

# 15

## Physical activity

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### SUMMARY

- Among adults, 11% of men and 8% of women undertook 30 minutes continuous activity of a moderate or vigorous intensity at least five days a week. Over three-quarters of men (76%) and women (81%) undertook less than one 30 minute session of moderate or vigorous activity a week, while the rest undertook 30 minutes continuous activity of at least moderate intensity on one to four days a week (men 13%, women 10%).
- A smaller proportion of boys than girls were in the high summary activity level; younger children were less likely than older children to be in this category.
- Low summary activity levels were more prevalent among overweight or obese adults and those with a raised waist circumference. However, activity levels were not associated with whether boys or girls were overweight, obese, or a normal weight for their age and height.
- Both adults and children in the Low Income Diet and Nutrition Survey (LIDNS) were around one-half to one-third as likely to be categorised in the high summary activity level as those in the general population, as measured by the Health Surveys for England and Scotland. Among adults, this may be linked to both low income and lack of employment.
- Physical activity scores were calculated based on time spent in different activities and metabolic equivalent scores based on published data. Scores were highest for children and for adults aged 19-34 and 35-49 and then decreased with increasing age. Boys had higher scores than men (36 vs. 31); girls had higher scores than women (35 vs. 31); boys aged 2-10 had higher scores than girls aged 2-10 (36 vs. 34); and girls aged 11-18 had higher scores than girls aged 2-10 (36 vs. 34).
- Physical activity scores decreased as Body Mass Index (BMI) increased for adults (men: normal weight 34, obese 29; women: normal weight 32, morbidly obese 29).
- Physical activity scores were highest in men and women without hypertension (both 32); they were lowest for men with controlled, and for women with uncontrolled, hypertension (26 and 27, respectively).

## 15.1 Introduction

### 15.1.1 Background

This chapter presents results on physical activity in two ways: first, as a summary measure of level of physical activity; secondly, as a physical activity score in order to give an estimation of activity-related energy expenditure. Results are given separately for adults and children, since they were asked different questions about their activities, and government recommendations for activity levels also differ for these two groups.

Physical activity is important as the main voluntary component of energy expenditure. Physical activity also improves well-being<sup>1</sup> and is important for health directly through developing and maintaining cardiovascular fitness<sup>2,3</sup> and musculo-skeletal strength and flexibility. Many diseases and dysfunctions are related to physical activity, through association with obesity and by a direct effect.<sup>4</sup> Physical activity reduces the risk of early death<sup>5,6,7</sup> and of a range of diseases including cardiovascular disease<sup>8</sup> and raised blood pressure; diabetes; cancer, particularly cancer of the colon; depression;<sup>9</sup> and osteoporosis.<sup>10</sup> Inactivity may account for 37% of coronary heart disease in the UK.<sup>11</sup> Being physically fit reduces the risks of obesity.<sup>2,3</sup>

The current Department of Health (DH) recommendations for adults are to accumulate **at least 30 minutes** of moderate or more vigorous activity<sup>12</sup> **at least five times** per week.<sup>4</sup> (This can be achieved through accumulating bouts of activity of at least 10 minutes' duration during the day.) For children, the recommendations are for at least 60 minutes of moderate or more vigorous activity every day.<sup>13</sup>

### 15.1.2 General methodology

Because of substantial differences in activity patterns between school children and older teenagers (aged 16 and over) who may or may not still be in full-time education, and different DH recommendations for activity levels, the children's physical activity questions were asked of those aged under 16, while the adult's physical activity questions were asked of those aged 16 and over. Data on physical activity were collected directly from respondents aged 13 and over, while parents reported data for their children aged 2-12.

Adults (and children aged 16-18) were asked about their activities in the four weeks prior to the interview, except for those questions asking for number of hours in a particular type of activity. For these questions, respondents were asked to give the average number of hours per week spent doing the activity.

The adult questionnaire was derived from that used in the 1990 Allied Dunbar National Fitness Survey<sup>14</sup> and then modified for use in the Health Survey for England (HSE). The questionnaire used in HSE was a much shorter version<sup>15</sup> and questions were modified in some cases to ask about exercise in the four weeks prior to interview (rather than in the past year). The version used in the Low Income Diet and Nutrition Survey (LIDNS) was the 'short' HSE version used in 1999 and 2002-2005.<sup>16</sup> (The questions are included in Appendix C, LIDNS CD.)

In addition to a single question about physical activity at work or education, adults were asked about three types of activity:

- Home activity (housework – light and heavy, manual work/DIY/home improvement and gardening) that lasted 30 minutes or more. Information was sought about frequency, duration and intensity for each of these activities.
- Walks of 30 minutes or more. Information was sought about frequency and participants were asked to rate their usual walking pace as slow, average, fairly brisk or fast.
- Sports and exercise lasting 15 minutes or more. Information was sought about frequency, duration, and intensity (whether or not the activity made them 'out of breath or sweaty').

The questions – including the minimum duration of activity enquired about - were originally designed in the 1990s for HSE to measure compliance with previous DH physical activity guidelines. As these are the questions still asked in HSE, they were also used in LIDNS for comparability. They may therefore underestimate the proportion of participants meeting the

current DH recommendations, as the questions do not allow individuals to accumulate activity over the course of a day.

For children aged 2-15, questions about physical activity related to the preceding seven days. For children, questions were asked about walking, sports and exercise, and play/general activity (excluding activities at school); the questionnaire is based on that used in HSE 1999, 2002 and 2004.<sup>17</sup> There were no minimum amounts of time for recording children’s activities. As for adults, the children’s questions can be found in Appendix C, LIDNS CD.

### 15.1.3 Deriving summary physical activity levels

For adults, summary physical activity levels are based on the weekly average physical activity carried out during the four weeks prior to interview. The categories used in the HSE reports were used, to aid comparisons:

- ‘High’ levels indicate adherence to the (previous) DH physical activity recommendations of 30 minutes continuous activity of at least moderate intensity on at least five days a week.
- ‘Medium’ levels indicate 30 minutes continuous activity of at least moderate intensity on one to four days per week.
- ‘Low’ levels indicate less than one 30-minute session of moderate or vigorous activity per week.

To aid analysis for calculating participation in recommended levels of activity, activities were classified into intensity levels based on the estimated energy expenditure involved (see Table 15A). Only vigorous and moderate levels of activity were included in the results in Section 15.2 (i.e. activities falling into the white cells in Table 15A).

Table 15A			
Classification of intensity of activity and inclusion for meeting recommendations, <sup>18</sup> by type of activity			
Intensity	Type of activity		
	Walking	Domestic activities	Sports and exercise
Vigorous			Made participant ‘sweaty or out of breath’
Moderate	‘Fairly brisk’ or ‘fast’ pace	Heavy housework or gardening/DIY	Did not make participant ‘sweaty or out of breath’
Light	‘Slow’ or ‘average’ pace	Other gardening/DIY	
Inactive		Other housework	

For children, summary physical activity levels activity levels are based on the seven days prior to interview:

- ‘High’ levels indicate adherence to the current DH physical activity recommendations for children of 60 minutes or more activity each day.
- ‘Medium’ levels indicate 30-59 minutes or more activity each day.
- ‘Low’ levels indicate less than 30 minutes activity each day.

No information was obtained from children about the intensity of their activity, apart from walking pace. Due to the inherent difficulties in ascribing consistent descriptions by parents or children of the intensity of physical activity of, for example, ‘active play’, the analyses include all activity of sufficient duration, regardless of its intensity. These results, therefore, may be an overestimate of the proportion of children in the high activity level. However, the children’s questionnaire excludes physical activity at school, so the activity levels for children may also underestimate the proportion who meet current DH recommendations. This approach is also consistent with that taken for the HSE and the Scottish Health Survey (SHS).

#### 15.1.4 Deriving the physical activity score

Activities can be classified by their intensity levels measured in metabolic equivalents (METs). Annex 15A describes in detail the calculation of the physical activity score for each respondent in the survey and provides examples for adults and children. In summary, the score was calculated in three stages:

1. The time spent in each activity (or group of activities) was calculated for one week. Assumptions were made where data were not available on activities such as sleeping and school.
2. Each activity (or group of activities) was assigned a MET value based on published data.<sup>19</sup> Where data were available on intensity of an activity, these were used in the assessment of the MET value.
3. The score was derived by multiplying the time spent in each activity (or group of activities) (in hours) by the assigned MET value for that activity. The sum of the scores for each activity provided an overall value for one week which was subsequently divided by seven to give a physical activity score for one day.

