ScotPHO
Public Health Information for Scotland

Are People in Scotland Becoming More Active?

Combined Results from Scotland's Routine National Surveys

June 2009

healthier scotland
SCOTTISH GOVERNMENT

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Scottish Public Health Observatory (ScotPHO) collaboration

The Public Health Observatory Division at NHS Health Scotland is part of the ScotPHO collaboration. Led by ISD Scotland and NHS Health Scotland, the collaboration brings together key national organisations in public health intelligence in Scotland. We are working closely together to ensure that the public health community has easy access to clear and relevant information and statistics to support decision making. For further information, please see the ScotPHO website at www.scotpho.org.uk

Executive summary

Physical inactivity places individuals at greater risk of many health problems. To gain health benefits, adults are currently advised to accumulate at least 30 minutes of moderate intensity activity on most days of the week (five or more).[1,2] Routine national household surveys are the main source of data for national monitoring of health behaviours. Two surveys have collected information on physical activity from people living in Scotland: the Scottish Health Survey (SHeS), conducted in 1995, 1998 and 2003, and the Health Education Population Survey (HEPS), which ran annually from 1996 until 2007. Each survey has reported its findings independently, but combining them offers the scope to make more definitive statements about population trends.

This study therefore triangulated repeat cross-sectional data from the SHeS and HEPS to examine whether there has been any significant change in the proportion of adults meeting the current recommendations for physical activity since the two surveys began. The start point was taken as 1995 and the end-point as 2006. Analysis was performed using multiple logistic regression modelling techniques, adjusting for the effects of gender, age and area-level deprivation. As a secondary aim, we also described differences in compliance with the recommendations by gender, age and deprivation. Data were included from all sweeps of both surveys available at the time of analysis: 1995, 1998 and 2003 from the SHeS; 1996 to 1999 and 2001 to 2006 from the HEPS. The analysis included all adults aged 16–64. Those aged 65 and over were excluded to ensure comparability over time and between the two surveys. The following findings are therefore representative only of men and women aged 16–64.

The results provide strong evidence of a small increase in the proportion of women (aged 16–64) meeting the current recommendations for physical activity from 1995 to 2006. This finding is based upon the triangulated data from both surveys, giving increased confidence that it reflects a real population trend. There was no significant change in the proportion of men (aged 16–64) meeting the recommendations over the same time period. However, there is some evidence of an increase from 1995/1996 to 2003, supported by the SHeS with weaker evidence from the HEPS.

Information about more recent trends is currently available only from the HEPS. Results from the 2004, 2005 and 2006 surveys suggest that there has been no change in male compliance with the recommendations for physical activity since the 2003 SHeS. The corresponding results for women also suggest broad stability. These findings must be treated with some caution as they are based upon a single source of evidence that is better suited to detecting trends over longer periods of time. Nonetheless, they provide useful preliminary evidence that there has been no reduction in compliance with the current physical activity recommendations since the launch of *Let's Make Scotland More Active* in 2003. It is not possible to draw final conclusions on early progress towards the national target until autumn 2009, when new data from the 2008 SHeS will become available.

This study confirms previous findings that compliance with the current recommendations for physical activity is patterned by gender, age and deprivation. More importantly, these patterns have not altered significantly from 1995 to 2006, demonstrating the persistence of health inequalities in physical activity.

The SHeS is the stated source for monitoring progress towards the national target for physical activity. Its large sample size generates very precise estimates, but low response presents a risk to the representativeness of more recent SHeS data. Already low in 2003, initial indications are that response rates declined further in 2008. The HEPS sample is small giving much lower statistical power, but its methodology was consistent over the time series and response rates high. Each survey has a contribution to make towards our understanding of retrospective physical activity trends over time. The first review process should therefore utilise HEPS data from 2003 to 2007, in addition to those from the 2003 and 2008 SHeS.

Key points on trends over time

- There is good evidence that women in Scotland have become slightly more active since the mid-1990s. Combined data from the SHeS and HEPS indicate a small increase in the proportion meeting the current recommendations for physical activity from 1995 to 2006.
- The combined survey data indicate no significant change in the proportion of men meeting the recommendations over the same time period (1995–2006). However, there is some evidence of an increase from 1995/1996 to 2003, supported by the SHeS with weaker evidence from the HEPS.

Recommendations for future monitoring

- The first review of progress towards the national physical activity target, currently scheduled for autumn 2009, should make use of all relevant national survey data. It should therefore utilise the HEPS data from 2003 to 2007, in addition to those from the 2003 and 2008 SHeS.
- Following decommissioning of the HEPS, the SHeS is now the sole national survey measuring physical activity levels in Scotland. As triangulation is no longer possible, it is vital that SHeS estimates are as robust as possible, that they are comparable over time and that response rates are maximised.

Introduction

Background

Physical inactivity places individuals at greater risk of many health problems, including coronary heart disease, certain cancers, diabetes, obesity, osteoporosis, disability and poor mental health. To gain health benefits, adults in Scotland are currently advised to accumulate at least 30 minutes of moderate intensity activity on most days of the week (five or more).[1,2]

Routine national household surveys are the main source of data for national monitoring of health behaviours. Two surveys have collected information on physical activity from adults living in Scotland: the Scottish Health Survey (SHeS), which was conducted in 1995, 1998 and 2003; and the Health Education Population Survey (HEPS), which ran annually from 1996 until 2007. Any single study has its own strengths and limitations and the likely impact of its distinct methodology must be borne in mind when interpreting the findings. Combining information from multiple sources, a technique known as triangulation, allows a more robust assessment of the research question. If the results from the various sources agree, we can have much greater confidence that they truly reflect what is happening within the population of interest.

Aims

This study therefore brought together data from the SHeS and HEPS in order to examine whether there has been any significant change in the proportion of adults meeting the current recommendations for physical activity since the two surveys began. The start point is taken as 1995, the year of the first SHeS, and the end-point as 2006, the last year for which HEPS data were available at the time of analysis. As physical activity levels vary by gender, age and deprivation,[3,4] each of these effects has been controlled for in the analysis.

As a secondary aim, we also looked for differences in compliance with the recommendations by gender, age and deprivation.

The results are considered within the context of Scotland's national target for physical activity set out in 2003 in the 20-year strategy *Let's Make Scotland More Active*: 50% of all adults aged over 16 meeting the minimum recommended levels of activity by 2022.[1]

Aims

Primary To examine trends over time (1995–2006) in compliance with the current recommendations for physical activity amongst adults in Scotland.

Secondary To describe differences in compliance with the recommendations by gender, age and deprivation.

Methods

Study design

This study triangulated repeat cross-sectional data from two of Scotland's major routine national household surveys providing information on health: the SHeS and the HEPS. Analysis was performed using multiple logistic regression modelling techniques to:

- examine trends over time in compliance with the current recommendations for regular physical activity, adjusting for the effects of gender, age, deprivation and individual survey
- describe any differences in compliance with the recommendations by gender, age and deprivation.

Details of the SHeS and HEPS purpose and methodologies (survey frequency, target population, sampling, response, method of data collection, fieldwork timing and measurement of physical activity) are provided in Appendix A.

Study population

Data were included for adults aged 16–64 from all sweeps of both surveys available at the time of analysis: 1995, 1998 and 2003 from the SHeS; 1996 to 1999 and 2001 to 2006 from the HEPS. Adults aged 65 and over were excluded from the analysis to give comparability over time for the SHeS and between the two surveys (see Appendix A for details of the survey samples).

Data handling and statistical analysis

Respondents were classified as meeting the current recommendations for physical activity if they achieved at least five sessions of moderate intensity activity and/or at least three sessions of vigorous intensity activity per week. Both surveys defined a moderate session as moderate intensity activities lasting at least 30 minutes and a vigorous session as vigorous intensity activities lasting at least 20 minutes. Area-level deprivation was assessed using the Carstairs index as the Scottish Index of Multiple Deprivation (SIMD) was not obtainable over the entire time series for both surveys. Respondents' postcode sectors were matched to 1991 Carstairs scores and these were then coded into quintiles, where 1 was the least deprived area and 5 the most deprived. Respondents were classified into one of five 10-year age bands for analysis by age: 16–24, 25–34, 35–44, 45–54 and 55–64.

A regression model with five explanatory variables was fitted to the data to examine the association between gender, age, deprivation, survey and compliance with the current recommendations for regular physical activity from 1995 to 2006. 'Meeting the physical activity recommendations' was entered as the dependent variable and was coded as either 1 for 'Yes' or 0 for 'No'. Gender, age, Carstairs deprivation quintile and survey (HEPS or SHeS) were entered as the categorical explanatory variables. Time (survey year) was entered as the only continuous explanatory variable.

The following subgroups were specified as the reference group for the categorical explanatory variables:

- age: those aged 16–24
- deprivation: the least deprived quintile
- survey: the HEPS. To assess the survey effect with a survey-by-year interaction in the model (i.e. the survey effect varied over time), it was also necessary to specify a single year as the reference value. The year 2000 was chosen as this was roughly mid-point in the time series.

All statistical analysis was undertaken using SPSS Version 14.0. Results have been described as statistically significant where $P < 0.05$. All variables were entered in a single step (the 'enter' method) and a modelling strategy which retained these main effects and adjusted for significant interactions was used to ascertain the most appropriate model to fit the data.

Significant interactions were observed between gender and many of the other explanatory variables, indicating different patterning in physical activity levels for men and women. Separate regression models, each with four explanatory variables (age, deprivation, survey, time), were therefore run for males and females, with all non-significant interactions eliminated from the final models.

To obtain accurate estimates of prevalence, survey data are weighted to correct for under- or over-representation of certain socio-demographic groups in the samples. We used the unweighted data as our aim was to test for associations between specific variables. Up- or down-weighting groups would have artificially inflated or deflated strands of evidence within the model, possibly giving rise to spurious associations. The weighted survey estimates are provided for comparison. As regression analysis gives information about trends and effects in relative terms only, we have also interpreted our results with reference to the corresponding weighted survey estimates in order to give a sense of absolute levels of activity.

