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Lack of Knowledge of Physical Activity Guidelines: Can Physical Activity Promotion Campaigns Do Better?

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Knowledge of Physical Activity Guidelines: Can Promotion Campaigns Do Better? Knox, ECL. Esliger, DW. Biddle, SJH & Sherar, LB.

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Word Count: 2,896

Objectives: To identify the prevalence of knowledge of the current UK physical activity guidelines which were introduced in 2010 and prior physical activity guidelines (30 minutes 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 2,860 UK adults (56% female, 89% white, 63% under 45 years old). In 2013 an online survey was disseminated and collected data from 1,797 UK adults on knowledge of the most recent physical activity guidelines. The 2013 sample was 70% female, 92% white, 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 influences on knowledge of physical activity guidelines.

Results: 18% of the 2013 sample accurately recalled current physical activity guidelines relative to 11% of the 2007 sample who accurately recalled the previous guidelines. Differences in knowledge of physical activity guidelines existed for marital status, gender, age, education and employment status within both 2007 and 2013 samples ($p<.05$). Males with lower education and employment status and older adults were less likely to know physical activity guidelines ($p<.05$). Knowledge of physical activity guidelines remained higher in the 2013 sample after controlling for demographic differences ($p<.05$).

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 amongst these groups.

Article Summary

Article Focus

- What was the prevalence of knowledge of physical activity guidelines in 2007?

- How did knowledge of physical activity guidelines change after being updated in 2010?

- Which demographic factors (gender, age, employment status, education and health) appear to influence knowledge of physical activity guidelines?

Key Messages

- The Department of Health has invested large amounts of money into the promotion of physical activity guidelines since the introduction of new guidelines in 2010.

- Knowledge of current physical activity guidelines within the UK adult population is not known.

- It is important to gage current knowledge and demographic influences on knowledge in order to improve promotion of physical activity guidelines by informational campaigns.

Strengths and Limitations

- The present study is limited because of differences between the two surveys. HSE 2007 was delivered via face-to-face interviews whereas the 2013 survey was delivered online.

Furthermore, convenience sampling was used for the 2013 survey with an over-representation of females and employed adults. However, other demographic variables, including ethnicity and age, were similar between the surveys, whilst employment status and age were statistically controlled for. We therefore believe that comparisons between both surveys are valid. In addition, the large sample size strengthens the present research.

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing Interests

None declared

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 United States (US) by the American College of Sports Medicine [4]. By 1995, American adults were being advised to accumulate at least 30 minutes 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 minutes of MVPA on at least 5 days a 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 Federal government were published following a comprehensive review of the scientific data by experts in the field. These guidelines were the first to state recommendations specifically as 150 minutes a week of MVPA [7]. Previously, guidelines in the UK had been disseminated separately by health agencies within each home country. In 2010 the four UK Chief Medical Officers published the first UK-wide PA guidelines [8]. 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 PA guidelines issued by the World Health Organisation [9].

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 [10]) and *'Get going for 150 minutes a week'* (Change4Life launched across the UK in 2009 [11]). The purpose of these campaigns is to encourage adults to reach or exceed PA guidelines.

In 2008, only ~5% of UK and US adults engaged in enough MVPA to meet recommendations [12, 13]. Theories such as the Precaution Adoption Process model (PAPM) and Protection Motivation Theory suggest that individuals must be accurately aware of their current actions [14-16], such as through self-monitoring [17], in light of alternative and desired actions to be able to initiate change i.e. I *do* this much MVPA but this much 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 [18]. 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 5 days a week were updated with 150 minutes a week, in 2010. Chaudhury and Shelton found that only 5% of UK adults aged 60-64 (N=561) accurately

recalled the general MVPA guideline in 2007 [19]. Less than 1% of adults (N=4,281) selected the correct guideline from a list of six options in a recent US survey [20]. 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 more powerful influence on behaviour change [21].

The objectives for this study are 1) to compare knowledge of current UK MVPA guidelines for adults (3 years after their introduction in 2010) with knowledge of prior MVPA guidelines (2004 up until 2010) in two large samples of adults, 2) to identify whether demographic characteristics such as, gender, age and SES, influence knowledge of PA guidelines at either time-point.

Methods

Survey and analytical sample.

