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7. Anthropometric measures and health

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The findings in this chapter take account of differences in age between people of differing Body Mass Index (BMI) and waist circumference and look at changes in outcome over a four-year period, 2002–03 to 2006–07 (wave 1 to wave 3) relative to their anthropometric measurements when first recruited in 1998–2001 (wave 0).

Key points arising from this chapter are:

- In men aged 50 to 55 and women aged 50 to 67 (at wave 1), BMI increased significantly between wave 0 and wave 2. BMI in women changed more over time than men's BMI. In men and women aged 50 to 74 (at wave 1), mean waist circumference increased significantly between wave 0 and wave 2.
- Increases in prevalence of moderate or severe back pain over a four-year period were associated with obesity and high waist circumference (at wave 0) among men and women but also with being overweight or having medium waist circumference among women.
- Neither BMI nor waist circumference reported at wave 0 was related to the prevalence rates of those who have fallen and had serious injuries occurring in any of the subsequent waves of data collection.
- Increased prevalence of reported shortness of breath over the four-year period was found among people who were either overweight or obese or had a high waist circumference at wave 0.
- Men and women who were obese or had high waist circumference at wave 0 had the highest increase over time (wave 1 to wave 3) in the prevalence of arthritis.
- Among overweight men and women and obese women, mean walking speed decreased significantly from wave 1 to wave 3. Men with low waist circumference and women with medium waist circumference had the greatest decrease in mean walking speed over four years.

- Greater waist circumference at wave 0 was related to higher odds of having cardiovascular disease at wave 3 in both men and women. These effects were independent of all covariates examined.
- Men and women who were obese or overweight at wave 0 had significantly lower quality of life scores than normal weight people in any of the subsequent waves. Increased waist circumference (at wave 0) was related to lower quality of life scores at wave 3 in women only.
- Normal weight and overweight men and obese women had a greater increase over time in the prevalence rates of depression.
- Greater waist circumference is associated with increased risk of death in men and women. Being underweight is associated with increased risk of death in men but not women.

7.1 Introduction

Obesity is a common public health problem. In England, more than half of all adults are currently classified as overweight or obese (The Information Centre, 2007). If current trends continue, obesity rates could well rise even higher (Zaninotto et al., 2006). The increase in the prevalence of obesity that has occurred over the last decade is of major public health concern but complex to tackle (Foresight Report, 2007).

Obesity creates a strain on health services, with a cost of £1 billion a year for treatment of disease brought on by obese adults (Department of Health, 2004a). The public health White Paper, *Choosing Health: Making Healthier Choices Easier* (Department of Health, 2004b), along with the *Physical Activity* and *Food Health* action plans (Department of Health, 2005a, 2005b), set out the action needed to combat obesity and increase physical activity as well as improve people's health through better diet and nutrition. The programme for action in relation to the *National Service Framework for Older People* (Department of Health, 2006) aims to promote healthy ageing and is the vehicle for delivering the older people's component of the White Paper *Choosing Health*, and it is also a key component in the delivery of the cross-government strategy for older people described in *Opportunity Age* (Department for Work and Pensions, 2005).

Obesity, as measured by increased BMI, is associated with serious chronic conditions such as type 2 diabetes, hypertension and hyperlipidaemia (i.e., high levels of lipids [fat] in the blood that can lead to narrowing and blockages of blood vessels), which are major risk factors for cardiovascular disease (Kopelman, 2000; Gensini et al., 1998). It is generally recognised that the central deposition of fat is more closely associated with these chronic diseases than Body Mass Index, especially in older people (Sjostrom, 1997). This is because, as people age, there is an increase in abdominal fat in relation to skeletal or total body fat and there is also a change in the distribution of fat mass that may result in little change in the overall BMI (Villareal et al., 2005).

While obesity can reduce a person's overall quality of life, and can lead to premature death, these associations of obesity have not been thoroughly

examined in older populations. Indeed it has been mooted that except at true statistical extremes, high body mass is a very weak predictor of mortality, and may even be protective in older populations (Campos et al., 2006).

In this chapter we describe change in BMI and waist circumference between wave 0 and wave 2 of ELSA. We also explore whether overweight, obesity or raised waist circumference are associated with a number of measures of ill health (pain reporting, chronic diseases), with reduced physical functioning and well-being (depressive symptoms and quality of life) and with mortality.

7.2 Methods and definitions

Methods

Height, weight and waist circumference were measured during the nurse visit carried out in wave 2. However, the ELSA sample was drawn from households that have previously responded to the Health Survey for England (HSE) in 1998, 1999 or 2001 and were born before March 1952. ELSA used the samples for these years to form 'ELSA wave 0'. For those who took part in wave 1 we had available height, weight and waist circumference measurements collected during the Health Surveys for England; the procedure for collecting measurements was the same in ELSA and HSE.

All analyses have been run on those core respondents who took part in waves 1–3 and either had valid BMI (2,593 men and 3,213 women) or valid waist circumference measurements (2,273 men and 2,862 women). This is a subsample of the original ELSA sample. Tables 7A.1 and 7A.2 report the age distribution of the sample by BMI and waist circumference and sex. For some analyses smaller numbers are involved because of restrictions on eligibility for the questions or because of missing answers.

Age standardisation has been used in all tables analysing health and well-being by BMI or waist category unless age is included as a break variable. Age standardisation removes the effect of differences in age distributions from comparisons between groups. Direct standardisation was applied for both sexes, expressing male and female data to the overall population, with the standards being the age distribution of the whole ELSA sample at wave 1.

All analyses that used data from the three waves have been weighted using the wave 3 longitudinal weight.

Height

Height was measured using a portable stadiometer with a sliding headplate, a base plate and three connecting rods marked with a metric scale (for full information on the methodology see Erens and Primatesta, 1999; Erens, Primatesta and Prior, 2001; Prior et al., 2003). Respondents were asked to remove their shoes. One measurement was taken with the respondent

stretching to the maximum height and the head in the Frankfort plane.[1] The reading was recorded to the nearest millimetre.

Weight

Weight was measured using a portable electronic scale. Respondents were asked to remove their shoes and any bulky clothing. A single measurement was recorded to the nearest 0.1 kg. Respondents who weighed more than 130 kg were asked for their estimated weights because the scales are inaccurate above this level. These estimated weights were included in the analysis.

Waist circumference

Waist circumference was defined as the midpoint between the lower rib and the upper margin of the iliac crest. It was measured using a tape with an insertion buckle at one end. The measurement was taken twice, using the same tape, and was recorded to the nearest even millimetre. Those whose waist circumference measurement differed by more than 3 cm had a third measurement taken. The mean of the two valid measurements (the two out of the three measurements that were closest to each other, if there were three measurements) were used in the analysis.

Change in health and functioning

Change in health has been measured in terms of changes in percentages ever reporting a condition between waves 1 and 3. For the chronic conditions reported in this chapter and for depression it is assumed that it will be rare for the condition to disappear completely even if it becomes symptomless, so 'ever reported' also reflects current prevalence of the condition. Change in mean (gait speed and quality of life) has been calculated as the difference between the mean value reported at wave 2 and the mean reported at wave 1, and the difference between the mean reported at wave 3 and the mean reported at wave 2.

Definitions

Body Mass Index (BMI)

Body Mass Index (BMI) is a widely accepted measure of weight for height and is defined as weight in kilograms divided by the square of the height in metres (kg/m^2). BMI was calculated for all those respondents for whom both a valid height and weight measurement were recorded.

Applying the classification of the World Health Organisation (2000) and NICE (2007) we categorised the BMI scores into four main groups:

- underweight group (<20.0 kg/m^2);
- normal (≥ 20.0 and <25 kg/m^2);
- overweight (≥ 25 and <30 kg/m^2);

[1] The Frankfort Plane is an imaginary line passing through the external ear canal and across the top of the lower bone of the eye socket, immediately under the eye. This line must be parallel with the floor. This gives the maximum vertical distance from the floor to the highest point of the skull.

- obese (≥30 kg/ m^2).

In general a BMI below 18.5 kg/m^2 is considered to be low and a BMI between 18.5 kg/m^2 and below 25.0 kg/m^2 is considered to be normal. However, there is no accepted definition for classification using BMI in older people (NICE, 2007), especially for what is considered underweight and normal. We anticipated that for older people a BMI below 20.0 kg/m^2 can be associated with health risks.

Waist circumference

BMI does not distinguish between mass due to body fat and mass due to muscular physique and does not take account of the distribution of fat. It has therefore been postulated that waist circumference may be a better measure than BMI or waist to hip ratio (World Health Organisation, 2000) to identify those with a health risk from their body shape. Among older people the fat distribution changes considerably and abdominal fat tends to increase with age. Therefore waist circumference can be considered an appropriate indicator of body fatness and central fat distribution among the elderly.

Waist circumference was categorised into three main groups using sex-specific cut-offs (Flegal, 2007):

- low risk (<94 cm for men and <80 cm for women);
- medium risk (≥94 cm and <102 cm for men; ≥80 cm and <88 cm for women);
- high risk (≥102 cm for men and ≥88 cm for women).

7.3 Change in anthropometric measures by age groups and sex

Methods

In this section we present changes over time (between wave 0 and wave 2) in BMI and waist circumference by age groups and sex (both at wave 1). We divided age into five equal groups. Mean changes in BMI and waist were calculated using data from the sample of people who took part in both wave 1 and wave 2, and had valid anthropometric measurements at wave 0 and wave 2 (BMI was not measured at wave 1). The median time between the first interview at wave 0 and the interview at wave 2 was 5.6 years.

