OBESITY IN SCOTLAND: AN EPIDEMIOLOGY BRIEFING

2007

Obesity in Scotland

An epidemiology briefing

2007

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Obesity in Scotland

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Foreword

I would like to welcome this report from the Scottish Public Health Observatory (ScotPHO), which addresses obesity, an important public health challenge for Scotland. ScotPHO is a collaboration between key national organisations involved in public health intelligence in Scotland and is supported by the Scottish Executive. The aim of the collaboration is to work together to ensure the public health community in Scotland has easy access to clear and relevant information and statistics to support decision-making.

This is the first in a series of reports by ScotPHO on key public health issues in Scotland. The report provides an overview of the epidemiology of obesity in Scotland, describing geographical and social variations in obesity, health inequalities and related morbidity and mortality. The report concludes by identifying some important information needs and gaps for public health intelligence on obesity in Scotland.

I am delighted to be able to provide the foreword to this report, which will act as a solid foundation for the provision of high quality public health intelligence in this area.

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Chair of Scottish Public Health Observatory Steering Group

Acknowledgements

We thank Annie Anderson, Kay Barton, Fiona Crawford, David Gordon, Laurence Gruer, Neil Hamlet, Phil Hanlon, David Ogilvie, Carrie Ruxton, Joyce Thomson and Wendy Wrieden for constructive and helpful comments on draft versions of the report. We also thank all those in the ScotPHO collaboration at Information Services Division (ISD) for their comments and input and a special thanks to Oliver Harding for preparing an earlier draft of the report.

Scottish Public Health Observatory (ScotPHO) collaboration

The ScotPHO team at ISD is part of a collaboration which brings together key national organisations involved in public health intelligence in Scotland, led by ISD and NHS Health Scotland. We are working together closely to ensure the public health community has easy access to clear and relevant information and statistics to support decision-making. This report is the first in a series of ScotPHO briefings on key public health topics in Scotland.

This report was written and prepared by Ian Grant, Colin Fischbacher and Bruce Whyte.

Glossary

BMI	Body Mass Index
CHSP-PS	Child Health Surveillance Programme, Pre School
CHSP-S	Child Health Surveillance Programme, School
CI	Confidence Interval
HSE	Health Survey for England
ISD	Information Services Division of NHS National Services Scotland
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NME sugars	Non-milk extrinsic sugars
OECD	Organisation for Economic Co-operation and Development
PAR	Population attributable risk
ScotPHO	Scottish Public Health Observatory
SHS	Scottish Health Survey
SIGN	Scottish Intercollegiate Guidelines Network
SIMD	Scottish Index of Multiple Deprivation
WC	Waist circumference
WHO	World Health Organization
WHR	Waist hip ratio

Tables and Charts

Tables

Charts

(Please note that unless otherwise stated, all charts in this report are not age adjusted)

Key messages

- At the individual level obesity results from a persistent imbalance between energy intake and energy expenditure. However, diet and physical activity are also influenced by the wider social context, which some have labelled the "obesogenic environment".

- The prevalence of obesity (BMI>30kg/m^2) in Scotland has increased over the past two decades, reaching 22% in men and 24% in women in 2003.

- Obesity in children is now common. In Scotland, nearly one in five (18%) boys and over one in ten (14%) girls aged 2–15 years are obese.

- Women in Scotland are more likely to be obese than women in England but levels of obesity among Scottish and English men are broadly the same.

- Scotland has one of the highest levels of obesity among OECD countries, second only to the United States of America.

- Obesity is linked to an increased risk of coronary heart disease, diabetes, cancer, kidney failure, arthritis, back pain and psychological damage, and decreases life expectancy. For example, type 2 diabetes is almost 13 times more likely to occur in obese women than in women of normal weight.

- Obesity in Scotland is linked to nearly 500,000 cases of high blood pressure, 30,000 cases of type 2 diabetes, and similar numbers of cases of osteoarthritis and gout.

- It is estimated that obese people in Scotland are 18% more likely to be hospitalised than those of normal weight.

- Obesity and its consequences cost the NHS in Scotland an estimated £171 million in 2001.

1. Introduction

Obesity is a growing worldwide problem. The World Health Organization Global Strategy on Diet, Physical Activity and Health states that obesity has reached epidemic proportions globally - at least 300 million people are obese.[1]

Within the UK, the second Wanless report, 'Securing Good Health for the Whole Population'[2] recognised that obesity has the potential to be of equal importance to smoking as a determinant of future health. The culture and environment of present day Britain has been described as 'obesogenic'[3 4] and it will take major changes in lifestyle and environment to slow or reverse the current trend of increasing levels of obesity and overweight.

The cost of treating obesity and obesity-related disease in Scotland was estimated at £171 million in 2001[5] and there are likely to be substantial non-treatment costs in addition.

Obesity continues to be a serious public health concern in Scotland as the prevalence rises. Scotland has national strategies for physical activity and diet. While these are clearly relevant to obesity, there is no specific obesity strategy for Scotland, and, unlike England and Wales, no specific targets have been set for the reduction of obesity.

The main purpose of this report from the Scottish Public Health Observatory (ScotPHO) is to review population data on obesity in Scotland in order to provide policy makers and practitioners with data to support decisions, strategies and action on obesity. The report examines geographical and social variations in obesity in Scotland. It looks at the health inequalities related to obesity, especially with respect to age and deprivation, and summarises the causes of obesity. Finally, morbidity and mortality associated with obesity are described. The report does not cover interventions for obesity in Scotland and does not review evidence about the effectiveness of interventions for obesity. Information about these topics is available from a range of other sources.[6 7 8 9 10]

2. Defining obesity

Obesity is defined as 'a condition characterised by excessive body fat'. Body fat can either be stored predominantly around the waist (central, android or apple-shaped obesity) or around the hips (general, gynoid or pear-shaped obesity).

The Body Mass Index (BMI) is used to measure general (or pear-shaped) obesity. BMI is defined as:

$$\text{BMI} = \frac{\text{body weight (Kg)}}{(\text{height (m)})^2}$$

A BMI of >30 kg/m^2 is considered "obese". BMI levels between 25 and 30 are considered "overweight".

Central or 'apple shaped' obesity, however, is measured using waist and hip circumference, from which the waist-hip ratio (WHR) can be calculated:

$$\text{WHR} = \frac{\text{waist girth (m)}}{\text{Hip girth (m)}}$$

There seems to be no consensus on waist-hip ratio, but in the UK a ratio of ≥0.95 is seen as a health risk for men and ≥0.85 as a health risk for women.

Waist circumference reflects the amount of abdominal fat and provides an independent prediction of the risk of obesity related medical conditions. Men who have a waist measurement equal to or greater than 102cm and women with a measurement of 88cm or more are at increased risk of obesity-related morbidity.[11]

Obesity is often defined using BMI. Nevertheless, there are a number of limitations with this approach, for example in relation to children and the elderly, or when comparing different ethnic groups [see Appendix 1]. Some research suggests that the use of BMI results in considerable underestimation of obesity and that WHR and waist circumference may be more appropriate measures.[12]

BMI is generally agreed to be an unsuitable measure of obesity in children. Obesity in children is usually defined using age-specific cut-offs. Further details are provided in Section 6 and Appendix 2.

In this report, we present data for adults from national surveys using BMI, WHR and waist circumference measurements. For children, we show BMI estimates calculated from year of age BMI thresholds based on the UK National BMI centile classification system.3.

3. Sources of data and information

This section reviews the main sources of data on obesity and its determinants in Scotland.

The Scottish Health Survey

The Scottish Health Survey is a national sample survey carried out in 1995, 1998 and 2003. It consisted of a face-to-face interview including questions on general health, cardiovascular disease, respiratory symptoms, eating habits, smoking, drinking, physical activity and accidents. The interviewer measured respondents' height and weight. The dietary questions included a food frequency questionnaire, but provided no accurate means of assessing total energy intake. The physical activity questions asked about participation in a range of activities and included an overall summary of activity level. A smaller group of respondents underwent more detailed measurements (including blood samples and waist and hip circumference) as part of a nurse visit. The 2003 survey included 8,148 interviews with adults over 16 years and 3,324 interviews with children aged 2-15 years. In the 2003 survey 67% of eligible households took part, and within households who responded, 89% of adults were interviewed. The sample size is sufficient to give accurate prevalence estimates for the whole population of Scotland and for groupings of NHS boards. The Scottish Health Survey is based on a nationally representative sample of adults in Scotland and remains the most authoritative source of information on levels of obesity in adults. However, it has a number of limitations. As there have only been three health surveys since 1995, it is difficult to model future trends in the prevalence of obesity. Recent work in England, based on the longer running Health Survey for England, has used models to predict that levels of obesity will continue to increase and that by 2010, 33% of men and 28% of women will be obese.[13] There is no reason to expect that the trend in Scotland will be more favourable. Modelling Scottish data may become possible with subsequent Scottish Health Surveys.

A further limitation of Scottish Health Survey data is the lack of robust estimates of obesity prevalence at local areas such as NHS boards. Although estimates of obesity at NHS board area are provided in the 2003 Scottish Health Survey, the sample sizes are small and the estimates imprecise. The response rate for the 2003 Scottish Health Survey was 60% amongst adults, and this is likely to introduce some degree of selection bias.[14] This is supported by work on the 1998 Scottish Health Survey that has shown that respondents have better life expectancy than the general Scottish population.[15]

More information on the 1995, 1998 and 2003 Scottish Health Surveys is available from:
http://www.scotland.gov.uk/ScottishHealthSurvey and
http://www.scotpho.org.uk/web/site/home/resources/OverviewofKeyDataSources/Surveys/SHES

Child Health Surveillance Programme (CHSP)

There are currently three child health information systems designed to ensure that children receive appropriate immunisation and surveillance. These include the Child Health Surveillance Programme - Pre-School (CHSP PS); the Child Health Surveillance Programme - School (CHSP S) and the Scottish Immunisation Recall System (SIRS). The systems allow the recording of the child's development, immunisation status, diagnoses, treatment and service needs. Each system can be linked by CHI (Community Health Index) number, providing a full surveillance programme.

Child Health Surveillance Programme: Pre-School (CHSP-PS)

The CHSP-PS system currently has 10 participating NHS boards [see appendix 3]. BMI for pre-school children is based on the height and weight measurements made at the child's 39 to 42 month review. Pre-school children taking part are on average 3.5 years old at time of review.

Child Health Surveillance Programme: School (CHSP-S)

The CHSP-S system currently has 10 participating NHS boards [see appendix 3]. BMI for school aged children is based on data recorded by school year groups P1 (Primary 1), P7 (Primary 7) and S3 (Secondary 3). P1 children are aged approximately 4-5 years old, P7 children 11-12 years old and S3 children 14-15 years old.

More information on the Child Health Surveillance Programme is available at:

http://www.isdscotland.org/isd/info3.jsp?pContentID=2531&p_applic=CCC&p_service=Content.show&

Health Behaviour in School-aged Children Survey (HBSC)

Health Behaviour in School-aged Children (HBSC) is a cross-national research study, which aims to increase understanding of young people's health and wellbeing, health behaviours and their social context. There are 36 participating countries and regions and data collection is carried out using a common research protocol. The first cross-national survey was conducted in 1983/84, the second in 1985/86 and since then data collection has been carried out every four years. The most recent survey, the sixth in the series, was conducted in 2001/02.

The survey is carried out on a nationally representative sample in each participating country. The sample in each country consists of approximately 1,500 children from each age group, giving a total sample size of 4,500 children. Young people attending school, aged 11 (P7), 13 (S2) and 15 (S4) years old are included in the sample. The survey collects information on self-reported subjective health and wellbeing, smoking, alcohol consumption, cannabis use, physical activity and sedentary behaviour, eating habits and body image, oral health, bullying and fighting, injuries and sexual health. The survey also collects information on the life circumstances of young people including family, school, peers and socioeconomic circumstances. The survey provides useful information on diet and physical activity in young people, but is limited to estimates at the national (Scottish) level however, comparisons with other participating countries in the HBSC survey allow for cross-national comparisons to be made.

More information on HBSC is available at: http://www.hbsc.org/ and
http://www.scotpho.org.uk/web/site/home/resources/OverviewofKeyDataSources/Surveys/hbsc

Mintel reports

Mintel (marketing intelligence) reports are commercially produced reports that focus on market areas or specific products. They are usually based on surveys of the general public and often include questions on beliefs and attitudes as well as on spending and other behaviour. They are typically based on sample sizes of around 2000 for the whole of the UK. The representative-ness of these samples is not always clear, so findings need to be interpreted with caution. More information on Mintel reports is available at: http://reports.mintel.com/.

Dietary surveys

Available information on diet in Scotland has been comprehensively reviewed in a Food Standards Agency report on monitoring Scottish dietary targets.[16] More details on the surveys mentioned in this section are available in the report.

The National Food Survey and its successor, **the Expenditure and Food Survey** cover around 600 households in Scotland, or around 1300 people. The survey is based on a 14-day recall of food and drink purchases and may provide a more objective measure than self-reported food intake. It also includes food consumed outside the home.

The National Diet and Nutrition Survey uses 7-day weighed food records. The survey is a UK-wide one but unfortunately has a small sample size in Scotland (less than 200).

The Scottish Health Survey has already been discussed. It includes questions that assess the frequency of consumption of a limited number of food groups. The relatively large sample size allows regional and other sub-group analyses.

The **Health Education Population Survey** has a sample size of around 1800 adults aged 16-74. It provides information on intake of a limited number of food groups.

Transport surveys

The Scottish Household Survey aims to provide a national sample of 31,000 interviews over two years, of adults aged 16 years and over. The survey includes questions on a wide range of topics including: household composition; accommodation; local communities; education and training; employment; income; travel and transport; and health and disability.

The **National Travel Survey** collects information on travel (within Great Britain) by Scottish residents. All travel for private purposes is included and recorded in a 'travel diary' (e.g. by car, bus, train, by foot, distance travelled, frequency of use). The survey, undertaken annually, has a sample size in Scotland of approximately 3500 adults. Information from this survey and transport-related information from the Scottish Household Survey are reported in the Scottish Executive's annual publication, Scottish Transport Statistics.

Other data sources

Further information on a range of other information sources used in this report, including the Scottish Morbidity Record (SMR) scheme, Practice Team Information, the Scottish Household Survey and OECD Health Data, are available from the Scottish Public Health Observatory at:

http://www.scotpho.org.uk/web/site/home/resources/OverviewofKeyDataSources/overview_key_datasources_home.asp

4. Causes of obesity

Constant weight is maintained when energy intake and expenditure are balanced. Obesity is a result of a sustained imbalance between the amount of energy consumed and the amount used in daily life.[17] However, this simplistic summary ignores the complex range of determinants, which influence energy intake and expenditure both independently and interactively. These have been summarised in a WHO report [Table 4.1].[18]

Table 4.1 Summary of strength of evidence on factors that might promote or protect against weight gain and obesity[a]

Evidence	Decreased Risk	No Relationship	Increased Risk
Convincing	Regular physical activity High dietary intake of NSP (dietary fibre)[b]		Sedentary lifestyles High intake of energy dense micronutrient-poor foods[c]
Probable	Home and school environments that support healthy food choices for children Breastfeeding		Heavy marketing of energy-dense foods and fast food outlets High intake of sugars, sweetened soft drinks and fruit juices. Adverse socio-economic conditions[d] (in developed countries, especially for women)
Possible	Low glycaemic index foods	Protein content of the diet	Large portion sizes High proportion of food prepared outside the home (developed countries) 'Rigid restrain/periodic disinhibition' eating patterns
Insufficient	Increased eating frequency		Alcohol

[a] Strength of evidence: the totality of the evidence was taken into account. The World Cancer Research Fund schemas was taken as the starting point but was modified in the following manner: randomized controlled trials were given prominence as the highest ranking study design (randomized controlled trials were not a major source of cancer evidence); associated evidence and expert opinion was also taken into account in relation to environmental determinants (direct trials were not usually available).

[b] Specific amounts will depend on the analytical methodologies used to measure fibre

[c] Energy-dense and micronutrient-poor foods tend to be processed foods that are high in fat and/or sugars. Low energy-dense (for energy-dilute) foods, such as fruit, legumes, vegetables and whole grain cereals, are high in dietary fibre and water

[d] Associated evidence and expert opinion included.

Important components of the "obesogenic" environment described in published reports[19 20 21] include the abundance and ready availability of energy-dense foods and drinks, the resulting "passive over-consumption" of energy, and an environment that limits opportunities for physical activity and promotes an almost universal sedentary state.

The following chapters consider the available data on obesity in adults and children in Scotland. For many of the possible causal factors shown in table 4.1, the data are severely limited or absent, but the limited data that are available are reviewed in section 7.

5. Obesity in Adults

This section describes data available on the prevalence of obesity among adults in Scotland. The section focuses on obesity (defined as a BMI > 30kg/m^2) rather than overweight (BMI 25-30kg/m^2) because obesity is associated with more severe health consequences than overweight. However, overweight is also associated with health consequences and for many people it is a prelude to becoming obese, so data on overweight are also included in this section. Additional measures of obesity such us waist circumference and waist-hip ratio are also reviewed.

The best source of routinely collected data for measuring the prevalence of obesity and overweight in Scotland is the Scottish Health Survey.[22] Since the first survey in 1995, height, weight, waist measurement and hip measurement have been routinely recorded, enabling analysis of BMI and WHR and waist circumference. This section draws on data from all three Scottish Health Surveys, 1995, 1998 and 2003, to describe the prevalence of obesity in Scotland.