For adults, this score is an estimate of energy expenditure, whereas for children the score can only be used as an indicator of energy expended in physical activity rather than as a direct measure of energy expenditure.<sup>20</sup>

Results based on calculated physical activity scores (Section 15.4) are shown for all ages, so the physical activity scores included in Tables 15.8, 15.9b and 15.10b are based on different questionnaires for children aged under 16 and those aged 16 -18.<sup>21</sup>

##### *Limitations of the physical activity score*

There are a number of limitations of the physical activity score used in the analyses in Section 15.4. The absolute MET intensities used to assign MET values to each type of activity may be inaccurate for people of different body mass and body fat percentage.<sup>19</sup> The published Compendium of Physical Activities does not take into account individual differences that may alter the energy cost of movement – such as age, gender, effort, pace and cardio-respiratory fitness – or other factors such as different environmental conditions in which activities are undertaken.<sup>19,22</sup> Therefore individual differences in energy expenditure for the same activity can be substantial and the true energy cost for a person may or may not be close to the stated mean MET level as presented in the Compendium.<sup>19</sup>

Another potential problem has to do with the nature of self-reported physical activity questionnaires which are poorly equipped to capture short bursts of physical activity, a problem particularly pertinent to children. In LIDNS, the questionnaire itself for adults did not allow for short bursts of activity to be recorded for any type of activity. In addition, the reliability of physical activity scores is reduced when there are frequent changes in activity.<sup>19</sup>

#### 15.1.5 Physical activity analyses

For the physical activity analyses, the 8% of males and females who had a limiting longstanding illness, and who had not had at least a 5 minute walk in the 4 weeks prior to interview, were excluded.<sup>23</sup> Percentages in the low activity groups, therefore, are likely to understate the values for the low income population as a whole but, more usefully, reflect activity patterns in those who are not limited by illness.

For the analysis of summary physical activity levels (Section 15.2), the results are presented for adults aged 19 and over in order to be comparable with the other chapters in this report (and results for older children aged 16-18 are not included). Physical activity scores (Section 15.4) are presented for all ages.

Comparisons between subgroups were carried out in STATA 9.0 using t-tests; where there were more than two groups to compare, ANOVA was used. Where a p value for ANOVA was <0.05, post-hoc comparisons were used to identify groups that differed from one another using multiple t-tests with the Bonferroni adjustment.<sup>24</sup> Differences between groups referred to in

the text are statistically significant ( $p < 0.05$ ) unless otherwise stated; however not all statistically significant differences have been described in the text.

Comparisons between countries/regions and household types will be affected by a number of factors, including possible variation in the age distribution between these subgroups. Because the sample bases for some ethnic groups are small (see Chapter 3, Table 3.9), data for summary activity levels and the physical activity score are not shown by ethnicity.

## 15.2 Summary physical activity levels

### 15.2.1 Adults' summary physical activity levels

Only 11% of men and 8% of women were categorised in the high activity level group. In men, the proportion in the high activity group fell with increasing age from 22% among those aged 19-34 to 2% in those aged 65 and over. Slightly more men had medium (13%) than high (11%) activity levels, while three-quarters of men (76%) were in the low activity category.

Activity levels in women did not differ significantly between those aged 19-34 and those aged 35-49 but women in these age groups were more likely to have medium, and less likely to have low, activity levels than either of the two older age groups (50-64 and 65 and over). They were also more likely to be highly active than those aged 65 and over. Overall, four in five women (81%) had low activity levels and 10% had medium activity levels.

In the youngest adult age group (19-34), significantly fewer women (11%) than men (22%) were in the high activity category, while women were more likely to have low activity levels (72%) than men (52%). There were no significant differences in activity levels between men and women in the other age groups. **(Table 15.1)**

### 15.2.2 Children's summary physical activity levels

Around half of children aged 2-10 (boys 52%, girls 49%) were active for less than 30 minutes every day on average, which is the low activity level. Over one-quarter of boys (26%) and girls (31%) aged 2-10 were in the high activity level. One-fifth of boys (23%) and girls (20%) aged 2-10 had medium activity levels. None of the differences between boys and girls aged 2-10 were significant.

A higher proportion of older children (34% of boys and 38% of girls aged 11-15) than younger children were in the high activity level, but this was only significant for boys. The proportions of boys and girls aged 11-15 who had low activity levels were 28% and 41%, respectively (but the difference was not significant). Among boys, significantly fewer were inactive in the older age group. Similar proportions of girls had medium activity levels in both age groups. **(Table 15.2)**

### 15.2.3 Summary physical activity levels by country/region

Activity levels among adults varied little by country/region and there were no significant differences in either men or women. **(Table 15.3)**

Among children, the only significant difference was that boys in Northern Ireland were less likely to be in the high activity level group (14%) than boys in Wales (39%). **(Table 15.4)**

### 15.2.4 Summary physical activity levels by household composition

Adults' activity levels vary substantially by age (see Section 15.2.1), so it is not surprising that activity levels vary by household composition, as these categories are defined by a combination of age and life-stage. For example, low activity levels were generally significantly higher in households of retired men or women than in households containing children and/or working age adults. **(Table 15.5)**

The data showed no variation in children's activity levels by household type. **(Table 15.6)**

## 15.3 Occupational activity level

Adults aged 19 and over who were in employment or attended college in the previous four weeks were asked to rate their activity level in general in their job or at college, as this can contribute significantly to their overall energy expenditure (see Section 15.4). Only a small proportion (14%) of adults had been employed during this period, and fewer (2%) had been at college in the preceding four weeks (one-fifth of whom had also been in employment during that period).

Of the men (18%) who had been in employment or at college in the previous four weeks, 39% reported being fairly, and 39% very, active. For women (16%) in employment or at college, the equivalent figures were 51% and 29%, respectively. About one-fifth of this group (men 22%, women 20%) described themselves as not very active or not at all active at work or at college. These responses reflect the types of occupations reported (see Chapter 3). (Table 15.7)

## 15.4 Physical activity score

### 15.4.1 Results for the physical activity score

Mean physical activity scores were highest for children and young adults and then decreased with increasing age. Significant differences included those seen between the mean physical activity scores for men and boys (31 compared with 36), for women and girls (31 compared with 35) and for men and women aged 19-34 (36 compared with 33). Mean physical activity scores were also significantly higher for boys than girls aged 2-10 (36 compared with 34) and for girls aged 11-18 than girls aged 2-10 (36 compared with 34). (Table 15.8)

Little variation was seen between country/region in the mean physical activity scores for males and females. (Tables 15.9a, 15.9b)

As would be expected given the differences in age distribution by household type, men and women living in households where all adults were retired had the lowest mean physical activity scores, while adults living in households with children had the highest. There were no differences in mean physical activity scores for children across household types. (Tables 15.10a, 15.10b)

### 15.4.2 Calculation of estimated energy expenditure

Data on energy intake in Chapter 5 show that mean daily total reported energy intakes were below the Estimated Average Requirements (EARs) for each sex and age group with the exception of girls aged 2-10. There are a number of possible reasons for this, including inadequate intake of energy, over- or under- estimates of energy requirements or mis-reporting of intake by respondents (see Chapter 5, Section 5.5 for further details). Chapter 11 uses respondents' physical activity score in a computation to estimate each individual's likely energy expenditure, which was used in turn as an approximation of their individual energy requirement. Reported energy intakes were then related to the estimated energy requirement in order to identify the likely extent of mis-reporting (see Chapter 11, Section 11.2.2).

## 15.5 Associations of physical activity measures with Body Mass Index, waist circumference and hypertension

This section investigates the associations between the summary physical activity level and the physical activity score with Body Mass Index (BMI), waist circumference and hypertension. Inter-relationships between these variables need to be borne in mind when interpreting the results. For example, variations in physical activity levels or scores associated with hypertension may be partly accounted for by variation in the age distribution of respondents or their BMI. As the data are cross-sectional, any relationships between variables must be considered associations and are not evidence of causality.

### **15.5.1 Associations between summary physical activity level and physical activity score, with BMI and waist circumference**

Overweight or obese men were more likely to have low summary activity levels (79% and 82% respectively) than men of normal weight (67%). Among women, more overweight (86%), obese (89%), and morbidly obese (BMI >40kg/m<sup>2</sup>) (93%) women had low summary activity levels than women of normal weight (68%). Women who were normal weight or underweight were more likely to have a high summary activity level (17% in each weight category) than women who were overweight (4%), obese (3%), or morbidly obese (5%).

Mean physical activity scores showed a similar pattern: scores decreased as BMI increased for both men (34 in normal weight men compared with 29 in obese men) and women (32 in normal weight women compared with 29 in morbidly obese women).

Low summary activity levels were significantly associated with a raised waist circumference in both men (90% of those with a raised waist circumference of 102cm or more compared with 72% of men with a normal waist circumference) and women (88% of those with a raised waist circumference of 88cm or more, 72% with a normal waist circumference). Significantly more men and women with a normal waist circumference had medium or high summary activity levels than men and women with a raised waist circumference.

A similar pattern was seen for mean physical activity scores. Mean physical activity scores were 28 and 29 in men and women with a raised waist circumference compared with 32 and 33 in men and women with a normal waist circumference, respectively. (Table 15.11)

Summary activity levels were not associated with weight category in boys or girls. (Table not available.)