Results

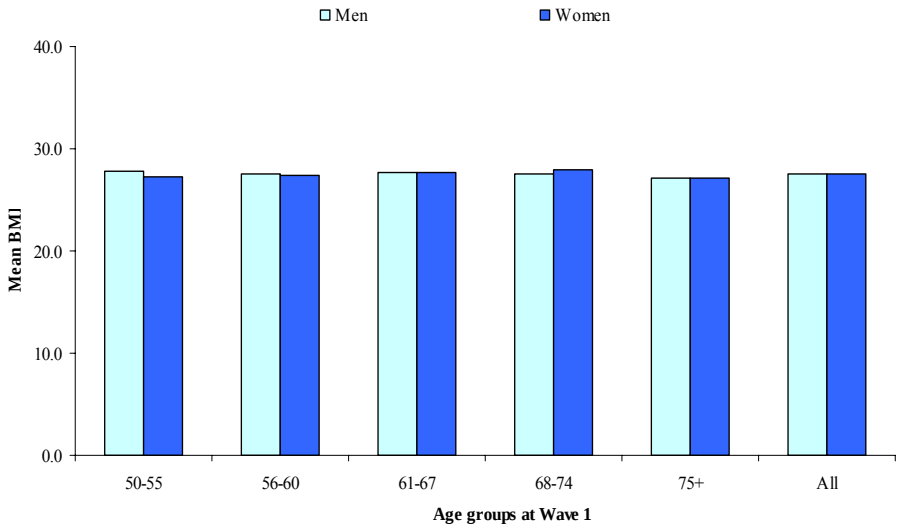
Changes in Body Mass Index (BMI) by age groups and sex

Mean BMI (measured at wave 0) in each of the age groups was over 27.0 kg/m^2, indicating that, on average, men and women were overweight (Figure 7.1). At wave 2, the same respondents had their BMI measured again. Figure 7.2 shows the change over time in mean BMI for men and women in each age group (both at wave 1). Among men aged 50 to 55, mean BMI increased significantly over time, while in all of the other age groups the change over time was not statistically significant. Among women, mean BMI increased

significantly over time up to the age of 67 while for those aged 68 and over there was no significant change over time in BMI. Generally there is a trend of smaller changes in BMI at progressively older ages, with some signs of reduction for the oldest group (but not statistically significant).

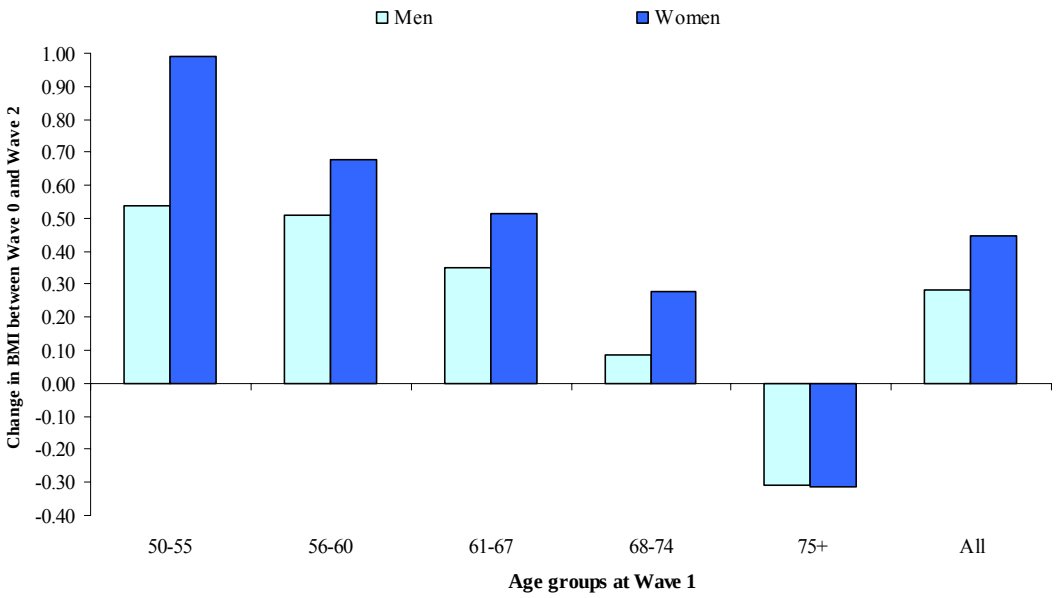
In both waves men had similar mean BMI (27.6 kg/m^2 at wave 0 and 27.8 kg/m^2 at wave 2) to women (27.5 kg/m^2 at wave 0 and 28.0 kg/m^2 at wave 2). However, the mean change over time is greater for women than for men in all age groups except those aged 75 years and over, being particularly marked in the youngest age group (50–55 in 2002–03).

Figure 7.1. Mean BMI at wave 0, by age and sex



Note: Sample: respondents in wave 1 and wave 2, with a valid BMI measurement at wave 0.

Figure 7.2. Change in mean BMI between wave 0 and wave 2, by age and sex

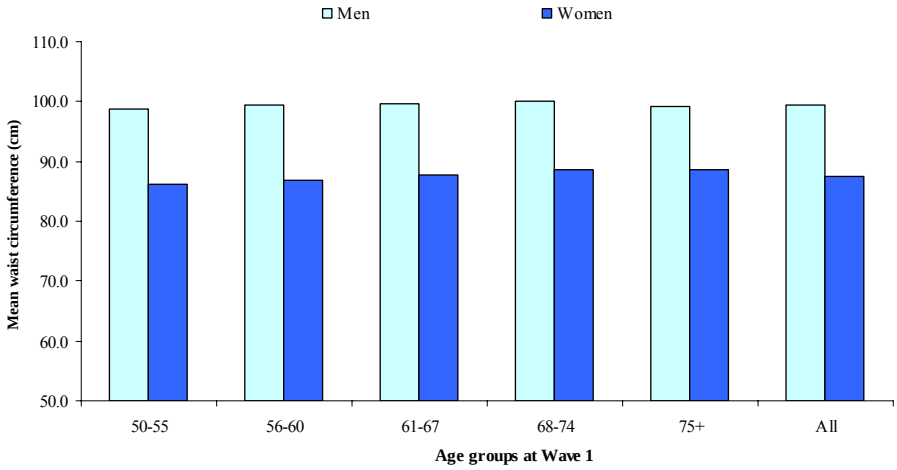


Note: Sample: respondents in wave 1 and wave 2, with a valid BMI measurement at wave 0.

Changes in waist circumference by age groups and sex

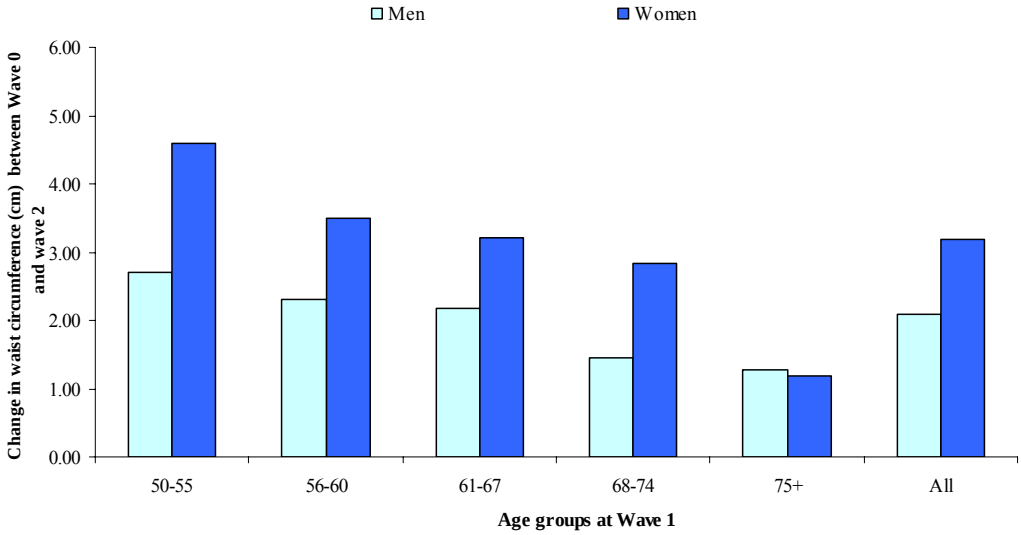
Figure 7.3 shows that, at wave 0, the mean waist circumference was over 99 cm among men and over 86 cm among women in each of the age groups. Over time, mean waist circumference increased significantly in each age group, with the exception of those aged 75 and over. As with BMI, the increases tended to be smaller at older ages. Although men have a higher mean waist circumference than women, the increase over time is greater in women than in men (mean of 3 cm compared to 2 cm overall), with the exception of those aged 75 and over (Figure 7.4).

Figure 7.3. Mean waist circumference (cm) at wave 0, by age and sex



Note: Sample: respondents in wave 1 and wave 2, with a valid waist circumference measurement at wave 0.

Figure 7.4. Change in mean waist circumference (cm) between wave 0 and wave 2, by age and sex



Note: Sample: respondents in wave 1 and wave 2, with a valid waist circumference measurement at wave 0.

7.4 Anthropometric measures and physical health

Anthropometric measures and back pain

Methods

All respondents were asked whether they were often troubled by pain and, if so, how bad the pain was most of the time. Respondents were asked separately about pain in their back, hip, knee and feet. We defined back pain as having severe or moderate pain in the back.

