Addressing inequalities in physical activity participation: Implications for public health policy and practice

Ruth F. Hunter a,b,⁎, Marco Boeri b,c,d, Mark A. Tully a,b, Paul Donnelly e, Frank Kee a,b

⁎ Corresponding author at: Centre for Public Health/UKCRC Centre of Excellence for Public Health (NI), Queen’s University Belfast, Institute of Clinical Science B, Royal Victoria Hospital, Grosvenor Road, Belfast, Northern Ireland BT12 6BJ, United Kingdom.

Available online 6 January 2015

Abstract

Objective. To investigate the characteristics of those doing no moderate-vigorous physical activity (MVPA) (0 days/week), some MVPA (1–4 days/week) and sufficient MVPA (∙5 days/week) to meet the guidelines in order to effectively develop and target PA interventions to address inequalities in participation.

Method. A population survey (2010/2011) of 4653 UK adults provided data on PA and socio-demographic characteristics. An ordered logit model investigated the covariates of 1) participating in no PA, 2) participating in some PA, and 3) meeting the PA guidelines. Model predictions were derived for stereotypical subgroups to highlight important policy and practice implications.

Results. Mean age of participants was 45 years old (95% CI 44.51, 45.58) and 42% were male. Probability forecasting showed that males older than 55 years of age (probability = 0.20; 95% CI 0.11, 0.28), and both males (probability = 0.31; 95% CI 0.17, 0.45) and females (probability = 0.38; 95% CI 0.27, 0.50) who report poor health are significantly more likely to do no PA.

Conclusions. Understanding the characteristics of those doing no MVPA and some MVPA could help develop population-level interventions targeting those most in need. Findings suggest that interventions are needed to target older adults, particularly males, and those who report poor health.

Introduction

The inexorable slide to a more inactive lifestyle offers worrying projections of future prevalence of morbidity and mortality from non-communicable diseases (Branca et al., 2007; WHO, 2010; Lee et al., 2012). Given the ongoing rise of chronic diseases associated with physical inactivity, the associated economic burden (Allender et al., 2007), and modest short-term effects of previous interventions, a major re-think is required if we are to change the health of our population.
that could be targeted in behaviour change interventions (Bauman et al., 2012). Further, a population-level shift could be achieved through targeting those who do some PA (but not enough to meet the guidelines) and encouraging them to do a little more in order to achieve the current guidelines. While this would reflect the approach suggested by Rose (Rose, 1981), we must still recognise that the characteristics of those “in the tail” (i.e. those doing no MVPA) may be distinct from those more centrally located in the distribution (i.e. those doing some MVPA) and so require different approaches.

We therefore postulate that those who do no MVPA are distinct from those who do some MVPA (but not enough to meet the guidelines) and therefore require specific, targeted interventions. By deriving the probability of belonging to a group who either do no MVPA or some MVPA, we can identify specific subgroups that merit different tailoring of behaviour change interventions. Therefore the aim of this study was to investigate the characteristics of those doing no MVPA (0 days/week, some MVPA (1-4 days/week) and sufficient MVPA (≥5 days/week) to meet the guidelines, using an approach common in econometrics. A similar approach has been successfully used in a small number of other studies investigating the economic determinants of PA participation (Farrell and Shields, 2002; Downward, 2007; Humphreys and Ruseski, 2009; Eberth and Smith, 2010; Brown and Roberts, 2011; Anokye et al., 2013), and has been found valuable in other settings (Green et al., 2014).

Materials and methods

Survey

Data were collected with regard to PA and socio-demographic and socio-economic characteristics in the Sport and Physical Activity Survey (SAPAS) (n = 4653), commissioned by Sport Northern Ireland (Sport NI, 2010). Interviews were conducted face-to-face using Computer Assisted Personal Interviewing (CAPI) among a stratified random sample of adults aged 16+ years across Northern Ireland. The fieldwork was carried out continuously over a 12-month period (July 2009–August 2010) and addresses were randomly selected from the Royal Mail’s Postal Address File (PAF). An individual aged 16 years and over within each selected household was randomly chosen to complete the survey by interviewing the resident with the most recent birthday.

