STRATEGIC INSIGHT PAPER FOR SPORT ENGLAND:

'CALORIE MAPPING' SPORTS PARTICIPATION IN ENGLAND

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ABSTRACT

The Active People Survey is a nationwide project commissioned by Sport England to investigate the sport and physical activity habits of the general population. The results of this survey provide valuable data to inform health-related Government strategy. The aim of this investigation was to provide a preliminary regional 'calorie map' of sport and physical activity. Utilising mode, frequency, duration and intensity of sport/physical activity data, energy expenditure values were ascribed to the 7 most popular sports/physical activities in the Active People Survey 2. The activities selected were: walking, cycling, swimming/diving, gym, football, golf and road running. Energy expenditure ($kcal \cdot week^{-1}$) was calculated using standard metabolic equations. Results revealed that, for much of the population, energy expenditure from walking, cycling, swimming/diving, and gym activities, was insufficient to provide a positive impact on health. However, more vigorous, high-impact pursuits, such as football and road running, or those performed over a long duration, such as golf, appear to provide a more beneficial stimulus for positive health adaptations. Males tended to expend more calories than females, although energy expenditure was higher in females for walking activity. These results suggest that further work is required to educate the public about the types and levels of sport and physical activity required to promote health and fitness. A general understanding of issues related to calorie expenditure would necessarily lead to an awareness of the important link between energy intake and energy expenditure. Sport and physical activity promotion activities should also encourage those who are already physically active to increase the frequency, intensity and/or duration of their activity bouts. Those who currently rely on walking as their sole form of exercise should supplement this with more deliberate forms of physical activity. Sport provides an excellent range of such activities. In order to maximise the health benefits of sport and physical activity, individuals should seek to incorporate both moderate (e.g. walking) and vigorous intensity (e.g. football) activities into their weekly routines. Future calorie mapping exercises should evaluate all sports/physical activities reported in the Active People Surveys, should compare successive surveys, and should provide a comprehensive evaluation of the impact of population demographics on sport and physical activity energy expenditure.

Key words: sport, physical activity, energy expenditure, health, METs, Active People Survey.

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1.0 INTRODUCTION

Sport makes a significant contribution to the wider health agenda, providing economic and social benefits to the community (Sport England, 2008). The "Choosing Health" White Paper, published in 2004, set out the UK Government agenda for supporting the public to make more informed choices about their health. The Government pledged to provide information, practical support and access to services, such that 'healthy choices' could be more easily taken.

The approaching 2012 Olympic Games in London has given sport and health a fresh impetus, and moved it higher up the Government's public health agenda. Sport England is committing 15% of its investment to increase regular participation in sport by 200,000 adults per annum, working towards a target of 1 million more sports participants by 2012-2013 (Sport England, 2008). This key performance indicator will be monitored through the Active People Survey.

The collection of data in the Active People Survey on population activity habits, particularly exercise duration, frequency, intensity, and type of sport or physical activity undertaken, makes it possible to estimate the calories (energy) expended during sport and physical activity. By carrying out a calorie mapping exercise, the key aim of this investigation was to quantify the contribution that sport participation makes to health. Key global public health agencies, such as the American College of Sports Medicine, recommend minimum weekly calorie expenditure targets that should be achieved through bouts of physical activity.

1.1 WHY PHYSICAL ACTIVITY?

It is recognised that sport and physical activity, along with a healthy diet, are key determinants of health (Department of Health, 2009a). Compared to those with a sedentary lifestyle, physically active individuals are at approximately half the risk of developing coronary heart disease (Department of Health, 2004a). Regular physical activity is also associated with improved mental health and a reduced risk of diabetes, obesity, osteoporosis and colon cancer. In older adults, physical activity is associated with increased functional capacity (Mazzeo & Tanaka, 2001). In September 2009 the UK Government

announced details of a new sports and physical activity scheme as part of the 'Change4Life' initiative. This scheme includes a Dance Champions Group, to promote dance participation in the lead up to the 2012 London Olympic Games, and the new 'Swim4Life' campaign to complement the existing free swimming scheme. These new initiatives will complement other such activities (e.g. Bike4Life), to comprise a comprehensive Change4Life social marketing campaign. The National Health Service (NHS) will have a key role in this promotion of physical activity, placing physical activity at the forefront of policy decisions and at the heart of the health service. These activities demonstrate national recognition for the importance of sport and physical activity. For the first time, sport and physical activity is being seen as a clinical need, rather than just a lifestyle choice.

Despite this, there is evidence that general physical activity levels are declining as lifestyles change (Department of Health, 2004a). However, whilst the distance travelled per year on foot and bicycle has fallen in the last three decades, there is evidence to suggest an increase in the proportion of people who choose to be active in their leisure time (Department for Transport, 2001).

Cancer and cardiovascular disease (heart disease and stroke) are the major causes of death in England, together accounting for almost 60% of premature deaths (Department of Health, 2004a). Increasing physical activity in the adult population would reduce the prevalence of these major lifestyle diseases, as well as reducing the risk of osteoporosis, back pain and osteoarthritis. Physical activity has also been shown to have positive effects on psychological wellbeing and mental health (Paluska & Schwenk, 2000).

1.2 Recommendations for Minimum Levels of Physical Activity

The Chief Medical Officer has recommended that the adult population (i.e. ages 16 years and over) should achieve 30 minutes of physical activity of at least moderate intensity on 5 days per week ("5x30") (Department of Health, 2004a). Whilst agreeing that moderate intensity activity should be encouraged, Haskell *et al*. (2007) also emphasised the need for vigorous intensity physical activity. Moderate and vigorous intensity tasks performed as part of everyday life (e.g. brisk walk, gardening, DIY tasks) can be counted towards the 5x30 target. However, the recommended amount of physical activity (whether moderate or

vigorous) should be in addition to the routine, light intensity, activities of daily living (e.g. casual walking, shopping, domestic chores).

Although it is widely acknowledged that an active lifestyle leads to better health, estimates suggest that only 31% of the adult population are sufficiently active to experience the health benefits (Department of Health, 2009). Data from the most recent Health Profile of England shows that 40% of the adult male population and just 28% of the adult female population achieve the minimum recommended level of physical activity (Department of Health, 2009a). It has been reported that levels of sport and physical activity decline significantly with age for both sexes, whilst higher academic achievement has been associated with greater engagement in physical activity (Department of Health, 2004a).

One function of the Choosing Health consultation (Department of Health, 2004b) was to develop an activity plan for the UK population that would contribute to the delivery of 'Game Plan', the strategy for delivering the Government's sport and physical activity objectives. Game Plan set out a vision for increasing physical activity participation, to get 70% of the population performing 30 minutes of moderate exercise five times a week by 2020 (Strategy Unit, 2002). The 2012 London Olympic Games provides a vital opportunity to encourage the UK population to become more physically active and could stimulate a golden age of sport and physical activity. Using this global celebration of sport as an inspiration, it is hoped that the London Olympics will provide sufficient momentum to achieve the Government's ambitious targets for sport and physical activity participation.

1.3 Physical Activity and Energy Expenditure

Physical activity includes many different forms of 'everyday' activity. Thus, walking to work, working out in a gym, attending a dance class, and informal family play activities are all forms of physical activity (Department of Health, 2009b). What is intrinsic to each of these forms of physical activity is the effect that movement has on the body, raising heart rate and breathing rate, eventually bringing about beneficial physiological adaptations. These are usually accompanied by an improvement in overall sense of wellbeing (Paluska & Schwenk, 2000). The simple concept of increased movement underpins the Change4Life health strategy discussed above (Department of Health, 2009c).

The energy cost of many physical activities has been established. Activities that are vigorous and involve large muscle groups require greater energy expenditure than do moderate or low intensity activities that utilise small muscle groups. For this reason, most health agencies (American College of Sports Medicine, 2006; Department of Health, 2004; Haskell *et al*., 2007) recommend activities that require large rhythmical contraction of muscle groups, performed at a moderate intensity (enough to raise breathing rate) over a prolonged period of time (10-90 minutes).

The energy expenditure of a wide range of physical activities have been obtained by directly measuring the oxygen cost of these activities in an adult population (Ainsworth *et al*., 1993, 2000; Montoye, 2000; Montoye *et al*., 1996; Olson *et al*., 1991; Zeni *et al*., 1996). The term metabolic equivalent (MET) is often used to describe exercise intensity (Ainsworth *et al*., 2000; Department of Health, 2004a). One MET is equivalent to the amount of energy expended during one minute of seated rest. Therefore, exercise performed at a level of intensity five times that of resting oxygen uptake (VO_2) is equivalent to 5 METs. An example of a 5 METs activity is walking at 4.0 miles·hour^{-1} on a level firm surface (Ainsworth, *et al*., 2000). Exercise of light intensity will usually have a MET value <3, moderate intensity 3-6 METs, and vigorous exercise >6 METs (Haskell *et al*., 2007).

Whilst providing a valuable tool, the MET approach has a number of limitations. The absolute energy expended during exercise at a 5-MET intensity depends on an individual's body size (i.e. a large person is likely to have a larger VO_2 than a small person) and their body fat percentage (Howell *et al*., 1999). As a result, the estimation of energy expenditure for weight-bearing activities may be underestimated when using MET tables and over-estimated for non-weight bearing activities (American College of Sports Medicine, 2010). Similarly, differences in age, cardiorespiratory fitness, exercise efficiency, and environmental conditions may impact on the accuracy of standardised MET values (Ainsworth *et al*., 1993, 2000).

In a public health setting, the MET approach is valuable as it provides a physiologically valid method to evaluate the contribution of various types of physical activity to overall daily and weekly energy expenditure. It also facilitates comparisons of energy expended between

different modes of activities. As an example, an adult walking at an average pace of 3 miles·hour^{-1} on a flat hard surface would be working at an intensity of 3.3 METs. If this is performed for the recommended 30 minutes, then the total accumulated energy expenditure would be 99 METs (3.3 METs x 30 min = 99 METs). If this individual began jogging at 5 miles·hour^{-1} (12 min·mile^{-1}), they would then be exercising at a metabolic rate that was 8 times that of resting metabolic rate, or 8 METs. Jogging for 20 minutes, accumulated energy expenditure would be 160 METs (8 METs x 20 min = 160 METs). If an adult is to achieve the Chief Medical Officer's "5x30" target, they should achieve a weekly value in the range of 450-900 MET·week^{-1} (based upon the MET range of 3-6 METs for moderate intensity effort and 5x30 min = 150 mins·week^{-1}; 3 METs x 150 min·week^{-1} = 450 MET·week^{-1}; 6 METs x 150 mins·week^{-1} = 900 MET·week^{-1}).

In order to accumulate the recommended weekly energy expenditure targets outlined, a person would need to engage in moderate intensity activity for a longer duration (i.e. more minutes), or shorter bouts of vigorous intensity activity (i.e. higher MET values). Haskell *et al*. (2007) suggested that vigorous intensity physical activity leads to a greater health benefit; hence the encouragement from public health agencies to mix moderate and vigorous intensity efforts.

1.4 Physical Activity and Energy Expenditure Recommendations

The specific physiological adaptations (e.g. weight loss, cholesterol reduction, enhanced maximal aerobic capacity) that result from physical activity are dependent upon the level of energy expenditure (American College of Sports Medicine, 2006). It is the interaction of intensity, duration and frequency of physical activity performed that will determine the net caloric expenditure.