Data were analysed from the 2007 Health Survey for England (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 [22]. 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. The present research excluded individuals aged <18 years and adults with health

conditions which restricted physical activity. This resulted in 4,491 eligible adults from which 2,860 had valid data for knowledge of contemporary (2004) PA 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). Staff from academic institutions, professional organisations (NHS, teaching bodies, trade unions etc.), and those attached to independent businesses were invited to complete the survey. Of the 2,332 respondents to the 2013 survey; 1,797 provided data for unprompted knowledge of current MVPA guidelines. Approval for the study was received from the host university ethics committee.

Measures

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 on 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 PA guidelines of 30 minutes/day and 5 days/week were considered correct [6].

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 [23]?'* 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 PA was included in analysis. Those who gave an answer consistent with current guidelines of 150 minutes/week were considered correct [8].

Statistical analysis.

Prevalence rates for UK adults with correct knowledge of MVPA guidelines in 2007 and in 2013 were calculated. Influences of gender, age, ethnicity, marital status, education, employment status and self-reported health were assessed using chi-squared analysis and standardised residuals adjusted for multiple comparisons (Bonferroni). Stepwise multiple logistic regression was used to investigate differences in knowledge between the 2007 HSE sample and the 2013 survey sample. Variables were selected based on chi-squared analysis, with significant demographic factors included in the model. IBM SPSS Statistics 19 was used with alpha set at 0.05.

Results

The 2007 HSE sample was: 56% female, 89% white and 63% under 45 years old. 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), 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 PA guidelines.

The 2013 survey sample was 70% female, 92% white and 57% under 45 years old. Without prompting, 18% accurately recalled the current PA recommendation. 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), students and single adults were more likely to recount old guidelines (30 minutes 5 days/week). Knowledge of guidelines according to demographic characteristics is shown in table one. Only 66% of individuals who recalled MVPA guidelines accurately recalled the intensity of PA 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 3% referred to intensity necessary to increase fitness, effort/exertion or used walking as an exemplar.

As gender was found to be an important moderator of knowledge of guidelines and differed between groups, a multiple logistic regression model was created to identify whether the gender difference accounted for differences in knowledge between 2007 and 2013 samples. In this model, adults from the 2007 HSE sample were significantly less likely to accurately recall MVPA guidelines (p<.001, OR=.58). Females were significantly more likely to be knowledgeable (p<. 05, OR=1.38). Education and employment status were then added to the

model. The difference between samples remained significant (p<.005 OR=.72). Only gender (p<.001) and education (p<.001) moderated the relationship between samples (2007 and 2013) and knowledge, accounting for 38% of the variance in knowledge of guidelines. In this model males (OR=.70) and those with the lowest education (OR=.57) were less likely to demonstrate accurate knowledge of guidelines.

Discussion

Results indicate that knowledge of PA guidelines has improved (11% to 18%) since guidelines were updated in 2010. However, in 2013, still only 18% of adult's 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. This is disappointing as improved knowledge of PA guidelines within the adult population would represent an initial step towards positive behaviour change. While knowledge alone is unlikely to stimulate behaviour change, awareness of the required behaviour is a determinant of behaviour change [24]. The PAPM suggests that individuals are unlikely to change their behaviour unless they become aware that their behaviour is not optimal [14]. Compared with 2007, adults in 2013 do not appear to be better educated regarding MVPA recommendations.

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 2010 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 [25]. Early publications from this campaign suggest it achieved high visibility and recall of its messages within target populations [25, 26]. While knowledge does appear to be moving in the right direction (at least for 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 [27]. Indeed, a search of PA campaign messages released since 2010 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'* while an advert released only a few months previously for MacMillan's Move More campaign suggested, *'Just a short walk can help…'* For World Physical Activity Day 2011 a Coca Cola sponsored advert reads *'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, 9% of adults from the 2013 sample reported the old guideline (2004-2010) when asked to recall the current guideline (2010). While the aforementioned messages are not necessarily incorrect if the aim is to promote PA generally, campaigns need to become more coherent if the strategy is to improve knowledge of guidelines. Indeed, the unification of US, UK and global PA guidelines will be undermined if the messages which follow are isolated and random [7-9]. The failure of PA 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 continuing lack of education pertaining to the guidelines, 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 PA guidelines. The Chief Medical Officers voiced concerns regarding the disproportionately low involvement in PA of disadvantaged groups in society [28]. Improved provision of information and opportunities