Results

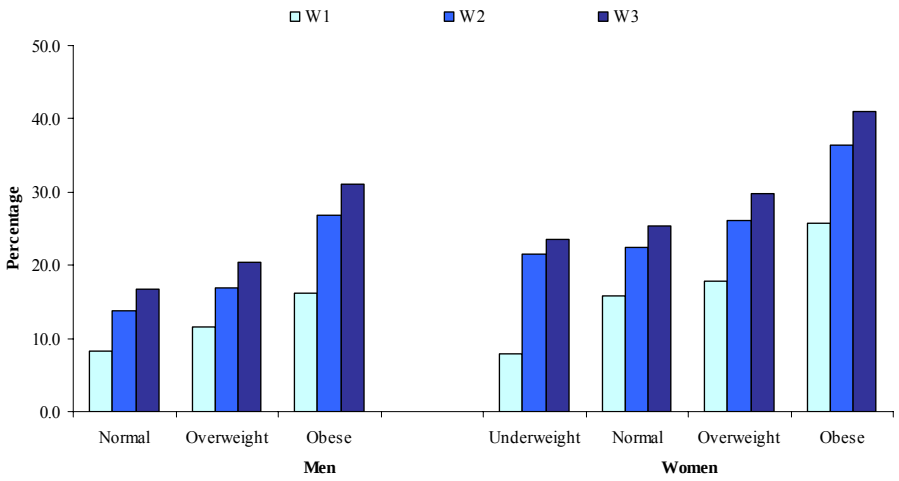
Changes in prevalence of back pain by Body Mass Index (BMI), waist circumference and sex

Figure 7.5 reports the change in prevalence rates of moderate and severe back pain for men and women, by BMI categories.

In both sexes the prevalence rates of severe and moderate back pain increased over time (between waves 1 and 2, waves 2 and 3 and waves 1 and 3) in each of the BMI categories. The exception was for underweight men, for whom the base was too small to detect a significant change, and for underweight women there was not a significant increase between wave 2 and wave 3.

Obese men and overweight and obese women had the greatest increase in the prevalence of severe and moderate back pain compared to normal weight people; this increase was of 15 percentage points for obese men and women and 12 percentage points for overweight women. Moreover, for obese and overweight women the increase in the prevalence of back pain over time was greater than for men in the same categories of BMI.

Figure 7.5. Percentage reporting severe or moderate back pain at each wave of ELSA, by BMI categories and sex

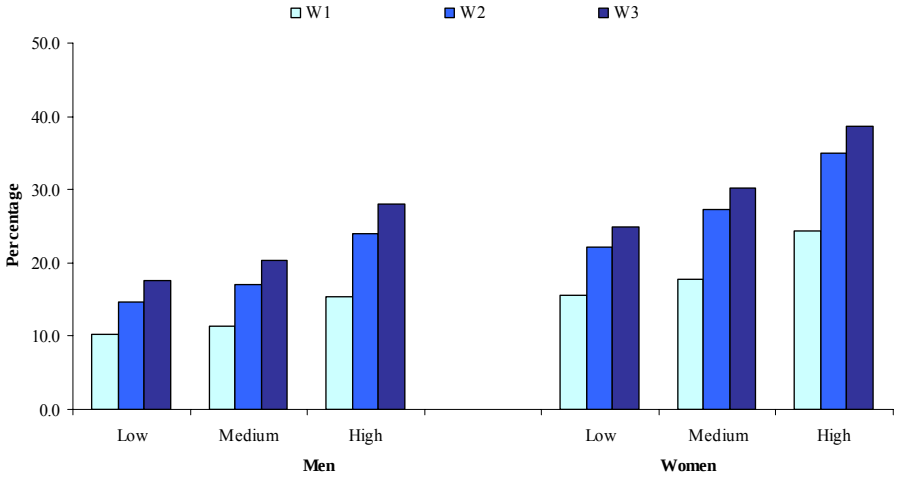


Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0. 'Normal' indicates BMI from 20.0 to 24.9. 'Overweight' indicates BMI from 25 to 29.9. 'Obese' indicates BMI 30 or more. Men underweight omitted because of small base. Age-standardised prevalence.

At wave 3, 31% of obese men and 41% of obese women had severe or moderate back pain, significantly higher percentages than those of overweight and normal weight people.

Figure 7.6 shows the change in the prevalence rates of moderate and severe back pain for men and women, by waist circumference categories. In both sexes, the prevalence rates of severe and moderate back pain increased wave on wave in all the waist circumference categories. Compared to those with low waist circumference, those with high waist circumference and women with medium waist circumference had greater increases in the prevalence of severe and moderate back pain, the greatest increase occurring among those with high waist circumference.

Figure 7.6. Percentage reporting severe or moderate back pain at each wave of ELSA, by waist circumference categories and sex



Notes: Waist circumference at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised prevalence.

Women had a higher increase in prevalence of back pain than men, especially those with a high waist circumference. At wave 3, 28% of men and 39% of women with high waist circumference reported having had severe and moderate back pain, which was significantly higher than the prevalence in those with a low and medium waist circumference.

Anthropometric measures and falls

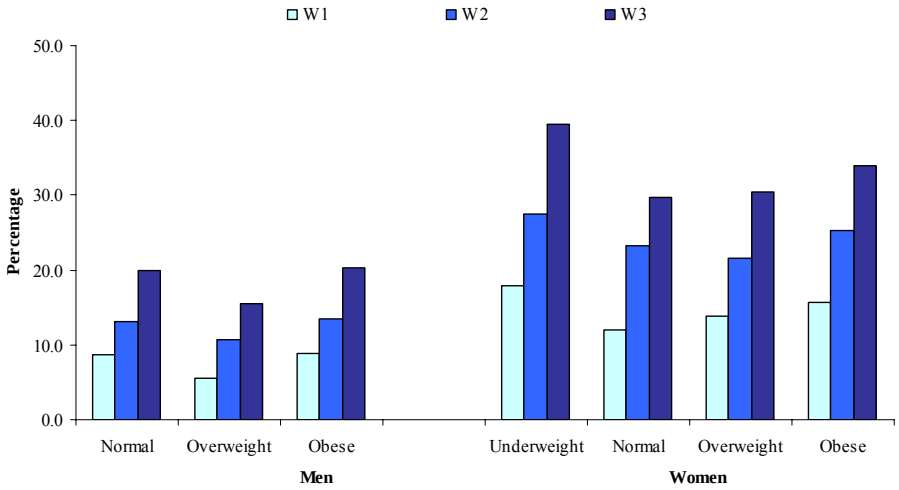
Methods

Respondents aged 60 years and over at wave 1 were asked whether they had fallen down during the previous two years. If they had fallen, they were asked the number of falls and whether they had injured themselves seriously enough to need medical treatment. For the purpose of this section we considered those falls with a serious injury. For BMI the sample analysed is formed of 1,531 men and 1,931 women, while for waist circumference the sample is formed of 1,337 men and 1,709 women.

Results

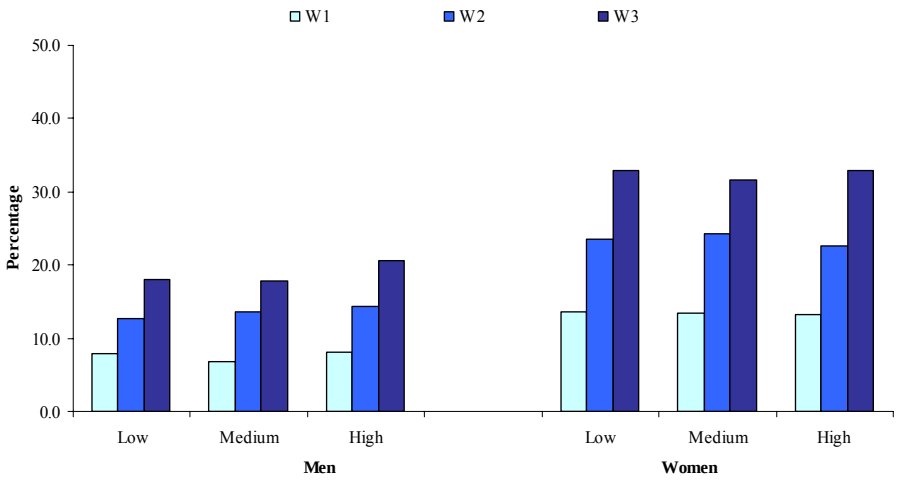
Among men, the prevalence of those who had fallen down and injured themselves seriously did not differ significantly at each wave by BMI or waist circumference category measured at wave 0 (Figures 7.7 and 7.8). In both sexes, there is a significant increase in the prevalence of falls between waves 1 and 2, between waves 2 and 3 and between waves 1 and 3 in all BMI and waist circumference categories, the only exception being underweight men and women for whom the base was too small to detect a significant trend over time. The increase over time was not related to BMI or waist circumference.

Figure 7.7. Percentage reporting falls with injury at each wave of ELSA, by BMI categories and sex



Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0. 'Normal' indicates BMI from 20.0 to 24.9. 'Overweight' indicates BMI from 25 to 29.9. 'Obese' indicates BMI 30 or more. Men underweight omitted because of small base. Age-standardised prevalence.

Figure 7.8. Percentage reporting falls with injury at each wave of ELSA, by waist circumference categories and sex



Notes: Waist circumference at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised prevalence.

Anthropometric measures and shortness of breath

Methods

Respondents were asked four questions about shortness of breath:

- Whether they have shortness of breath when hurrying on level ground or walking.
- Whether they get shortness of breath when walking with other people of the same age on level ground.
- Whether they have to stop for breath when walking at their own pace on level ground.
- Whether they have ever experienced attacks of shortness of breath with wheezing.