Common methods to express sport and physical activity data include: duration (total minutes spent in activity [number of sessions*session time]); metabolic equivalents (METs; a MET is an estimate of intensity based on the ratio of working metabolic rate to resting metabolic rate); and kilocalories (kcal). A progression of the three methods for calculating energy expenditure during activity is illustrated in Figure 1.1.

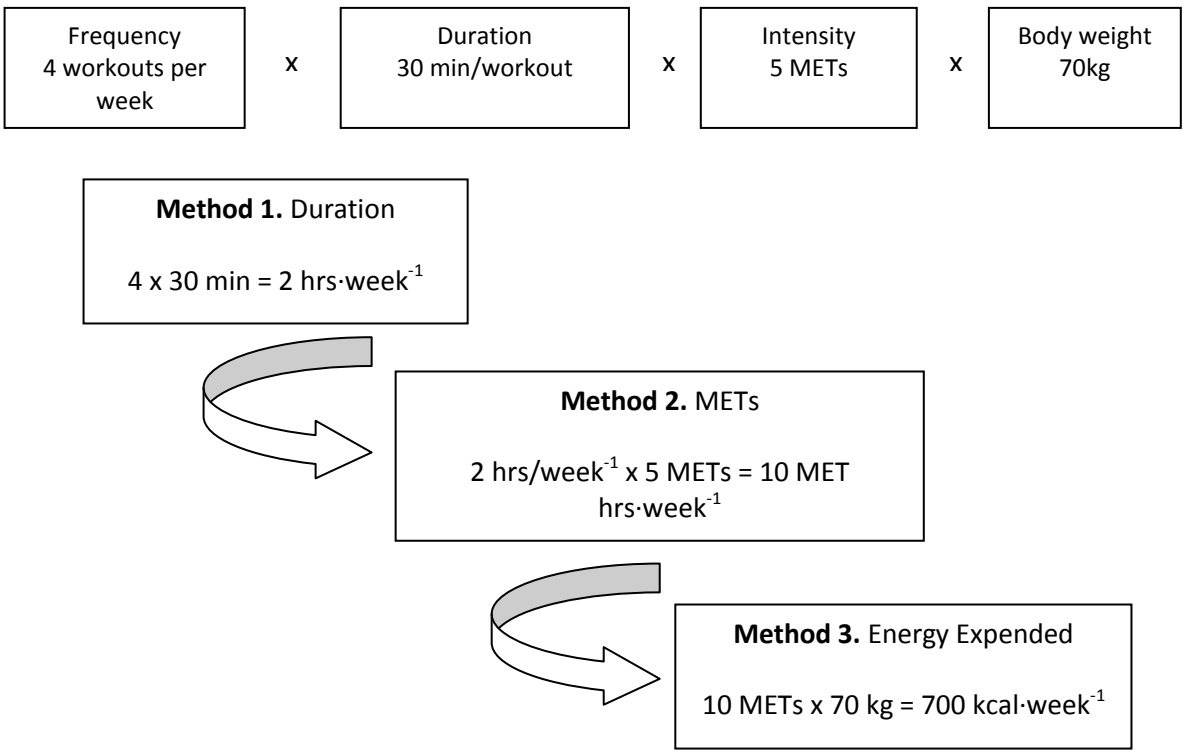

Figure 1.1 Methods of summarising physical activity data (American College of Sports Medicine, 2010)

When using these calculations the assumption is made that MET values are representative of the way an activity is performed, regardless of the skill level of the individual or the pace of the activity. Furthermore, it is assumed that the metabolic cost of performing activities (in METs) is constant among individuals, regardless of body weight (American College of Sports Medicine, 2010).

For simplicity, individual differences in resting energy expenditure are often overlooked; 1 MET is considered to be equivalent to a VO_2 of 3.5 ml·O_2·kg^{-1}·min^{-1}. Expressed as caloric expenditure, 1 MET represents an energy expenditure of approximately 1.2 kcal·min^{-1} for a 70kg individual (American College of Sports Medicine, 2010).

All adults should expend 150-400 kcal of energy per day through sport and/or physical activity (American College of Sports Medicine, 2006). The lower end of this range represents a minimal caloric threshold of approximately 1000 kcal·$week^{-1}$. This level of activity has been shown to reduce the risk of all-cause mortality by 20-30% (Nelson *et al*., 2007). Because

there is a strong dose-response relationship between physical activity and health and fitness, there should be progression toward the upper end of the recommended range of 300-400 kcal·day^{-1} (2100-2800 kcal·week^{-1}), particularly if weight loss is a target outcome. Indeed, recent recommendations from the Chief Medical Officer suggest that a minimum of 60 min·day^{-1} of activity is required for weight loss or healthy weight maintenance (Department of Health, 2004a). Ross & Janssen (2001) suggested that physical activity energy expenditure in excess of 2000 kcal·week^{-1} is required for short and long-term weight control.

1.5 Aims of Investigation

The primary aim of this investigation was to provide a preliminary calorie map of sport and physical activity in England using data from the Active People Survey 2. Survey questions relating to the mode, frequency, duration and intensity of physical activity performed were utilised. A secondary aim was to investigate energy expenditure from a range of sports and physical activities, to establish those activities that provide the highest and the lowest levels of energy expenditure. The results of this investigation will illustrate whether or not the sport and physical activity being performed by the sampled population is sufficient to have a positive impact on health. Whilst the target 5x30 minutes of weekly activity might be achieved by a substantial fraction of the population, this does not necessarily mean that activity levels are sufficient to promote positive health adaptations. The calculation of physical activity caloric expenditure provides valuable information on the potential health-promoting benefits of the sport and physical activity performed by adults in England.

2.0 METHODS

2.1 SOURCE DATA

A key aim of the Active People Survey (APS) is to establish how much of the adult population of England (% of respondents) are active at the recommended levels. However, as questions relating to the frequency, duration, and intensity of activity are included, the APS surveys also provide a valuable opportunity to quantify the energy expended through sport and physical activity.

The Active People Survey 2 (APS 2) identified 256 sports and physical activities. The preliminary investigation carried out here considered the 7 most popular sports/physical activities: walking (134,920 participants), swimming/diving [indoors] (23,769 participants), cycling (20,280 participants), gym (18,615 participants), football (7,247 participants), golf (7,098 participants), and road running (5,243 participants). This selection includes 3 out of the 4 activities promoted by the UK Government in the Change4Life health campaign. Dance was not included due to the low number of dance participants recorded in APS 2.

2.2 CALCULATING ENERGY/CALORIE EXPENDITURE

Standard metabolic calculations and MET values were used to calculate energy expenditure for each day of sport/physical activity completed (Q11: "Number of days in last 4 weeks"). The compendium tables of Ainsworth *et al*. (2000) were used to prescribe metabolic equivalents (METs) for each sport/physical activity at 3 intensities (Q13, negative response: 'raised breathing rate?'; Q13, positive response: 'raised breathing rate?'; and Q14, positive response: 'out of breath or sweaty?'). These compendium tables have been used previously by Haskell *et al*. (2007) and the UK Chief Medical Officer (Department of Health, 2004a).

Using a range of nested logic functions in Microsoft Excel, caloric expenditure was calculated for each sport/physical activity session as (Ainsworth, 2009; American College of Sports Medicine, 2006):

$$kcal \cdot session^{-1} = (METs \times body\ weight\ [kg]) / 60 \times session\ duration\ (min)$$

Taking account of the number of sessions completed in the previous 4 weeks, this data was averaged to produce monthly, weekly, and daily calorie expenditure values. (Note: Walking

and cycling calculations utilised a 30-minute session duration. This was because 'average session duration' data was not available for these activities.)

It was beyond the scope of this analysis to accommodate all variables that might impact on the energy cost of movement. Ideally a correction factor would be available for different physical activities. However, no such correction is currently available. The only variable that could be accounted for was body weight. However, actual body weight data was not available. Therefore, body weight was factored into the calorie mapping calculations using a range of weights (10kg increments between 60-100kg) to accommodate for variation in the UK adult population.

Establishing caloric expenditure during exercise is problematic due to the many variables that can influence it. These include factors such as inter-individual differences in skill, co-ordination, exercise efficiency (VO_2 per unit workload), and the variation in exercise intensity within an activity. Further error is introduced when asking an individual to report their 'usual' level of effort/intensity during sport and physical activity. Therefore, these analyses/data should be used with caution. Indeed, even direct attempts to establish energy expenditure through methods such as accelerometry have identified a variety of limitations (American College of Sports Medicine, 2006).

2.3 DATA ANALYSIS

Caloric expenditure and demographic data were prepared using Microsoft Excel pivot tables. Data were reported as means for sport, region, local authority, and sex.

Preliminary statistical analyses were carried out to evaluate differences between sports and ethnic groups (walking only). One-way ANOVA and Tukey post-hoc tests were performed using the SPSS statistical software package (versions 16 and 17). The alpha level was set at $P < 0.05$. An adjustment was made to the ethnic group data to accommodate 5,109 blank responses. These were converted to category 5, classified as 'Other'.

3.0 RESULTS

3.1 Regional Energy Expenditure

Regional weekly energy expenditure values for the 7 most popular activities recorded in the Active People Survey 2 are reported in Tables 3.1-3.7. As body weight data was not collected in APS 2, average values are reported for the illustrative range 60kg-100kg. Values for each weight category are not qualitatively different. Therefore, it is appropriate to consider values for a reference individual of 70kg, this representing an 'average' adult.

The most popular physical activity reported in the Active People Survey 2 was walking (APS 2 Question 2). 134,920 individuals (total sample = 191,325) reported having completed 'at least one continuous walk lasting 30 minutes' in the 'last 4 weeks'. The South West reported the highest regional energy expenditure for walking exercise (mean for all body weights = 457 kcal·week^{-1}). The lowest level was reported in the West Midlands (mean for all body weights = 442 kcal·week^{-1}). The minimum recommended daily physical activity energy expenditure is 150 kcal (American College of Sports Medicine, 2006), this would require a minimum weekly energy expenditure of 750 kcal (5 sessions·week^{-1} x 150 kcal). Assuming walking to be the only physical activity undertaken, this minimum level was not achieved through walking exercise for any region (or body weight) (see Figure 3.1).

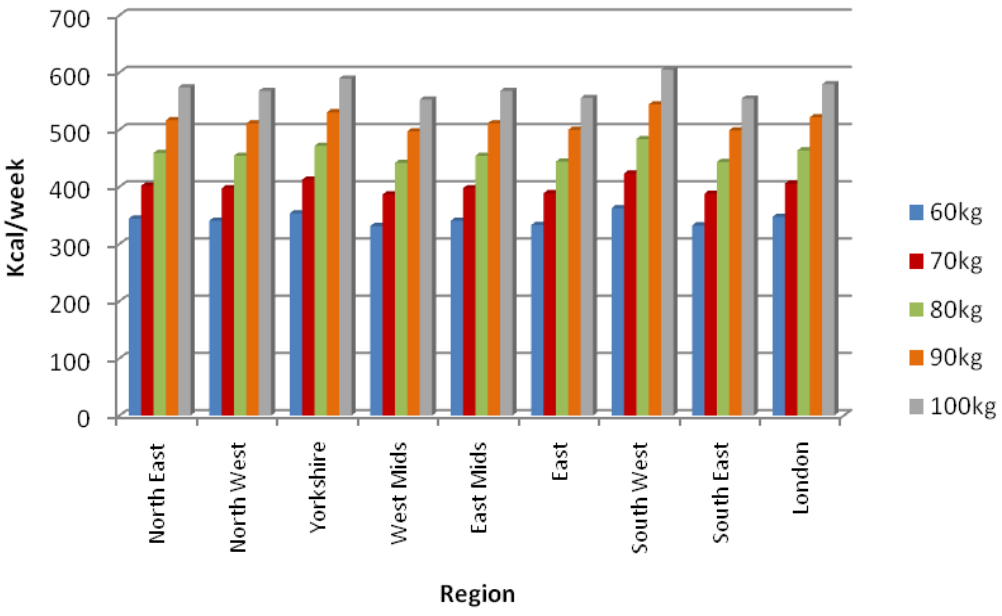

Figure 3.1 Regional calorie map for walking.