### **15.5.2 Associations between summary physical activity level and physical activity score with hypertension**

Men and women with hypertension (see footnote 'd' to Table 15.12 for definition) were more likely to have low summary activity levels than men and women without hypertension. This difference was significant for men and women with treated hypertension, whether controlled or not. Women without hypertension were more likely to have high summary activity levels (10%) than women with untreated hypertension (7%), controlled hypertension (3%), or treated but uncontrolled hypertension (1%). Women without hypertension were also more likely to have medium summary activity levels (13%) than women with treated but uncontrolled hypertension (1%).

Mean physical activity scores showed a similar pattern. Physical activity scores were highest in men and women without hypertension (both 32). Scores were lowest for men with controlled hypertension (26) and lowest for women with uncontrolled hypertension (27).

Confounding by age may explain some of the association seen between summary physical activity levels and physical activity scores and hypertension. (Table 15.12)

## **15.6 Comparison of the summary physical activity level with the physical activity score**

In broad terms, the summary physical activity level and the physical activity score should compare favourably. In practice, they measure slightly different things: the summary activity level reflects the pattern and intensity of activities; the physical activity score represents the cumulative energy expenditure across an average day, regardless of the way in which the energy was expended.

A comparison of summary activity level with the physical activity score shows that, for each age and sex group, mean physical activity scores increase in line with the summary activity level, indicating considerable overlap between these two classifications. However there is wide variability in the physical activity score and there may be instances where respondents are

grouped as having a moderate or high summary activity level while at the same time having a relatively low physical activity score if they are primarily sedentary outside their periods of intense physical activity.

These people could, in theory, be meeting the recommendations set out by DH but have a low overall energy balance and therefore have a low physical activity score (e.g. they are moderately active for 30 minutes five days a week but do not do much other activity). Additionally, there are a number of differences in the methodology for each classification of physical activity and a direct comparison of the two methods may be misleading. The calculation of the physical activity score may be confounded by a number of factors such as those discussed in Section 15.1.4. (Tables 15.13a, 15.13b)

## 15.7 Comparison with other surveys

### 15.7.1 Summary physical activity level

Comparisons of the summary physical activity level are made with the HSE and the SHS, but not with the National Diet and Nutrition Survey (NDNS) because of methodological differences between LIDNS and the NDNS.<sup>25</sup>

#### *Adults*

In the HSE 2003<sup>26</sup> and SHS 2003,<sup>27</sup> adults were asked by an interviewer about their activities in the four weeks prior to interview, using a questionnaire very similar to that used in LIDNS.<sup>28</sup>

Table 15.14 compares the three surveys using the same age bands as HSE and SHS, the same analytical criteria for physical activity used for LIDNS, and limits the LIDNS data to responses from participants living in England and Scotland. In both the HSE<sup>26</sup> and the SHS,<sup>27</sup> there was a fall with increasing age in the proportion having high activity levels and a similar increase in the prevalence of low activity levels. This was also seen in men in LIDNS, but the decline started from a much lower level and was more pronounced: by the 35-44 age group, the proportion in the high level had halved in England/Scotland for men in LIDNS. For women in England/Scotland in LIDNS, the changes were less dramatic with age as so few women of any age were in the high activity level group. The proportion of men and women in England/Scotland in the high activity level group was significantly lower in LIDNS than in HSE/SHS for each age group. (Table 15.14)

The lower activity levels in LIDNS adults may be linked directly with income, which was positively associated with activity in HSE 2003, with the lowest activity levels found in the bottom income quintile<sup>29</sup> (although for men, those in the 2nd to 4th quintiles were more likely to have high activity levels than those in the highest quintile). There is also an important indirect link, as very few adults in LIDNS were in employment, which contributes to overall activity levels and therefore to the likelihood of being categorised in the high activity level. The link with income is probably related to a number of factors, including: lack of access to facilities (barriers such as cost, lack of transport, and neighbourhood safety); the availability of opportunities for activity (requirements for childcare, the presence of facilities or knowledge of their existence); and priorities in difficult personal circumstances.<sup>30</sup>

The low levels of physical activity in the low income population is of particular concern because of the direct and indirect relationships between physical activity and a range of chronic diseases.<sup>4-11</sup> Both incidence of and mortality from these are greater in deprived populations and in sedentary people. Part of the excess burden of disease in the low income population may be due to low levels of physical activity.

#### *Children*

In the SHS 2003<sup>31</sup> and the HSE 2002,<sup>32</sup> parents of children aged 2-12 were asked by an interviewer about their children's activities in the seven days prior to interview, using an identical questionnaire to that used in LIDNS. Children aged 13-15 were interviewed directly, using the same questionnaire as in LIDNS (as were those aged 16-18 but using the adult version of the questionnaire).



In the SHS 2003, 74% of boys and 63% of girls aged 2-15 participated in physical activity for 60 minutes or more on all seven days prior to interview (the high activity level for children).<sup>31</sup> This was higher than the 70% of boys and 61% of girls in the HSE 2002 categorised in the high activity level.<sup>32</sup> The proportions did not vary significantly by quintile of equivalised household income in Scotland<sup>31</sup> or England.<sup>32</sup> For comparison, 28% of boys and 34% of girls aged 2-15 in LIDNS were in the high activity level. Although participation in sports and exercise was clearly positively associated with equivalised household income in the HSE 2002, walking at least five times per week was strongly negatively associated with income.<sup>32</sup> (Table not available.)

Children's activity levels in LIDNS were not only lower than in HSE/SHS, but were also unusual in that more girls than boys in LIDNS were in the high activity level.

One of the most consistent findings in physical activity epidemiology is the decline in physical activity levels with age.<sup>32</sup> A number of prospective studies have found that the largest decreases occur around ages 12-15.<sup>33</sup> LIDNS was therefore also unusual in not finding this decrease: the proportion in the high activity level in LIDNS was higher in the older age group (34% of boys, 38% of girls aged 11-15) than among those aged 2-10 (26% of boys, 31% of girls), although not significantly so, while the prevalence of low activity levels decreased significantly in boys aged 11-15 (28%) compared with those aged 2-10 (52%). (Table not available.) The reason for this difference would appear to be explained by the extremely low levels of activity reported for children aged 2-10. There is no methodological reason to explain why LIDNS found younger children to be so inactive. One could speculate whether it reflected, for example, reduced access to outdoor spaces in which to play and be active.

### 15.7.2 Physical activity score

The physical activity score cannot be compared with the HSE or the SHS since neither survey calculated scores for activity levels. Comparisons cannot be made with the NDNS for several reasons. In the 4-18 age range, methodological differences between the NDNS and LIDNS prevent any direct comparison of the results. The authors of the NDNS 4-18 years suggest that physical activity scores are probably overestimated due partly to rounding up of time spent in different activities.<sup>20</sup> LIDNS did not use a diary method and so it is more likely that the activity level is underestimated.

In adults, results for the physical activity score were not presented in the NDNS 19-64 years since it was found to overestimate the level of physical activity for the dataset, beyond that expected in a general adult population.<sup>34</sup> Values in a subsequent report on under-reporting of energy intake in the NDNS 19-64 years were revised using lower MET values but no further analysis of the physical activity scores was undertaken.<sup>35</sup> Detailed data on physical activity were not collected in the NDNS 65 years and over.<sup>36</sup>

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- 21 The NDNS 4-18 years and NDNS 19-64 years have classified physical activity scores into groups depending on the age of the respondent. However, due to methodological differences between NDNS and LIDNS, the standard classification method for the physical activity score was deemed inappropriate for LIDNS. In order to determine energy requirements in Chapter 11, the equations used called for respondents to be grouped into four energy expenditure bands: sedentary, low active, active, and very active. These were defined in terms of multiples of Basal Metabolic Rate (i.e. METs/hour): sedentary ( $\geq 1.0 < 1.4$ ); low active ( $\geq 1.4 < 1.6$ ); active ( $\geq 1.6 < 1.9$ ); and very active ( $\geq 1.9 < 2.5$ ). (See: Institute of Medicine of the National Academies. *Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids*. Washington, DC: National Academies Press, 2005.) If these are multiplied to cover a 24 hour period, they give corresponding values of: sedentary ( $\geq 24 < 33.6$ ); low active ( $\geq 33.6 < 38.4$ ); active ( $\geq 38.4 < 45.6$ ); and very active ( $\geq 45.6 < 60$ ). In Chapter 11, values of less than 24 or of 60 and over were deemed to be physiologically out of range and were excluded from the analyses. In Chapter 15, however, they are included for purposes of classification. While these values do not correspond exactly to the bands shown in Tables 15.8 to 15.10b, they give an indication of the values for METs corresponding to different levels of energy expenditure over an entire day, e.g. most people are classified as low active.
- 22 Ainsworth BE, Haskell WL, Leon AS, Jacobs DR Jr, Montoye HJ, Sallis JF, Paffenbarger RS Jr. Compendium of Physical Activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc* 1993;25:71-80.
- 23 Respondents aged 16 and over (the age at which the adult physical activity questionnaire was used) were excluded from the analysis if they had a long standing illness, disability or infirmity that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview. Additionally respondents were excluded if they couldn't walk at all.
- 24 p values were multiplied by the number of comparisons made. For example, if three groups (A, B and C) were being compared, the p values from the t-test were multiplied by 3 (AxB, AxC, BxC); if four groups (A, B, C and D) were being compared, p values were multiplied by 6 (AxB, AxC, AxD, BxC, BxD, CxD).
- 25 In the NDNS 19-64 years, data for adults came from a seven day activity diary recorded by participants. Physical activity levels in children in the NDNS 4-18 years were ascertained in different ways at different ages: by questionnaire for children aged 4-6, and in a seven-day activity diary for those aged 7-18.
- 26 Stamatakis E. Physical activity. In: Sproston K, Primatesta P, eds. *Health survey for England 2003. Volume 2 Risk factors for cardiovascular disease*. London: TSO, 2004.
- 27 Stamatakis E. Adult physical activity. In: Bromley C, Sproston K, Shelton N, eds. *The Scottish Health Survey 2003. Volume 2 Adults*. Edinburgh: The Scottish Executive, 2005.
- 28 The SHS 2003 used the adult physical activity questionnaire from HSE 1997 and 1998. Although both LIDNS and