Data

Dependent variables: participation in physical activity

Data were collected with respect to frequency, duration and intensity of physical activities in the home, work, active travel, and recreation domains during the previous seven days, using the Global Physical Activity Questionnaire (GPQ) (Bull et al., 2009). Based on the PA guidelines (extant at the time of the survey) of “at least 30 min per day, on at least 5 days per week” (Department of Health, Physical Activity, Health Improvement and Prevention, 2004; U.S. Department of Health and Human Services, 2008), PA was categorised as “none” (0 days/week doing ≥30 min of MVPA), “some” (1–4 days/week doing ≥30 min of MVPA) or “sufficient” (5 or more days/week doing ≥30 min of MVPA).

Independent variables: socio-demographic and socio-economic characteristics

Self-reported data were collected for gender, age, highest level of education, marital status, number of children, car ownership, disability, employment status, social class, area level socio-economic position (SEP) and self-rated health. Age was grouped into three categories, namely aged 16–34 years old, aged 35–54 years old, and aged 55 years and over. Highest level of education was grouped into no formal qualifications, GCSE or equivalent, A level or equivalent and degree or above. Employment status was categorised as economically active (working full time/part time) and economically inactive (including retired, student, unemployed). Disability was dichotomised as having a disability or not. Number of children was classified as none, one child, and two children or more. Marital status was categorised as single, married/co-habiting and divorced/widowed. Social class was dichotomised into ABC1 (managerial, administrative and professional) and C2DE (skilled, semi-skilled and unskilled manual workers, pensioners, casual and lowest grade workers). Area level SEP was based on the Northern Ireland Multiple Deprivation Measure (MDM) (Northern Ireland Statistics and Research Agency, 2005). Using respondents’ home postcode, individuals were allocated a MDM score which was categorised into tertiles ranging from the most to the least deprived area of residence. Self-rated health was answered on a 5-point scale; 1 = very good, 2 = good, 3 = average, 4 = poor, and 5 = very poor. Car ownership was classified as access to no cars, access to one car and access to two or more cars.

Statistical analyses

Descriptive statistics were calculated using frequencies for categorical variables. Bivariate correlations (Pearson’s chi-squared tests of independence) were used to conservatively identify predictors for potential inclusion in the model. Socio-demographic and socio-economic variables that were associated with the dependent variable (membership of a particular PA category) at the p ≤ 0.10 level were included. The nominal indicator of “sufficient MVPA” (i.e. met PA guidelines) was assigned as the reference category. A series of analyses that used ordered logit models were conducted (Brown and Roberts, 2011), adjusting for socio-demographic and socio-economic characteristics to estimate the coefficients of covariates related to participating in none, some or sufficient MVPA (see Appendix I for Econometric Specification). Analyses were undertaken separately for men and women as previous research has shown important differences in physical activity behaviour (Azevedo et al., 2007; Brown and Roberts, 2011; Anokye et al., 2013). Three behaviours were modelled: (1) not participating in any MVPA (0 days/week doing ≥30 min of MVPA); (2) participating in some MVPA (1–4 days/week doing ≥30 min of MVPA); and, (3) participating in sufficient MVPA to meet the guidelines (5 or more days/week doing ≥30 min of MVPA). As Odds Ratios (ORs) estimated from the ordered logit model are not directly interpretable, we used the model to forecast the probability of participation in MVPA. The model was applied to forecast the probability of doing none, some or sufficient MVPA, given certain individual socio-demographic and socio-economic characteristics.

In addition, we also constructed profiles of policy relevant population stereotypes using a combination of socio-demographic and socio-economic characteristics and forecast their probability of doing no MVPA, some MVPA or sufficient MVPA to meet the guidelines. The scenarios were purposively selected to reflect a diverse population and those identified as most in need in our society. All analyses were weighted to reflect Northern Ireland population demographic characteristics and non-response. Data were analysed using STATA 11 for Windows.

Results

Demographic characteristics

Table 1 shows the demographic characteristics of the sample (n = 4653). The mean age of the sample was 45 years old (95% CI 44.51, 45.58) and 42% were male. Further, 53% were economically inactive, 31% had no formal qualifications, 43% lived in the most deprived areas and two thirds of the sample (66%) did not report sufficient activity to meet the guidelines. Overall, 29% did no MVPA and 37% did some MVPA but not enough to meet the UK guidelines.