Table 3.1 Regional weekly energy expenditure for walking (APS 2 Question 2) (N = 134,920).

	Energy expenditure (Kcal.week^{-1})					
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	344	402	459	517	574	68.3
North West	341	397	454	511	568	69.6
Yorkshire	354	413	472	530	589	71.1
West Mids	331	387	442	497	552	68.2
East Mids	341	398	454	511	568	70.4
East	333	389	444	500	555	69.7
South West	363	423	484	544	605	74.5
South East	333	388	443	499	554	71.9
London	348	406	464	522	580	69.5
Mean (Kcal)	**343**	**400**	**457**	**515**	**572**	**70.4**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

Table 3.2 Regional weekly energy expenditure for swimming (sport 003) (N = 23,769).

	Energy expenditure (Kcal.week^{-1})					
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	220	257	293	330	367	11.4
North West	212	247	282	318	353	12.6
Yorkshire	204	238	272	306	340	12.9
West Mids	195	228	260	293	325	11.9
East Mids	192	224	257	289	321	12.3
East	203	237	271	305	339	12.7
South West	198	231	264	297	330	12.6
South East	194	227	259	292	324	12.9
London	194	226	258	290	323	12.0
Mean (Kcal)	**201**	**235**	**269**	**302**	**336**	**12.4**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

Swimming/diving [indoors] (sport 003) was the second most popular physical activity in the Active People Survey 2, with 23,769 individuals (total sample = 191,325) having undertaken this activity in the 4 weeks prior to questioning. Of the 7 sports/physical activities investigated, swimming was ranked lowest for weekly energy expenditure (Table 3.9). These

data suggest that, with the highest energy expenditure for this activity, a 100-kg person from the North East achieved just 49% of the minimum recommended weekly energy expenditure from swimming/diving [indoors] alone (367 kcal·week^{-1}).

Cycling was the third most popular physical activity reported in the Active People Survey 2. 20,280 individuals (total sample = 191,325) reported having completed 'at least one continuous cycle ride lasting 30 minutes' in the 'last 4 weeks'. The highest weekly energy expenditure for cycling activity was reported in London (mean for all body weights = 614 kcal·week^{-1}). The lowest value was reported in the East region with an energy expenditure of 508 kcal·week^{-1} (mean result for all body weights). Only a 100kg person in London achieved the minimum recommended weekly energy expenditure from cycling alone (Table 3.3 and Figure 3.2).

Table 3.3 Regional weekly energy expenditure for cycling (APS 2 Question 6) (N = 20,280).

	Energy expenditure (Kcal.week^{-1})					
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	406	473	541	609	676	8.3
North West	446	520	595	669	743	8.7
Yorkshire	416	485	555	624	693	9.6
West Mids	390	455	520	585	650	9.3
East Mids	402	469	537	604	671	10.7
East	381	445	508	572	635	12.4
South West	382	446	510	574	637	11.5
South East	386	451	515	579	644	12.2
London	460	537	614	690	767	10.2
Mean (Kcal)	**408**	**476**	**544**	**612**	**680**	**10.3**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

The fourth most popular activity reported in APS 2 was gym. The mean weekly energy expenditure for all body weights for this activity exceeded 600 kcal in all regions, with a high of 703 kcal·week^{-1} in the North East (Table 3.4). However, only individuals in the 90kg and 100kg categories expended sufficient energy through this activity to meet the weekly recommendations for energy expenditure from sport and physical activity. However, given

that many gym activities are weight-supported (e.g. rowing machine, weight bench) and that MET values (used to derive calorie values) may be inaccurate for such activities (see Section 1.4), these results should be treated with caution.

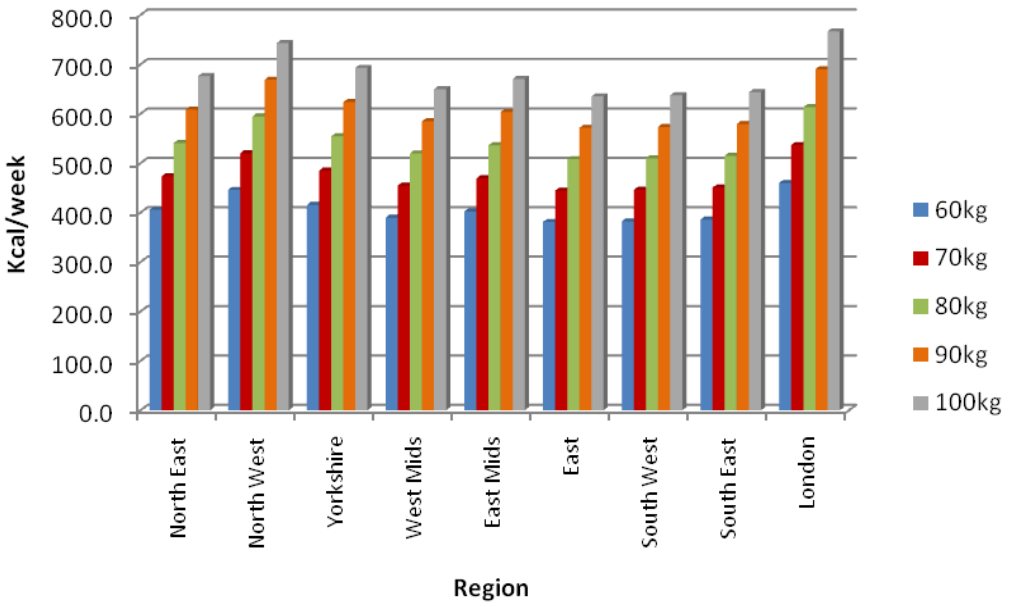

Figure 3.2 Regional calorie 'map' for cycling.

Table 3.4 Regional weekly energy expenditure for gym (sport 014) (N = 18,615).

Energy expenditure (Kcal.week^{-1})						
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	528	616	703	791	879	9.0
North West	526	614	701	789	877	9.9
Yorkshire	512	598	683	768	854	9.1
West Mids	516	603	689	775	861	9.5
East Mids	502	586	669	753	837	9.1
East	492	574	656	738	821	9.5
South West	464	542	619	696	774	7.7
South East	479	559	639	719	799	10.2
London	490	572	653	735	817	12.9
Mean (Kcal)	**501**	**585**	**668**	**752**	**835**	**9.7**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

Data presented in Table 3.5 suggests that football provides a valuable means of achieving minimum levels of weekly energy expenditure. Even for a 60kg individual in the East region, which reported the lowest energy expenditure per week, football provided sufficient energy expenditure (836 kcal·week^{-1}) to meet the 750 kcal·week^{-1} physical activity energy expenditure target. The highest energy expenditure for football was reported in the South West (mean for all body weights = 1303 kcal·week^{-1}) and the lowest in the East (mean for all body weights = 1114 kcal·week^{-1}).

Table 3.5 Regional weekly energy expenditure for football (sport 049) (N = 7,247).

	Energy expenditure (Kcal.week^{-1})					
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	893	1042	1191	1340	1489	3.9
North West	878	1025	1171	1317	1464	4.0
Yorkshire	921	1075	1229	1382	1536	3.6
West Mids	925	1079	1234	1388	1542	3.8
East Mids	888	1036	1184	1332	1480	3.7
East	836	975	1114	1253	1393	3.9
South West	977	1140	1303	1466	1628	2.9
South East	838	978	1118	1257	1397	3.7
London	913	1065	1217	1369	1522	4.6
Mean (Kcal)	**897**	**1046**	**1196**	**1345**	**1494**	**3.8**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

Golf/pitch & putt/putting was the sixth most popular sport/physical activity in the Active People Survey 2. Although golf is a low intensity sport, the prolonged duration of this activity resulted in the highest weekly energy expenditures of the 7 sports analysed (mean for all regions and all body weights = 1502 kcal·week^{-1}). Indeed, the mean energy expenditure (for all body weights) exceeded the minimum recommended levels (750 kcal·week^{-1}) by a factor of two in 6 out of the 9 regions (Table 3.6).

A total of 7,098 individuals reported having taken part in road running during the 4 weeks prior to questioning. The North East reported the highest weekly energy expenditure from

this activity (Table 3.7) (mean for all body weights = 934 kcal·week^{-1}), with the lowest values being reported in Yorkshire (mean for all body weights = 777 kcal·week^{-1}). With the exception of Yorkshire, all individuals over 70kg achieved the minimum recommended weekly energy expenditure from road running.

Table 3.6 Regional weekly energy expenditure for golf (sport 092) (N = 7,098).

	Energy expenditure (Kcal.week^{-1})					
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	1229	1434	1639	1844	2049	3.3
North West	1167	1362	1557	1751	1946	3.4
Yorkshire	1242	1449	1656	1862	2069	3.8
West Mids	1129	1317	1505	1693	1881	3.7
East Mids	1169	1364	1559	1754	1949	3.8
East	1091	1273	1455	1637	1819	4.2
South West	1166	1360	1555	1749	1943	3.6
South East	1050	1225	1400	1575	1750	4.5
London	895	1044	1193	1342	1491	2.3
Mean (Kcal)	**1127**	**1314**	**1502**	**1690**	**1878**	**3.6**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

Table 3.7 Regional weekly energy expenditure for road running (sport 075) (N = 5,243).

	Energy expenditure (Kcal.week^{-1})					
Region	**60kg**	**70kg**	**80kg**	**90kg**	**100kg**	**Population %***
North East	700	817	934	1050	1167	2.3
North West	637	743	849	955	1062	2.7
Yorkshire	583	680	777	874	971	2.5
West Mids	684	798	912	1026	1140	2.2
East Mids	660	770	880	990	1100	2.4
East	669	781	892	1004	1115	2.6
South West	693	808	924	1039	1154	2.9
South East	669	781	892	1004	1115	3.1
London	686	801	915	1029	1144	3.7
Mean (Kcal)	**665**	**775**	**886**	**997**	**1108**	**2.7**

*Percentage of respondents, per region, undertaking activity in 4 weeks prior to survey.

The final column in Tables 3.1-3.7 provides the percentage of the population from each of the 9 regions who participated in each activity during the 4 weeks prior to survey. A mean 70.4% of respondents across the regions had participated in walking, 12.4% in swimming, 10.3% in cycling, 9.7% in gym-based activities, 3.8% in football, 3.6% in golf and 2.7% in road running. The range of percentages shown in Table 3.8 are relatively narrow for swimming (1.5%), football (1.7%), golf (2.2%) and road running (1.5%), suggesting that there is relatively small variation in regional participation statistics. The difference between the highest and lowest regional respondents was greatest for walking (6.3%), gym activities (5.2%), and cycling (4.1%); suggesting more regional variation for these activities. The distribution of figures across the regions suggests that no individual region skews the figures. London had the highest percentage of respondents for 3 activities: gym, football and road running, but had the lowest percentage of respondents for golf. The South East had the highest percentage of respondents for swimming (with Yorkshire) and golf. The South West had the highest percentage of respondents for walking, but the lowest for gym and football. A full list of the percentage respondents for the 7 selected activities is shown in Table 3.8.

