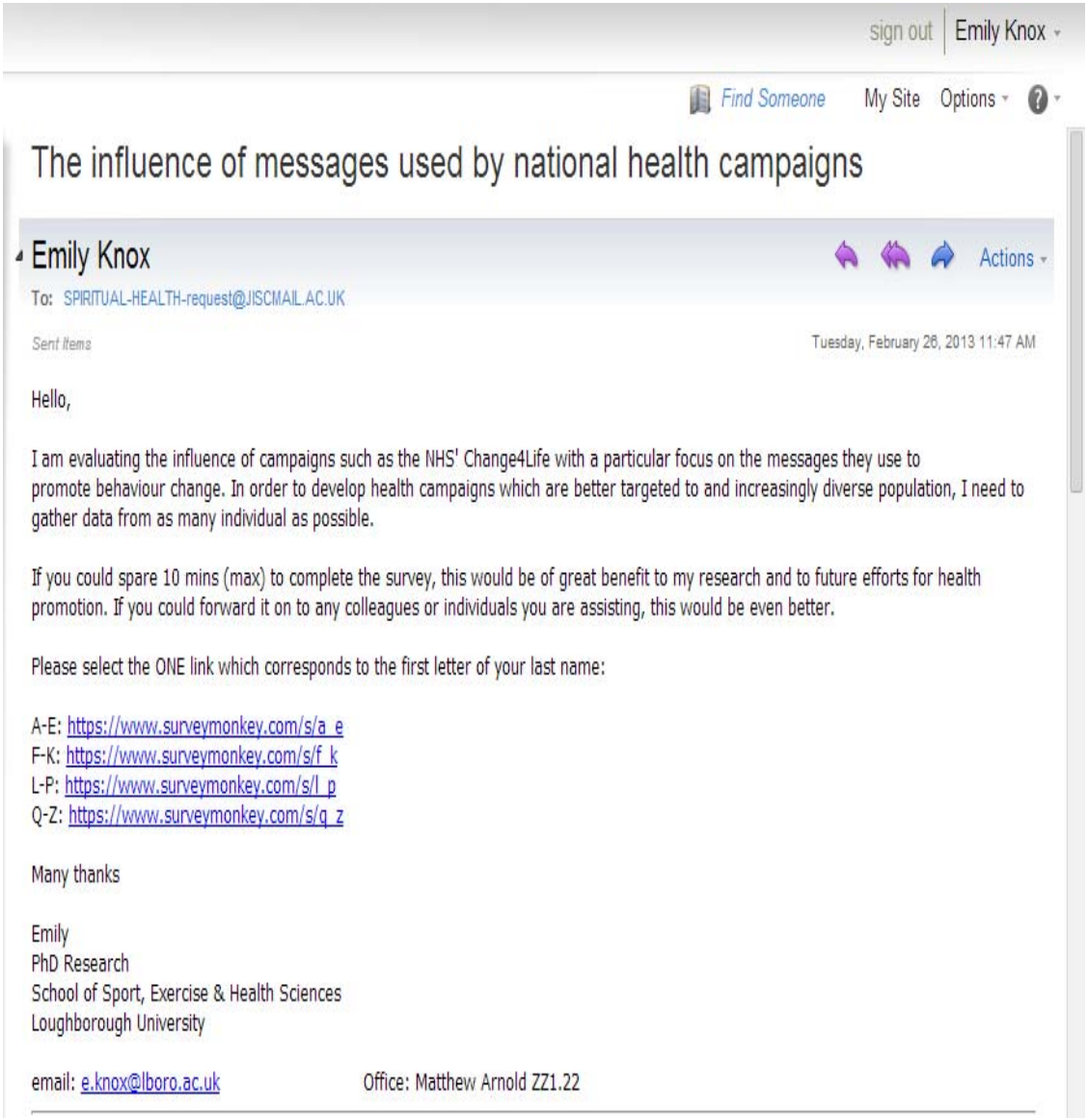
5) Please indicate on a scale below the extent to which you trust the current physical activity guidelines?