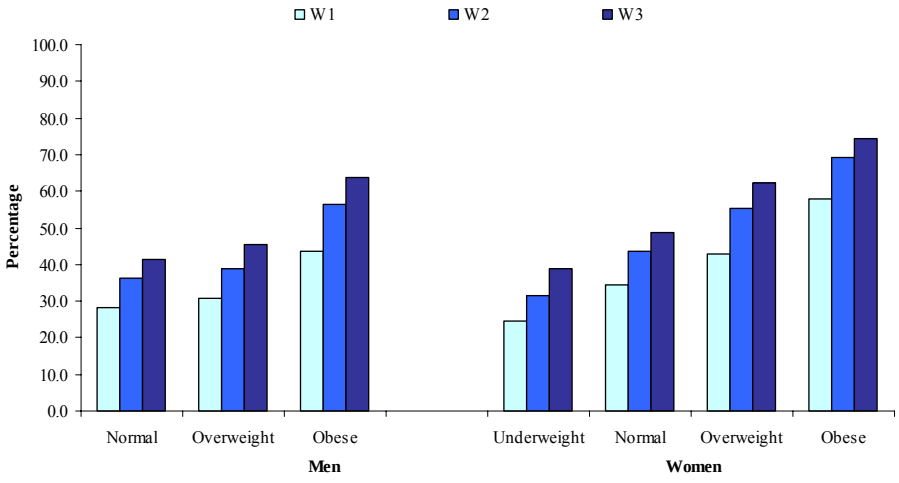
Respondents were considered to have experienced shortness of breath if they answered affirmatively to any of the above questions.

Results

There is a positive gradient across the BMI and waist circumference categories in the increase in prevalence of reported shortness of breath from wave 1 to wave 3, wave 1 to wave 2 and wave 2 to wave 3 (Figures 7.9 and 7.10).

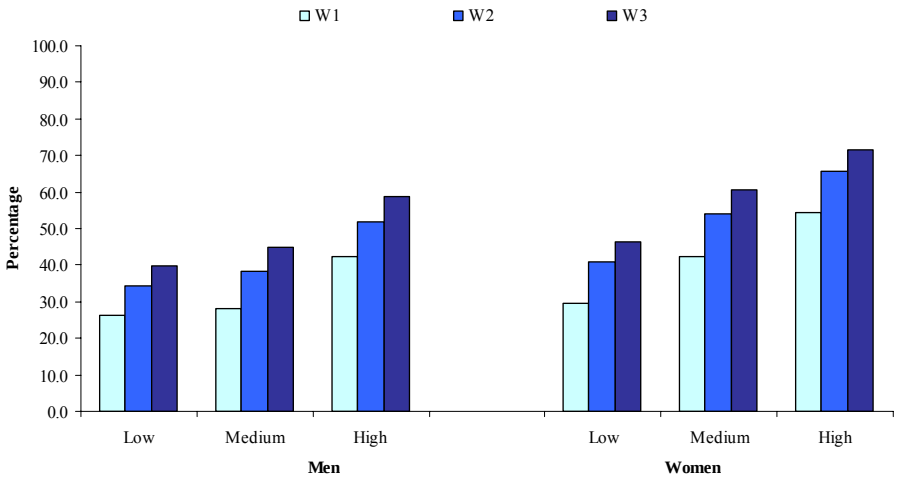
In both sexes, the prevalence of shortness of breath reported has increased over time in each BMI category with obese men and overweight women reporting the greatest increase over time, despite starting from a higher prevalence at wave 1. Similarly, the prevalence rates of shortness of breath present a clear increase in each waist circumference category. Thus, a greater increase was apparent in those with medium and high waist circumference than for those with a low waist circumference.

Figure 7.9. Percentage experiencing shortness of breath at each wave of ELSA, by BMI categories and sex



Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0. 'Normal' indicates BMI from 20.0 to 24.9. 'Overweight' indicates BMI from 25 to 29.9. 'Obese' indicates BMI 30 or more. Men underweight omitted because of small base. Age-standardised prevalence.

Figure 7.10. Percentage experiencing shortness of breath at each wave of ELSA, by waist circumference categories and sex



Notes: Waist circumference at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised prevalence.

Underweight and normal weight women had similar patterns in the prevalence rates of shortness of breath and in the changes over time.

Experience of shortness of breath, as defined in this chapter, was very common among people with relatively high weight or abdominal fat. At wave 3, 64% of obese men, 74% of obese women and 59% of men and 66% of women with high waist circumference reported having experienced shortness of breath. Overall, women reported higher prevalence rates of shortness of breath than men at each wave. Overweight and obese women reported significantly more shortness of breath than men in the same BMI categories ($p<0.001$). Similarly, there was a significant difference in the prevalence of shortness of breath reported by women in the medium and high waist circumference categories compared to those reported by men ($p<0.001$).

Anthropometric measures and arthritis

Methods

Arthritis is defined as having been diagnosed by a doctor as having any form of arthritis, such as rheumatoid arthritis or osteoarthritis.

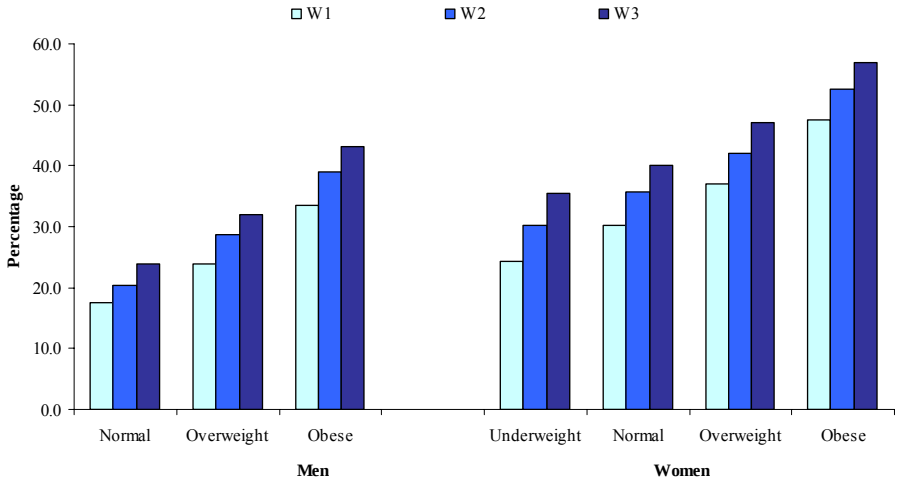
Results

The prevalence of arthritis increased significantly over time in each of the BMI and waist circumference categories. The prevalence of arthritis also differed significantly at each wave across the BMI groups and waist circumference categories with obese men and women (at wave 0) reporting the highest prevalence rates of arthritis at each of the subsequent waves. The increase over time in the prevalence of arthritis was highest among overweight and obese men (8 and 10 percentage point increase, respectively).

At wave 3, 43% of obese men, 57% of obese women and 41% of men and 57% of women with high waist circumference reported having arthritis.

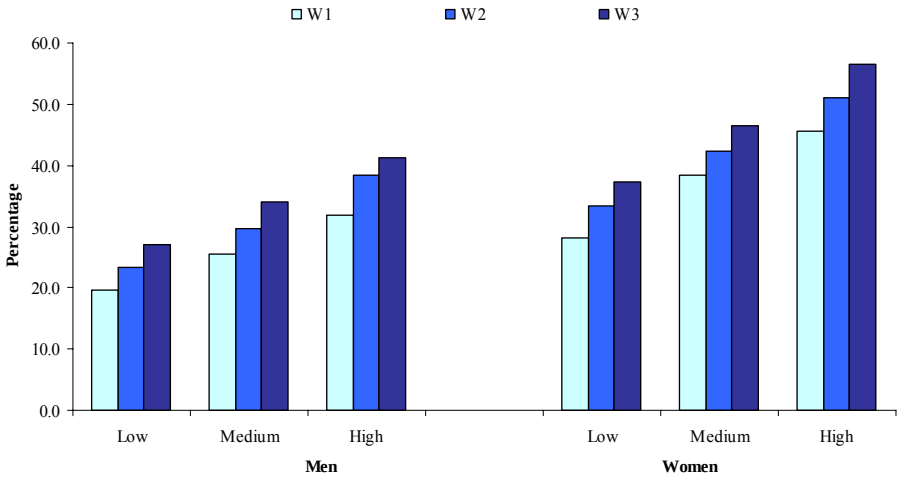
Women compared to men reported higher prevalence rates of arthritis; this was true in each of the BMI groups and for all waist circumference groups measured at wave 0 (Figures 7.11 and 7.12).

Figure 7.11. Percentage reporting arthritis at each wave of ELSA, by BMI categories and sex



Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0. 'Normal' indicates BMI from 20.0 to 24.9. 'Overweight' indicates BMI from 25 to 29.9. 'Obese' indicates BMI 30 or more. Men underweight omitted because of small base. Age-standardised prevalence.

Figure 7.12. Percentage reporting arthritis at each wave of ELSA, by waist circumference categories and sex



Notes: Waist circumference at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised prevalence.

Anthropometric measures and gait speed

Methods

All respondents aged 60 years and over at wave 1 completing the interviews on their own behalf were eligible for the walking speed test, which was performed as part of the main ELSA interview. The test involved timing how long it took to walk a distance of eight feet. Respondents began with both feet together at the beginning of the course. The interviewer started timing as soon as the respondent placed either foot down on the floor across the start line. They were asked to walk (not race) to the other end of the course at their usual speed, just as if they were walking down the street to the shops, and to walk all the way past the other end of the tape before stopping. Timing was stopped when either foot was placed on the floor across the finish line. Respondents were then asked to repeat the test by lining up their feet and walking back along the course, all the way past the other end. The gait speed test was carried out in each wave.