5.1 Obesity as measured by BMI, waist circumference and WHR

Data from the Scottish Health Surveys show that for people aged 16 to 64 years, there has been an increase in the prevalence of obesity (defined as BMI>30 kg/m^2) in both men and women between 1995 and 2003 [Charts 5.1 and 5.2]. There has been little change in the prevalence of overweight in men and women since 1995.

In the Scottish Health Survey, central obesity (apple-shaped) is defined as a WHR of 0.95 or more in men and 0.85 or more in women (aged 16-64) and as a raised waist circumference in men of 120 cm or more and 88cm or more in women. The proportion of people with central obesity is increasing, particularly in women, with nearly a doubling of the prevalence of raised WHR and raised waist circumference between 1995 and 2003 [Chart 5.2]. Although the increase in levels of central obesity among women seems very large, similar trends have been observed in England over the same period of time.[23]

Chart 5.1 Prevalence of overweight and obesity (measured by BMI, WHR, WC) in Scotland, men aged 16-64, 1995, 1998, 2003 (Source: Scottish Health Survey (SHS) 2003)

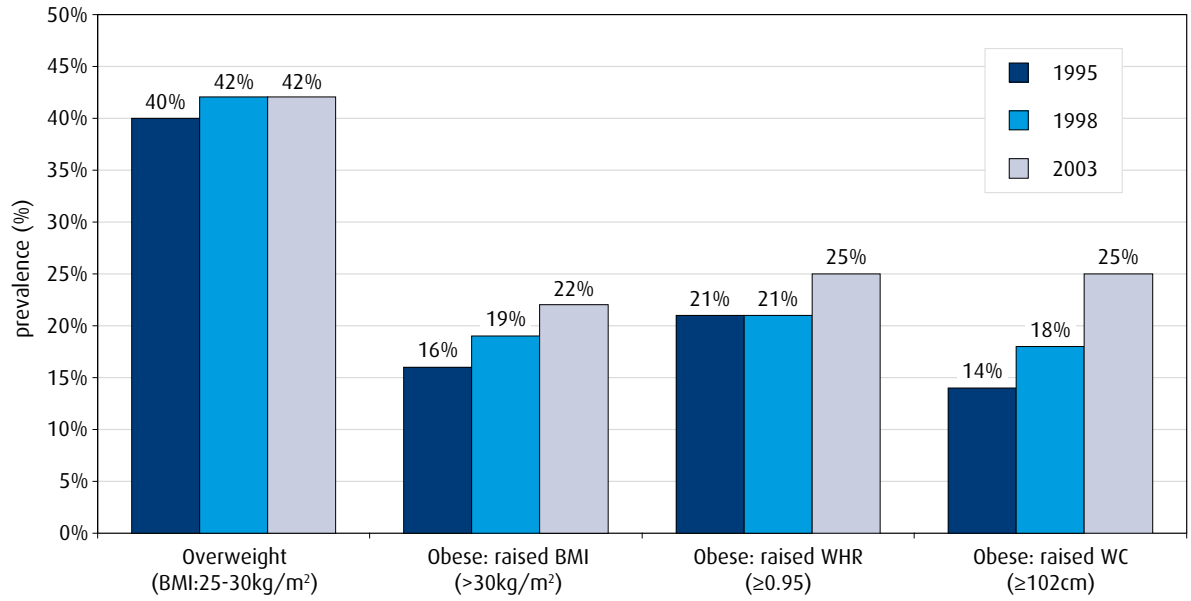
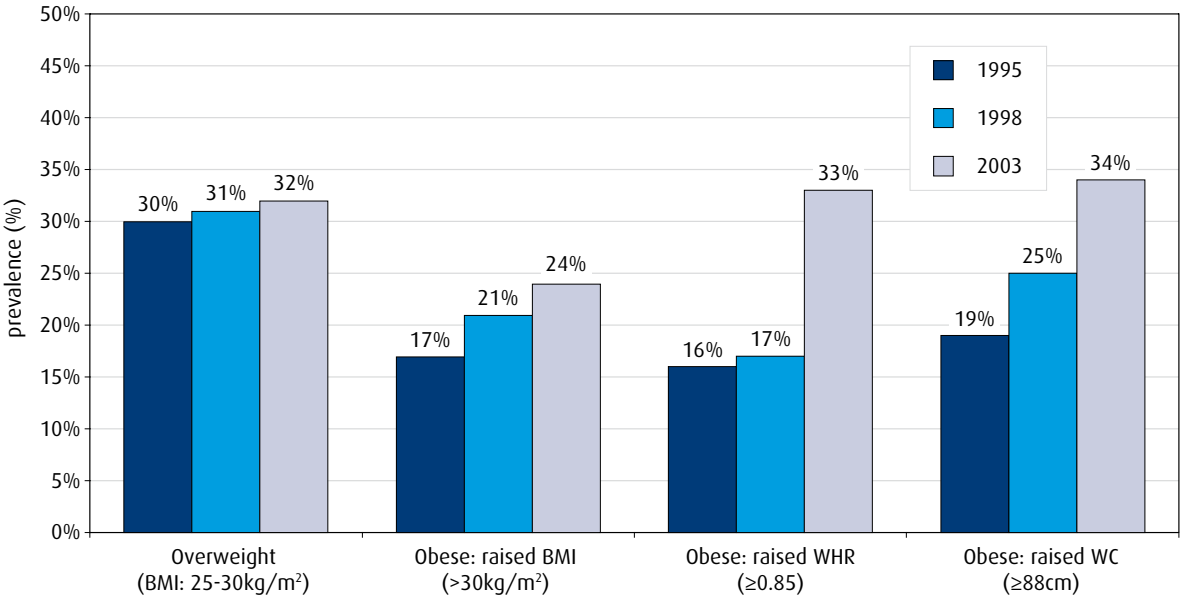


Chart 5.2 Prevalence of overweight and obesity (measured by BMI, WHR, WC) in Scotland, women aged 16-64, 1995, 1998, 2003 (Source: SHS 2003)



5.2 Geographical variation

The 2003 Scottish Health Survey reports by NHS board areas, the prevalence of adults who are overweight and obese [Charts 5.3 and 5.4] and those who have a raised waist circumference [Charts 5.5 and 5.6]. The sample sizes for boards are smaller so the estimates are less accurate than for Scotland as a whole. Confidence intervals representing the uncertainty of the NHS board estimates are therefore provided. Caution should be used in interpreting differences between NHS board areas as many of the confidence intervals overlap.

The prevalence of obesity or overweight (measured by BMI) in men was significantly higher than the national average in Orkney, Shetland, Western Isles and Dumfries and Galloway NHS board areas [Chart 5.3] and the prevalence in women was significantly higher than the national average in Lanarkshire NHS board area [Chart 5.4].

The prevalence of obesity in men, as measured by a raised waist circumference was significantly lower than the national average in Forth Valley and Tayside NHS board areas and the prevalence in women was significantly lower than the national average in Lothian NHS board area. No areas had a significantly raised waist circumference compared to the national average [Charts 5.5 and 5.6].

Chart 5. 3 Percentage of men, aged 16 and over, overweight or obese (BMI>25 kg/m²), NHS board of residence, 2003 (Source: SHS 2003)

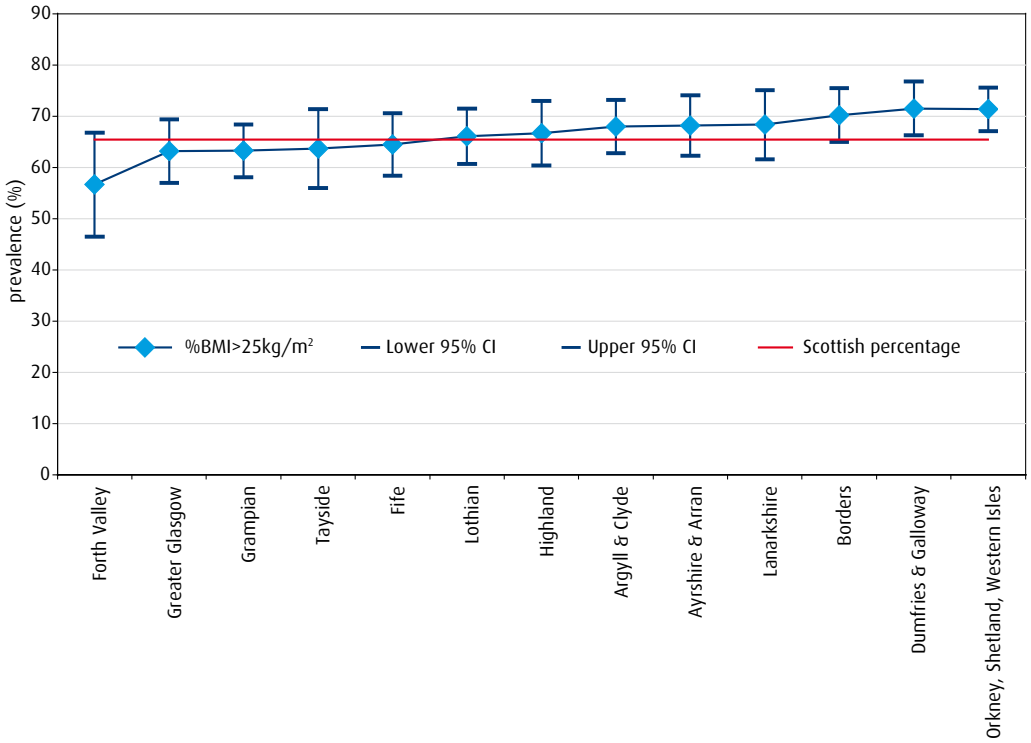


Chart 5.4 Percentage of women, aged 16 and over, overweight or obese (BMI>25 kg/m²), NHS board of residence, 2003 (Source: SHS 2003)

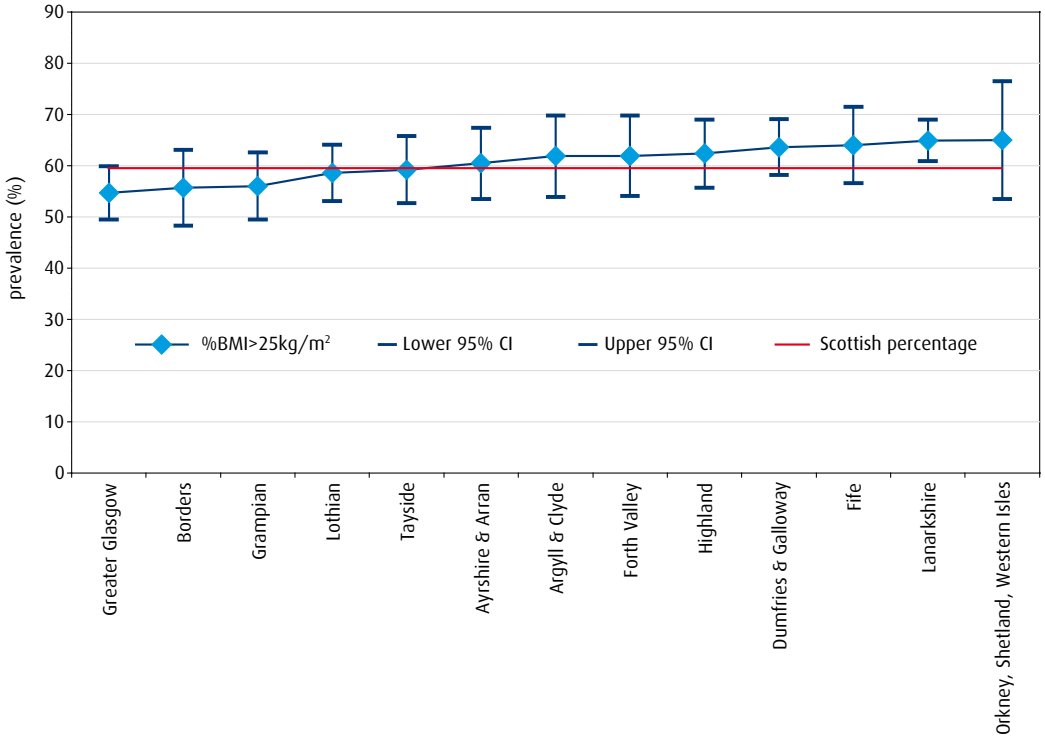


Chart 5.5 Percentage of men, aged 16 and over, with raised waist circumference (≥102cm), NHS board of residence, 2003

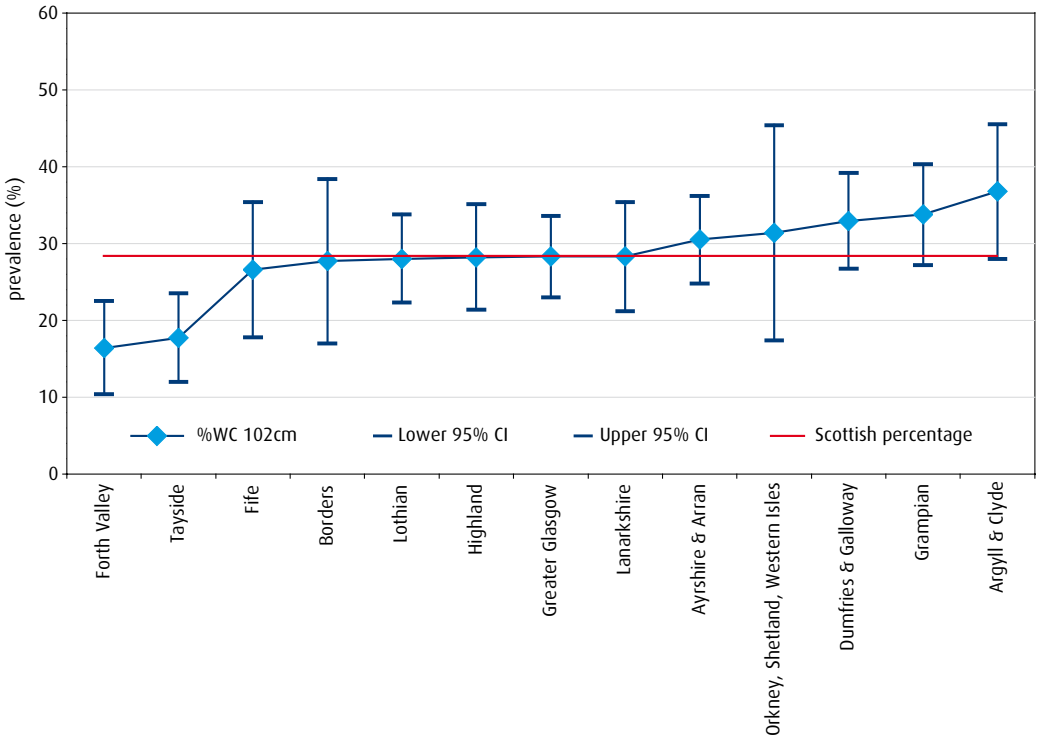
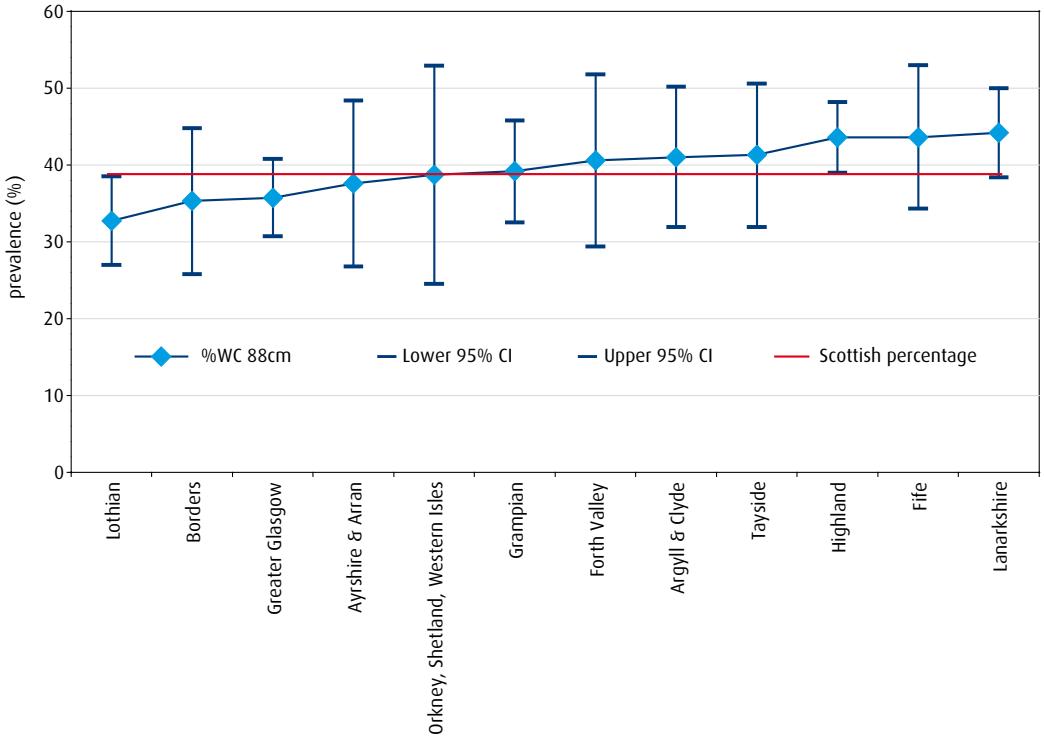


Chart 5.6 Percentage of women, aged 16 and over, with raised waist circumference (≥88cm), NHS board of residence, 2003



5.3 Age and gender

Obesity, as measured by BMI, peaks for men at 55-64 years of age though for measures of waist-hip ratio and waist circumference, the peak for men is at 65-74 years. For women, obesity levels peak at 65-74 years irrespective of obesity measure used [Charts 5. 7 and 5.8]. Differences between men and women are more pronounced at ages 16-34 years and 75 years and over for both general and central measures of obesity. Lower prevalence of obesity in older age groups may be partly a selection effect due to higher mortality among obese people at younger ages.