Appendix

3

Example of an invitation letter to complete the online survey used in Chapters 3, 5 and 6


sign out
Emily Knox
Find Someone
My Site
Options
The influence of messages used by national health campaigns
Emily Knox
Actions
To: SPIRITUAL-HEALTH-request@JISCMAIL.AC.UK
Sent Items
Tuesday, February 26, 2013 11:47 AM
Hello,
I am evaluating the influence of campaigns such as the NHS' Change4Life with a particular focus on the messages they use to promote behaviour change. In order to develop health campaigns which are better targeted to and increasingly diverse population, I need to gather data from as many individual as possible.
If you could spare 10 mins (max) to complete the survey, this would be of great benefit to my research and to future efforts for health promotion. If you could forward it on to any colleagues or individuals you are assisting, this would be even better.
Please select the ONE link which corresponds to the first letter of your last name:
A-E: https://www.surveymonkey.com/s/a_e
F-K: https://www.surveymonkey.com/s/f_k
L-P: https://www.surveymonkey.com/s/l_p
Q-Z: https://www.surveymonkey.com/s/q_z
Many thanks
Emily
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School of Sport, Exercise & Health Sciences
Loughborough University
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Office: Matthew Arnold ZZ1.22

Appendix

4

Survey items used in Chapters 3, 5 and 6

1. Introduction

This questionnaire is part of a research study run at Loughborough University and is for UK BASED individuals ONLY. The questionnaire asks about your involvement in different health activities. The questionnaire should take approximately 10 minutes to complete.

All information you provide in this questionnaire will be anonymous and completely confidential. All information will be held by Loughborough University, will be used only for the purposes of research, and its storage and usage will conform to the requirements of the Data Protection Act (1998).

Taking part in this study is voluntary. You are under no obligation to complete this questionnaire, and are free to withdraw from the study at any point. You are even free to withdraw from the study after completing the survey by contacting the researcher and asking for the information to be destroyed.

If you have any questions or comments please contact the researcher: Emily Knox at Loughborough University
Tel: 07534746477 or Email: E.Knox@lboro.ac.uk

Thank you for taking the time to complete the questionnaire. We value your responses.

Proceed to the survey if you consent to participate in this research

Next

Walk Th Short form JISC

Exit this survey

Demographics

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Loughborough University

It would be helpful if we could have a little information about you. This is so we can compare groups based on demographic characteristics. However, you are free to skip any question if you do not want to provide this information.

1. Select one option from each drop down box. Any information you provide is entirely confidential.

	Gender	Age	Ethnic background	Marital status	Highest level of education	Current employment status
Demographics						

Previous Next

Health Status

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Loughborough University

The next question refers to your perception of your current health

*** 2. Using the 5-point scale provided below please rate your CURRENT health status**

	Poor	Rather poor	Average	Rather good	Good
I would say that my health currently is					

Previous Next

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Loughborough University

*** 3. 'In the past week, on how many days have you done a total of 30 min or more of physical activity, which was enough to raise your breathing rate?**

This may include sport, exercise and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job'.

Previous Next

Sedentary Time

*** 4. This question is about the time that you spent SITTING during the last 7 days. Include time at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, sitting in a motor wehicle, reading or sitting or lying down to watch television.**

During the LAST 7 DAYS, how much time in total did you usually spend sitting on a WEEKDAY?

During the LAST 7 DAYS, how much time in total did you usually spend sitting on a WEEKEND day?