For BMI the sample analysed is formed of 1,261 men and 1,582 women, while for waist circumference the sample is formed of 1,092 men and 1,379 women.

Results

The distributions of change in walking speed (between wave 1 and wave 3) of those with valid BMI measurements and of those with valid waist circumference measurements were approximately normal, with a positive kurtosis, i.e. with higher peaks around the mean (zero) which means a higher probability of values near the mean and lower probability of extreme values than a normally distributed variable.

Table 7A.3 shows the change over time in the mean walking speed (metre per second) by BMI groups and sex. In normal weight men the decrease in the mean walking speed occurred only between wave 1 and wave 3. Among those who were overweight at wave 0 there was a significant decrease in the mean walking speed wave on wave. For overweight men, this decrease was large in comparison to the decrease apparent for normal weight and obese men. Among obese men, the male group with the slowest initial walking speed, the apparent decrease over time was not significant; thus, although still the slowest at wave 3 there was a smaller margin between them and the overweight group. For women the overall decline in walking speed between wave 1 and wave 3 was similar and significant for all groups, such that obese women remained at a disadvantage compared to the other groups.

Table 7A.4 reports that men with a low waist circumference measurement at wave 0 had the greatest decrease in mean walking speed between wave 1 and wave 3. For women the overall decline in walking speed between wave 1 and wave 3 was greatest among those with medium waist circumference.

At wave 3 the mean walking speed of obese men was 0.785 (s.e. 0.02) and that of obese women 0.700 (s.e. 0.01), both significantly lower than in the other BMI groups. Similarly men and women with high waist circumference had the slowest speeds at wave 3. Generally, within BMI and waist circumference categories women had lower mean walking speed (i.e. poorer mobility functioning) than men.

Anthropometric measures and CVD

Methods

Cardiovascular disease (CVD) was defined as having ever had angina, heart attack or stroke. During the interview respondents were asked whether a doctor had ever told them that they suffered from angina, heart attack or stroke. At each wave this information was updated.

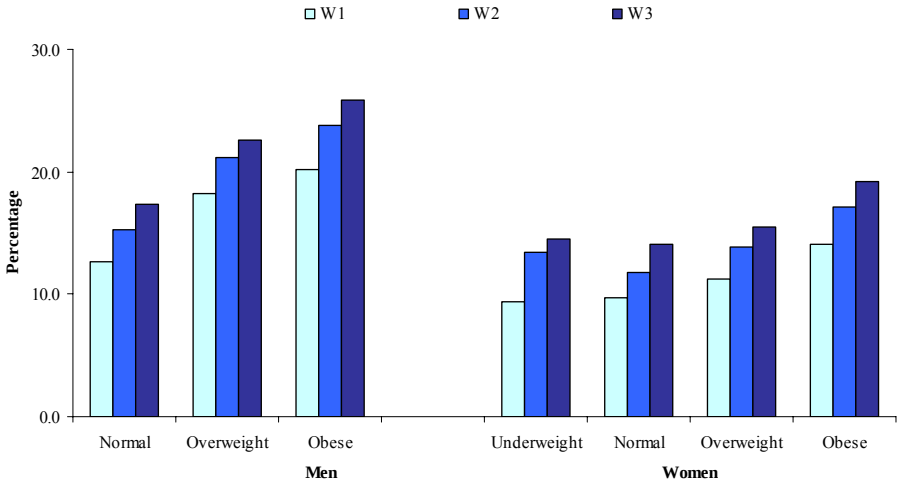
Results

Figures 7.13 and 7.14 show that among men and women in any of the BMI and waist circumference groups (at wave 0), the prevalence of CVD increased significantly over time. Men who were obese and women who were obese or had high waist circumference had the greatest increase in prevalence rates of CVD (6% increase in obese men versus 4% in the other BMI groups and 5% in obese or high waist circumference women versus 3% and 4% in women with low and medium waist circumference). Men with high waist circumference had similar increase in CVD prevalence to those with medium waist circumference.

Among women, the prevalence of CVD did not differ significantly between normal weight and underweight and between normal weight and overweight, at any wave. At wave 3, but not at earlier waves, women with high waist circumference had statistically significant higher prevalence of CVD than women with a medium waist circumference.

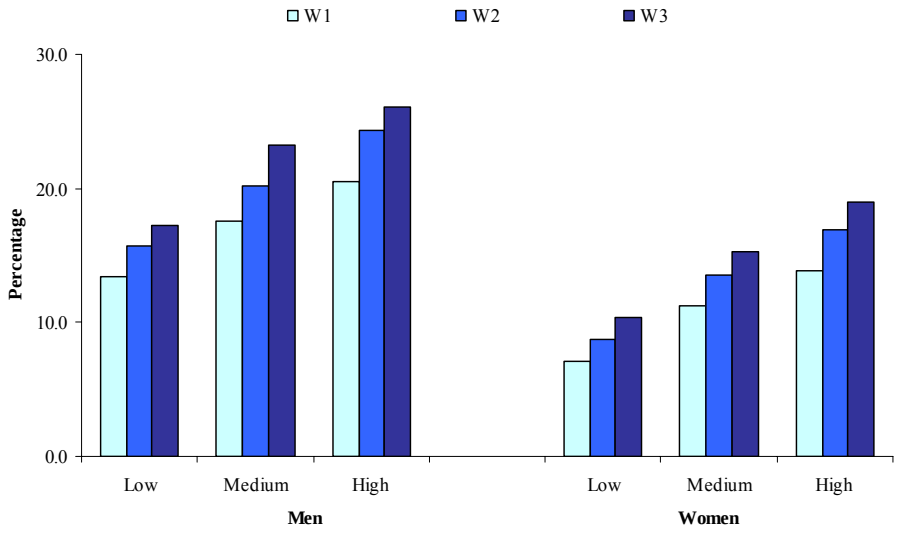
At wave 3, among both obese men and those with high waist circumference 26% had ever reported CVD; for women the prevalence in the obese and high waist circumference groups was the same, at 19%. Men in general had higher prevalence of CVD than women regardless of BMI or waist circumference.

Figure 7.13. Percentage reporting CVD at each wave of ELSA, by BMI categories and sex



Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0. 'Normal' indicates BMI from 20.0 to 24.9. 'Overweight' indicates BMI from 25 to 29.9. 'Obese' indicates BMI 30 or more. Men underweight omitted because of small base. Age-standardised prevalence.

Figure 7.14. Percentage reporting CVD at each wave of ELSA, by waist circumference categories and sex



Notes: Waist circumference at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised prevalence.

Table 7A.5 reports the odds ratios (OR) for the longitudinal association between waist circumference, measured at wave 0, and prevalence of CVD at wave 3. It does not model change in prevalence over time. Waist circumference was categorised in 5 cm groups and used as continuous measures in the regression analysis; the distribution of this variable was the same as the distribution of the original variable. The models were run separately for men and women and first adjusted for age only (at wave 1) and then subsequently adjusted for age, marital status, limiting long-standing illness, smoking status, alcohol consumption, physical activity and wealth, all measured at wave 1, and the year of interview at wave 0.

The results show that in both sexes, 5 cm increase in waist circumference is significantly related with higher odds of reporting CVD at wave 3 independently of age (OR: 1.11 [CI 1.06; 1.16], p<0.001 in men; OR: 1.16 [CI 1.11; 1.21], p<0.001 in women) and independently of age, marital status, limiting long-standing illness, cigarette smoking, alcohol consumption, physical activity and wealth, all at wave 1, and year of interview at wave 0 (OR: 1.07 [CI 1.02; 1.12], p<0.01 in men; OR: 1.08 [CI 1.04; 1.13], p<0.001 in women).

7.5 Anthropometric measures and well-being

Previous studies have shown that among old people increased body weight and/or Body Mass Index is associated with lower quality of life and/or with poor mental health (Jia and Lubetkin, 2005; Lopez-Garcia et al., 2003; Daviglus et al., 2003). In this section we want to explore the association

between anthropometric measures, such as BMI and waist circumference, measured at wave 0, and well-being reported at wave 3.

Methods

The two measures of well-being reported in this section are quality of life and depressive symptoms. Quality of life was measured using the CASP-19 in the self-completion booklet. CASP-19 contains 19 questions on four sub-domains of quality of life. These sub-domains (from which the acronym is derived) are: Control, Autonomy, Self-realisation and Pleasure. We used the total score of CASP-19 which ranges from 0 to 57, with higher scores indicating better quality of life (Hyde et al., 2003).

The eight-item version of the CES-D was used to estimate the prevalence of depressive symptoms. The questions asked the degree to which the respondent had experienced depressive symptoms, such as restless sleep, being unhappy and so on, over the past month. The total score ranges from 0 to 8, which was recoded as: 0, '0–2 symptoms' of depression and 1, '3+ symptoms' of depression (Steffick, 2000). Analyses were also carried out using a cut-off of four or more symptoms of depression; since results produced the same pattern we decided to keep a cut-off of three or more symptoms to have greater power.

Waist circumference was categorised in 5 cm groups and used as continuous measures in the regression analysis; the distribution of this variable was the same as the distribution of the original variable.

Results

Quality of life and anthropometric measures

Table 7A.6 reports changes in the mean scores of quality of life between wave 1 and wave 3, by BMI categories at wave 0. Between wave 1 and wave 2 the mean quality of life slightly decreased in each BMI group (except underweight); however the change was not statistically significant. Significant decreases in quality of life of men and women were found between wave 1 and wave 3 ($p<0.001$) and between wave 2 and wave 3 in most of the BMI groups ($p<0.01$), the exceptions being obese men and underweight men and women. Men who were obese at wave 0 had the greatest decrease in quality of life over time. Overweight men had the smallest decrease in their quality of life between waves 1 and 2; however, they had the highest decrease in the long term (wave 1 to wave 3), compared to normal weight and obese. The greatest decrease in mean quality of life of women occurred among overweight women between waves 1 and 3 although obese women had the lowest mean of quality of life at each wave ($p=0.001$).

