

13

Blood pressure

Jennifer Mindell and Kirsten Herrick

SUMMARY

- Mean systolic blood pressure (SBP) was 133mmHg in men and 126mmHg in women. Mean SBP was lower in boys (102mmHg) and girls (104mmHg) aged 4-10 than in children aged 11-18 (mean 114mmHg in boys, 109mmHg in girls). In adults, mean SBP was 127mmHg in men aged 19-34 and 140mmHg in those aged 65 and over (113mmHg and 141mmHg for women aged 19-34 and 65 and over, respectively).
- Mean diastolic blood pressure (DBP) was 74mmHg in men and 73mmHg in women. Mean DBP varied less by age, ranging from 62mmHg in boys and 64mmHg in girls aged 4-10 to 77mmHg in men and 78mmHg in women aged 50-64, with older adults having levels of 71mmHg in men and 72mmHg in women.
- Forty-two percent of men and 35% of women had hypertension (SBP \geq 140mmHg and/or DBP \geq 90mmHg and/or on medication for hypertension). This was higher in men and women aged 65 and over (62% and 63%, respectively) compared with those aged 19-34 (18% and 7%, respectively). There was a male preponderance in prevalence in those aged under 50.
- Forty-five percent of men and 60% of women with hypertension were on drug treatment; adequate control of blood pressure was obtained in only 53% of men and 48% of women on drug treatment.
- Age-standardised mean SBP and DBP were significantly higher in men in Northern Ireland than in England or Scotland. Mean DBP was lower in women from Wales than in women from the other three countries. In women but not men, age-standardised prevalence of hypertension was substantially higher in Scotland (56%) than in the other three countries (Northern Ireland 41%, Wales 35%, England 34%).
- Mean SBP and DBP in the Low Income Diet and Nutrition Survey (LIDNS) were very similar to findings from the most recent national surveys of the general population in England (Health Survey for England (HSE) 2003) and Scotland (Scottish Health Survey (SHS) 2003). However, prevalence of hypertension appeared to be higher in LIDNS than in HSE 2003 for men and than in SHS 2003 for men and women. This may reflect the different age profiles of the surveys or the greater prevalence of cardiovascular risk factors in more deprived groups, giving a lower threshold for treating hypertension.

13.1 Introduction

This chapter presents results on blood pressure in two ways: as levels of systolic and diastolic pressure in both adults and children, and as prevalence and treatment of hypertension among adults (Sections 13.3-13.5). First, there is a short introduction (Section 13.1) explaining why raised blood pressure is important, the links between blood pressure and diet, and between blood pressure and socio-economic factors. It also describes the measurement method and the definitions used for this chapter, which is followed by response rates to the blood pressure measurements (Section 13.2). Finally, in Section 13.6, comparisons of blood pressure in LIDNS are made with the general population from other national surveys.

Hypertension, persistently high blood pressure, is the second most important preventable risk factor for premature death in economically developed countries, accounting for almost 11% of loss of healthy life.¹ It is a major predisposing factor for stroke and other cerebrovascular disease² as well as for heart disease,¹ with a continuous positive relationship between increased blood pressure level and risk of disease.³ Current guidelines define hypertension as sustained blood pressure $\geq 140/90$ (systolic blood pressure (SBP) ≥ 140 and/or diastolic blood pressure (DBP) ≥ 90).^{4,5,6} Drug treatment is recommended for anyone with sustained blood pressure $\geq 160/100$, and at lower levels for those with existing cardiovascular disease, diabetes, or with damage caused by the raised BP.⁴

Blood pressure is related to nutrient intake both directly and indirectly. Dietary sodium increases BP and there are therefore national guidelines for sodium intake.^{3,7,8,9,10} Fruit and vegetable consumption may decrease BP owing to their potassium content.^{8,11} Alcohol increases SBP¹² but appears to decrease DBP.⁸ Blood pressure also rises with increasing body mass index.¹³ Regular physical activity can reduce blood pressure;⁵ a sedentary lifestyle increases the risk of hypertension both through lack of activity and through an increased risk of obesity.