HSE 2003 used a shorter version of this questionnaire, none of the questions omitted in LIDNS and HSE 2003 were needed for determining summary physical activity levels. Since the core questions needed to derive activity levels were exactly the same in LIDNS, HSE 2003 and SHS 2003, it is possible to make direct comparisons between all three surveys using the same definitions for the summary physical activity levels.

- 29 In the HSE 2003, 37% of men and 24% of women aged 16 and over in England were categorised in the high activity level; for those in the lowest quintile of income, the proportions were 29% of men and 22% of women. In LIDNS, only 11% of men and 8% of women (aged 19 and over) were in the high activity level. (Neither the HSE nor LIDNS results were age-standardised.)
- 30 Limiting longstanding illness was twice as high in LIDNS as in HSE 2003 (see Chapter 3). While (some) adults with a limiting longstanding illness were excluded from the analysis of levels of physical activity in LIDNS, they were not excluded from the HSE/SHS results. This analytical difference suggests that the differences in physical activity levels between LIDNS and HSE/SHS are even larger than those shown in Table 15.14.
- 31 Stamatakis E. Physical activity. In: Bromley C, Sproston K, Shelton N, eds. *The Scottish Health Survey 2003. Volume 3 Children*. Edinburgh: The Scottish Executive, 2005.
- 32 Stamatakis E. Physical activity. In: Sproston K, Primatesta P, eds. *Health Survey for England 2002. Volume 1 The Health of Children and Young People*. London: HMSO, 2003.
- 33 Caspersen CJ, Merritt RK, Stephens T. International activity patterns. In: Dishman RK, ed. *Advances in Exercise Adherence*. Human Kinetics. USA: Champaign, 1994.
- 34 Ruston R, Hoare J, Henderson L, Gregory J, Bates CJ, Prentice A, Birch M. National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 4: Nutritional status (anthropometry and blood analytes), blood pressure, and physical activity. London: TSO, 2004.
- 35 Rennie K, Coward A, Jebb S. Under-reporting of energy intake in the National Diet and Nutrition Survey: Adults aged 19-64. Not published.
- 36 Finch S, Doyle W, Lowe C, Bates CJ, Prentice A, Smithers G, Clarke PC. National Diet and Nutrition Survey: people aged 65 years and over. Volume 1: Report of the diet and nutrition survey. London: TSO, 1998.

## Tables

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Table 15.1

Summary physical activity level, adults, by sex and age					
<i>Aged 19 and over<sup>a</sup></i>					
Summary physical activity level <sup>b</sup>	Age group				Total
	19-34	35-49	50-64	65+	
	%	%	%	%	%
<b>Men</b>					
Low	52	71	87	94	76
Medium	26	16	5	4	13
High	22	13	9	2	11
<b>Women</b>					
Low	72	73	87	96	81
Medium	17	14	6	2	10
High	11	13	7	2	8
<i>Base (unweighted)</i>					
Men	186	193	193	233	805
Women	474	452	284	429	1639

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Summary physical activity levels are based on average weekly activity in the four weeks prior to interview. Low levels are defined as less than one 30-minute moderate or vigorous activity session per week. Medium activity levels indicate 30 minutes or more at least moderate activity on one to four days per week. High levels indicate 30 minutes or more at least moderate activity on at least five days a week.

Table 15.2

Summary physical activity level, children, by sex and age			
<i>Aged 2-15<sup>a</sup></i>			
Summary physical activity level <sup>b</sup>	Age group		Total
	2-10	11-15	
	%	%	%
<b>Boys</b>			
Low	52	28	44
Medium	23	39	28
High	26	34	28
<b>Girls</b>			
Low	49	41	46
Medium	20	21	20
High	31	38	34
<i>Base (unweighted)</i>			
Boys	234	124	358
Girls	270	152	422

<sup>a</sup> Results are not shown for informants aged 16-18 as the adult recommendations apply and they were given the adult version of the physical activity questionnaire, so results are not comparable with those elsewhere in the report.

<sup>b</sup> Summary physical activity levels are based on activity in the seven days prior to interview. Low levels indicate less than 30-minutes activity each day. Medium levels indicate 30-59 minutes activity each day. High levels indicate 60 minutes or more activity every day.

Table 15.3

Summary physical activity level, adults, by sex and country/region								
<i>Aged 19 and over<sup>a</sup></i>								
Summary physical activity level <sup>b</sup>	Country/region							Total
	England				Scotland	Wales	Northern Ireland	
	North	Central/Midlands	South	All England				
	%	%	%	%	%	%	%	%
<b>Men</b>								
Low	73	76	76	75	77	83	76	76
Medium	11	14	14	13	13	11	13	13
High	16	10	10	12	10	6	10	11
<b>Women</b>								
Low	79	82	81	81	83	86	78	81
Medium	11	8	10	10	13	9	14	10
High	9	10	9	9	4	6	7	8
<i>Base (unweighted)</i>								
Men	220	105	199	524	105	89	87	805
Women	446	200	440	1086	169	180	204	1639

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Summary physical activity levels are based on average weekly activity in the four weeks prior to interview. Low levels are defined as less than one 30-minute moderate or vigorous activity session per week. Medium activity levels indicate 30 minutes or more at least moderate activity on one to four days per week. High levels indicate 30 minutes or more at least moderate activity on at least five days a week.

Table 15.4

## Summary physical activity level, children, by sex and country/region

Aged 2-15<sup>a</sup>

Summary physical activity level <sup>b</sup>	Country/region							Total 2-15
	England				Scotland	Wales	Northern Ireland	
	North	Central/Midlands	South	All England				
	%	%	%	%	%	%	%	
<b>Boys</b>								
Low	42	43	44	43	53	35	65	44
Medium	22	31	34	29	14	26	22	28
High	36	26	23	28	33	39	14	28
<b>Girls</b>								
Low	52	41	45	47	36	43	52	46
Medium	19	12	21	18	36	27	23	20
High	29	47	34	35	28	30	25	34
<i>Base (unweighted)</i>								
Boys	93	54	94	241	31	46	40	358
Girls	110	52	108	270	35	59	58	422

<sup>a</sup> Results are not shown for informants aged 16-18 as the adult recommendations apply and they were given the adult version of the physical activity questionnaire, so results are not comparable with those elsewhere in the report.

<sup>b</sup> Summary physical activity levels are based on activity in the seven days prior to interview. Low levels indicate less than 30-minutes activity each day. Medium levels indicate 30-59 minutes activity each day. High levels indicate 60 minutes or more activity every day.

Table 15.5

## Summary physical activity level, adults, by sex and household type

Aged 19 and over<sup>a</sup>

Summary physical activity level <sup>b</sup>	Household type						Total
	1 adult of working age	1 adult of retirement age	2+ adults, at least 1 of working age	2+ adults, all of retirement age	1 adult, 1+ children	2+ adults, 1+ children	
	%	%	%	%	%	%	
<b>Men</b>							
Low	68	97	76	88	60	66	76
Medium	23	2	14	7	12	12	13
High	9	1	10	5	29	21	11
<b>Women</b>							
Low	81	93	79	99	71	75	81
Medium	11	3	11	1	19	11	10
High	7	4	10	-	10	13	8
<i>Base (unweighted)</i>							
Men	220	123	197	93	32	140	805
Women	162	376	233	100	529	239	1639

- No observations.

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Summary physical activity levels are based on average weekly activity in the four weeks prior to interview. Low levels are defined as less than one 30-minute moderate or vigorous activity session per week. Medium activity levels indicate 30 minutes or more at least moderate activity on one to four days per week. High levels indicate 30 minutes or more at least moderate activity on at least five days a week.