Previous Next

Media Message

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Loughborough University

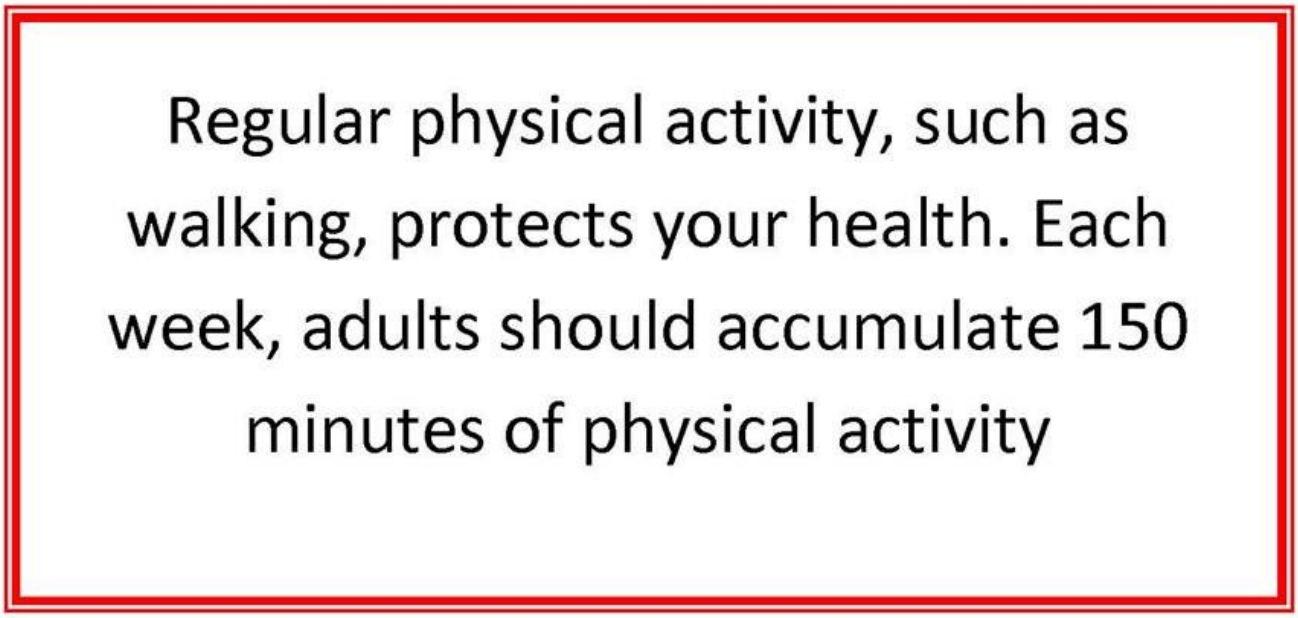
You will now be presented with an informative message about physical activity. The message is representative of messages used in public health campaigns. It is important that you fully read the message as it provides important information about physical activity and should be considered when answering the questions which follow.

Previous Next

Walk Th Short form JISC

Exit this survey

Message



Previous Next

Physical Activity Behaviour

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'Regular physical activity, such as walking protects your health. Each week, adults should accumulate 150 minutes of physical activity'.

Now that you have read this physical activity message, we would like to know what you think about your current engagement in physical activity.

*** 5. Please complete the following statement by selecting one of the five options.**

My level of physical activity is...

- Very Low
- Somewhat Low
- Sufficient
- Somewhat High
- Very High

Previous Next

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Loughborough University

The questions on the following pages will ask you about moderate-to-vigorous physical activity. Here, PHYSICAL ACTIVITY IS DEFINED AS - activities such as walking which also last for at least 10 minutes without stopping. Please use this definition when responding to the following questions.

*** 6. To what extent do you feel that you need to engage in more moderate-to-vigorous physical activity in the next 6 months?**

Definitely not necessary	Unnecessary	Moderately unnecessary	Somewhat unnecessary	Undecided	Somewhat necessary	Moderately necessary	Definitely necessary
○	○	○	○	○	○	○	○

*** 7. How likely do you think you are to experience or develop the following (heart disease, cancer, ill health and weight gain) at some time in the future, because of the amount of physical activity you do?**

Extremely unlikely	Very unlikely	Moderately unlikely	Somewhat unlikely	Undecided	Somewhat likely	Moderately likely	Very likely	Extremely likely
○	○	○	○	○	○	○	○	○

Previous Next

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Loughborough University

NOTE: Moderate-to-vigorous physical activity = activities such as walking which also last for at least 10 minutes without stopping.

*** 8. To what extent do you agree with the following statement?**

I am _____to regularly engage in more moderate-to-vigorous physical activity

	Completely agree	Mostly agree	Slightly agree	Unsure	Slightly disagree	Mostly disagree	Completely disagree
motivated	○	○	○	○	○	○	○
planning	○	○	○	○	○	○	○
determined	○	○	○	○	○	○	○

Previous Next

Physical Activity Influences

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Loughborough University

NOTE: Moderate-to-vigorous physical activity = activities such as walking which also lasts for at least 10 minutes without stopping.

*** 9. Most of the people who are important to me....**

	Strongly agree	Mostly agree	Slightly agree	Unsure	Slightly disagree	Mostly disagree	Strongly disagree
think I should engage in more moderate-to-vigorous physical activity	○	○	○	○	○	○	○
engage in sufficient moderate-to-vigorous physical activity themselves	○	○	○	○	○	○	○
influence my decisions regarding moderate-to-vigorous physical activity	○	○	○	○	○	○	○

Previous Next

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Loughborough University

NOTE: Moderate-to-vigorous physical activity = activities such as walking and which also last for at least 10 minutes without stopping.