In economically developed countries, both SBP and prevalence of hypertension are inversely related to social class and education level, after adjustment for age. The differences in mean blood pressure are not due to differential rates of diagnosis or treatment. A substantial part of the socio-economic differences in SBP and DBP is explained by changes in body mass index (BMI).¹⁴

For the Low Income Diet and Nutrition Survey (LIDNS), BP was measured in the respondent's home by a trained nurse, using the Omron HEM 907. This machine was chosen as it is used in the Health Survey for England (HSE), having been validated as an accurate way to measure BP in the community.¹⁵ Using the appropriate size cuff, three measurements were taken at one minute intervals after a five minute rest, using the right arm, with the respondent seated. The nurse also asked about medication used and its purpose. The results presented in this chapter are based on the means of the second and third measurements of SBP and DBP.

Hypertension is defined using the threshold value of SBP ≥ 140 mmHg or DBP ≥ 90 mmHg¹ or the use of medication prescribed to lower blood pressure, in line with current guidance.⁴ Adults were classified into one of four groups:

| | |
|-----------------------------|--|
| Normotensive – untreated: | SBP < 140 and DBP < 90 and not currently on medication prescribed specifically to treat raised BP |
| Hypertensive – controlled | SBP < 140 and DBP < 90 and currently on medication prescribed specifically to treat raised BP |
| Hypertensive – uncontrolled | SBP ≥ 140 and / or DBP ≥ 90 and currently on medication prescribed specifically to treat raised BP |
| Hypertensive – untreated | SBP ≥ 140 and / or DBP ≥ 90 and not currently on medication prescribed specifically to treat raised BP |

The last three groups together comprise those with hypertension for the purpose of this report. When interpreting the results, it should be taken into account that hypertension can be diagnosed only when sustained rises in BP are detected, while this study measured BP on a single occasion. The reported rates of hypertension, therefore, are likely to be overestimates.

As blood pressure and the prevalence of hypertension are known to increase substantially with age, results presented are either age-specific or, for adults, are age-standardised, e.g. to enable comparisons across countries. The results were age-standardised using the overall LIDNS adult population.

13.2 Response rate

Based on respondents who were visited by a nurse, BP measurements were attempted from 99% of men and 98% of women aged 19 and over, and from 78% of boys and 76% girls aged 4-18. However, the measurements from some respondents were excluded because they had eaten, drunk alcohol, exercised or smoked in the half hour preceding the nurse visit; the proportion who had done so varied from 33% of men and 25% of women aged 19-34 to 11% and 12% respectively aged 65 and over. Small numbers of respondents were excluded because the measurement was refused or three valid readings were not obtained or attempted. Thus 70% of men and 76% of women who had a nurse visit had three valid BP measurements, as did 60% of boys and 66% of girls.

Subsequent analyses are restricted to respondents with three valid BP measurements. Results have been weighted for non-response to the nurse visit, in an attempt to make the results representative of the low income population (see Chapter 2 and Appendix O, LIDNS CD).

(Table 13.1)

13.3 Blood pressure by sex and age

13.3.1 Systolic blood pressure (SBP)

Mean SBP was 133mmHg in men and 126mmHg in women. There were no differences by sex in either children aged 4-11 or adults aged 50 and over, but it was lower in females than males age groups 11-18, 19-34 and 35-49. Mean SBP varied by age, ranging from 127mmHg in men aged 19-34 to 140mmHg aged 65 and over, and from 113mmHg to 141mmHg, respectively, in women. In children, mean SBP was 102mmHg in boys aged 4-10 and 114mmHg in boys aged 11-18, and 104mmHg and 109mmHg in those age groups, respectively, in girls. Median and mean SBP were very similar to each other in every age group in both males and females.

The 5th and 10th centile levels of SBP varied little with age and were very similar in males and females for each age group. The 90th and 95th centiles varied more markedly with age and showed a larger sex difference. Figure 13A shows mean, 10th and 90th centiles for SBP by sex and age.