Table 2 presents the predicted probability of doing none, some or sufficient MVPA depending on a range of socio-demographic and socio-economic variables. Probabilities are computed using results from the ordered logit model, (whose details are in Appendix II). The 95% CI allows us to understand whether the probability (a number between 0 and 1 with values approaching 1 indicating greater probability) of doing none, some or sufficient MVPA is different between people with certain socio-demographic and socio-economic characteristics.

No physical activity

Males who are older (aged 55 years or older) (Prob. 0.20; 95% CI 0.11, 0.28) and those in poor health (Prob. 0.31; 95% CI 0.17, 0.45) are more likely to do no MVPA compared to younger males and those with very good health (Prob. 0.09; 95% CI 0.05, 0.12). A similar pattern was apparent for females, in that those who were older (Prob. 0.25; 95% CI 0.17, 0.34) and those in poor health (Prob. 0.38; 95% CI 0.27, 0.50) were more likely to do no MVPA compared to younger females in very good health (Prob. 0.21; 95% CI 0.14, 0.27).
Table 1
Demographic characteristics (n = 4653), n and % (Northern Ireland, 2014).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Males (n = 1967/42%)</th>
<th>Females (n = 2686/58%)</th>
<th>Overall (n = 4653)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–34 years old</td>
<td>531 (27.0%)</td>
<td>792 (29.5%)</td>
<td>1323 (28.4%)</td>
</tr>
<tr>
<td>35–54 years old</td>
<td>693 (35.2%)</td>
<td>899 (33.5%)</td>
<td>1592 (34.2%)</td>
</tr>
<tr>
<td>55 years or older</td>
<td>743 (37.8%)</td>
<td>995 (37.0%)</td>
<td>1738 (37.4%)</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economically inactive</td>
<td>928 (47.2%)</td>
<td>1552 (57.8%)</td>
<td>2480 (53.3%)</td>
</tr>
<tr>
<td>Economically active</td>
<td>1039 (52.8%)</td>
<td>1134 (42.2%)</td>
<td>2173 (46.7%)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>599 (30.5%)</td>
<td>848 (31.6%)</td>
<td>1447 (31.1%)</td>
</tr>
<tr>
<td>Married/cohabiting</td>
<td>1094 (55.6%)</td>
<td>1180 (43.9%)</td>
<td>2274 (48.9%)</td>
</tr>
<tr>
<td>Divorced/widowed</td>
<td>274 (13.9%)</td>
<td>658 (24.5%)</td>
<td>932 (20.0%)</td>
</tr>
<tr>
<td>Highest level of education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>605 (30.8%)</td>
<td>816 (30.4%)</td>
<td>1421 (30.5%)</td>
</tr>
<tr>
<td>GCSE or equivalent</td>
<td>609 (31.0%)</td>
<td>881 (32.8%)</td>
<td>1490 (32.0%)</td>
</tr>
<tr>
<td>'A' level or equivalent</td>
<td>421 (21.4%)</td>
<td>541 (20.1%)</td>
<td>962 (20.7%)</td>
</tr>
<tr>
<td>Degree or higher</td>
<td>332 (16.9%)</td>
<td>448 (16.7%)</td>
<td>780 (16.8%)</td>
</tr>
<tr>
<td>No. of children in household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No children</td>
<td>1448 (73.6%)</td>
<td>1686 (62.8%)</td>
<td>3134 (67.4%)</td>
</tr>
<tr>
<td>1 child</td>
<td>222 (11.3%)</td>
<td>454 (16.9%)</td>
<td>676 (14.5%)</td>
</tr>
<tr>
<td>2 or more children</td>
<td>297 (15.1%)</td>
<td>546 (20.3%)</td>
<td>843 (18.1%)</td>
</tr>
<tr>
<td>Disability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>517 (26.3%)</td>
<td>808 (30.1%)</td>
<td>1325 (28.5%)</td>
</tr>
<tr>
<td>No</td>
<td>1450 (73.7%)</td>
<td>1878 (69.9%)</td>
<td>3328 (71.5%)</td>
</tr>
<tr>
<td>Social group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2DE</td>
<td>1131 (57.5%)</td>
<td>1565 (58.3%)</td>
<td>2696 (57.9%)</td>
</tr>
<tr>
<td>ABC1</td>
<td>836 (42.5%)</td>
<td>1121 (41.7%)</td>
<td>1957 (42.1%)</td>
</tr>
</tbody>
</table>