Results

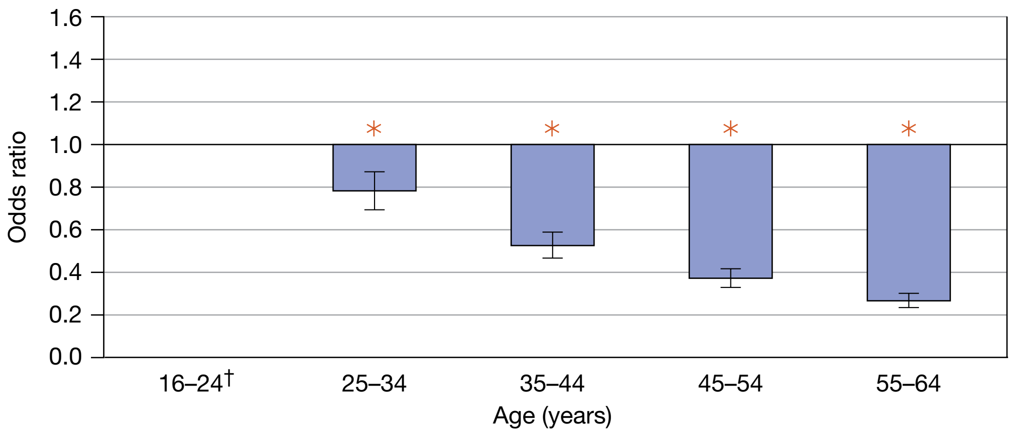
From 1995 until 2006, a total of 34,789 respondents aged 16–64 (44% men, 56% women) completed the physical activity questions in the SHeS and HEPS.

Results have been described as statistically significant where $P < 0.05$, shown in the figures by a red asterisk (*).

Men

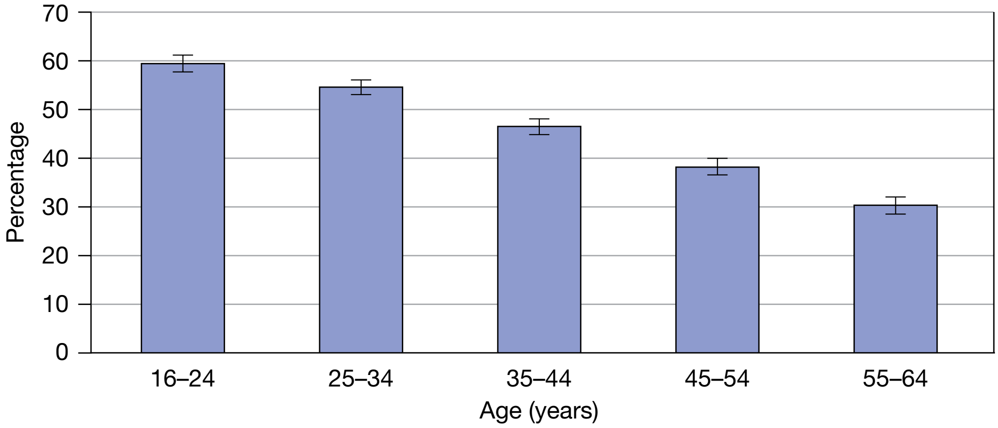
Data for a total of 15,167 respondents [5,529 (36%) from the HEPS and 9,638 (64%) from the SHeS] were entered into the model for men. Full results are given in Table B1 of Appendix B. Age and deprivation were both significant ($P < 0.001$), demonstrating that each has a significant independent effect on male compliance with the recommendations. Compared with those aged 16–24, men in each of the older age groups were significantly less likely to meet the physical activity recommendations (Figure 1) and there was no evidence that this finding varied over time, by survey or by deprivation quintile. The odds ratio (OR) for men aged 55–64 was estimated at 0.28 [95% confidence interval (CI) 0.24 to 0.31], suggesting that for any given year, deprivation quintile and survey, their odds of being regularly physically active were roughly one-quarter that of those aged 16–24. The significance of age in the model is supported by the combined weighted survey estimates, which show a stepwise reduction in the percentage of men achieving the recommendation with increasing age (Figure 2). Based upon the combined survey data from 1995 to 2006, only 30% of men aged 55–64 were regularly physically active compared with 59% of those aged 16–24 (Figure 2).

Figure 1 **Modelled results for effect of age on male odds of meeting the physical activity recommendations, 1995–2006 (unweighted survey data)**



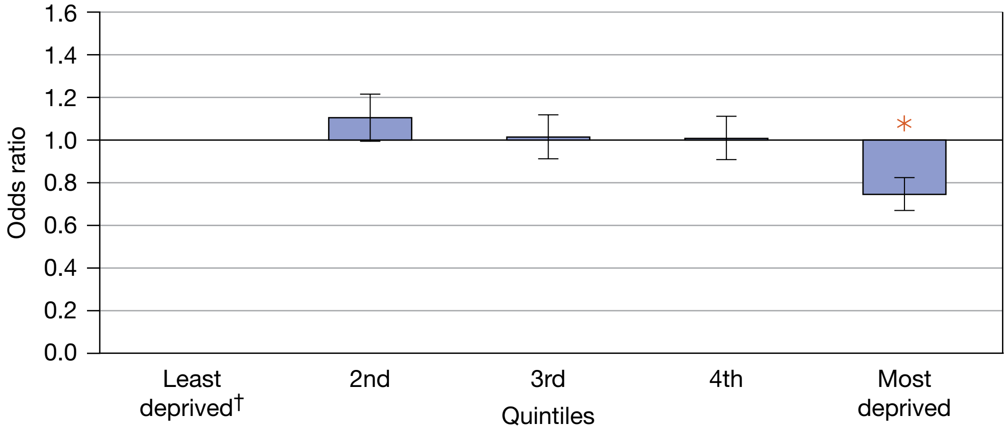
*$P < 0.05$.
†Reference group.

Figure 2 **Percentage of men meeting the recommendations by age group, 1995–2006 (weighted survey estimates)**



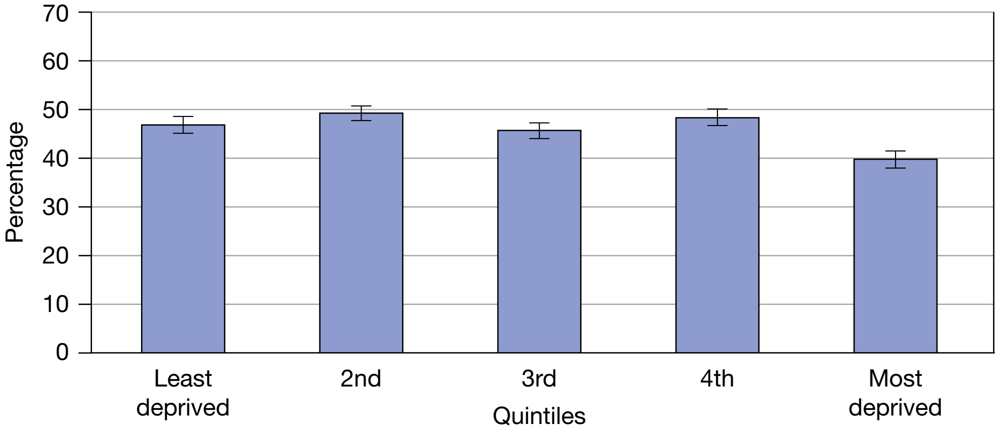
The effect of deprivation was significant only for those living in the most deprived fifth of areas (Figure 3). Compared with those living in the most affluent quintile, they were significantly less likely to be regularly physically active over the period of measurement, irrespective of age and survey (OR 0.74, 95% CI 0.67 to 0.83, $P<0.001$). Again, this finding is supported by the weighted and amalgamated survey estimates. Figure 4 shows overlap in the 95% confidence intervals for all but the most deprived quintile, 40% of whom were regularly physically active compared with 47–50% in the remaining four quintiles.

Figure 3 **Modelled results for effect of deprivation on male (16–64 years) odds of meeting the physical activity recommendations, 1995–2006 (unweighted survey data)**



*$P<0.05$.
†Reference group.

Figure 4 **Percentage of men aged 16–64 meeting the recommendations by deprivation quintile, 1995–2006 (weighted survey estimates)**



Based upon comparison in the year 2000, survey was also significant in the model with lower odds of a man meeting the recommendations in the SHeS compared to the HEPS, regardless of age or deprivation (OR 0.91, 95% CI 0.84 to 0.98, $P=0.01$). The year 2000 was selected for comparison as it is roughly mid-point in the time series. However, the size of the survey effect would differ depending upon which year the two surveys were compared. Indeed, comparison in certain years (1996, 1998, 2001, 2003) would show no effect at all. Because the HEPS has a smaller sample size, its estimates are less precise than those from the SHeS, shown by considerable variation from year to year (Figure 5). If you were to draw a line of best fit through the HEPS data points, the difference between the two surveys would be very small and is therefore unlikely to be of practical importance.

A significant interaction was found between the *survey* and *time* variables ($P<0.001$), indicating different trends over time between the two surveys. The data from each were therefore modelled separately (Appendix B, Tables B2a and B2b). While the results from the SHeS suggest that there has been a small but significant increase in the prevalence of male compliance with the recommendations over time, for any given age group and deprivation quintile (OR 1.03, 95% CI 1.02 to 1.05, $P<0.001$), no significant change was observed for the HEPS ($P=0.80$) (Figure 6).