for these groups to engage in PA was a target of the government backed campaigns Change4Life and HealthyPeople [29, 30]. Despite these pledges, PA 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 SES, are urgently required. Secondly, adults generally consider only the duration component of PA recommendations. While the 2007 HSE sample were asked specifically for the recommended duration of PA, 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 13% did so. Only 2% 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 PA, the intensity of walking varies greatly within the population. Brisk walking is promoted by many PA campaigns as an example of MVPA, but in actuality, the walking performed by many is less than brisk [31, 32]. While such campaigns may increase the perceived accessibility of PA and cater to adults' PA preferences [33], they often fail to educate individuals about the necessity for PA 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 PA of low intensity but not sufficient PA to meet guidelines. In addition, adults may struggle to see the difference between their own current behaviours and the behaviour 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 [14]. 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 PA is not of a sufficient intensity. With the emergence of alternative strategies to improve health, for example, 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 [34-36]. Guidelines regarding sedentary behaviour have already been developed in Canada and Australia and current UK PA guidelines recommend developing sedentary behaviour guidelines as a priority [8, 37, 38]. The various discourses surrounding PA 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 PA is rapidly increasing, transmitting such knowledge to the general population may require more complex messages but an understanding of how to effectively develop such messages lags behind.

Knowledge of guidelines was low in the present study (i.e. 325 of 1,797 adults knew the duration component of MVPA guidelines); however, this is more than reported for American adults, where less than 1% knew PA guidelines when surveyed in 2009 (N=4,281) [20]. There are two possible reasons why knowledge was higher in the present study. Firstly, in this study, the PA guideline had been consistent for at least three years prior to both samples completing their respective surveys. In the American study, only 10 months separated dissemination of a changed guideline and completion of the survey. Indeed, 33.3% of American adults selected the old 30 minute 5 days per week guideline relative to 9% in the present study [20]. 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.

Conclusions

The present study identified knowledge of PA recommendations in two large UK adult samples from 2007 and 2013. Results indicate that knowledge of guidelines has slightly improved. This study has implications for future promotional campaigns. Messages need to be developed to target individuals with lower education and employment status. In addition, further research is needed to develop an effective strategy for promoting more comprehensive educational messages related to PA guidelines. Campaigns need to straddle the thin line between messages which capture awareness, and are informational and motivational. In the present study, only 2% of adults acknowledged that PA should be effortful. Intensity is an important aspect of health-enhancing PA and should not be neglected by PA campaigns. Increasing understanding of the intensity continuum will likely result in a broader range of PA being included in PA media campaigns. Messages from these campaigns need to work in synergy to ensure effective communication of the benefits of the various forms of accumulating PA.

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None

Competing Interests

None

Contributorship

EK initiated the study, designed the data collection tools (2013 survey), monitored data collection for the 2013 sample, planned the statistical analysis, cleaned and analysed the data for the whole study and drafted and revised the paper. She is guarantor.
DE revised the draft paper
SB revised the draft paper
LS revised the data collection tools (2013 survey) and revised the draft paper

Data sharing

HSE 2007 data is available open-access from the ESDS website at:

http://www.esds.ac.uk/findingData/hseTitles.asp

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Table one. Proportions 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%	2860	18%	1797
Gender				
male	9.3%	1239	15.2%	540
female	12.2%*	1621	19.4%*	1250
Ethnicity				
White	10.7%	2550	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%*	2210	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%	1590	18.5%	932
divorced/separated	12.3%	302	14.7%	143
widowed	4.7%	43	34.8%	23
Self-rated health				
good	11.1%	1284	20.3%	576
rather good	10.5%	1251	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 indicates greater probability of accurate awareness or knowledge of guidelines within this category.

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Objectives: To identify the prevalence of knowledge of the current UK physical activity guidelines which were introduced in 2010 and prior physical activity guidelines (30 minutes 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 2,860 UK adults (56% female, 89% white, 63% under 45 years old). In 2013 an online survey was disseminated and collected data from 1,797 UK adults on knowledge of the most recent physical activity guidelines. The 2013 sample was 70% female, 92% white, 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 influences on knowledge of physical activity guidelines.