Chart 5.7 Prevalence of overweight and obesity (measured by BMI, WHR, WC) in men by age, Scotland 2003 (Source: SHS 2003)

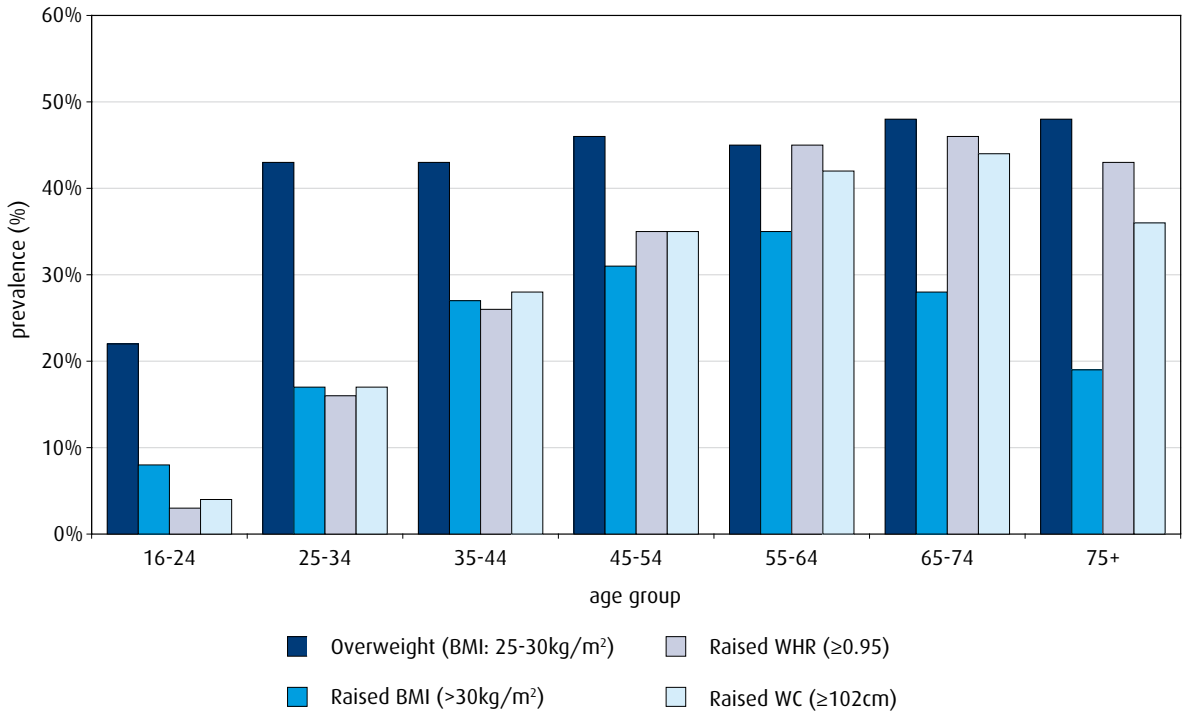
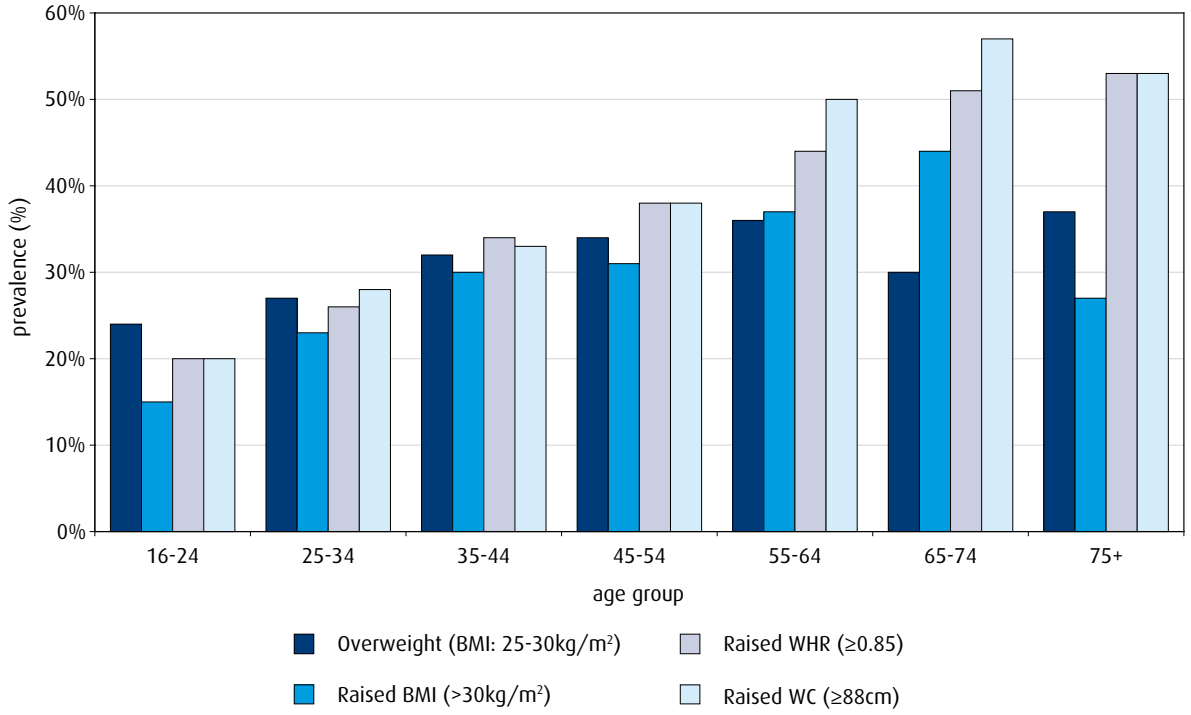


Chart 5.8 Prevalence of overweight and obesity (measured by BMI, WHR, WC) in women by age, Scotland 2003 (Source: SHS 2003)



The prevalence of obesity in both men and women aged between 16 and 64 years, has been increasing over the last 8 years. There are, however, some notable gender differences in these trends. There have been marked increases in the prevalence of obesity (as measured by a BMI >30kg/m²) since 1995 among men 55-64 years of age, with levels of obesity in this age group rising from 21% in 1995 to 35% in 2003. However, among women the most notable increases in the prevalence of obesity have been in those aged under 45: in women aged 35-44 years, the prevalence of obesity has risen by 8% between 1995 and 2003 and by 6% in those aged 35 years and younger [Charts 5.9 and 5.10].

Chart 5.9 Trends in obesity (BMI>30 kg/m²) among men aged 16-64 years, Scotland, 1995, 1998 and 2003 (Source: SHS 2003)

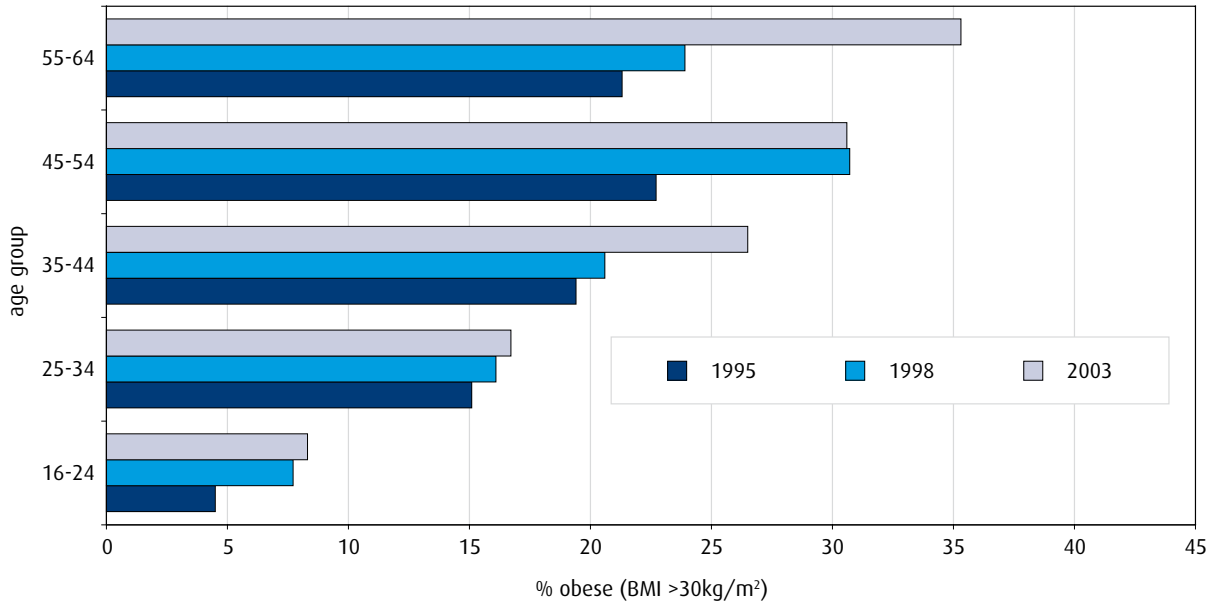


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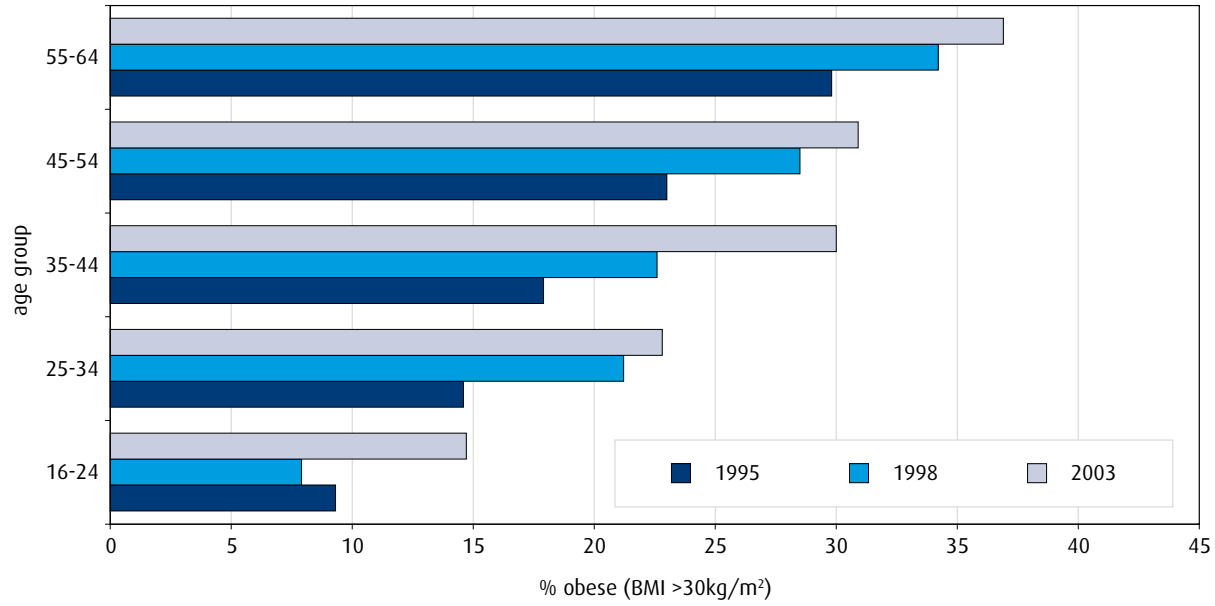
Chart 5.10 Trends in obesity (BMI>30 kg/m²) among women aged 16-64 years, Scotland, 1995, 1998 and 2003 (Source: SHS 2003)



Measures of central obesity show some marked differences in gender by age. Raised waist circumference levels, for example, have increased considerably in men aged 25 and over and in women aged 16 and over: the most notable increases since 1995 have been in men aged 35-44 and 75 years and over (14% and 15% respectively) and in women aged 25-34 and 75 years and over (14% and 18% respectively) [Charts 5.11 and 5.12].

Chart 5.11 Trends in obesity (waist circumference ≥102cm) among men aged 16-64 years, Scotland, 1995, 1998 and 2003 (Source: SHS 2003)

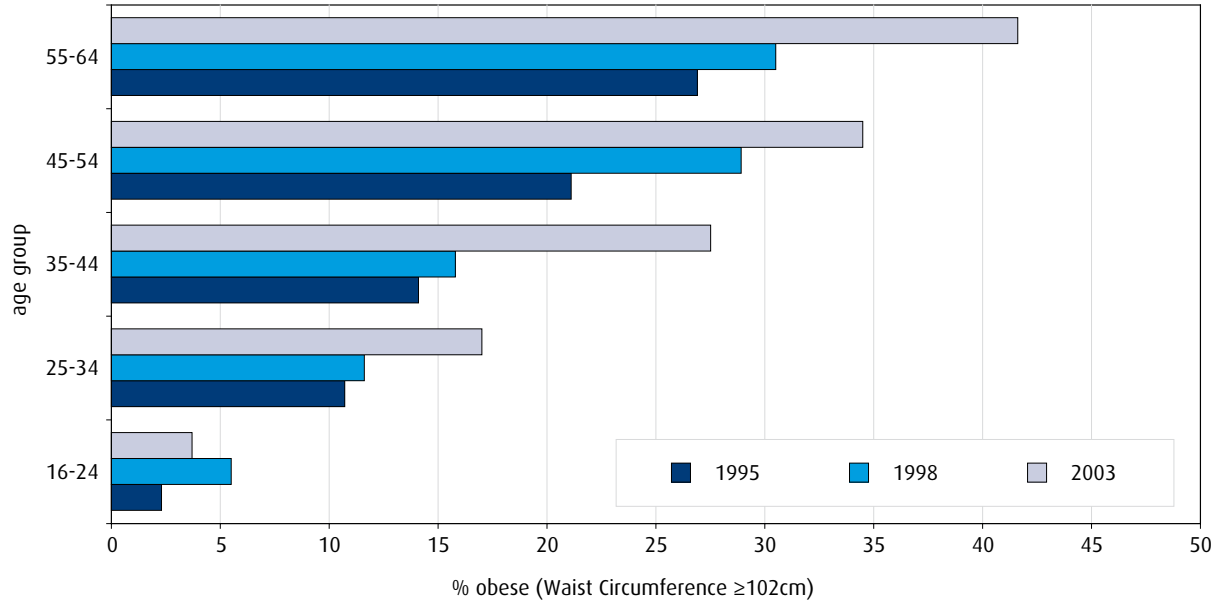
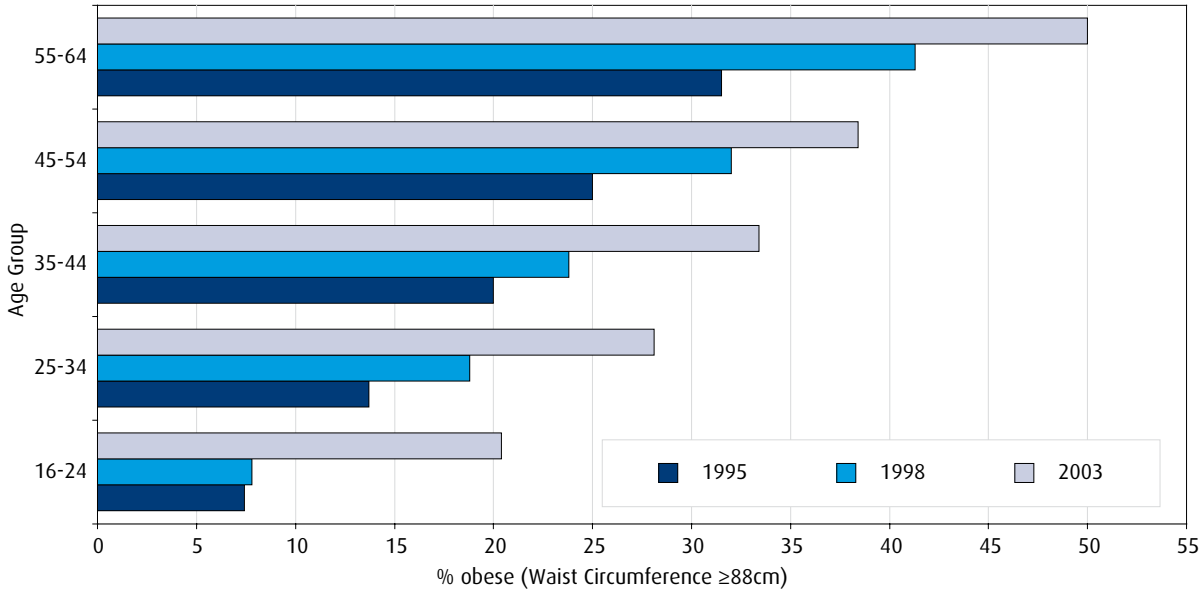


