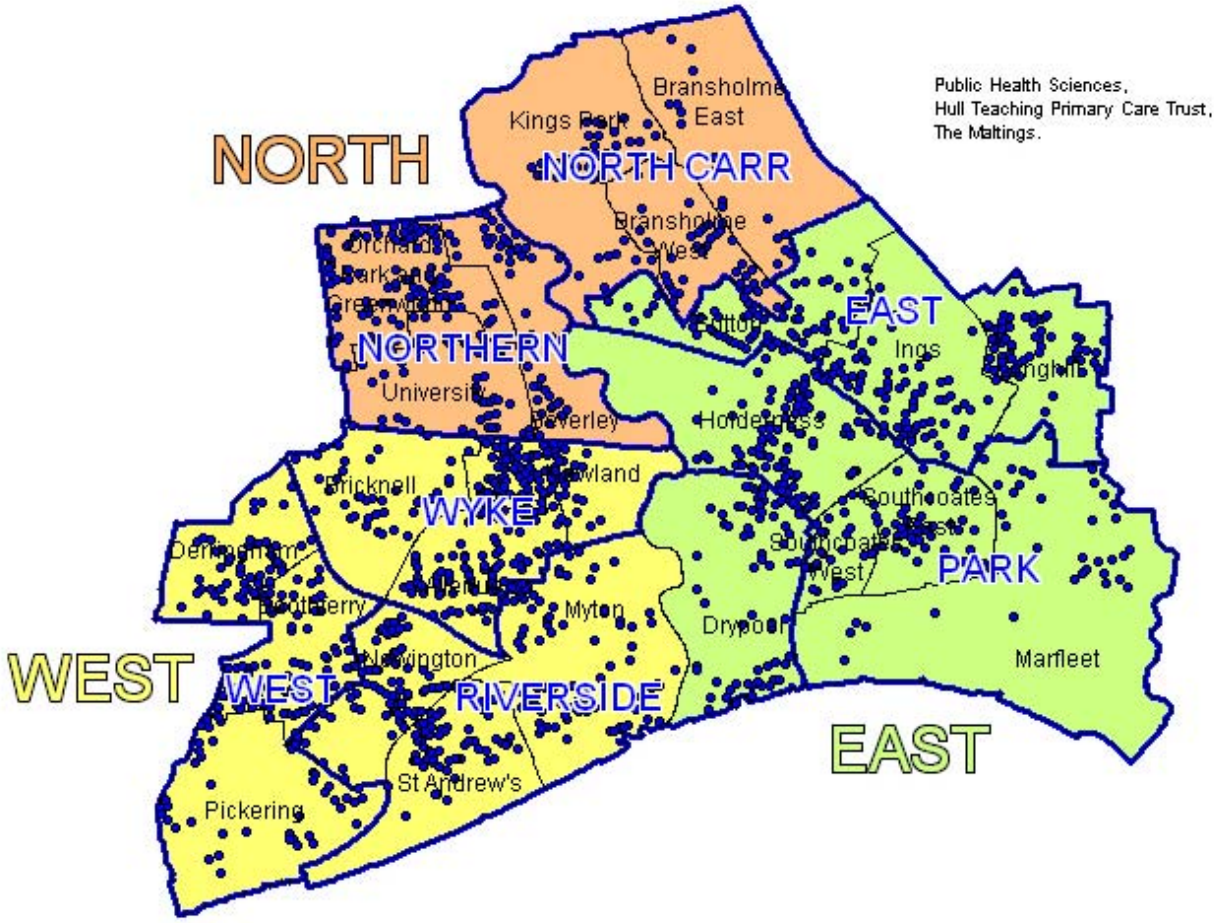
Hull's Health and Lifestyle Survey 2007

Obesity and Exercise Report



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April, 2008.

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Summary

The prevalence of obesity in England was higher for 2004 (22.7% for men and 23.2% for women) compared to Hull for 2007 (18.3% for men and 23.1% for women). The prevalence of being overweight was very similar for England and Hull in women (33.9% and 32.7% respectively), but higher in men in Hull compared to England (48.6% and 43.9% respectively). The prevalence of overweight and obesity in Hull has changed relatively little in adults between the 2003 and 2007 Health and Lifestyle surveys.

The prevalence of overweight and obesity increased with age until aged 64 years with a steeper gradient for women (from 29.9% to 69.9%), but higher overall values for men (from 46.0% to 77.6%). Overweight and obesity levels fell after the age of 65 years (66.9% for men and 55.8% for women aged 75+ years).

Overweight and obesity levels were very similar for Hull and England with the exception of young men. The prevalence of overweight and obesity in young men was 46.0% in Hull (ages 18-24 years) compared to 31.0% for England (ages 16-24 years).

Men and women living in the most deprived areas and those with poorer physical health were more likely to be obese. However, the prevalence was high enough for concern in all groups, and a broad focus is required to address the problem of obesity.

Exercise levels are relatively low in Hull compared to England, and similarly vary with age and gender.

The national recommended guideline for exercise is to undertake 30 minutes or more of vigorous or moderate exercise on at least five occasions per week. 29% of men and 24% of women in Hull undertook sufficient exercise based on this definition, compared to 37% of men and 25% of women in England. In Hull, 9% of men and 7% of women stated that they did not undertake any exercise, and this percentage increased with age.

People with fewer qualifications and with worse physical and mental health were less likely to fulfil the national exercise guidelines, and people living in more deprived areas, on lower incomes, with lower levels of qualifications and poorer physical and mental health were more likely to never exercise. However, as with obesity, prevalence was low enough for concern in all groups, and a broad focus is required to address the problem of lack of exercise.

Hull's Health and Lifestyle Survey 2007: Obesity and Exercise Report

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Aim

To examine obesity and exercise information from Hull's 2007 Health and Lifestyle Survey in more detail than the main summary report which is available on www.hullpublichealth.org

Methods

Survey methodology

During early 2007, an adult (18+ years) Health and Lifestyle survey was carried out in Hull by the Hull Teaching Primary Care Trust (PCT) with a target of 4,000 residents. The survey was funded by OneHull with the fieldwork and data entry being undertaken by SMSR. Individuals were approached through interviewers knocking on doors and inviting the household member to participate in the survey; an interview was completed or a questionnaire was left for self-completion and the interviewer collected the questionnaire at an agreed later date. Quota sampling was used based on gender, ten-year age group, nine geographical areas and employment status so that the resulting sample was broadly representative of Hull's overall population with regard to these characteristics. A total of 4,086 residents participated in the survey, with approximately one in three households approached having a household member agreeing to participate in the survey. Concurrently, a Black and Minority Ethnic group (BME) Health and Lifestyle survey was undertaken. However, due to the survey methodology the survey responders were not necessarily representative of Hull's BME population, so findings have not been included within this report. Additionally, a final question within the questionnaire asked if survey responders would like to become part of a Hull PCT panel member to help with further research. From individuals agreeing to become panel members, six 'reflector' groups were held involving 8-12 participants where more in-depth information was obtained on health and risk factors. It is not known how well these few participants represented views and opinions of Hull's residents within their individual groups. Further information on the BME survey responders and reflector group findings in relation to the overweight, obesity and exercise are given in reports on www.hullpublichealth.org

Statistical terms

The term statistically significant in relation to statistical testing, standardisation and confounding are explained in the ***Appendix*** on ***page 59***.

Deprivation

The Index of Multiple Deprivation 2004 score is a measure of deprivation derived for lower layer Super Output Area (LSOA) across England. These geographical areas have

a minimum population size of 1,000 and a mean population size of 1,500. Each individual participating in the survey was assigned a deprivation score based on the LSOA in which they lived (from their postcode). Individual deprivation scores were then assigned to one of five different groups ranging from the 20% most deprived to the 20% least deprived areas in Hull (local quintiles).

Comparisons over time

A local Health and Lifestyle survey was carried out in Hull by the Public Health Development Team[1] during 2003 which included information on levels of exercise as well as other health and health-related lifestyle information. A random sample of people aged between 16 and 84 years who were registered with a Hull General Practitioner (GP) were sent a self-completion questionnaire during 2003. The questionnaire was returned by 1,716 Eastern Hull PCT and 1,560 West Hull PCT residents (out of 6,500) giving an overall response rate of 50% which compares favourably to other recent general population surveys, especially in urban areas.

Although the most recent survey carried out during 2007 used different survey methodology (quota sampling), both surveys are broadly representative of the population of Hull as a whole, and can be validly compared to give recent trends.

National comparisons

The Health Survey for England collects height, weight and exercise information on its survey responders. Height and weight are measured by the research nurses. Therefore, measures of overweight and obesity are more accurate compared to self-reported height and weight (see ***Data considerations*** on ***page 6***).

Body mass index and weight classifications

The Body Mass Index (BMI) is the usual method of assessing obesity in adults. Survey respondents were asked to give their height and weight. From this information, BMI was calculated for each person. The calculation is: BMI = weight (kilograms) divided by height (in metres) squared. The following classifications are then routinely used:

- Underweight (BMI less than 20);
- Desirable weight (BMI 20+ but less than 25);
- Overweight (BMI 25+ but less than 30);
- Obese (BMI 30+ but less than 40);
- Morbidly obese (BMI 40+).

Note that some classifications used underweight as having a BMI of less than 18.5.

[1] Working across four PCTs within Hull and East Riding of Yorkshire.

Data considerations

The local Health and Lifestyle survey collected information on self-reported height and weight rather than measured height and weight. From research[2], it is well known that both men and women, in general, overestimate their height and underestimate their weight. Therefore, it is difficult to compare the percentage of people classified as overweight or obese locally with those for England, because of these differences in the data collection methods. In order to enable a more valid comparison, the self-reported heights and weights have been adjusted[3] to give an adjusted BMI figure for each survey respondent. The effect of these changes is to increase the percentage of overweight and obese people in the local survey from 35.0% and 16.8% respectively to 40.6% and 20.7% (***Table 1***). Of the 1,531 who self-reported they were of desirable weight, 364 (24%) were overweight following the adjustment. This shows even a relatively small adjustment of 1-2cm and 1-2kg can make a considerable difference to the prevalence of overweight and obesity. In the rest of this report the adjusted BMI figures will be used unless otherwise stated.

Table 1: Adjustment of body mass index in local survey to take into account that height is overestimated and weight is underestimated when self-reported – changes in BMI categorisation

Numbers of survey responders		**Adjust body mass index (used in analysis)**				
		Under-weight	**Desirable weight**	**Over-weight**	**Obese**	**Total**
Body mass index (self-reported)	**Underweight**	211	98	0	0	309
	Desirable weight	0	1,167	364	0	1,531
	Overweight	0	0	1,189	149	1,338
	Obese	0	0	0	643	643
	Total	211	1,265	1,553	792	3,821

Classification of levels of exercise

The national recommended guideline for exercise is to exercise moderately or vigorously for at least 30 minutes on at least five days per week. Survey responders were asked "In a usual week, how many times do you exercise lasting at least 30 minutes?" with response categories of the following for vigorous, moderate and light

[2] A survey of 4,808 British men and women aged 35-76 which compared self-reported and measured height and weight (Spencer et al. 2002), found that height was overestimated by on average 1.23cm for men and 0.60cm for women, but the extent of the overestimation was greater in older men and women, shorter men and heavier women. They also found that weight was underestimated by on average 1.85kg for men and 1.40kg for women and the extent of the underestimation was greater in heavier men and women, but did not vary with age or height (although other studies have found that the elderly particularly underestimate their weight (Jalkanen et al. 1987; Kuczmarski et al. 2001).

[3] People over-estimate their height and under-estimate their weight to differing degrees depending on their gender and age. However, as exact information was not provided within the Spencer article and for simplicity, the same height and weight adjustments were applied for men and for women regardless of their age.

exercise: never; once or twice a week; three or four times a week; or five or more times a week. Examples of the exercise levels were provided:

- Vigorous exercise: "e.g. running, jogging, squash, swimming lengths, aerobics, fast cycling, football";
- Moderate exercise: "e.g. fast walking, dancing, gentle swimming, golf, heavy housework, heavy gardening/digging";
- Light exercise: "e.g. walking at average pace, table tennis, light housework, light gardening/weeding".

The exercise categories were combined into four groups: (i) fulfilling the national recommended guidelines for exercise; (ii) exercises moderately or vigorously but does not fulfil national recommended guidelines; (iii) light exercise only; or (iv) never exercises. It was assumed that survey responders who undertook exercise "once or twice a week" or "three or four times a week" exercised 1.5 and 3.5 times per week on average.

The previous Health and Lifestyle survey conducted during 2003 used a similar format for the exercise question, but asked about exercise undertaken in the previous seven days and which lasted 20 minutes or more, and with the "three or more times" combined for the response categories.

Results

Prevalence of overweight and obesity

Using these adjusted estimates of the body mass index, the percentages in each BMI category for Hull men and women are given in ***Figure 1*** together with the percentages for the Health Survey for England 2004[4]. BMI values for the 2003 Hull survey have been adjusted for self-reporting in a similar manner. The number of survey responders and percentages are given in ***Table 2***.

[4] Using measured height and weight. HSE 2004 is the latest HSE data where underweight is defined as having a BMI 20 or under. HSE 2005 definition uses BMI under 18.5 to define underweight.

Figure 1: BMI category adjusted percentages by gender and survey

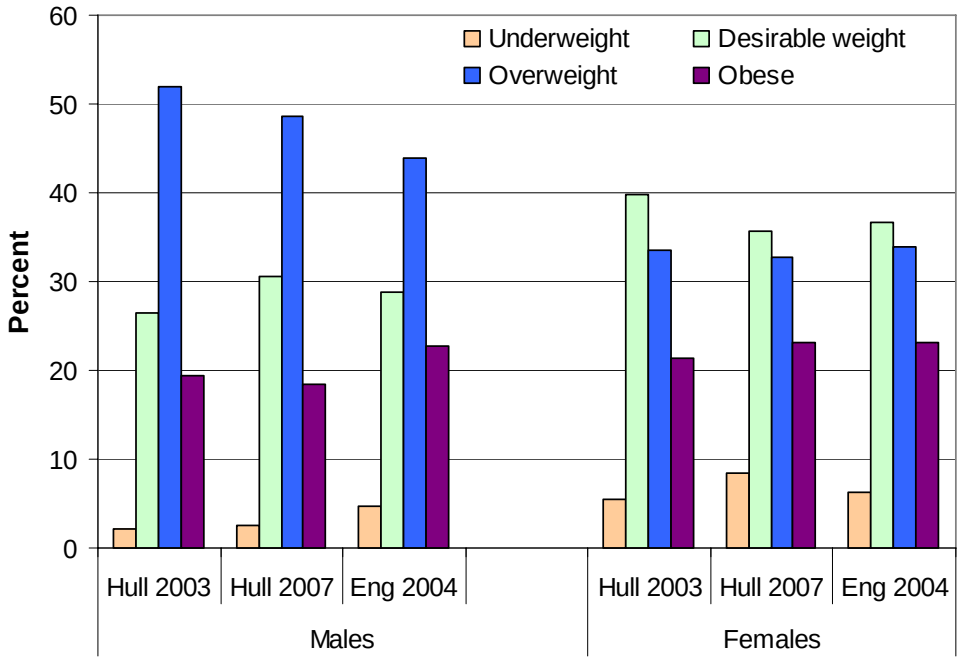


Table 2: Percentages in BMI (adjusted) categories by gender and survey

Gender	Survey/year	Number of survey responders	Percentage of survey responders in each adjusted BMI category			
			Under-weight	Desirable weight	Over-weight	Obese
Males	Hull 2003	2,175	2.3	26.4	52.0	19.4
	Hull 2007	1,914	2.6	30.5	48.6	18.3
	England 2004	2,444	4.7	28.8	43.9	22.7
Females	Hull 2003	2,870	5.4	39.8	33.4	21.3
	Hull 2007	1,907	8.5	35.7	32.7	23.1
	England 2004	3,135	6.3	36.7	33.9	23.2

This confirms the 2003 survey conclusion that Hull's obesity levels are no greater than the national average, in contradiction to the "findings" of a flawed analysis by Experian International which gave Hull Britain's highest obesity index rating, which was seized upon by the mass media who reported that Hull was top of the fat league and "Britain's top obesity hot-spot"[5].

Body mass index and age

For both males and females the percentage of people who are overweight or obese rises to a peak at 55-64 – with 79.3% of males and 70.8% of females in Hull (***Figure 2***

[5] Daily Mail: 1st March 2004, page 25.

and ***Figure 3***). This pattern of rising obesity up to ages around 60 is very similar to the national pattern for both males and females.

Figure 2: Percentage of overweight and obese males by age group; Hull 2007

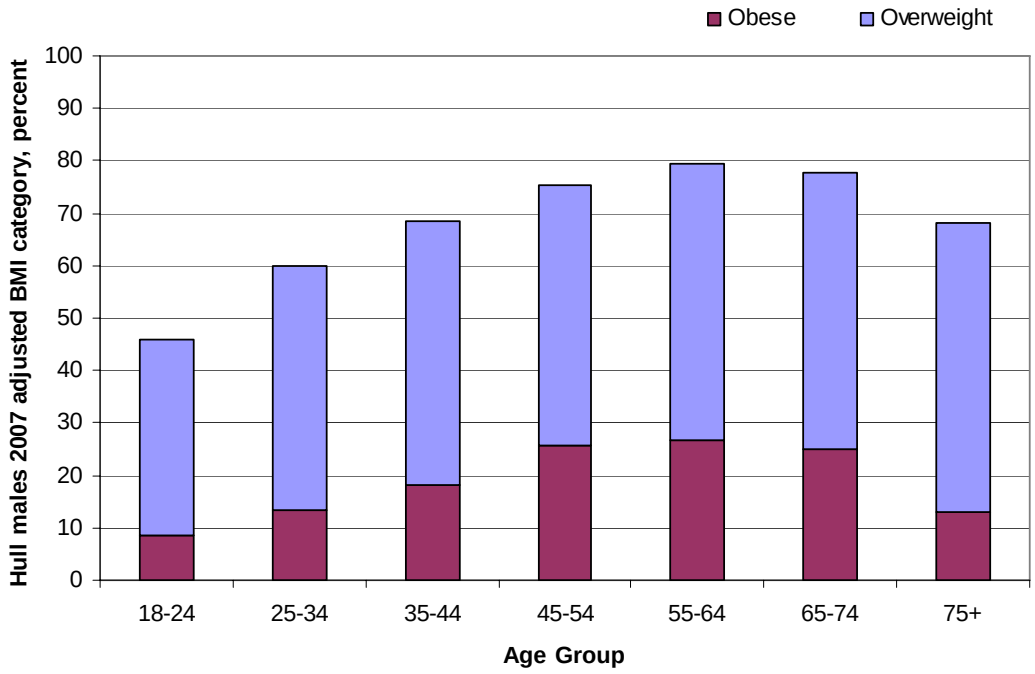
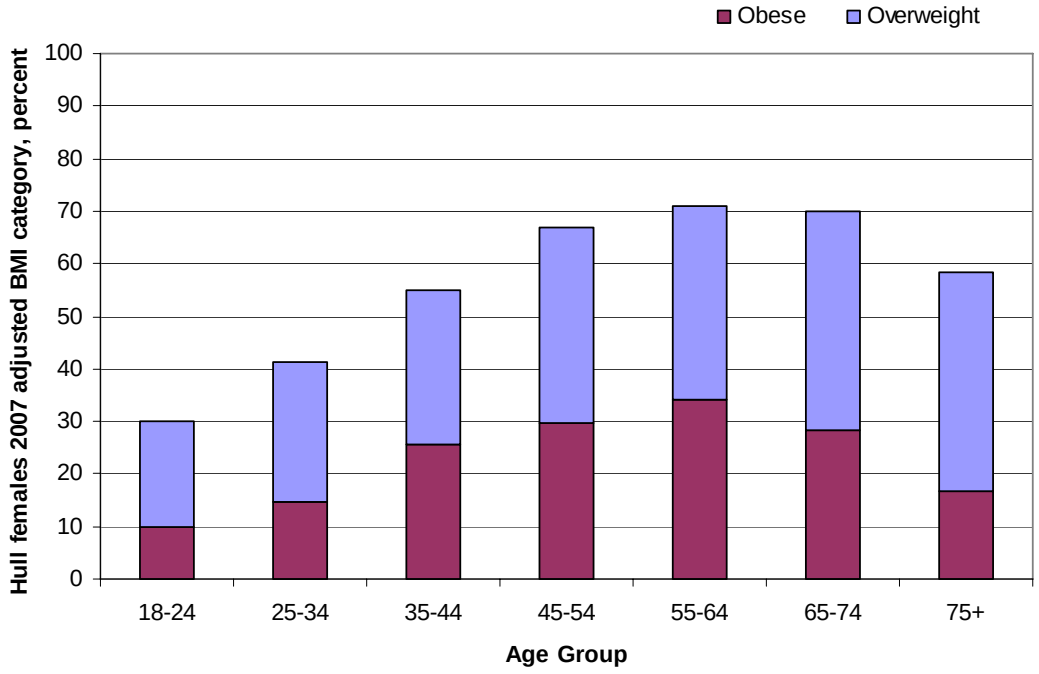


Figure 3: Percentage of overweight and obese females by age group; Hull 2007



When comparing differences in the age distribution of overweight and obesity in Hull 2007 with the most recent England figures (2004), we can see from ***Figure 4*** that there is little difference for males. However for females (***Figure 5***) there is a consistently higher level of overweight and obesity for Hull for all age groups above 35. This indicates a twofold difference – higher levels of overweight and obesity in the over 35s in Hull, contrasted with relatively lower levels in Hull's younger age groups. Despite these increases for older Hull females, their overweight and obesity levels are still generally below those of males.

Figure 4: Overweight and obesity in men, Hull compared to England

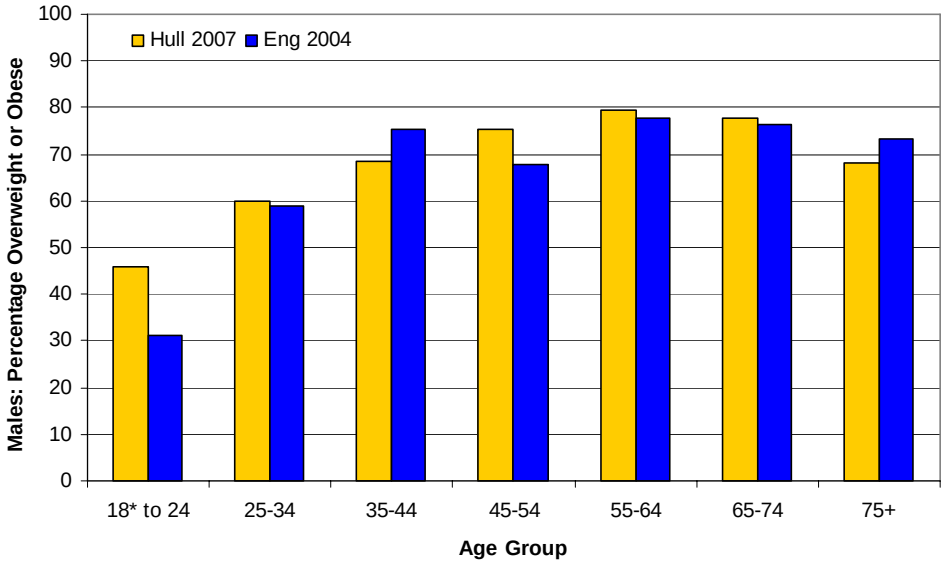
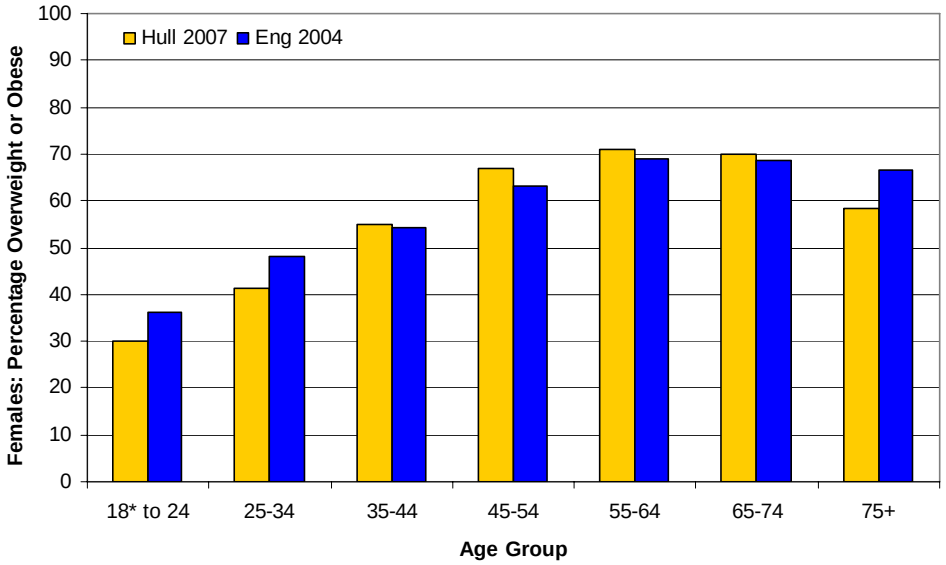


Figure 5: Overweight and obesity in women, Hull compared to England



Body mass index and geographical area of residence

On the basis of their postcode, survey responders were assigned to local authority Areas and PCT Localities. For each Area and Locality, ***Table 3*** and ***Table 4*** give the percentage of survey responders within each weight classification based on their adjusted BMI. No particular areas or Localities stand out as having greatly higher or lower rates of obesity or overweight, showing that this to be a problem affecting all parts of Hull.