*** 10. Engaging in more moderate-to-vigorous physical activity each week would be...**

	Completely agree	Mostly agree	Slightly agree	Unsure	Slightly disagree	Mostly disagree	Completely disagree
Useless	○	○	○	○	○	○	○
Harmful	○	○	○	○	○	○	○
Wise	○	○	○	○	○	○	○
Enjoyable	○	○	○	○	○	○	○
Pleasant	○	○	○	○	○	○	○
Boring	○	○	○	○	○	○	○

Previous Next

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Loughborough University

NOTE: Moderate-to-vigorous physical activity = activities such as walking which also last for at least 10 minutes without stopping.

*** 11. Engaging in more moderate-to-vigorous physical activity each week will...**

	True	Moderately true	Slightly true	Undecided	Slightly false	Moderately false	False
make me feel good	○	○	○	○	○	○	○
increase my fitness	○	○	○	○	○	○	○
improve my appearance	○	○	○	○	○	○	○
help relieve stress	○	○	○	○	○	○	○
take too much time	○	○	○	○	○	○	○

Previous Next

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*** 12. Using the scale provided below, please state how important the listed outcomes are to you at this moment in time**

	Not important	Somewhat important	Moderately important	Important
Feel good	○	○	○	○
Improve your health	○	○	○	○
Improve your appearance	○	○	○	○
Relieve stress	○	○	○	○
Increase your fitness	○	○	○	○

Previous Next

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NOTE: Moderate-to-vigorous physical activity = activities such as walking which also last for at least 10 minutes without stopping.

*** 13. Using the scale provided, please rate how likely the listed barriers are to prevent you from engaging regularly in more moderate-to-vigorous physical activity**

	Extremely likely	Likely	Somewhat likely	Unsure	Somewhat unlikely	Unlikely	Extremely unlikely
Bad weather	○	○	○	○	○	○	○
Lack of time	○	○	○	○	○	○	○
Lack of facilities	○	○	○	○	○	○	○
Feeling tired	○	○	○	○	○	○	○

Previous Next

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NOTE: Moderate-to-vigorous physical activity = activities such as walking which also last for at least 10 minutes without stopping.

*** 14. To what extent do you agree with the statements below?**

	Strongly disagree	Disagree	Disagree somewhat	Undecided	Agree somewhat	Agree	Strongly agree
Whether or not I regularly engage in more moderate-to-vigorous physical activity is completely up to me	○	○	○	○	○	○	○
If it were completely up to me I am confident I would be able to engage in more moderate-to-vigorous physical activity	○	○	○	○	○	○	○

Previous Next

Working Conditions

15. The following questions concern your experiences while at work/studying. Please tell us whether or you agree with the following statements

If you are not currently employed and/or studying, please skip this question

At work/whilst studying....

- I am expected to carry out tasks I don't always fully agree with
- I have a high work load
- I often have to rush to get things done
- I am often interrupted from my work
- Some tasks require a lot of time and effort
- I often work independently
- I can be creative
- My job/subject matches my skills and expertise
- Tasks are often repetitive
- I have power over many of the decisions made about my job/study
- Tasks are diverse
- I have opportunities to learn new things
- There is potential for me to develop my potential

16. If you are not currently employed and/or studying, please skip this question

Please tell us whether you agree with the following statements...

- I feel totally worn out after a day at work/studying
- I feel tired in the morning when I have to get up and go to work/study
- I have to work too hard
- I feel like I am totally exhausted
- My work is definitely too stressful
- I worry about my work even when I am off duty/not at university

Environment

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*** 17. The following question asks about the environment in which you live**

In my neighbourhood...

	True	Moderately true	Slightly true	Undecided	Slightly false	Moderately false	False
most places to buy things I need are within easy walking distance of my residence	○	○	○	○	○	○	○
there are several free or low cost facilities, such as parks, paths, and recreation centres	○	○	○	○	○	○	○
there are many attractive natural sights	○	○	○	○	○	○	○

Previous Next

Knowledge of Physical Activity Guidelines

*** 18. What are the physical activity guidelines?**

If you don't know just state 'Don't know'.