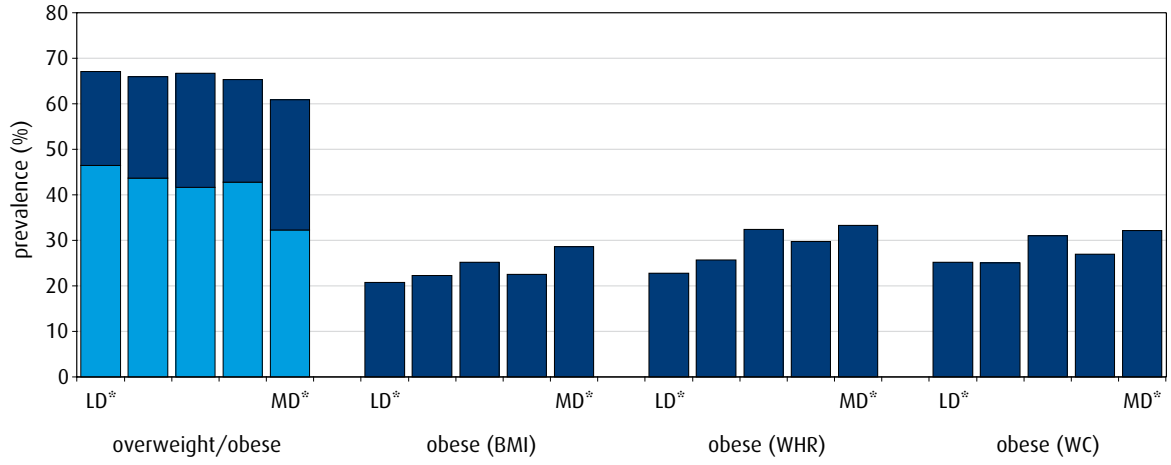
Chart 5.12 Trends in obesity (waist circumference ≥88cm) among women aged 16-64 years, Scotland, 1995, 1998 and 2003 (Source: SHS 2003)



5.4 Obesity and deprivation

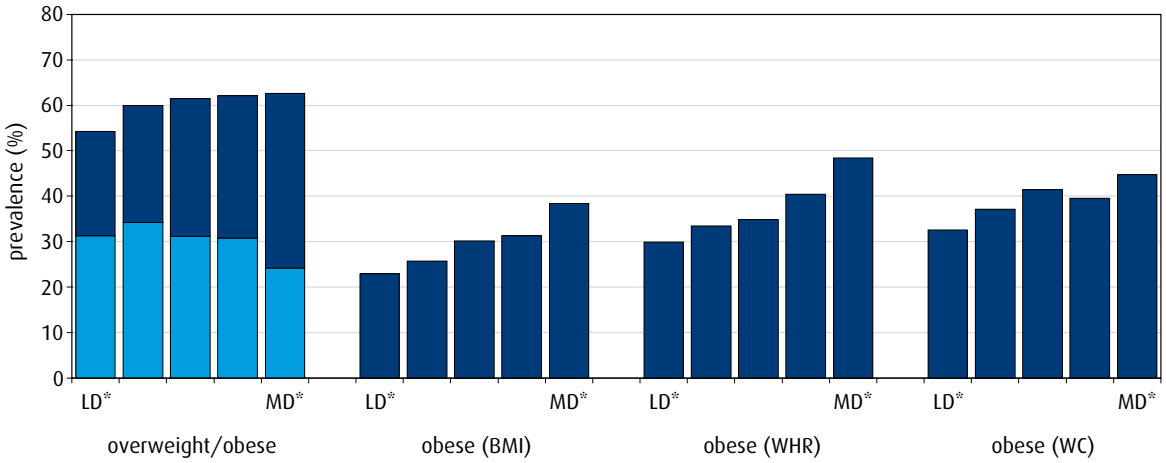
The 2003 Scottish Health Survey presents data on the prevalence of obesity by socioeconomic status, using the Scottish Index of Multiple Deprivation (SIMD), an area based measure of social deprivation. For general and central measures of obesity, there tends to be increasing prevalence with increasing deprivation, though the relationship with deprivation is generally stronger in women than in men [Chart 5.13 and Chart 5.14].

Chart 5.13 Prevalence of central and general obesity (age-standardised) in men, by SIMD, Scotland, 2003 (Source: Scottish Health Survey 2003)



* LD (least deprived quintile), MD (most deprived quintile)

Chart 5.14 Prevalence of central and general obesity (age-standardised) in women, by SIMD, Scotland, 2003. (Source: Scottish Health Survey 2003)



* LD (least deprived quintile), MD (most deprived quintile)

Another way of looking at the relationship between socio-economic status and obesity is to calculate the population attributable risk (PAR). Broadly, PAR is the proportion of the disease in the population that is due to exposure to a risk factor. It is calculated by estimating the number of cases that would occur if everyone in a population was free of exposure to a particular risk factor. In this analysis the "risk factor" is deprivation and the "disease" obesity, and the calculation is based on the whole Scottish population having the same level of deprivation as the least deprived group (SIMD quintile 1).

Using the following formula and data from the 2003 Scottish Health Survey;[24]

$$\frac{I_p - I_u}{I_p}$$

where I_u = incidence in the "unexposed" population and I_p = incidence in total population

it is estimated that a reduction of 1.4 cases of obesity per 100 population could be expected in the most deprived twenty per cent of Scotland's communities if they had the same level of deprivation across all quintiles. Such a reduction represents a 5.3% decrease in the overall prevalence of obesity in the population and implies that around a fifth of cases of obesity in Scotland can be attributed to deprivation.

5.5 International comparisons

5.5.1 Comparisons between Scotland and England

This section compares BMI overweight and obesity estimates for Scotland (based on the 2003 Scottish Health Survey) and England (using data from the 2001/02 Health Survey for England (HSE).

Although the proportion of men who were obese (BMI>30kg/m^2) was similar for Scotland and England (24% in Scotland and 23.2% in England), women in Scotland were more likely to be obese than women in England (29.4% and 25.9% respectively) [Charts 5.15 and 5.16].

Chart 5.15 Prevalence of obesity (BMI>30 kg/m²), Scotland (2003) and England (2001/02), men aged 16 and over (Source: SHS 2003)

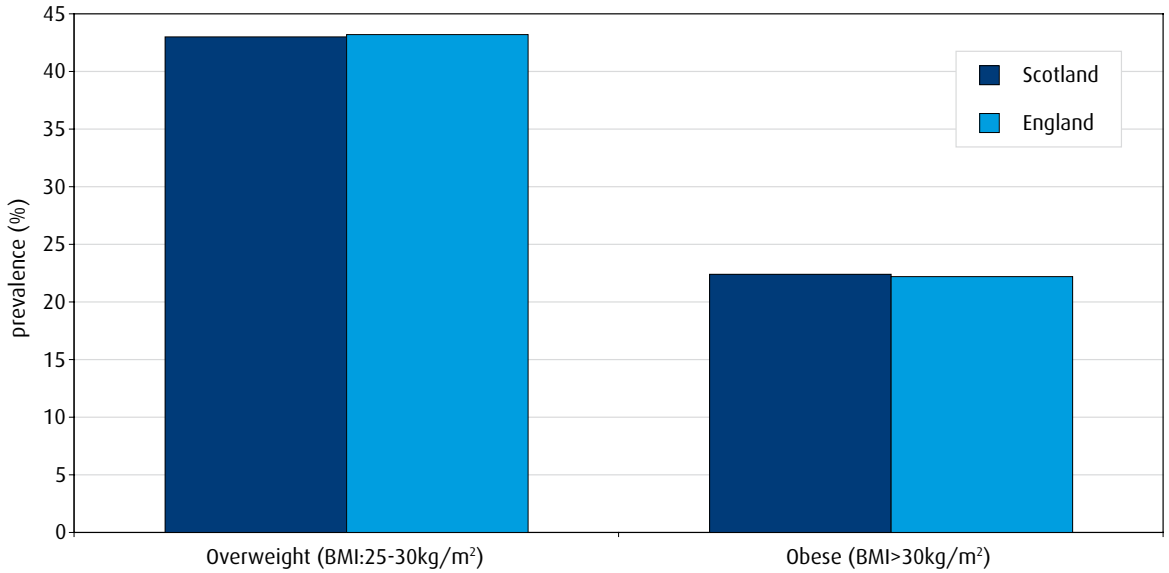
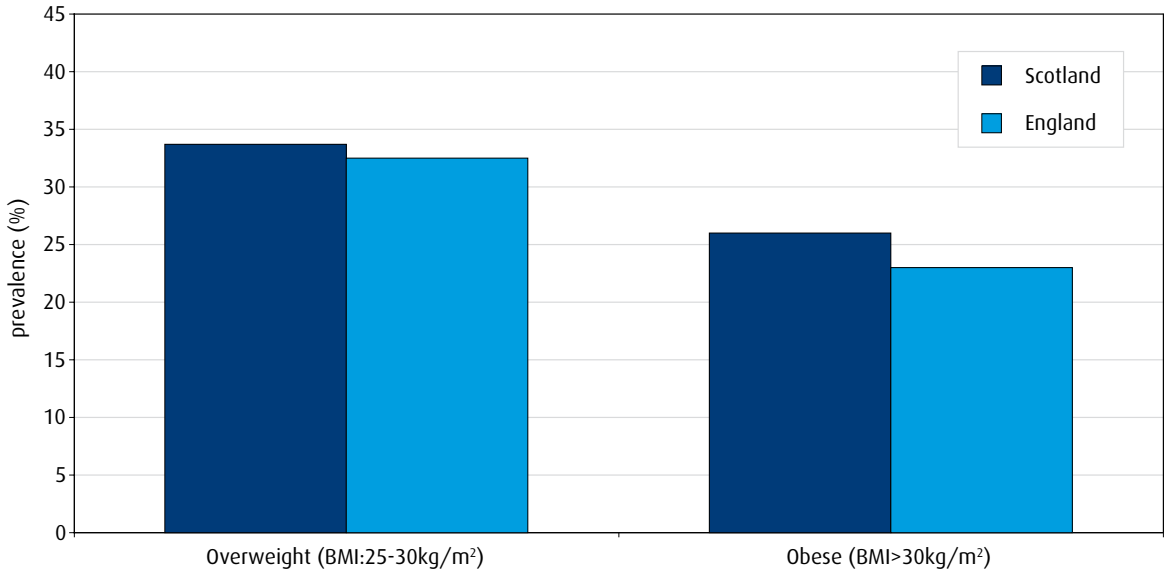


Chart 5.16 Prevalence of obesity (BMI>30 kg/m²), Scotland (2003) and England (2001/02), women aged 16 and over (Source: SHS 2003)



In both Scotland and England, there was a general trend for levels of obesity to increase with age in both men and women, except in the oldest age categories. Obesity levels among men in Scotland and England were broadly similar across all age groups though men aged 55-64 in Scotland were more likely to be obese than men aged 55-64 in England (33.3% and 26.7% respectively) and women aged 65-74 in Scotland were more likely to obese than similar aged women in England (40.5% and 30.1% respectively) [Charts 5.17 and 5.18].

Chart 5.17 Prevalence of obesity (BMI>30 kg/m²), in men, Scotland (2003) and England (2001/02), aged 16 and over, by age (Source: Scottish Health Survey 2003)

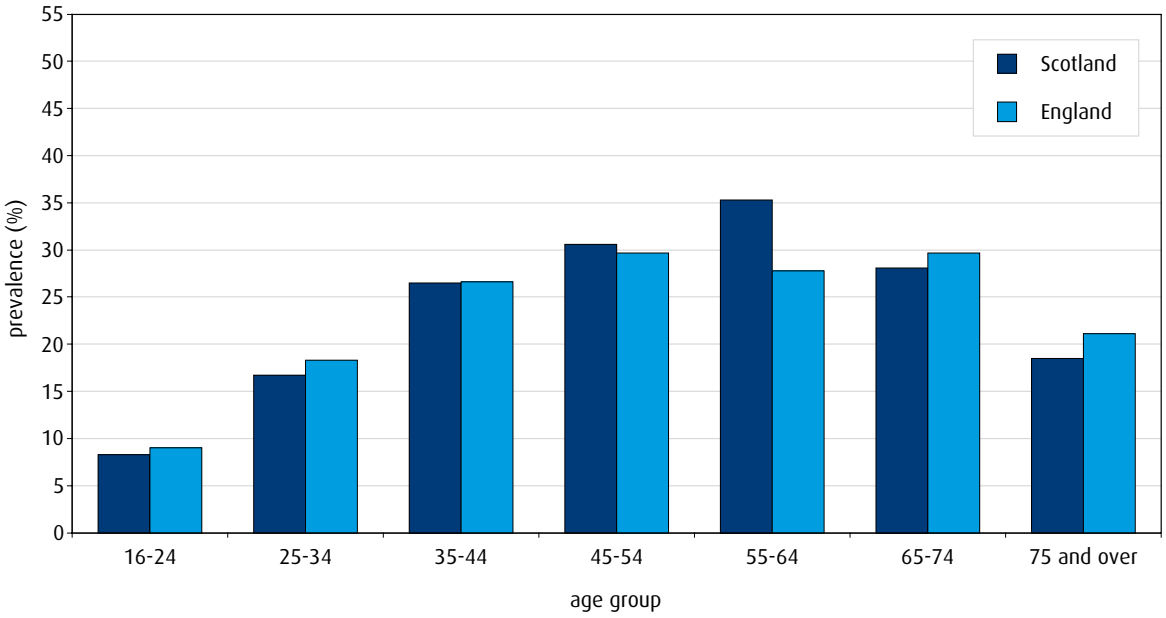
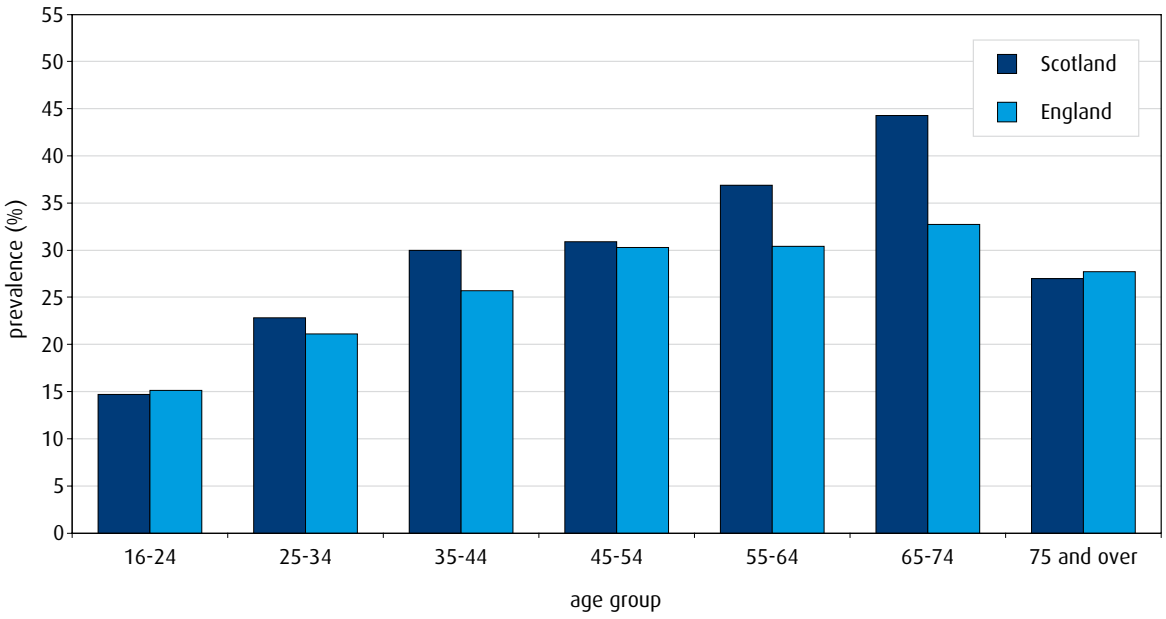


Chart 5.18 Prevalence of obesity (BMI>30 kg/m²), in women, Scotland (2003) and England (2001/02), aged 16 and over, by age (Source: Scottish Health Survey 2003)



There are no clear patterns in the prevalence of overweight in Scotland and England by age group, though women aged 16-24 in Scotland are more likely to be overweight than women aged 16-24 in England (24.2% and 16.2%) respectively, whilst women aged 65-74 in England are more likely to be overweight than women aged 65-74 in Scotland (39% and 30%) [charts 5.19 and 5.20].