Table 3.8 Regional levels of participation in 7 most popular sports/physical activities.

Activity	Mean % Participating in the Last 4 Weeks	Cross-regional range of % participation	Region with lowest rate of participation	Region with highest rate of participation
Walking	70.4	68.2 - 74.5	West Midlands	South West
Swimming	12.4	11.4 - 12.9	North East	South East/Yorkshire
Cycling	10.3	8.3 - 12.4	North East	East
Gym	9.7	7.7 - 12.9	South West	London
Football	3.8	2.9 - 4.6	South West	London
Golf	3.6	2.3 - 4.5	London	South East
Road Running	2.7	2.2 - 3.7	West Midlands	London

3.2 Sports/Physical Activity Energy Expenditure Comparisons

A one-way ANOVA identified significant differences between the mean regional values for each sport/physical activity ($P < 0.001$). Post-hoc analysis suggested that walking and cycling energy expenditures were not different ($P > 0.05$) but revealed a significant difference

between cycling and gym ($P < 0.02$) and between all other sports ($P < 0.0001$). Table 3.9 identifies the rank order of weekly energy expenditures per sport for a 70kg individual.

Table 3.9 Weekly calorie expenditure for 7 most popular sports/physical activities.

	Energy expenditure (kcal.week^{-1})						
Region	**Walking**	**Cycling**	**Swimming**	**Gym**	**Football**	**Golf**	**Road Running**
North East	402	473	257	616	1042	1434	817
North West	397	520	247	614	1025	1362	743
Yorkshire	413	485	238	598	1075	1449	680
West Mids	387	455	228	603	1079	1317	798
East Mids	398	469	224	586	1036	1364	770
East	389	445	237	574	975	1273	781
South West	423	446	231	542	1140	1360	808
South East	388	451	227	559	978	1225	781
London	406	537	226	572	1065	1044	801
Mean (kcal)	**400**	**476**	**235**	**585**	**1046**	**1314**	**775**
Rank order	**6th**	**5th**	**7th**	**4th**	**2nd**	**1st**	**3rd**

Reference values for a 70kg individual.

3.3 Preliminary Social-Demographic Analysis

A social-demographic analysis between the sexes identified higher levels of weekly energy expenditure in males in all regions for cycling, gym and football (Table 3.10). Conversely, females expended more energy weekly in all regions for walking activity. Perhaps surprisingly, the weekly energy expenditure for females taking part in golf was higher than males in 4 out of 9 regions. Females in Yorkshire and the East region also expended more weekly energy than males whilst road running. Weekly energy expenditure from swimming was greater in males in all regions except the West Midlands.

Table 3.10 Weekly calorie expenditure for 7 sports/physical activities for males and females.

	Energy expenditure (kcal.week^{-1})						
Sex	**Walking**	**Cycling**	**Swimming**	**Gym**	**Football**	**Golf**	**Road Running**
North East	**402**	**473**	**257**	**616**	**1042**	**1434**	**817**
Male	*399*	*533*	*268*	*721*	*1082*	*1458*	*849*
Female	*404*	*374*	*252*	*533*	*593*	*1280*	*782*
North West	**397**	**520**	**247**	**614**	**1025**	**1362**	**743**
Male	*389*	*587*	*263*	*682*	*1037*	*1374*	*788*
Female	*404*	*409*	*240*	*562*	*893*	*1310*	*689*
Yorkshire	**413**	**485**	**238**	**598**	**1075**	**1449**	**680**
Male	*394*	*532*	*272*	*643*	*1145*	*1417*	*647*
Female	*424*	*418*	*226*	*564*	*608*	*1560*	*718*
West Mids	**387**	**455**	**228**	**603**	**1079**	**1317**	**798**
Male	*378*	*511*	*225*	*670*	*1108*	*1339*	*808*
Female	*393*	*365*	*229*	*550*	*890*	*1222*	*786*
East Mids	**398**	**469**	**224**	**586**	**1036**	**1364**	**770**
Male	*382*	*550*	*245*	*688*	*1063*	*1363*	*786*
Female	*409*	*360*	*216*	*515*	*844*	*1371*	*754*
East	**389**	**445**	**237**	**574**	**975**	**1273**	**781**
Male	*366*	*498*	*238*	*635*	*1017*	*1219*	*775*
Female	*404*	*376*	*237*	*527*	*671*	*1509*	*787*
South West	**423**	**446**	**231**	**542**	**1140**	**1360**	**808**
Male	*396*	*515*	*235*	*603*	*1141*	*1387*	*849*
Female	*441*	*364*	*230*	*499*	*1132*	*1257*	*766*
South East	**388**	**451**	**227**	**559**	**978**	**1225**	**781**
Male	*363*	*504*	*235*	*626*	*987*	*1208*	*823*
Female	*405*	*379*	*224*	*512*	*916*	*1295*	*733*
London	**406**	**537**	**226**	**572**	**1065**	**1044**	**801**
Male	*383*	*596*	*247*	*623*	*1140*	*1101*	*848*
Female	*421*	*455*	*216*	*532*	*599*	*815*	*749*
Mean (kcal)	**400**	**476**	**235**	**585**	**1046**	**1314**	**775**

Reference values for a 70kg individual.

A feasibility analysis identified a significant difference in energy expenditure between ethnic groups for walking ($P < 0.001$). Post-hoc analysis revealed a significant difference between

ethnic group 1 (“White”) and group 5 (“Other”) ($P < 0.0001$), between group 3 (“Asian”) and group 5 (“Other”) ($P < 0.026$), and between group 5 (“Other”) and group 6 (“Chinese”) ($P < 0.011$).

For reference, calorie expenditure for the top 7 sports/physical activities for each Local Authority is presented in Appendix 1 (Figure A1.1).

4.0 DISCUSSION

4.1 The Feasibility of Calorie Mapping

The results of this investigation build upon the findings of the Health Profile of England 2008 (Department of Health, 2009a). As illustrated in Figure A1.2, the Health Profile of England provided basic descriptive data showing the fraction of the adult population that are physically active in each of the 9 Government regions. By using such data to calculate mean energy expenditure levels for seven sports/physical activities, this investigation illustrates the feasibility of completing a comprehensive 'calorie map' of sport and physical activity in England.

4.2 How Effective are the Most Popular Sports/Physical Activities?

The calorie mapping completed in this investigation considered the seven most popular sports reported in the Active People Survey 2. The accessibility of walking made this activity by far the most popular physical activity. Despite this popularity, the results of this investigation suggest that walking, on its own, does not provide sufficient energy expenditure to stimulate any significant health benefit. For a reference 70kg individual, walking only accounted for 56% of the minimum recommended weekly energy expenditure. Clearly, some individuals carry out more than one type of physical activity per week, helping them achieve recommended energy expenditure levels. However, given that just 11.3% of APS 2 respondents reported having undertaken at least 2 sports in the 4 weeks preceding questioning, it is unlikely that a combination of activities contributes to energy expenditure for most people. The prevalence of walking participation (71% APS 2 respondents) compared to the other popular activities (e.g. swimming: 12% APS 2 respondents) suggests that walking is the sole form of physical activity for most people. This analysis shows that the energy expenditure associated with walking is not sufficient to meet even the minimum recommended level of energy expenditure. It is vital, therefore, that individuals who currently rely on walking as their sole form of exercise, supplement this with additional, or more deliberate forms of physical activity. Sport provides an excellent range of such activities.

Few of the sports/physical activities considered provided sufficient energy expenditure to achieve the minimum recommended caloric expenditure. The exceptions were provided by road running, football and golf.

A surprising finding of this investigation was that physical activities commonly associated with significant health and fitness benefits (walking, cycling, swimming, gym activities and road running) provided lower levels of energy expenditure than sports activities (golf and football). This suggests that sports that are often carried out for reasons of enjoyment and social interaction, rather than for specific health reasons, may actually provide a more effective stimulus to health and fitness.

Whilst swimming did not appear to lead to high levels of energy expenditure, it is acknowledged to provide a significant contribution to other aspects of physical health, like muscular strength and flexibility (Lin *et al*., 2004). These fitness components are particularly important for older adults in order to prevent functional deterioration and to preserve independence and quality of life (Lin *et al*., 2004).

Energy expenditure through physical activity normally relates to those movements that involve large rhythmical muscle contractions performed in aerobic type exercise (e.g. walking, running, cycling, and swimming). Whilst aerobic activities may potentially provide the greatest health benefit, other aspects of fitness are important for overall health, function and wellbeing. Strength and flexibility contribute to a muscle's ability to produce force and movement around joint complexes. Strength and flexibility development are considered an important part of physical development in children. The Department of Health recommends that children complete two activity sessions per week that specifically target strength and flexibility (Department of Health, 2004a). Older adults lose muscular strength and flexibility with advancing age, so activities that help preserve it should form part of an exercise programme. Improvement in each of these fitness components will: allow comfortable execution of functional tasks of daily living; will contribute to a reduced incidence of falls; and will help to maintain lean body weight and manage healthy levels of body fat. This may require more deliberate forms of strength and flexibility training, e.g. using resistance equipment or performing passive stretching exercises (Nelson *et al*., 2007).

Although only seven sports/physical activities were considered in this investigation, these findings may have important implications for strategic decisions on the promotion of key health-promoting physical activities.

4.3 Regional Variation in Sport and Physical Activity Energy Expenditure

This investigation identified some variation in energy expenditure between regions and, indeed, local authorities. Considering a 'regional' calorie map, summing regional weekly energy expenditure values for all 7 sports/physical activities for a reference adult of 70kg, the highest values were reported in the North East (5040 kcal·week^{-1}). The lowest levels of energy expenditure were reported in the South East (4608 kcal·week^{-1}), whilst London was ranked 8th (out of 9) (4650 kcal·week^{-1}). Although there were regional differences between sports, the combined results are relatively consistent across sports. The North East was ranked high, and the South East and London were ranked low in most sports/physical activities (see Table 3.9). The reasons for these regional variations in energy expenditure are beyond the scope of this investigation.

Six out of the 7 activities selected had the highest number of participants in southern regions (London, South East or South West). The West Midlands or North East regions had the lowest levels of participation in walking, swimming, cycling, and road running. This evidence suggests that there may be a North-South divide in sport and physical activity participation levels.

4.4 Socio-Demographic Variations

4.4.1 Sex-Related Energy Expenditure Differences

The Health Survey for England and the Health Profile of England have reported values for the percentage of male and female populations who are performing the minimum recommended level of physical activity (5 sessions of 30 minutes duration at moderate intensity per week). However, these reports do not provide detailed insight into these observations (e.g. activities undertaken, activity duration, and activity-related energy expenditure). Although the level of physically active adults is important, it is the energy expended from such activity which determines whether or not it is health promoting (American College of Sports Medicine, 2006).