Previous Next

Physical Activity Guidelines

19. What are the physical activity guidelines? Please reconsider this question in terms of

- Number of minutes per week

- Number of minutes per day and number of sessions per week

- Intensity

If your answer is the same as Q18 then leave blank.

Previous Next

Perception of moderate to vigorous physical activity

*** 20. What effort would YOU associate with the following three descriptions of physical activity?**

e	No exertion at all	Extremely light	Very light	Light	Somewhat hard	Hard	Very hard	Extremely hard	Maximal exertion
Moderate-to-vigorous	○	○	○	○	○	○	○	○	○
Walking	○	○	○	○	○	○	○	○	○
Activity which causes you to breathe harder, sweat and raises your heart rate	○	○	○	○	○	○	○	○	○

Previous Next

Message Preferences

*** 21. The following questions refer to the physical activity message you were shown. The message you received was as follows...**

'Regular physical activity, such as walking, protects your health. Each week, adults should accumulate 150 minutes of physical activity'.

Below is a list of statements which relate to your perception of the message. Please rate your agreement with each statement on the scale provided

When I was FIRST shown the message....

	Completely Disagree	Disagree	Neutral	Agree	Completely Agree
I READ the message	○	○	○	○	○
I TRUSTED the message	○	○	○	○	○
I found the message INTERESTING	○	○	○	○	○
I found the message INFORMATIVE	○	○	○	○	○
I REMEMBERED the message	○	○	○	○	○
I LIKED the message	○	○	○	○	○

Previous Next

Survey Completed

The survey is now complete. Thank you for taking the time to complete this questionnaire.

Previous Done

Appendix

5

JISC mailing list subscribers to which the online survey in Chapters 5, 6 and 7 was deployed

JISCMail List	Topic	Subscribers
ACAD-AE-MED	Accident and Emergency Academic List	341
ACCESS-VOCATIONAL-GUIDANCE	Adult vocational guidance and counselling list	72
ACCESSIBUILT	Accessibuilt list	251
ACUMEN	Assembly for Comparative Urbanisation and the Material Environment	38
ACUPUNCTURE	Acupuncture research in the UK and beyond.	156
ADM-HEA	Announcements and discussion related to the activities of ADM-HEA	542
ADMIN-ARTDES	Art and Design Administration list	104
ADMIN-BUSINESS-INTELLIGENCE	List for discussion of business intelligence issues in HE/FE administration	277
ADMIN-DEVELOP	ADMIN-DEVELOP	1519
ADMIN-DISTANCE-LEARNING	Distance Learning programmes mailing list	219
ADMIN-EO	HEEON equal opportunities list	446
ADMIN-FINANCE	List for HE administrators interested in financial matters	414
ADMIN-GRAD	Topics in postgraduate administration mailing list	231
ADMIN-HEALTH	HE health care administrators mailing list	118
ADMIN-HEERA	HEERA (the Higher Education External Relations Association)	845
ADMIN-HEFCE	HEFCE alerts to higher education institutions	5254
ADMIN-MEDICA	Medical or Health care Schools and Faculties administrators list	94
ADMIN-PAYROLL	Payroll administration mailing list	113
ADMIN-PLANNING	Academic, financial or space planning in UK universities	933
ADMIN-SCOTS	Administrative issues of relevance to Scottish HEIs	158
ADMIN-SLC	List for discussions regarding Student Loans Company and Bursaries	426
admin-staff	This list provides a means for communication for HE and FE Administration	378
Admin-Student	Admin-student	808
ADMIN-TECHTRANS	Technology transfer mailing list	64
AHFAP	AHFAP, for image professionals in the UK cultural heritage sector	150
ALL-AE	ALL-AE	37
ALS	Additional Learning Support Managers in FE	51
AMIELGBT	Association of Managers in Education (AMiE) Lesbian Gay Bisexual Transgender (LGBT) Mailing List	17
ARC-APG	ARC Assessment Practitioners Group	252
ARCAPG	ARC Admissions Practitioners' Group	217
ARCHIVES-NRA	Archivists, conservators and records managers.	4249
ARCLIB-MEMBERS	Architecture Librarians group	113
ARMA	Research management and administration issues, UK or overseas.	1574
ARMA-ETHICS-RG	Discussion forum for research ethics and governance	245
ASSISTECH	A discussion list for Assistive Technology professionals.	322
AT-TRAINERS	Assistive Technology Trainers	98
ATHENS	Discussion list for OpenAthens Administrators	184