Table 15.6

**Summary physical activity level, children, by sex and household type**Aged 2-15<sup>a</sup>

Summary physical activity level <sup>b</sup>	Household type		Total 2-15 %
	1 adult, 1+ children %	2+ adults, 1+ children %	
<b>Boys</b>			
Low	44	44	44
Medium	31	25	28
High	26	31	28
<b>Girls</b>			
Low	44	48	46
Medium	20	22	20
High	36	30	34
<i>Base (unweighted)</i>			
Boys	221	137	358
Girls	258	164	422

<sup>a</sup> Results are not shown for informants aged 16-18 as the adult recommendations apply and they were given the adult version of the physical activity questionnaire, so results are not comparable with those elsewhere in the report.

<sup>b</sup> Summary physical activity levels are based on activity in the seven days prior to interview. Low levels indicate less than 30-minutes activity each day. Medium levels indicate 30-59 minutes activity each day. High levels indicate 60 minutes or more activity every day.

Table 15.7

**Self-reported occupational activity level, adults, by sex and age**

Aged 19 and over in employment or in education

Occupational activity level	Age group				Total %
	19-34 %	35-49 %	50-64 %	65+ %	
<b>Men</b>					
Not at all active	3	-	[-]	a	2
Not very active	14	33	[25]	a	21
Fairly active	46	29	[18]	a	39
Very active	38	38	[57]	a	39
<b>Women</b>					
Not at all active	2	11	[6]	a	7
Not very active	16	10	[8]	a	13
Fairly active	56	47	[58]	a	51
Very active	25	32	[28]	a	29
<i>Base (unweighted)</i>					
Men	61	31	11	2	105
Women	86	99	27	1	213

- No observations.

[ ] Fewer than 30 observations.

<sup>a</sup> Numbers not shown as bases too small.

Table I5.8

## Physical activity score, by sex and age

Aged 2 and over<sup>a</sup>

Physical activity score (METs) <sup>b</sup>	Age group		Total children	19-34	35-49	50-64	65+	Total adults
	2-10	11-18						
<b>Males</b>								
Cumulative %								
Less than 25	-	3	1	16	16	35	37	26
Less than 28	-	6	3	29	49	64	72	53
Less than 31	33	27	31	46	60	78	82	66
Less than 33	47	44	45	54	68	85	89	74
Less than 35	53	54	53	59	74	87	91	78
Less than 37	66	64	65	65	80	92	94	83
Less than 40	76	75	76	72	86	94	97	87
Less than 43	84	86	85	78	91	96	98	91
Total	100	100	100	100	100	100	100	100
Mean	36	37	36	36	32	29	28	31
Median	34	34	34	32	28	26	26	28
Lower 2.5 percentile	29	25	28	23	24	23	23	23
Upper 2.5 percentile	53	71	60	69	67	67	41	61
Standard deviation	7	10	9	12	11	10	5	10
<b>Females</b>								
Cumulative %								
Less than 25	-	1	0	6	8	21	36	17
Less than 28	-	4	2	33	32	52	73	47
Less than 31	39	28	34	53	56	68	91	67
Less than 33	59	50	55	64	64	75	95	74
Less than 35	72	65	69	73	73	82	97	81
Less than 37	80	74	77	77	80	86	98	86
Less than 40	85	77	82	85	87	92	99	90
Less than 43	90	82	86	87	91	93	99	92
Total	100	100	100	100	100	100	100	100
Mean	34	36	35	33	33	30	27	31
Median	32	33	32	30	30	28	26	28
Lower 2.5 percentile	29	26	29	24	24	23	23	23
Upper 2.5 percentile	51	62	59	58	56	51	36	55
Standard deviation	6	9	7	9	9	7	4	8
<i>Base (unweighted)</i>								
Males	237	197	434	183	191	193	232	799
Females	277	214	491	474	450	284	430	1638

- No observations.

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> For respondents aged 16 and over, physical activity scores are average daily activity scores based on the four weeks prior to interview. For respondents aged under 16, physical activity scores are average daily activity scores based on the week prior to interview.



Table 15.9a

## Physical activity score, adults, by sex and country/region

Aged 19 and over<sup>a</sup>

Physical activity score (METs) <sup>b</sup>	Country/region							Total
	England				Scotland	Wales	Northern Ireland	
	North	Central/Midlands	South	All England				
<b>Men</b>								
Cumulative %								
Less than 25	24	31	23	25	27	38	35	26
Less than 28	50	54	52	52	59	61	67	53
Less than 31	63	68	65	65	69	79	73	66
Less than 33	73	77	72	73	74	82	78	74
Less than 35	77	80	75	77	80	86	83	78
Less than 37	86	80	80	82	84	87	85	83
Less than 40	89	89	86	87	84	89	91	87
Less than 43	92	91	90	91	89	89	91	91
Total	100	100	100	100	100	100	100	100
Mean	32	31	32	31	32	30	30	31
Median	28	27	28	28	27	26	26	28
Lower 2.5 percentile	23	23	23	23	23	23	23	23
Upper 2.5 percentile	67	59	61	61	75	68	79	61
Standard deviation	11	10	10	10	12	9	11	10
<b>Women</b>								
Cumulative %								
Less than 25	16	15	20	18	16	14	11	17
Less than 28	43	42	51	46	56	44	41	47
Less than 31	64	63	70	66	73	68	65	67
Less than 33	71	70	77	74	79	77	76	74
Less than 35	79	80	83	81	85	85	79	81
Less than 37	84	85	86	85	87	90	83	86
Less than 40	89	91	92	90	91	93	87	90
Less than 43	92	92	94	93	91	93	92	92
Total	100	100	100	100	100	100	100	100
Mean	31	31	30	31	30	31	31	31
Median	29	29	28	28	27	28	29	28
Lower 2.5 percentile	23	24	23	23	24	24	24	23
Upper 2.5 percentile	55	53	52	53	58	60	59	55
Standard deviation	9	8	8	8	9	8	7	8
<i>Base (unweighted)</i>								
Men	219	105	195	519	104	89	87	799
Women	445	200	440	1085	180	169	204	1638

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Physical activity scores are average daily activity scores based on the four weeks prior to interview.

Table 15.9b

Physical activity score, children, by sex and country/region								
Aged 2-18 <sup>a</sup>								
Physical activity score (METs) <sup>b</sup>	Country/region							Total
	England				Scotland	Wales	Northern Ireland	
	North	Central/Midlands	South	All England				
<b>Boys</b>								
Cumulative %								
Less than 25	2	-	-	1	9	1	2	1
Less than 28	3	0	3	2	9	1	2	3
Less than 31	33	20	32	30	35	28	52	31
Less than 33	42	36	51	45	50	37	65	45
Less than 35	46	52	57	52	64	50	67	53
Less than 37	62	64	67	65	71	60	72	65
Less than 40	77	68	78	76	78	69	82	76
Less than 43	85	78	88	85	88	78	84	85
Total	100	100	100	100	100	100	100	100
Mean	36	38	36	37	35	37	35	36
Median	36	35	33	34	33	35	31	34
Lower 2.5 percentile	27	29	28	29	24	26	25	28
Upper 2.5 percentile	56	61	68	60	49	68	67	60
Standard deviation	8	9	9	9	6	9	9	9
<b>Girls</b>								
Cumulative %								
Less than 25	-	1	0	0	-	2	-	0
Less than 28	0	5	1	2	4	2	2	2
Less than 31	38	25	38	35	16	37	55	34
Less than 33	56	42	62	56	40	58	69	55
Less than 35	69	60	72	69	62	72	73	69
Less than 37	73	72	81	77	77	80	85	77
Less than 40	77	74	85	80	89	90	95	82
Less than 43	82	81	89	85	90	98	97	86
Total	100	100	100	100	100	100	100	100
Mean	36	37	34	35	35	33	32	35
Median	32	34	32	32	34	32	31	32
Lower 2.5 percentile	29	26	29	29	27	25	28	29
Upper 2.5 percentile	59	62	51	59	59	43	48	59
Standard deviation	8	10	6	7	7	4	5	7
<i>Base (unweighted)</i>								
Boys	111	60	114	285	49	39	61	434
Girls	125	62	125	312	66	39	74	491

- No observations.

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> For respondents aged 16 and over, physical activity scores are average daily activity scores based on the four weeks prior to interview. For respondents aged under 16, physical activity scores are average daily activity scores based on the week prior to interview.