Figure 5 **Percentage of men aged 16–64 meeting the recommendations over time (weighted survey estimates)**

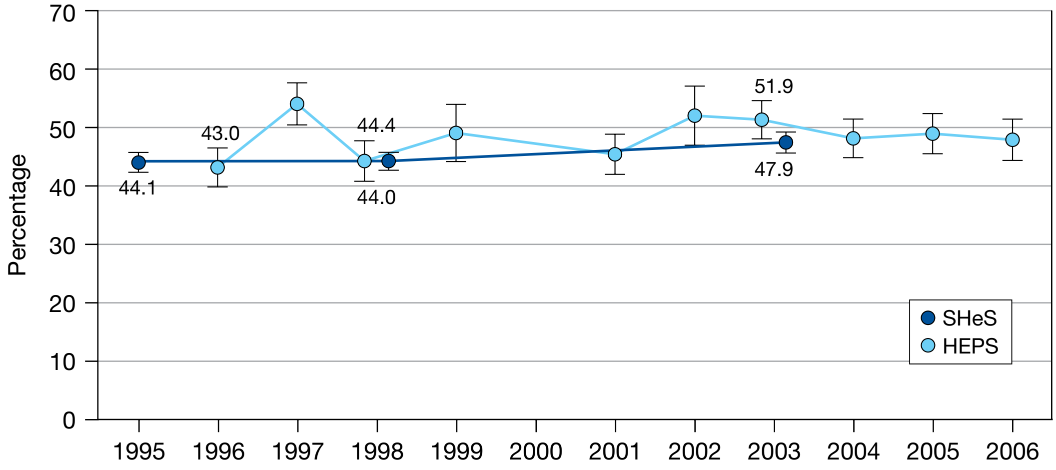
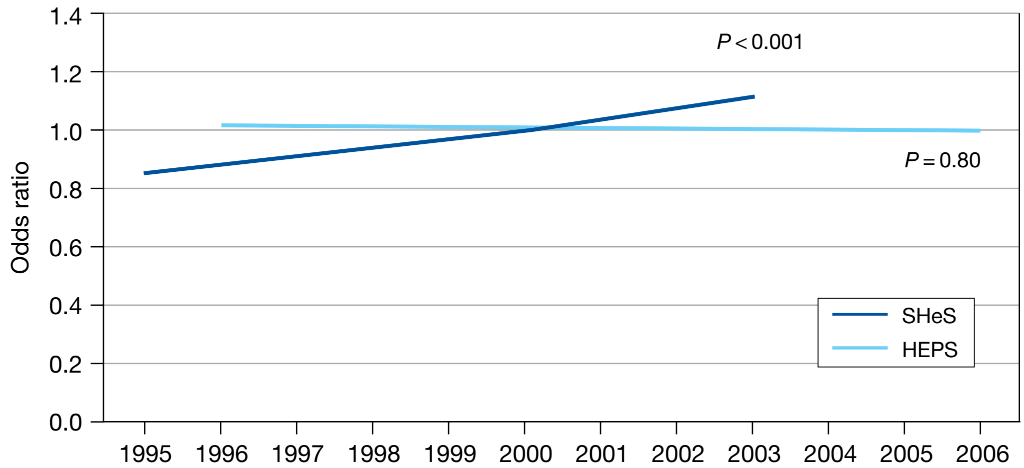


Figure 6 **Modelled results for male (16–64 years) trend over time in meeting the recommendations, 1995–2006, modelled separately for the SHeS and HEPS (unweighted survey data)**

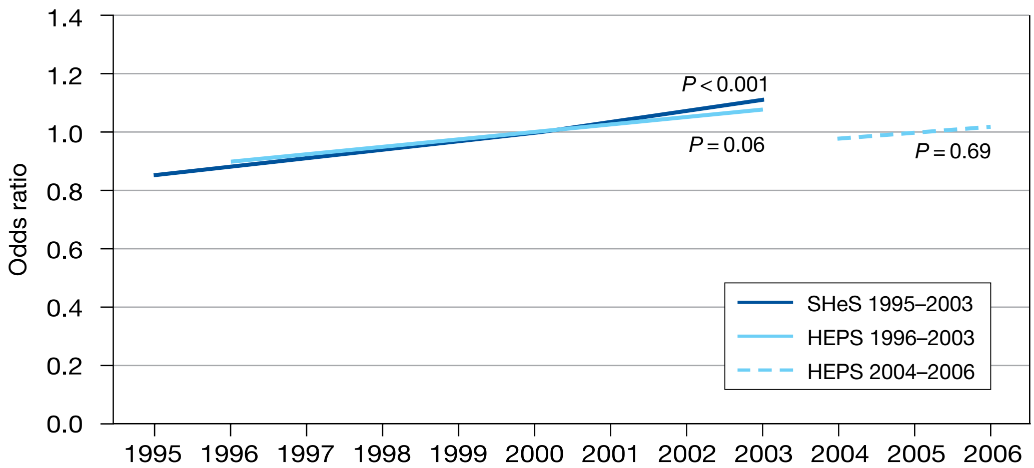


There are several possible explanations for this lack of agreement between the two surveys. The first is that no real change has occurred in men's physical activity levels from 1995 to 2006 and the improvement observed by the SHeS is instead attributable to alterations in its methodology. Substantial modifications were introduced to the survey's physical activity module in 1998 (see Appendix A for further details). In 2003, the overall sampling design was altered from one adult per household to all adults per household, contributing to a fairly considerable decline in individual response: 81% in 1995, 76% in 1998, 60% in 2003 (see Appendix A, Figure A1). Although weighting corrects for under-representation in the sample, participation bias may have occurred if those who took part in the survey differed in their physical activity behaviour from those who did not.

Secondly, the HEPS' lower statistical power may conceal a real rise in the proportion of men participating in regular physical activity from 1995 to 2006. The survey sample was small (around 1800 per year) leading to wide confidence intervals, considerable uncertainty about the size of the true population value at any single point of time and quite substantial fluctuations from year to year, especially visible in the earlier part of the series. The survey is therefore best suited to detecting trends over long rather than short periods of time. On the other hand, its methodology and response were consistent across the series, both advantageous in terms of measuring time trends.

Thirdly, the HEPS series may contain two distinct trends – an initial increase, matching the SHeS trend, followed by more recent stability – which effectively cancel each other out when analysing the data across the full series. The weighted survey estimates rose from 43% in 1996 to around one-half of respondents in 2003, 2004, 2005 and 2006 (52%, 49%, 50%, 49%; Figure 5). In order to test this hypothesis, the HEPS data were modelled separately for 1996–2003 and for 2004–2006. The year 2003 was chosen as the cut-off point to achieve consistency with timing of the SHeS. The results of this analysis (Figure 7; Appendix B, Tables B3a and B3b) provide weak evidence of an increase in male compliance with the recommendations from 1996 to 2003 ($P = 0.06$), with no evidence of a change thereafter ($P = 0.69$). The weighted HEPS estimates increased by 9% from 1996 to 2003 (43% to 52%), but the width of the confidence intervals indicates considerable uncertainty about the true size of the difference (Figure 5). The weighted SHeS figures, which are more precise, increased by 4% from 1995 to 2003 (44% to 48%).

Figure 7 **Modelled results for male (16–64 years) trend over time in meeting the recommendations, HEPS data modelled separately for 1996–2003 and 2004–2006 (unweighted survey data); SHeS provided for comparison**



Women

Data for a total of 19,459 respondents [7,396 from the HEPS (38%) and 12,063 (62%) from the SHeS] were entered into the model for women. Full results from the analysis are provided in Appendix B, Tables B4–6. Survey year was significant ($P < 0.001$) with a positive odds ratio (1.03, 95% CI 1.02 to 1.04), indicating an increase in the proportion of women participating in regular physical activity from 1995 to 2006 (Figure 8). Survey year did not interact significantly with any other variable in the model, demonstrating that this finding is true of women in each age group and deprivation quintile and that it was supported by both surveys. The weighted estimates from the SHeS suggest that compliance with the recommendations has increased amongst women aged 16–64 from 32% in 1995 to 36% in 2003 (Figure 9). Corresponding HEPS estimates from 2003 to 2006 are much less precise, showing considerable variation from year to year, but also suggest that just over one-third of women are regularly physically active (40%, 35%, 38%, 43%).

Figure 8 **Modelled results for female (16–64 years) trend over time in meeting the recommendations, 1995–2006 (unweighted survey data)**

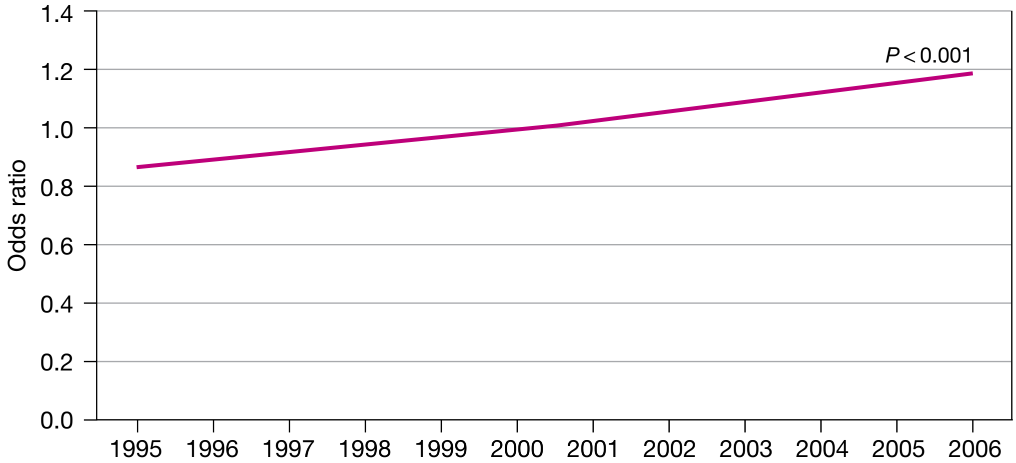
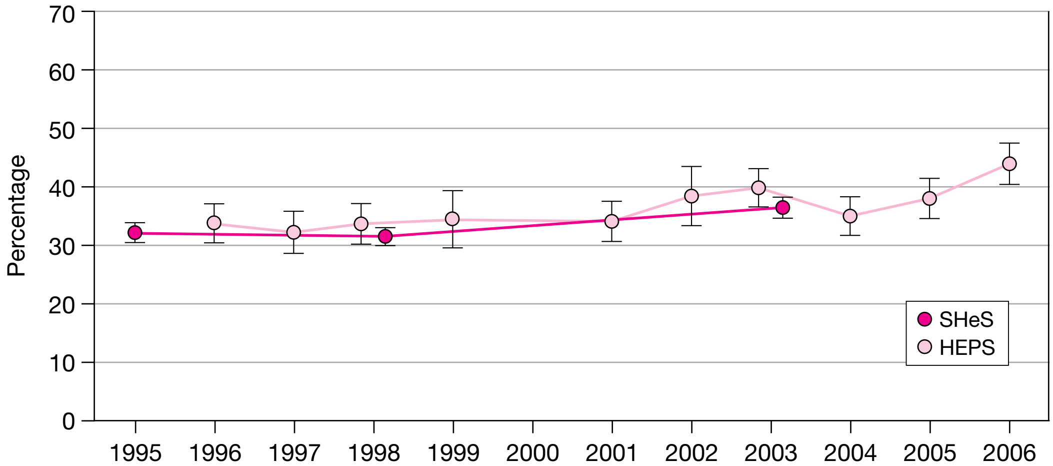


Figure 9 **Percentage of women aged 16–64 meeting the recommendations over time (weighted survey estimates)**