Results: 18% of the 2013 sample accurately recalled current physical activity guidelines relative to 11% of the 2007 sample who accurately recalled the previous guidelines. Differences in knowledge of physical activity guidelines existed for marital status, gender, age, education and employment status within both 2007 and 2013 samples ($p<.05$). Males with lower education and employment status and older adults were less likely to know physical activity guidelines ($p<.05$). Knowledge of physical activity guidelines remained higher in the 2013 sample after controlling for demographic differences ($p<.05$).

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 amongst these groups.

Article Summary

Article Focus

- What was the prevalence of knowledge of physical activity guidelines in 2007?

- How did knowledge of physical activity guidelines change after being updated in 2010?

- Which demographic factors (gender, age, employment status, education and health) appear to influence knowledge of physical activity guidelines?

Key Messages

- The Department of Health has invested large amounts of money into the promotion of physical activity guidelines since the introduction of new guidelines in 2010.

- Knowledge of current physical activity guidelines within the UK adult population is not known.

- It is important to gage current knowledge and demographic influences on knowledge in order to improve promotion of physical activity guidelines by informational campaigns.

Strengths and Limitations

- The present study is limited because of differences between the two surveys. HSE 2007 was delivered via face-to-face interviews whereas the 2013 survey was delivered online.

Furthermore, convenience sampling was used for the 2013 survey with an over-representation of females and employed adults. However, other demographic variables, including ethnicity and age, were similar between the surveys, whilst 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 strengthens the present research.

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing Interests

None declared

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 United States (US) by the American College of Sports Medicine [4]. By 1995, American adults were being advised to accumulate at least 30 minutes 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 minutes of MVPA on at least 5 days

a 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 Federal government were published following a comprehensive review of the scientific data by experts in the field. These guidelines were the first to state recommendations specifically as 150 minutes a week of MVPA [7]. Previously, guidelines in the UK had been disseminated separately by health agencies within each home country. In 2010 the four UK Chief Medical Officers published the first UK-wide PA guidelines [8]. 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 PA guidelines issued by the World Health Organisation [9].

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 [10]) and *'Get going for 150 minutes a week'* (Change4Life launched across the UK in 2009 [11]). The purpose of these campaigns is to encourage adults to reach or exceed most current PA guidelines.

In 2008, only ~5% of UK and US adults engaged in enough MVPA to meet recommendations [12, 13]. Theories such as the Precaution Adoption Process model (PAPM) and Protection Motivation Theory suggest that individuals must be accurately aware of their current actions [14-16], such as through self-monitoring [17], in light of alternative and desired actions to be able to initiate change i.e. I *do* this much MVPA but this much 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 [18]. 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 5 days a week were updated with 150 minutes a week, in 2010.

Chaudhury and Shelton found that only 5% of UK adults aged 60-64 (N=561) accurately recalled the general MVPA guideline in 2007 [19]. Less than 1% of adults (N=4,281) selected the correct guideline from a list of six options in a recent US survey [20]. 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 more powerful influence on behaviour change [21].

The objectives for this study were 1) to compare knowledge of current UK MVPA guidelines for adults (3 years after their introduction in 2010) with knowledge of prior MVPA guidelines (2004 up until 2010) in two large samples of adults, 2) to identify whether demographic characteristics such as, gender, age and SES, influence knowledge of PA guidelines at either time-point.

Methods

Survey and analytical sample.

Data were analysed from the 2007 Health Survey for England (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 [22]. 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. The present research excluded individuals aged <18 years and adults with health

conditions which restricted physical activity. This resulted in 4,491 eligible adults from which 2,860 had valid data for knowledge of contemporary (2004) PA 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). Staff from academic institutions, professional organisations (the UK National Health Service [NHS], teaching bodies, trade unions etc.), and those attached to independent businesses were invited to complete the survey. Of the 2,332 respondents to the 2013 survey; 1,797 provided data for unprompted knowledge of current MVPA guidelines. Approval for the study was received from the host university ethics committee.

Measures

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 on 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 PA guidelines of 30 minutes/day and 5 days/week were considered correct [6].

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 [23]?'* 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 PA was included in analysis. Those who gave an answer consistent with current guidelines of 150 minutes/week were considered correct [8].

Statistical analysis.