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- Manual workers
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- Therapists
- Library/Records
- Community/Environment
- Other

JISCMail List	Topic	Subscribers
ATTITUDES	Attitudes Research	43
AUA-MCHE	AUA - Managing Change in HE	880
BARSPOSTGRAD	Postgraduate members of the British Association for Romantic Studies	26
BIOLOGY-TEACHING	Biology-teaching mailing list	126
BISA-RESEARCH	BISA Postgraduate Network	722
BOB-NATIONAL-ADMIN	BoB National Administrators & Development	74
BRITISH-IRISH-POETS	British & Irish poets	304
BSA-WORK-EMPLOYMENT-ECONOMICLIFE	BSA STUDY GROUP ON WORK, EMPLOYMENT AND ECONOMIC LIFE	177
BSATG	BSA Teaching Group	148
BUSINESS-ETHICS	The purpose of this list is to facilitate networking on business ethics.	146
BUSINESS-INFORMATION-ALL	Business-Information-All mailing list	167
BUSINESS-PROCESS-MANAGEMENT	Business Processes	254
BUSINESS-RESEARCH	Business Research mailing list	296
BUSINESSDISCOURSENET	The mailing list for Business Discourse researchers and teachers	91
CHIRAD	UK Health Informatics R&D intelligence	29
CLASSICS-TEACHING	Learning and Teaching in Classics	72
CMHN-EDUCATION-AND-PRACTICE	Training of community mental health nurses in the UK.	42
COMMUNITY-DEVELOPMENT	Managing community led projects	98
COMMUNITY-HEALTH	The Community Health Workers List	67
COMPASSIONATECOMMUNITIES	Compassionate Communities	16
CONSUMER-HEALTH-INFORMATICS	For developers/evaluators of computerised info for patients/public.	115
CRITICAL-MANAGEMENT	Critical Perspectives on Work, Management and Organization	644
DC-LIBRARIES	DCMI Libraries Community	293
DENTAL-HEALTH	Dental and oral public health issues	90
DIST-NURSE	District nursing	33
EMFEESTNETWORK	East Midlands FE Estates Managers Network	22
ENGINEERING-ALL	This is the super-list for the engineering group of lists.	210
ENGLISH-HEACADEMY	Discussion and information on teaching and learning in English studies	428
ENRGHISED	Early career researcher forum for health geography	115
ESEE-STUDENTS	ESEE students and early career researchers	80
EVENT-MANAGEMENT	Special event, festival, conference and exhibition management	264
EVIDENCE-BASED-HEALTH	Evidence based health (EBH)	1927
FACS-EVENTS	FACS events	104
FAST	Forum for the Analysis of Sport Technology	30
FORENSIC-EDUCATION	For teachers of forensic science in HE	140
FUEL-POVERTY-POSTGRADUATES	Fuel Poverty Postgraduate Network	25
GP-UK	GP-UK	266