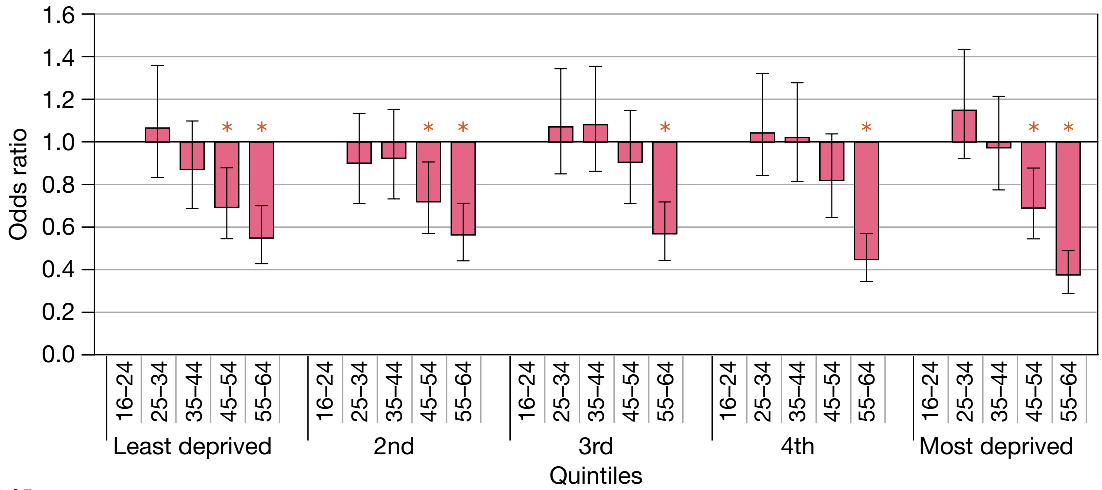


Although the HEPS estimates tend to be slightly higher (Figure 9), survey was not significant in the final model ($P=0.26$, based upon comparison of the modelled estimates for the year 2000), demonstrating that the proportion of women meeting the recommendations did not differ significantly between the two surveys. Again, this result was consistent by age and deprivation.

A significant interaction between age and deprivation ($P=0.02$) revealed that the effect of age upon women's participation in physical activity varies by deprivation quintile. Age and deprivation were therefore modelled separately (Appendix B, Tables B5 and B6).

Compared with those aged 16–24, women aged 55–64 were significantly less likely to be regularly physically active regardless of area deprivation (Figure 10). Those aged 45–54 were significantly less likely to meet the current recommendations for activity in three of the five deprivation quintiles (the first, second and fifth). These effects have not altered over time and are apparent in both surveys. The effect of age is most pronounced in the most deprived areas: those aged 55–64 living in the 40% most deprived areas (i.e. fourth and fifth quintiles) are around half as likely to meet the recommendations compared with those aged 16–24 in the same quintiles (fourth quintile OR 0.45, 95% CI 0.35 to 0.57, $P<0.001$; fifth quintile OR 0.38, 95% CI 0.29 to 0.49, $P<0.001$). This pattern is also evident in the weighted survey estimates, which show the widest gap in rates of regular physical activity between the youngest and oldest individuals living in the most deprived quintile (Figure 11).

Figure 10 **Modelled results for effect of age on female odds of meeting the recommendations, 1995–2006, modelled separately within each deprivation quintile (unweighted survey data)**



*$P<0.05$.

Women living in the most deprived areas were less likely to be regularly physically active than those in the most affluent areas. This effect was consistent across age groups, although the evidence was weaker amongst 35–44 year-olds ($P=0.06$, Figure 12). Amongst those aged 55–64, significantly lower rates of compliance were observed in both the fourth and fifth most deprived areas. Amongst those aged 25–34, women living in the most affluent 20% of areas were significantly more likely to meet the recommendations than those in all but one of the remaining quintiles (third). These effects were consistent over time and between both surveys. See Figure 13 for the corresponding weighted survey estimates.

Figure 11 **Percentage of women meeting the recommendations by age within each deprivation quintile, 1995–2006 (weighted survey estimates)**

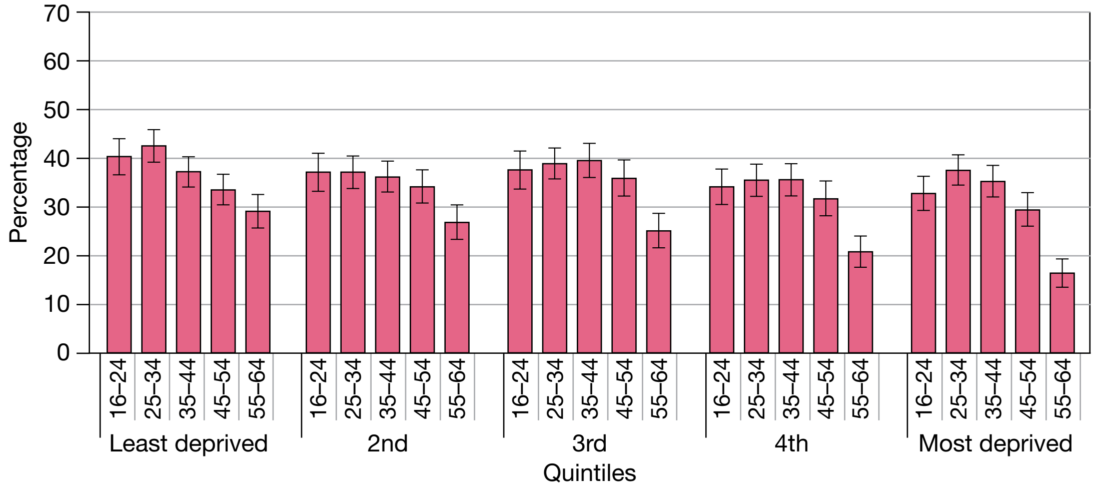
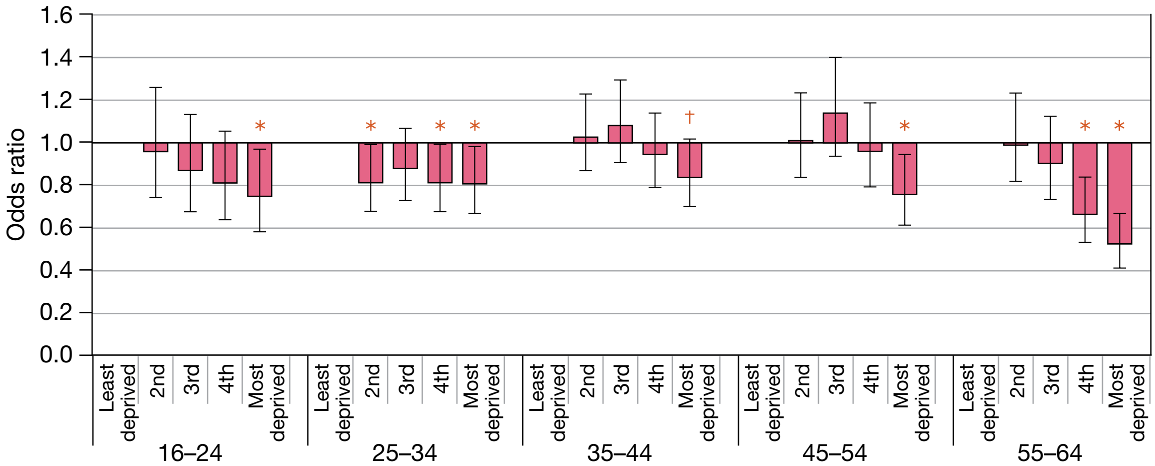
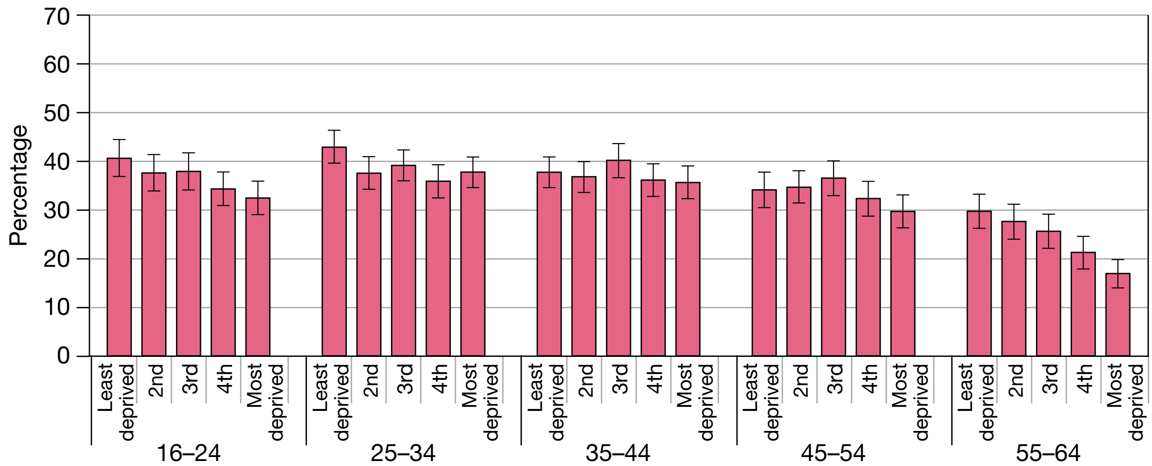


Figure 12 **Modelled results for effect of deprivation on female odds of meeting the recommendations, 1995–2006, modelled separately within each age group (unweighted survey data)**



*$P < 0.05$.
†$P = 0.06$.