Chart 5.19 Overweight prevalence (BMI 25-30 kg/m²), in men, Scotland (2003) and England (2001/02), aged 16 and over, by age (Source: Scottish Health Survey 2003)

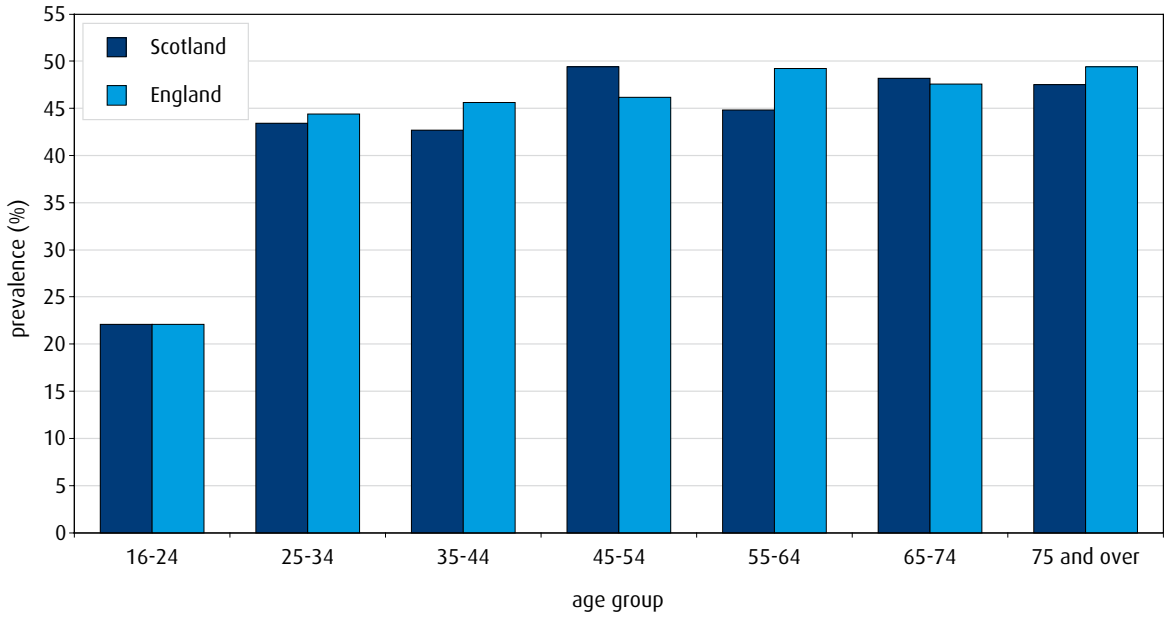
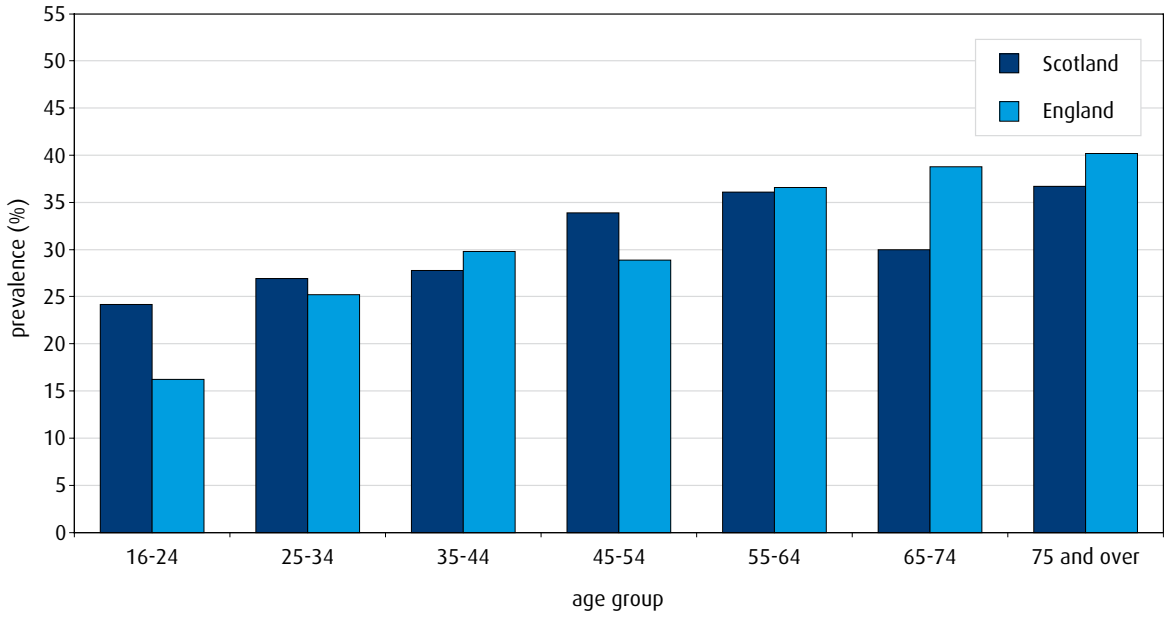


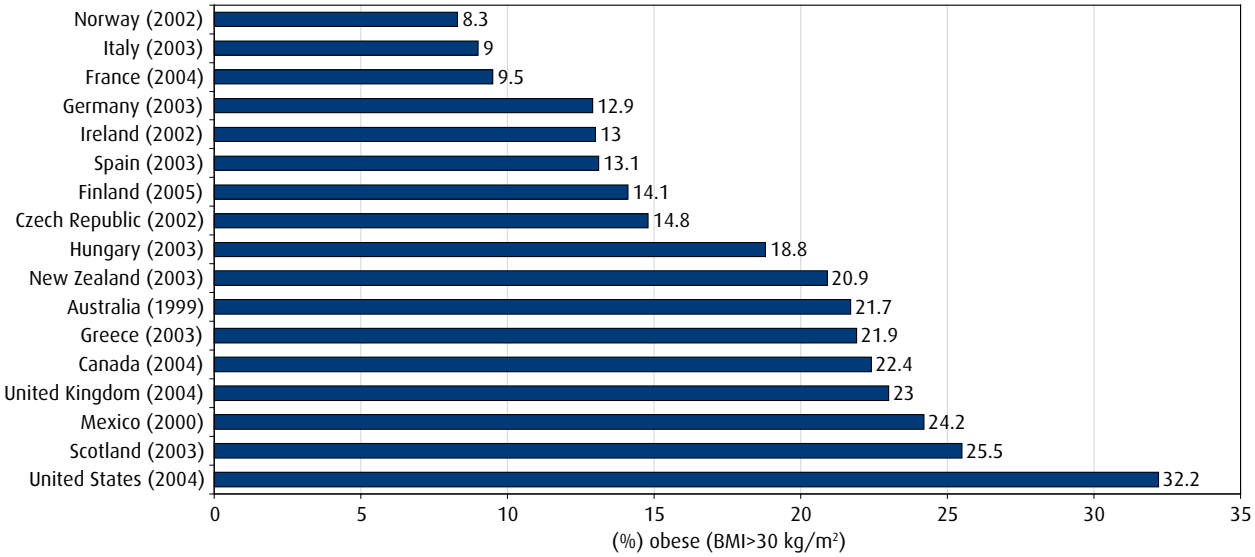
Chart 5.20 Overweight prevalence (BMI 25-30 kg/m²), in women, Scotland (2003) and England (2001/02), aged 16 and over, by age (Source: Scottish Health Survey 2003)



5.5.2 International comparisons

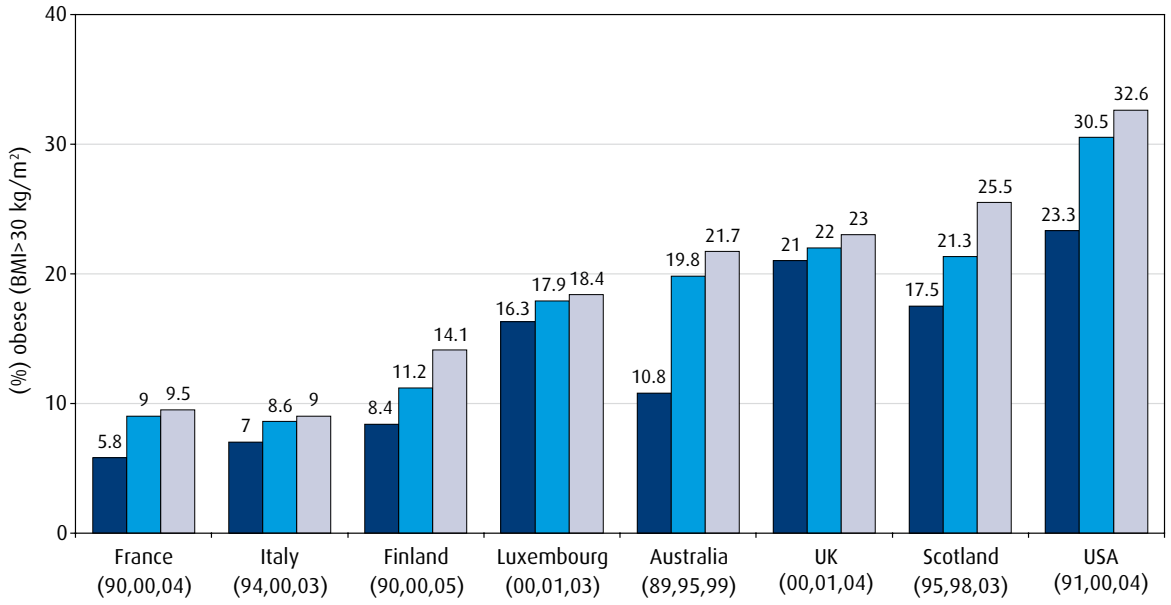
The prevalence of obesity in OECD (Organisation for Economic Co-operation and Development) countries varies from one in eight of the adult population in Germany to just under one in three of the adult population in the United States. In Scotland, the prevalence of obesity among adults, 25.5% in 2003, is well above the OECD average. Although the prevalence of obesity in Scotland remains lower than in the United States (32.2% in 2004), it remains one of the highest of all OECD countries, above Mexico, Canada, United Kingdom and Australia [Chart 5.21].

Chart 5.21 Obesity in OECD countries, percentage of adult population, aged from 15 years and over, with a BMI>30kg/m² (Source: OECD Health data, 2006)[25]



Obesity rates have also increased in recent decades in all OECD countries, although again there are notable differences between countries. The rate of obesity has more than doubled over the past twenty years in the United States, Spain and Finland, while it has almost tripled in Australia and more than tripled in the United Kingdom. Obesity data is only available for Scotland from 1995 onwards. However, even in that short period the prevalence of obesity in the adult population has increased by 46% [Chart 5.22].

Chart 5.22 Trends in obesity (BMI>30kg/m²) among selected OECD countries, selected years (Source: OECD Health data 2006)



6. Obesity in Children

6.1 Measuring obesity in children

BMI is the most widely used means of assessing body composition (see Section 2). However, the normal BMI for children is not static and varies with both age and sex. The cut-off values for BMI between normal weight, overweight and obesity which are applied to adults are not suitable for children. It is therefore necessary to use specific reference charts that provide BMI thresholds for overweight and obesity for boys and girls for each year of age. The main approach in Scotland (and in the UK) to calculating these thresholds is the UK National BMI centile classification system (see Appendix 2). BMI thresholds for use in studies of international comparisons of prevalence and obesity in children are also available.[26]

There are a number of potential sources of information on obesity prevalence in children at a national level in Scotland: the Scottish Health Survey, the Child Health Surveillance Programme (CHSP) and the Health Behaviour in School-aged Children study. These data sources are described in Section 3.

6.2 Prevalence of obesity in pre-school and school age children

The increase in obesity prevalence among children is not a particularly recent phenomenon. Between the late 1960s and early 1990s in Scotland, the percentage of primary school children (aged 4-6 years) who were overweight or obese was generally higher than would be expected according to the UK reference standard. Furthermore, the percentage of 13-15 year olds who were overweight or obese increased markedly between the late 1970s and early 1980s.[27] Similar increases in obesity levels amongst children (aged 4-11 years) were also reported between the mid 1980s and late 1990s.[28]

Data from the 2003 Scottish Health Survey suggests that these trends have continued amongst boys aged 2-15 years. Between 1998 and 2003, estimates of the prevalence of obesity among boys increased from 14% to 18%. For girls aged 2-15 years, however, there would appear to be little change in obesity estimates over the same time period [Table 6.1].[29]

Table 6.1 Prevalence of obesity in children aged 2-15 years by sex*, Scotland 1998 and 2003
(Source: Scottish Health Survey 2003)

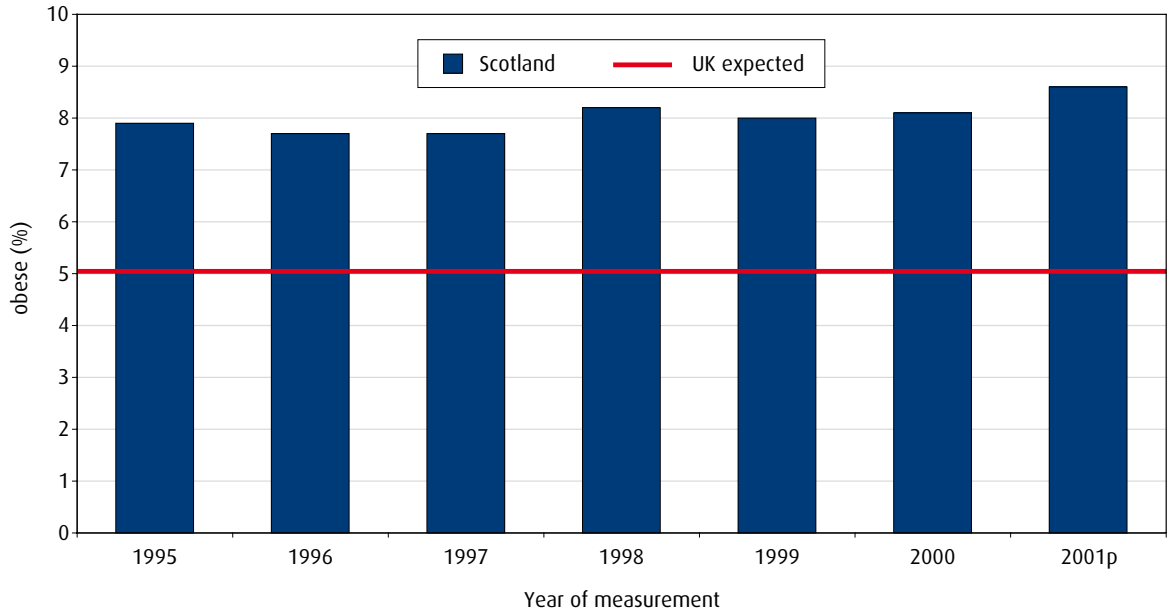
	2-6 years	7-11 years	12-15 years	Total
Boys				
1998	12.3%	15.4%	15.6%	14.4%
2003	13.0%	19.8%	20.9%	18.0%
Girls				
1998	13.5%	13.9%	15.2%	14.2%
2003	12.0%	14.9%	14.7%	13.8%

* Comparable data are only available from the 1998 and 2003 Scottish Health Survey, as a different overweight/obesity classification method was used in the 1995 Scottish Health Survey.

Similar trends can be observed from CHSP data. Among Scottish children born in 2001, 8.6% were obese by the time they reached 3.5 years of age, compared to 7.9% of children born in 1995 who were obese by 3.5 years of age. This compares to a UK 1990 reference growth standard of 5%[(a)] [Chart 6.1].[29]

(a)In 1995, new reference growth curves for the weight and height of UK children were published, replacing the Tanner-Whitehouse reference curves used since the 1960s. The new curves represent UK children in 1990 and are widely accepted as the reference for growth screening for the UK. The reference data used were collected between 1978 and 1990 and were obtained by combining data from 11 distinct surveys which were representative of children in England, Scotland and Wales. From this national dataset, BMI reference curves for children and young people were established providing BMI centiles covering birth to 23 years of age.

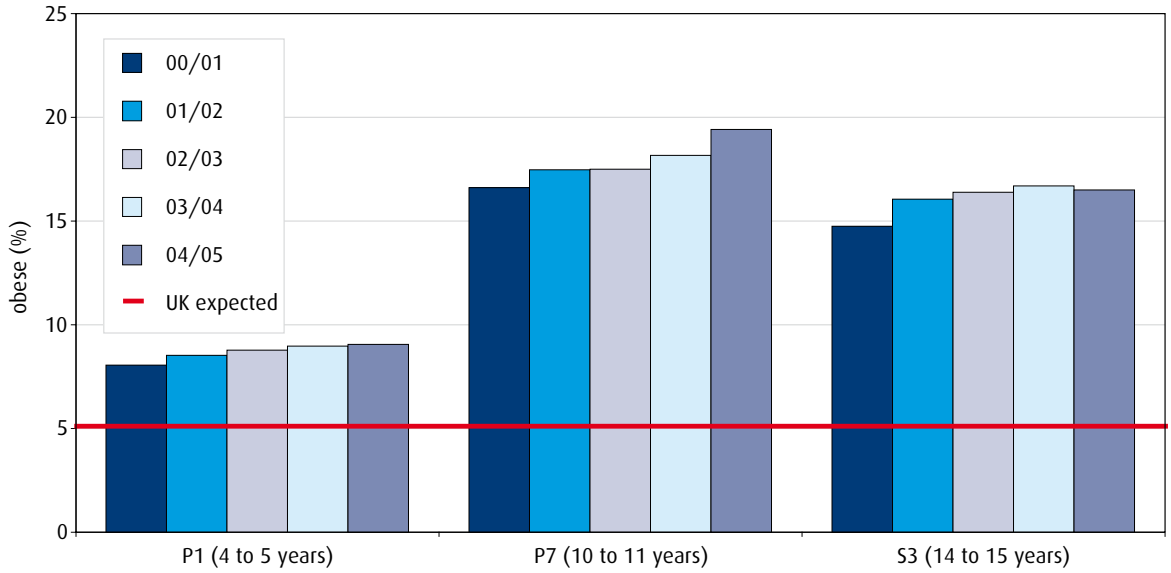
Chart 6.1 Percentage of pre-school aged children* receiving a review who were obese (>=95th centile), 1995 - 2001, Scotland (source: CHSP-PS, ISD Scotland)



* the average age for pre-school children in this sample was approximately 3.5 years

Data from the Child Health Surveillance Programme show a rising prevalence of obesity among school age children between 2000/01 and 2004/05 [Chart 6.2]. At all ages, the percentage of Scottish school age children who were obese was higher than the UK expected figure (i.e. the reference growth standard) of 5%. Children in Primary 7 had the highest levels of obesity, with almost one in five estimated to be obese, in 2004/05.