Table 15.10a

## Physical activity score, adults, by sex and household type

Aged 19 and over<sup>a</sup>

Physical activity score (METs) <sup>b</sup>	Household type						Total
	1 adult of working age	1 adult of retirement age	2+ adults, at least 1 of working age	2+ adults, all of retirement age	1 adult, 1+ children	2+ adults, 1+ children	
<b>Men</b>							
Cumulative %							
Less than 25	19	36	31	35	16	19	26
Less than 28	44	76	55	65	30	43	53
Less than 31	64	86	64	78	55	56	66
Less than 33	74	94	72	82	59	61	74
Less than 35	76	95	75	87	61	68	78
Less than 37	80	97	81	89	77	75	83
Less than 40	85	99	87	97	81	78	87
Less than 43	91	99	90	98	81	84	91
Total	100	100	100	100	100	100	100
Mean	31	27	31	28	36	35	31
Median	28	26	27	26	30	29	28
Lower 2.5 percentile	24	23	23	23	23	23	23
Upper 2.5 percentile	57	39	64	44	75	79	61
Standard deviation	9	5	11	5	15	13	10
<b>Women</b>							
Cumulative %							
Less than 25	14	35	22	24	5	8	17
Less than 28	53	70	47	66	28	36	47
Less than 31	68	90	60	83	52	58	67
Less than 33	77	94	67	89	63	64	74
Less than 35	81	96	75	97	71	76	81
Less than 37	85	98	80	99	78	81	86
Less than 40	92	98	84	100	86	88	90
Less than 43	93	99	86	100	90	91	92
Total	100	100	100	100	100	100	100
Mean	30	27	32	28	33	33	31
Median	28	26	28	27	31	29	28
Lower 2.5 percentile	24	23	23	23	24	24	23
Upper 2.5 percentile	56	37	58	37	54	67	55
Standard deviation	7	4	10	4	8	10	8
<i>Base (unweighted)</i>							
Men	219	123	197	92	32	136	799
Women	163	377	233	100	526	239	1638

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Physical activity scores are average daily activity scores based on the four weeks prior to interview.

Table 15.10b

### Physical activity score, children, by sex and household type

Aged 2-18<sup>a</sup>

Physical activity score (METs) <sup>b</sup>	Household type		Total <sup>c</sup>
	1 adult, 1+ children	2+ adults, 1+ children	
<b>Boys</b>			
Cumulative %			
Less than 25	0	2	1
Less than 28	2	3	3
Less than 31	30	31	31
Less than 33	48	43	45
Less than 35	55	52	53
Less than 37	70	60	65
Less than 40	78	73	76
Less than 43	87	82	85
Total	100	100	100
Mean	36	37	36
Median	34	35	34
Lower 2.5 percentile	29	27	28
Upper 2.5 percentile	60	60	60
Standard deviation	9	9	9
<b>Girls</b>			
Cumulative %			
Less than 25	0	0	0
Less than 28	1	2	2
Less than 31	34	36	34
Less than 33	55	55	55
Less than 35	65	73	69
Less than 37	76	78	77
Less than 40	80	83	82
Less than 43	86	87	86
Total	100	100	100
Mean	35	35	35
Median	32	32	32
Lower 2.5 percentile	29	29	29
Upper 2.5 percentile	59	59	59
Standard deviation	7	7	7
<i>Base (unweighted)</i>			
Boys	264	167	434
Girls	291	191	491

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> For respondents aged 16 and over, physical activity scores are average daily activity scores based on the four weeks prior to interview. For respondents aged under 16, physical activity scores are average daily activity scores based on the week prior to interview.

<sup>c</sup> Includes 12 respondents where the eldest household member is aged 18 or younger. These are not shown separately, but are included in the total.

Table 15.11

**Summary physical activity level and physical activity score, adults, by sex, Body Mass Index (BMI) and waist circumference**
Aged 19 and over<sup>a</sup>

Summary physical activity level <sup>b</sup> and physical activity score <sup>c</sup>	BMI <sup>d</sup>					Waist circumference <sup>e</sup>	
	Under-weight	Normal weight	Over-weight	Obese	Morbidly obese	Normal	Raised
<b>Men</b>							
Summary physical activity level (%)							
Low	[80]	67	79	82	[100]	72	90
Medium	[10]	17	11	9	[-]	15	7
High	[10]	16	10	9	[-]	13	3
Physical activity score (METs)							
Mean	[34]	34	30	29	[28]	32	28
Median	[30]	30	27	26	[28]	28	26
Lower 2.5 percentile	[23]	23	23	23	[23]	23	23
Upper 2.5 percentile	[67]	75	58	60	[32]	67	58
Standard deviation	[13]	12	9	8	[3]	11	7
<b>Women</b>							
Summary physical activity level (%)							
Low	78	68	86	89	93	72	88
Medium	6	15	10	7	2	14	8
High	17	17	4	3	5	14	4
Physical activity score (METs)							
Mean	31	32	30	30	29	33	29
Median	29	29	28	28	28	29	27
Lower 2.5 percentile	23	23	23	23	23	24	23
Upper 2.5 percentile	49	57	49	50	54	58	51
Standard deviation	7	9	8	7	7	10	7
Base (unweighted) <sup>f</sup>							
Men	17	266	272	208	8	352	225
Women	40	536	492	410	94	583	603

- No observations.

[ ] Fewer than 30 observations.

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Summary physical activity levels are based on average weekly activity in the four weeks prior to interview. Low levels are defined as less than one 30-minute moderate or vigorous activity session per week. Medium activity levels indicate 30 minutes or more at least moderate activity on one to four days per week. High levels indicate 30 minutes or more at least moderate activity on at least five days a week.

<sup>c</sup> Physical activity scores are average daily activity scores based on the four weeks prior to interview.

<sup>d</sup> Underweight: BMI  $\leq 18.5 \text{ kg/m}^2$ ;  
 Normal weight: BMI over 18.5,  $\leq 25 \text{ kg/m}^2$ ;  
 Overweight: BMI over 25,  $\leq 30 \text{ kg/m}^2$ ;  
 Obese: BMI over 30,  $\leq 40 \text{ kg/m}^2$ ;  
 Morbidly obese: BMI over  $40 \text{ kg/m}^2$ .

<sup>e</sup> Normal:  $< 102 \text{ cm}$  (men);  $< 88 \text{ cm}$  (women). Raised:  $\geq 102 \text{ cm}$  (men);  $\geq 88 \text{ cm}$  (women).

<sup>f</sup> Bases for men and women apply to summary physical activity level and vary slightly for physical activity score.

Table 15.12

### Summary physical activity level and physical activity score, adults, by sex and hypertension

Aged 19 and over<sup>a</sup>

Summary physical activity level <sup>b</sup> and physical activity score <sup>c</sup>	Hypertensive categories <sup>d</sup>			
	Normotensive untreated	Hypertensive controlled	Hypertensive uncontrolled	Hypertensive untreated
<b>Men</b>				
Summary physical activity level (%)				
Low	74	97	96	84
Medium	17	3	3	6
High	9	-	0	10
Physical activity score (METs)				
Mean	32	26	30	29
Median	28	25	27	26
Lower 2.5 percentile	23	23	23	23
Upper 2.5 percentile	67	47	53	64
Standard deviation	11	4	6	9
<b>Women</b>				
Summary physical activity level (%)				
Low	77	93	98	89
Medium	13	5	1	4
High	10	3	1	7
Physical activity score (METs)				
Mean	32	28	27	30
Median	29	26	26	27
Lower 2.5 percentile	24	23	23	23
Upper 2.5 percentile	57	51	34	56
Standard deviation	9	6	3	8
<i>Base (unweighted)<sup>e</sup></i>				
Men	229	37	40	123
Women	571	94	90	127

- No observations.

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Summary physical activity levels are based on average weekly activity in the four weeks prior to interview. Low levels are defined as less than one 30-minute moderate or vigorous activity session per week. Medium activity levels indicate 30 minutes or more at least moderate activity on one to four days per week. High levels indicate 30 minutes or more at least moderate activity on at least five days a week.

<sup>c</sup> Physical activity scores are average daily activity scores based on the four weeks prior to interview.

<sup>d</sup> Normotensive untreated: Blood pressure (BP) <140/90 and not taking drugs prescribed for hypertension; Hypertensive controlled: BP <140/90 and taking drugs prescribed for hypertension; Hypertensive uncontrolled: systolic BP (SBP) ≥140 and/or diastolic BP (DBP) ≥90 and taking drugs prescribed for hypertension; Hypertensive untreated: systolic BP (SBP) ≥140 and/or diastolic BP (DBP) ≥90 and not taking drugs prescribed for hypertension.

<sup>e</sup> Bases for men and women apply to summary physical activity level and vary slightly for physical activity score.