Figure 13 **Percentage of women meeting the recommendations by deprivation quintile within each age group, 1995–2006 (weighted survey estimates)**

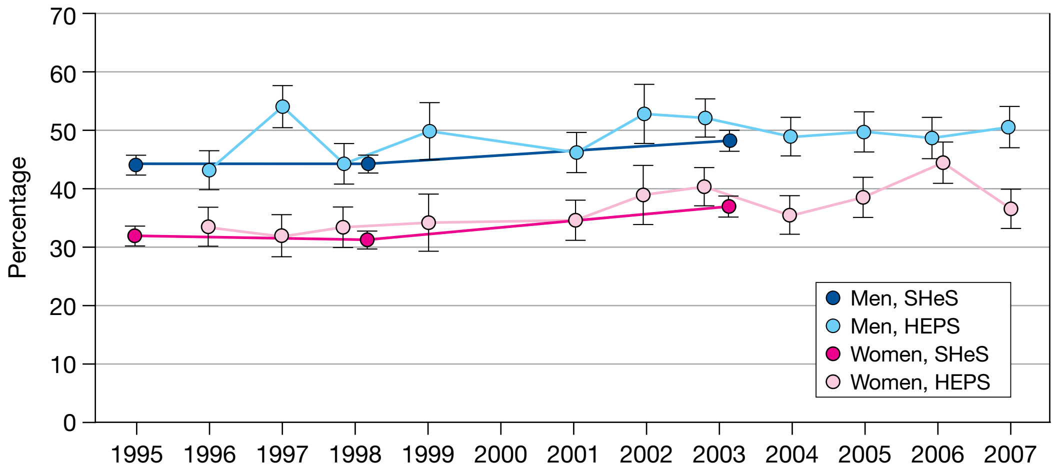


Gender difference

Significant interactions between gender and many of the other explanatory variables indicated different patterning in physical activity levels for men and women by age, deprivation, survey and over time. The data were therefore modelled separately for each gender (the results of which are given in the previous two subsections), but this means that the regression analysis did not describe the difference in male and female compliance with the current recommendations for physical activity. The weighted survey estimates are therefore presented in order to show the gender difference over time. Readers are directed to the original reports from the most recent SHeS and HEPS surveys for further analysis of physical activity levels by sex.[3,4]

Both surveys show that men are significantly more likely to meet the current recommendations for physical activity than women (Figure 14). Results from the 2003 SHeS suggested that 48% of men aged 16–64 were regularly physically active compared with only 36% of women. Results from the 2007 HEPS are very similar: 50% of men and 36% of women. HEPS data are presented up to 2007 as it was unclear whether the 2005 and 2006 estimates marked the beginning of a reduction in the gender gap. The difference between men and women in 2007 is consistent with that in previous years, suggesting that the earlier convergence is due to random variation.

Figure 14 **Percentage of men and women aged 16–64 meeting the recommendations over time (weighted survey estimates)**



Discussion

Improving physical activity levels is a public health priority in Scotland.[1,5] Monitoring data have been collected in two routine national household surveys – the SHeS and HEPS – and now span a period of more than a decade starting from 1995. Each survey has reported its findings independently but combining them offers the scope to make more definitive statements about population trends. This study therefore triangulated the available data from both surveys to examine whether there has been any significant change in the proportion of adults meeting the current recommendations for physical activity. As a secondary aim, we also looked for differences in compliance with the recommendations by gender, age and deprivation.

Analysis was undertaken using multiple logistic regression techniques covering the 12-year period from 1995 to 2006. Data were included for all adults aged 16–64; those aged 65 and over were excluded to give comparability over time and between the two surveys. The following findings are therefore representative only of men and women aged 16–64.

Scotland's national physical activity strategy, *Let's Make Scotland More Active*,[1] was published in 2003 and sets a target of 50% of all adults aged over 16 meeting the minimum recommended levels of activity by 2022 – a goal which requires average increases of 1% a year across the population, based upon estimates from the 1998 SHeS. The strategy recommended that progress towards the target be assessed every 5 years using data from the SHeS. The first review[2] was conducted in 2008 but will not take stock of current progress towards the target until autumn 2009, when new data from the 2008 SHeS become available. The current study includes four years of HEPS data from the time the target was set (2003–2006). Although not the preferred source, they provide useful insight into progress ahead of the official review process. However, final conclusions cannot be drawn until the new SHeS data become available.

Time trends

Results from our analysis suggest that the proportion of women aged 16–64 participating in regular physical activity increased slightly from 1995 to 2006. A small improvement was observed in both surveys, giving increased confidence that a real change has occurred. In addition, there were no interactions with age or deprivation, indicating that regular physical activity has become more common in women of all ages and levels of affluence. Amongst women aged 16–64, the SHeS figure rose from 32% in 1995 to 36% in 2003. Subsequent HEPS estimates have varied – to be expected given the smaller sample size – but the most recent estimate from the 2007 survey was also 36%.

The results for men are much less straightforward, but they provide weak evidence of increased participation in regular physical activity from 1995/1996 to 2003 with stability thereafter. When the data from both surveys were originally entered into the model, a significant interaction between the *survey* and *year* variables indicated different trends over time, so each survey had to be modelled separately. This was initially done for the SHeS from 1995 to 2003, and for the HEPS from 1996 to 2006. Subjective assessment of the HEPS time series suggested that it may contain two distinct trends, so it was further subdivided into two and the results modelled separately for 1996 to 2003 and 2004 to 2006 (see pages 9–10 for further details).

Looking first at the period from the earliest SHeS and HEPS until 2003, both surveys suggest that compliance with the current recommendations for physical activity has risen to around one-half of men aged 16–64: SHeS, 44% in 1995 to 48% in 2003; HEPS, 43% in 1996 to 52% in 2003. The evidence was weaker from the HEPS but its much smaller sample size (approximately 1800 per year) confers considerably less statistical power to detect true differences. The SHeS result is complicated by alterations to the survey's methodology. Substantial changes were made to the physical activity module in 1998, limiting comparability of the data with those from 1995. In 2003, the sampling design was changed from one adult per household to all adults per household, contributing to a sizeable reduction in individual response (81% in 1995, 76% in 1998, 60% in 2003). Notwithstanding these limitations, broad agreement between the two surveys suggests that the observed increase is reflective of a real improvement in male compliance with the physical activity recommendations from 1995/1996 to 2003.

Turning to more recent trends, data beyond 2003 are currently available only from the HEPS. Modelled results from the 2004, 2005 and 2006 surveys suggest that participation in regular physical activity has stabilised at around 50% amongst men aged 16–64. Estimates were almost static over the three years: 49%, 50%, 49%. At 50%, the figure from the 2007 survey continues the pattern of stability.

Monitoring progress towards the national target

When the national target was set in 2003 – 50% of adults meeting the minimum recommendations for physical activity by 2022 – the strategy recommended that this should be achieved by simultaneously working on three different approaches:

- maintaining existing levels of activity, i.e. avoiding any further reduction
- increasing activity levels across the entire population
- changing physical activity levels in specific sections of the population.[1]

The first of these is probably the most realistic goal at this early stage in the life of the strategy.

Although we did not set out to examine trends in physical activity behaviour after the launch of the national strategy, this was achieved for men in trying to reach an understanding of change over the longer term. For consistency, we therefore used HEPS data to examine recent trends for women. Female estimates from 2003 onwards have shown considerable variability from year to year, but no consistent time trend was apparent suggesting that women's physical activity levels have remained broadly stable since the launch of the strategy. The unusually high 2006 estimate was followed in 2007 by a return to a level more consistent with previous years, suggesting random sampling error rather than an increasing trend.

Our findings on recent trends must be treated with some caution as they are based upon a single source of evidence which, due to its relatively small annual sample (approximately 1800), is better suited to detecting trends over longer periods of time. Nonetheless, they provide useful preliminary evidence that there has been no reduction in compliance with the current physical activity recommendations since the launch of *Let's Make Scotland More Active* in 2003 – a promising start to tackling Scotland's physical activity challenge at this initial stage of the strategy's implementation. It is not possible to draw final conclusions on early progress towards the national target until autumn 2009, when new data from the 2008 SHeS become available.

The SHeS is the stated source for monitoring progress towards the national target for physical activity. The survey's large sample size generates very precise estimates; however, low response presents a risk to the representativeness of more recent SHeS data. Already low in 2003, initial indications are that response has declined further in 2008. The HEPS sample is small giving much lower statistical power, but it maintained a relatively high response rate over the full series (around 70% from 1996 to 2007) and so is less susceptible to potential participation bias. Its methodology also remained consistent. It is not clear which of the two surveys provides the most robust picture of physical activity time trends during the period investigated (1995–2006); the advantage of the SHeS is its precision at any single point in time and the HEPS its reliability over the series. Each has a contribution to make towards our understanding of retrospective physical activity trends over time. The first review of progress towards the national target should therefore make use of the relevant data from both: SHeS 2003 and 2008 and HEPS 2003 to 2007.

The HEPS analysis presented here includes data only up to 2006. Further work is in progress to examine HEPS trends from 2003 to 2007. We will report on these results later this year in time to feed into the official review.

Because the current guidelines[6] state that activity can be accumulated in bouts as short as 10 minutes, the 2008–11 SHeS questionnaire was revised to include activities of 10–14 minutes' duration.[i] Should this change have any impact upon population measures of activity, the time series will be maintained by creation of a synthetic measure that is directly comparable to the data from 1998 and 2003.

Following decommissioning of the HEPS in 2007, the SHeS is now the only national survey measuring the physical activity levels of people living in Scotland. With the loss of further opportunity to triangulate national survey data on physical activity, it is even more important that its estimates are as robust and response rates as high as possible. As the designated source to monitor progress towards the national target, they must also be comparable over time. This does not preclude future improvement, but any change should be introduced in a way that enables its impact to be quantified so that previous results can be adjusted to maintain a consistent time series.

Inactivity

For comparison, we employed the same methods – multiple logistic regression analysis of triangulated data from the SHeS and HEPS time series – to examine trends over time in the proportion of people who do little or no physical activity. In accordance with *Let's Make Scotland More Active* (p14),[1] inactivity was defined as 30 minutes of moderate or vigorous intensity physical activity less than once a week. The results very closely mirrored those already presented for meeting the physical activity recommendations. Trends towards increased participation in regular activity were matched by trends towards reduced inactivity. This was the case for both men and women. Further details of the inactivity analysis are provided on the ScotPHO website.

Inequalities

Triangulation of the available data from the SHeS and HEPS surveys confirms previous findings that compliance with the current recommendations for physical activity varies by gender, age and deprivation. These effects were consistent across the two surveys. They also showed

i In 1998 and 2003, the SHeS reported bouts of activity only if they lasted 15 minutes or more.

no significant change since the two surveys began in 1995 and 1996, demonstrating the persistence of health inequalities in physical activity.

Male compliance with the current recommendations for physical activity declined progressively with increasing age. For every 10-year increase in age, men were significantly less likely to meet the recommendations, with only 30% of those aged 55–64 regularly physically active compared with 59% of those aged 16–24. Additionally, men living in the most deprived fifth of areas were significantly less likely to be regularly physically active than those in the least deprived quintile: 40% compared with 47%. These effects were independent of each other, showing that older men are less likely to be regularly physically active regardless of their level of deprivation, while those living in the most deprived fifth of areas are less likely to be regularly physically active irrespective of their age. The inequalities gap for deprivation, albeit smaller than that for age, is important given the priority attached to the reduction of socio-economic inequalities in health.[7]

The relationship between age, deprivation and female compliance with the physical activity recommendations was less straightforward. A significant interaction between age and deprivation showed that the effect of age differs by level of deprivation and the effect of deprivation differs by age. Each was therefore modelled separately.