Table 3 offers the model predictions for four policy-relevant stereotypes which are similar to those highlighted by Sport England (2010), illustrating the probabilities of participating in none, some or sufficient MVPA to meet the guidelines. Results show that males, aged 55 years or older, who are economically inactive, in poor health and living in the most deprived areas are likely to do no MVPA. (Prob. 0.80; 95% CI 0.67, 0.93), some MVPA (Prob. 0.17; 95% CI 0.07, 0.27) or sufficient MVPA (to meet the guidelines) (Prob. 0.03; 95% CI 0.01, 0.06). This is in stark contrast to younger males who are economically active, in very good health and live in the least deprived areas (no MVPA Prob. 0.09; 95% CI 0.05, 0.12; some MVPA Prob. 0.32; 95% CI 0.25, 0.40; or sufficient MVPA Prob. 0.59; 95% CI 0.49, 0.70).

For females the pattern is similar, with those aged 55 years or older, economically inactive, in poor health and living in the most deprived areas being much more likely to do no MVPA (Prob. 0.44; 95% CI 0.30, 0.59) compared to younger females, who are economically active, in very good health and live in the least deprived areas (Prob. 0.21; 95% CI 0.14, 0.27). Similarly, the younger, “better off” females are more likely to do sufficient PA (Prob. 0.38; 95% CI 0.29, 0.47) than older, “disadvantaged” females (Prob. 0.17; 95% CI 0.08, 0.25).

Discussion
Principal findings

Current UK and US PA guidelines have once again underlined the problems caused by inactive lifestyles (U.S. Department of Health and Human Services, 2010; DoH, 2011), the degree of change needed in the population and the magnitude of the expected benefits if we meet the minimum guidelines for PA participation. The benefits are considerable, but won’t be realised unless we figure out better ways to help us all achieve them. Our results show that specific socio-demographic and socio-economic characteristics distinguish those who do or don’t some MVPA from those who do sufficient MVPA. Older males (aged 55 years and older) and those with poor health are more likely to do no MVPA or some MVPA. Similarly women with poor health are more likely to do no MVPA or some MVPA at levels less than required by guidelines. These findings accord with those from an earlier review of the correlates of adult PA levels (Bauman et al., 2012) and previous studies employing an econometric modelling approach (Farrell and Shields, 2002; Downward, 2007; Humphreys and Ruseski, 2009; Eberth and Smith, 2010; Brown and Roberts, 2011; Anokye et al., 2013). In particular, previous research has identified that older participants are in the most important group to target with PA interventions (Taylor et al., 2004), as are those with poor self-rated health (Abu-Omar et al., 2004; Bergman et al., 2008). Bergman et al. (2008) demonstrated gender specific patterns; however, in contrast identified women as less likely to reach the high PA category. Further, modelling of policy relevant stereotypes shows clearly that for both genders, the most disadvantaged in our society (i.e. older, economically inactive, poor health, living in deprived areas) have a significantly higher probability of doing no MVPA than doing some MVPA or sufficient MVPA to meet the guidelines.

Public health policy and practice

These findings can inform the development of population-level PA behaviour change interventions and therefore have significant public health policy and practice implications to address inequalities in participation. Clearly, older adults, in particular men, and those with poor health are in need of targeted behaviour change interventions. Previous research has highlighted the importance of the General Practitioner (GP) in the promotion of PA, and recommended that behavioural change strategies and collaboration between GPs and health promotion specialists be maximised (Khan et al., 2011; Hinrichs and Brach, 2012).
Olkie, 2012). However, much work needs to be done to ensure that GPs are confident to deliver effective PA information and guidance (Dunlop and Murray, 2013).