Prevalence rates for UK adults with correct knowledge of MVPA guidelines in 2007 and in 2013 were calculated. Influences of gender, age, ethnicity, marital status, education, employment status and self-reported health were assessed using chi-squared analysis and standardised residuals adjusted for multiple comparisons (Bonferroni). Stepwise multiple logistic regression was used to investigate differences in knowledge between the 2007 HSE sample and the 2013 survey sample. Variables were selected based on chi-squared analysis, with significant demographic factors included in the model. IBM SPSS Statistics 19 was used with alpha set at 0.05.

Results

The 2007 HSE sample was: 56% female, 89% white and 63% under 45 years old. 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), 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 PA guidelines.

The 2013 survey sample was 70% female, 92% white and 57% under 45 years old. Without prompting, 18% accurately recalled the current PA recommendation. 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), students and single adults were more likely to recount old guidelines (30 minutes 5 days/week). Knowledge of guidelines according to demographic characteristics is shown in table one. Only 66% of individuals who recalled MVPA guidelines accurately recalled the intensity of PA 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 3% referred to intensity necessary to increase fitness, effort/exertion or used walking as an exemplar.

As gender was found to be an important moderator of knowledge of guidelines and differed between groups, a multiple logistic regression model was created to identify whether the gender difference accounted for differences in knowledge between 2007 and 2013 samples. In this model, adults from the 2007 HSE sample were significantly less likely to accurately recall MVPA guidelines (p<.001, OR=.58). Females were significantly more likely to be knowledgeable (p<. 05, OR=1.38). Education and employment status were then added to the

model. The difference between samples remained significant (p<.005 OR=.72). Only gender (p<.001) and education (p<.001) moderated the relationship between samples (2007 and 2013) and knowledge, accounting for 38% of the variance in knowledge of guidelines. In this model males (OR=.70) and those with the lowest education (OR=.57) were less likely to demonstrate accurate knowledge of guidelines.

Discussion

Results indicate that knowledge of PA guidelines has improved (11% to 18%) since guidelines were updated in 2010. However, in 2013, still only 18% of adult's 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. This is disappointing as improved knowledge of PA guidelines within the adult population would represent an initial step towards positive behaviour change. While knowledge alone is unlikely to stimulate behaviour change, awareness of the required behaviour is a determinant of behaviour change [24]. The PAPM suggests that individuals are unlikely to change their behaviour unless they become aware that their behaviour is not optimal [14]. Compared with 2007, adults in 2013 do not appear to be better educated regarding MVPA recommendations.

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 2010 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 [25]. Early publications from this campaign suggest it achieved high visibility and recall of its messages within target populations [25, 26]. While knowledge does appear to be moving in the right direction (at least for 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 [27]. Indeed, a search of PA campaign messages released since 2010 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'* while an advert released only a few months previously for MacMillan's Move More campaign suggested, *'Just a short walk can help…'* For World Physical Activity Day 2011 a Coca Cola sponsored advert reads *'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, 9% of adults from the 2013 sample reported the old guideline (2004-2010) when asked to recall the current guideline (2010). While the aforementioned messages are not necessarily incorrect if the aim is to promote PA generally, campaigns need to become more coherent if the strategy is to improve knowledge of guidelines. Indeed, the unification of US, UK and global PA guidelines will be undermined if the messages which follow are isolated and random [7-9]. The failure of PA 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 continuing lack of education pertaining to the guidelines, 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 PA guidelines. The Chief Medical Officers voiced concerns regarding the disproportionately low involvement in PA of disadvantaged groups in society [28]. Improved provision of information and opportunities

for these groups to engage in PA was a target of the government backed campaigns Change4Life and HealthyPeople [29, 30]. Despite these pledges, PA 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 SES, are urgently required. Secondly, adults generally consider only the duration component of PA recommendations. While the 2007 HSE sample were asked specifically for the recommended duration of PA, 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 13% did so. Only 2% 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 PA, the intensity of walking varies greatly within the population. Brisk walking is promoted by many PA campaigns as an example of MVPA, but in actuality, the walking performed by many is less than brisk [31, 32]. While such campaigns may increase the perceived accessibility of PA and cater to adults' PA preferences [33], they often fail to educate individuals about the necessity for PA 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 PA of low intensity but not sufficient PA to meet guidelines. In addition, adults may struggle to see the difference between their own current behaviours and the behaviour 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 [14]. 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 PA is not of a sufficient intensity. With the emergence of alternative strategies to improve health, for example, 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 [34-36]. Guidelines regarding sedentary behaviour have already been developed in Canada and Australia and current UK PA guidelines recommend developing sedentary behaviour guidelines as a priority [8, 37, 38]. The various discourses surrounding PA 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 PA is rapidly increasing, transmitting such knowledge to the general population may require more complex messages but an understanding of how to effectively develop such messages lags behind.