It has been widely reported (Department of Health, 2009a) that males are more physically active than females. Having a larger stature and greater musculature than the average female, the average male also has a significantly greater body weight. Males tend to expend more energy (i.e. burn more calories) during physical activity than females for two reasons: 1) for historical and social reasons (Choi, 2000), a higher percentage of males are physically active than females (Department of Health, 2009a), and 2) for a given bout of physical activity, an individual with a greater body weight will expend more energy than a lighter individual. In line with this rationale, the results of this investigation showed that males generally expended more calories during their activity bouts than females. However, there were some exceptions (see section 3.3). Most notably, females expended more energy per week through walking than males in all regions. Similar weekly caloric expenditure was calculated for males and females for swimming/diving [indoors] in all regions; although, female values exceeded male values in the West Midlands only. Males expended more energy through weekly football activity than females. However, in the South West, female values were just 9 $kcal \cdot week^{-1}$ lower than male values. Indeed, the female values were the 4^{th} highest of any region and for either sex.

4.4.2 Ethnic Group Related Energy Expenditure Differences

In previous physical activity surveys, concern has been expressed about the low participation rates amongst certain ethnic groups, particularly those of Asian origin (Department of Health, 2004b). In this investigation, a preliminary investigation of weekly energy expenditure for walking between ethnic groups identified significant differences. White, Asian and Chinese groups were all different to the “Other” group. However, this analysis was affected by an unbalanced design and a large number of blank responses. These data require further analysis to establish whether important energy expenditure differences exist between ethnic groups.

Research has shown that people tend to over-estimate their fitness levels and the amount of physical activity that they perform (Department of Health, 2009b). It is therefore appropriate to assume that the picture of activity levels described by this investigation may represent a ‘best case scenario’.

5.0 STUDY LIMITATIONS

5.1 SURVEY DATA

In order to provide an accurate calorie map, detailed data are required for activity frequency, duration, and intensity. Survey data are dependent upon participant recall over relatively long time periods and are, therefore, subject to large inaccuracies. As the Active People Survey was not designed specifically to provide data for calorie mapping, it provides only limited data relating to exercise intensity. This restricts the robustness of the calorie mapping results provided.

5.2 PHYSICAL ACTIVITY COMPENDIA

In order to calculate caloric expenditure values, MET values for generic physical activities were used. These values do not account for differences in body weight, adiposity, age, sex, efficiency of movement (mechanical or metabolic), or environmental conditions. Whilst these factors mean that error in the calculation of energy expenditure for any given individual may be large, it is probable that such errors are smoothed as a result of the large sample examined.

When establishing the MET level for a given activity the Compendium of Physical Activities (Ainsworth *et al*., 2000) was used. However, exact matches with the Active People Survey 2 questions/responses were not always available. In such cases, the authors matched to 'similar' activities and, on one occasion, provided a non-coded value half way between values available for high and low intensities. In all cases where exact matches were not available, conservative MET values were utilised, reflecting minimum rather than maximum energy expenditure. For a full discussion of the limitations of this approach see Ainsworth *et al*. (2000).

5.3 DATA HANDLING AND PROCESSING

Data handling and processing of the large Active People Survey data sets provided major difficulties during data analysis. The complex calculations required to calculate energy expenditure within Microsoft Excel were severely restricted by a lack of computer processing power and memory. These limitations meant that transfer of data into

appropriate statistical analysis software was not possible. Future calorie mapping exercises should investigate the efficacy of alternative software packages (e.g. Matlab).

6.0 RECOMMENDATIONS AND DIRECTIONS FOR FUTURE RESEARCH

6.1 RECOMMENDATIONS

6.1.1 LEVELS OF PHYSICAL ACTIVITY

In order to achieve some health benefit from sport and physical activity, adults should perform a minimum of 30 minutes of moderate intensity physical activity on 5 days a week, or 20 minutes of vigorous intensity physical activity on 3 days a week. Individuals might also seek to combine moderate and vigorous intensity activities and should target an intensity in the range 450-900 MET·week^{-1} (over and above low intensity activities of daily living). The lower end of this range could be achieved by walking at 2.5 miles·hour^{-1} on a firm surface (equivalent to 3.0 METs) for 30 minutes 5 times per week (30 min x 5 = 150 mins·week^{-1} x 3.0 METs = 450 MET·week^{-1}). This level of energy expenditure might also be achieved by combining different sessions. For example, a 30-minute football session would provide 300 MET·week^{-1} (30 mins·week^{-1} x 10.0 METs = 300 MET·week^{-1}). Adding two 30-minute walk sessions at moderate intensity (60 mins·week^{-1} x 3.0 METs = 180 MET·week^{-1}) would allow the minimum MET target of 450 MET·week^{-1} to be achieved. A combination of one vigorous intensity 30-minute football session and two moderate intensity 30-minute walk sessions accumulates more energy expenditure (300 METs + 180 min = 480 MET·week^{-1}) and takes less time than the five moderate intensity walks (90 minutes vs. 150 minutes).

Physical activity beyond the minimum recommendations (450 MET·week^{-1}), including that performed at a higher intensity, will likely provide additional health benefits (Haskell *et al*., 2007). Broadly, sport provides a greater opportunity to engage in vigorous exercise than conditioning activities such as gym and walking. Sports such as football and road running require higher energy expenditure and, therefore, may lead to improved personal fitness and health.

The shape of the dose-response curve, points of maximal benefit and the possible contribution from physical activity bouts shorter than 10 minutes, are as yet unknown (Haskell *et al*., 2007). The optimal combination of moderate and vigorous intensity physical activity, to produce an achievable programme of effective exercise, also requires further investigation.

6.1.2 Types of Sport/Physical Activity

Exercising at moderate-vigorous intensity has potentially the greatest benefits for health (American College of Sports Medicine, 2006). This is reflected in the total calories expended during activity, which can be a reflection of time spent in the activity and/or the intensity of the activity.

Participation in endurance-type (and muscle-strengthening) physical activities above the minimum recommended amounts provides additional health benefits, reduces the risk for premature chronic health conditions and mortality related to a sedentary lifestyle, and potentially results in higher levels of physical fitness. Of the 7 sports/physical activities selected in this investigation, when carried out as the sole physical activity, only football, road running and golf provided sufficient caloric expenditure to stimulate these positive health benefits. If only carrying out cycling, swimming/diving, walking, and gym activities, individuals should seek to increase the intensity and or duration of activity in order to gain positive health adaptations.

6.1.3 The Female Calorie Map

The number of females achieving sufficient energy expenditure from the activities investigated above may be even less than suggested, as these conclusions are based upon body weights in the range 60kg-100kg. Although most females are accommodated by this range, a significant fraction of the female population may be below this weight. Lower body weights would necessarily reduce the caloric expenditures described in section 3 above. Golf may provide one exception, as relatively high energy expenditures were recorded for both males and females (>1000 $kcal \cdot week^{-1}$). In order to achieve minimum activity levels, golf may therefore offer an effective choice for females. Golf may also provide valuable social interaction, stimulating both physical and mental wellbeing. However, the relatively long duration of golf activity may be impractical for large portions of our time-conscious society.

6.1.4 Using Calorie Mapping Techniques to Plan Physical Activity

Working backwards from the caloric goals to determine the volume (duration and frequency) of exercise needed to reach the goal is useful in providing key strategic

information to the public about appropriate exercise prescription components (American College of Sports Medicine, 2006).

It should be remembered that 1 MET represents resting metabolic rate and that energy expenditure goals are based on net caloric expenditure from exercise. For a 70kg individual performing a 6 MET activity, the net caloric expenditure from the exercise is actually 5 METs. Therefore, the net caloric expenditure from the exercise is 6 $kcal \cdot min^{-1}$ (5 x 1.2 $kcal \cdot min^{-1}$). If this individual is attempting to attain the 1000 $kcal \cdot week^{-1}$ target threshold, it is simple to calculate the amount of this 6 MET physical activity that needs to be performed (1000 / 6 = 167 $min \cdot week^{-1}$ or approximately 34 $min \cdot day^{-1}$ for 5 days or 24 $min \cdot day^{-1}$ for each day of the week).

6.1.5 Calorie Mapping and Education

The Change4Life campaign (Department of Health, 2009c) seeks to educate the population to “eat better, move more and live longer”. Although a descriptive tool, calorie mapping methods might also be used to complement such education activities. Understanding the concept of energy balance (calorie intake=calorie expenditure) would stimulate the population to avoid being inactive and overeating. Linking calorie expenditure to different sports and physical activities may help people to recognise the need to accumulate sufficient energy expenditure through a weekly exercise regimen in order to sustain a healthy body and lifestyle.

6.2 Directions for Future Research

In order for there to be confidence in the calorie mapping exercise, the data being used needs to be as accurate as possible. Further work needs to be performed on the collection of data from large population samples, but particularly where it is critical to achieve accurate recall in terms of quantity of activity performed. Of particular relevance to this calorie mapping exercise, the estimation and reporting of the intensity dimension needs to be more detailed. Another aspect of the intensity problem is that in existing data sets, a single intensity value is reported for all physical activity completed in the 4 week sample period. Clearly, the intensity of effort will often vary dramatically within a session and from one bout of physical activity to the next.

Building upon the experiences and successful outcomes of this investigation, a number of questions for future research have been identified.

Methodological Question:

- Can a more accurate and detailed method of data collection be established to enable the collection of exercise mode, frequency, intensity, and duration data?

Analytical Questions:

- How has the calorie map of England changed since suitable data first became available?
- Is there a North/South divide in the amount of energy expended through sport and physical activity?
- What is the impact of education level on weekly levels of energy expenditure?
- Can specific Local Authorities be targeted to have a large impact on national levels of energy expenditure?
- Which non-mainstream sports/physical activities provide the most effective caloric expenditure and, therefore, potentially the greatest health benefit?

7.0 CONCLUSIONS

The adult population of England appears to be expending too few calories through sport and/or physical activity. Some sport activities seem to provide a suitable opportunity to expend large amounts of calories, e.g. football and golf. From the activities sampled, football, golf and road running meet the weekly minimum energy expenditure, but not the higher energy expenditure thresholds (2100-2800 kcal·week^{-1}) which likely offer greater health benefits.

Thus, even for those individuals engaged in regular physical activity, energy expenditure needs to be increased if the health benefits of exercise are to be realised. Therefore, the key question stemming from this investigation and a key problem to add to the physical activity debate is: How can health promoters get the active population to expend more energy during their exercise bouts?

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A.1 APPENDIX – Local Authority Energy Expenditure

Table A1.1 Weekly calorie expenditure for top 7 physical activities/sports for all Local Authorities (April 2009 designation).