Similar results were obtained for waist circumference. Men and women with medium waist circumference had the greatest decrease over time in their mean quality of life (Table 7A.7). While women with high waist circumference had lower quality of life scores than the others at each wave, men with high waist circumference had lower mean quality of life scores than men with normal waist circumference at waves 1 and 2 but not at wave 3.

Table 7A.8 reports the unstandardised regression coefficients for the longitudinal association between quality of life (at wave 3) and waist

circumference (at wave 0). The regressions have been run separately for men and women and first adjusted for age only (at wave 1) and then subsequently adjusted for age, marital status, limiting long-standing illness, smoking status, alcohol consumption, physical activity and wealth, all measured at wave 1, and the year of interview at wave 0. Among men, for 5 cm increase in waist circumference, quality of life decreases by 0.263 point ($p<0.01$); however, when the model is adjusted for other variables, the negative association between waist circumference and quality of life is no longer significant. In the age-adjusted model of women, for a 5 cm increase in waist circumference there is a decrease in quality of life of 0.491 ($p<0.001$); when the model is further adjusted for other variables, the coefficient decreases in magnitude to 0.191, but remains statistically significant.

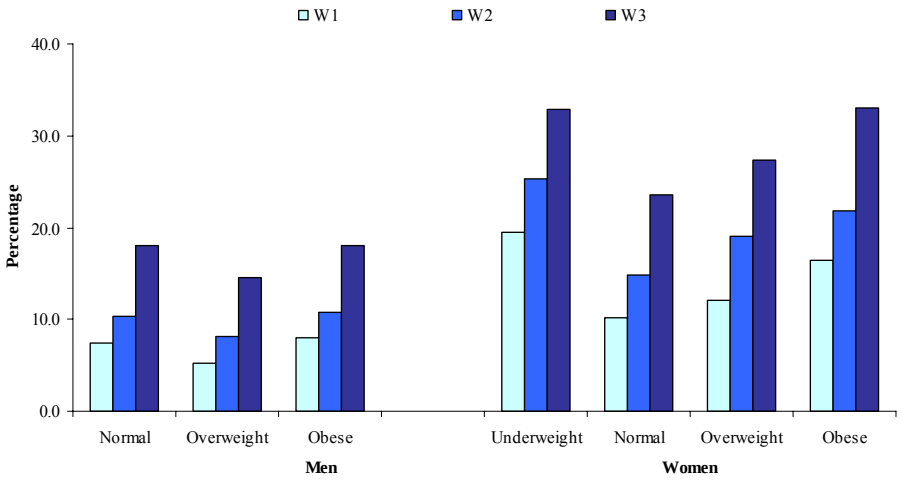
Symptoms of depression and anthropometric measures

Figure 7.15 reports changes in the prevalence of symptoms of depression (three or more), by BMI groups at wave 0, separately for men and women. In both sexes, the prevalence of symptoms of depression increased significantly wave on wave in each of the BMI groups. The greatest increase over time occurred among obese women.

Among men, the prevalence rates of symptoms of depression did not differ significantly according to the BMI groups in any of the three waves.

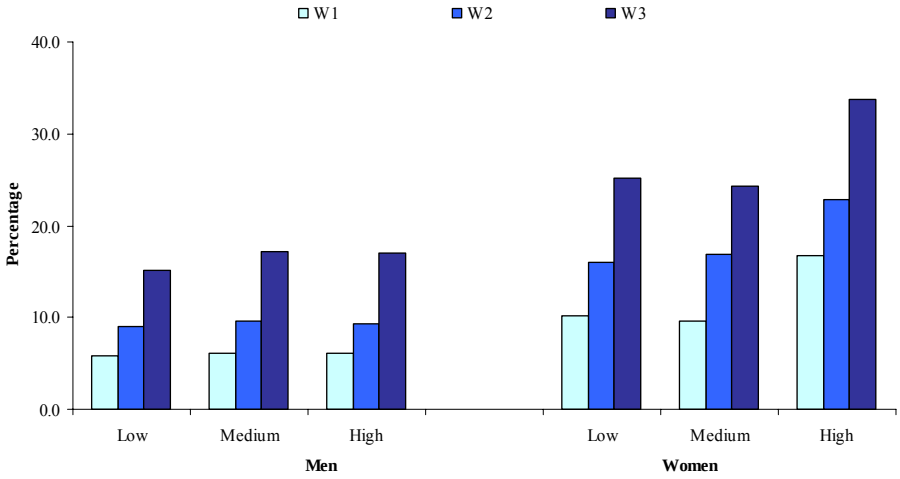
At wave 3 33% of women who were obese at wave 0 reported three or more symptoms of depression, compared to 24% of women with a normal weight. This was the only significant difference at wave 3; in fact, for overweight and underweight women the prevalence rates of depression were significantly higher than for normal weight women at wave 1 and wave 2, but no longer at wave 3.

Figure 7.15. Percentage reporting symptoms of depression at each wave of ELSA, by BMI categories and sex



Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0. 'Normal' indicates BMI from 20.0 to 24.9. 'Overweight' indicates BMI from 25 to 29.9. 'Obese' indicates BMI 30 or more. Men underweight omitted because of small base. Age-standardised prevalence.

Figure 7.16. Percentage reporting symptoms of depression at each wave of ELSA, by waist circumference categories and sex



Notes: Waist circumference at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised prevalence.

In general, women reported higher prevalence of three and more symptoms of depression than men in each of the BMI categories.

Figure 7.16 reports changes in the prevalence of symptoms of depression (three or more) by waist circumference at wave 0, separately for men and women. The prevalence of symptoms of depression increased significantly in each of the waist circumference categories; however, men with medium and high waist circumference and women with high waist circumference had the greatest increase over time.

At wave 3, 17% of men with medium and high waist circumference and 15% of men with low waist circumference reported three or more symptoms of depression. However, the prevalence rates of symptoms of depression did not differ significantly according to the waist circumference groups in any of the three waves. At wave 3, 34% of women with high waist circumference reported having three and more symptoms of depression; this was significantly higher than in the other two groups and mirrored patterns observed at earlier waves. The prevalence rates of symptoms of depression were similar for those with low and medium waist circumference at wave 3 and also in the previous waves.

Women reported higher prevalence of three and more symptoms of depression than men in each of the waist circumference categories.

Table 7A.9 reports the odds ratios (OR) for the longitudinal association between waist circumference, measured at wave 0, and symptoms of depression at wave 3. The models were run separately for men and women and first adjusted for age only (at wave 1) and then subsequently adjusted for age, marital status, limiting long-standing illness, smoking status, alcohol consumption, physical activity and wealth, all measured at wave 1, and the

year of interview at wave 0. Among men, there was no association between waist circumference and symptoms of depression. By contrast, among women, a 5 cm increase in waist circumference corresponded to an odds ratio of reporting three or more symptoms of depression at wave 3 of 1.13 ($p<0.001$) in the model adjusted for age only. When further adjustment was made, the odds ratio decreased to 1.07, but remained statistically significant ($p<0.001$).

7.6 Anthropometric measures and mortality

Methods

The mortality data have been described in Chapter 8. In this paragraph we look at the relationships between BMI and waist circumference and deaths occurring after wave 1. We give the percentage who died by age and sex (at wave 1) according to the BMI and waist circumference categories (at wave 0). We then report the odds ratios of the logistic regression that explores the association between BMI and waist circumference (mutually adjusted), at wave 0, and deaths. The models were run separately for men and women and first adjusted for age only (at wave 1) and then subsequently adjusted for age, marital status, limiting long-standing illness, smoking status, alcohol consumption, physical activity and wealth, all measured at wave 1, and the year of interview at wave 0. Mortality data have been weighted for wave 1 weight.

Results

Among respondents of wave 1, BMI measured at wave 0 was not related to all causes of mortality (Table 7A.10).

Among those aged 50–74, men with a high waist circumference were most likely to die and women with medium and high waist circumference more likely to die than those with low waist circumference. There were no statistically significant differences according to the waist categories in the likelihood of death among men and women aged 75 and over (Table 7A.11).

Table 7A.12 shows the results from the logistic regression for the longitudinal association between the anthropometric groups and death. Underweight in men was associated with a greatly increased risk of mortality compared to normal weight men (OR: 3.83 [CI 1.73; 8.48], p=0.001). This effect was independent of waist circumference, age, marital status, limiting long-standing illness, cigarette smoking, alcohol consumption, physical activity and wealth at wave 1 and year of interview at wave 0 (OR: 2.78 [CI 1.21; 6.43], p=0.017). Overweight was protective of mortality compared to normal weight men (OR: 0.65 [CI 0.47; 0.91], p=0.012); this effect was independent of waist circumference and age but was not independent of additional covariates. Men with moderate and high waist circumference were more likely to die than men with low waist circumference and this remained true after adjusting for BMI and other covariates.

In women, being underweight at wave 0 was associated with a greatly increased risk of mortality compared to normal weight (OR: 1.88 [CI 1.01; 3.49], p=0.047); this was true only in the model adjusted for age and waist. In

the fully adjusted model BMI was not associated with all causes of mortality. By contrast, having medium and high waist circumference (compared to low waist circumference) was associated with increased risk of death in women, independently of BMI and other covariates, such as age, marital status, limiting long-standing illness, smoking status, alcohol consumption, physical activity and wealth, all measured at wave 1, and the year of interview at wave 0.