Table 3: Adjusted body mass index by Area and Locality for men

Area/Locality	Number of survey responders	Adjusted body mass index (%) for men			
		Underweight	Desirable weight	Overweight	Obese
North Carr	124	4.0	29.8	45.2	21.0
Northern	260	1.5	31.9	48.5	18.1
North Locality	**384**	**2.3**	**31.3**	**47.4**	**19.0**
East	264	0.8	25.4	55.3	18.6
Park	348	4.0	33.0	46.0	17.0
Riverside (East)	96	4.2	24.0	54.2	17.7
East Locality	**708**	**2.8**	**29.0**	**50.6**	**17.7**
Riverside (West)	292	3.4	29.8	42.8	24.0
West	275	0.7	26.2	55.6	17.5
Wyke	255	3.1	39.2	43.9	13.7
West Locality	**822**	**2.4**	**31.5**	**47.4**	**18.6**
TOTAL	1,914	2.6	30.5	48.6	18.3

Table 4: Adjusted body mass index by Area and Locality for women

Area/Locality	Number of survey responders	Adjusted body mass index (%) for women			
		Underweight	Desirable weight	Overweight	Obese
North Carr	141	9.2	30.5	31.9	28.4
Northern	247	8.1	33.6	31.2	27.1
North Locality	**388**	**8.5**	**32.5**	**31.4**	**27.6**
East	302	4.3	36.8	33.1	25.8
Park	343	9.3	37.0	34.4	19.2
Riverside (East)	111	7.2	40.5	35.1	17.1
East Locality	**756**	**7.0**	**37.4**	**34.0**	**21.6**
Riverside (West)	189	10.1	33.3	29.6	27.0
West	277	4.0	32.5	41.2	22.4
Wyke	297	15.5	40.1	24.9	19.5
West Locality	**763**	**10.0**	**35.6**	**32.0**	**22.4**
TOTAL	**1,907**	**8.5**	**35.7**	**32.7**	**23.1**

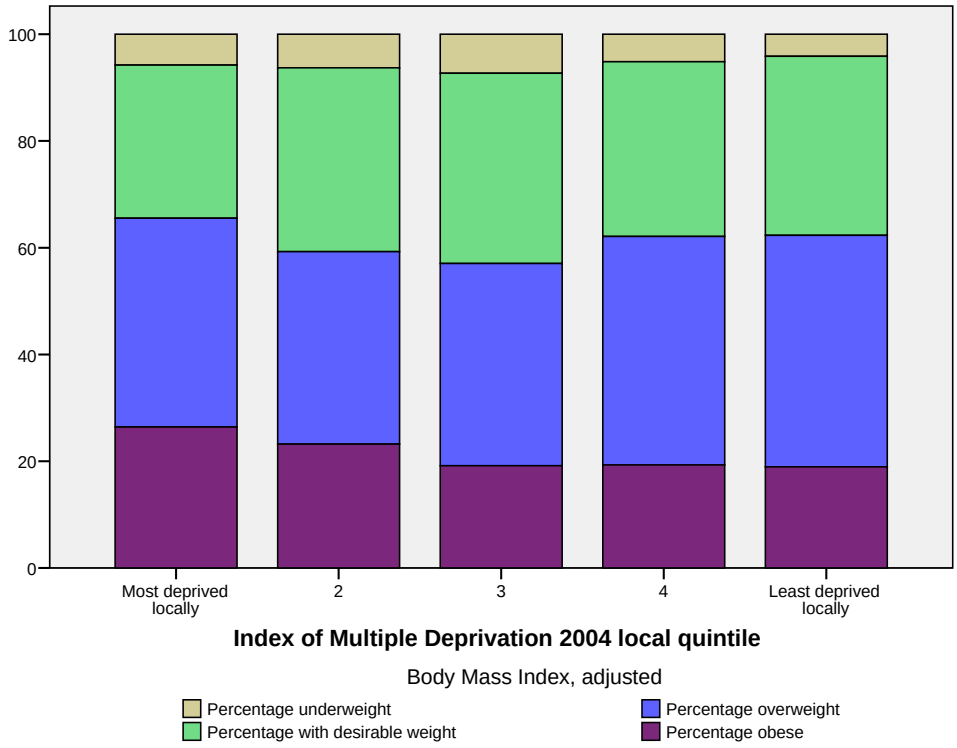
Use of standardisation

It is important that overweight and obesity are examined in relation to the prevalence within different groups if the aim is to provide strategies and solutions to focus on that specific group. For instance, if the prevalence of obesity is highest for people living in the most deprived areas in Hull, then there needs to be help provided for these people regardless of whether deprivation is the cause or other factors such as an older population. However, if you want to know if the prevalence is higher for those living in the most deprived areas, i.e. if deprivation is associated with the prevalence of obesity, it is necessary to take into account factors such as age and gender which are known to influence the prevalence and be associated with deprivation. If age and gender are not taken in to consideration, then if a difference in the prevalence of obesity is found, it will not be known whether deprivation is associated with the increased prevalence or whether the difference can be explained by other means such as a difference in the age structure of the populations among the deprivation categories. See ***Confounders*** on ***page 59*** and ***Standardisation*** on ***page 60*** for more information.

Prevalence of BMI categories in relation to measures of deprivation

The prevalence of obesity in relation to local deprivation quintile is given in ***Figure 6*** (26% in the most deprived quintile and 19% in the least deprived quintile). The prevalence of overweight and obesity is 66% and 62% respectively (very similar).

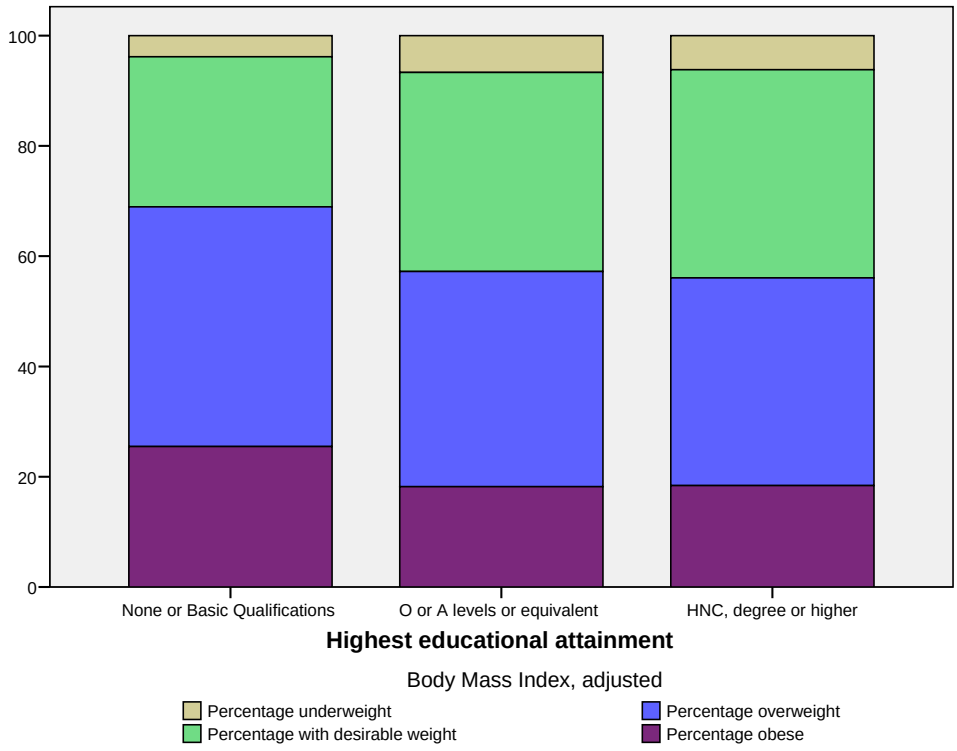
Figure 6: Prevalence of BMI categories by deprivation (unadjusted for age and gender)



Whilst there is a very small difference in the prevalence of obesity for those with an after tax household income[6] of less than £10,000 (24.3%) in relation to those with an income of £20,000 or more (19.3%), the prevalence of overweight and obesity combined were very similar (62.8% and 62.6% respectively).

Figure 7 gives the prevalence of overweight and obesity by highest educational attainment. The prevalence of obesity is 25.5% for people with only basic qualifications compared to 18.4% for people with degrees, and the prevalence of overweight and obesity are 68.9% and 54.1% respectively. However, age could be a confounder. In addition, it must be remembered that just because an association has been shown to exist between obesity and other factor (e.g. disability levels), this does ***not*** prove that one causes the other. Furthermore, causation may run either way, or may be linked through another variable.

Figure 7: Prevalence of BMI categories by highest educational attainment (unadjusted for age and gender)



Prevalence of BMI categories in relation to measures of physical and mental health

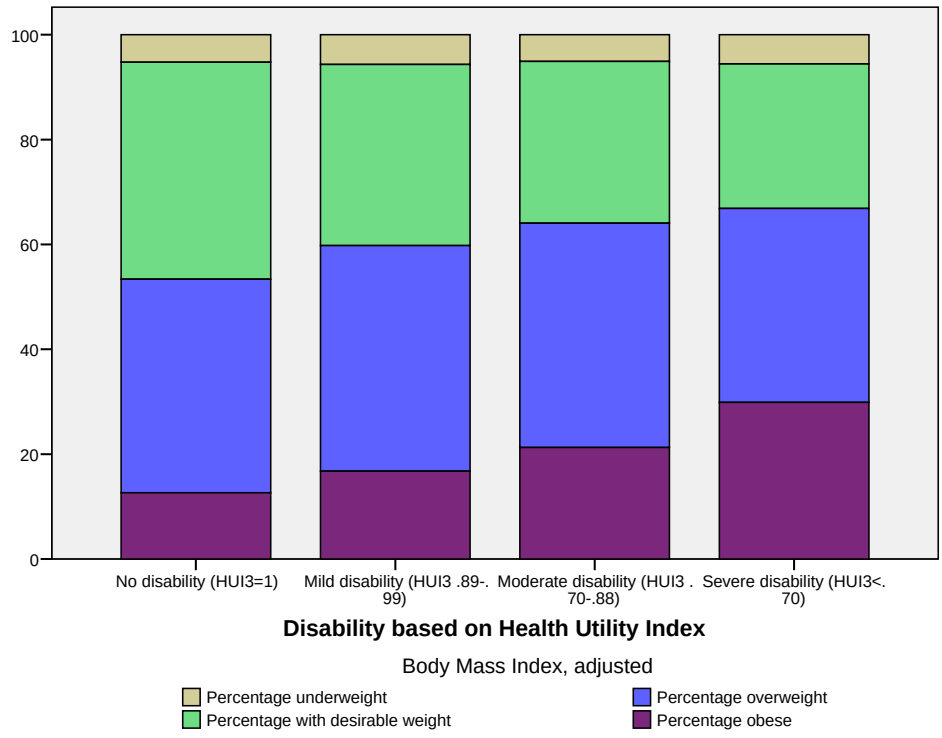
The Health Utility Index (HUI) is a scored health status measure reporting health-related quality of life on single attributes (vision, hearing, speech, ambulation/mobility, pain,

[6] After tax household income estimated from income group given and estimated tax using assumptions on tax and national insurance contributions. Note that only 60% of survey providers provided information on their income.

dexterity, self-care, emotion and cognition) as well as having a single summary measure from the combination of these attributes. The summary measure from –0.36 to 1 with 0 denoting death, 1 denoting the best health status and negative scores denoting very poor health scores[7]. The HUI can be divided into four categories: No disability (score 1); mild disability (score 0.89 to 0.99); moderate disability (score 0.70 to 0.88); and severe disability (score <0.70).

Figure 8 illustrates the prevalence of overweight and obesity based on these four levels of disability. There is a higher prevalence of obesity for those with severe disability (29.9%) compared to those with no disability (12.6%). However, the percentage overweight in the severe disability category is the lowest. Therefore, the relationship between the prevalence of overweight and obesity combined and disability is less strong than obesity alone (53.4% for no disability compared to 66.9% for severe disability group). It is very likely that age will be a confounder.

Figure 8: Prevalence of BMI categories by level of disability on the Health Utilities Index (unadjusted for age and gender)

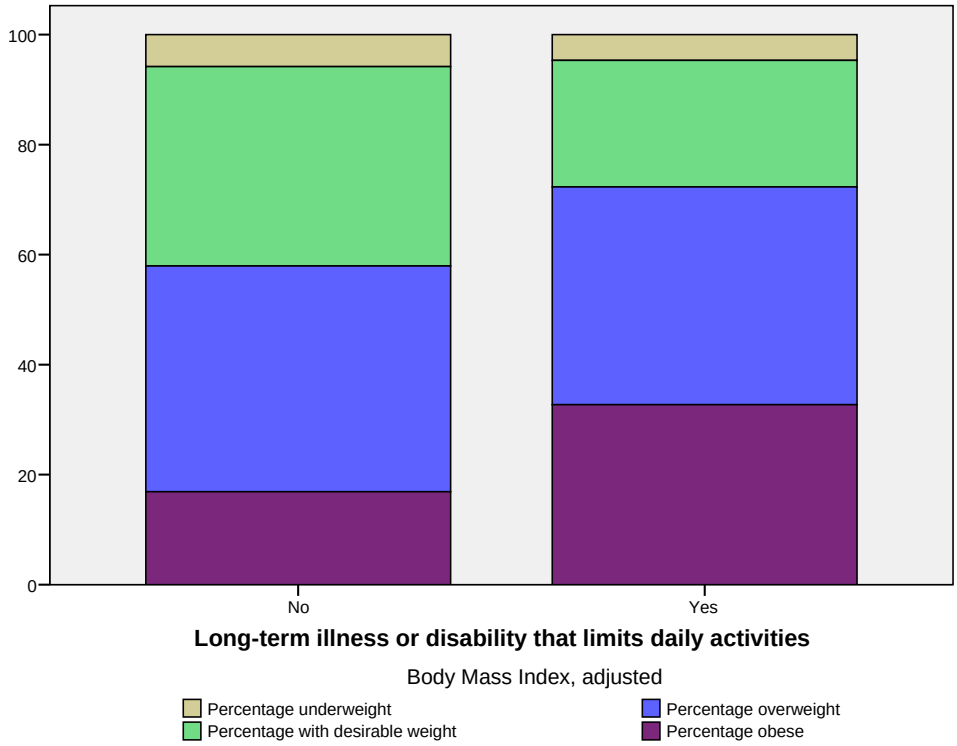


[7] It was not possible to calculate a summary score for all individuals unless a score was available for every attribute. For those who failed to answer all the questions and only had one or two of the attributes missing, the value of the attribute was imputed randomly from among the possible choices for the attribute for that particular person so that the summary score could be estimated (single attribute score remained missing). For example, if a person stated they could see well enough to read ordinary newsprint without glasses but it is not known whether they need glasses to see well enough to recognise a friend on the other side of the street, then the person would either be classified as scoring 3 (with glasses) or 1 (without glasses). If the person had only missed answering questions for two attributes at the most, then a value of 1 or 3 would be randomly imputed for 'modified vision score' so the summary score could be calculated.

Survey responders were asked if they had any illness or disability which had lasted for longer than one month, and if so, whether this illness or disability limited their activities in any way. Survey responders were classified into two groups: (i) those did not have a long-term illness or disability or those who had long-term illness or disability which did not affect their activities; and (ii) those who had a long-term illness or disability which also affected their activities.

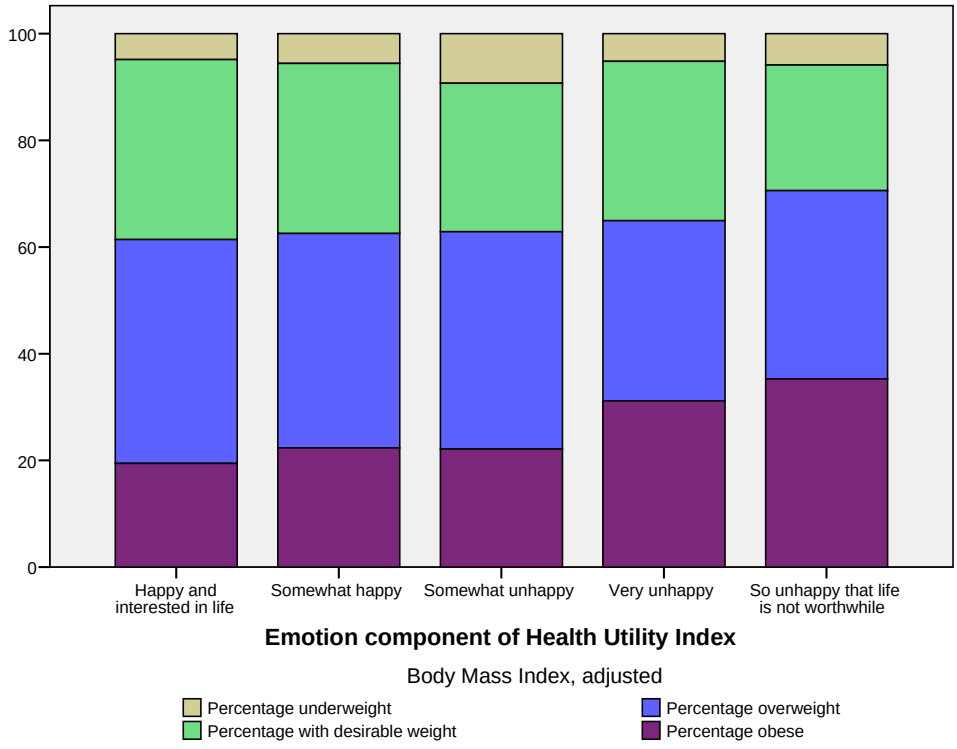
There is also a strong relationship between having a limiting long-term illness or disability and the prevalence of overweight and obesity (***Figure 9***). The prevalence of obesity is 16.9% for survey responders with no limiting long-term illness or disability compared to 32.7% for those with such an illness or disability. The percentage overweight is similar between the two groups (41.0% and 39.6% respectively). It is very likely that age will be a confounder.

Figure 9: Prevalence of BMI categories by limiting long-term illness or disability (unadjusted for age and gender)



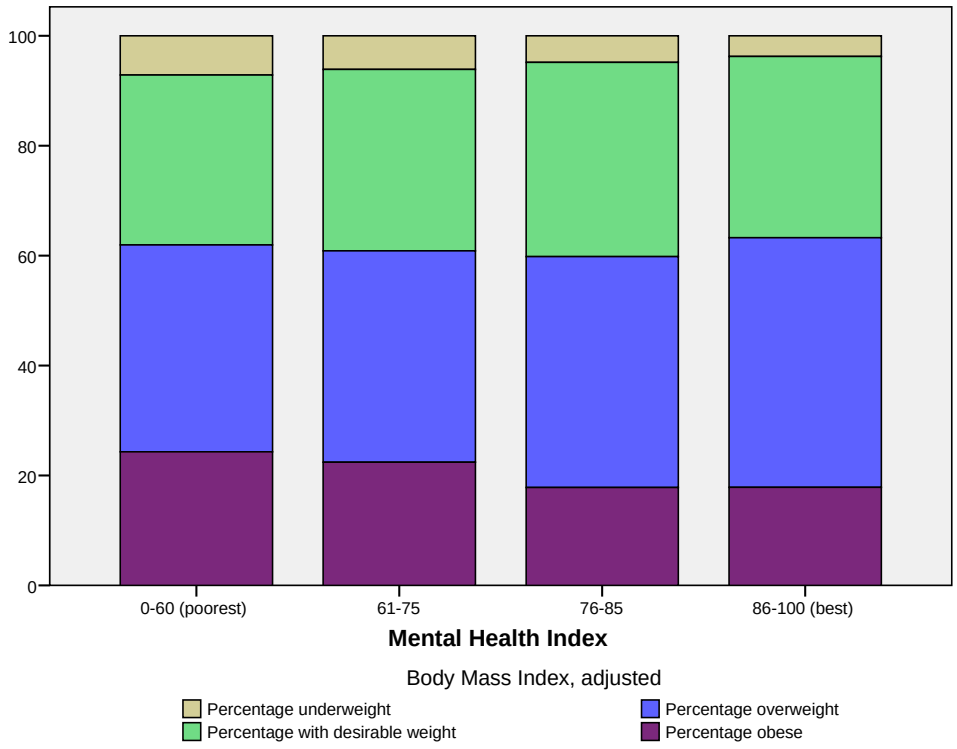
The prevalence of obesity is highest for those who classify themselves as unhappy (***Figure 10***). The prevalence is 35.3% for the 34 people in the survey who stated that they were "so unhappy that life was not worthwhile" and 31.2% for the 77 people in the survey who were "very unhappy" compared to 19.5% of those who were "happy and interested in life". The numbers of people in the survey who were the unhappiest were relatively small so the prevalence should be not over-interpreted. The prevalence of overweight and obesity combined was very similar across all of the five emotion categories of the Health Utility Index.

Figure 10: Prevalence of BMI categories by emotion component of Health Utility Index (unadjusted for age and gender)



The Mental Health Index (part of the SF-36 health status score) shows a similar pattern with the highest prevalence of obesity in those with the poorest mental health (arbitrarily defined on the basis of a score of 0-60 out a possible score range of 0-100). The prevalence of obesity was 24.3% in those with the lowest Mental Health Index score and 17.9% for those with the highest score (***Figure 11***). In a similar manner to the emotion component of the Health Utility Index, there was very little difference in the prevalence of overweight and obesity combined across the categories.