Knowledge of guidelines was low in the present study (i.e. 325 of 1,797 adults knew the duration component of MVPA guidelines); however, this is more than reported for American adults, where less than 1% knew PA guidelines when surveyed in 2009 (N=4,281) [20]. There are two possible reasons why knowledge was higher in the present study. Firstly, in this study, the PA guideline had been consistent for at least three years prior to both samples completing their respective surveys. In the American study, only 10 months separated dissemination of a changed guideline and completion of the survey. Indeed, 33.3% of American adults selected the old 30 minute 5 days per week guideline relative to 9% in the present study [20]. 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.

Conclusions

The present study identified knowledge of PA recommendations in two large UK adult samples from 2007 and 2013. Results indicate that knowledge of guidelines has slightly improved. This study has implications for future promotional campaigns. Messages need to be developed to target individuals with lower education and employment status. In addition, further research is needed to develop an effective strategy for promoting more comprehensive educational messages related to PA guidelines. Campaigns need to straddle the thin line between messages which capture awareness, and are informational and motivational. In the present study, only 2% of adults acknowledged that PA should be effortful. Intensity is an important aspect of health-enhancing PA and should not be neglected by PA campaigns. Increasing understanding of the intensity continuum will likely result in a broader range of PA being included in PA media campaigns. Messages from these campaigns need to work in synergy to ensure effective communication of the benefits of the various forms of accumulating PA.

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Table one. Proportions 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%	2860	18%	1797
Gender				
male	9.3%	1239	15.2%	540
female	12.2%*	1621	19.4%*	1250
Ethnicity				
White	10.7%	2550	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 (years)				
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%*	2210	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%	1590	18.5%	932
divorced/separated	12.3%	302	14.7%	143
widowed	4.7%	43	34.8%	23
Self-rated health				
good	11.1%	1284	20.3%	576
rather good	10.5%	1251	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 indicates greater probability of accurate awareness or knowledge of guidelines within this category.

Lack of Knowledge of Physical Activity Guidelines: Can Physical Activity Promotion Campaigns Do Better?

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

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Main Outcomes: Knowledge of physical activity guidelines in 2007 and 2013. Demographic correlates of knowledge of physical activity guidelines.

Results: 18% of the 2013 sample accurately recalled current physical activity guidelines compared to 11% of the 2007 sample who accurately recalled the previous guidelines. Differences in knowledge of physical activity guidelines existed for marital status, gender, age, education and employment status within both 2007 and 2013 samples ($p<.05$). Males with lower education and employment status (unemployed including student and retired) and older adults were less likely to know physical activity guidelines ($p<.05$). Knowledge of

physical activity guidelines remained higher in the 2013 sample after controlling for demographic differences ($p<.05$).

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 groups.

Article Summary

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- What was the prevalence of knowledge of physical activity guidelines in 2007?

- How did knowledge of physical activity guidelines change after being updated in 2011?

- Which demographic factors (i.e. gender, age, employment status, education and health) appear to influence knowledge of physical activity guidelines?

Key Messages

- The Department of Health has invested large amounts of money into the promotion of physical activity guidelines since the introduction of new guidelines in 2011.

- Knowledge of current physical activity guidelines within the UK adult population is not known.

- It is important to gage current knowledge and demographic associations with knowledge in order to improve promotion of physical activity guidelines by informational campaigns.

Strengths and Limitations

- The present study is limited because of differences between the two surveys. HSE 2007 was delivered via face-to-face interviews whereas the 2013 survey was delivered online. Furthermore, convenience sampling was used for the 2013 survey with an over-representation of females and employed adults. However, other demographic variables, including ethnicity and age, were similar between the surveys, whilst 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 strengthens the present research.