7.7 Discussion and conclusions

In this chapter we have reported changes in BMI and waist circumference between wave 0 and wave 2. We have also described the relationships between anthropometric measures at wave 0 and several health conditions, quality of life and mortality at subsequent waves.

We found that while BMI increased significantly (between wave 0 and wave 2) only for men in the youngest age group (50 to 55) and for women up to the age of 67, waist circumference increased significantly in both men and women up to the age of 74. We also found that although mean BMI and waist circumference did not differ significantly by sex, BMI and waist circumference both increased more over time among women than among men.

Among men we found that being obese at wave 0 was accompanied by greater increases over time in prevalence of reporting back pain, shortness of breath, arthritis and CVD and also by greater reduction in quality of life. Being overweight at wave 0 was related to greater change in prevalence of reported shortness of breath, arthritis and greater measured reduction in mobility functioning. Men with high waist circumference at wave 0 were also more likely to experience increased shortness of breath, arthritis and CVD over time and greater decrease in physical functioning. We have also shown that men being underweight at wave 0 was related to increased risk of death compared to being normal weight, even after taking into account waist circumference and other covariates. In agreement with previous research (Campos et al., 2006), we found that men who were overweight at wave 0 were less likely to die than normal weight men; however, once we adjusted the model for other covariates, this relationship was no longer significant, suggesting that not accounting for these covariates may lead to a conclusion that overweight is protective of mortality while this is not the case in our population. On the other hand, men with medium and high waist circumference (at wave 0) were clearly more likely to die at subsequent waves than men with low waist circumference, even after taking into account the effect of BMI and other covariates.

The health of women who were obese at wave 0 deteriorated more than women of normal BMI between waves in the following ways: relative increases in reported back pain, arthritis and CVD; greater decrease in measured physical functioning; lower quality of life score at each subsequent wave and increased prevalence rates of three and more symptoms of depression. In addition, being overweight at wave 0 was related to excess increase in prevalence rates of back pain, shortness of breath, arthritis and lower mobility functioning at subsequent waves compared to women of

normal BMI. Underweight women, compared to normal weight, showed greater increases in the prevalence of three and more symptoms of depression at subsequent waves.

Compared with women who had low waist circumference, those with high waist circumference (at wave 0) showed greater increases in prevalence of reported back pain, shortness of breath and arthritis, greater decrease in physical functioning, lower quality of life score at each subsequent wave and greater increases in prevalence rates of three and more symptoms of depression at subsequent waves. The risk of increased prevalence of back pain, and greater deterioration in walking speed and quality of life, was also higher for women with medium waist circumference (at wave 0).

Waist circumference, but not increased BMI (as measured at wave 0), was predictive of mortality among women. After accounting for BMI and other covariates, women with medium and high waist circumference (at wave 0) were more likely to die than women with low waist circumference.

We have also shown that, in both sexes, increased waist circumference (as measured at wave 0) was a predictor for greater risk of having CVD at wave 3; this effect was independent of adjustments. At all waves obese men and women and men with high waist circumference had higher prevalence of arthritis than the other groups; however, they did not deteriorate more than others.

In general women were more likely than men to report higher prevalence rates of back pain, arthritis, falls, shortness of breath, symptoms of depression and lower mobility functioning. This was true especially for obese and overweight women and women with high waist circumference compared to men in the same categories. A possible explanation of the difference between the sexes is that women in general are more disadvantaged than men, especially at older ages. Previous studies have reported that older women are disadvantaged by their relative lack of financial and material resources, which derive from their family caregiving and from their lower position in the labour market. Compared to their male counterparts, older women have poorer health and higher levels of disability and are more likely to provide care to a co-resident family member (Arber and Ginn, 1995).

Attrition could have introduced some bias into our results. To correct at least in part for biases due to loss of respondents, we used longitudinal weights that adjust for differential attrition. In addition we compared basic characteristics of the complete sample analysed in this chapter (i.e., those with valid BMI and waist circumference measurements) with the ELSA sample who completed the three waves. We found that the respondents in the sample analysed in this chapter were on average younger, less likely to have a limiting long-standing illness and less likely to be in the bottom quintile of wealth (all measured at wave 1) than the ELSA sample overall. The two samples did not differ in terms of mean BMI and waist circumference.

To conclude, we have shown that it is important to understand the adverse effects that not only high BMI but also large waist circumference might have on the future health of older people. While it is often believed that BMI can have a protective effect on the health of older people, we have shown that this

is not the case; notably we have shown that an apparent protective effect for mortality in men disappears after adjusting for alcohol consumption, cigarette smoking status and physical activity. It is also important to highlight that while increased BMI was unrelated to mortality in either men or women, waist circumference was, even among those with moderate waist circumference. Our results also stress the importance that being fat or thin can have on the well-being of people. This reinforces policies that aim to counter perceptions that a decline in quality of life and mental health is a 'normal' consequence of ageing rather than the consequence of factors such as high BMI and waist circumference; these perceptions can inhibit action to ameliorate the situation.

In terms of policy our findings confirm that anthropometric measures are still relevant to health at older ages; we also highlight the fact that increased waist circumference is as much of a concern as obesity.

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Appendix 7A
Tables on anthropometric measures and health

Table 7A.1. Age distribution, by Body Mass Index (BMI) and sex

Respondents to the three waves (2,593 men and 3,213 women)

	Underweight		Normal		Overweight		Obese	
	n	%	n	%	n	%	n	%
Men								
50–55	9	[30.0]	142	23.5	333	24.0	163	28.5
56–60	3	[10.0]	140	23.2	250	18.0	113	19.7
61–67	11	[36.7]	130	21.5	335	24.2	127	22.2
68–74	6	[20.0]	111	18.4	305	22.0	108	18.9
75+	1	[3.3]	81	13.4	163	11.8	62	10.8
Total	30	100	604	100	1,386	100	573	100
Women								
50–55	31	35.6	267	26.9	297	23.3	203	23.6
56–60	17	19.5	195	19.7	243	19.1	159	18.5
61–67	7	8.0	229	23.1	277	21.7	200	23.3
68–74	19	21.8	170	17.1	275	21.6	192	22.3
75+	13	14.9	131	13.2	182	14.3	106	12.3
Total	87	100	992	100	1,274	100	860	100

Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0 kg/m^2. 'Normal' indicates BMI from 20.0 to 24.9 kg/m^2. 'Overweight' indicates BMI from 25 to 29.9 kg/m^2. 'Obese' indicates BMI 30 kg/m^2 or more. Age at wave 1.

Table 7A.2. Age distribution, by waist circumference and sex

Respondents to the three waves (2,273 men and 2,862 women)

	Low		Medium		High	
	n	%	n	%	n	%
Men						
50–55	189	26.8	173	23.5	201	24.1
56–60	143	20.3	138	18.8	165	19.8
61–67	152	21.6	173	23.5	188	22.6
68–74	131	18.6	158	21.5	175	21.0
75+	90	12.8	93	12.7	104	12.5
Total	705	100	735	100	833	100
Women						
50–55	237	29.3	195	25.3	284	22.2
56–60	184	22.8	126	16.3	236	18.4
61–67	171	21.2	181	23.5	272	21.2
68–74	137	17.0	156	20.2	291	22.7
75+	79	9.8	114	14.8	199	15.5
Total	808	100	772	100	1,282	100

Notes: Waist at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age at wave 1.

Table 7A.3. Changes in mean walking speed between waves, by Body Mass Index (BMI) and sex

Respondents aged 60+ with a valid BMI measurement

	Underweight	Normal	Overweight	Obese
		Mean walking speed m/s		
Men				
Wave 1	–	0.9194	0.9268	0.8261
(s.e. of the mean)		(0.017)	(0.011)	(0.018)
Wave 2	–	–0.0282	–0.0353	–0.0065
(s.e. of the difference)		(0.023)	(0.016)	(0.027)
Wave 3	–	–0.0253	–0.0445	–0.0345
(s.e. of the difference)		(0.024)	(0.015)	(0.030)
Women				
Wave 1	[0.8997]	0.8900	0.8453	0.7720
(s.e. of the mean)	[(0.049)]	(0.013)	(0.011)	(0.014)
Wave 2	[0.0077]	–0.0163	–0.0323	–0.0308
(s.e. of the difference)	[(0.073)]	(0.019)	(0.016)	(0.019)
Wave 3	[–0.0806]	–0.0551	–0.0370	–0.0409
(s.e. of the difference)	[(0.076)]	(0.018)	(0.016)	(0.018)
Unweighted N				
Men	*16*	*294*	*705*	*246*
Women	*32*	*477*	*662*	*411*

Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0 kg/m^2. 'Normal' indicates BMI from 20.0 to 24.9 kg/m^2. 'Overweight' indicates BMI from 25 to 29.9 kg/m^2. 'Obese' indicates BMI 30 kg/m^2 or more. Age-standardised figures.

Table 7A.4. Changes in means of walking speed between waves, by waist circumference and sex

Respondents aged 60+ with a valid waist measurement

	Low	Medium	High
	Mean walking speed m/s		
Men			
Wave 1	0.9373	0.8917	0.8569
(s.e. of the mean)	(0.016)	(0.014)	(0.016)
Wave 2	–0.0488	–0.0117	–0.0302
(s.e. of the difference)	(0.023)	(0.020)	(0.021)
Wave 3	–0.0184	–0.0344	–0.0352
(s.e. of the difference)	(0.024)	(0.021)	(0.022)
Women			
Wave 1	0.8820	0.8606	0.7993
(s.e. of the mean)	(0.015)	(0.014)	(0.012)
Wave 2	–0.0168	–0.0252	–0.0393
(s.e. of the difference)	(0.022)	(0.020)	(0.016)
Wave 3	–0.0419	–0.0555	–0.0305
(s.e. of the difference)	(0.022)	(0.020)	(0.016)
Unweighted N			
Men	*329*	*369*	*394*
Women	*358*	*395*	*626*

Notes: Waist at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised figures.