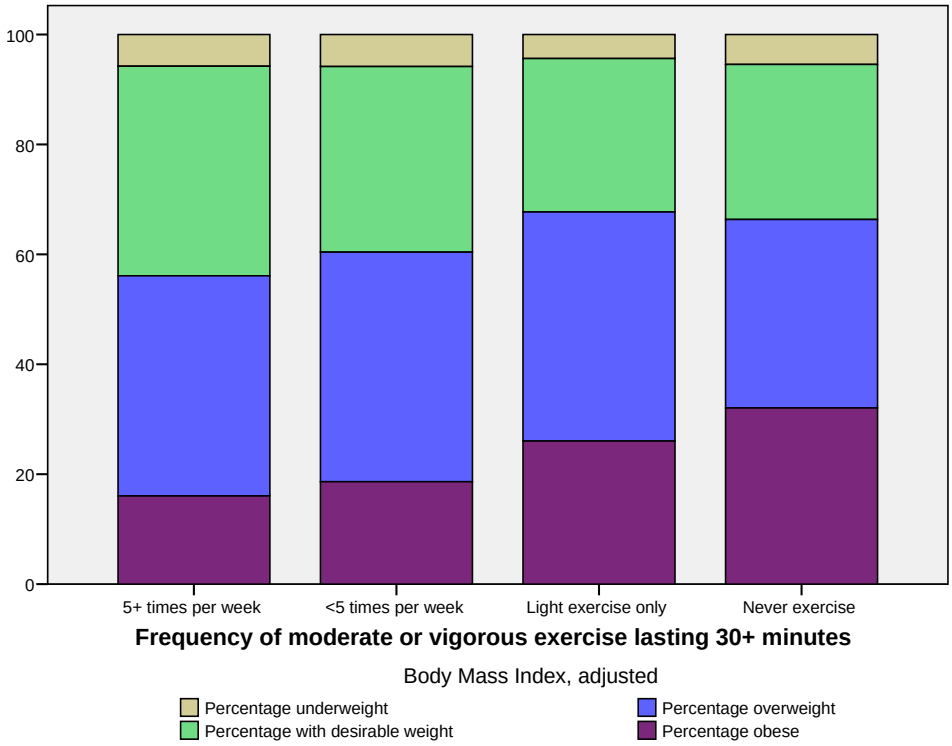
Figure 11: Prevalence of BMI categories by Mental Health Index (unadjusted for age and gender)



Prevalence of BMI categories in relation to exercise and 5-A-DAY

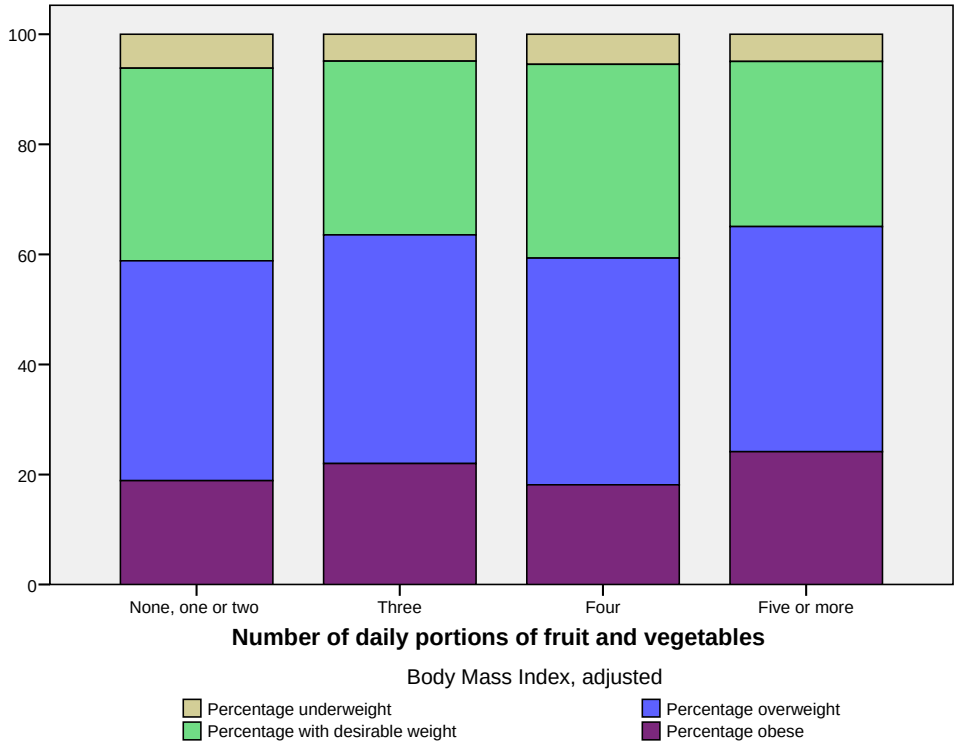
The prevalence of obesity is higher for survey responders who never exercise (32.1%) compared to those who fulfil the national exercise guidelines on weekly exercise levels (16.0%). However, it is very likely that age will be a confounder. The relationship between the prevalence of overweight and obesity combined and exercise levels is less pronounced for obesity alone as survey responders who never exercise have the lowest percentage of people who are classified as overweight (***Figure 12***).

Figure 12: Prevalence of BMI categories by exercise levels (unadjusted for age and gender)



There is no strong trend with the prevalence of overweight and obesity in relation to fruit and vegetable consumption (***Figure 13***). Those eating five or more portions of fruit and vegetables daily have the highest prevalence of obesity (24.1%) compared to those eating zero, one or two portions (18.9%), three portions (22.0%) and four portions (18.1%), but it is likely that this association is confounded with age.

Figure 13: Prevalence of BMI categories by fruit and vegetable consumption (unadjusted for age and gender)



Age-standardised prevalence of BMI categories

In order to examine whether deprivation, education, income, smoking status, physical health status, mental health status, fruit and vegetable consumption and exercise levels have an effect on the prevalence of obesity or overweight, it is necessary to take into consideration gender and especially age. See ***Confounders*** on ***page 59*** and ***Standardisation*** on ***page 60***. For some factors, there was a different pattern for the age-standardised prevalence between men and women, and the adjusted prevalence were presented separately. For other factors, there was a similar pattern in the age-standardised prevalence for men and women, and the age-gender standardised prevalence were presented.

Furthermore, it is possible to predict the percentage of people who are obese or who are overweight or obese for a particular group of individuals (e.g. based on deprivation) in a (logistic regression) model that adjusts for gender and age group. The odds-ratio is the resulting statistic that is produced with a 95% confidence interval (see ***Odds ratio*** on ***page 61*** and ***Confidence interval*** on ***page 61***). The odds-ratios are given in the ***Appendix*** on ***page 62***. A statistical test has been undertaken as part of the logistic regression model analysis, and it is possible from this test to state whether the age-adjusted or age-gender-adjusted prevalence of obesity or prevalence of overweight and obesity combined are significantly different[8] among different groups of people (see ***Significance testing*** on ***page 59***).

As mentioned earlier, simply because there is a statistically significant difference in the prevalence of obesity between different groups of individuals (e.g. those with no disability compared to those with severe disability) does ***not*** imply that there is causality. Furthermore, even if there is causality, it can run in either direction. For example, people who are obese may be more likely to be classified as having a severe disability due to their obesity and poorer health. However, people with severe disability may be more likely to become obese as they may exercise less than more able people.

[8] Even if there were no underlying differences in the overall population, one would expect slight variations in the prevalence among different groups of people in the sample of survey responders just through chance and random variation. Significance testing is a way to assess how likely the difference is due to chance and how likely the difference is due to some underlying difference. However, even if the difference is statistically significant among the groups, it could still be not important epidemiologically if the prevalence is high for all groups, and the aim is to reduce the prevalence to set levels for all.

Age-standardised prevalence of BMI categories in relation to measures of deprivation

The age-standardised percentage of people who were classified as obese (***Figure 14***; ***Table 5***) was statistically significantly higher in the most deprived local quintile (26.6%) compared to the least deprived local quintile (17.7%). There were only small differences in the prevalence of overweight and obesity combined, with the percentages ranging from 57.6% to 61.3% in the least deprived four quintiles and only very marginally higher in the most deprived quintile (65.4%), and these differences were not statistically significant.

Figure 14: Age-gender standardised prevalence of BMI categories by deprivation

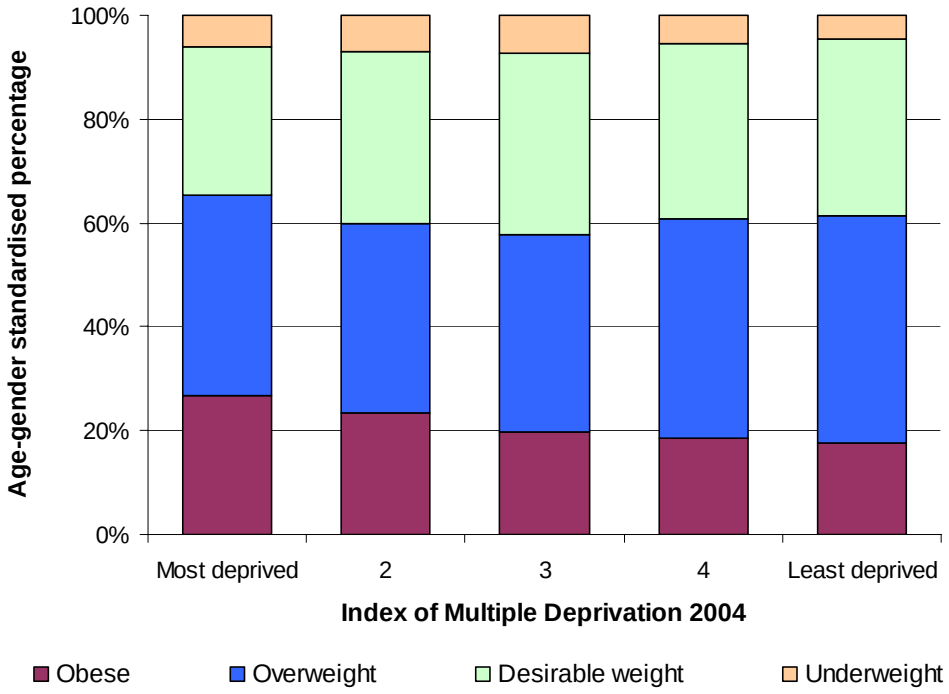


Table 5: Age-gender standardised prevalence of BMI categories in relation to deprivation

Index of Multiple Deprivation 2004 local quintile	Age-gender standardised percentages			
	Underweight	Desirable weight	Overweight	Obese
Most deprived	6.0	28.6	38.8	26.6
2	7.1	33.2	36.2	23.5
3	7.2	35.2	37.9	19.8
4	5.4	33.7	42.3	18.5
Least deprived	4.6	34.1	43.7	17.7

The association between the age-standardised prevalence of overweight and obesity and estimated household after tax income differed between men and women, so are illustrated in ***Figure 15*** and ***Table 6*** for and women separately. There was no statistically significant difference in the percentage of men or women who were obese, but there was a statistically significant difference in the percentage of men who were overweight or obese between the lowest and highest income categories.

Figure 15: Age-standardised prevalence of BMI categories by income

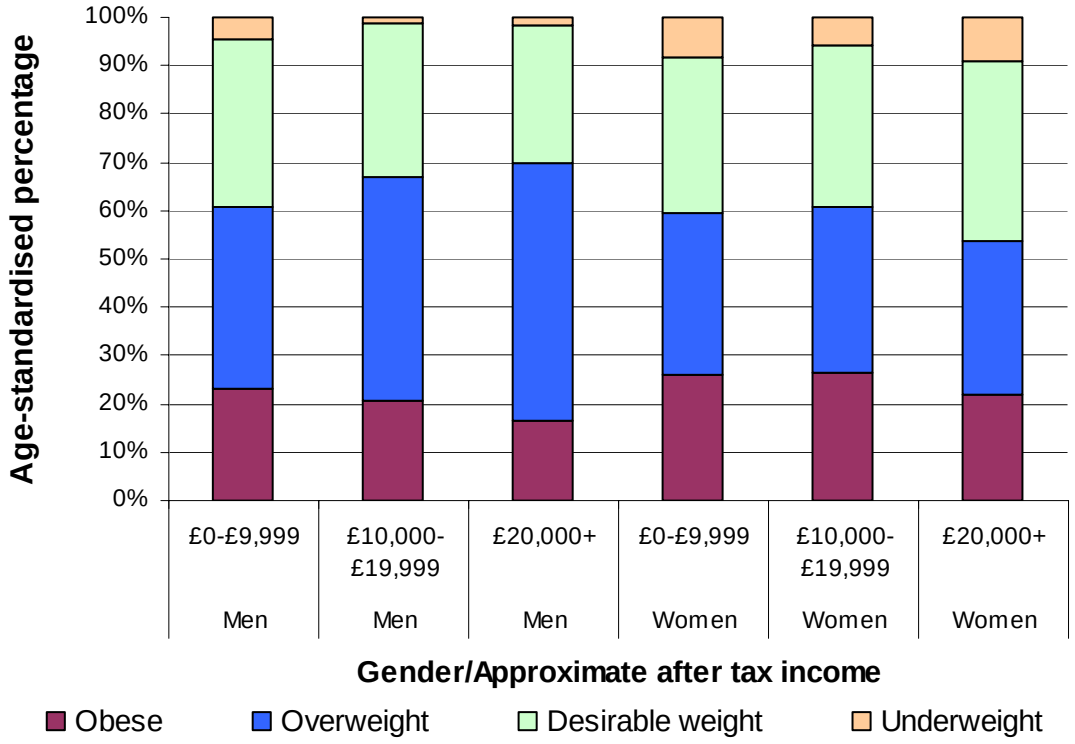


Table 6: Age-standardised prevalence of BMI categories in relation to income

Gender	Est household after tax income	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	£0-£9,999	4.6	34.9	37.5	23.1
	£10,000-£19,999	1.4	31.9	46.1	20.7
	£20,000+	1.6	28.5	53.5	16.4
Women	£0-£9,999	8.3	32.2	33.7	25.8
	£10,000-£19,999	5.7	33.6	34.3	26.4
	£20,000+	8.0	33.5	28.2	19.6

There was no statistically significant difference in the age-standardised prevalence of obesity for people with no qualifications or basic qualifications compared to those with a HNC, degree or higher degree qualification (***Figure 16***; ***Table 7***). However, there was a statistically significant difference in the adjusted percentage of women who were overweight or obese. Nevertheless, the prevalence of overweight and obesity for those with a degree or higher qualification was still high and needs to be addressed.

Figure 16: Age-standardised prevalence of BMI categories by highest educational attainment

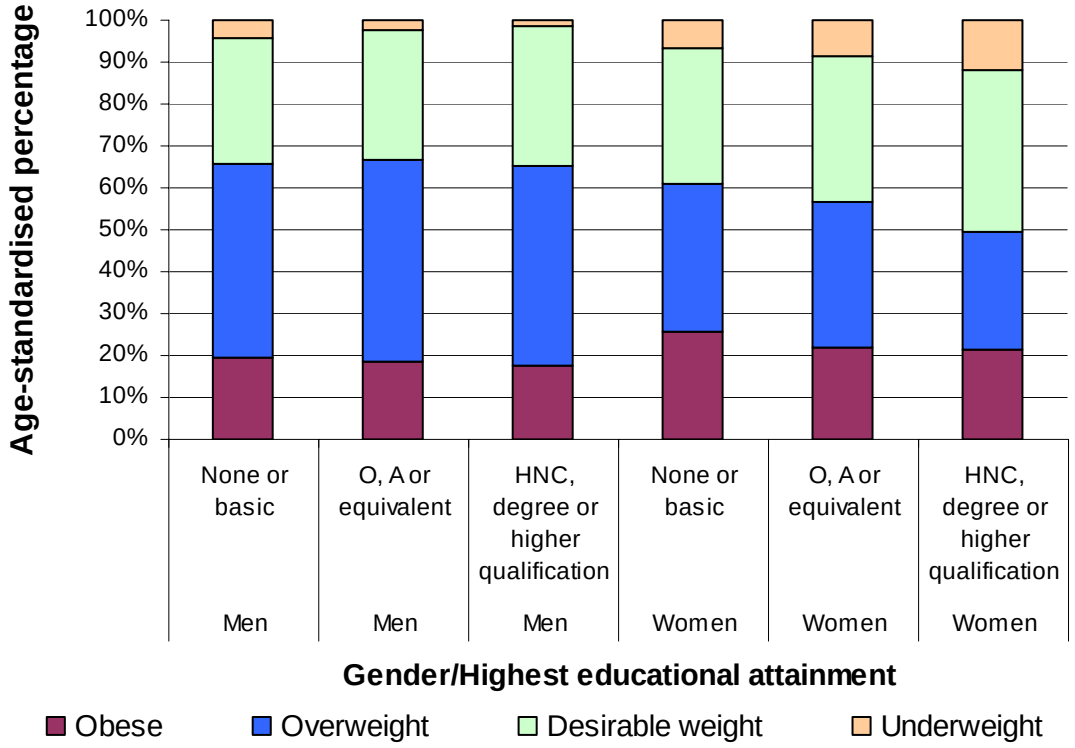


Table 7: Age-standardised prevalence of BMI categories in relation to highest educational attainment

Gender	Highest educational attainment	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	None or basic	4.4	30.2	45.9	19.6
	O, A or equivalent	2.6	30.8	48.1	18.5
	HNC, degree or more	1.5	33.1	48.0	17.4
Women	None or basic	6.5	32.5	35.1	25.9
	O, A or equivalent	8.5	34.8	34.8	22.0
	HNC, degree or more	11.8	38.8	28.0	21.4

Age-standardised prevalence of BMI categories in relation to smoking status

In men, relative to never smokers, the age-standardised prevalence of obesity was significantly higher for former smokers, but there was no difference between rates for never smokers and current smokers (***Figure 17***; ***Table 8***). This could be that the ex-smokers have put on weight after they have quit smoking, or had put on weight whilst smoking and became overweight with effects on their health which encouraged them to quit, but without reducing their weight. However, the effects are less marked in the women (and not statistically significant). For men, relative to current smokers, ex-smokers and never smokers were more likely to be overweight or obese (and the differences were statistically significant). There was no statistically significant difference in the adjusted percentage obese or overweight and obese combined for women.

Figure 17: Age-standardised prevalence of BMI categories by smoking status

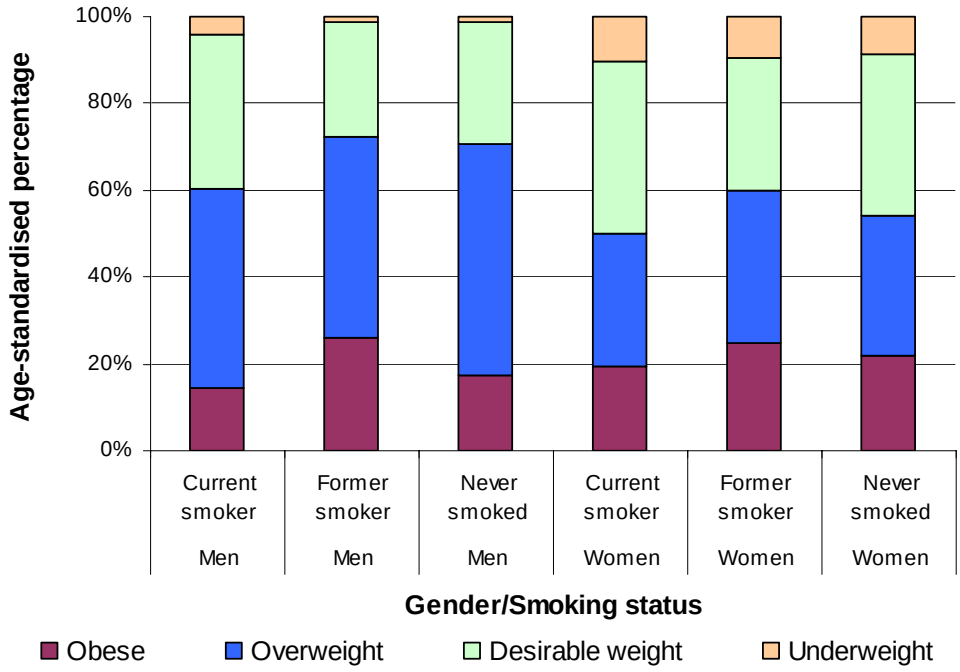


Table 8: Age-standardised prevalence of BMI categories in relation to smoking status

Gender	Smoking status	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	Current smoker	4.3	35.4	45.8	14.6
	Former smoker	1.4	26.1	46.4	26.1
	Never smoked	1.3	28.2	53.3	17.3
Women	Current smoker	10.3	39.8	30.4	19.4
	Former smoker	9.5	30.7	35.1	24.8
	Never smoked	8.5	37.5	31.9	22.1

Age-standardised prevalence of BMI categories in relation to Locality of residence

For men, there was no significant difference in the age-standardised percentage who were obese or in the percentage who were overweight or obese among the three Localities (***Figure 18***; ***Table 9***). However, for women, the adjusted prevalence of obesity was higher in North Locality compared to East Locality, and whilst the difference was statistically significant, the prevalence was relatively high in all three Localities and needs to be addressed. There was no difference in the prevalence of overweight and obesity combined for women among the three Localities.

Figure 18: Age-standardised prevalence of BMI categories by Locality

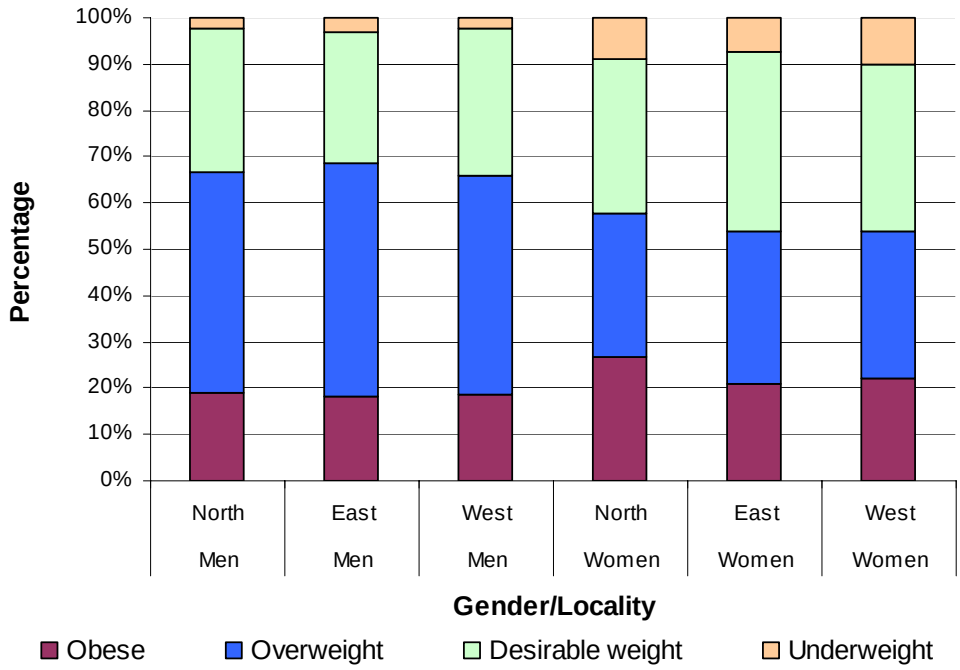


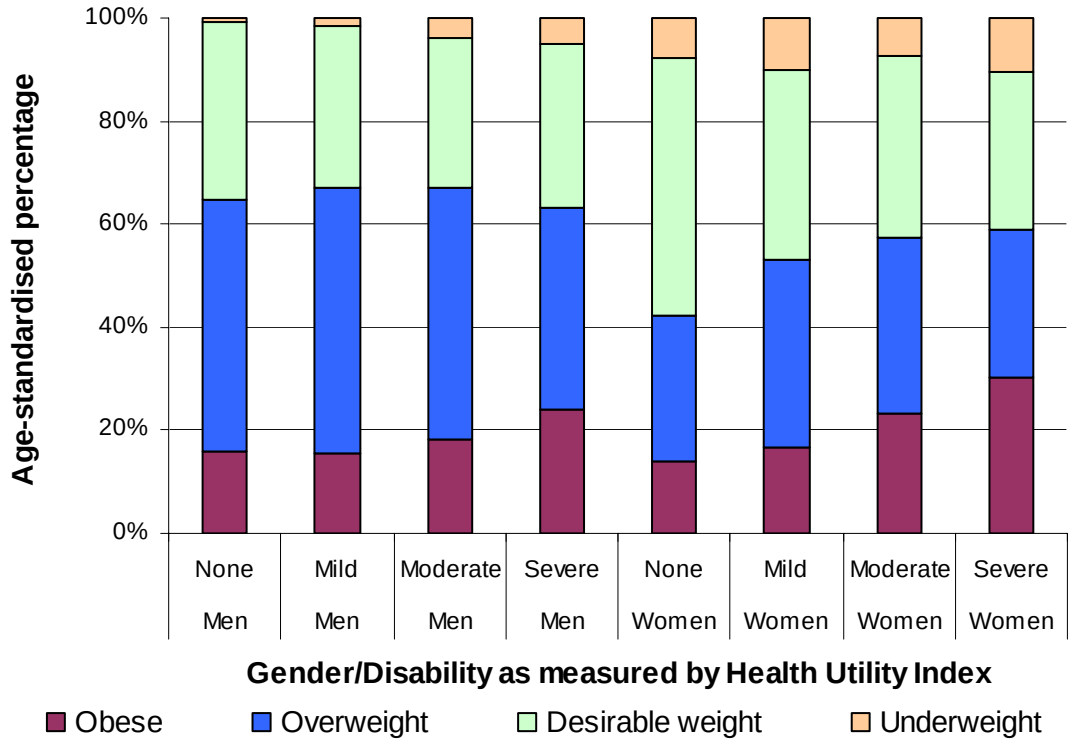
Table 9: Age-standardised prevalence of BMI categories in relation to Locality

Gender	Locality	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	North	2.2	31.0	47.8	19.0
	East	3.0	28.6	50.3	18.1
	West	2.4	31.5	47.3	18.8
Women	North	8.9	33.3	31.1	26.7
	East	7.4	38.8	32.9	20.8
	West	10.2	36.0	31.8	22.1

Age-standardised prevalence of BMI categories in relation to measures of physical and mental health

For men, there is relatively small difference in the age-standardised prevalence of overweight and obesity combined among the levels of disability as classified by the Health Utility Index (see ***page 13***)[9], but the prevalence of obesity alone was slightly higher (and statistically significant) in men with severe disability compared to men with no disability (***Figure 19***; ***Table 10***). For women, the adjusted percentages obese and the percentages overweight and obese combined were statistically significant with the prevalence higher for those with severe disability compared to those with no disability. It would be expected that people who are morbidly obese would have increased disability because of their obesity. It is interesting that the pattern is different for women, and there is no clear explanation of why this might be the case. It is possible that severe disability in women results from different components compared to men (as defined on basis of vision, hearing, etc as well as mobility, cognition), which affects emotion and/or exercise levels which could have an influence on obesity. It is also possible that women could limit their exercise with severe disability, but men continue to exercise or obtain exercise if they have a physically active job.