(Table 13.2, Figure 13A)

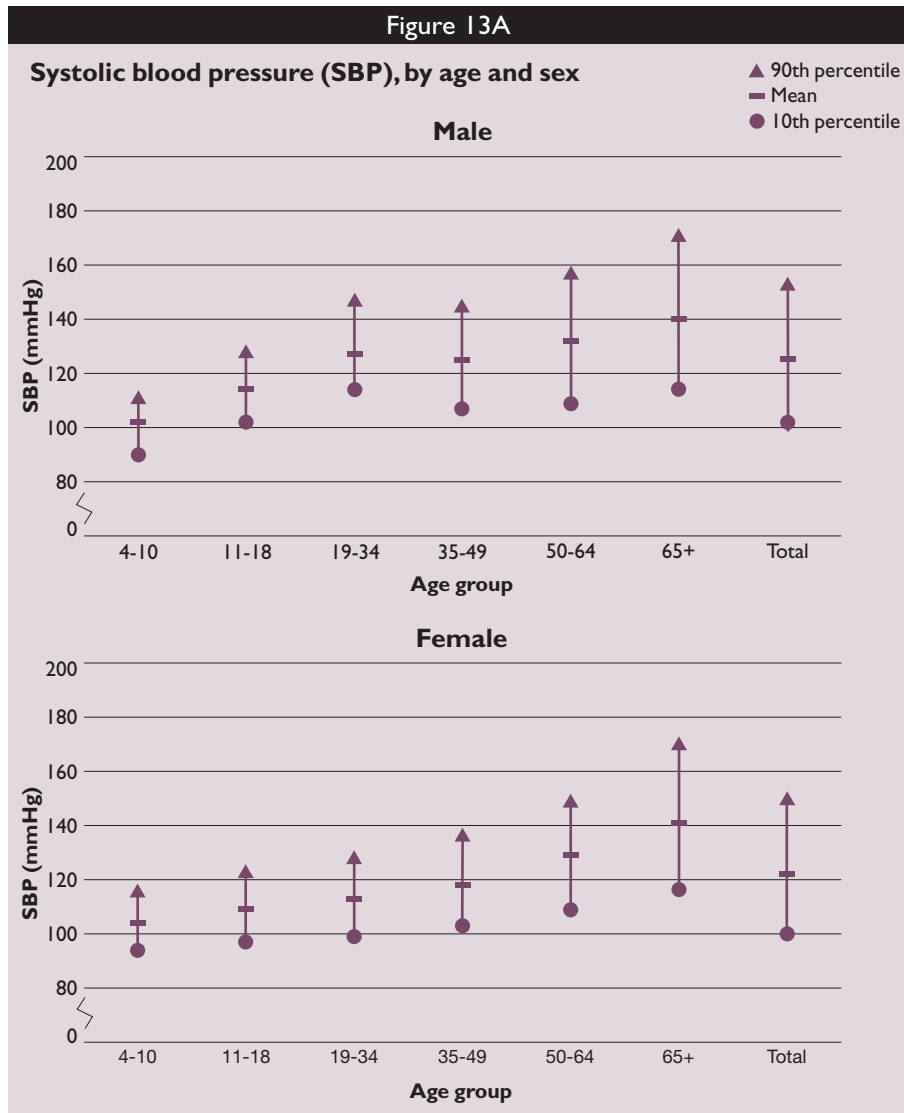
13.3.2 Diastolic blood pressure (DBP)

Mean DBP was 74mmHg in men and 73mmHg in women. There were no differences by sex in either adults or children. Mean DBP varied with age, from 62mmHg in boys and 64mmHg in girls aged 4-10 to 77mmHg in men and 78mmHg in women aged 50-64, but was lower in adults aged 65 and over (71mmHg in men and 72mmHg in women). The lower mean DBP levels in adults aged 65 and over may represent a survivor effect, whereby those with raised DBP were more likely to have died prematurely or not to have been included in the survey, being too ill or disabled to take part or not living in a private household, or that drug treatment for hypertension (particularly isolated systolic hypertension, common in older people) resulted in lower DBP levels.