Table 15.13a

## Physical activity score, adults, by age, sex and summary physical activity level

Aged 19 and over<sup>a</sup>

Physical activity score (METs) <sup>b</sup> and age group	Summary physical activity level <sup>c</sup>								
	Men			Women			Total		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
<b>19-34</b>									
Mean	30	39	48	31	38	41	31	38	45
Median	29	37	52	29	33	38	29	35	44
Lower 2.5 percentile	23	27	26	24	25	27	24	25	26
Upper 2.5 percentile	44	71	78	49	85	67	47	80	76
Standard deviation	6	10	15	6	14	12	6	13	14
<b>35-49</b>									
Mean	30	[35]	[49]	30	34	44	30	34	45
Median	27	[34]	[53]	29	32	39	28	33	39
Lower 2.5 percentile	24	[24]	[27]	24	26	27	24	24	27
Upper 2.5 percentile	56	[53]	[87]	47	51	76	47	52	79
Standard deviation	7	[7]	[17]	6	7	15	6	7	16
<b>50-64</b>									
Mean	27	[30]	[49]	29	[34]	[41]	28	[33]	45
Median	26	[28]	[36]	27	[33]	[41]	27	[33]	40
Lower 2.5 percentile	23	[24]	[26]	23	[27]	[29]	23	[25]	27
Upper 2.5 percentile	41	[40]	[83]	47	[44]	[56]	43	[41]	72
Standard deviation	4	[6]	[24]	6	[5]	[8]	6	[6]	17
<b>65+</b>									
Mean	27	[29]	[31]	27	[30]	[32]	27	[29]	[32]
Median	26	[28]	[32]	26	[29]	[28]	26	[29]	[30]
Lower 2.5 percentile	23	[23]	[25]	23	[25]	[24]	23	[23]	[24]
Upper 2.5 percentile	41	[53]	[37]	35	[55]	[48]	38	[55]	[48]
Standard deviation	5	[6]	[5]	3	[7]	[8]	4	[6]	[7]
<b>Total</b>									
Mean	28	36	48	29	36	42	29	36	44
Median	26	35	46	28	32	39	27	33	40
Lower 2.5 percentile	23	24	26	23	25	27	23	25	26
Upper 2.5 percentile	42	56	90	44	65	76	44	63	78
Standard deviation	6	9	17	6	11	13	6	10	15
<i>Base (unweighted)</i>									
19-34	96	41	46	350	82	41	446	123	87
35-49	140	29	22	342	65	43	482	94	65
50-64	167	10	16	249	17	18	416	27	34
65+	214	13	5	408	11	10	622	24	15
Total	617	93	89	1349	175	112	1966	268	201

[ ] Fewer than 30 observations.

<sup>a</sup> Respondents aged 16 and over were excluded if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview.

<sup>b</sup> Physical activity scores are average daily activity scores based on the four weeks prior to interview.

<sup>c</sup> Summary physical activity levels are based on average weekly activity in the four weeks prior to interview. Low levels are defined as less than one 30-minute moderate or vigorous activity session per week. Medium activity levels indicate 30 minutes or more at least moderate activity on one to four days per week. High levels indicate 30 minutes or more at least moderate activity on at least five days a week.

Table 15.13b

## Physical activity score, children, by age, sex and summary physical activity level

Aged 2-15<sup>a</sup>

Physical activity score (METs) <sup>b</sup> and age group	Summary physical activity level <sup>c</sup>								
	Boys			Girls			Total 2-15		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
<b>2-10</b>									
Mean	32	36	42	31	34	38	32	35	40
Median	30	35	41	30	32	36	30	33	38
Lower 2.5 percentile	29	31	33	29	30	32	29	30	32
Upper 2.5 percentile	46	53	60	48	49	53	47	49	56
Standard deviation	5	6	7	4	4	6	5	5	7
<b>11-15</b>									
Mean	31	34	38	31	34	40	31	34	39
Median	30	33	36	30	32	36	30	33	36
Lower 2.5 percentile	29	30	32	29	31	33	29	30	32
Upper 2.5 percentile	41	52	60	37	49	53	37	50	53
Standard deviation	2	4	5	2	4	6	2	4	6
<b>Total 2-15</b>									
Mean	32	35	41	31	34	39	32	35	40
Median	30	33	38	30	32	36	30	33	37
Lower 2.5 percentile	29	30	32	29	30	32	29	30	32
Upper 2.5 percentile	45	52	60	47	49	53	45	49	53
Standard deviation	5	5	7	3	4	6	4	5	7
<i>Base (unweighted)</i>									
2-10	119	59	54	144	60	65	263	119	119
11-15	35	37	50	64	35	53	99	72	103
Total 2-15	154	96	104	208	95	118	362	191	222

<sup>a</sup> Summary physical activity level results are not available for comparison with physical activity scores for informants aged 16-18 as the adult recommendations apply so results are not comparable with other ages.

<sup>b</sup> For respondents aged under 16, physical activity scores are average daily activity scores based on the week prior to interview.

<sup>c</sup> Summary physical activity levels are based on the seven days prior to interview. Low levels indicate less than 30-minutes activity each day. Medium levels indicate 30-59 minutes activity each day. High levels indicate 60 minutes or more activity every day.



Table 15.14

**Proportion in the high summary physical activity level in LIDNS, HSE and SHS, adults, by sex and age<sup>a</sup>**

*Aged 25 and over<sup>b</sup>*

Sex, high summary physical activity level and survey <sup>c</sup>	Age group						Total 25+
	25-34	35-44	45-54	5-64	65-74	75+	
	%	%	%	%	%	%	%
<b>Men</b>							
LIDNS	26	12	14	8	3	1	12
HSE	44	41	38	32	17	8	37
SHS	54	44	39	34	23	11	40
<b>Women</b>							
LIDNS	10	15	10	6	4	0	9
HSE	29	30	31	23	13	3	24
SHS	38	37	33	26	16	5	29
<i>Bases (unweighted)</i>							
<i>Men</i>							
LIDNS	89	104	82	107	101	86	629
HSE	1025	1263	1101	1103	807	557	6602
SHS	455	733	616	633	510	327	3610
<i>Women</i>							
LIDNS	216	244	150	148	168	183	1255
HSE	1285	1618	1279	1307	952	903	8234
SHS	600	887	795	778	581	493	4538

<sup>a</sup> All three surveys used a similar questionnaire. To enable direct comparison with LIDNS and Health Survey for England (HSE) 2003, results from Scottish Health Survey (SHS) 2003 shown in this table include only activity sessions that lasted at least 30 continuous minutes (results taken from Table 4.11 in Bromley C et al (eds) Scottish Health Survey 2003 volume 2. Adults. (2005) Edinburgh: Scottish Executive). However, while adults in LIDNS were excluded from analyses of physical activity if they couldn't walk at all, if they had a long standing illness that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview, such adults in HSE/SHS were not excluded.

<sup>b</sup> The youngest age group of adults has been excluded from this table as participants aged 16-18 are classified as adults in HSE/SHS but as children in LIDNS.

<sup>c</sup> 30 minutes or more activity of at least moderate intensity on five or more days per week on average in the four weeks prior to interview.

## Annex 15A

# Met values

This annex describes in detail the methodology used for calculating the physical activity score. Details of the assumptions made for the amount of time spent in each activity, along with the MET values assigned to different types of activities and examples of the calculations are provided.

### 15A.1 Calculating time spent in each activity

#### *Respondents aged 16 and over*

Respondents aged 16 and over were asked to consider the past four weeks and specify (1) the number of hours/minutes spent on average per week and (2) the level of activity, for a range of different activities. These included activities at work, college and home including light and heavy housework, gardening and manual work, and walking, sports and exercise. Level of activity was assessed in different ways depending on the type of activity.

To assess the level of activity at work and/or at college, respondents were asked how physically active they were, and the total number of hours per week on average spent on each. For housework, manual work and gardening, respondents were asked, for each activity, if they had done any of the tasks listed on a show card, and the total number of hours per week on average spent on each activity.

Respondents were asked to describe their usual walking pace. They were also asked to specify, for a given list of sports and exercise, the amount of time spent doing each sport during the four weeks prior to the interview. In order to assess the level of activity for each sport, respondents were asked if the effort was usually enough to make them 'out of breath or sweaty'.

#### *Respondents aged under 16*

Respondents aged under 16 were asked to consider activities done in the seven days prior to interview and to specify the number of hours/minutes spent doing each activity. Level of activity was asked only for walking, in the same way as it was asked for those aged 16 and over.

Activities considered for those aged under 16 included walking, housework or gardening, sports and other active things such as riding a bike, kicking a ball around and jumping around. For sports and other activities, such as 'active play', respondents were asked when they did these exercises - during the week and/or at the weekend and for how many days and for how long per week. For those aged under 16, the time spent doing each sport was not asked in the same way it was for those aged 16 and over – it was only required that they specify the total time spent playing sport and doing 'other active things'.

#### *Assumptions regarding the time spent on each activity*

A number of assumptions were made for each respondent in order to calculate a weekly and daily number of hours spent on each type of activity. The assumptions included:

- The number of hours spent sleeping, which varied with age:
  - Aged 2 – 4: 12 hours/day or 84 hours/week
  - Aged 5 – 7: 11 hours/day or 77 hours/week
  - Aged 8 – 11: 10 hours/day or 70 hours/week
  - Aged 12 – 15: 9 hours/day or 63 hours/week
  - Aged 16 and over: 8 hours/day or 56 hours/week
- The number of hours spent at school for those aged 2-15 was 6.25 hours/day or 31.25 hours/week. Time spent at school was allocated for all children to account for the main part of the day likely to be spent in an equivalent activity level.