Looking first at the impact of age, older women are less likely to be regularly physically active but there is not a gradual decline with increasing age as seen in men. Rates of participation in regular physical activity are very similar amongst women aged 16–44, but they decline thereafter. Women aged 55–64 were significantly less likely to be regularly physically active, regardless of deprivation. Women aged 45–54 were also less likely to meet the recommendations if they lived in the most deprived quintile or the two least deprived quintiles, i.e. at the extremes of deprivation. Thus, living in the least well-off or most well-off areas is associated with a reduced likelihood of regular activity at a younger age. The effect of age was also heightened by deprivation, with the widest gap in rates of regular participation between the youngest and oldest amongst women living in the most deprived quintile.

Women living in the most deprived areas were less likely to meet the current recommendations for physical activity than those in the most affluent areas, regardless of age. The very lowest rate of compliance with the recommendations was observed amongst the oldest age group living in the most deprived fifth of areas. Only 17% were regularly physically active compared with 41% of those aged 16–24 living in the least deprived quintile.

The regression analysis did not compare men and women's compliance with the current recommendations for physical activity. Different gender patterning required the data to be modelled separarely for each sex so that there was no result for the difference *between* them. Looking instead at the weighted survey estimates, both surveys show that men are significantly more likely to meet the current recommendations for physical actvity than women. Results from the 2003 SHeS suggested that around one-half of men aged 16–64 were regularly physically active compared with just over one-third of women (48% compared with 36%). These figures are very similar to those from the final HEPS which was conducted in 2007: 50% of men and 36% of women.

Strengths and limitations

Triangulation enables data from more than one source to be pooled, increasing sample size and power and thereby allowing more definitive statements to be made about population trends.

By including data from both the SHeS and HEPS, this study makes the most of the information currently available for monitoring physical activity in Scotland.

The use of multiple logistic regression analysis provides a powerful means of dealing with confounding, enabling trends over time to be examined after adjusting for the effects of other variables known to have an influence on physical activity levels (gender, age and deprivation). However, the results give information about trends and effects in relative terms only. To give a sense of absolute levels of activity, we have therefore interpreted them with reference to the corresponding weighted survey estimates.

Trends over time in compliance with the recommendations for physical activity were analysed from 1995 to 2006. Results from the regression analysis effectively describe the overall trend averaged across the entire 12 years, but the available data are not evenly spread across them. The HEPS was conducted in ten of the twelve years and the SHeS in three (1995, 1998 and 2003). The results do not give information about shorter-term trends, other than where this has been done to test a specific hypothesis. The SHeS gives no information about trends since 2003. The HEPS supplies information about more recent trends but its data have relatively wide confidence intervals.

Where the results from the various data sources agree, triangulation increases confidence that they truly reflect what is happening within the population. But explaining differences is much less straightforward. Our initial analysis showed differing results for male trends over time from the SHeS and HEPS. We interpreted these with respect to the methodological strengths and limitations of each survey. Further analysis also enhanced our understanding.

Using 1995, 1998 and 2003 SHeS data to assess physical activity time trends, the survey's strengths include its large sample size, subsequent high levels of precision and a detailed physical activity module covering a broad range of activities. However, improvements to the module in 1998 and change to the overall sampling design in 2003 mean that estimates from the three surveys are not directly comparable. It is therefore unclear to what extent observed changes in physical activity reflect real change within the population or methodological change. Falling response rates are an additional concern. Although weighting corrects for under-representation of specific subgroups, estimates will not be representative if those who take part are different in their behaviour from those who do not. The potential for participation bias has increased over the SHeS series as response rates have declined.

Using HEPS data to examine physical activity trends over time, the survey's strengths relate to its high response (around 70% across the series), reducing the potential for participation bias, and a consistent methodology. However, its sample size is small leading to wide confidence intervals, considerable uncertainty about the size of the true population value and quite substantial fluctuations from year to year. The survey is therefore better suited to detecting trends over long rather than short periods of time. In addition, it does not capture as broad a range of activities as the SHeS (for example, walking is limited to leisure-time walking only) and the reference period refers to a typical week rather than a specified period of time prior to the interview.

The findings presented here are representative only of men and women aged 16–64. Adults aged 65 and over were excluded from the analysis to allow comparability for the SHeS over time and between the SHeS and HEPS. Given the strong age effect – reduced compliance with the current recommendations for physical activity with older age – our results will overestimate the prevalence of regular physical activity amongst the whole adult population (i.e. including those aged 65 and over).

Conclusions

Triangulated data from the SHeS and HEPS provide strong evidence of a small increase in the proportion of women meeting the minimum physical activity recommendations from 1995 to 2006, regardless of age or deprivation. This finding is consistent between the two surveys, indicating that it reflects a real population trend. Amongst women aged 16–64, estimates suggest that participation in regular physical activity has risen from 32% in 1995 to around 36% from 2003 onwards.

The combined data from the two surveys showed no significant change in the proportion of men (aged 16–64) meeting the recommendations from 1995 to 2006. However, there is some evidence of an increase from 1995/1996 to 2003, supported by the SHeS with weaker evidence from the HEPS. Over four in ten men aged 16–64 were regularly physically active when the two surveys first began (1995 SHeS 44%, 1996 HEPS 43%), rising to around one-half in 2003 (SHeS 48%, HEPS 52%).

Information about more recent trends is currently available only from the HEPS. Results from the 2004, 2005 and 2006 surveys suggest no further change in male compliance with the current recommendations for physical activity since the last SHeS in 2003. Estimates for those aged 16–64 have remained at or very close to 50%. Recent estimates for women are much more variable but show no consistent time trend, also suggesting broad stability since 2003. Some caution is required with these findings as the HEPS' small sample size makes it better suited to detecting trends over longer periods of time. Nonetheless, they provide useful preliminary evidence that there has been no reduction in compliance with the current physical activity recommendations since the launch of *Let's Make Scotland More Active* in 2003. It is not possible to draw final conclusions on early progress towards the national target (50% of adults meeting the minimum recommendations by 2022) until autumn 2009, when new data from the 2008 SHeS become available.

The SHeS is the stated source for monitoring progress towards the national target for physical activity. Its large sample size generates very precise estimates, but low response presents a risk to the representativeness of more recent SHeS data. Already low in 2003, initial indications are that response rates declined further in 2008. The HEPS sample is small giving much lower statistical power, but its methodology was consistent over the time series and response rates high. Each survey has a contribution to make towards our understanding of retrospective physical activity trends over time. The first review process should therefore utilise HEPS data from 2003 to 2007, in addition to those from the 2003 and 2008 SHeS.

Triangulation of the data from both surveys confirms previous findings that compliance with the current recommendations for physical activity is patterned by gender, age and deprivation. Moreover, these patterns have not altered significantly since the two surveys began in 1995 and 1996, clearly demonstrating the persistence of health inequalities in physical activity.

For men, compliance with the recommendations declines progressively with increasing age, regardless of deprivation. Additionally, men living in the most deprived fifth of areas are less likely to be regularly physically active, irrespective of age.

The picture is more complex for women. Older women are less likely to be regularly physically active but there is not a gradual decline with increasing age, as seen in men. Women aged 55–

64 are less likely to meet the recommendations regardless of deprivation, but those aged 45–54 are less likely to do so only if they live in the most deprived or most affluent areas. Deprivation also magnifies the effect of age, with the widest gap in rates of regular participation between the youngest and oldest women living in the most deprived 20% of areas. Women living in the most deprived areas are less likely to meet the recommendations than those in the most affluent areas, irrespective of age. The oldest women living in the most deprived fifth of areas are most at risk of not meeting the recommendations.

Following decommissioning of the HEPS at the end of 2007, the SHeS is now the only nationally representative, population-based resource measuring the amount of time that adults in Scotland spend in physical activity. From 2008 onwards, it will not be possible to triangulate SHeS physical activity data with those from other national surveys. It is therefore vital that SHeS estimates are as robust as possible, that they are comparable over time and that response rates are maximised.

Recommendations for future monitoring

- The first review of progress towards the national physical activity target, currently scheduled for autumn 2009, should make use of all relevant national survey data. It should therefore utilise the HEPS data from 2003 to 2007, in addition to those from the 2003 and 2008 SHeS.
- Following decommissioning of the HEPS, the SHeS is now the sole national survey measuring physical activity levels in Scotland. As triangulation is no longer possible, it is vital that SHeS estimates are as robust as possible, that they are comparable over time and that response rates are maximised.

References

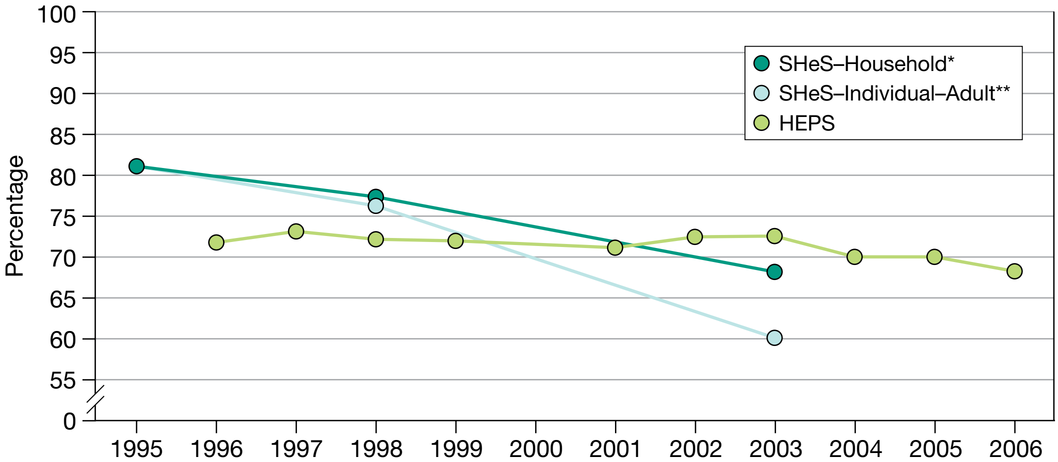
1. Physical Activity Task Force. *Let's make Scotland more active: A strategy for physical activity*. Edinburgh: Scottish Executive; 2003.
2. Physical Activity Review Group. *Five-year review of 'Let's Make Scotland More Active – A strategy for physical activity*.' Edinburgh: NHS Health Scotland; 2009.
3. Bromley C, Sproston K, Shelton N (eds). *The Scottish Health Survey 2003. Volume 2: Adults*. Edinburgh: Scottish Executive; 2005.
4. Bassett C, Gilby N, Catto S. *Health Education Population Survey: Update from 2007 survey*. Glasgow: NHS Health Scotland; 2008.
5. The Scottish Government. *Healthy eating, active living: An action plan to improve diet, increase physical activity and tackle obesity (2008–2011)*. Edinburgh: The Scottish Government; 2008.
6. Haskell WL, Lee I, Pate RR, Powell KE, Blair SN, Franklin BA, *et al*. Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Circulation* 2007;116(9):1081–1093.
7. The Scottish Government. *Equally well: Report of the ministerial task force on health inequalities*. Edinburgh: The Scottish Government; 2008.