Median and mean DBP were very similar to each other in every age group in both sexes. The 90th and 95th centiles varied markedly with age and peaked in the 50-64 age group. The 5th and 10th centile levels of DBP varied less with age. There was little difference between sexes. Figure 13B shows mean, 10th and 90th centiles for DBP by sex and age.

(Table 13.3, Figure 13B)

Figure 13A

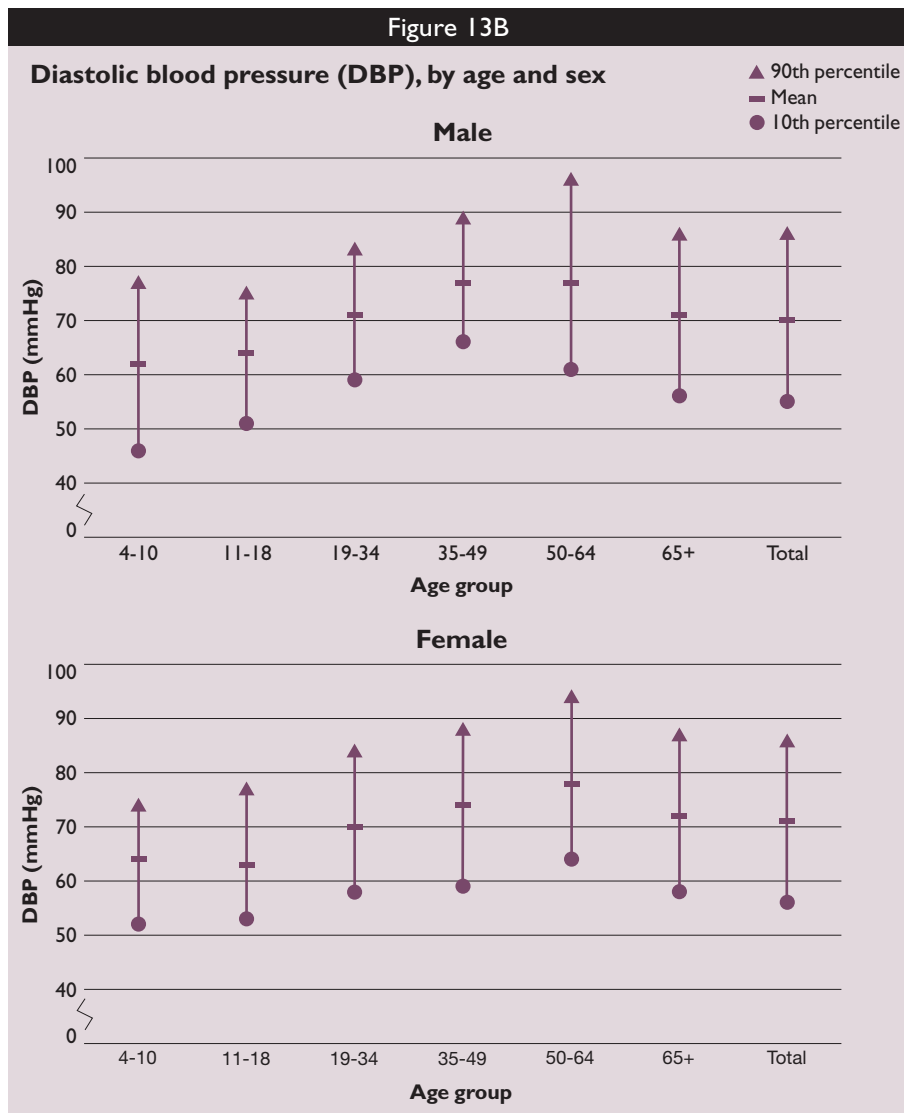


13.3.3 High blood pressure in adults

Forty-two percent of men and 35% of women had hypertension (i.e. were taking drugs prescribed to lower their blood pressure or had a measured SBP ≥ 140 mmHg or a measured DBP ≥ 90 mmHg). This varied from 18% of men and 7% of women aged 19-34 to 62% of men and 63% of women aged 65 and over. The male preponderance in prevalence disappeared by age 50-64 (49% of men, 51% of women).