Figure 19: Age-standardised prevalence of BMI categories by disability as classified from the Health Utility Index



[9] Disability based on the Health Utility Index uses information combined for a number of health attributes: vision; hearing; speech; mobility; dexterity; self-care; emotion; cognition; and pain and discomfort.

Table 10: Age-standardised prevalence of BMI categories in relation to disability as classified from the Health Utility Index

Gender	Disability based on Health Utility Index	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	None	0.9	34.6	48.8	15.8
	Mild	1.4	31.6	51.4	15.6
	Moderate	4.0	29.1	48.8	18.1
	Severe	5.1	31.6	39.4	23.9
Women	None	7.6	50.2	28.0	14.1
	Mild	10.1	36.9	36.2	16.8
	Moderate	7.2	35.6	33.8	23.4
	Severe	10.4	30.7	28.7	30.2

The age-standardised prevalence of obesity and the adjusted prevalence of overweight and obesity are both statistically significantly different among those with different levels of general health for both men and women (***Figure 20***; ***Table 11***). People who are obese will be more likely to have poorer health, and people with poorer health will probably exercise less, which could influence their weight.

Figure 20: Age-standardised prevalence of BMI categories by general health

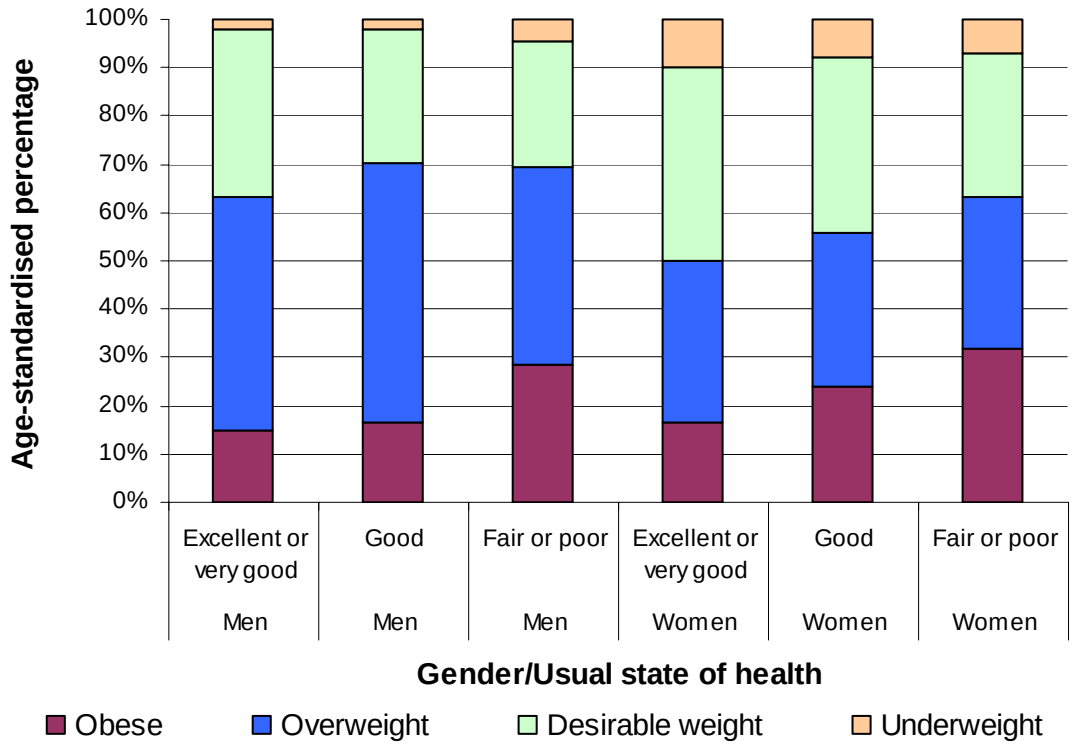


Table 11: Age-standardised prevalence of BMI categories in relation to general health

Gender	General health	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	Excellent/very good	2.1	34.5	48.2	15.1
	Good	1.9	27.8	53.8	16.5
	Fair or poor	4.5	26.0	41.0	28.4
Women	Excellent/very good	10.0	40.1	33.5	16.3
	Good	7.9	36.3	31.8	24.0
	Fair or poor	7.2	29.8	31.1	32.0

People with a long-term illness or disability which limits daily activities are more likely to be obese for men and women, and more likely to be overweight or obese for women (***Figure 21***; ***Table 12***). The differences are statistically significant. There is no difference in the adjusted prevalence of overweight and obesity combined for men between those with and without long-term illnesses or disabilities which limit their daily activities.

Figure 21: Age-standardised prevalence of BMI categories by limiting long-term illness or disability

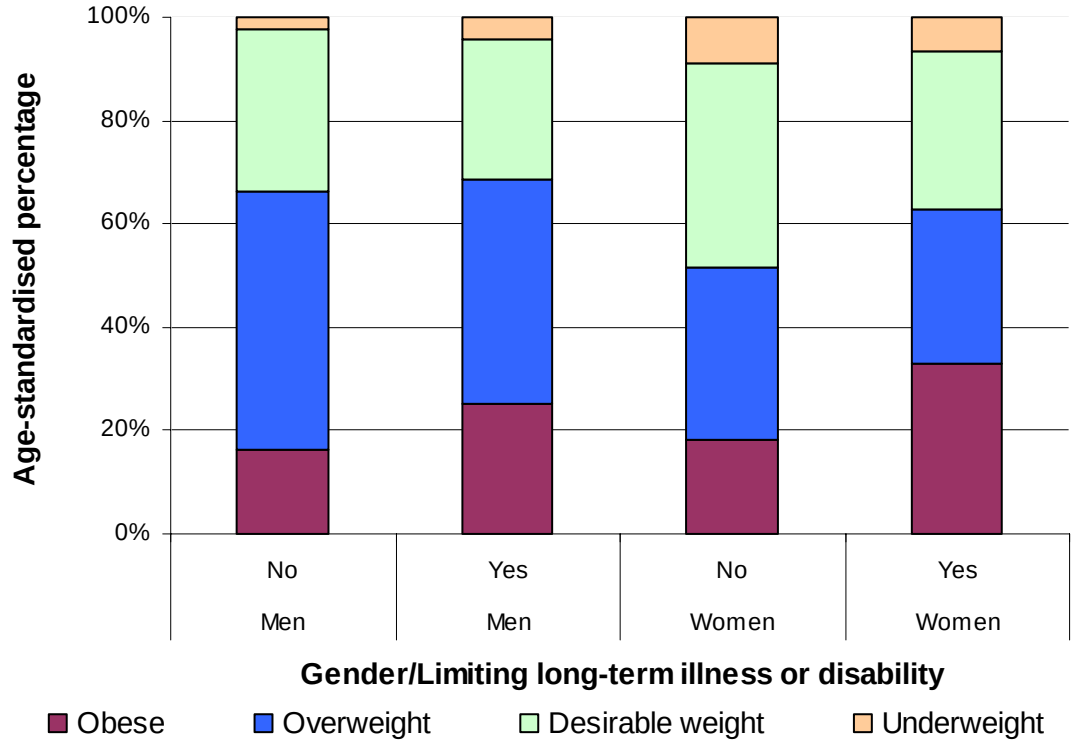


Table 12: Age-standardised prevalence of BMI categories in relation to limiting long-term illness or disability

Gender	Long-term illness or disability that limits daily activities	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	No	2.2	31.6	49.9	16.3
	Yes	4.2	27.1	43.5	25.1
Women	No	9.0	39.3	33.3	18.3
	Yes	6.6	30.4	30.0	33.0

The emotion component of the Health Utilities Index has been examined in relation to the age-standardised prevalence of obesity (***Figure 22***; ***Table 13***). The numbers of people in the "so unhappy that life is not worthwhile" category are small so this category has been combined with the "very unhappy" category. There are relatively small differences in the age-standardised prevalence of obesity and the adjusted prevalence of overweight and obesity for both men and women among the categories, with none of the differences statistically significant.

Figure 22: Age-standardised prevalence of BMI categories by emotion component of Health Utility Index

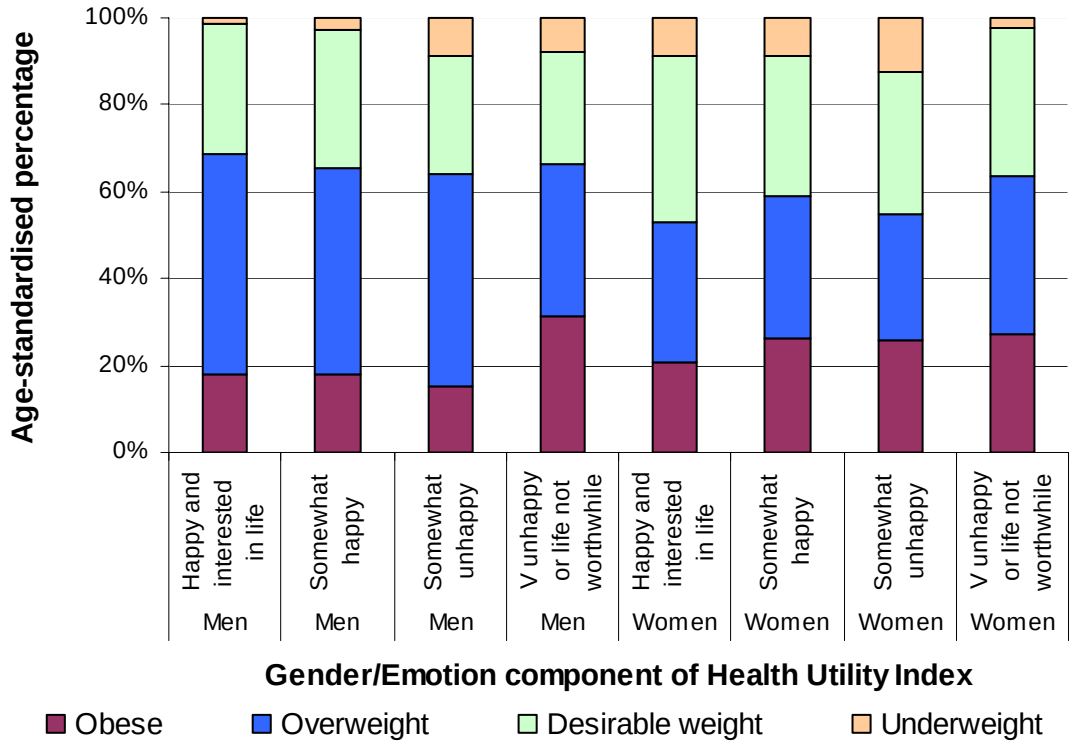


Table 13: Age-standardised prevalence of BMI categories in relation to emotion component of Health Utility Index

Gender	Emotion component of Health Utility Index	Age-standardised percentages			
		Under-weight	Desirable weight	Over-weight	Obese
Men	Happy & interested in life	1.5	29.8	50.6	18.1
	Somewhat happy	2.8	31.6	47.8	17.8
	Somewhat unhappy	9.0	26.8	49.2	15.1
	V unhappy/life not worthwhile	8.0	25.7	35.0	31.3
Women	Happy & interested in life	8.6	38.4	32.5	20.5
	Somewhat happy	8.9	32.2	32.8	26.1
	Somewhat unhappy	12.5	32.7	28.9	25.9
	V unhappy/life not worthwhile	2.5	34.1	36.2	27.2

The age-standardised prevalence of obesity is slightly higher for those with poorer mental health as defined arbitrarily of having a score of 60 or less on the Mental Health Index for women (***Figure 23***; ***Table 14***). This difference is statistically significant with women with a Mental Health Index score of 0-75 denoting poorer mental health being more likely to be obese compared to women with a Mental Health Index score of 86-100 denoting the best mental health. There was no significant difference for men or for the adjusted prevalence of overweight and obesity combined for either men or women.

Figure 23: Age-standardised prevalence of BMI categories by Mental Health Index

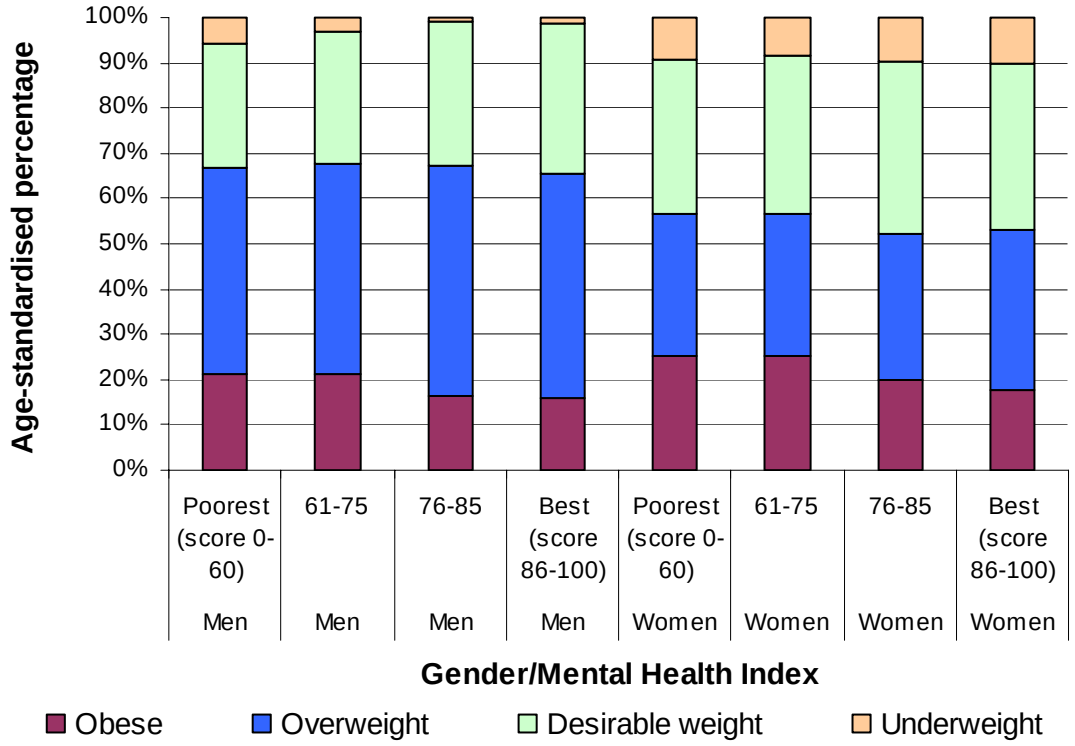


Table 14: Age-standardised prevalence of BMI categories in relation to Mental Health Index

Gender	Mental Health Index	Age-standardised percentages			
		Underweight	Desirable weight	Overweight	Obese
Men	Poorest (score 0-60)	5.9	27.4	45.4	21.4
	61-75	3.3	29.2	46.1	21.4
	76-85	0.9	31.9	50.8	16.4
	Best (score 86-100)	1.1	33.4	49.4	16.1
Women	Poorest (score 0-60)	9.2	34.2	31.4	25.2
	61-75	8.3	35.1	31.3	25.3
	76-85	9.5	38.4	32.1	19.9
	Best (score 86-100)	10.0	36.9	35.6	17.5

Age-standardised prevalence of BMI categories in relation to exercise and 5-A-DAY

The patterns of overweight and obesity in relation to exercise levels were similar for men and women, so the information for men and women have been combined with the age-gender standardised prevalence given in ***Figure 24*** and ***Table 15***. There was a statistically significant difference in the prevalence of obesity among the categories, but no significant difference in the prevalence of overweight and obesity combined.

Figure 24: Age-gender standardised prevalence of BMI categories by exercise

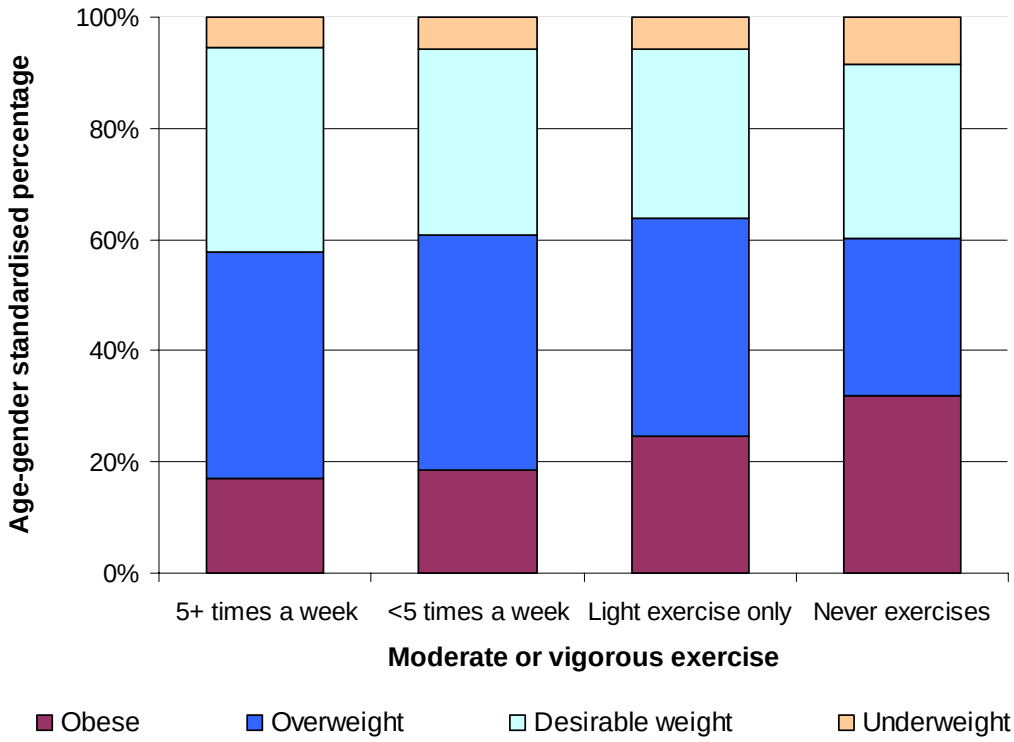
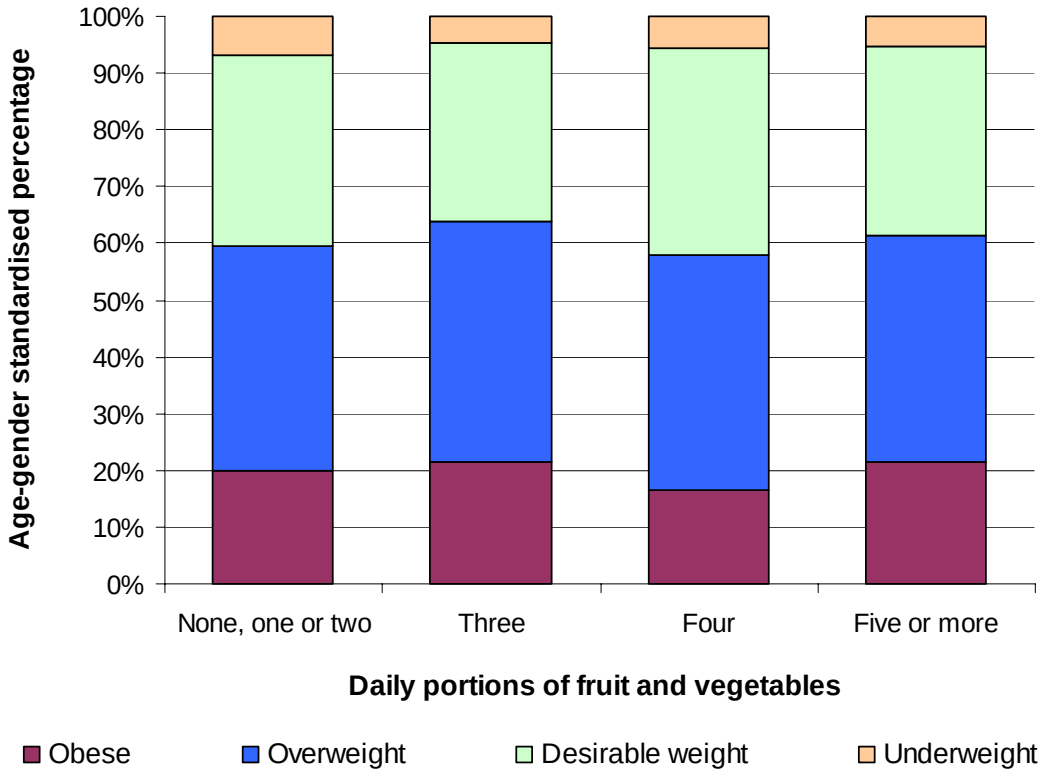


Table 15: Age-gender standardised prevalence of BMI categories in relation to exercise levels

Moderate or vigorous exercise of 30+ minutes	Age-standardised percentages			
	Underweight	Desirable weight	Overweight	Obese
5+ times a week	5.6	36.5	40.8	17.1
<5 times a week	5.8	33.3	42.2	18.6
Light exercise only	5.8	30.4	39.1	24.7
Never exercises	8.5	31.4	28.2	31.9

The age-standardised prevalence of obesity was also examined in relation to the number of portions of fruit and vegetables combined (***Figure 25***; ***Table 16***). The information for men and women were combined as the pattern was similar for both genders. There was little difference in the age-gender-standardised prevalence of obesity or overweight among the four categories[10] with the prevalence of obesity being slightly lower for those eating four portions of fruit and vegetables daily. There is no particular reason why this might be the case, and it is likely to be just random variation.

Figure 25: Age-gender standardised prevalence of BMI categories by 5-A-DAY



[10] The four categories were chosen as approximately similar number of survey responders were classified in each of the categories.