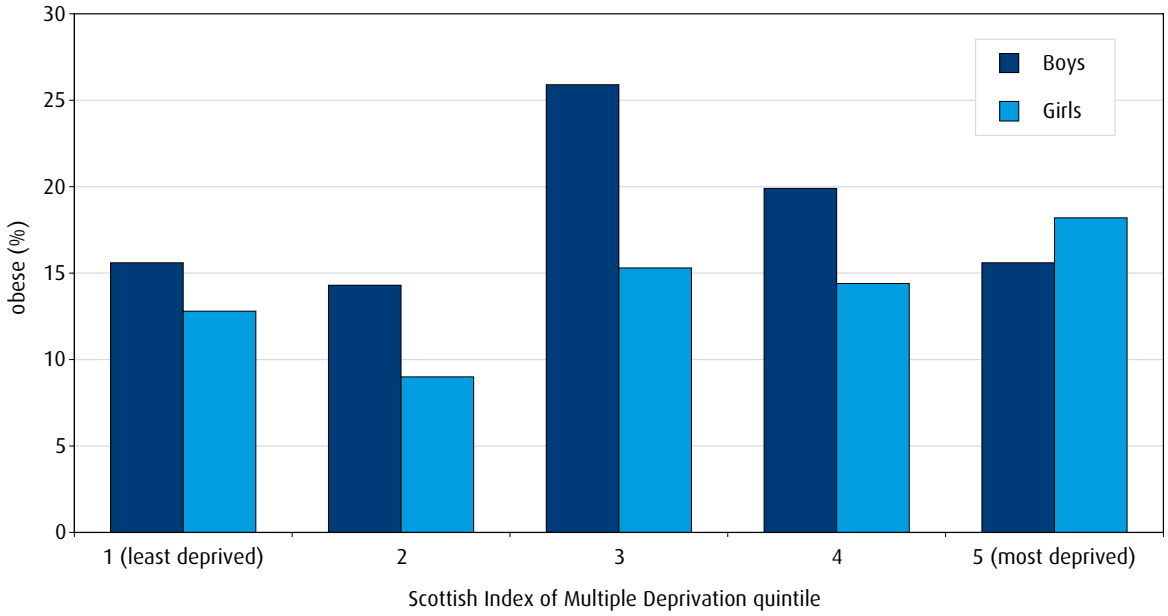
Chart 6.2 Percentage of school aged children receiving a review who are obese (>=95th centile), by year group, 2000/01 –2004/05, Scotland (source: CHSP-S, ISD Scotland)



6.3 Obesity and deprivation

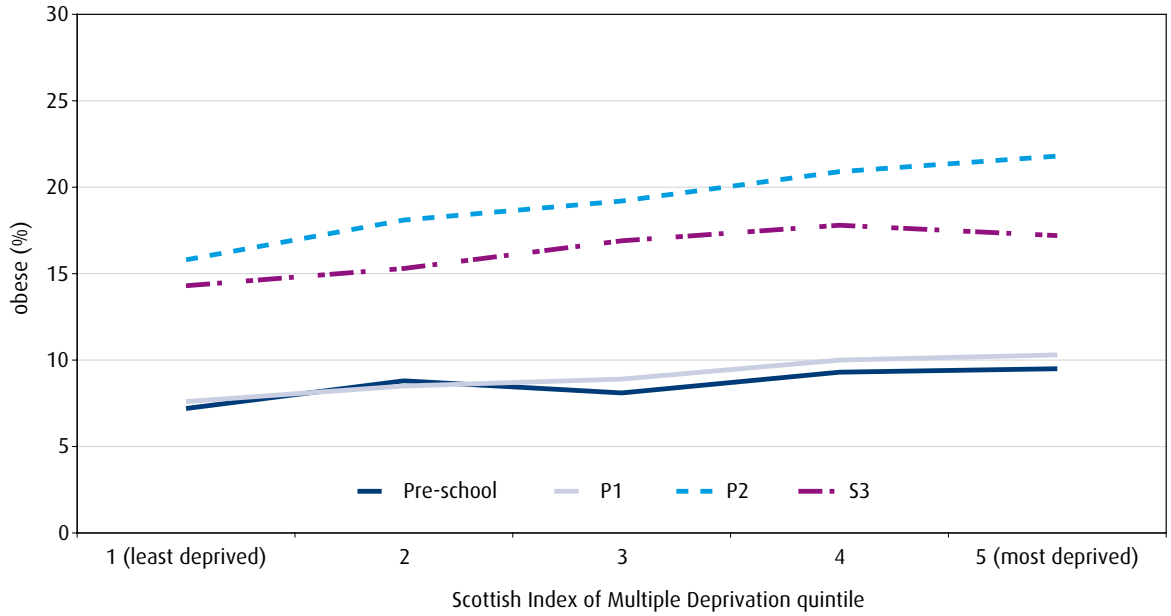
Evidence of a relationship between area deprivation and obesity in childhood remains mixed.[30] The 2003 Scottish Health Survey found that for boys and girls, the prevalence of obesity was significantly associated with deprivation, though it did not follow any simple pattern [chart 6.3].

Chart 6.3 Obesity prevalence by Scottish Index of Multiple Deprivation (SIMD) quintile and gender, 2003 (source; Scottish Health Survey 2003)



However, data from CHSP, which also confirms that deprivation is strongly associated with obesity in pre school and school age children, would seem to suggest a clear pattern with the lowest levels of prevalence in quintile 1, rising steadily to the highest levels in quintile 5 for all year groups [chart 6.4]. A recent study of primary school children in Eastern Scotland also found much higher levels of obesity among children from lower income groups compared to high income groups. It was estimated that the lower income groups were 65% more likely than the higher income groups to develop obesity.[31]

Chart 6.4 Obesity in pre-school children and school age children by Scottish Index of Multiple Deprivation (SIMD) quintile, Scotland, 2003 (Source CHSP PS,S, ISD Scotland)



6.4 National comparisons

Charts 6.5 and 6.6 show obesity levels in children in Scotland and England. Boys aged 7-11 and 12 to 15 years in Scotland are more likely to be obese (19.8% and 20.9% respectively) than boys of similar ages in England (17.3% and 17.4% respectively). However, for girls the opposite was true, as girls aged 7-11 and 12-15 years in Scotland were less likely to be obese (14.9% and 14.7% respectively) than similar aged girls in England (17.9% and 18.4% respectively).

Chart 6.5 Obesity (>=95th centile for BMI standard) prevalence amongst boys aged 2 to 15 years, Scotland and England, by age, 2003 (Source: Scottish Health Survey 2003, Health Survey of England 2001/02))

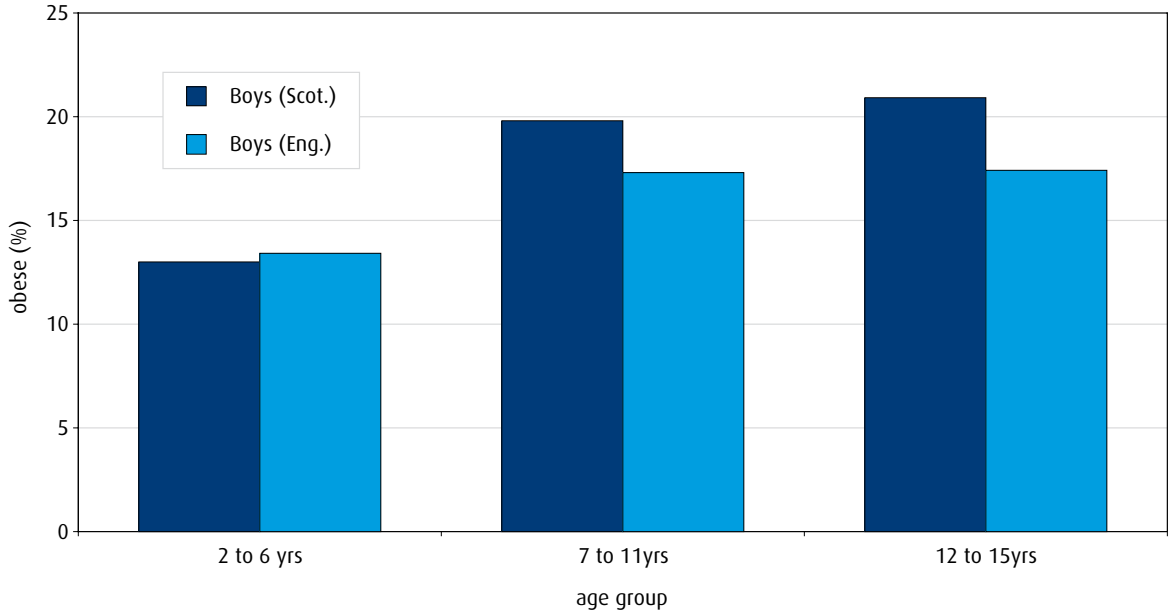
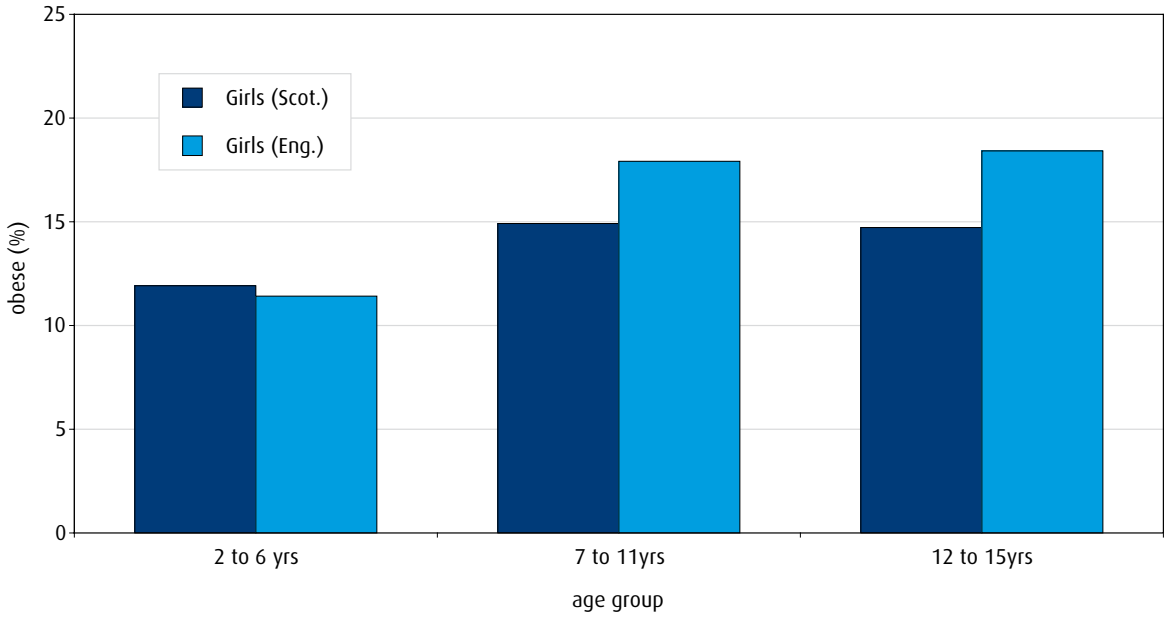


Chart 6.6 Obesity (>=95th centile for BMI standard) prevalence amongst girls aged 2 to 15 years, Scotland and England, by age, 2003 (Source: Scottish Health Survey 2003)



International comparisons of obesity are problematic because of the use of non-representative samples, differences in the measures of height and weight and differences in the gender and ages of children surveyed.[32] In recently published research drawing on data from a cross sectional study of 34 (mainly) European countries from the 2001-2002 Health Behaviour in School-aged Children Study, overweight and obesity prevalence was found to be particularly high in North America, Great Britain and south-western Europe.[33]

7. Factors related to the development of obesity

7.1 Energy expenditure

Discussion of physical activity often focuses on exercise, including sport, fitness and leisure activities. While these activities are important, for most of the population the majority of physical activity occurs as part of other activities such as transport, employment or housework. The decline in daily levels of physical activity and rise in sedentary lifestyles are increasingly seen as important factors contributing to the obesity epidemic in developing developed countries.[34]

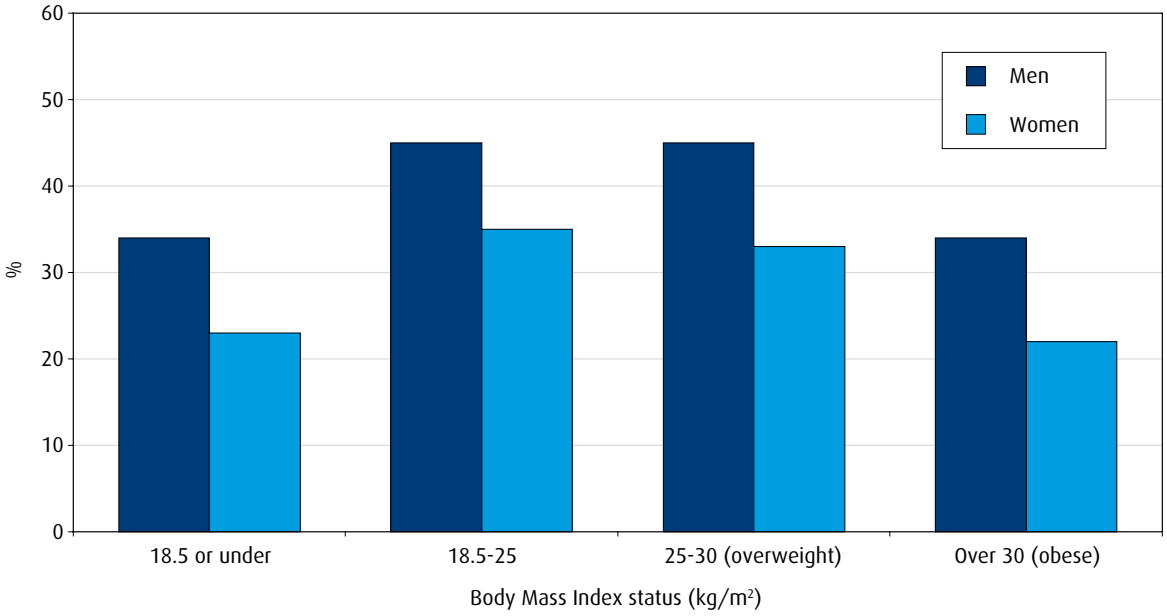
7.1.1 Physical activity related to lifestyle

The Scottish Physical Activity Strategy aims to address the high prevalence of inactivity in the Scottish population. The key physical activity recommendation being promoted through the strategy is that adults should accumulate at least 30 minutes of moderate activity (equivalent to brisk walking) on most days of the week. Information on general levels of physical activity in the adult Scottish population is available from the Scottish Health Survey. Many of the survey's summary measures are used to determine the proportion of the population who meet the Scottish Executive's recommended levels of physical activity [Box 1].

Box 1[35]**.**

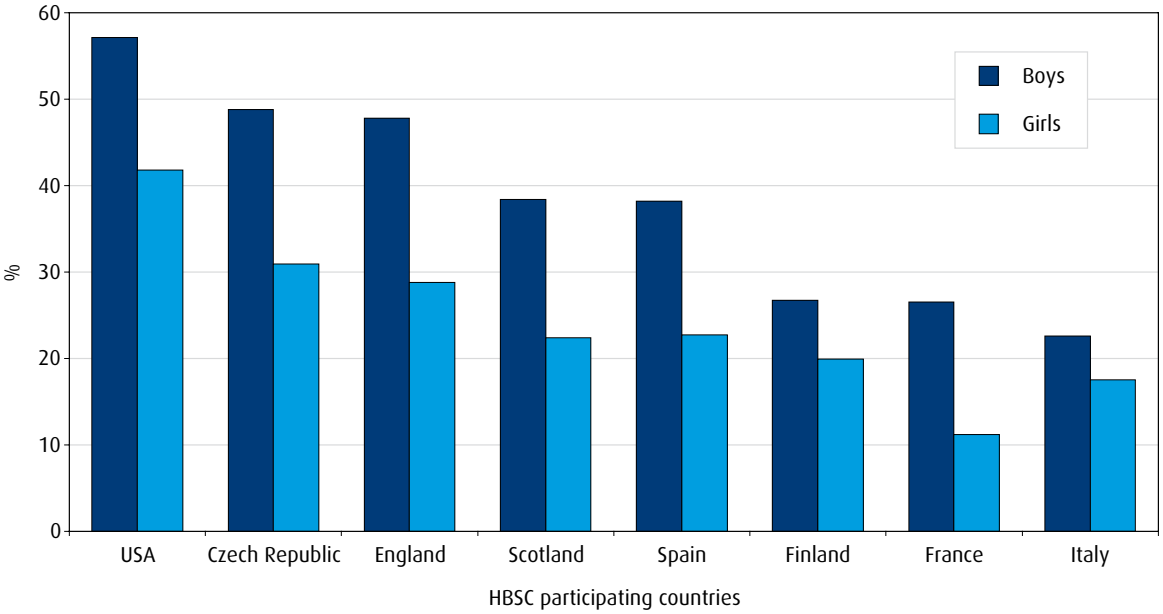
- The proportion of the population participating in physical activity for at least 15 minutes in the last four weeks increased from 80% in 1998 to 83% in 2003 in men, and from 80% to 82% in women aged 16-74.
- The proportions of men and women aged 16-74 meeting the physical activity recommendations increased significantly from 41% in 1998 to 44% in 2003 in men, and from 30% in 1998 to 33% in 2003 in women.
- Obese people, however, were far less likely to meet physical activity recommendations than people of normal weight or who were overweight [Chart 7.1].