Figure 13C shows the prevalence of untreated, treated but uncontrolled, and well-controlled hypertension by sex and age. In the youngest men, no cases of high blood pressure detected in the survey were being treated. It should be remembered that hypertension is diagnosed, and treatment indicated, on the basis of sustained high blood pressure but measurements were taken only on a single occasion for LIDNS. There were fewer of the youngest women with hypertension but one-third were being treated. This may be because blood pressure is measured routinely when women attend health services for contraception or antenatal care. Young men are much less likely to visit a doctor and are less likely to have their BP measured routinely. More than half the women aged 35 and over with hypertension were on drug treatment but for men this was achieved only in those aged 65 and over. Only one-third of men aged 35-64 with raised blood pressure were on drug treatment. However, of those on drug treatment, adequate control of BP ($< 140/90$) was achieved in almost all men aged 35-49 and in around half of men aged 50 and over. Adequate BP control was attained in almost all women aged 19-34 on drug treatment, but in less than two-fifths of women aged 65 and over.

(Tables 13.4, 13.5, Figure 13C)



13.4 Blood pressure by country/region

Observed¹⁶ mean SBP in men varied significantly between countries. It was lowest in Scotland (129mmHg) and highest in Wales (138mmHg) and Northern Ireland (139mmHg). Observed mean SBP did not vary significantly across the English regions. After age-standardisation to the overall LIDNS population, mean SBP remained significantly higher in Northern Ireland than in England or Scotland.

In men, observed mean DBP did not vary between countries or regions but after age-standardisation, DBP was also higher in Northern Ireland than in England or Scotland.

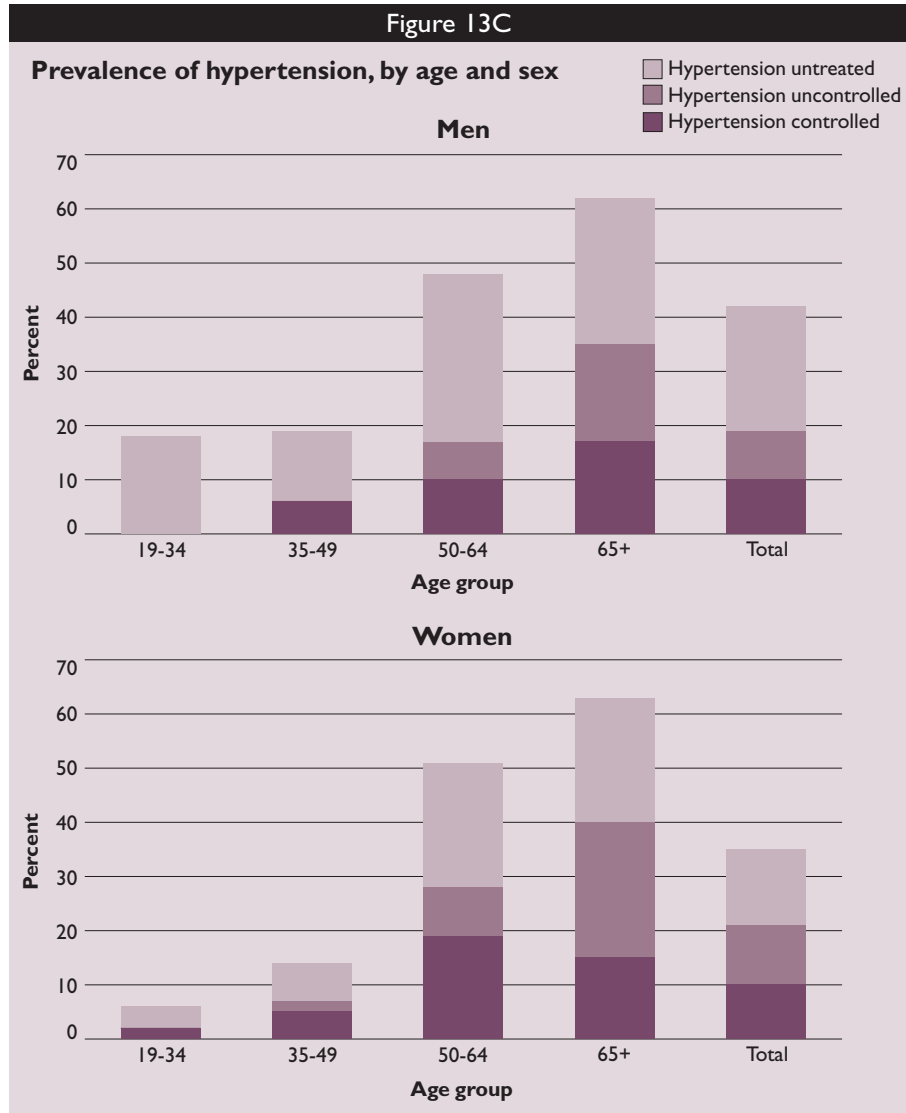
Although observed mean SBP in women was higher in Scotland (131mmHg) than in Northern Ireland (123mmHg), the differences between countries were due to differences in the ages of the adults. Following age-standardisation, mean SBP was significantly higher in women in the North of England (age-standardised mean 129mmHg) compared with those from the South (age-standardised mean 124 mmHg).