Table 16: Age-gender standardised prevalence of BMI categories in relation to 5-A-DAY

Daily portions of fruit and vegetables	Age-standardised percentages			
	Underweight	Desirable weight	Overweight	Obese
None, one or two	6.9	33.8	39.6	19.8
Three	4.7	31.6	42.3	21.5
Four	5.7	36.3	41.4	16.5
Five or more	5.4	33.2	39.8	21.6

Summary of statistically significant differences in the age-standardised prevalence of obesity and overweight and obesity among groups

The following factors influence obesity after adjusting for age:

- deprivation (those living in most deprived two local quintiles more likely to be obese than least deprived quintile);
- exercise (those who only undertook light exercise or never exercised were more likely to be obese compared to those who fulfilled the national exercise guidelines);
- smoking in men (male former smokers more likely to be obese compared to never smokers);
- Locality in women (women living in North more likely to be obese compared to those in East);
- disability as mentioned on the Health Utility Index (men and women with severe disability and women with moderate disability more likely to be obese compared to those with no disability);
- usual health (men and women with fair or poor health and women with good health were more likely to be obese compared to those with excellent or very good health);
- limiting long-term illness or disability (men and women with long-term illness or disability which limited daily activities more likely to be obese compared to those with no such illness or disability);
- mental health in women (women with poorer mental health (score of 0-75) were more likely to be obese compared to those with the best mental health (score 86-100)).

The following factors influence overweight and obesity after adjusting for age:

- income in men (men with the after tax household incomes of £20,000+ were more likely to be overweight or obese compared to those with incomes less than £10,000);
- qualifications in women (women with O levels, A levels or equivalent or with none or basic qualifications were more likely to be overweight or obese compared to those with degrees or higher qualifications);
- smoking in men (former and never smokers were more likely to be overweight or obese compared to current smokers);
- disability as mentioned on the Health Utility Index in women (women with moderate or severe disability more likely to be overweight or obese compared to those with no disability);
- usual health (men and women with good, fair or poor health were more likely to be overweight or obese compared to those with excellent or very good health);
- limiting long-term illness or disability in women (women with long-term illness or disability which limited daily activities more likely to be overweight or obese compared to those with no such illness or disability).

Exercise and age

Overall, just over a quarter of people exercised sufficiently to fulfil the national recommended guidelines (see ***page 6***), 42% exercised moderately or vigorously but did not fulfil the guidelines, 24% only undertook light exercise and 8% never exercised. As expected, exercise levels differed with age. Younger survey responders were more likely to exercise compared to older survey responders, and men were more likely to exercise compared to women although gender differences reduced as age increased. ***Table 17*** gives the number and percentage of survey responders by level of exercise for different age groups. Over 40% of men aged 18-34 years fulfilled the national recommended guidelines for exercise but this fell to 5.1% for men aged 75+ years, whereas just over 30% of women aged 18-34 years, whereas just over 30% of women aged 18-34 years exercised moderately or vigorously for 30+ minutes five or more times a week and this fell to 6.6% for those aged 75+ years. The percentage of survey responders who never exercised increased with age; the percentage was only 3.8% for men and 1.9% for women aged 18-24 years but increased to 19% for both men and women aged 75+ years. Exercise levels are also summarised in ***Figure 26*** and ***Figure 27*** for men and women respectively.

Table 17: Frequency of undertaking exercise

Gender	Age (yrs)	Number of survey responders	Percentage by frequency of undertaking exercise			
			Fulfils national recommendations	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
Men	18-24	292	46.9	39.4	9.9	3.8
	25-34	364	41.5	42.9	9.3	6.3
	35-44	377	35.3	45.9	12.5	6.4
	45-54	286	23.4	45.1	21.0	10.5
	55-64	246	16.7	39.4	29.3	14.6
	65-74	221	12.2	39.8	35.7	12.2
	75+	178	5.1	31.5	44.4	19.1
	Total	**1,964**	**28.8**	**41.4**	**20.4**	**9.4**
Women	18-24	269	31.6	54.3	12.3	1.9
	25-34	374	35.0	48.7	13.2	3.2
	35-44	374	29.9	48.1	16.6	5.3
	45-54	319	24.5	42.0	25.4	8.2
	55-64	301	17.3	39.5	34.2	9.0
	65-74	245	10.6	29.4	49.4	10.6
	75+	183	6.6	18.6	55.7	19.1
	Total	**2,065**	**24.0**	**42.0**	**26.7**	**7.3**

Figure 26: Frequency of undertaking exercise in men

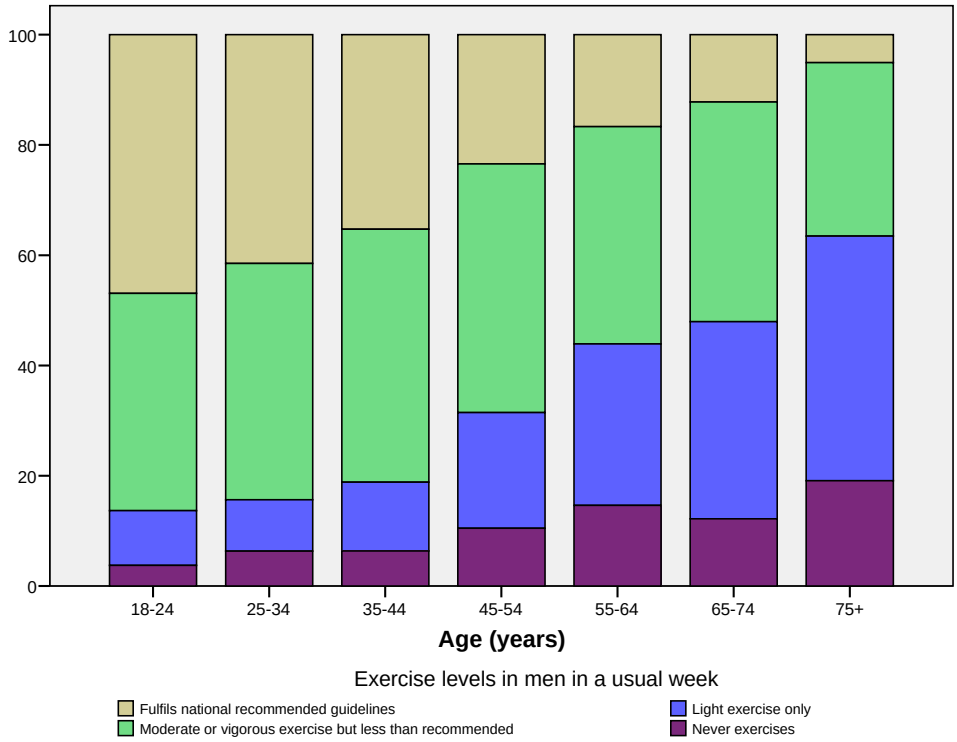
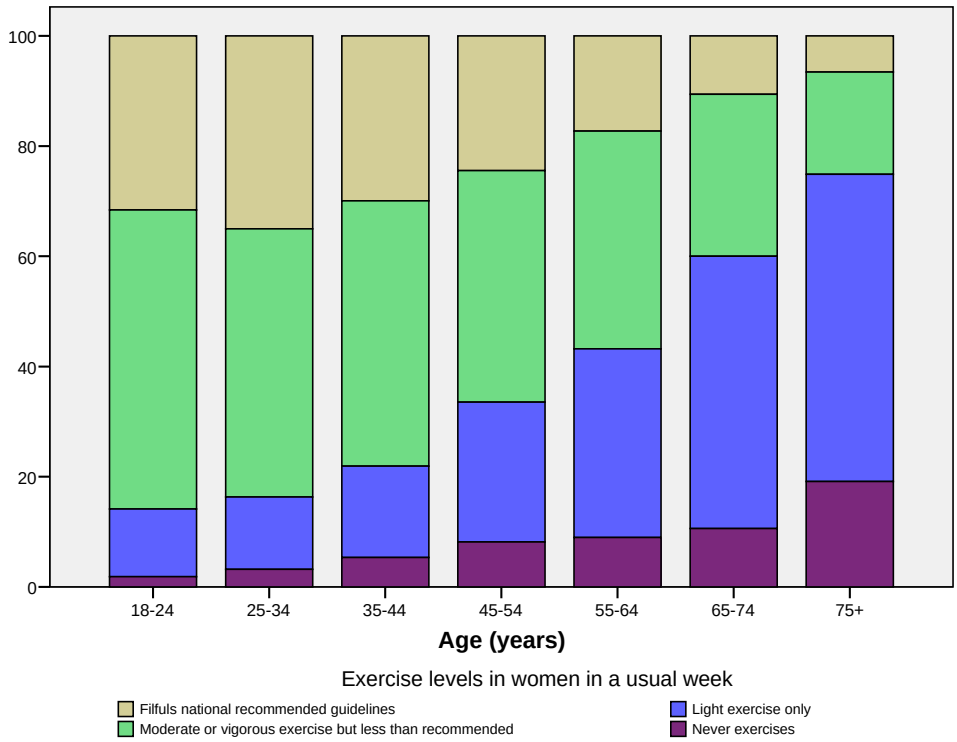


Figure 27: Frequency of undertaking exercise in women



Exercise levels in comparison with England

The Health Survey for England conducted during 2004 collected information on the level of physical activity undertaken. ***Figure 28*** and ***Figure 29*** compare the percentage of people achieving the national recommended exercise guidelines in England and in Hull for men and women respectively. The ages of survey responders differs slightly between the surveys. The youngest survey responders in the Health Survey for England are aged 16-24 years whereas the youngest survey responders in the local health and lifestyle survey are aged 18-24 years. This is unlikely to make a great deal of difference, although some of those aged 16-17 years may be at school and participating in sport at school. It can be seen that the percentage achieving the national exercise guidelines are lower in Hull for men for all age groups and women for most age groups with the only exceptions in the 25-34 year and 75+ year age groups for women.

Figure 28: Percentage of men fulfilling national recommended exercise guidelines, England and Hull

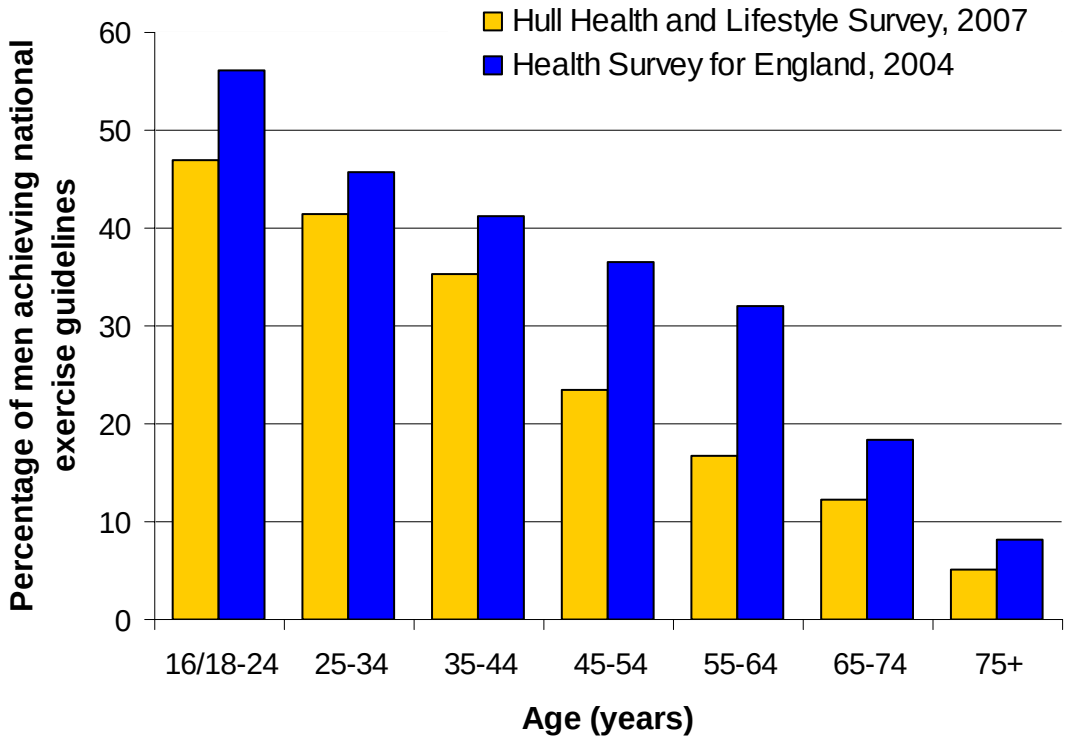
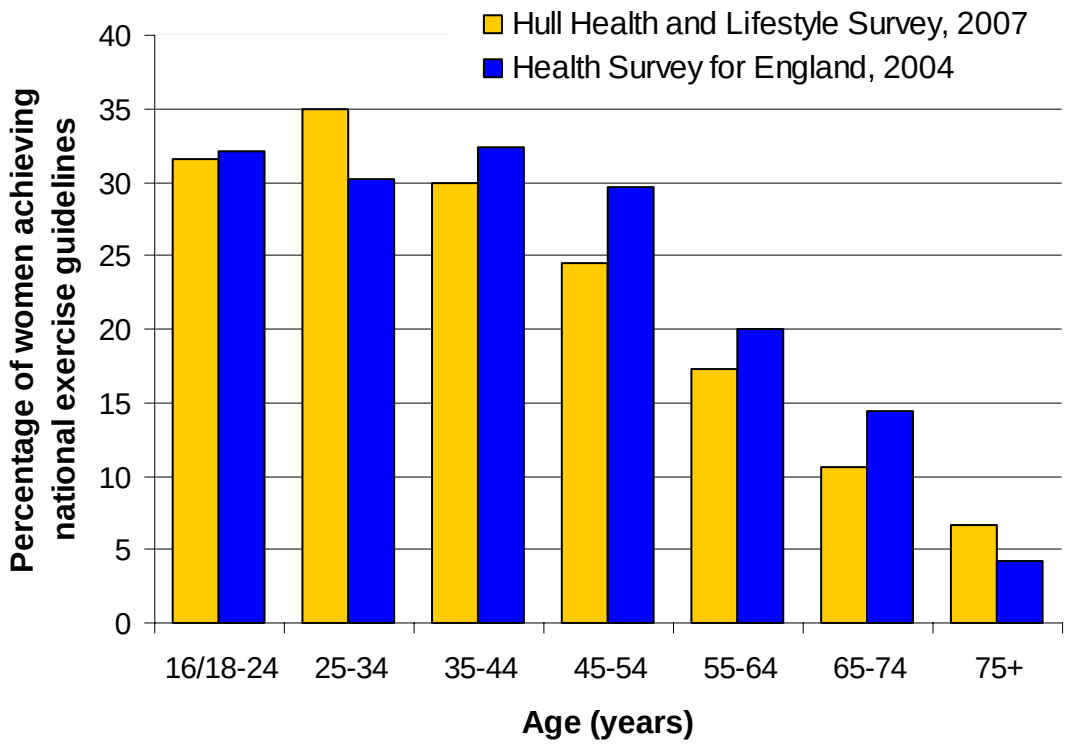


Figure 29: Percentage of women fulfilling national recommended exercise guidelines, England and Hull



Exercise trends over time

It is difficult to compare the trends over time in Hull as there has only been one previous health and lifestyle survey during 2003 which used a different survey methodology (postal survey rather than quota sampling survey with personal contact) and the question on exercise was slightly different (periods of exercise of 20 minutes or more not 30 minutes or more and frequency combined three or four times with five or more times). It is not possible to examine the percentage of people undertaking periods of 20 minutes or 30 minutes of moderate or vigorous exercise five or more occasions a week as only "three or more times per week" was used in the 2003 health and lifestyle survey. However, comparisons can be made in relation to the specific components of the exercise questions (frequency of vigorous, moderate and light exercise).

For men, the percentage undertaking vigorous exercise is similar between the 2003 and 2007 surveys particularly for those aged 18-34 years. For the 35-54 year age group for men, it appears that there has been a slight shift towards more men exercising vigorously with the number exercising at this level three or more times per week remaining unchanged, but the percentage exercising once or twice per week increasing with a resulting lower percentage never exercising vigorously. The percentage of men aged 65+ years who exercise vigorously is low, but there has been a small shift towards increasing levels of exercise at a vigorous level. Correspondingly, the percentage of men who never exercise has fallen. This is despite the different definitions, and if the

same definition was used for both surveys it is possible that this improvement would be greater. In the previous survey, 3.5% of men aged 65-74 years had exercised on three or more sessions of 20 minutes or more in the previous week, but this increased to 8.7% for the latest survey and involved exercising, in an average week, for sessions involving 30 minutes or more. The figures for men aged 75+ increased from 1.4% to 3.8%. As well as the change in the duration of the sessions, it is possible that the reference time period had an influence on the results. The previous survey asked about exercise undertaken for last week, but the current survey asked about exercise undertaken in a 'usual week'. It is possible that survey responders overestimate their exercise levels when asked about exercising in a usual week. Their usual intentions regarding exercising may influence their response.

For men, in relation to moderate exercise levels, there is no clear pattern across the age groups over time, although for most age groups, there appears to be a reduction in the levels of moderate exercise. This could be because slightly more are exercising vigorously.

For men, there appears to be a higher percentage undertaking light exercise three or more times a week in 2007 compared to 2003. It is possible that as there has been more recent publicity about the benefits of walking, that people are more likely to classify the walking that they undertake as exercise in 2007 and they might not have done so as readily during the 2003 survey. Furthermore, it becomes difficult to interpret light exercise given the previous questions about vigorous and moderate exercise. It is possible that the frequency of exercise does not change, and due to busy lifestyles and time constraints on available time to exercise this may be a reasonable assumption for many people. However, within the exercise that is undertaken, the intensity of the exercise could be higher with people classifying their exercise as moderate rather than light. Therefore, it is not necessarily a bad thing if the frequency of light exercise decreases over time, depending on the changes in the frequency of moderate and vigorous exercise.

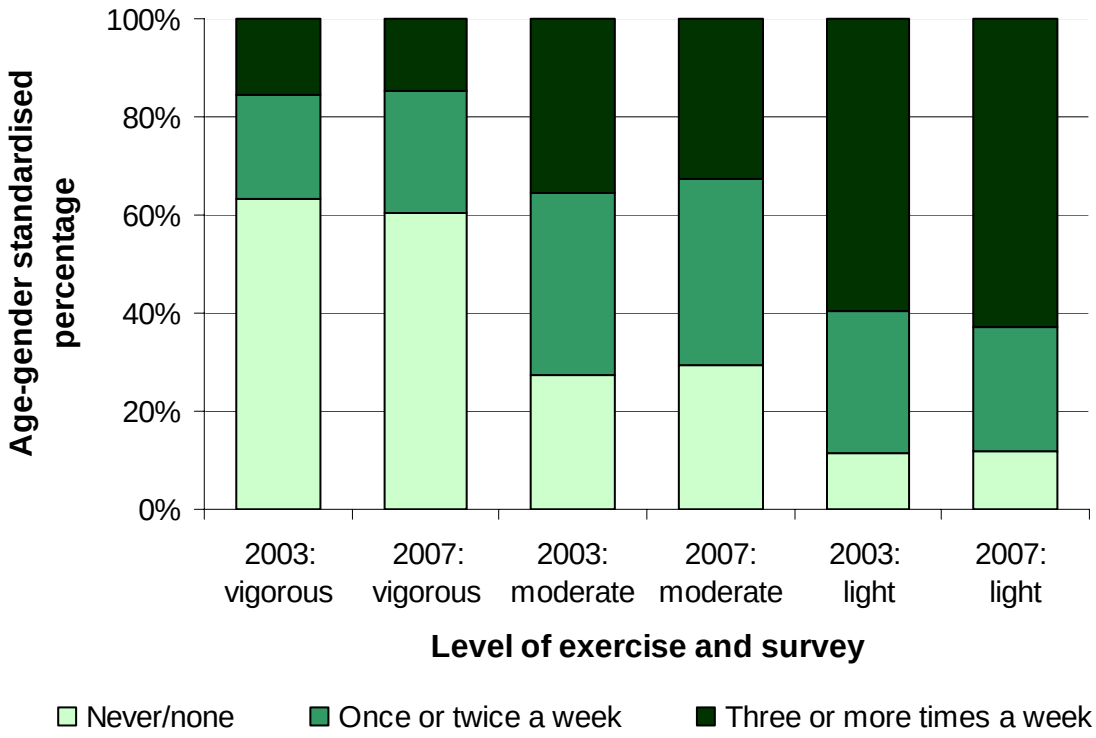
For women aged 18-34 years, there appears to be a slight increase in the percentage exercising at a vigorous level with a slightly higher percentage exercising three or more occasions per week or a slightly lower percentage never exercising vigorously. However, the differences are relatively minor. In the 35-44 year age group, there is little difference between the surveys. For women aged 45-64 years, there is a slight decrease in the frequency of vigorous exercise. This could be due to the differing definitions; some women may exercise for 20 minute sessions at a vigorous level, but not for 30 minutes. For those aged 65+ years, there is a similar pattern to the men, with a small percentage exercising vigorously at this age, but a slightly higher percentage for the current survey compared to the survey conducted during 2003.

As for men, there is no clear pattern for women in relation to moderate exercise, although there is a suggestion that exercise levels might have decreased. Again, this could be because some women particularly those aged 18-34 years are undertaking more vigorous exercise. A similar pattern for light exercise occurs for women as it did

for men, with a suggestion that there is a higher percentage undertaking light exercise more regularly.

Figure 30 gives the age-gender standardised percentages undertaking vigorous, moderate and light exercise. The standardised percentages in general summarise the findings for specific age groups mentioned above reasonably well, in that the percentage never exercising vigorously appears to have reduced slightly, those participating in moderate exercise appears to have reduced slightly and there appears to be a slight increase in the percentage undertaking light exercise three or more times a week. However, as illustrated, the differences are very slight.

Figure 30: Age-gender standardised percentage of survey responders undertaking 20 or 30 minute sessions of vigorous, moderate and light exercise, 2003 versus 2007 survey



Survey responders were classified by their maximum level or intensity of exercise in order to avoid interpreting the information for people who may have changed their intensity of exercise rather than their number of exercise sessions. The same problems with defining the duration of the session remain. Survey responders in the 2003 survey are classified based on the number of exercise session lasting 20 or more minutes whereas survey responders in the most recent 2007 survey are classified based on sessions of 30 minutes or more. Therefore, direct comparison is difficult as it is possible that some people may exercise at a particular level, say vigorously, for 20 minute periods but not for 30 minute periods.

Figure 31 illustrates the percentages of male survey responders by their maximum or highest exercise intensity: never; light; moderate; or vigorous. For most age groups for men, there is a higher percentage of men undertaking vigorous exercise for 30+ minutes in 2007 compared to undertaking 20+ minutes of vigorous exercise in 2003. As a consequence the percentage undertaking moderate or light exercise has generally remained the same or reduced slightly. The percentages reporting that they never undertake any exercise, even light exercise, has remained similar for 2003 and 2007. The percentage who state that they never exercise is generally between 5% and 7% for the younger age groups but increases to around 16% for those aged 75+ years.