Appendix A: Survey methodologies

Samples and general methodology

The SHeS monitors the health of the general population living in private households throughout Scotland. The survey was first conducted in 1995 and then repeated in 1998 and 2003. Following review and redevelopment, it is now running continuously from 2008 to 2011. The sample is drawn from the Postcode Address File, using multi-stage stratified clustered random probability sampling, with all those living in private households in Scotland eligible for inclusion. Age of the target population has been extended over the series: 16–64 years in 1995, 2–74 years in 1998, individuals of all ages from 2003. Achieved sample size was approximately 8,000 adults in the 1995 and 2003 surveys and just over 9,000 in 1998. The 1995 and 1998 surveys sampled one adult per household, but in 2003 the design was altered to include all adults per household. Thus, in 1995 and 1998 there was no difference between household and individual response – 81% and 76% respectively. In 2003, household response declined to 68% and individual response to 60% (Figure A1). Data are collected during face-to-face interviews conducted in people's homes using computer-assisted personal interviewing (CAPI) techniques. Fieldwork for the first two surveys lasted roughly one year but was slightly longer for the 2003 survey. The adult physical activity module is administered to all those aged 16 and over.

Figure A1 **Survey response rates over time**



*Defined as the percentage of sampled households in which at least one eligible person is interviewed.
**Defined as the percentage of eligible adults interviewed.

The HEPS monitored health-related knowledge, attitudes, behaviours and behavioural motivation among adults in Scotland. The survey was first conducted in 1996 and ran until 2007, when it was decommissioned and replaced with the Knowledge, Attitudes and Motivations (KAM) module in the SHeS from 2008. (Content of the new module is broadly similar to that of the previous survey, except for behaviours, which were dropped as they are covered in the core SHeS.) The HEPS targeted adults aged 16–74 living in private households in mainland Scotland. The achieved sample size was approximately 1800 people each year with a minimum response rate of 70%, attained in all years except 2006 when it dropped slightly to 68%. The sample was drawn from the Postcode Address File using a multi-stage clustered random sampling design. Data were collected via CAPI-assisted face-to-face interviews. Fieldwork was undertaken in two waves each year, usually in March and September, although the 2006 and 2007 spring waves were brought forward to January to evaluate the smoking ban. The survey was suspended for three waves during 1999–2000, so the 1999 estimates are based on a sample size half of that usually obtained and there are no estimates for the year 2000. The physical activity module was administered to all participants. In 2002, only half of the sample answered the usual physical activity questions as a new World Health Organization measure of physical activity was trialled with the remainder.

Measurement of physical activity

SHeS

The methodology for the SHeS physical activity module changed from 1995 to 1998/2003 (Appendix A, Table A1). In 1995, respondents were asked to report any physical activities done in an average week, either at work or in their free time. Fixed response options were used to determine frequency (ranging from less than once a week to 6–7 times a week or more) and duration (from less than 10 minutes to 2 hours or longer). Heavy housework and heavy gardening/DIY/building work (see Table A2 for listed examples) was assumed to be of moderate intensity, with reported activity lasting at least 30 minutes counted as a single session. Participation in sports and exercise was assessed using a list of specific activities, including an 'other' option and two for walking (Table A2), and intensity determined by asking about the effect on respondents' breathing (normal/faster than normal/gasping for breath).

From 1998 onwards, respondents were asked to recall all physical activity done outwith their paid job over the 4-week period immediately prior to interview. A separate set of questions was used to assess level of occupational activity. Respondents were asked to report sports and exercise and walking activity only if it lasted 15 minutes or more; the questionnaire captured heavy housework, gardening and DIY done for less than 15 minutes at a time but this was coded as zero. Questions on frequency and duration were revised to an open format (permitted answers of 0 to 28 days for frequency, duration recorded in hours and minutes) and sports and exercise intensity was established by asking whether or not the effort was usually enough to make them out of breath or sweaty. Walking was removed from the sports and exercise section and a separate bank of questions was added, incorporating measurement of walking intensity in terms of pace (slow, steady average, fairly brisk, fast). Walking was counted as a moderate intensity activity session if the pace was at least fairly brisk and it lasted at least 30 minutes. Running and squash were classified as vigorous intensity regardless of effort rating. Dancing (except that done for fitness) and exercises such as press-ups and sit-ups were classed as moderate intensity if they were done for at least 30 minutes and made the person out of breath or sweaty. All other sports and exercise activities were classified as vigorous intensity if they made the participant out of breath or sweaty, otherwise they were classed as moderate intensity.

Throughout the series, moderate intensity activities lasting at least 30 minutes were counted as moderate sessions, and vigorous intensity activities lasting at least 20 minutes were counted as vigorous sessions.

HEPS

Like the 1995 SHeS, HEPS respondents were asked to report physical activity done in a typical week. The survey covered the same broad types of physical activity (sports and exercise, walking, heavy work around the home and heavy gardening), except an additional option was included to assess occupational activity (heavy manual work as part of your job) and the walking category covered only leisure-time walking (Tables A1 and A2). The questionnaire included a separate item on day-to-day walking in order to assess inclination towards active living, but the result was not factored into the overall assessment of physical activity. An 11-item list of specific activities (including an 'other' option) was used to aid recall (Table A2). For each activity mentioned, respondents were asked how often it was done to the point where they were breathing faster than usual, whether they usually put in enough effort to make them sweaty and out of breath, and how long on average they spent doing the activity each time it was undertaken. Unlike the SHeS, no minimum time period was used to collect the data on duration, with a permitted range of answers from 1 to 360 minutes.

Activities were categorised as either moderate or vigorous intensity sessions depending upon their type, intensity and duration (Table A2). Heavy work around the home, heavy gardening and heavy job-related manual work was classed as moderate intensity activity if it made respondents breathe faster than usual or made them sweaty and out of breath. All other sports and exercise activities, including leisure-time walking, were classed as moderate intensity activity if they made the participant breathe faster than usual and as vigorous intensity if they became sweaty and out of breath. Like the SHeS, moderate intensity activities lasting at least 30 minutes were counted as moderate sessions, and vigorous intensity activities lasting at least 20 minutes were counted as vigorous sessions.

Table A1 **Methodology for physical activity modules in each survey**

	HEPS 1996–2006	SHeS 1995	SHeS 1998–2003
	I would like to ask you about any physical activity you do, not including day-to-day walking. In a typical week, which, if any, of the following physical activities* have you done to the point where you were breathing faster than usual through physical exertion?	I'd like to ask you about some of the things you do at work or in your free time that involve physical activity. Which of the following activities on this card* would you normally take part in during an average week?	I'd like you to think about the physical activities you have done in the last few weeks (when you were not doing your paid job). Have you done any heavy housework/gardening, DIY, building work or other similar heavy manual work/ sports or exercise in the past 4 weeks?
Reference period	Typical week	Average week	Past 4 weeks
Sports and exercise			
Frequency	How many times do you usually do this activity in a week? *Open response (permitted numeric range from 0 to 10)*	On how many occasions per week do you usually go (insert activity*)? *Less than once a week* *Once a week* *2–3 times a week* *4–5 times a week* *6–7 times a week or more*	On how many separate days did you do (insert activity*) for at least 15 minutes a time? *(Permitted numeric range from 0 to 28)*
Intensity	Respondents first asked to give details of physical activities* done to the point where they were breathing faster than usual through physical exertion. THEN (for each activity mentioned): Do you usually put enough effort into this activity to make you sweaty and out of breath? *Y/N/DK*	When you go (insert activity) do you usually find yourself: *Breathing normally* *Breathing faster than normal* *Gasping for breath*	Was the effort usually enough to make you out of breath or sweaty? *Y/N*
Duration	How long, on average, do you do this activity on each occasion? *Open response (permitted numeric range from 1 to 360 minutes)*	How much time do you usually spend doing (insert activity)? *Less than 10 minutes* *10 minutes, less than 20 minutes* *20 minutes, less than 30 minutes* *30 minutes, less than 2 hours* *2 hours or longer*	How much time did you usually spend doing (insert activity) on each day? Only count times you did it for at least 15 minutes. *Open response (recorded in hours and minutes)*
Minimum time period	✗	✗	15 minutes
Housework			
Frequency	As above for sports and exercise	As above for sports and exercise	During the past 4 weeks, on how many days have you done this kind of heavy housework? *(Permitted numeric range from 1 to 28)*
Intensity	As above for sports and exercise	Asks about heavy activities only,* which are coded as moderate intensity	Asks about heavy activities only,* which are coded as moderate intensity

	HEPS 1996–2006	SHeS 1995	SHeS 1998–2003
Duration	As above for sports and exercise	As above for sports and exercise	On the days you did heavy housework, how long did you usually spend? *Open response (less than 15 minutes coded as 0)*
Minimum time period	✗	✗	15 minutes
Gardening and DIY			
Frequency	As above for sports and exercise	As above for sports and exercise	As above for housework
Intensity	As above for sports and exercise	As above for housework	As above for housework
Duration	As above for sports and exercise	As above for sports and exercise	As above for housework
Minimum time period	✗	✗	15 minutes
Walking	Leisure-time walking (e.g. hill-walking, golf, rambling)†	Golf/hill-walking Other walking of 1 mile or more	All walking (country walks, to and from work, any other walks)
Frequency	As above for sports and exercise	As above for sports and exercise	On how many days did you do a walk of at least 15 minutes?
Intensity	As above for sports and exercise	As above for sports and exercise	Which of the following usually describes your walking pace? *Slow/steady average/fairly brisk/fast – at least 4 mph*
Duration	As above for sports and exercise	As above for sports and exercise	How long did you usually spend walking each time you did a walk for 15 minutes or more? *Open response (less than 15 minutes coded as 0)*
Minimum time period	✗	✗	15 minutes
Occupational activity	Captured only if in list of activities*	Captured only if in list of activities*	Were you in paid employment or self-employed in the past 4 weeks? *Y/N*
Frequency	As above for sports and exercise	As above for sports and exercise	✗
Intensity	As above for sports and exercise	As above for sports and exercise	IF in paid employment/self-employed in past 4 weeks THEN: Thinking about your job in general would you say that you are: *Very physically active* *Fairly physically active* *Not very physically active* *Not at all physically active*
Duration	As above for sports and exercise	As above for sports and exercise	✗
Minimum time period	✗	✗	✗

*See Table A2 for list.