Age-standardised mean DBP was lower in women from Wales than in women from the other three countries.

The prevalence of hypertension did not differ significantly between countries or regions in men. However, in women, the age-standardised prevalence of hypertension was substantially higher in Scotland (56%) than in the other three countries (Northern Ireland 41%, Wales 35%, England 34%).

(Tables 13.6a, 13.6b, 13.6c, 13.6d)

Figure 13C



13.5 Blood pressure by household type

As blood pressure varies so significantly with age, it is unsurprising that mean SBP, mean DBP and prevalence of hypertension were higher in households comprising retired adults than in households of working age adults. It was not possible to age-standardise the results for household type because the categorisation is based on adults' ages.

13.6 Comparison with other surveys

13.6.1 Adults

Comparisons with the general population can be made with national surveys, including the HSE and the Scottish Health Survey (SHS). However, such comparisons need to be treated with caution, as there are disproportionately more young and old people in the low income population than in the general population. (This differs from the comparisons made between countries in Section 13.4, when the results were age-standardised; the reference population used for the age standardisation in that analysis was not an external population but the total adults LIDNS population.)

Blood pressure levels

SBP in LIDNS varied markedly with age, as has been found in other national surveys.^{14,17} In all of these studies, it was higher in men than women up to the age of 65 but was higher in women than men in adults aged 65 and over.

National surveys undertaken in 2003 in England (HSE) and Scotland (SHS) were used to compare results from LIDNS with the general population. Both HSE and SHS used the same measurement protocol and equipment (Omron) as LIDNS for measuring blood pressure. Mean SBP in LIDNS was very similar to the findings in HSE 2003¹⁴ and in SHS 2003.^{17,18} **(Table 13.7)**

The HSE 2003 and SHS 2003 showed mean DBP varied less than SBP with age, values being highest around age 55 and lower in older people; this was similar to the LIDNS results. Neither HSE 2003 nor SHS 2003 found a relationship between quintile of income and mean blood pressure after adjustment for age.^{14,17}

Prevalence and treatment of hypertension

LIDNS also used the same definition of hypertension as HSE 2003 and SHS 2003. In HSE 2003, 32% of men and 30% of women (aged 16 and over) had hypertension;¹⁴ in SHS 2003, the equivalent figures were 33% of men and 32% of women.¹⁷ These rates appear to be lower than those in LIDNS for men and women in Scotland and for men in England. However, it is difficult to make precise comparisons, as both blood pressure and hypertension vary so much with age: the observed prevalence of hypertension among Scottish men participating in LIDNS was 37%, but was 47% after age-standardisation to the LIDNS population (and neither of these figures relate directly to the age distribution of the general population in Scotland).