Chart 7.1 Percentage of adults aged 16 years and over meeting physical activity recommendations, by BMI status and sex, 2003 (age standardised) (Source: SHS 2003)



Information on general levels of physical activity among Scottish school age children is available from the cross-national research study, Health Behaviour in School-aged Children (HBSC) [see Section 3]. The proportion of 15 year olds meeting current physical activity guidelines,[a] by selected countries participating in the HBSC survey can be found in chart 7.2.

Chart 7.2 Percentage of 15 year olds meeting current physical activity guidelines by selected HBSC participating countries, 2001/02[36]



7.1.2 Physical activity related to travel and transport

There is little or no information available about the amount of energy expenditure on travel in Scotland. Scottish Transport Statistics and the Scottish Household Survey provide information on the use of different modes of travel in Scotland, such as by bus, car and on foot. These data suggest that modes of travel that require less energy expenditure are becoming more common, although the changes are less pronounced in more recent years [Box 2].

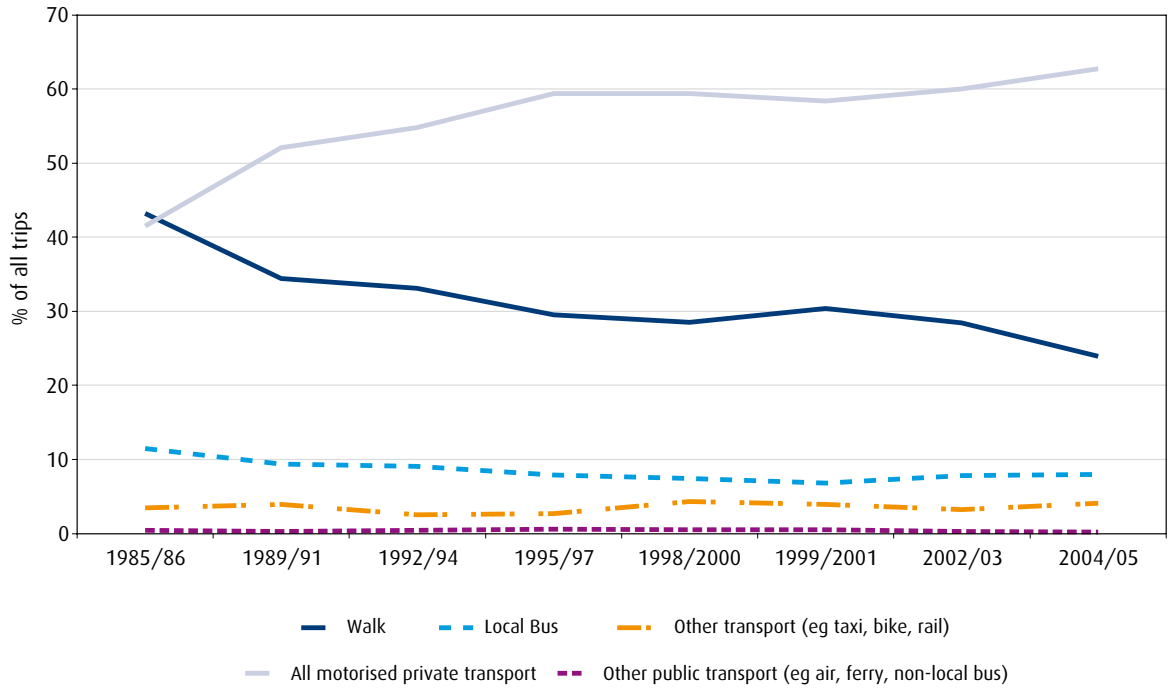
Box 2.

In Scotland:

- Between 1985/86 and 2002/03, there was a 15% drop in the proportion of journeys taken by foot, a 4% drop in journeys taken by local bus and an increase of 19% in the proportion of journeys by motorised private transport [Chart 7.3].[37]
- On average, in 2002, people spent 8 minutes per day less walking than in 1985; and 16 minutes per day more in the car (as passenger or driver).[38]
- The number of motor vehicles licensed in 2004 was over 2.4 million, 3% more than the previous year, and 29% higher than the number in 1994.[39]

[a] Guidelines for recommended physical activity levels among young people were re-examined in 1997 by an international working group of experts. Two primary recommendations were produced: (1) inactive young people should participate in physical activity of at least moderate intensity for at least 30 minutes a day (2) all young people should ideally participate in such activity for I hour per day[34]

Chart 7.3 Main mode of transport, as a percentage of all trips, Scotland, 1985/86 to 2004/05
(Source: Scottish Transport Statistics, 2006)



7.1.3 Physical activity in the course of employment and daily living

Little or no information is available about the level of energy expenditure in the course of employment and daily living in Scotland. However, changes in the economy over the last few decades have resulted in fewer people being engaged in heavy manual labour or in physically active jobs in Scotland [Box 3]. These trends could be expected to reduce the amount of energy expenditure in the workplace.

Box 3.

- Between 1998 and 2003 there was a decline in the population of Scotland employed in sectors which may involve some physical activity, such as manufacturing, (from 15.1% to 10.6%); and an increase in the proportion employed in mainly desk-based jobs, such as banking and finance (from 15.1% to 17.6%).[40]
- The 2003 Scottish Health Survey indicates that 37% of men and 45% women are in jobs that do not involve any significant level of physical activity, compared to 30% and 39% respectively in 1995.[41]

The proportion of respondents in the Scottish Health Survey who reported heavy housework, gardening and do-it-yourself activities did not change appreciably between 1998 and 2003 [Box 4].

Box 4.

In Scotland in 2003;[42]

- 41% of men and 63% of women aged 16-74 reported at least one occasion of heavy housework for at least 15 minutes in the last four weeks.
- 71% of men and 89% of women aged 16-74 reported not having been involved in even one occasion of heavy manual work/gardening/DIY (of at least 15 minutes duration) in the last four weeks.
- 64% of men and 71% of women aged 16-74 had not walked for at least 15 continuous minutes (at a fairly brisk or fast pace) in the last four weeks.
- These figures do not vary significantly from those reported in 1998.

7.1.4 Physical activity as a part of leisure, exercise and sport

Little or no information is available about the level of energy expenditure as part of leisure, exercise and sport in Scotland. However, marketing surveys report that the number of leisure centres in the UK has increased, as have visits to leisure centres. Results from the 2003 Scottish Health Survey suggest that around half of Scottish adults participated in sports for at least 15 minutes in the previous four weeks [Box 5].

Box 5.

- The number of local authority-owned leisure centres in the UK grew by 18% between 1999 and 2004 (or by more than a fifth since 1997) to reach 3,959.[43]
- Admissions to local authority leisure centres in the UK increased by 10% between 1999 and 2004.[44]
- More than a third (34.3%) of people in Scotland use parks at least once a week, whereas only about 10% of people use sports and leisure facilities or swimming pools this frequently.[45]
- 50% of men and 40% of women in Scotland reported having participated in some sports and exercise (of at least 15 minutes' duration) in the last four weeks.[46]

7.2 Energy intake

In the Western world, the availability of cheap energy-dense food has never been so great. Availability is dependent on factors such as production, distribution and purchase. Over the past 25-30 years, there have been changes in many countries, including Scotland in the quantity and content of food available and in the way it is eaten. Heavy marketing of energy-dense foods has been identified by WHO as a possible factor contributing to obesity, as discussed in section 4. There are no reliable national data on energy intake in Scotland. This partly reflects the fact that measuring energy intake accurately is difficult, expensive and time-consuming.

Data on diet have recently been comprehensively reviewed in a report for the Food Standards Agency on monitoring progress towards Scottish dietary targets.[47] Some of the findings of this report are particularly relevant to obesity, specifically data relating to the consumption of energy-dense foods (which might increase obesity) and consumption of foods with high levels of fibre and low energy density (which might decrease obesity). Data from the 1996 NFS and the 2003/04 EFS show an increase in the intake of non-milk extrinsic sugars (present in soft drinks and confectionary) and a decline in bread consumption, particularly for wholemeal bread, both trends which might be expected to have unfavourable effects on obesity. The review also presented evidence that people living in more deprived areas obtained a larger proportion of their energy intake from non-milk extrinsic sugars and had a lower intake of fruit and vegetables and wholemeal bread.

7.2.1 The food 'environment'

No reliable routine information is available nationally on the environment in which food is bought and consumed in Scotland. Most food is acquired from retail outlets or from a wide variety of fast food and other catering outlets, including restaurants. The number of such outlets may serve as some indication of the basic physical and social environment. Information is available on the number of food retail outlets [Box 6]. Marketing surveys provide information on shopping habits, cooking in the home and on eating out [Box 7], but it is not clear whether these reports are always based on representative samples and the results should be treated with caution.

Box 6.

In Scotland, between 1998 and 2003,[48] there was:

- a 4.8% increase in the number of restaurants and a 33.8% increase in turnover
- an 18% decrease in the number of retail outlets, but an 11.7% and 27.1% increase in employment and turnover respectively, suggesting a trend towards increasing size of outlets

Box 7.

- Over two-thirds (70%) of people in the UK report major shopping for food at least once a week and approximately 75% say that they use the car when shopping for food.[49]
- In 2003/04, a greater proportion of weekly household expenditure in Scotland was spent on food and non-alcoholic drinks than in the United Kingdom as a whole (12% and 10% respectively).[50]
- Approximately one in five (18%) Scottish people say they rarely cook, compared to 16% for the UK.[51]
- In 2003 51% of Scots reported eating out at least once every 2 weeks, compared to 45% for the UK.[52]

7.2.2 Food choice

The location where food is eaten and the type of food consumed can be important for energy intake. The less involvement an individual has in preparing a meal, the less information they have on the energy content of the meal. People tend to have less control over portion size and energy content of meals prepared outside the home than those they prepare themselves. Limited information is available to examine these issues in Scotland. Marketing reports suggest that Scots are more likely to snack between meals and eat meals in front of a television [Box 8]. The limitations of such reports have been discussed in section 3, and should be borne in mind when interpreting these figures.

Box8.

- In Scotland, 44% of people reported snacking between meals, compared to 32% for the UK as a whole.[53]
- 59% of people living in Scotland report eating their main meal in front of the television compared to 46% in England.[54]
- 56% of Scots have purchased from a fast food restaurant in the last four weeks, compared to 57% in England, 55% in Northern Ireland and 51% in Wales.[55]

Data from the Scottish Health Survey and from a report reviewing the Scottish Diet Action Plan indicate that the Scottish diet is low in fruit and vegetables but rich in energy-dense foods [Box 9 and Box 10].[56] [57] [58] The decline between 1995 and 2003 in the proportion of respondents reporting that they ate biscuits or drank soft drinks every day is surprising. It is important to bear in mind that these are self-reported figures and that they may not be consistent with reports of sales of food items.

Box 9[59].

In Scotland, in 2003, amongst those aged 16-64:

- Over a third (36%) of men and 28% of women reported eating biscuits once a day or more, compared to 40% and 35% respectively in 1995.
- 31% of men and 20% of women drank (non-diet) soft drinks once a day or more, compared to 32% and 21% respectively in 1995.
- 27% of men and 21% of women ate crisps and other savoury snacks once a day or more, compared to 22% and 20% respectively in 1995.
- Fruit and vegetable consumption was lower in Scotland than in England for both men and women aged 16 and over; the mean number of portions consumed by men was 3.0 in Scotland and 3.2 in England; the corresponding figures for women were 3.2 and 3.5 respectively.

Box 10[60].

- There has been an increase in NME (non milk intrinsic) sugars intake from 13.6% in 1996 to 16.7% in 2003/04, which is likely to have a negative effect on overall energy intake.
- Saturated fatty acid intake levels have not fallen significantly between 1996 and 2003/04.
- Fat intake, as a percentage of food energy, has decreased slightly from 39.6% in 1996 to 37.6% in 2003/04.
- There is a clear gradient in fruit and vegetable consumption by SIMD quintile. In the most deprived quintile (Quintile 5), mean daily consumption was 183g per day, compared to 312g in the least deprived quintile (Quintile 1).

7.3 Other factors related to the development of obesity

Genes associated with obesity have been identified and suggest that some variation in BMI may be explained by genetic factors.[61 62 63] Genetic factors are obviously unlikely to explain the rapid increases in the prevalence of obesity seen in many countries.

Children who are not breastfed may have a greater tendency to develop obesity later in life.[64] One systematic review has concluded that breast-feeding has a small but consistent protective effect against obesity in children.[65] One study has suggested that maternal smoking in pregnancy may increase the tendency to overweight and obesity later in life, a finding which is consistent with earlier research.[66]

8. Morbidity and mortality related to obesity

Obesity has important health consequences, increasing the risk of disability, impaired quality of life, chronic disease and death.

8.1 Obesity and morbidity

It is well established that obesity is associated with an increased risk of many serious diseases.[67] Table 8.1, taken from the National Audit Office report,[68] indicates the extent to which obesity increases the risks of developing a number of these diseases relative to the non-obese population. For many diseases, the relative risk is higher for obese women than for obese men, e.g. the risk of type 2 diabetes is almost 13 times greater in obese women than in women of normal weight.

Table 8.1 Estimated increase in risk of various diseases in obese people [69]

Disease	Relative risk in women	Relative risk in men
Type 2 diabetes	12.7	5.2
Hypertension	4.2	2.6
Myocardial infarction	3.2	1.5
Colon cancer	2.7	3.0
Angina	1.8	1.8
Gall bladder diseases	1.8	1.8
Ovarian cancer	1.7	-
Osteoarthritis	1.4	1.9
Stroke	1.3	1.3

The main diseases related to obesity are listed in Table 8.2, in which the estimated percentage of cases attributable to obesity, based on a systematic review of the literature, is applied to data on incidence or prevalence to give an estimate of the number of cases attributable to obesity in Scotland.[70]

Table 8.2 The estimated prevalence of obesity-related diseases and the estimated number of cases attributable to obesity in Scotland in 2003

Disease		Estimated proportion attributable to obesity[71] (%)	Estimated number of prevalent cases/annual incident cases in Scotland[72] (n)	Estimated number of cases in Scotland attributable to obesity (2003) (n)
Cardiovascular				
	Hypertension	36%	1,329,696 (p)	478,691
	Angina pectoris	15%	250,344 (p)	37,552
	Myocardial Infarction	18%	135,432 (p)	24,378
	Stroke	6%	92,340 (p)	5,540
Endocrine				
	Type 2 diabetes	47%	73,872 (p)	34,720
Neoplastic				
	Colon cancer	29%	2,242 (i)	650
	Ovarian cancer	13%	616 (i)	80
	Prostate cancer	3%	2,318 (i)	70
	Endometrial cancer	14%	449 (i)	63
	Rectal cancer	1%	1,123 (i)	11
Musculo-skeletal				
	Osteoarthritis	12%	118,500 (p)	14,220
	Gout	47%	20,150 (p)	9,470
Gastro-intestinal				
	Gallstones	15%	11,350 (p)	1,702

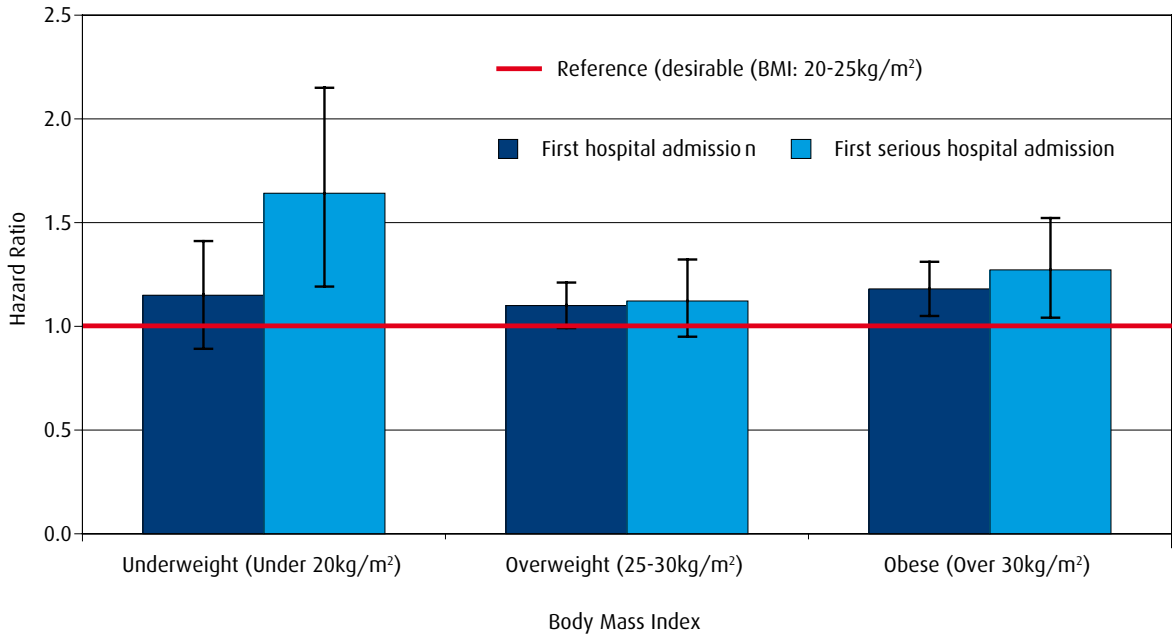
(p) = prevalence, (i) = incidence

Based on the attributable fractions for obesity, it is estimated that in 2003 obesity may have accounted for nearly 500,000 cases of hypertension (high blood pressure) and over 50,000 cases of coronary heart disease (angina pectoris plus myocardial infarction). Nearly 900 cancers, mostly cancer of the colon, could be attributed to obesity. Obesity also accounts for over 30,000 people with type 2 diabetes, 14,000 people with osteoarthritis and 10,000 people with gout (Table 8.2). The Renfrew and Paisley study recently reported that overweight and obesity accounted for a major proportion of type 2 diabetes, in men and women aged 45-64 years, as identified from hospital discharge and death records.[73] The health effects of the diseases above vary; some will be fatal, others like gallstones go largely unnoticed.