Figure 31: Intensity of exercise in men, 2003 versus 2007

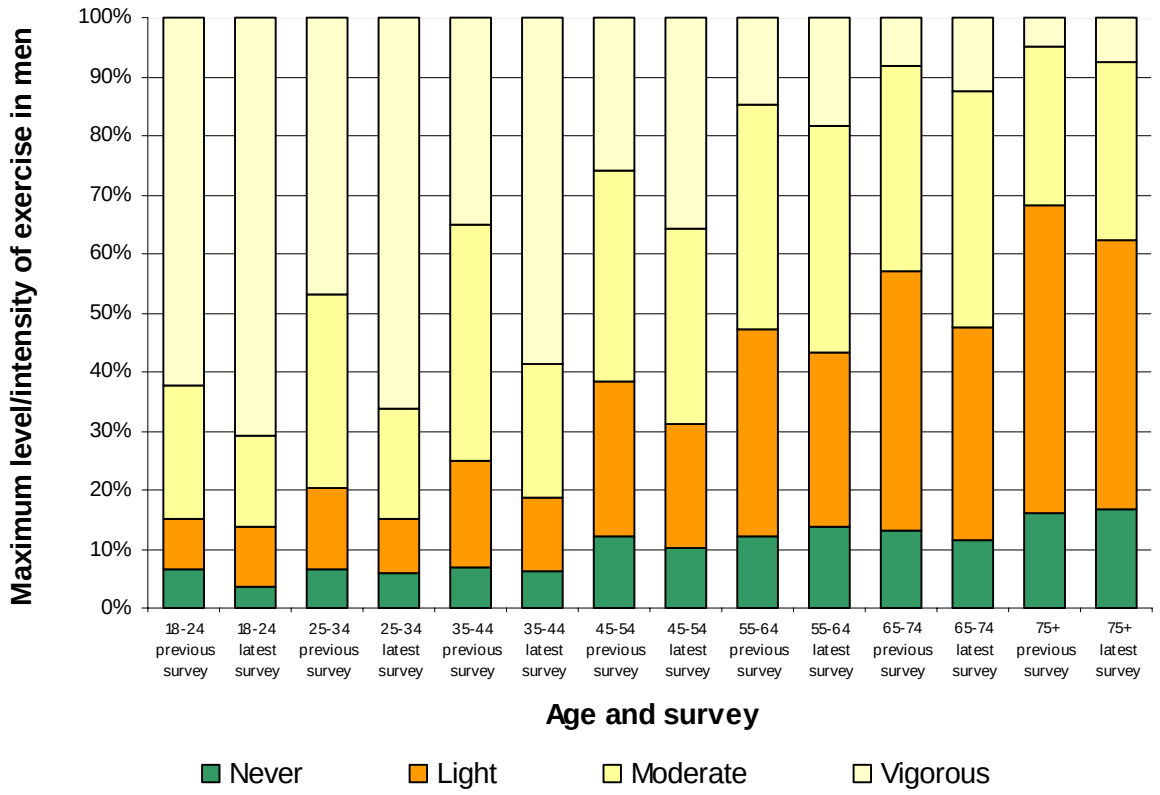
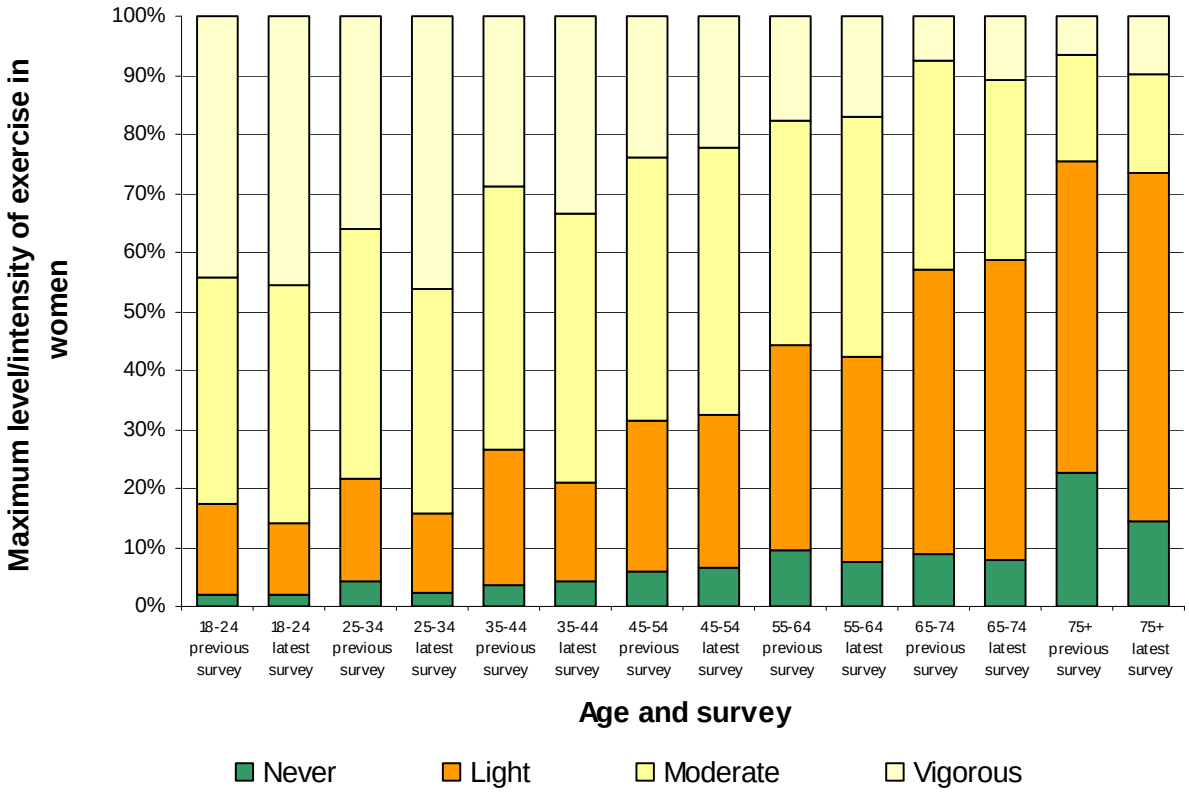


Figure 32 gives the same information for women, and a similar pattern is evident for the women with a slightly higher percentage reporting exercising at a vigorous intensity level for 30+ minutes for the 2007 survey compared to undertaking vigorous exercise for 20+ minutes in the 2003 survey.

Figure 32: Intensity of exercise in women, 2003 versus 2007



For both men and women, this suggests that there could be a slight improvement in terms of exercise levels especially given the stricter definition in terms of the duration of the sessions for the most recent survey. However, it is also possible that the differing definition could influence the findings. The 2003 survey asked for information on exercise for the previous week but the 2007 survey asked about exercise levels in a usual week. As mentioned, earlier it is possible that people could overestimate their 2007 exercise levels as their intentions could influence the results. For example, there may be an intention to go to the gym or undertake a specific exercise class or fitness activity on a specific day of the week, and the survey responder may complete the questions as if they do this every week, but they may only actually go three out of four times. Alternatively, as the 2003 survey asked about exercise levels in the previous week, it is possible that the survey responder has another commitment or was ill, the week before they completed the questionnaire and did undertake their usual levels of exercise. Therefore, it is necessary to treat the comparisons over time cautiously, and not place undue weight on any changes noted.

Exercise levels in relation to measures of deprivation

As well as the prevalence of obesity being associated with age as mentioned above, exercise levels are also associated with age. As there is a strong association between local deprivation quintile and age group, and between exercise and age, this will influence any examination of deprivation and exercise. Age is a so-called *confounder*

(see ***Confounders*** on ***page 59***). More young people from the survey live in the most deprived areas in Hull and a higher percentage of older survey responders live in the least deprived areas (and the association is statistically significant). It would be anticipated that people living in the most deprived areas would exercise less than those living in less deprived areas. However, as younger people exercise more frequently, this could mask or reduce the effect with regard to anticipated lower exercise levels in the most deprived areas.

One solution is to examine the relationship between deprivation and exercise for three different age groups (18-44, 45-64 and 65+ years). For men, in the 18-44 year age group, 37% of men in the most deprived local quintile compared to 45% of men living in the least deprived quintile exercise sufficiently to fulfil the national recommended guidelines (there is a statistically significant trend in the percentages undertaking different levels of exercise from fulfilling guidelines to never over the five deprivation quintiles, p=0.026). For women aged 18-44 years, the percentages are 36% and 27% respectively (and the trend in the percentages for the different exercise levels over the five quintiles is not statistically significant, p=0.7). For men and women combined the differences are not statistically significant (p=0.086).

For men aged 45-64 years, 14% and 19% fulfilled the national exercise guidelines in the most deprived least deprived local quintiles respectively, and there was a statistically significant trend in the percentages undertaking different levels of exercise among the deprivation quintiles (p<0.001). The figures for women were 13% in the most deprived quintile and 22% in the least deprived quintile, which was also statistically significant over the four exercise categories and the deprivation quintiles (p<0.001).

For those aged 65+ years, there was less of a difference for men between the most deprived and least deprived quintiles for those fulfilling the national exercise guidelines (7% and 8% respectively), however, there was a similar pattern as other age groups in that those living in the most deprived areas tended to exercise less frequently. For men, 34% exercised moderately or vigorously in the most deprived quintile compared to 43% in the least deprived quintile, and 27% never exercised in the most deprived quintile compared to 11% in the least deprived quintile. These differences in the percentages over the four exercise categories and the five deprivation quintiles were statistically significant (p=0.004). For women aged 65+ years, 12% in the most deprived quintile and 25% in the least deprived quintile exercised moderately or vigorously but not sufficiently to fulfil the national guidelines whereas 25% in the most deprived quintile never exercised compared to 11% in the least deprived quintile. However, for women the association between the five deprivation quintiles and the four exercises level was not statistically significant in this age group (p=0.1), but were for men and women combined (p=0.001).

Another alternative solution to deal with confounders, is to standardise (as mentioned in the obesity section on ***page 12***). The age-standardised percentages are summarised in ***Figure 33***. There is only a very small difference in the standardised percentages fulfilling the national exercise recommended guidelines across the local deprivation quintiles increasing from 24.5% in the most deprived quintile to 28.4% in the second

least deprived quintile and falling back to 26.7% in the least deprived quintile. The standardised percentage never exercising is 12.2% in the most deprived quintile, 15.7% in the second most deprived quintile reducing to 6.5%, 4.9% and 5.7% in the middle, second least deprived and least deprived quintile respectively. Furthermore, a higher percentage in the most deprived quintile undertake light exercise only compared to the least deprived quintile and a lower percentage undertake moderate or vigorous exercise but less than the national guidelines.

As mentioned in the obesity section, it is also possible to use a logistic regression model to predict the people who never exercise or fulfil the exercise guidelines using age group, gender and the factor of interest (e.g. deprivation). The odds-ratio is the resulting statistic that it produced with a 95% confidence interval (see ***Odds ratio*** on ***page 61*** and ***Confidence interval*** on ***page 61***). The odds-ratios are given in the ***Appendix*** on ***page 62***. A statistical test has been undertaken as part of the logistic regression model analysis, and it is possible from this test to state whether the age-adjusted or age-gender-adjusted prevalence of obesity or prevalence of overweight and obesity combined are significantly different[11] among different groups of people (see ***Significance testing*** on ***page 59***).

Whilst there may be statistically significant differences in the percentages (that are bigger than would be expected from random variation), in most cases, the percentage who fulfil the national exercise guidelines are relatively low. Therefore, in general, exercise levels need to be addressed in most groups regardless of whether the level is significantly lower in a particular group of people. Furthermore, if an association does occur between exercise levels and a particular factor (e.g. deprivation), it does not imply that the relationship is causal. Additionally, even if a relationship is causal, it could work in both directions or be related through another variable (such as health status).

For exercise levels, the pattern across the different factors appears to be reasonably consistent for the different factors examined for males and females, albeit with exercise levels themselves differing slightly as observed in ***Figure 26*** and ***Figure 27***. Therefore, the percentages have been standardised for both age and gender.

Age-standardised prevalence of exercise levels in relation to measures of deprivation

Figure 33 and ***Table 18*** give the age-gender standardised percentages of people exercising to different levels based on their local deprivation quintile. People living in the most deprived two quintiles were significantly more likely to never exercise compared to people in the least deprived quintile. However, there was no difference in the percentage of people exercising sufficiently to meet the national guidelines among the five deprivation quintiles.

[11] Even if there were no underlying differences in the overall population, one would expect slight variations in the prevalence among different groups of people in the sample of survey responders just through chance and random variation. Significance testing is a way to assess how likely the difference is due to chance and how likely the difference is due to some underlying difference. However, even if the difference is statistically significant among the groups, it could still be not important epidemiologically if the prevalence is high for all groups, and the aim is to reduce the prevalence to set levels for all.

Figure 33: Age-gender standardised percentage undertaking different levels of exercise in relation to deprivation

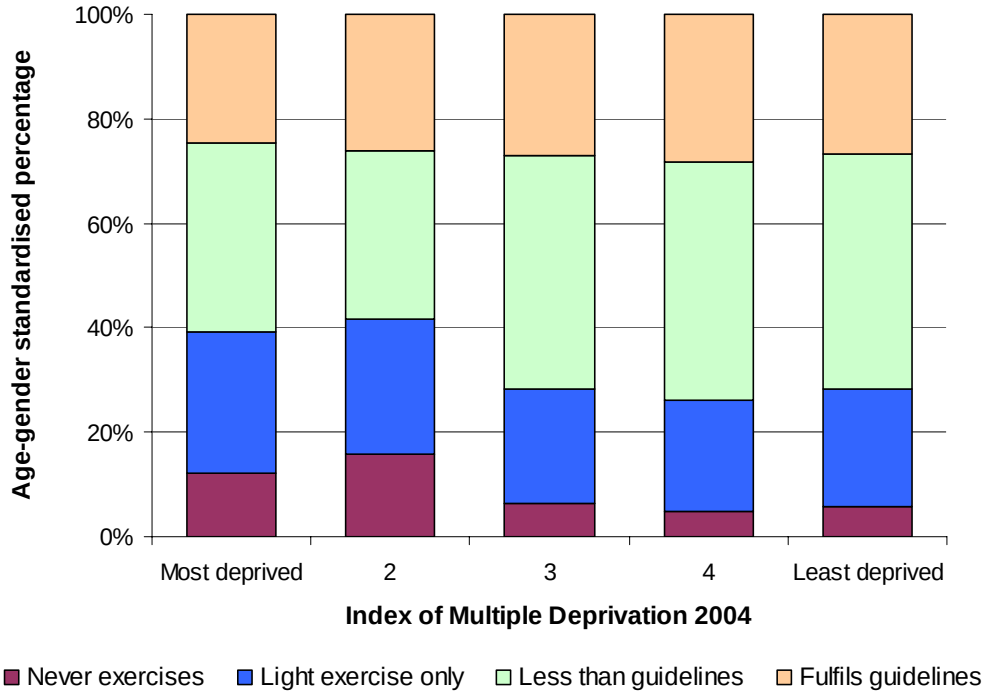


Table 18: Age-gender standardised percentages undertaking different levels of exercise in relation to deprivation

Index of Multiple Deprivation 2004 local quintile	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
Most deprived	24.5	36.1	27.2	12.2
2	26.2	32.1	25.9	15.7
3	27.1	44.7	21.8	6.5
4	28.4	45.6	21.1	4.9
Least deprived	26.7	45.0	22.5	5.7

There is also a strong relationship between (after tax) household income and age[12] so age is a confounder. ***Figure 34*** and ***Table 19*** illustrates the age-gender standardised

[12] Approximately one-third of those aged 18-24 years had an after tax household income of less than £10,000 but this fell to 18% for those aged 25-34 years and gradually increased to 33% for those aged 55-64 years and increased more dramatically for those aged 65-74 years (49%) and 75+ years (64%). Of those aged 18-24 years, 29% had an after tax household income of £20,000 or more and this increased to around 40% for those aged 25-54 years but feel to 24%, 10% and 1.7% for those aged 55-64, 65-74 and 75+ years respectively.

percentages by estimated after tax household income. There was a statistically significant difference in the percentage who never exercised, with those on the lower incomes more likely to never exercise. However, there was no significant difference among the income categories in the percentage who fulfilled the national exercise guidelines.

Figure 34: Age-gender standardised percentages undertaking different levels of exercise in relation to after tax household income

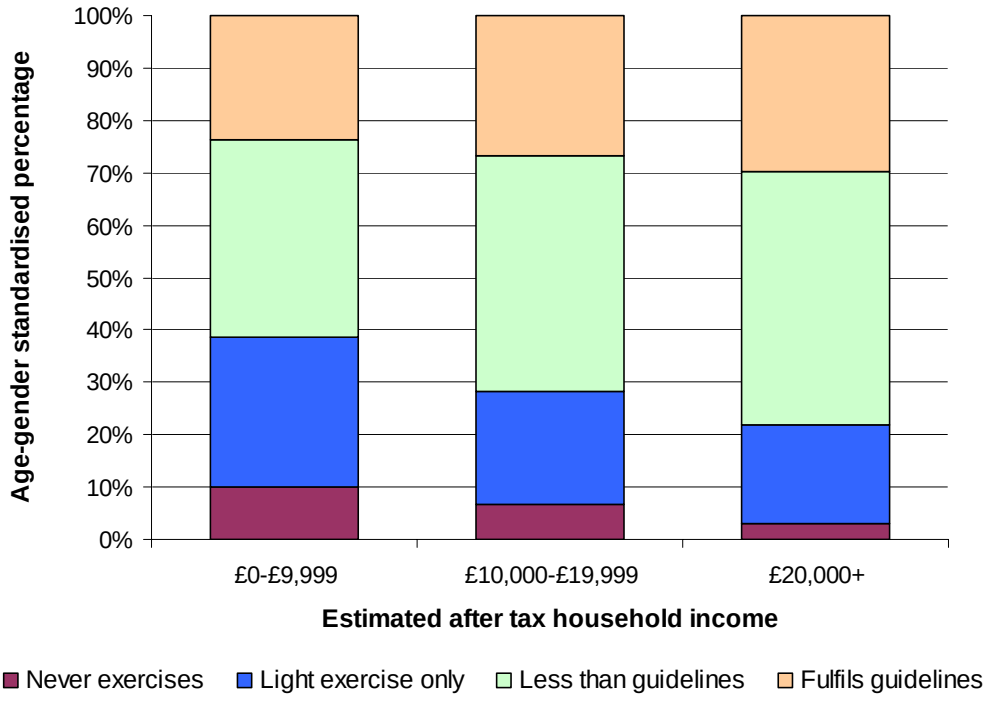


Table 19: Age-gender standardised percentages undertaking different levels of exercise in relation to after tax household income

After tax household income	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
£0-9,999	23.6	37.6	28.8	9.9
£10,000-19,999	26.7	45.2	21.6	6.5
£20,000+	28.1	46.0	17.7	2.9

The age-gender standardised percentages undertaking different levels of exercise is given in ***Figure 35*** and ***Table 20*** in relation to highest educational attainment. People who had none or basic qualifications were significantly more likely to never exercise compared to those with a degree or higher qualifications. Furthermore, people with a degree or higher qualification were significantly more likely to exercise sufficiently to fulfil national guidelines compared to those people with none or basic qualifications.

Figure 35: Age-gender standardised percentages undertaking different levels of exercise in relation to highest educational attainment

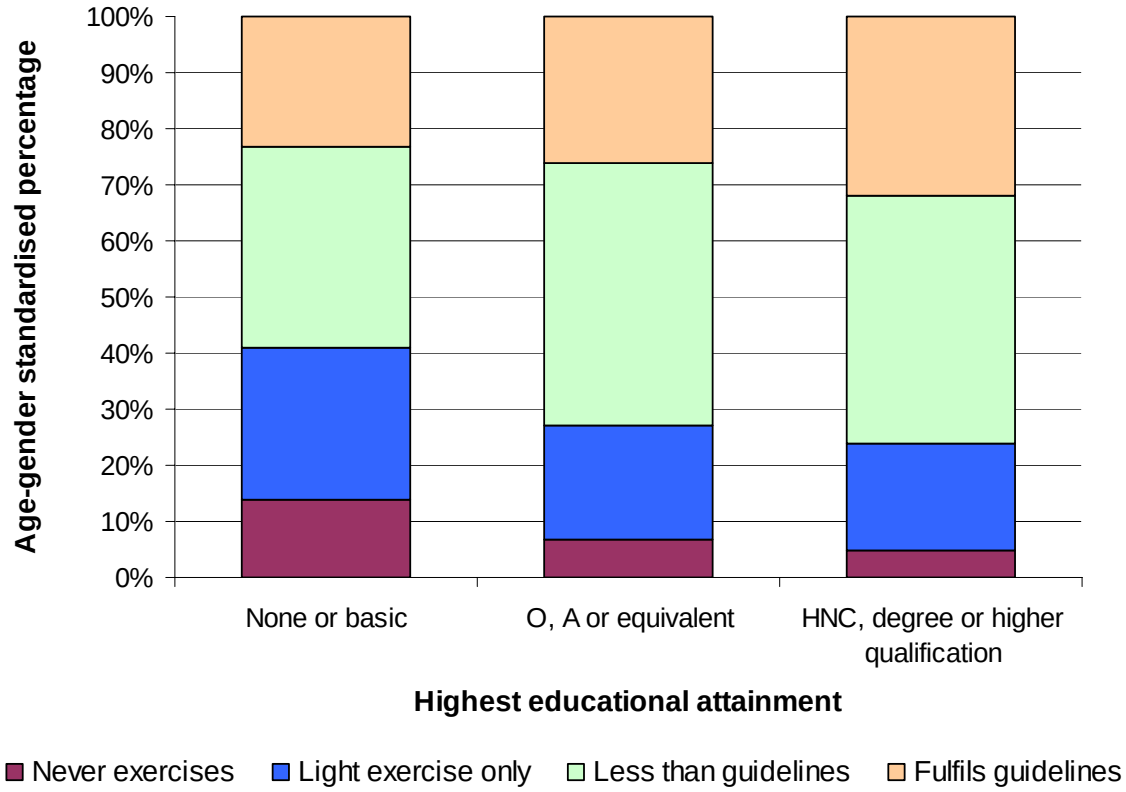


Table 20: Age-gender standardised percentages undertaking different levels of exercise in relation to highest educational attainment

Highest educational attainment	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
None or basic	23.4	35.6	27.0	14.0
O, A or equiv	26.0	46.9	20.5	6.6
HNC, degree, etc	31.9	44.2	19.1	4.8

Age-standardised prevalence of exercise levels in relation to smoking status

The age-gender standardised percentages undertaking different levels of exercise is given in ***Figure 36*** and ***Table 21*** in relation to smoking status. Current smokers were significantly more likely to never exercise compared to those who had never smoked, but there was no difference between the smoking categories for the percentage who fulfilled the national exercise guidelines.

Figure 36: Age-gender standardised percentages undertaking different levels of exercise in relation to smoking status

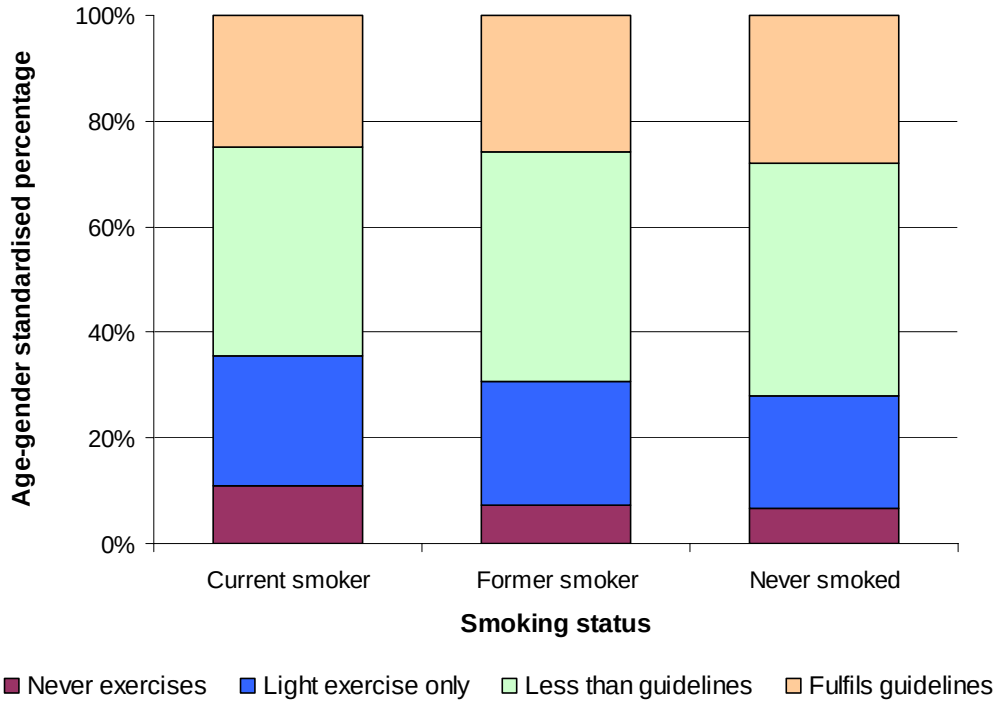


Table 21: Age-gender standardised percentages undertaking different levels of exercise in relation to smoking status

Smoking status	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
Current smoker	24.8	39.6	24.6	11.0
Former smoker	25.9	43.3	23.5	7.3
Never smoked	28.0	44.0	21.3	6.7

Age-standardised prevalence of exercise levels in relation to Locality of residence

The age-gender standardised percentages undertaking different levels of exercise is given in ***Figure 37*** and ***Table 22*** in relation to Locality of residence. Compared to people living in East Locality who had the lowest percentage of people who never exercised, North Locality had a significantly higher percentage of people who never exercised. Compared to people living in North Locality who had the lowest percentage of people who exercised sufficiently to fulfil the national guidelines, people in East Locality had a significantly higher percentage of people fulfilling the national exercise guidelines.