### Strengths and weaknesses of the study

This is the first study to investigate how socio-demographic and socio-economic characteristics can distinguish those who do no MVPA from those who undertake some MVPA and those who meet PA guidelines. However, it is important to note that within the “some PA” category, there is substantial variation in PA levels. Ecomometric models have attracted renewed interest in epidemiology, for example, in the “rediscovery” of instrumental variables in Mendelian Randomisation approaches that attempt to control for unobserved confounding (Zohoori and Savitz, 1997; Davey Smith and Ebrahim, 2005). The novel modelling approach employed has allowed us to derive predicted likelihoods of doing no activity, some activity and sufficient activity to meet the guidelines, according to the known socio-demographic and socio-economic characteristics of any population subgroup. This helped us uncover significant implications for public health policy and practice in terms of the need to better target population-level PA promotion resources. It is one of the few studies to adopt a population-level approach as previous research has investigated domain-specific (Kaewthummanukul and Brown, 2006; Kirk and Rhodes, 2011) or subgroup-specific correlates (Allender et al., 2008; Van Stralen et al., 2009). However, our sample data was cross-sectional and therefore we cannot infer causality. Also, since the survey collected self-reported PA data, it may be subject to some reporting bias (Sallis and Saelens, 2000; Adams et al., 2005; Ferrari et al., 2007). However, cross-sectional studies can inform population-level target groups for behaviour change interventions (Bauman et al., 2012).

### Future research

Research has demonstrated that there are three main levels of influence on PA levels: individual, social and environmental. Public health specialists have long recognised that berating individuals to change their behaviour seldom works and have adopted a broader approach which recognises the role of supportive environments that can make healthy choices easier. For population-level behaviour change, future research must also investigate built and social environment characteristics in order to inform the development of multilevel interventions targeting older males and those of poor health, based on the socio-ecological model (Sallis et al., 2008). Further, longitudinal studies will help identify determinants of population-level behaviour change. In addition, previous research has identified different correlates for different domains of PA (Ball et al., 2006; Timperio et al., 2006; Clandian et al., 2010). Multilevel models to explain all domains of PA (transport, leisure, occupation, home) will lead to improved, behavioural-specific and contextually tailored interventions (Bauman et al., 2012).

### Conclusion

Understanding the characteristics of those doing no MVPA and some MVPA could help us develop population-level interventions targeting...
those most in need. Our findings suggest that specific socio-demographic and socio-economic characteristics distinguish those who do or do not some MVPA from those who do sufficient MVPA. Older males (aged 55 years and older) and those with poor health are more likely to do no MVPA or some MVPA. Modelling of policy relevant stereotypes shows clearly that for both genders, the most disadvantaged in our society (i.e. older, economically inactive, poor health, living in deprived areas) are most in need. These findings can inform the development of population-level PA behaviour change interventions and therefore have significant public health policy and practice implications to address inequalities in PA participation.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

Funding

This research was supported by funding from the National Prevention Research Initiative (NPRI) (grant number G0802045) and their funding partners (Alzheimer’s Research Trust; Alzheimer’s Society; Biotechnology and Biological Sciences Research Council; British Heart Foundation; Cancer Research UK; Chief Scientist Office, Scottish Government Health Directorate; Department of Health; Diabetes UK; Economic and Social Research Council; Engineering and Physical Sciences Research Council; Health and Social Care Research and Development Division of the Public Health Agency (HSC R&D Division); Medical Research Council; The Stroke Association; Welsh Assembly Government; and World Cancer Research Fund, and the UKCRC Centre of Excellence for Public Health (NI)). The funders were not involved in the study design, collection, analysis or interpretation of data, in the writing of the report, or in the decision to submit the article for publication.

Contributorship statement

RFH had the initial concept for the study. PD, MAT and FK were involved in the design of the survey, and PD was responsible for the acquisition of the data. MB and RFH were responsible for analysing and interpreting data. RFH drafted the manuscript. All authors critically revisued the manuscript for important intellectual content. FK is the guarantor.

Acknowledgments

The authors wish to acknowledge Sport Northern Ireland for granting access to the data from the Northern Ireland-wide survey.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jpyned.2014.12.040.

References