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
North East	**402**	**473**	**257**	**616**	**1042**	**1434**	**817**
Gateshead	*377*	*538*	*248*	*628*	*1017*	*1105*	*1728*
Newcastle upon Tyne	*397*	*568*	*252*	*669*	*1047*	*1196*	*755*
North Tyneside	*380*	*396*	*256*	*766*	*811*	*1517*	*729*
South Tyneside	*418*	*591*	*324*	*604*	*1054*	*1243*	*587*
Sunderland	*383*	*490*	*239*	*609*	*1729*	*1337*	*423*
Hartlepool UA	*343*	*328*	*292*	*635*	*818*	*2069*	*391*
Middlesbrough UA	*402*	*574*	*286*	*795*	*1078*	*1263*	*832*
Redcar & Cleveland UA	*381*	*519*	*228*	*628*	*807*	*1184*	*703*
Stockton-on-Tees UA	*360*	*496*	*350*	*664*	*747*	*1131*	*853*
Darlington UA	*379*	*490*	*225*	*622*	*859*	*1106*	*1023*
County Durham	*407*	*477*	*235*	*596*	*1189*	*1333*	*702*
Northumberland	*422*	*437*	*258*	*560*	*922*	*1603*	*909*
North West	**397**	**520**	**247**	**614**	**1025**	**1362**	**743**
Allerdale	*451*	*437*	*263*	*671*	*763*	*1749*	*1062*
Barrow-in-Furness	*403*	*415*	*196*	*557*	*955*	*1356*	*977*
Carlisle	*413*	*355*	*269*	*659*	*751*	*1141*	*889*
Copeland	*444*	*584*	*266*	*664*	*1531*	*1460*	*1068*
Eden	*456*	*496*	*245*	*592*	*829*	*1002*	*803*
South Lakeland	*475*	*495*	*185*	*487*	*1160*	*1753*	*658*
Bolton	*363*	*439*	*255*	*667*	*869*	*1988*	*548*
Bury	*379*	*519*	*206*	*737*	*964*	*3132*	*562*
Manchester	*365*	*652*	*245*	*919*	*1153*	*914*	*518*
Oldham	*364*	*589*	*196*	*646*	*719*	*1506*	*878*
Rochdale	*376*	*617*	*246*	*582*	*1085*	*1416*	*783*
Salford	*403*	*522*	*327*	*565*	*784*	*1203*	*544*
Stockport	*350*	*438*	*379*	*480*	*1148*	*1183*	*1084*
Tameside	*389*	*466*	*198*	*563*	*1016*	*690*	*700*
Trafford	*369*	*622*	*249*	*621*	*608*	*1348*	*742*
Wigan	*373*	*604*	*212*	*598*	*596*	*1593*	*763*
Knowsley	*395*	*565*	*306*	*752*	*1211*	*1450*	*1191*
Liverpool	*399*	*636*	*258*	*659*	*1141*	*1128*	*653*
St Helens	*384*	*425*	*299*	*654*	*1478*	*1495*	*342*
Sefton	*387*	*509*	*272*	*683*	*1172*	*776*	*603*
Wirral	*412*	*563*	*308*	*601*	*1619*	*2195*	*598*
Halton UA	*441*	*511*	*279*	*606*	*995*	*1069*	*661*
Warrington UA	*381*	*473*	*183*	*532*	*672*	*1125*	*656*
Blackburn with Darwen UA	*394*	*477*	*248*	*546*	*896*	*1154*	*525*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Blackpool UA	*430*	*689*	*249*	*570*	*1069*	*1317*	*738*
Chester and Cheshire West	*403*	*484*	*232*	*614*	*874*	*1299*	*802*
Cheshire East	*385*	*490*	*198*	*551*	*1278*	*1556*	*895*
Burnley	*415*	*471*	*230*	*611*	*1226*	*1461*	*871*
Chorley	*374*	*538*	*234*	*657*	*1068*	*1235*	*835*
Fylde	*409*	*496*	*258*	*514*	*896*	*1280*	*760*
Hyndburn	*394*	*404*	*225*	*604*	*1243*	*1314*	*807*
Lancaster	*401*	*596*	*238*	*700*	*1036*	*1200*	*781*
Pendle	*394*	*424*	*244*	*535*	*1387*	*1505*	*441*
Preston	*426*	*473*	*184*	*556*	*852*	*1583*	*689*
Ribble Valley	*392*	*499*	*404*	*588*	*946*	*1189*	*701*
Rossendale	*359*	*452*	*258*	*630*	*1019*	*1414*	*549*
South Ribble	*377*	*504*	*227*	*582*	*605*	*1361*	*895*
West Lancashire	*350*	*444*	*252*	*650*	*708*	*1259*	*487*
West Lancashire	*439*	*590*	*219*	*470*	*1032*	*1274*	*1045*
Yorkshire	**413**	**485**	**238**	**598**	**1075**	**1449**	**680**
Barnsley	*426*	*430*	*276*	*710*	*1074*	*1333*	*584*
Doncaster	*399*	*373*	*252*	*524*	*928*	*1564*	*1098*
Rotherham	*340*	*426*	*219*	*715*	*1159*	*1323*	*356*
Sheffield	*372*	*558*	*278*	*498*	*1052*	*1375*	*667*
Bradford	*381*	*576*	*224*	*762*	*1826*	*1748*	*438*
Calderdale	*432*	*600*	*219*	*450*	*1353*	*1176*	*620*
Kirklees	*376*	*383*	*205*	*639*	*652*	*1317*	*427*
Leeds	*412*	*458*	*353*	*510*	*1507*	*1378*	*764*
Wakefield	*410*	*576*	*227*	*734*	*927*	*1746*	*516*
Kingston upon Hull, City of	*421*	*553*	*216*	*813*	*2017*	*1559*	*1539*
East Riding of Yorkshire UA	*400*	*486*	*238*	*592*	*980*	*1803*	*548*
North East Lincolnshire UA	*420*	*473*	*264*	*673*	*919*	*1330*	*747*
North Lincolnshire UA	*421*	*516*	*242*	*525*	*1118*	*1617*	*1154*
York UA	*392*	*528*	*183*	*589*	*628*	*1176*	*701*
Craven	*450*	*457*	*216*	*428*	*710*	*1041*	*532*
Hambleton	*417*	*461*	*223*	*431*	*923*	*1975*	*529*
Harrogate	*428*	*442*	*225*	*629*	*1060*	*1503*	*670*
Richmondshire	*446*	*443*	*235*	*443*	*731*	*1034*	*798*
Ryedale	*464*	*466*	*221*	*511*	*473*	*1109*	*653*
Scarborough	*432*	*468*	*258*	*658*	*625*	*1321*	*809*
Selby	*414*	*450*	*222*	*617*	*1126*	*1447*	*667*
West Mids	**387**	**455**	**228**	**603**	**1079**	**1317**	**798**
Birmingham	*391*	*471*	*230*	*622*	*1127*	*1317*	*721*
Coventry	*348*	*452*	*173*	*683*	*1581*	*1429*	*1142*
Dudley	*393*	*424*	*207*	*586*	*793*	*949*	*642*
Sandwell	*375*	*616*	*224*	*622*	*658*	*1737*	*1046*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Solihull	*347*	*422*	*240*	*600*	*634*	*1053*	*531*
Walsall	*345*	*379*	*258*	*584*	*1167*	*1677*	*672*
Wolverhampton	*419*	*567*	*471*	*652*	*1313*	*995*	*521*
Herefordshire UA	*396*	*467*	*205*	*612*	*513*	*1192*	*783*
Telford & Wrekin UA	*388*	*364*	*243*	*686*	*1133*	*929*	*584*
Stoke-on-Trent UA	*368*	*509*	*277*	*635*	*989*	*507*	*1225*
Shropshire	*418*	*443*	*218*	*596*	*804*	*1243*	*950*
Cannock Chase	*375*	*634*	*220*	*679*	*863*	*1924*	*1123*
East Staffordshire	*385*	*465*	*205*	*568*	*692*	*1385*	*676*
Lichfield	*372*	*406*	*264*	*512*	*1123*	*1474*	*891*
Newcastle-under-Lyme	*407*	*448*	*252*	*559*	*1300*	*1563*	*659*
South Staffordshire	*382*	*483*	*219*	*569*	*1490*	*1420*	*791*
Stafford	*379*	*439*	*281*	*498*	*669*	*1701*	*828*
Staffordshire Moorlands	*379*	*548*	*230*	*597*	*527*	*1032*	*602*
Tamworth	*351*	*411*	*228*	*612*	*2003*	*1148*	*757*
North Warwickshire	*394*	*562*	*214*	*422*	*754*	*1242*	*922*
Nuneaton & Bedworth	*349*	*285*	*240*	*644*	*942*	*1379*	*669*
Rugby	*404*	*524*	*203*	*572*	*740*	*1634*	*692*
Stratford-on-Avon	*407*	*316*	*181*	*593*	*1840*	*1025*	*531*
Warwick	*359*	*544*	*207*	*522*	*957*	*1029*	*666*
Bromsgrove	*387*	*431*	*185*	*765*	*928*	*1697*	*1531*
Malvern Hills	*389*	*405*	*266*	*640*	*1659*	*1409*	*616*
Redditch	*371*	*400*	*199*	*547*	*972*	*1173*	*841*
Worcester	*389*	*504*	*225*	*661*	*732*	*1155*	*1040*
Wychavon	*387*	*440*	*160*	*546*	*1588*	*1568*	*634*
Wyre Forest	*384*	*396*	*220*	*602*	*1863*	*1094*	*654*
East Mids	**398**	**469**	**224**	**586**	**1036**	**1364**	**770**
Derby UA	*388*	*449*	*192*	*459*	*1156*	*1149*	*679*
Leicester UA	*411*	*413*	*203*	*679*	*1268*	*1084*	*660*
Rutland UA	*415*	*524*	*211*	*584*	*788*	*1544*	*847*
Nottingham UA	*415*	*578*	*375*	*649*	*1125*	*1069*	*896*
Amber Valley	*395*	*397*	*227*	*509*	*1096*	*1496*	*598*
Bolsover	*379*	*529*	*235*	*650*	*891*	*1207*	*1097*
Chesterfield	*379*	*532*	*236*	*614*	*976*	*1276*	*1161*
Derbyshire Dales	*401*	*501*	*204*	*533*	*1116*	*1454*	*1185*
Erewash	*371*	*380*	*225*	*548*	*940*	*1320*	*477*
High Peak	*420*	*596*	*180*	*499*	*627*	*1697*	*554*
North East Derbyshire	*381*	*405*	*260*	*587*	*849*	*1152*	*831*
South Derbyshire	*398*	*383*	*198*	*601*	*864*	*1183*	*837*
Blaby	*372*	*512*	*239*	*668*	*782*	*1425*	*721*
Charnwood	*355*	*386*	*235*	*632*	*1377*	*1380*	*929*
Harborough	*386*	*431*	*209*	*560*	*459*	*1133*	*971*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Hinckley & Bosworth	*382*	*497*	*173*	*566*	*906*	*845*	*826*
Melton	*413*	*448*	*177*	*568*	*813*	*1385*	*396*
North West Leicestershire	*411*	*478*	*225*	*472*	*1493*	*1643*	*829*
Oadby & Wigston	*384*	*447*	*223*	*620*	*1107*	*1987*	*807*
Boston	*409*	*484*	*239*	*696*	*1812*	*1889*	*369*
East Lindsey	*431*	*658*	*235*	*578*	*656*	*1582*	*1184*
Lincoln	*386*	*562*	*223*	*738*	*1880*	*1175*	*749*
North Kesteven	*351*	*535*	*212*	*610*	*559*	*1702*	*746*
South Holland	*421*	*493*	*208*	*609*	*1065*	*1072*	*818*
South Kesteven	*412*	*408*	*245*	*630*	*888*	*1574*	*717*
West Lindsey	*454*	*360*	*232*	*563*	*1511*	*1155*	*728*
Corby	*410*	*459*	*239*	*630*	*1054*	*1297*	*716*
Daventry	*400*	*477*	*231*	*556*	*955*	*1286*	*928*
East Northamptonshire	*395*	*440*	*176*	*727*	*1019*	*1547*	*702*
Kettering	*397*	*360*	*193*	*582*	*1391*	*1292*	*1021*
Northampton	*372*	*463*	*213*	*651*	*1080*	*893*	*349*
South Northamptonshire	*404*	*438*	*201*	*431*	*438*	*1175*	*568*
Wellingborough	*375*	*420*	*246*	*473*	*1199*	*1411*	*819*
Ashfield	*443*	*436*	*239*	*578*	*1334*	*1231*	*296*
Bassetlaw	*426*	*481*	*211*	*551*	*1250*	*1975*	*950*
Broxtowe	*376*	*425*	*196*	*481*	*758*	*1160*	*784*
Gedling	*382*	*438*	*237*	*565*	*750*	*1435*	*997*
Mansfield	*399*	*520*	*266*	*635*	*1077*	*1188*	*578*
Newark & Sherwood	*414*	*526*	*209*	*603*	*721*	*1493*	*699*
Rushcliffe	*363*	*425*	*205*	*541*	*730*	*1580*	*739*
East	**389**	**445**	**237**	**574**	**975**	**1273**	**781**
Peterborough UA	*367*	*399*	*300*	*522*	*1063*	*1238*	*278*
Cambridge	*354*	*515*	*256*	*610*	*1136*	*823*	*1183*
East Cambridgeshire	*358*	*450*	*245*	*553*	*1175*	*1011*	*1281*
Fenland	*387*	*467*	*259*	*724*	*1151*	*1177*	*1363*
Huntingdonshire	*366*	*419*	*203*	*661*	*755*	*1242*	*735*
South Cambridgeshire	*364*	*482*	*198*	*509*	*625*	*1443*	*1071*
Breckland	*400*	*485*	*246*	*539*	*666*	*1580*	*467*
Broadland	*359*	*340*	*179*	*522*	*1215*	*1409*	*741*
Great Yarmouth	*420*	*447*	*315*	*608*	*1243*	*1574*	*1103*
Kings Lynn & West Norfolk	*451*	*388*	*239*	*668*	*758*	*1518*	*776*
North Norfolk	*429*	*410*	*229*	*581*	*954*	*1527*	*1009*
Norwich	*383*	*613*	*196*	*554*	*1132*	*906*	*360*
South Norfolk	*407*	*493*	*179*	*565*	*747*	*1713*	*902*
Babergh	*435*	*414*	*235*	*597*	*1164*	*1622*	*721*
Forest Heath	*410*	*435*	*202*	*545*	*551*	*1334*	*538*