- Where data were missing, the number of hours for respondents in a full time job was assumed to be 38.5 hours/week.
- For those aged under 16, the mid-point of the time period was taken to calculate the number of hours spent in each activity, e.g. if '5 minutes, less than 15 minutes' had been selected, 9.5 minutes was used. For the highest time category where there was no mid-point, e.g. 4 hours or more, the actual time recorded was used in the calculation.

### 15A.2 Calculating total time for the week for each individual

The total time spent on each activity per week was calculated for each individual. For those aged 16 and over, the time spent in leisure (very light) activity was calculated as the time left over after time spent at work, college, walking, sleeping and doing home activities and sports was deducted. For those aged under 16, the time spent on leisure activity is calculated as the time left over after time spent at school, walking, sleeping and doing home activities, sports and other active things is deducted. The calculated number of hours added up to more than 168 for the week in 1% of the sample and these respondents were therefore removed from the analyses.

### 15A.3 Calculating the physical activity score

Using the definition for a MET as the ratio of work metabolic rate to a standard resting metabolic rate of 1.0 ( $4.184\text{kJ}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ ), 1 MET is considered a resting metabolic rate obtained during quiet sitting.<sup>1</sup> A MET value reflects the intensity of the activity as a multiple of 1 MET.

The physical activity score is derived by multiplying the duration of each activity in hours by the MET score assigned for the activity to give total MET hours of activity for each individual. For those activities where the intensity varied, for example exercise for those aged 16 and over could have made them out of breath or sweaty or not, MET values specific to the intensity were applied. Rather than use average MET values for the activity categories, where possible individual MET values were assigned in order to increase the level of accuracy in calculating the physical activity score. Values were assigned independently by two members of the LIDNS research team based on those in the published Compendium of Physical Activities.<sup>1</sup> Where differences occurred between the two researchers, these were discussed and a value was agreed. The Compendium provides a coding scheme of specific activities with their respective MET intensity levels. Activities are listed in the Compendium as multiples of the resting MET level and range from 0.9 METs (sleeping) to 18 METs (running at 10.9mph).<sup>1</sup>

The total physical activity score for the week is divided by seven to give the average daily physical activity score for each individual. For adults, this score is an estimate of energy expenditure, while for children the score can only be used as an indicator of energy expended in physical activity rather than as a direct measure of energy expenditure.<sup>2</sup>

### 15A.4 MET values assigned for different types of activities

Details of the MET values assigned to different types of activities for those aged 16 and over and those aged under 16 are given in Tables A15.1 and A15.2, respectively. A MET of 1.0 was assumed for leisure activity equivalent to watching TV, sitting, reading etc. A MET of 2.3 was assumed for time at school which allowed for most of the school day being spent in sedentary activity, while lunch and break times would be more active. (Tables A15.1, A15.2)

### 15A.5 Examples of physical activity scores

Two examples of how the physical activity score is derived are given. Example 1 (Table A15.3) shows the physical activity score for an adult aged 20, and Example 2 (Table A15.4) shows the physical activity score for a child aged 9. (Tables A15.3, A15.4)

The Compendium of Physical Activities provides data for adults without handicaps or other conditions that would sufficiently alter their mechanical or metabolic efficiency.<sup>1</sup> Respondents suffering from a limiting longstanding illness, and who had not had at least a 5 minute walk in the 4 weeks prior to interview, were excluded from the analysis (8%).<sup>3</sup>

Table A15.1

Met values assigned for those aged 16 and over		
Aged 16 and over		
Activity	Met value	
Walking		
Slow pace	2.5	
Steady, average pace	3.3	
Fairly brisk pace	3.8	
Fast pace – at least 4mph	5.0	
Work		
Very physically active	6.5	
Fairly physically active	3.5	
Not very physically active	2.3	
Not at all physically active	1.5	
College		
Very physically active	3.7	
Fairly physically active	3.1	
Not very physically active	2.3	
Not at all physically active	1.5	
Sports <sup>a</sup>	Sweaty/ out of breath	Not sweaty/ out of breath
Swimming	8.0	5.0
Cycling	8.0	5.0
Workout at gym/exercise bike/ weight training	6.9	3.33
Aerobics/keep fit/gymnastics/ dance for fitness	5.75	4.38
Any other type of dancing	4.83	3.0
Running/jogging	9.0	5.0
Football/rugby	9.5	5.0
Badminton/tennis	5.75	4.5
Squash	12.0	5.0
Exercises (e.g. press ups/sit ups)	8.0	4.25
Housework – light <sup>b</sup>	2.96	
Housework – heavy <sup>c</sup>	3.08	
Gardening <sup>d</sup>	3.89	
Manual work <sup>e</sup>	5.93	
Sleep	0.9	
Leisure <sup>f</sup>	1.0	

<sup>a</sup> Only those sports listed on the show card have been included in the table - some respondents specified 'other sports' such as table tennis. MET values for these other sports have not been included here but were used to calculate the activity scores.

<sup>b</sup> Based on hoovering; dusting; ironing; general tidying; washing floors and paintwork.

<sup>c</sup> Based on spring cleaning; walking with heavy shopping (more than 5 mins); cleaning windows; scrubbing floors with scrubbing brush.

<sup>d</sup> Based on hoeing, weeding, pruning; mowing with a power mower; planting flowers/seeds; decorating; minor household repairs; car washing and polishing; car repairs and maintenance.

<sup>e</sup> Based on 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.

<sup>f</sup> Based on watching television; sitting; reading; writing; talking or talking on the phone; listening to music; watching a movie.

Table A15.2

Met values assigned for those aged 2-15	
Aged 2-15	
Activity	Met value
Walking	
Slow pace	2.5
Steady, average pace	3.3
Fairly brisk pace	3.8
Fast pace – at least 4mph	5.0
Housework and gardening <sup>a</sup>	4.0
Sports <sup>b</sup>	6.25
Other activities <sup>c</sup>	4.97
School <sup>d</sup>	2.3
Sleep	0.9
Leisure <sup>e</sup>	1.0

<sup>a</sup> Based on hoovering; cleaning a car; mowing grass; sweeping up leaves.

<sup>b</sup> Based on playing football, rugby or netball in a team, including club, match or practice; playing tennis, squash or badminton, including club, match or practice; going swimming including out of school swimming lessons; gymnastics including toddler gym or tumble tots etc; dance lessons, ballet lessons, ice skating; horse riding; disco dancing; and any other organised sports, team sports or exercise activities.

<sup>c</sup> Based on riding a bike; kicking a ball around; running about (outdoors or indoors); playing active games; jumping around.

<sup>d</sup> Based on the majority of the school day being spent in sedentary activity, with more active lunch and break times.

<sup>e</sup> Based on watching television; sitting; reading; writing; talking or talking on the phone; listening to music; watching a movie.

Table A15.3

**Example 1: Physical activity score for an adult aged 20**

Type of activity	Total time/ per week (hours)	Intensity level	MET value assigned	Activity score (hours* MET)
Work	16.0	Not very	2.3	36.8
College	0.0	-	-	-
Walking	3.0	Steady	3.3	9.9
Light housework	3.0	n/a	2.96	8.88
Heavy housework	0.0	n/a	-	-
Gardening	0.0	n/a	-	-
Manual work	0.0	n/a	-	-
Sports				
Running/jogging	2.0	Sweaty	9	18
Football/rugby	1.0	Sweaty	9.5	9.5
Sleep	56	n/a	0.9	50.4
Leisure (leftover)	87	n/a	1.0	87
Total	168	-	-	220.48/7 = 31.50 per day

Table A15.4

**Example 2: Physical activity score for a child aged 9**

Type of activity	Total time/ per week (hours)	Intensity level	MET value assigned	Activity score (hours* MET)
Walking	2.5	Slow	2.5	6.25
Housework and gardening	0.0	n/a	-	-
Sports				
Weekend	2.0	n/a	6.25	12.5
Weekday	5.0	n/a	6.25	31.5
Other active things				
Weekend	3.0	n/a	4.97	14.91
Weekday	2.5	n/a	4.97	12.425
School	31.5	n/a	2.3	72.45
Sleep	70	n/a	0.9	63
Leisure (leftover)	51.5	n/a	1.0	51.5
Total	168	-	-	264.285/7 = 37.76 per day

**Notes and references**

- 1 Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, O'Brien WL, Bassett Jr DR, Schmitz KH, Emplaincourt PO, Jacobs DR Jr, Leon AS. Compendium of Physical Activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc* 2000;32(9 Suppl.):S498-S516.
- 2 Ainsworth BE, Haskell WL, Leon AS, Jacobs DR Jr, Montoye HJ, Sallis JF, Paffenbarger RS Jr. Compendium of Physical Activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc* 1993;25:71-80.
- 3 Respondents aged 16 and over (the age at which the adult physical activity questionnaire was used) were excluded from the analysis if they had a long standing illness, disability or infirmity that limited activity and they had not walked continuously for at least 5 minutes in the four weeks prior to interview. Additionally respondents were excluded if they couldn't walk at all.