Figure 37: Age-gender standardised percentages undertaking different levels of exercise in relation to Locality

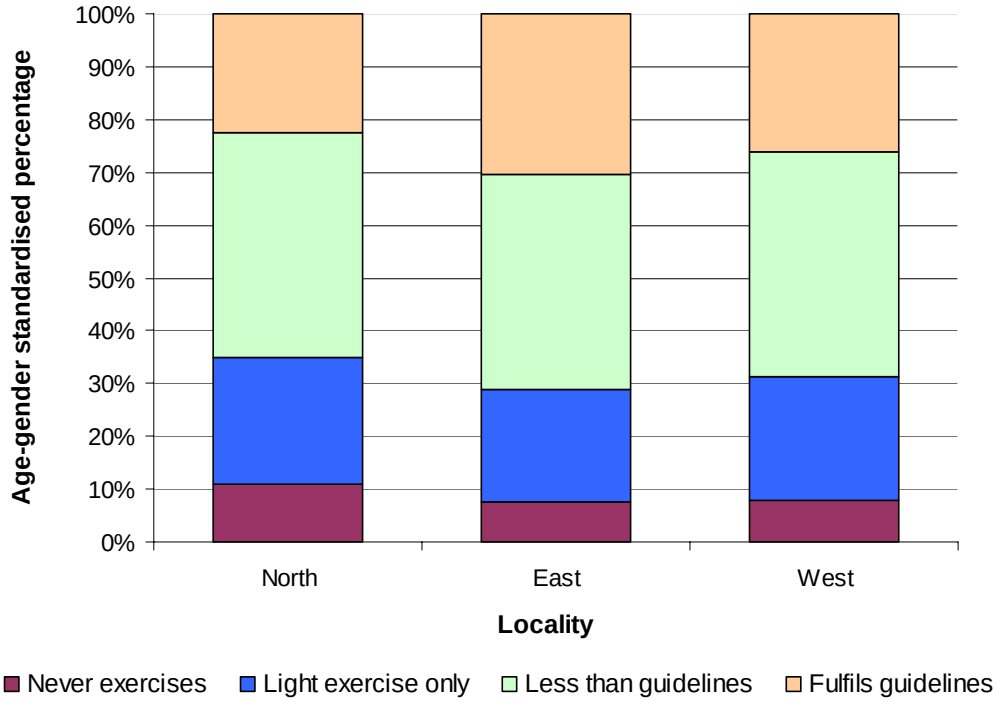


Table 22: Age-gender standardised percentages undertaking different levels of exercise in relation to Locality

Locality	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
North	22.6	42.5	24.0	11.0
East	30.4	40.7	21.3	7.7
West	26.0	42.7	23.5	7.8

Age-standardised prevalence of exercise levels in relation to measures of physical and mental health

The age-gender standardised percentages undertaking different levels of exercise is given ***Figure 38*** and ***Table 23*** in relation to disability as measured by the Health Utility Index (see ***page 13***). Whilst there is a relationship present, there is still 20% of those with severe disability undertaking sufficient exercise to fulfil the national exercise guidelines. This can be partly explained by the definition of disability as defined by the HUI. The HUI does not exclusively measure physical disabilities, which would or may limit the ability to exercise. There is a significant difference in the percentage fulfilling the national exercise guidelines between those with severe disability compared to those with moderate, mild or no disability. The percentage of people who never exercise is also statistically significantly different between groups, with people with moderate or severe disability more likely to never exercise compared to those with no disability.

Figure 38: Age-gender standardised percentages undertaking different levels of exercise in relation to disability as measured by the Health Utility Index

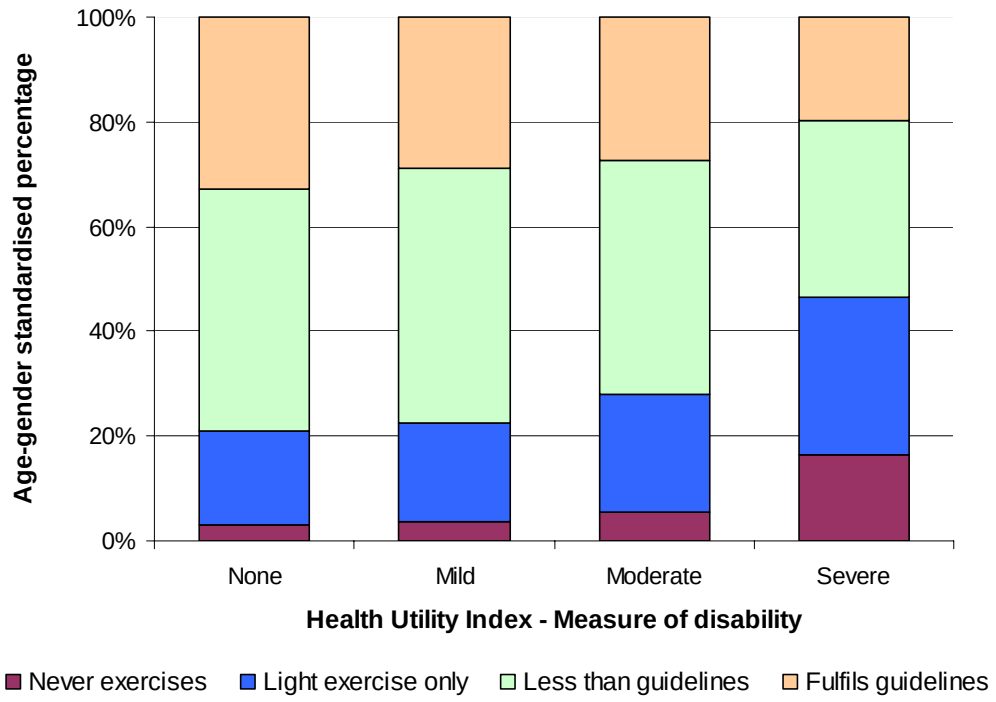


Table 23: Age-gender standardised percentages undertaking different levels of exercise in relation to disability as measured by the Health Utility Index

Health Utility Index: measure of disability	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
None	32.9	46.0	18.2	2.9
Mild	28.8	48.9	18.8	3.6
Moderate	27.4	44.5	22.5	5.5
Severe	19.7	33.6	30.3	16.4

The age-gender standardised percentages undertaking different levels of exercise are given in ***Figure 39*** and ***Table 24*** in relation to self-reported usual state of health. Even after adjusting for age, unsurprisingly, people who report the worst health are more likely to exercise less. One third of people with excellent or very good health fulfil the national exercise guidelines compared to 15% of those whose health is fair or poor. People with good, fair or poor health were significantly more likely to never exercise compared to those who had excellent or very good health, and people with good, very good or excellent health were more likely to exercise sufficiently to fulfil the national guidelines compared to those with fair or poor health.

Figure 39: Age-gender standardised percentages undertaking different levels of exercise in relation to general health

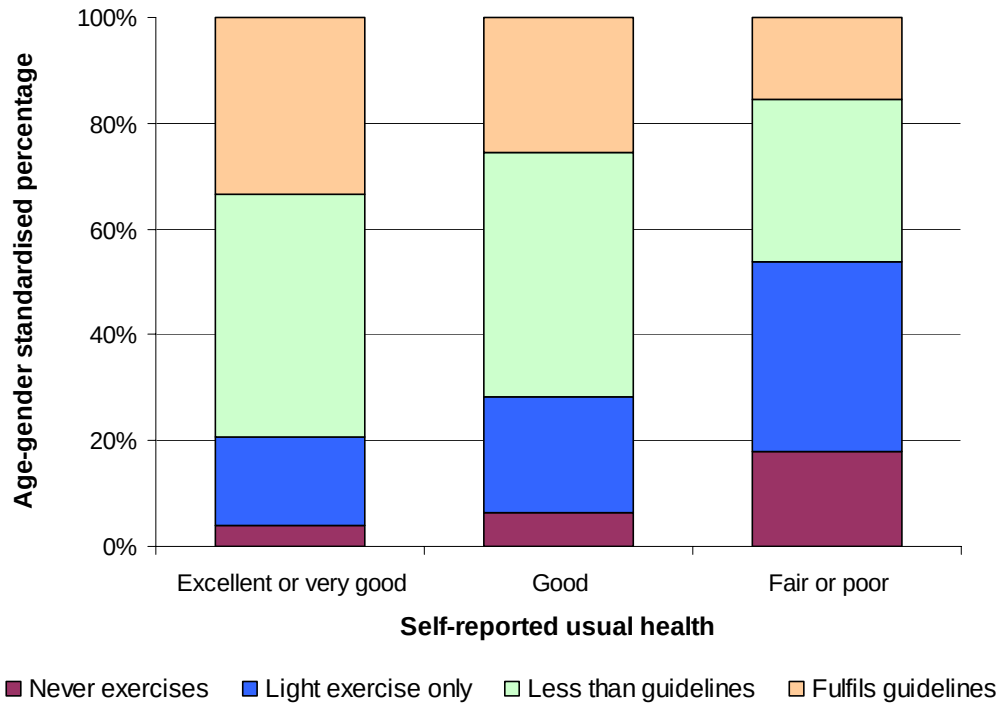


Table 24: Age-gender standardised percentages undertaking different levels of exercise in relation to general health

General health	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
Excellent/very good	33.3	45.9	16.9	3.8
Good	25.5	46.4	21.8	6.3
Fair or poor	15.4	30.6	35.9	18.0

The age-gender standardised percentages undertaking different levels of exercise are given in ***Figure 40*** and ***Table 25*** in relation to long-term illness or disability which limited daily activities. As expected, having an illness or disability that affects daily activities is associated with exercising less frequently or vigorously, and the differences in the percentages between the two groups were statistically significant.

Figure 40: Age-gender standardised percentages undertaking different levels of exercise in relation to limiting long-term illness or disability

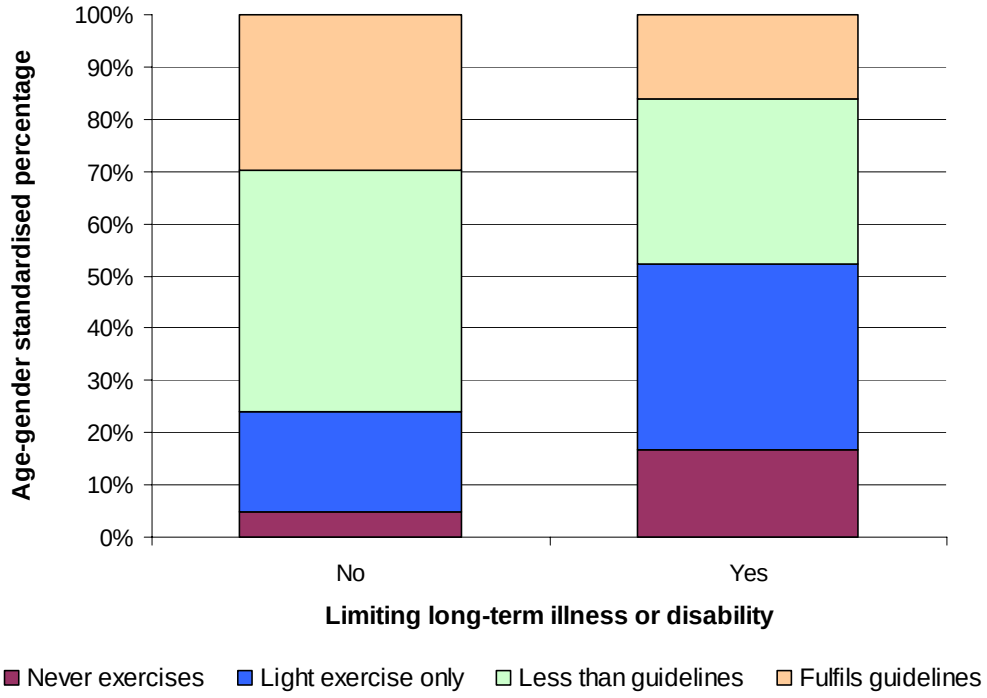


Table 25: Age-gender standardised percentages undertaking different levels of exercise in relation to limiting long-term illness or disability

Limiting long-term illness or disability	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
No	29.8	46.1	19.4	4.8
Yes	16.1	31.6	35.5	16.8

The age-gender standardised percentages undertaking different levels of exercise is given in ***Figure 41*** and ***Table 26*** in relation to the emotion component of the Health Utility Index. There was a significant trend in the percentage not exercising and the percentage fulfilling the national exercise guidelines with those who were the happiest undertaking the most exercise and those who were the most unhappy undertaking the least exercise.

Figure 41: Age-gender standardised percentages undertaking different levels of exercise in relation to emotion component of Health Utility Index

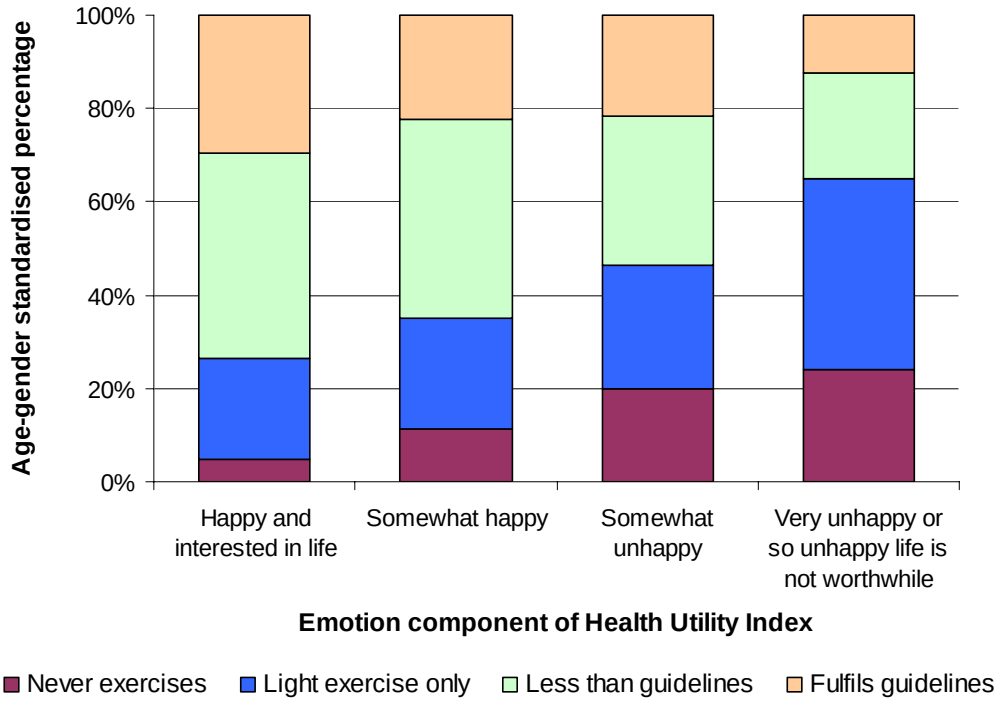


Table 26: Age-gender standardised percentages undertaking different levels of exercise in relation to emotion component of Health Utility Index

Emotion component of Health Utility Index	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Mod/vig exercise but less than guidelines	Light exercise only	Never exercises
Happy & interested in life	29.4	44.1	21.6	4.9
Somewhat happy	22.3	42.6	23.7	11.3
Somewhat unhappy	21.8	31.9	26.4	19.8
V unhappy/life not worthwhile	12.4	22.8	40.8	24.0

Figure 42 and ***Table 27*** give the age-gender standardised percentages undertaking different levels of exercise for four different (arbitrarily defined) categories on the Mental Health Index. Similar to the emotion component on the Health Utility Index, there was an association with exercise levels and mental health. There was a statistically significant difference in the percentage never exercising for those with the best mental health (score 86-100) compared to those with the poorest mental health (score 0-60), but no difference for those with intermediate Mental Health Index scores. There was a statistically significant trend in the percentage fulfilling the national exercise guidelines with those with the poorest mental health having the lowest percentage.

Figure 42: Age-gender standardised percentages undertaking different levels of exercise in relation to Mental Health Index

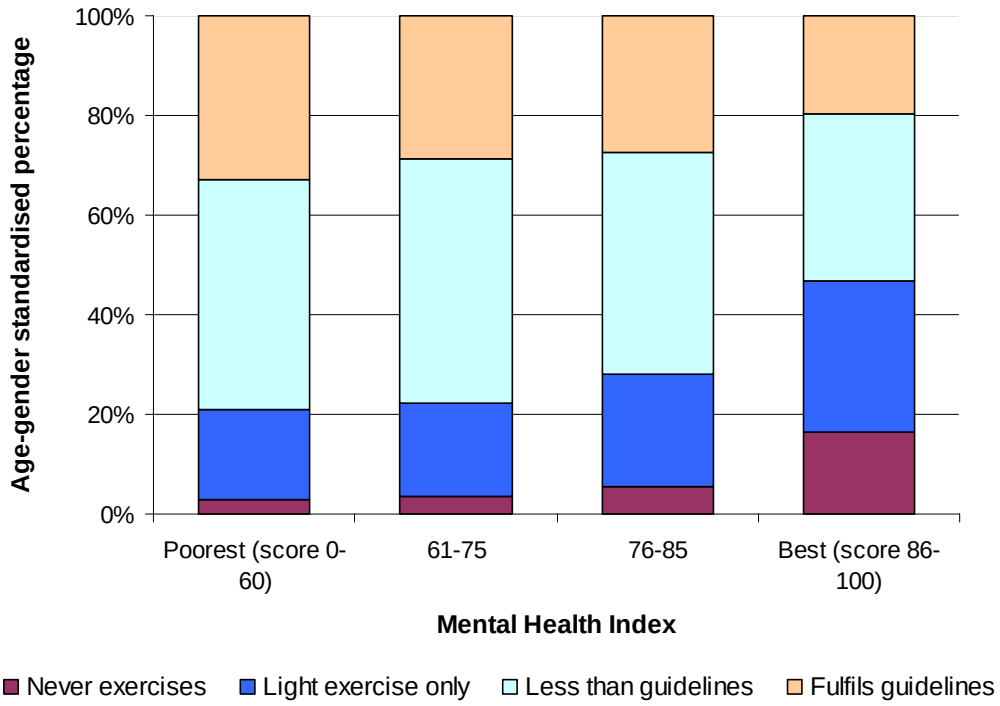


Table 27: Age-gender standardised percentages undertaking different levels of exercise in relation to Mental Health Index

Mental Health Index	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Mod/vig exercise but less than guidelines	Light exercise only	Never exercises
Poorest (score 0-60)	32.9	46.0	18.2	2.9
61-75	28.8	48.9	18.8	3.6
76-85	27.4	44.5	22.5	5.5
Best (score 86-100)	19.7	33.6	30.3	16.4

Age-standardised prevalence of exercise levels in relation to 5-A-DAY

Those who eat the most portions of fruit and vegetables tend to exercise the most even after adjusting for age (***Figure 43***; ***Table 28***). The percentage never exercising for those eating five or more portions of fruit and vegetables daily (4.3%) is one-third that of those who eat less than three portions daily (14.1%). Furthermore, the percentage undertaking light exercise is considerably lower for those eating five or more portions (18.4% versus 28.1%).

Figure 43: Age-gender standardised percentages undertaking different levels of exercise in relation to 5-A-DAY

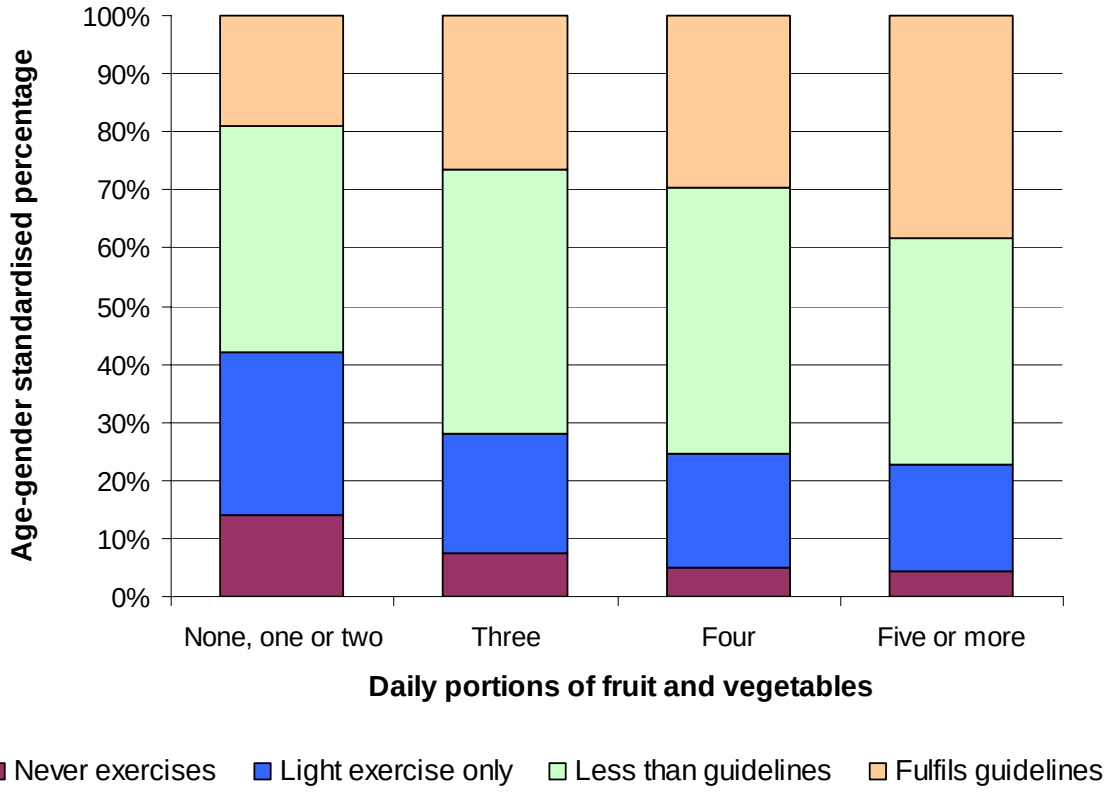


Table 28: Age-gender standardised percentages undertaking different levels of exercise in relation to 5-A-DAY

General health	Age-gender standardised percentages			
	Fulfils national recommended guidelines	Moderate or vigorous exercise but less than guidelines	Light exercise only	Never exercises
None, one or two	19.0	38.9	28.1	14.1
Three	26.6	45.3	20.6	7.5
Four	29.6	45.7	19.7	5.1
Five or more	38.3	39.0	18.4	4.3

Summary of statistically significant differences in the age-standardised prevalence of never exercising and meeting national exercise guidelines among groups

The following factors influence the percentage never exercising after adjusting for age and gender:

- deprivation (those living in most deprived two local quintiles were more likely to never exercise than least deprived quintile);
- income (those with after tax household incomes of less than £10,000 or between £10,000-£19,999 were more likely to never exercise compared to those with incomes of £20,000+);
- qualifications (those with none or basic qualifications were more likely to never exercise compared to those with a degree or higher qualification);
- smoking (current smokers were more likely to never exercise compared to never smokers);
- Locality (those living in North Locality were more likely to never exercise compared to East Locality);
- disability as mentioned by the Health Utility Index (those with moderate or severe disability were more likely to never exercise compared to those with no disability);
- usual health (those with good, fair or poor health were more likely to never exercise compared to those with excellent or very good health);
- limiting long-term illness or disability (those with long-term illness or disability which limited daily activities more likely to never exercise compared to those with no such illness or disability);
- emotional component of Health Utility Index (those who were “somewhat happy”, “somewhat unhappy”, “very unhappy” or “so unhappy that life is not worthwhile” were more likely to never exercise compared to those who were “happy and interested in life”);
- mental health (those with the poorest mental health (Mental Health Index 0-60) were more likely to never exercise compared to those with the best mental health (Mental Health Index 86-100));
- fruit and vegetable consumption (those eating less than four portions of fruit/ veg daily were more likely to never exercise compared to those who ate 5+).