†Excludes all other walking activity.

Table A2 **List of physical activities included in each survey and criteria for classification as a vigorous or moderate intensity session**

Activity	HEPS	SHeS 1995	SHeS 1998 and 2003	Duration and intensity criteria for classification as a vigorous or moderate session
Housework, gardening and occupational activity				30+ minutes and breathing faster than usual = Moderate
Heavy work around the home *(e.g. housework, DIY)*	✓			
Heavy gardening	✓			
Heavy manual work as part of your job	✓			
Heavy housework *[e.g. moving heavy furniture, spring cleaning, walking with heavy shopping (for more than 5 minutes), cleaning windows, scrubbing floors with a scrubbing brush]*		✓	✓	30+ minutes = Moderate
Heavy gardening, DIY and building work *(e.g. digging/clearing rough ground, building in stone/bricklaying, mowing large areas with a hand mower, felling trees/chopping wood, mixing/laying concrete, moving heavy loads, refitting a kitchen or bathroom)*		✓		
Heavy gardening, DIY and building work, or any similar heavy manual work *(list of examples as for 1995)*			✓	
Sports and exercise Running/jogging	✓	✓	✓	HEPS 30+ minutes and breathing faster than usual = Moderate 20+ minutes and sweaty and out of breath = Vigorous SHeS 20+ minutes = Vigorous
Squash		✓	✓	20+ minutes = Vigorous
Swimming	✓	✓	✓	HEPS 30+ minutes and breathing faster than usual = Moderate 20+ minutes and sweaty and out of breath = Vigorous SHeS 30+ minutes = Moderate 20+ minutes and out of breath/sweaty = Vigorous

Activity	HEPS	SHeS 1995	SHeS 1998 and 2003	Duration and intensity criteria for classification as a vigorous or moderate session
Cycling	✓		✓	
Cycling/exercise bike		✓		
Sports *(e.g. football, tennis, etc.)*	✓			
Football/rugby		✓	✓	
Badminton/tennis		✓	✓	
Exercise *(e.g. keep-fit, aerobics, weight training, etc.)*	✓			
Weight training		✓		
Dancing	✓			
Workout at a gym/exercise bike/weight training			✓	
Aerobics/keep-fit/gymnastics/dance for fitness		✓	✓	
Exercises *(e.g. press-ups, sit-ups, etc.)*		✓	✓	30+ minutes and out of breath/sweaty = Moderate
Any other type of dancing		✓	✓	
Golf/hill-walking		✓		
Other walking of 1 mile or more		✓		
Other		✓	✓	30+ minutes = Moderate 20+ minutes and out of breath/sweaty = Vigorous
Walking Leisure-time walking *(e.g. hill walking, golf, rambling)*	✓			30+ minutes and breathing faster than usual = Moderate 20+ minutes and sweaty and out of breath = Vigorous
All walking (country walks, to and from work, any other walks)			✓	30+ minutes and pace fairly brisk/fast = Moderate
Other* (please specify)	✓			30+ minutes and breathing faster than usual = Moderate 20+ minutes and sweaty and out of breath = Vigorous

*The SHeS asks about other activities within the sports and exercise category.

Appendix B: Tables

Table B1 **Male logistic regression model – HEPS and SHeS combined**

Predictor	Exp(B) odds ratio	95% CI Lower	95% CI Upper	*P*-value
Deprivation quintile				**<0.001**
1st (least deprived)	1			
2nd	1.103	0.997	1.221	0.06
3rd	1.015	0.917	1.124	0.77
4th	1.003	0.905	1.112	0.96
5th (most deprived)	0.744	0.668	0.828	**<0.001**
Age group				**<0.001**
16–24	1			
25–34	0.786	0.700	0.882	**<0.001**
35–44	0.531	0.474	0.594	**<0.001**
45–54	0.380	0.338	0.427	**<0.001**
55–64	0.275	0.244	0.310	**<0.001**
Time effect (per year)*	0.998	0.982	1.013	0.76
Survey/year interaction	1.036	1.015	1.057	**<0.001**
Survey effect at year 2000				**0.01**
HEPS	1			
SHeS	0.906	0.841	0.975	**0.01**

*Time effect for the surveys combined was not significant, but a significant interaction between the *survey* and *year* variables indicated different trends over time for each. The data from each survey were therefore modelled separately – see Tables B2a and B2b.

Table B2 **Male time effects – modelled separately for the HEPS and SHeS**

(a) HEPS

		95% CI		
Predictor	**Exp(B) odds ratio**	**Lower**	**Upper**	***P*-value**
Time effect (per year)	0.998	0.98	1.01	0.803

(b) SHeS

		95% CI		
Predictor	**Exp(B) odds ratio**	**Lower**	**Upper**	***P*-value**
Time effect (per year)	1.033	1.02	1.05	**<0.001**

Table B3 **Male time effects from the HEPS – modelled separately for 1996–2003 and for 2004–2006**

(a) HEPS 1996–2003

		95% CI		
Predictor	**Exp(B) odds ratio**	**Lower**	**Upper**	***P*-value**
Time effect (per year)	1.026	0.999	1.053	0.06

(b) HEPS 2004–2006

		95% CI		
Predictor	**Exp(B) odds ratio**	**Lower**	**Upper**	***P*-value**
Time effect (per year)	1.02	0.91	1.15	0.69

Table B4 **Female logistic regression model – HEPS and SHeS combined**

		95% CI		
Predictor	**Exp(B) odds ratio**	**Lower**	**Upper**	**P-value**
Time effect (per year)	1.030	1.020	1.039	**<0.001**
Age group				**<0.001**
16–24	1			
25–34	1.061	0.832	1.353	0.635
35–44	0.871	0.690	1.098	0.242
45–54	0.693	0.545	0.881	**0.003**
55–64	0.550	0.430	0.704	**<0.001**
Deprivation quintile				0.168
1st (least deprived)	1			
2nd	0.963	0.735	1.262	0.784
3rd	0.870	0.665	1.138	0.309
4th	0.811	0.624	1.056	0.120
5th (most deprived)	0.751	0.579	0.975	**0.031**
Survey effect at year 2000				0.262
HEPS	1			
SHeS	0.963	0.901	1.029	0.262
Age/deprivation interaction*				**0.023**

*The significant interaction between age and deprivation suggests that age effects are different in each deprivation quintile, and that the effects of deprivation vary by age group. Accordingly, these effects were modelled separately – see Tables B5 and B6.

Table B5 **Female age effects – modelled separately within each deprivation quintile**

	Predictor		95% CI		
Deprivation quintile	**Age group**	**Exp(B) odds ratio**	**Lower**	**Upper**	***P*-value**
1st (least deprived)	16–24	1			**<0.001**
	25–34	1.06	0.83	1.36	0.62
	35–44	0.87	0.69	1.10	0.24
	45–54	0.69	0.54	0.88	**0.003**
	55–64	0.55	0.43	0.70	**<0.001**
2nd	16–24	1			**<0.001**
	25–34	0.90	0.71	1.13	0.37
	35–44	0.92	0.73	1.15	0.46
	45–54	0.72	0.57	0.91	**0.006**
	55–64	0.56	0.44	0.71	**<0.001**
3rd	16–24	1			**<0.001**
	25–34	1.07	0.85	1.34	0.58
	35–44	1.08	0.86	1.35	0.52
	45–54	0.90	0.71	1.14	0.39
	55–64	0.57	0.44	0.72	**<0.001**
4th	16–24	1			**<0.001**
	25–34	1.05	0.84	1.31	0.67
	35–44	1.02	0.81	1.27	0.89
	45–54	0.82	0.65	1.03	0.09
	55–64	0.45	0.35	0.57	**<0.001**
5th (most deprived)	16–24	1			**<0.001**
	25–34	1.14	0.92	1.42	0.23
	35–44	0.97	0.77	1.21	0.77
	45–54	0.69	0.54	0.88	**0.003**
	55–64	0.38	0.29	0.49	**<0.001**

Table B6 **Female deprivation effects – modelled separately within each age group**

	Predictor		95% CI		
Age group	**Deprivation quintile**	**Exp(B) odds ratio**	**Lower**	**Upper**	***P*-value**
16–24	1st (least deprived)	1			0.16
	2nd	0.96	0.73	1.26	0.76
	3rd	0.87	0.66	1.13	0.30
	4th	0.81	0.62	1.05	0.12
	5th (most deprived)	0.75	0.58	0.97	**0.03**
25–34	1st (least deprived)	1			0.17
	2nd	0.81	0.67	0.99	**0.04**
	3rd	0.87	0.72	1.06	0.18
	4th	0.81	0.66	0.99	**0.04**
	5th (most deprived)	0.81	0.66	0.98	**0.03**
35–44	1st (least deprived)	1			0.11
	2nd	1.02	0.86	1.22	0.80
	3rd	1.07	0.90	1.29	0.44
	4th	0.94	0.78	1.13	0.52
	5th (most deprived)	0.84	0.69	1.01	0.06
45–54	1st (least deprived)	1			**0.009**
	2nd	1.01	0.83	1.23	0.95
	3rd	1.13	0.92	1.39	0.23
	4th	0.96	0.78	1.18	0.68
	5th (most deprived)	0.75	0.60	0.93	**0.01**
55–64	1st (least deprived)	1			**<0.001**
	2nd	0.99	0.81	1.23	0.95
	3rd	0.90	0.72	1.11	0.32
	4th	0.66	0.52	0.83	**<0.001**
	5th (most deprived)	0.52	0.41	0.67	**<0.001**

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