Income was inversely, and area deprivation positively, associated with increased prevalence of hypertension in the SHS 2003. Income and National Statistics Socio-Economic Classification (NS-SEC) were inversely associated with prevalence of hypertension in HSE 2003.¹⁴ Age-standardisation abolished most associations with socio-economic inequalities in HSE 2003¹⁴ and SHS 2003.¹⁷ However, the association persisted for the age-standardised prevalence of hypertension in women with income in HSE 2003¹⁴ and with area deprivation in SHS 2003.¹⁷ Age-standardisation reduced the associations with NS-SEC in HSE 2003.¹⁴ It is possible that differences in the age distribution of adults in these surveys accounts for part of the difference in prevalence, as LIDNS included a slightly larger proportion of older people, in whom hypertension is much more common, than in the general population (see Chapter 3). Although mean BP in men did not differ substantially between these three surveys, there is also some evidence that hypertension is being diagnosed and treated more often in those at higher risk of cardiovascular disease, which includes a higher proportion of those in deprived circumstances.¹⁹

(Table 13.7)

Of those identified in HSE 2003 as having hypertension, this had been diagnosed in 54% of men and 59% of women, was being treated in 37% of men and 46% of women, and was successfully controlled in 46% of men and 44% of women who were on treatment.¹⁴ In Scotland, hypertension had been diagnosed in 37% of men and 49% of women identified in SHS 2003 as having hypertension. It was successfully controlled in 48% of men and 44% of women who were on treatment.¹⁷ (Table not available.)

Rates of treatment and control of hypertension in adults aged 65 and over are given in Table 13.8. The rate of drug treatment in women was higher for respondents in LIDNS than in HSE.¹⁴ No other differences were significant.¹⁷ **(Table 13.8)**

13.6.2 Children

For children, it is difficult to compare SBP levels between LIDNS and other surveys because SBP varies with height and age; moreover, the age groups used for reporting results vary between different national surveys.²⁰ The most recent population BP levels in children living in Scotland come from the SHS 2003, and in children living in England from the HSE 2001/02.²⁰ (The English data were measured using a Dinamap BP machine but the results had already been converted using regression equations to be equivalent to Omron readings, to enable comparisons to be made.)^{18,20}

Mean DBP was higher in boys aged 11-18 in LIDNS than in boys aged 10-15 in HSE or SHS ($p < 0.004$). This could be due to differences in age and/or height. No other differences were seen in mean SBP or mean DBP. Table 13.9 shows results from HSE for comparison with LIDNS results for England; for comparisons with SHS, it is necessary to compare with overall LIDNS results, as numbers were too small to separately analyse Scottish children in LIDNS. (Table 13.9)