Ipswich	*427*	*462*	*229*	*665*	*1385*	*1633*	*688*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Mid Suffolk	*393*	*447*	*198*	*575*	*1221*	*1251*	*646*
St Edmundsbury	*439*	*478*	*199*	*741*	*679*	*994*	*845*
Suffolk Coastal	*463*	*438*	*386*	*468*	*798*	*1617*	*1020*
Waveney	*413*	*482*	*193*	*509*	*396*	*1017*	*888*
Luton UA	*378*	*402*	*191*	*563*	*1015*	*934*	*1212*
Southend UA	*399*	*618*	*211*	*803*	*445*	*904*	*824*
Thurrock UA	*381*	*484*	*296*	*679*	*1275*	*1348*	*944*
Central Bedfordshire	*391*	*410*	*288*	*681*	*886*	*1453*	*673*
Bedford	*380*	*510*	*242*	*479*	*1135*	*854*	*772*
Basildon	*402*	*485*	*242*	*571*	*1078*	*846*	*706*
Braintree	*404*	*418*	*404*	*617*	*609*	*1033*	*855*
Brentwood	*346*	*418*	*166*	*508*	*695*	*1171*	*834*
Castle Point	*362*	*390*	*261*	*483*	*1265*	*1564*	*1330*
Chelmsford	*359*	*440*	*206*	*568*	*1058*	*1502*	*447*
Colchester	*382*	*475*	*258*	*456*	*1103*	*1596*	*421*
Epping Forest	*374*	*353*	*214*	*424*	*886*	*2084*	*948*
Harlow	*357*	*506*	*238*	*589*	*1009*	*903*	*1152*
Maldon	*430*	*500*	*313*	*516*	*2026*	*1441*	*510*
Rochford	*392*	*339*	*238*	*530*	*528*	*1190*	*304*
Tendring	*409*	*360*	*229*	*712*	*1046*	*1353*	*1039*
Uttlesford	*425*	*374*	*171*	*567*	*1541*	*1364*	*898*
Broxbourne	*326*	*407*	*222*	*627*	*1057*	*1655*	*944*
Dacorum	*381*	*335*	*222*	*540*	*916*	*1139*	*765*
East Hertfordshire	*342*	*405*	*198*	*459*	*923*	*1055*	*474*
Hertsmere	*405*	*437*	*232*	*584*	*687*	*1168*	*677*
North Hertfordshire	*366*	*382*	*242*	*589*	*981*	*1066*	*669*
St Albans	*376*	*420*	*174*	*535*	*983*	*1021*	*463*
Stevenage	*371*	*417*	*256*	*677*	*1113*	*1137*	*994*
Three Rivers	*412*	*469*	*249*	*542*	*933*	*1125*	*652*
Watford	*368*	*508*	*235*	*543*	*866*	*1164*	*580*
Welwyn Hatfield	*338*	*433*	*308*	*543*	*798*	*1047*	*742*
South West	**423**	**446**	**231**	**542**	**1140**	**1360**	**808**
Bath & North East Somerset	*421*	*335*	*213*	*643*	*822*	*1281*	*592*
Bristol, City of UA	*386*	*537*	*175*	*564*	*838*	*1432*	*1186*
North Somerset UA	*415*	*503*	*212*	*599*	*1136*	*1167*	*538*
South Gloucestershire UA	*378*	*341*	*210*	*487*	*1037*	*1175*	*873*
Plymouth UA	*426*	*505*	*270*	*584*	*1047*	*1104*	*1169*
Torbay UA	*446*	*605*	*244*	*702*	*942*	*1615*	*751*
Bournemouth UA	*387*	*425*	*314*	*750*	*900*	*845*	*672*
Poole UA	*359*	*536*	*196*	*578*	*699*	*1471*	*894*
Swindon UA	*368*	*532*	*238*	*547*	*1085*	*996*	*952*
Cornwall	*433*	*458*	*265*	*483*	*2053*	*1631*	*867*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Isles of Scilly	*519*	*445*	*164*	*385*	*1011*	*2205*	*449*
East Devon	*468*	*445*	*227*	*594*	*715*	*1032*	*614*
Exeter	*445*	*458*	*203*	*512*	*1432*	*1038*	*527*
Mid Devon	*409*	*355*	*214*	*477*	*3939*	*2487*	*645*
North Devon	*457*	*330*	*234*	*407*	*841*	*2517*	*637*
South Hams	*397*	*392*	*238*	*607*	*817*	*1359*	*499*
Teignbridge	*448*	*486*	*238*	*477*	*696*	*1416*	*849*
Torridge	*432*	*330*	*251*	*541*	*880*	*1196*	*972*
West Devon	*452*	*384*	*207*	*466*	*698*	*1189*	*1056*
Christchurch	*435*	*520*	*213*	*608*	*692*	*1474*	*931*
East Dorset	*410*	*369*	*214*	*459*	*851*	*1565*	*803*
North Dorset	*447*	*478*	*236*	*375*	*715*	*1674*	*1244*
Purbeck	*449*	*461*	*264*	*538*	*782*	*1090*	*846*
West Dorset	*440*	*456*	*173*	*449*	*391*	*1223*	*817*
Weymouth & Portland	*437*	*501*	*281*	*454*	*1065*	*1328*	*678*
Cheltenham	*396*	*573*	*193*	*485*	*2927*	*1693*	*690*
Cotswold	*466*	*475*	*241*	*553*	*604*	*1185*	*814*
Forest of Dean	*405*	*343*	*196*	*568*	*633*	*1285*	*478*
Gloucester	*392*	*516*	*208*	*559*	*894*	*881*	*844*
Stroud	*401*	*459*	*203*	*549*	*1093*	*1312*	*575*
Teweekesbury	*417*	*414*	*219*	*448*	*484*	*1152*	*987*
Mendip	*410*	*436*	*266*	*1024*	*1180*	*1420*	*724*
Sedgemoor	*464*	*355*	*360*	*573*	*1244*	*1256*	*957*
South Somerset	*390*	*424*	*193*	*518*	*692*	*1114*	*590*
Taunton Deane	*412*	*418*	*234*	*499*	*719*	*1348*	*921*
West Somerset	*495*	*506*	*222*	*582*	*1220*	*1749*	*961*
Wiltshire	*406*	*427*	*205*	*513*	*826*	*1241*	*842*
South East	**388**	**451**	**227**	**559**	**978**	**1225**	**781**
Medway UA	*359*	*255*	*206*	*533*	*713*	*1092*	*567*
Bracknell Forest UA	*385*	*554*	*197*	*549*	*704*	*1173*	*796*
West Berkshire UA	*363*	*400*	*239*	*621*	*1126*	*1248*	*742*
Reading UA	*374*	*531*	*254*	*560*	*872*	*1553*	*985*
Slough UA	*408*	*649*	*283*	*579*	*1144*	*1363*	*429*
Windsor & Maidenhead UA	*419*	*464*	*174*	*532*	*769*	*1544*	*594*
Wokingham UA	*325*	*315*	*189*	*621*	*1013*	*1700*	*804*
Milton Keynes UA	*346*	*493*	*213*	*636*	*649*	*1511*	*447*
Brighton & Hove UA	*410*	*463*	*260*	*588*	*697*	*804*	*927*
Portsmouth UA	*380*	*532*	*258*	*625*	*1797*	*1312*	*669*
Southampton UA	*387*	*356*	*239*	*528*	*1301*	*2125*	*783*
Isle of Wight UA	*408*	*463*	*217*	*400*	*1510*	*1065*	*989*
Aylesbury Vale	*395*	*473*	*188*	*438*	*965*	*925*	*783*
Chiltern	*385*	*375*	*163*	*492*	*1763*	*1303*	*758*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
South Bucks	*350*	*478*	*232*	*604*	*2470*	*1260*	*717*
Wycombe	*414*	*549*	*172*	*504*	*965*	*840*	*831*
Eastbourne	*384*	*498*	*466*	*577*	*958*	*1309*	*2343*
Hastings	*399*	*488*	*407*	*684*	*726*	*462*	*1550*
Lewes	*452*	*491*	*229*	*690*	*1089*	*1525*	*570*
Rother	*388*	*489*	*207*	*682*	*704*	*1392*	*918*
Wealden	*383*	*336*	*198*	*701*	*618*	*923*	*554*
Basingstoke & Deane	*380*	*448*	*233*	*533*	*1342*	*1640*	*714*
East Hampshire	*371*	*536*	*201*	*546*	*619*	*1185*	*808*
Eastleigh	*341*	*356*	*199*	*498*	*874*	*1426*	*836*
Fareham	*395*	*412*	*234*	*590*	*1209*	*1582*	*778*
Gosport	*379*	*563*	*196*	*527*	*937*	*1198*	*1195*
Hart	*367*	*404*	*211*	*596*	*613*	*1120*	*815*
Havant	*364*	*518*	*259*	*523*	*847*	*1368*	*917*
New Forest	*381*	*316*	*184*	*567*	*1410*	*1296*	*481*
Rushmoor	*356*	*329*	*249*	*522*	*962*	*1328*	*793*
Test Valley	*354*	*347*	*217*	*542*	*974*	*1305*	*489*
Winchester	*418*	*379*	*217*	*469*	*746*	*1117*	*509*
Ashford	*425*	*463*	*210*	*620*	*1688*	*1375*	*751*
Canterbury	*411*	*437*	*210*	*422*	*839*	*1042*	*423*
Dartford	*409*	*396*	*226*	*715*	*843*	*1182*	*848*
Dover	*399*	*471*	*196*	*555*	*729*	*977*	*408*
Gravesham	*403*	*410*	*203*	*660*	*931*	*1259*	*1023*
Maidstone	*417*	*450*	*354*	*708*	*946*	*1107*	*840*
Sevenoaks	*390*	*315*	*218*	*414*	*753*	*1282*	*508*
Shepway	*388*	*541*	*253*	*474*	*613*	*1047*	*804*
Swale	*430*	*335*	*253*	*673*	*1406*	*965*	*790*
Thanet	*437*	*494*	*273*	*457*	*1142*	*1094*	*823*
Tonbridge & Malling	*368*	*479*	*224*	*531*	*1586*	*1156*	*669*
Tunbridge Wells	*389*	*457*	*214*	*489*	*909*	*1184*	*691*
Cherwell	*422*	*442*	*205*	*603*	*590*	*1596*	*693*
Oxford	*392*	*497*	*216*	*553*	*488*	*827*	*617*
South Oxfordshire	*394*	*506*	*208*	*589*	*940*	*1359*	*940*
Vale of White Horse	*369*	*554*	*197*	*523*	*1034*	*1161*	*782*
West Oxfordshire	*399*	*510*	*202*	*543*	*1245*	*1022*	*825*
Elmbridge	*372*	*458*	*181*	*495*	*923*	*1422*	*637*
Epsom & Ewell	*386*	*550*	*186*	*538*	*670*	*1256*	*916*
Guildford	*350*	*598*	*173*	*502*	*1133*	*929*	*921*
Mole Valley	*395*	*423*	*187*	*515*	*883*	*1110*	*281*
Reigate & Banstead	*354*	*498*	*211*	*479*	*1003*	*1325*	*846*
Runnymede	*362*	*383*	*197*	*611*	*919*	*1348*	*707*
Spelthorne	*363*	*351*	*225*	*556*	*821*	*1273*	*876*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Surrey Heath	*371*	*442*	*306*	*531*	*738*	*860*	*691*
Tandridge	*377*	*480*	*217*	*567*	*765*	*996*	*755*
Waverley	*408*	*475*	*193*	*530*	*832*	*1087*	*666*
Woking	*358*	*456*	*213*	*528*	*852*	*1281*	*680*
Adur	*419*	*550*	*197*	*644*	*1165*	*1018*	*771*
Arun	*413*	*363*	*346*	*648*	*796*	*1420*	*688*
Chichester	*504*	*448*	*226*	*501*	*794*	*941*	*898*
Crawley	*377*	*348*	*190*	*687*	*829*	*1097*	*416*
Horsham	*384*	*386*	*278*	*521*	*388*	*1177*	*830*
Mid Sussex	*367*	*445*	*264*	*475*	*1062*	*1263*	*716*
Worthing	*378*	*378*	*199*	*574*	*980*	*1292*	*1117*
London	**406**	**537**	**226**	**572**	**1065**	**1044**	**801**
City of London	*385*	*525*	*271*	*612*	*2940*	*643*	*799*
Barking & Dagenham	*388*	*398*	*218*	*592*	*1417*	*954*	*694*
Barnet	*394*	*608*	*201*	*616*	*963*	*1127*	*603*
Bexley	*368*	*356*	*248*	*545*	*1580*	*980*	*653*
Brent	*403*	*490*	*222*	*607*	*1131*	*894*	*750*
Bromley	*364*	*453*	*266*	*548*	*1008*	*875*	*915*
Camden	*471*	*580*	*240*	*507*	*993*	*521*	*756*
Croydon	*362*	*430*	*229*	*675*	*987*	*1065*	*563*
Ealing	*410*	*532*	*223*	*673*	*1170*	*796*	*568*
Enfield	*360*	*454*	*175*	*618*	*931*	*1393*	*2529*
Greenwich	*393*	*439*	*253*	*536*	*985*	*1338*	*697*
Hackney	*466*	*741*	*250*	*615*	*3212*	*235*	*785*
Hammersmith & Fulham	*441*	*597*	*418*	*597*	*995*	*537*	*932*
Haringey	*425*	*463*	*216*	*576*	*865*	*1350*	*627*
Harrow	*373*	*419*	*201*	*591*	*1023*	*903*	*543*
Havering	*369*	*436*	*177*	*531*	*961*	*1854*	*437*
Hillingdon	*415*	*459*	*173*	*536*	*984*	*1339*	*633*
Hounslow	*399*	*429*	*194*	*563*	*1319*	*708*	*646*
Islington	*435*	*703*	*267*	*472*	*583*	*1262*	*2139*
Kensington & Chelsea	*461*	*699*	*246*	*579*	*948*	*639*	*810*
Kingston upon Thames	*380*	*446*	*216*	*516*	*699*	*1615*	*530*
Lambeth	*379*	*599*	*197*	*586*	*771*	*392*	*793*
Lewisham	*398*	*646*	*235*	*537*	*958*	*861*	*1009*
Merton	*392*	*528*	*218*	*532*	*813*	*874*	*502*
Newham	*495*	*552*	*238*	*519*	*1021*	*907*	*847*
Redbridge	*370*	*457*	*252*	*616*	*986*	*885*	*578*
Richmond upon Thames	*370*	*516*	*166*	*550*	*1201*	*1382*	*1028*
Southwark	*441*	*654*	*178*	*593*	*1197*	*694*	*815*
Sutton	*348*	*508*	*169*	*492*	*517*	*909*	*681*
Tower Hamlets	*426*	*584*	*192*	*549*	*1141*	*493*	*462*