The following factors influence the percentage fulfilling the national exercise guidelines after adjusting for age and gender:

- qualifications (those with a degree or higher qualification were more likely to meet the national exercise guidelines compared to those with no qualifications or basic qualifications);
- Locality (those living in East Locality were more likely to meet the national exercise guidelines compared to North Locality);
- disability as mentioned by the Health Utility Index (those with no disability or mild or moderate disability were more likely to meet the national exercise guidelines compared to those with a severe disability);
- usual health (those with good, very good or excellent health were more likely to meet the national exercise guidelines compared to those with fair or poor health);
- limiting long-term illness or disability (those without a limiting long-term illness or disability more likely to meet the national exercise guidelines compared to those with a limiting long-term illness or disability);
- emotional component of Health Utility Index (those who were “happy and interested in life” were more likely to meet the national exercise guidelines compared to those who were “very unhappy” or “so unhappy that life is not worthwhile”);
- mental health (those with the best mental health (Mental Health Index 61-100) were more likely to meet the national exercise guidelines compared to those with the poorest mental health (Mental Health Index 0-60));
- fruit and vegetable consumption (those eating three or more portions of fruit and vegetables daily were more likely to meet the national exercise guidelines compared to those who ate zero, one or two portions).

Conclusions

Whilst there are statistically significant difference among groups in the prevalence of obesity and overweight and the percentage undertaking different levels of exercise, in general the prevalence of overweight and obesity are high in all groups and levels of exercise levels are low in all groups to necessitate action. Therefore, particular groups could be targeted, but a broad more general approach to tackling the problem of obesity and lack of exercise is required.

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Appendix

Significance testing

It is often useful to compare a particular summary measure, for instance, mean, median, measure of risk among different groups. Since there is natural variation associated with virtually all measurements and since we generally only have a sample and have not measured the entire population, it is necessary to distinguish between differences which are close enough together to be explained by chance and difference which are 'unlikely' to be explained by chance. Such a comparison can be undertaken using a statistical test which takes into the account chance variation. When undertaking a statistical test, we assume that there is no difference in the summary measure among the groups and then calculate the probability of obtaining the difference we observe in our sample (i.e. in the data we have). If the calculated probability, or so-called p-value, is small then this means that there is a small chance of obtaining such a result under the assumption that there is no difference. Therefore, if the probability is small enough (generally, less than one in twenty or less than 0.05) then we assume that the original assumption must be incorrect and that there really is a difference. Since this is based on probabilities and assumptions, just because a small p-value is observed, it does not necessarily mean that the original assumption of no difference between the groups is untrue. However, clearly the smaller the p-value, the more likely it is that the original assumption is untrue. Similarly, just because you obtain a large p-value and therefore have no evidence to reject the original assumption, it does not mean that it is actually true, it could be that there is simply insufficient evidence to show otherwise (for example, a small number of people or small number of people with a particular event). If a small p-value is obtained ($p<0.05$) then the difference is deemed '***statistically significant***'. However, this does not necessarily mean that the result is important clinically. It is possible that 50% of those living in one area report poor health compared to another area whose residents report 47%. If the number of people involved in the survey was sufficiently large, it is possible to obtain a statistically significant difference between these areas. However, from a medical point of view it may be considered not very important and the fact that both areas report high levels of poor health may be more important. That is, there could be a statistically significant difference in a particular statistic (percentage or odds-ratio) between two different groups, but that does not necessarily mean that the difference is clinically relevant/important or clinically significant

Confounders

When examining the relationship between two factors, for example, levels of exercise and deprivation, another third variable could influence the relationship indirectly if it is associated with both variables. This third variable is called a confounder, and can mask true relationships, create artificial non-existent relationships or distort a relationship. With a confounder present, the association could be observed between the two factors observed (e.g. exercise and the factor of interest) indirectly through *their* association with age, and there could be no real true association between exercise and the factor of interest.

Age and gender are confounders in relation to exercise for many associations, as many of the other factors which we would like to examine in relation to exercise are also associated with age and gender, particularly so for age. For example, in the survey responders, deprivation and income are both associated with age. Younger people tend to live in the most deprived areas of the city, and there is a U shaped distribution for age and income with the youngest and oldest having the lowest incomes.

Therefore, if an association is found between levels of exercise and say deprivation, it is likely to be influenced by the association between exercise and age and between deprivation and age.

One solution is to age standardise the levels of exercise, for example, by calculating the age standardised percentage achieving the national exercise guidelines.

Standardisation

The prevalence of ill-health, risk factors and disease and mortality within a particular population will depend on the age and gender structure of that population (as well as many other factors such as deprivation).

In terms of the provision of resources, the prevalence of ill-health, disease and risk factors in the population, it is most helpful to report on the prevalence without taking into account the age and gender distribution of the population. This is because it is necessary to treat and have the provision to treat the existing population, regardless of the age and gender structure. However, if one wishes to assess whether one population has an excess rate of disease or if there is a difference in the prevalence of exercise levels among different groups of people living in areas of differing levels of deprivation, it is necessary to take the age and gender structure into consideration. Otherwise any differences found may be simply due to differences in the age and gender structure of the different populations, and not due to the factor of interest, e.g. deprivation. The age and gender structure can be taken into consideration by using standardisation. Generally, standardised rates are age-standardised or age-gender-standardised, but rates can also be standardised to other differences within the populations.

Direct standardisation involves applying the rates of disease observed in the study group of people to a ‘standard’ population. Indirect standardisation involves applying the rates of disease in a ‘standard’ population to the study group of people. The rates of disease are calculated for each gender and age group, for example, males aged 0-9, 10-19, 20-29 years etc and females aged 0-9, 10-19, 20-29 years etc. The standard population can be an English population, the European Standard Population or a local population for a specific time period. Direct standardisation results in an age-gender standardised rate of disease (often per 10,000 or 100,000 population). Indirect standardisation results in a standardised mortality (or morbidity) ratio (SMR). The SMR will take the value of 100 if the sample group has the same mortality (or morbidity) rate as the ‘standard’ population, and an SMR greater (less) than 100 if the sample group has a greater (lower) mortality rate relative to the standard population. Standardisation is frequently used when producing mortality rates, but the same procedures can be used

to calculate other statistics such as the percentage undertaking a specific level of exercise.

Odds ratio

The odds-ratio is used as a measure of risk (but it is not the same as another commonly used measure of risk, the relative risk). The odds of people being obese (or odds of never exercising) is the ratio of the number of people who are obese (or never exercise) to the number of people who are not obese (or do exercise). The odds-ratio is obtained from the odds of being obese in one group, for example, people living in the most deprived local quintile, divided by the odds of being obese in another comparison group, for example, people living in the next most deprived local quintile. It is used to compare the odds (or risk) of obesity in one group relative to a reference group (generally the next response category). For a factor with just two categories, it is a straightforward comparison, for example, between males and females. However, for a factor with more than two categories, it is comparison of one category with the next categories, for example, the most deprived quintile compared to the second most deprived quintile, or the second least deprived quintile compared to the least deprived quintile. An odds-ratio of more than one means that there is increased odds (or risk) of obesity in the group compared to the reference group, and an odds-ratio less than one means that the odds (or risk) of obesity in the group is less than the reference group. For example, an odds-ratio of 1.4 means that the odds of obesity in the most deprived group is 40% higher than the next most deprived group.

Confidence interval

Since we only have a sample and have not examined data from the entire population (e.g. all residents in the PCT over all time periods of interest), we only have an estimate of the particular characteristic we wish to measure, for example, percentage of men aged 45-54 years who are obese. The 95% confidence interval (CI) gives a range of values for which we are 95% confident that the interval will contain the true, underlying statistic (e.g. percentage or mean or difference between two means) of the entire population. Having a range of values for which the population statistic lies is much more useful than having a single value. The interval also takes into consideration the number of people for which the estimate is based, so that if there are many people surveyed the interval tends to be narrower (and therefore more useful). The 95% confidence interval for a difference in a percentage or mean between two groups that does not include the value zero (i.e. the percentage or mean is not the same for both groups) will have a p-value less than 0.05[13]. Confidence intervals can also be produced for odds-ratios resulting from logistic regression models.

[13] In rare cases this is not the case depending on the way in which the statistical test is undertaken and the assumptions made, however, if it is not true then the p-value will be close to 0.05.

Results from logistic regression models

Results noted below if p<0.01 for entire group. All other factors are not statistically significant. However, for all models there is a high level of unexplained variability.

Predicting people who are ***obese***

Gender	Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
Both	Least deprived	Second least deprived	1.03 (0.81, 1.31)	0.81	…no significant difference in odds of being obese
		Middle deprivation	1.14 (0.88, 1.48)	0.33	…no significant difference in odds of being obese
		Second most deprived	1.51 (1.14, 2.00)	0.004	…those living in second most deprived quintile increased odds of 1.5 times the comparison group of being obese
		Most deprived	1.73 (1.34, 2.23)	<0.0005	…those living in most deprived quintile increased odds of 1.7 times the comparison group of being obese
	Fulfils guidelines	Exercise – <5+	1.11 (0.89, 1.37)	0.36	…no significant difference in odds of being obese
		Exercise – light	1.60 (1.25, 2.03)	<0.0005	…those who exercise only lightly increased odds of 1.6 times the comparison group of being obese
		Exercise – never	2.22 (1.63, 3.02)	<0.0005	…those who never exercise increased odds of 2.2 times the comparison group of being obese
Men	Never smoked	Former smoker	1.57 (1.16, 2.13)	0.004	…former smoker increased odds of 1.6 times the comparison group of being obese
		Current smoker	0.80 (0.59, 1.09)	0.15	…no significant difference in odds of being obese
	No disability based on Health Utility Index	Mild disability	1.10 (0.75, 1.62)	0.63	…no significant difference in odds of being obese
		Moderate disability	1.27 (0.86, 1.89)	0.23	…no significant difference in odds of being obese
		Severe disability	2.05 (1.41, 2.99)	<0.0005	…those with severe disability have increased odds of 2.1 times the comparison group of being obese
	Excellent or v good health	Good health	1.16 (0.87, 1.55)	0.31	…no significant difference in odds of being obese
		Fair or poor health	2.22 (1.63, 3.03)	<0.0005	…those with fair or poor health have increased odds of 2.2 times the comparison group of being obese
	Limiting long-term illness	No limiting long-term illness	1.83 (1.38, 2.43)	<0.0005	…those with a long-term illness or disability that limits their daily activities have increased odds of 1.8 times the comparison group of being obese

Predicting people who are ***obese*** continued

Gender	Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
Women	East Locality	North Locality	1.43 (1.07, 1.91)	0.015	…those living in North Locality have increased odds of 1.4 times the comparison group of being obese
		West Locality	1.10 (0.86, 1.41)	0.45	…no significant difference in odds of being obese
	No disability based on Health Utility Index	Mild disability	1.14 (0.76, 1.71)	0.52	…no significant difference in odds of being obese
		Moderate disability	1.71 (1.14, 2.55)	0.010	…those with moderate disability have increased odds of 1.7 times the comparison group of being obese
		Severe disability	2.63 (1.77, 3.89)	<0.0005	…those with severe disability have increased odds of 2.6 times the comparison group of being obese
	Excellent or v good health	Good health	1.64 (1.25, 2.14)	<0.0005	…those with good health have increased odds of 1.6 times the comparison group of being obese
		Fair or poor health	2.44 (1.83, 3.24)	<0.0005	…those with fair or poor health have increased odds of 2.4 times the comparison group of being obese
	No limiting long-term illness	Limiting long-term illness	2.28 (1.78, 2.92)	<0.0005	…those with a long-term illness or disability that limits their daily activities have increased odds of 2.3 times the comparison group of being obese
	Good mental health (index 86-100)	Index 76-85	1.19 (0.82, 1.71)	0.36	…no significant difference in odds of being obese
		Index 61-75	1.60 (1.12, 2.27)	0.009	…those with Mental Health Index of 61-75 have increased odds of 1.6 times the comparison group of being obese
		Poorest mental health (index 0-60)	1.58 (1.12, 2.24)	0.009	…those with Mental Health Index of 0-60 have increased odds of 1.6 times the comparison group of being obese

Even after adjusting for age, there was no significant difference in the percentage of people who were obese for the following factors:

- among the three income categories (men and women);
- among the three qualifications categories (men and women);
- among three smoking categories (women only);
- among three Localities (men only);
- among five categories for Health Utility Index emotion component (men and women);
- among four categories for Mental Health Index (men only);
- among four 5-A-DAY categories (men and women).

Predicting people who are ***overweight or obese***

Gender	Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
Men	After tax household income <£10,000	£10,000-19,999	1.22 (0.90, 1.67)	0.20	…no significant difference in odds of being overweight or obese
		£20,000+	1.64 (1.17, 2.31)	0.004	…those with after tax household income £20,000+ have increased odds of 1.6 times the comparison group of being overweight or obese
	Current smoker	Former smoker	1.70 (1.28, 2.25)	<0.0005	…former smoker have increased odds of 1.7 times the comparison group of being overweight or obese
		Never smoked	1.57 (1.25, 1.97)	<0.0005	…never smoker have increased odds of 1.6 times the comparison group of being overweight or obese
	Excellent or v good health	Good health	1.43 (1.14, 1.79)	0.002	…those in good health have increased odds of 1.4 times the comparison group of being overweight or obese
		Fair or poor health	1.33 (1.00, 1.76)	0.049	…those in fair or poor health have increased odds of 1.3 times the comparison group of being overweight or obese
Women	Degree or higher qualifications	O or A / equiv	1.52 (1.16, 1.99)	0.002	…those with O or A levels or equivalent qualifications have increased odds of 1.5 times the comparison group of being overweight or obese
		None or basic	1.79 (1.32, 2.42)	<0.0005	…those with none or basic qualifications have increased odds of 1.8 times the comparison group of being overweight or obese
	No disability based on Health Utility Index	Mild disability	1.20 (0.90, 1.61)	0.22	…no significant difference in odds of being overweight or obese
		Moderate disability	1.51 (1.11, 2.07)	0.009	…those with moderate disability have increased odds of 1.5 times the comparison group of being overweight or obese
		Severe disability	1.69 (1.24, 2.31)	<0.0005	…those with severe disability have increased odds of 1.7 times the comparison group of being overweight or obese
	Excellent or v good health	Good health	1.27 (1.03, 1.58)	0.029	…those with good health have increased odds of 1.3 times the comparison group of being overweight or obese
		Fair or poor health	1.60 (1.23, 2.07)	<0.0005	…those with fair or poor health have increased odds of 1.6 times the comparison group of being overweight or obese
	No limiting long-term illness	Limiting long-term illness	1.69 (1.34, 2.15)	<0.0005	…those with a long-term illness or disability that limits their daily activities have increased odds of 1.7 times the comparison group of being overweight or obese

Predicting people who are ***overweight or obese*** continued

Even after adjusting for age, there was no significant difference in the percentage of people who were overweight or obese for the following factors:

- among the five local deprivation quintiles (men and women combined);
- among the four exercise categories (men and women combined);
- among the three income categories (women only);
- among the three qualification categories (men only);
- among the three smoking categories (women only);
- among the three Localities (both men and women);
- among the four Health Utility Index disability categories (men only);
- between those with and without limiting long-term illness or disability (men only);
- among the four Health Utility Index categories on the emotional scale (both men and women);
- among the four arbitrarily defined categories on the Mental Health Index (both men and women);
- among the four fruit and vegetable consumption categories (both men and women).

Predicting people who ***never exercise***

Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
Least deprived	Second least deprived	0.92 (0.62, 1.35)	0.65	…no significant difference in odds of never exercising
	Middle deprivation	1.25 (0.83, 1.88)	0.28	…no significant difference in odds of never exercising
	Second most deprived	3.42 (2.34, 5.00)	<0.0005	…those living in the second most deprived areas of Hull have increased odds of 3.4 times the comparison group of never exercising
	Most deprived	2.42 (1.68, 3.50)	<0.0005	…those living in the most deprived areas of Hull have increased odds of 3.4 times the comparison group of never exercising
After tax household income £20,000+	£10,000-19,999	2.02 (1.21, 3.36)	0.007	…those with after tax household incomes £10,000-£19,999 have increased odds of 2.0 times the comparison group of never exercising
	<£10,000	2.94 (1.76, 4.92)	<0.0005	…those with after tax household incomes less than £10,000 have increased odds of 2.9 times the comparison group of never exercising
Degree or higher qualifications	O or A / equiv	1.35 (0.89, 2.04)	0.16	…no significant difference in odds of never exercising
	None or basic	3.29 (2.23, 4.85)	<0.0005	…those with none or basic qualifications have increased odds of 3.3 times the comparison group of never exercising
Never smoked	Former smoker	1.18 (0.87, 1.58)	0.29	…no significant difference in odds of never exercising
	Current smoker	1.73 (1.31, 2.28)	<0.0005	…current smokers have increased odds of 1.7 times the comparison group of never exercising
East Locality	North Locality	1.59 (1.19, 2.14)	0.002	…those living in North Locality have increased odds of 1.6 times the comparison group of never exercising
	West Locality	1.07 (0.82, 1.39)	0.63	…no significant difference in odds of never exercising
No disability based on Health Utility Index	Mild disability	1.08 (0.62, 1.91)	0.78	…no significant difference in odds of never exercising
	Moderate disability	1.79 (1.04, 3.08)	0.036	…those with moderate disability have increased odds of 1.8 times the comparison group of never exercising
	Severe disability	6.48 (3.95, 10.6)	<0.0005	…those with severe disability have increased odds of 6.5 times the comparison group of never exercising
Excellent or v good health	Good health	1.70 (1.21, 2.40)	0.002	…those with good health have increased odds of 1.7 times the comparison group of never exercising
	Fair or poor health	5.89 (4.28, 8.10)	<0.0005	…those with fair or poor health have increased odds of 5.9 times the comparison group of never exercising
No limiting long-term illness	Limiting long-term illness	4.39 (3.40, 5.67)	<0.0005	…those with limiting long-term illness or disability have increased odds of 4.4 times the comparison group of never exercising

Predicting people who ***never exercise*** continued

Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
Health Utility Index – "happy and interested in life"	"Somewhat happy"	2.55 (1.94, 3.36)	<0.0005	…those who are "somewhat happy" have increased odds of 2.6 times the comparison group of never exercising
	"Somewhat unhappy"	5.04 (3.42, 7.43)	<0.0005	…those who are "somewhat unhappy" have increased odds of 5.0 times the comparison group of never exercising
	"Very unhappy" or "so unhappy that life is not worthwhile"	6.63 (4.09, 10.7)	<0.0005	…those who are "very unhappy" or "so unhappy that life is not worthwhile" have increased odds of 6.6 times the comparison group of never exercising
Good mental health (index 86-100)	Index 76-85	0.84 (0.55, 1.27)	0.40	…no significant difference in odds of never exercising
	Index 61-75	1.31 (0.89, 1.92)	0.18	…no significant difference in odds of never exercising
	Poorest mental health (index 0-60)	2.57 (2.52, 5.05)	<0.0005	…those who have poorest mental health (arbitrarily defined as score of 0-60) have increased odds of 2.6 times the comparison group of never exercising
Five or more portions of fruit and vegetables daily	Four portions	1.17 (0.76, 1.80)	0.46	…no significant difference in odds of never exercising
	Three portions	1.75 (1.19, 2.58)	0.004	…those eating three portions of fruit and vegetables daily have increased odds of 1.8 times the comparison group of never exercising
	None, one or two portions	3.71 (2.59, 5.31)	<0.0005	…those eating zero, one or two portions of fruit and vegetables daily have increased odds of 3.7 times the comparison group of never exercising

Even after adjusting for age and gender, there was no significant difference in the percentage of people who never exercised among the three body mass index categories (underweight/desirable weight, overweight and obese) for men and women combined.

Predicting people who ***exercise to levels recommended in national guidelines***

Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
None or basic qualifications	O or A / equiv	1.04 (0.85, 1.27)	0.69	…no significant difference in odds of exercising to guidelines
	Degree or higher qualifications	1.42 (1.15, 1.77)	0.001	…those with degree or higher qualification have increased odds of 1.4 times the comparison group of exercising to guidelines
North Locality	East Locality	1.54 (1.25, 1.90)	<0.0005	…those living in East Locality have increased odds of 1.5 times the comparison group of exercising to guidelines
	West Locality	1.22 (0.99, 1.50)	0.057	…no significant difference in odds of exercising to guidelines
Severe disability based on Health Utility Index	Moderate disability	1.61 (1.28, 2.03)	<0.0005	…those with moderate disability have increased odds of 1.5 times the comparison group of exercising to guidelines
	Mild disability	1.73 (1.40, 2.15)	<0.0005	…those with mild disability have increased odds of 1.7 times the comparison group of exercising to guidelines
	No disability	2.07 (1.64, 2.60)	<0.0005	…those with no disability have increased odds of 2.1 times the comparison group of exercising to guidelines
Fair or poor health	Good health	2.11 (1.64, 2.71)	<0.0005	…those with good health have increased odds of 2.1 times the comparison group of exercising to guidelines
	Excellent or v good health	3.02 (2.37, 3.85)	<0.0005	…those with excellent or very good health have increased odds of 3.0 times the comparison group of exercising to guidelines
Limiting long-term illness	No limiting long-term illness	2.42 (1.92, 3.05)	<0.0005	…those with no long-term illnesses or disabilities that limit daily activities have increased odds of 2.4 times the comparison group of exercising to guidelines
"Very unhappy" or "so unhappy that life is not worthwhile"	"Somewhat unhappy"	1.71 (0.91, 3.20)	0.095	…no significant difference in odds of exercising to guidelines
	"Somewhat happy"	1.72 (1.00, 2.98)	0.052	…no significant difference in odds of exercising to guidelines
	Health Utility Index – "happy and interested in life"	2.56 (1.51, 4.36)	0.001	…those who are "happy and interested in life" have increased odds of 2.6 times the comparison group of exercising to guidelines
Poorest mental health (index 0-60)	Index 61-75	1.40 (1.14, 1.73)	0.001	…those who have Mental Health Index of 61-75 have increased odds of 1.4 times the comparison group of exercising to guidelines
	Index 76-85	1.45 (1.18, 1.79)	<0.0005	…those who have Mental Health Index of 76-85 have increased odds of 1.5 times the comparison group of exercising to guidelines
	Good mental health (index 86-100)	1.64 (1.31, 2.05)	<0.0005	…those who have the best mental health (Index 86-100) have increased odds of 1.6 times the comparison group of exercising to guidelines

Predicting people who ***exercise to levels recommended in national guidelines*** continued

Comparison group	Factor	Odds-ratio (95% CI)	p-value	In relation to comparison group…
Zero, one or two portions of fruit and vegetables daily	Three portions	1.65 (1.34, 2.03)	<0.0005	…those who eat three portions of their 5-A-DAY have increased odds of 1.7 times the comparison group of exercising to guidelines
	Four portions	1.90 (1.51, 2.38)	<0.0005	…those who eat four portions of their 5-A-DAY have increased odds of 1.9 times the comparison group of exercising to guidelines
	Five or more portions	3.05 (2.47, 3.77)	<0.0005	…those who eat five or more portions of their 5-A-DAY have increased odds of 3.1 times the comparison group of exercising to guidelines

Even after adjusting for age and gender, there was no significant difference in the percentage of people who exercised sufficiently to meet the national guidelines (moderate or vigorous exercise of 30+ minutes on 5+ occasions per week) for the following factors (men and women combined):

- among the five local deprivation quintiles;
- among the three after tax household income categories;
- among the three smoking categories;
- among three body mass index categories (underweight/desirable, overweight and obese).

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