Table 7A.5. Logistic regression for the association between CVD at wave 3 and waist circumference at wave 0, by sex

Respondents with a valid answer to the CVD question and valid waist measurement

	Men				Women			
	Base	Odds ratio	95% CI	p-value	Base	Odds ratio	95% CI	p-value
Model 1	2,482				3,108			
Waist (5 cm increase)		1.11	1.06; 1.16	<0.001		1.16	1.11; 1.21	<0.001
Model 2	2,459				3,071			
Waist (5 cm increase)		1.07	1.02; 1.12	<0.01		1.08	1.04; 1.13	<0.001

Notes: Model 1 adjusted for age at wave 1. Model 2 adjusted for age, marital status, limiting long-standing illness, cigarette smoking, alcohol consumption, physical activity and wealth, all at wave 1, and year of interview at wave 0.

Table 7A.6. Changes in means of quality of life scores (CASP-19), by Body Mass Index (BMI) and sex

Respondents with a valid BMI measurement

	Underweight	Normal	Overweight	Obese
		Mean quality of life		
Men				
Wave 1	–	44.2	43.7	42.7
(s.e. of the mean)		(0.39)	(0.24)	(0.51)
Wave 2	–	–0.8	–0.4	–0.9
(s.e. of the difference)		(0.59)	(0.35)	(0.79)
Wave 3	–	–1.5	–2.0	–1.4
(s.e. of the difference)		(0.61)	(0.37)	(0.76)
Women				
Wave 1	44.1	44.5	43.9	42.0
(s.e. of the mean)	(1.18)	(0.33)	(0.32)	(0.40)
Wave 2	+0.9	–0.3	–0.4	–0.3
(s.e. of the difference)	(1.65)	(0.47)	(0.46)	(0.57)
Wave 3	–2.5	–1.8	–2.1	–1.7
(s.e. of the difference)	(1.63)	(0.47)	(0.47)	(0.57)
Unweighted N				
Men	*19*	*431*	*1,006*	*370*
Women	*52*	*709*	*844*	*554*

Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0 kg/m^2. 'Normal' indicates BMI from 20.0 to 24.9 kg/m^2. 'Overweight' indicates BMI from 25 to 29.9 kg/m^2. 'Obese' indicates BMI 30 kg/m^2 or more. Age-standardised figures.

Table 7A.7. Changes in means of quality of life between waves, by waist circumference at wave 0 and sex

Respondents with a valid waist measurement

	Low	Medium	High
	Mean quality of life		
Men			
Wave 1	43.8	43.8	42.5
(s.e. of the mean)	(0.33)	(0.34)	(0.39)
Wave 2	–0.3	–0.6	–0.6
(s.e. of the difference)	(0.50)	(0.50)	(0.58)
Wave 3	–1.8	–1.9	–1.6
(s.e. of the difference)	(0.53)	(0.54)	(0.58)
Women			
Wave 1	44.6	44.5	42.3
(s.e. of the mean)	(0.38)	(0.34)	(0.34)
Wave 2	–0.4	–0.2	–0.5
(s.e. of the difference)	(0.55)	(0.49)	(0.48)
Wave 3	–1.5	–2.6	–1.8
(s.e. of the difference)	(0.56)	(0.53)	(0.48)
Unweighted N			
Men	*514*	*517*	*566*
Women	*587*	*542*	*808*

Notes: Waist at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Age-standardised figures.

Table 7A.8. Linear regression coefficients for the association between quality of life score at wave 3 and waist circumference at wave 0, by sex

Respondents with valid answers to the CASP-19 questionnaire and valid waist measurement

	Men				Women			
	Base	Regression coefficient	95% CI	p-value	Base	Regression coefficient	95% CI	p-value
Model 1	2,081				2,541			
Waist (5 cm increase)		–0.263	–0.428; –0.097	0.002		–0.491	–0.626; –0.355	<0.001
Model 2	1,956				2,511			
Waist (5 cm increase)		–0.005	–0.332; 0.321	0.957		–0.191	–0.323; –0.059	<0.01

Notes: Model 1 adjusted for age at wave 1. Model 2 adjusted for age, marital status, limiting long-standing illness, cigarette smoking, alcohol consumption, physical activity and wealth, all at wave 1, and year of interview at wave 0.

Table 7A.9. Logistic regression for the association between symptoms of depression at wave 3 and waist circumference at wave 0, by sex

Respondents with valid answers to the CES-D questionnaire and valid waist measurement

	Men				Women			
	Base	Odds ratio	95% CI	p-value	Base	Odds ratio	95% CI	p-value
Model 1	2,440				3,043			
Waist (5 cm increase)		1.03	0.98; 1.08	0.217		1.13	1.09; 1.17	<0.001
Model 2	2,418				3,007			
Waist (5 cm increase)		0.99	0.94; 1.04	0.740		1.07	1.03; 1.11	<0.001

Notes: Three or more symptoms of depression at wave 3 and waist measured at wave 0. Model 1 adjusted for age at wave 1. Model 2 adjusted for age, marital status, limiting long-standing illness, cigarette smoking, alcohol consumption, physical activity and wealth, all at wave 1, and year of interview at wave 0.

Table 7A.10. Deaths from all causes, by Body Mass Index (BMI) at wave 0, age and sex

Respondents with a valid BMI measurement and who gave consent for mortality record linkage

		Underweight	Normal	Overweight	Obese
			% died		
Men	50–74	13.8	7.4	5.9	8.9
	75+	–	34.4	33.7	32.9
	All	25.4	12.2	10.6	12.7
Women	50–74	6.3	3.4	4.1	4.9
	75+	[46.1]	27.7	25.5	25.0
	All	20.3	8.8	9.1	8.8
Unweighted N					
Men	50–74	*58*	*851*	*1,932*	*861*
	75+	*11*	*198*	*403*	*163*
	All	*69*	*1,049*	*2,334*	*1,024*
Women	50–74	*112*	*1,302*	*1,635*	*1,208*
	75+	*49*	*313*	*426*	*253*
	All	*161*	*1,615*	*2,061*	*1,461*

Notes: BMI at wave 0. 'Underweight' indicates BMI <20.0 kg/m^2. 'Normal' indicates BMI from 20.0 to 24.9 kg/m^2. 'Overweight' indicates BMI from 25 to 29.9. kg/m^2. 'Obese' indicates BMI 30 kg/m^2 or more. Deaths between 2002 and January 2008.

Table 7A.11. Deaths from all causes, by waist circumference at wave 0, age and sex

Respondents with a valid waist measurement and who gave consent for mortality record linkage

		Low	Medium	High
			% died	
Men	50–74	5.8	6.6	9.3
	75+	34.3	39.6	37.0
	All	10.6	13.2	14.6
Women	50–74	1.5	4.8	5.3
	75+	28.5	28.6	29.8
	All	6.5	10.8	11.6
Unweighted N				
Men	50–74	*933*	*968*	*1,167*
	75+	*201*	*252*	*279*
	All	*1,134*	*1,220*	*1,446*
Women	50–74	*1,039*	*943*	*1,588*
	75+	*198*	*268*	*473*
	All	*1,237*	*1,211*	*2,061*

Notes: Waist at wave 0. 'Low' indicates waist <94 cm for men and <80 cm for women. 'Medium' indicates waist from 94 cm to 101.9 cm for men and from 80 cm to 87.9 cm for women. 'High' indicates waist 102 cm or more for men and 88 cm or more for women. Deaths between 2002 and January 2008.

Table 7A.12. Logistic regression for the association between deaths and BMI and waist circumference, by sex

Respondents with a valid BMI and waist measurement and who gave consent for mortality record linkage

	Men				Women			
	Base	Odds ratio	95% CI	p-value	Base	Odds ratio	95% CI	p-value
Model 1	3,518				4,160			
BMI								
Normal weight		1				1		
Underweight		3.83	1.73; 8.48	0.001		1.88	1.01; 3.49	0.047
Overweight		0.65	0.47; 0.91	0.012		0.85	0.60; 1.22	0.376
Obese		0.72	0.47; 1.11	0.138		0.88	0.58; 1.34	0.542
Waist								
Low		1				1		
Medium		1.70	1.20; 2.40	0.003		1.78	1.17; 2.68	0.006
High		2.05	1.37; 3.05	<0.001		2.16	1.38; 3.37	0.001
Model 2	3,464				4,088			
BMI								
Normal weight		1				1		
Underweight		2.78	1.21; 6.43	0.017		1.71	0.93; 3.16	0.085
Overweight		0.75	0.53; 1.06	0.101		0.88	0.61; 1.26	0.487
Obese		0.70	0.45; 1.08	0.110		0.83	0.54; 1.29	0.415
Waist								
Low		1				1		
Medium		1.66	1.15; 2.40	0.006		1.69	1.10; 2.59	0.016
High		1.87	1.23; 2.84	0.003		1.97	1.25; 3.10	0.003

Notes: Deaths between 2002 and January 2008, BMI and waist measured at wave 0. Model 1 adjusted for age at wave 1. Model 2 adjusted for age, marital status, limiting long-standing illness, cigarette smoking, alcohol consumption, physical activity and wealth, all at wave 1, and year of interview at wave 0.