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JISCMail List	Topic	Subscribers
HEA-ADMIN-NETWORK	Higher Education Academy Admin Network	47
HEALTH-CARE-MANAGEMENT	Developments in the management of Health-Care	171
HEALTH-EQUITY-NETWORK	The Health Equity Network (HEN)	587
HEALTH-FOR-ALL	World Health Organization's Health For All	188
HEALTH-PROMOTION	The field of health promotion	172
HEALTH-SERVICES-RESEARCH	A list for the Health Services Research Community.	576
HEALTHFUTURESUK	Policy Futures for UK Health	83
HEALTHPSYCHOLOGYPOSTGRADUATENET	Health Psychology Postgraduate Network	214
HEALTHWALKS	Health Walks mailing list	62
HPU	Health Promoting Universities.	76
HRM	Human Resource Management	184
I-NTERNET	knowledge e-promotion	12
IFG-PUBLIC-MANAGEMENT-RESEARCH	Institute for Government Public Management Research Network	177
INDUSTRIAL-RELATIONS-RESEARCH	Industrial relations research	366
IRISH-MIDWIFERY-EGROUP	IRISH-MIDWIFERY-EGROUP	304
JISC-BCE	JISC Business and Community Engagement	39
JISC-GECO-HEALTH	JISC GECO Geo and Health Discussion List	22
JISC-LLLWFE-SSBR	Lifelong Learning and WorkForce Development Programme support	90
JOBSHARE	LIS Job-sharers and Part-timers Discussion Group	99
KTP-MIDLANDS	Midlands KTP Office Managers Mailing List	41
LIBRARY-DESIGN	Library design	366
LIS-MEDICAL	UK medical/ health care library community / information workers	1609
MANAGEMENT-HISTORY	Research and Teaching in Management, Business and Labour History	311
MANAGEMENT-RESEARCH	For discussion of issues related to management research	415
MATURESTUDENTS	Mature Students Discussion List	59
MECCSA-POLICY	Media, Communications & Cultural Studies Association (MeCCSA) - Policy Network	203
MEDEV	Education in medicine, dentistry and veterinary medicine	1221
MINORITY-ETHNIC-HEALTH	Health of minority ethnic communities in the UK	570
NARRATIVE-HEALTH-RESEARCH	Narrative in health and related fields	242
NCCPE-SCE	Student-Community Engagement Network	150
NRICH-MAST	NRICH MaST Teacher announcement list	324
NRICH-MAST-TUTORS	NRICH MaST Tutor discussion mailing list	69
NURSING-POLICY	HE research & discussion in nursing policy	85
NUS-MATUREPARTTIME	NUS Mature and Part-time maillist	56
NUS-POSTGRAD	NUS list for discussion of issues around postgraduate education and	234
OCC-HEALTH	Occupational Health mailing list	1110
OCCENVMED	Occupational and environmental medicine and occupational health	229

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JISCMail List	Topic	Subscribers
PETROLEUM-DATA-MANAGEMENT	Petroleum Data Management	56
PHILOSOPHY-OF-MANAGEMENT	The BAM Philosophy of Management Mailing List	52
PMF	People Management Framework PMF User Group	37
POLICY-FUTURES-FOR-UK-HEALTH	The Future of UK Health Burdens, Challenges and Opportunities	63
POSTGRADHISTMEDFORUM	Postgraduate Forum for the History of Medicine	102
PSPGROUP	Psychosocial Studies Postgraduate Group	35
PUBLIC-HEALTH	A discussion forum and information resource for public health	921
RECORDS-MANAGEMENT-UK	The Information and Records Management Society mailing list	1690
SMALL-BUSINESS-ISSUES	Academic discussion relating to small business issues	177
SOCIAL-POLICY	Social-Policy is run by SPA for all social policy specialists	1379
SOCIAL-POLICY-POSTGRADUATE	Postgraduate members of Social Policy Association (SPA).	246
SOCIAL-POLICY-SWAP	Social Policy Learning and Teaching Support Network	206
SOCIAL-WORK-EDUCATION	social work	290
SOCIALWORK-ALCOHOL-DRUGS	List for social workers working with substance use issues	218
SOCIALWORK-HEALTHINEQUALITIES	Contacts and Members of SW and Health Inequalities Network	376
SPIRITUAL-HEALTH	Announcement list for the Spirituality and Health centre	26
SPORT-BUSINESS-MANAGEMENT	Announcement list for developments in Sport Business Management	82
SPRU-S	Research about social security, living standards and poverty/welfare issues	70
STUDENT-LED	Student-led Activity Discussion List	
STUDENT-RETENTION-AND-SUCCESS	Student Retention in HE	61
SWAP-ELEARNING	social-work-ltsn-elearning	
SWENT	South Wales Email Network of Therapists	450
TEACHER-RESEARCHER	Teacher researchers' list for the mentoring and coaching Special Interest Group	
TOTAL-QUALITY-CONSTRUCTION	Pursuit of excellence in the construction sector mailing list	64
UKSOCWORK	UKSOCWORK	210
UNISCIENCESTORES	University Science Store Managers	69
WERC-OLDER-PEOPLE-RESEARCH	Wales Ethnicity Research Collaboration: A focus on Older People	55
XERTEFORTEACHERS	A list to facilitate and support teachers using Xerte Online Toolkits	164
STUDENT-ACTIVITIES	NUS Student Activities	23
STUDENT-MEDIA	student media	15
STUDENT-WELFARE	Campaigns Network	

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