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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 United States (US) by the American College of Sports Medicine [4]. By 1995, American adults were being advised to accumulate at least 30 minutes 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 minutes of MVPA on at least 5 days per 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 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 PA guidelines [8]. 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 PA guidelines issued by the World Health Organisation [9].

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 [10]) and *'Get going for 150 minutes a week'* (Change4Life launched across the UK in 2009 [11]). The purpose of these campaigns is to encourage adults to reach or exceed current PA guidelines.

In 2008, only ~5% of UK and US adults engaged in enough MVPA to meet recommendations [12, 13]. Theories such as the Precaution Adoption Process model (PAPM) and Protection Motivation Theory suggest that individuals must be accurately aware of their current actions [14-16], such as through self-monitoring [17], in light of alternative and desired actions to be able to initiate change i.e. I *do* this much MVPA but this much 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 [18]. 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 5 days per week were updated with 150 minutes per week in 2011. Chaudhury and Shelton found that only 5% of UK adults aged 60-64 (N=561)

accurately recalled the general MVPA guideline in 2007 [19]. Less than 1% of adults (N=4,281) selected the correct guideline from a list of six options in a recent US survey [20]. 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 [21].

The objectives for this study were 1) to compare knowledge of current UK MVPA guidelines for adults (3 years after their introduction in 2011) with knowledge of prior MVPA guidelines (2004 up until 2010) in two large samples of adults, 2) to identify whether demographic characteristics such as, gender, age and SES, are associated with knowledge of PA guidelines at either time-point.

Methods

Survey and analytical sample.

Data were analysed from the 2007 Health Survey for England (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 [22]. 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. The present research excluded individuals aged <18 years and adults with health

conditions which restricted physical activity. This resulted in 4,491 eligible adults from which 2,860 had valid data for knowledge of contemporary (2004) PA 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). Staff from UK academic institutions, professional organisations (the National Health Service [NHS], teaching bodies, trade unions etc.), and those attached to independent businesses were invited to complete the survey. Of the 2,332 respondents to the 2013 survey; 1,797 provided data for unprompted knowledge of current MVPA guidelines. Approval for the study was received from the host university ethics committee.

Measures

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 PA guidelines of 30 minutes/day and 5 days/week were considered correct [6].

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 [23]?'* 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 PA was included in analysis. Those who gave an answer consistent with current guidelines of 150 minutes/week were considered correct [8].

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 using chi-squared analysis and standardised residuals adjusted for multiple comparisons (Bonferroni). Stepwise multiple logistic regression was used to investigate differences in knowledge between the 2007 HSE sample and the 2013 survey sample. Variables were selected based on chi-squared analysis, with significant demographic factors included in the model. IBM SPSS Statistics 19 was used with alpha set at 0.05.

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 PA guidelines.

The 2013 survey sample was 70% female, 92% white and 57% under 45 years. Without prompting, 18% accurately recalled the current PA recommendation. 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 5 days/week). Knowledge of guidelines according to demographic characteristics is shown in table one. Only 66% of individuals who recalled MVPA guidelines accurately recalled the intensity of PA 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 3% referred to intensity necessary to increase fitness, effort/exertion or used walking as an exemplar.

As gender was found to be an important moderator of knowledge of guidelines and differed between groups, a multiple logistic regression model was created to identify whether the gender difference accounted for differences in knowledge between 2007 and 2013 samples. In this model, adults from the 2007 HSE sample were significantly less likely to accurately recall MVPA guidelines (p<.001, OR=.58). Females were significantly more likely to be knowledgeable (p<. 05, OR=1.38). When education and employment status were

added to the model, the difference between samples remained significant (p<.005 OR=.72). Only gender (p<.001) and education (p<.001) moderated the relationship between samples (2007 and 2013) and knowledge, accounting for 38% of the variance in knowledge of guidelines. In this model, males (OR=.70) and those with the lowest education (OR=.57) were less likely to demonstrate accurate knowledge of guidelines.

Discussion

Results indicate that knowledge of PA guidelines has improved (11% to 18%) since guidelines were updated in 2011. However, in 2013, still only 18% of adult's 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. This is disappointing as improved knowledge of PA guidelines within the adult population would represent an initial step towards positive behaviour change. While knowledge alone is unlikely to stimulate behaviour change, awareness of the required behaviour is a determinant of behaviour change [24]. The PAPM suggests that individuals are unlikely to change their behaviour unless they become aware that their behaviour is not optimal [14]. Compared with 2007, adults in 2013 do not appear to be better educated regarding MVPA recommendations.