8.1.1 Obesity and risk of hospital admission

Work has been undertaken to link information from respondents to the 1998 Scottish Health Survey to subsequent records of hospital admission.[74] Data from this project show that compared to those of normal weight, obese and overweight people are at 18% (95% CI, 6% to 31%) and 10% (95% CI, -1% to 21%) higher risk[b] respectively of being hospitalised. People who are underweight are 15% more likely than those of normal weight to be hospitalized, though it is unclear whether other serious underlying conditions such as cancers contribute to this figure [Chart 8.1]. The risk of serious hospital admission[c] for people with obesity was 27% (95% CI, 6% to 52%) [see Appendix 4]. An analysis using similar linkage methods for participants in the Renfrew-Paisley study found that compared with those of normal weight, obese people had admission rates 12% higher and 21% higher among men and women respectively.[75]

Chart 8.1 Age and sex-standardised risk of first hospital admission and first serious hospital admission in those with BMI >25 kg/m²and <20 kg/m²compared with those with BMI 20–25 kg/m² (Source: unpublished work, Scottish Record Linkage Project[76])



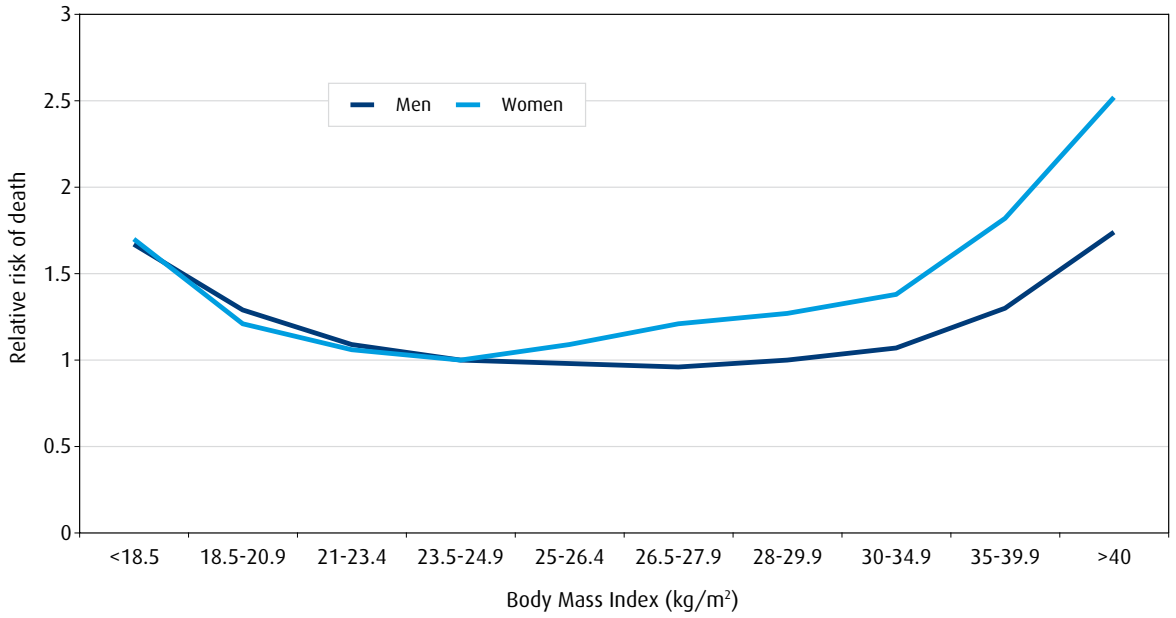
8.2 Obesity and mortality

Specific mortality data related to obesity in Scotland is not currently available. Obesity is a known risk factor for a range of chronic diseases but is not usually recorded as an underlying cause of death. Epidemiological studies have shown an increase in mortality associated with overweight and obesity.[77] [78] [79] A recent observational study including more than half a million people aged 50 to 71 years of age at baseline and followed up for a decade, found a 2-3 times increase in the risk of mortality during midlife among obese people [Chart 8.2].[80] An analysis of the Renfrew/Paisley data from the Midspan prospective cohort study found only a weak to modest association between obesity and mortality. However, when analysis was restricted to non-smokers, obesity was associated with a doubling of risk in men and a 60% increase in women: relative risk for all cause mortality from obesity was 2.10 for men (95% CI, 1.66 to 2.66) and 1.56 for women (95% CI, 1.39 to 1.76).[81]

[b] Calculated as a Hazard Ratio

[c] The seriousness/complexity of an admission was measured by analyzing Healthcare Resource Groups (HRGs); an admission was classified as serious or complex if it was at least as serious as an acute myocardial infarction.

Chart 8.2 Relative risk* of mortality from all causes, for non-smokers, aged 50-71 years
(Source: Adams et al 2006)



* Reference Category (relative-risk = 1) had BMI of 23.5-24.9 kg/m²

9. Conclusions

The main purpose of this briefing is to describe the epidemiology of obesity and of its determinants in Scotland, to draw attention to the seriousness of the problem and to provide information to support those who are developing and implementing strategies to address obesity.

This report has highlighted the extent of obesity as a major public health problem for both children and adults in Scotland. Approximately one in six boys and one in seven girls in Scotland are obese; among adults one in four men and one in five women are obese. Obesity levels in both adults and children have risen steadily over the last 10 years, with marked increases in men aged 35-64 years and in women aged 35-44 years [Sections 5 and 6]. These figures provide little evidence that current approaches to obesity are having any impact. The prevalence of obesity is associated with area level measures of deprivation for both adults and children, though this relationship is stronger in women than men.

Levels of obesity in Scotland and England are broadly similar for men though Scotland has higher levels of obesity among women. International comparisons show that Scotland has very high levels of obesity compared with European countries.

The increasing levels of obesity are of serious concern given the levels of morbidity and mortality associated with obesity. It is estimated that obese people in Scotland are 18% more likely to be hospitalised than those of normal weight [Section 8]. Furthermore, obesity increases the risk of many serious diseases; for example, obese women are 12 times more likely to suffer from Type 2 diabetes and five times more likely to suffer from hypertension, while obese men are five times more likely to develop type 2 diabetes and three times more likely to develop colon cancer. We estimate that nearly half a million cases of hypertension, 35 000 cases of Type 2 diabetes and 10 000 cases of gout and gallstones in Scotland are attributable to obesity [Section 8]. Existing international evidence in relation to mortality related to obesity suggests that the risk of death among obese people is two to three times higher than among people of normal weight [Section 8].

Why does Scotland have such high levels of obesity? At the individual level, obesity is the result of an imbalance between energy intake and expenditure. Do Scots have unusually high energy intake or unusually low energy expenditure, or both? Unfortunately data are not available to estimate energy intake. Data from marketing surveys suggest that compared to England there may be greater expenditure on food and more snacking between meals, but these data may not be reliable. Evidence suggests a downward trend in walking, greater use of cars and less active jobs, though such trends are common to many industrialised countries.

A recent House of Commons Health Select Committee report on obesity drew attention to the dangers of focussing on individual behaviour and of neglecting the wider context in which obesity develops. The report drew attention to the importance of the marketing of energy-dense food, particularly to children. It also recommended that solutions address environmental as well as individual factors. To support this broad-based approach we need better information to monitor the wider determinants of obesity.

9.1 Future data sources

Ongoing work to address the obesity epidemic needs to be supported by robust information. There are a number of potential new sources of information that could be useful.

The Scottish Health Survey

The Scottish Health Survey (SHS) remains a valuable source of information on prevalence of obesity in Scotland. It is expected that the impending changes to the survey, which include moving to a continuous survey and providing more robust prevalence estimates at NHS board level, will improve its utility for monitoring obesity and overweight in Scotland.

The new General Medical Services (GMS) contract

The modifications to the Quality and Outcomes Framework (QOF) of the new GMS contract that came into effect in 2005/06 included incentives to maintain a register of people with a BMI of over 30 (indicator OB1). The number of people on this register for each practice will be available centrally, but an important limitation is that at present there is no mechanism to collect other information nationally (such as age and sex) to interpret these data.

Linkage work

There may be the potential to link data relating to obesity from different sources. For example, record linkage between the Scottish Health Survey and Scottish Morbidity Record (SMR) is already in place. Linkage with primary care data via the Community Health Index (CHI) is in principle possible although privacy and other information governance concerns would need to be addressed. Such linkage work could be used to explore the association between obesity and a range of cancers (particularly breast, prostate and colon cancer) and between obesity and alcoholic liver disease.

Other possible sources of information

The new pharmacy contract allows pharmacists to take on a broader public health role. In the future this might include the management of obesity and collection of data on obesity.

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Appendices

APPENDIX 1. Body Mass Index

The clinical definition of obesity uses the body mass index (BMI). BMI is defined as:

$$BMI = \frac{\text{body weight (kg)}}{(\text{height (m)})^2}$$

The following categories are used;

Table A1 Commonly used BMI categories.

BMI(kg/m²)	Weight status
Less than 18.5	Underweight
18.5 - <25.0	Normal
≥25.0 - 29.9	Overweight
30.0 and above	Obese
Above 40	Very obese (morbidly obese)

The BBC BMI online calculator can be accessed at the following URL:

http://www.bbc.co.uk/health/healthy_living/your_weight/bmimetric_index.shtml

Limitations of Body Mass Index

BMI as a measure of 'fatness', although practical, has limitations. The body is made up of different tissue types which vary in their density (often classified as 'fat' and 'lean'). BMI does not take this into account – two people with a similar BMI may have very different body compositions. Variation in body composition, which may affect the interpretation of BMI, depends on factors such as sex, age, ethnicity and disease. In particular, problems arise when looking at children (see Appendix 2), the elderly or when comparing ethnic groups

The 'normal' BMI range may be wider for older people than for those aged under 65. The association between BMI and mortality becomes weaker after the age of 75. Most available data on obesity in Scotland relate to people aged 65 years and under.

The relationship between BMI and percentage body fat can vary significantly with ethnicity. For a given BMI, some Asian populations will tend to have a higher percentage of body fat than white European populations. Therefore it may be useful to define the upper limit for a normal BMI as lower for such Asian populations. For black populations the opposite can be true and a higher cut-off point for a normal BMI may be appropriate. When comparing obesity among different ethnic groups, it can be more useful to use the definition based on WHR than the standard BMI classification.

Overall, despite limitations, BMI is the most practical measure of overweight and obesity, which has the advantage of a degree of consensus on its use. BMI alone gives a relatively good indication of individual risk. Combining with information on other risk factors gives a more sophisticated and potentially more accurate indication of risk. Other such risk factors may relate to obesity, e.g. waist circumference or estimates of percentage body fat, or relate to other physical or lifestyle factors, e.g. smoking, raised blood pressure etc.

A more detailed discussion on the assessment of obesity and its clinical implications is available as part of the BMJ series on obesity.[83]

Appendix 2. National BMI centile classification scheme

The National BMI centile classification scheme uses reference curves based on data from several British studies between 1978 and 1990. From this national dataset, BMI reference curves for children and young people were established providing BMI centiles covering birth to 23 years of age. Obesity is defined as being ≥95th centiles of the UK reference curves from 1990 [Table A2]. This system, however, arbitrarily assumes a prevalence of obesity of 5% at time of data collection. There is limited evidence that cut-off points are related to morbidity or health outcomes.

Table A2 1990 UK Reference Standards

Group	Definition	What this means
Very low BMI (Very underweight)	≤ 2nd centile	Children whose BMI is within the bottom 2% of the 1990 UK reference range for their age and sex.
Low BMI (Underweight)	≤ 5th centile	Children whose BMI is within the bottom 5% of the 1990 UK reference range for their age and sex.
Overweight	≥ 85th centile	Children whose BMI is within the top 15% of the 1990 UK reference range for their age and sex.
Obese	≥ 95th centile	Children whose BMI is within the top 5% of the 1990 UK reference range for their age and sex.
Severely obese	≥ 98th centile	Children whose BMI is within the top 2% of the 1990 UK reference range for their age and sex.

The reference charts on which the above classification are based upon are available at the following URL: http://www.sign.ac.uk/guidelines/fulltext/69/annex1.html

Appendix 3. Participation in Child Health Surveillance Programme

All NHS boards provide a Child Health Surveillance Programme and the majority of Boards record these reviews using the Child Health Systems Project (CHSP).

CHSP - Pre-School (CHSP-PS) currently has 10 participating NHS boards [Table A3.1]. The pre-school analysis is based on data recorded at the 39-42 month review.

Table A3.1 Scottish NHS boards participating in CHSP-PS

NHS board	Implementation date
Argyll & Clyde	1991
Ayrshire & Arran	1993
Borders	1995
Dumfries & Galloway	Dec 2000
Fife	1994
Forth Valley	Dec 1997
Greater Glasgow	1995
Grampian	N/A
Highland	N/A
Lanarkshire	1992
Lothian	1994
Orkney	N/A
Shetland	N/A
Tayside	1995
Western Isles	N/A

The Child Health Surveillance School (CHSP-School) system began development in late 1993. The system was initially piloted in Borders NHS Board followed by a second pilot in West Lothian NHS Trust. There are now 10 participating NHS boards, these are (Table A3.2):

Table A3.2 Scottish NHS boards participating in CHSP-S

NHS board	Implementation date
Argyll & Clyde (partial)	2001
Ayrshire and Arran	N/A
Borders	1995
Dumfries & Galloway	2004
Fife	2000
Forth Valley	2005
Grampian	2005
Greater Glasgow	N/A
Highland	N/A
Lanarkshire	1999
Orkney	N/A
Shetland	N/A
Tayside	2002
West Lothian NHS Trust/Lothian Health Board*	1997/2004
Western Isles	2003

* West Lothian NHS Trust from 1997 and all of Lothian NHS board area from 2004

Appendix 4. Risk of hospital admission by body mass index

Table A4 Age & sex standardised association' between biological risk factors and hospital admission

			1. First Hospital Admission			2. First Serious Hospital Admission		
Biological Risk Factors	**N**	**N(%)[1]**	**Hazard Ratio**	**95% (CI)**	**Significance**	**Hazard Ratio**	**95% (CI)**	**Significance**
BMIGROUP - (Combined)								
Underweight (Under 20)	383	4.9	1.15	(0.94 to 1.41)	n/s	1.64	(1.19 to 2.25)	p<0.01
Desirable (20-25)†	2,528	32.5	1.00			1.00		
Overweight (25-30)	2,730	34.2	1.10	(0.99 to 1.21)	n/s	1.12	(0.95 to 1.32)	n/s
Obese (Over 30)	1,615	19.5	1.18	(1.06 to 1.31)	p<0.01	1.27	(1.06 to 1.52)	p<0.05
Missing	718	8.8	1.21	(1.05 to 1.39)	p<0.05	1.56	(1.24 to 1.97)	p<0.001
BMIGROUP - (Male)								
Underweight (Under 20)	137	4.1	1.18	(0.87 to 1.60)	n/s	1.40	(0.83 to 2.35)	n/s
Desirable (20-25)†	1,019	30.7	1.00			1.00		
Overweight (25-30)	1,404	39.2	1.01	(0.88 to 1.17)	n/s	1.00	(0.79 to 1.27)	n/s
Obese (Over 30)	670	18.6	1.02	(0.86 to 1.20)	n/s	1.16	(0.87 to 1.54)	n/s
Missing	277	7.4	1.28	(1.01 to 1.63)	p<0.05	1.82	(1.3 to 2.54)	p<0.001
BMIGROUP - (Female)								
Underweight (Under 20)	246	5.7	1.15	(0.87 to 1.51)	n/s	1.82	(1.21 to 2.73)	p<0.01
Desirable (20-25)†	1,509	34.4	1.00			1.00		
Overweight (25-30)	1,326	29.4	1.17	(1.03 to 1.34)	p<0.05	1.25	(1.01 to 1.55)	p<0.05
Obese (Over 30)	945	20.4	1.32	(1.15 to 1.52)	p<0.001	1.37	(1.08 to 1.73)	p<0.05
Missing	441	10.3	1.16	(0.96 to 1.39)	n/s	1.36	(0.99 to 1.86)	n/s

Notes:

[1] Weighted category proportions using survey weighting variable - *weighta*

† - reference category of variable

Source: Scottish Health Survey linked to ISD hospital admissions data