Table A.1 continued.

Local Authority	Walking	Cycling	Swimming	Gym	Football	Golf	Road Running
Waltham Forest	*433*	*469*	*247*	*616*	*788*	*1094*	*650*
Wandsworth	*364*	*575*	*307*	*569*	*814*	*1332*	*866*
Westminster	*427*	*577*	*193*	*555*	*2010*	*582*	*1231*
Mean (Kcal)	**399**	**470**	**234**	**581**	**1036**	**1304**	**780**

Reference values for a 70kg individual.

A.2 APPENDIX – Health Profile of England

HEALTH PROFILE OF ENGLAND
Summary of Indicators - Regions (using Local Health Profile data)

	INDICATOR	Period	Unit[1]	England	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West
	Our communities												
1	Deprivation	2005	%	19.9	33.6	31.7	27.2	16.6	27.4	6.2	28.5	5.9	9.2
2	Children in poverty	2005	%	22.4	26.0	25.0	23.0	19.5	24.8	16.9	33.9	15.4	16.9
3	Statutory homelessness	2005-06	cr per 1000	4.4	5.2	4.4	4.2	3.7	5.8	3.5	6.8	2.8	3.6
4	GCSE achievement (5 A*-C)	2006-07	%	60.1	60.5	60.3	57.8	57.9	59.3	61.2	60.9	62.0	59.5
5	Violent crime	2006/07	cr per 1000	19.3	18.8	19.7	20.8	18.3	19.7	14.6	24.3	18.6	17.2
6	Carbon emissions	2005	t CO_2 pr³	7.6	9.0	7.6	8.3	8.3	7.4	7.8	6.8	7.3	7.7
	Children's and young people's health												
7	Smoking in pregnancy	2006-07	%	16.1	23.6	20.8	19.6	18.3	16.3	14.4	8.9	15.2	16.8
8	Breast feeding initiation	2006-07	%	69.2	49.8	59.8	62.5	70.5	60.3	69.7	81.9	75.6	75.8
9	Physically active children	2006-07	%	85.7	87.0	85.8	84.1	85.9	85.1	86.6	84.9	85.0	88.6
10	Obese children	2006-07	%	9.9	10.9	10.2	9.7	9.7	10.4	9.1	11.3	8.7	9.0
11	Children's tooth decay (at age 5)	2005-06	mean	1.5	2.0	2.0	1.8	1.3	1.0	1.1	1.7	1.1	1.6
12	Teenage pregnancy (under 18)	2004-06	cr per 1000	41.1	49.7	45.4	47.2	40.2	45.7	32.8	46.9	33.4	33.7
	Adults health and lifestyle												
13	Adults who smoke	2003-05	%	24.1	29.1	26.0	25.5	24.9	24.0	23.5	23.3	21.8	21.5
14	Binge drinking adults	2003-05	%	18.0	26.5	23.0	22.0	17.7	17.9	15.2	12.7	16.2	15.3
15	Healthy eating adults	2003-05	%	26.3	18.5	23.6	24.7	25.9	25.1	27.0	29.7	30.4	25.9
16	Physically active adults	2005-06	%	11.6	11.4	11.1	11.1	11.6	10.5	11.3	11.6	12.5	12.6
17	Obese adults	2003-05	%	23.6	25.2	24.5	24.1	25.6	26.5	24.8	18.4	22.0	23.2
	Disease and poor health												
18	Under-15s not in good health	2001	%	11.6	13.4	12.4	11.8	10.4	12.1	10.4	13.1	10.4	10.7
19	Incapacity benefits for mental illness	2006	cr per 1000	27.5	40.8	40.5	28.3	24.1	28.5	20.0	26.9	19.4	26.3
20	Hospital stays related to alcohol	2006-07	r per 100,000	260.3	422.9	424.2	250.9	238.0	252.5	170.0	239.7	201.9	247.3
21	Drug misuse	2004-05	cr per 1000	9.9	9.5	11.4	11.7	8.2	10.6	6.5	14.4	6.4	9.4
22	People diagnosed with diabetes	2005-06	%	3.7	3.8	3.9	3.7	3.9	4.0	3.4	4.0	3.3	3.5
23	Sexually transmitted infections												
24	New cases of tuberculosis	2004-06	cr per 100,000	15.0	5.0	9.0	11.0	12.0	17.0	7.0	44.0	8.0	5.0
25	Hip fractures in over-65s	2006-07	r per 100,000	479.8	552.3	493.9	484.0	480.1	499.0	467.6	454.4	467.5	462.7
	Life expectancy and causes of death												
26	Life expectancy - male[4]	2004-06	years	77.3	75.8	75.8	76.6	77.3	76.6	78.3	77.4	78.5	78.5
27	Life expectancy - female[4]	2004-06	years	81.6	80.1	80.3	81.0	81.3	81.1	82.3	82.0	82.4	82.7
28	Infant deaths	2004-06	cr per 1000	5.0	4.9	5.6	5.8	5.1	6.5	4.1	5.0	4.0	4.4
29	Deaths from smoking[2]	2004-06	r per 100,000	225.4	285.8	270.0	249.2	218.2	228.8	199.3	225.1	197.9	192.3
30	Early deaths: heart disease & stroke	2004-06	r per 100,000	84.2	99.8	102.2	90.5	84.6	90.7	72.9	89.0	70.2	69.5
31	Early deaths: cancer	2004-06	r per 100,000	117.1	136.0	131.0	122.3	115.1	119.2	108.3	114.6	109.8	108.1
32	Road injuries and deaths	2004-06	cr per 100,000	56.3	44.6	57.5	65.1	63.7	50.5	64.4	52.6	55.3	49.8

Key

GREEN = significantly better than national average
AMBER = not significantly different from national average
RED = significantly worse than national average
NO SHADE = significance not calculated, or data unavailable

Figure A2.1 Excerpt from Health Profile of England 2008.