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 [25]. Early publications from this campaign suggest it achieved high visibility and recall of its messages within target populations [25, 26]. While knowledge does appear to be moving in the right direction (at least for 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 [27]. Indeed, a search of PA 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'* while an advert released only a few months previously for MacMillan's Move More campaign suggested, *'Just a short walk can help…'* For World Physical Activity Day 2011, a Coca Cola sponsored advert reads *'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, 9% 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 PA guidelines will be undermined if the messages which follow are isolated and random [7-9]. The failure of PA 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 continuing lack of education pertaining to the guidelines, 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 PA guidelines. The Chief Medical Officers voiced concerns regarding the disproportionately low involvement in PA of disadvantaged groups in society [8]. Improved provision of information and opportunities for

these groups to engage in PA was a target of the government backed campaigns 'Change4Life' and 'HealthyPeople' [28, 29]. Despite these pledges, PA 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 SES, are urgently required. Secondly, adults generally consider only the duration component of PA recommendations. While the 2007 HSE sample were asked specifically for the recommended duration of PA, 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 13% did so. Only 2% 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 PA, the intensity of walking varies greatly within the population. Brisk walking is promoted by many PA campaigns as an example of MVPA, but in actuality, the walking performed by many is less than brisk [30, 31]. While such campaigns may increase the perceived accessibility of PA and cater to adults' PA preferences [32], they often fail to educate individuals about the necessity for PA 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 PA of low intensity but not sufficient PA 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 [14]. 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 PA 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 [33-35]. Guidelines regarding sedentary behaviour have already been developed in Canada and Australia and current UK PA guidelines recommend developing sedentary behaviour guidelines as a priority [8, 36, 37]. The various discourses surrounding PA 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 PA 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% adults knew the duration component of MVPA guidelines); however, this is more than reported for American adults, where less than 1% knew PA guidelines when surveyed in 2009 (N=4,281) [20]. There are two possible reasons why knowledge was higher in the present study. Firstly, in this study, the PA guideline had been consistent for at least three years prior to both samples completing their respective surveys. In the American study, only 10 months separated dissemination of a changed guideline and completion of the survey. Indeed, 33.3% of American adults selected the old 30 minute 5 days per week guideline relative to 9% in the present study [20]. 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.

Conclusions

The present study identified knowledge of PA recommendations in two large UK adult samples from 2007 and 2013. Results indicate that knowledge of guidelines has slightly improved. This study has implications for future promotional campaigns. Messages need to be developed to target individuals with lower education and employment status. In addition, further research is needed to develop an effective strategy for promoting more comprehensive educational messages related to PA guidelines. Campaigns need to straddle the thin line between messages which capture awareness, and are informational and motivational. In the present study, only 2% of adults acknowledged that PA should be effortful. Intensity is an important aspect of health-enhancing PA and should not be neglected by PA campaigns. Increasing understanding of the intensity continuum will likely result in a broader range of PA 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 PA.

Competing Interests

None declared

Contributorship

EK initiated the study, designed the data collection tools (2013 survey), monitored data collection for the 2013 sample, planned the statistical analysis, cleaned and analysed the data for the whole study and drafted and revised the paper. She is guarantor.

DE revised the draft paper

SB revised the draft paper

LS revised the data collection tools (2013 survey) and revised the draft paper

Data sharing

HSE 2007 data is available open-access from the ESDS website at:

http://www.esds.ac.uk/findingData/hseTitles.asp

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Table one. Proportions 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%	2860	18%	1797
Gender				
male	9.3%	1239	15.2%	540
female	12.2%*	1621	19.4%*	1250
Ethnicity				
White	10.7%	2550	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 (years)				
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%*	2210	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%	1590	18.5%	932
divorced/separated	12.3%	302	14.7%	143
widowed	4.7%	43	34.8%	23
Self-rated health				
good	11.1%	1284	20.3%	576
rather good	10.5%	1251	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 indicates greater probability of accurate awareness or knowledge of guidelines within this category.