Notes and references

- 1 World Health Organisation. The world health report 2002: Reducing risks, promoting healthy life. Geneva: WHO, 2002.
- 2 Shaper AG, Phillips AN, Pocock SJ, Walker M, Macfarlane PW. Risk factors for stroke in middle aged British men. *BMJ* 1991; 302(6785):1111-1115.
- 3 Scientific Advisory Committee on Nutrition (SACN). Salt and health. London: TSO, 2003.
- 4 Williams B, Poulter NR, Brown MJ, Davis M, McInnes GT, Potter JF, Sever PS, Thom SM; BHS guidelines working party, for the British Hypertension Society. Guidelines for the management of hypertension: report of the fourth working party of the British Hypertension Society, 2004 - BHS IV. *J Human Hypertension* 2004; 18:139-185.
- 5 National Institute for Health and Clinical Excellence. CG18 Hypertension: Management of hypertension in adults in primary care. Clinical guideline no 18. London: NICE, 2004.
- 6 Scottish Intercollegiate Guidelines Network (SIGN). Hypertension in older people. A national clinical guideline. SIGN publication no 49. Edinburgh: SIGN, 2001.
- 7 Elliott P. Commentary: Role of salt intake in the development of high blood pressure. *Int J Epidemiol* 2005; 34: 975-978.
- 8 Haijar IM, Grim CE, George V, Kotchen TA. Impact of diet on blood pressure and age-related changes in blood pressure in the US population: analysis of NHANES III. *Arch Intern Med*. 2001; 161:589-593.
- 9 Department of Health. Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. London: HMSO, 1991. [Report on Health and Social Subjects: 41].
- 10 Department of Health. Nutritional aspects of cardiovascular disease. London: HMSO, 1994.
- 11 Whelton PK, He J, Cutler JA, Brancati FL, Follmann D, Klag MJ. Effects of oral potassium on blood pressure. Meta-analysis of randomized controlled clinical trials. *JAMA*. 1997; 277: 1624-1632.
- 12 Marmot MG, Elliott P, Shipley MJ, Dyer AR, Ueshima H, Beevers DG, Stamler R, Kesteloot H, Rose G, Stamler J. Alcohol and blood pressure: the INTERSALT study. *BMJ* 1994; 308: 1263-7.
- 13 Dyer AR, Elliott P. The INTERSALT study: relations of body mass index to blood pressure. INTERSALT Co-operative Research Group. *J Hum Hypertens*. 1989; 3: 299-308.
- 14 Falaschetti, E. Blood pressure. In Sproston K, Primatesta P, eds. Health Survey for England 2003. Volume 2 Risk factors for cardiovascular disease. London: TSO, 2004.
- 15 Sproston K, Primatesta P, eds. Health Survey for England 2003. Volume 3. Methodology and documentation. London: TSO, 2004.
- 16 Because the population age structure differed between countries and regions, results are presented as observed and age-standardized.
- 17 Chaudhury M. Blood pressure. In Bromley C, Sproston K, Shelton N, eds. The Scottish Health Survey 2003. Volume 2 Adults. Edinburgh: The Scottish Executive, 2005.
- 18 NDNS had used a different machine for measuring blood pressure (Dinamap), which is known to produce different measurements from the Omron. Omron-equivalent data were not available for comparison with LIDNS. As it had been agreed that new analyses of data from other surveys would not be conducted, no comparison between LIDNS and NDNS blood pressure results can be presented. For children, the HSE in 2001 had also used Dinamap equipment but the measurements had previously been converted to Omron-equivalent readings for comparison in the SHS, so were available for use in this report.
- 19 Mindell J, Zaninotto P, Falaschetti E. Manuscript in preparation.
- 20 Chaudhury M. Blood pressure. In Bromley C, Sproston K, Shelton N, eds. The Scottish Health Survey 2003. Volume 3 Children. Edinburgh: The Scottish Executive, 2005.

Tables

- 13.1 Response to blood pressure measurement, by sex and age
- 13.2 Systolic blood pressure (SBP), by sex and age
- 13.3 Diastolic blood pressure (DBP), by sex and age
- 13.4 Blood pressure level using 140/90 mmHg definition, adults, by sex and age
- 13.5 Percentage with hypertension who were being treated and controlled, adults, by sex and age
- 13.6a Observed systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition, men, by country/region
- 13.6b Age-standardized systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition, men, by country/region
- 13.6c Observed systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition, women, by country/region
- 13.6d Age-standardized systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition, women, by country/region
- 13.7 Blood pressure levels in national surveys, adults, by sex and country
- 13.8 Percentage with hypertension who were being treated or controlled in national surveys, adults aged 65 and over, by sex and country
- 13.9 Blood pressure levels in national surveys, children, by sex, age and country

Table 13.1

Response to blood pressure measurement, by sex and age

Aged 4 and over who had a nurse visit

| Response to blood pressure measurement | Age group | | | | | | | Total adults | Total |
|--|-----------|-------|----------------|-------|-------|-------|-----|--------------|-------|
| | 4-10 | 11-18 | Total children | 19-34 | 35-49 | 50-64 | 65+ | | |
| | % | % | % | % | % | % | % | % | % |
| Males | | | | | | | | | |
| Three valid BP measurements | 47 | 74 | 60 | 63 | 61 | 68 | 85 | 70 | 66 |
| Ate, drank alcohol or smoked in the previous half hour | 28 | 22 | 25 | 33 | 36 | 32 | 11 | 26 | 26 |
| Not known if ate, drank, or smoked | - | - | - | - | - | - | - | - | - |
| Three valid readings not obtained | 17 | 3 | 10 | 1 | 2 | 0 | 3 | 2 | 5 |
| Refused, not obtained, not attempted | 9 | 0 | 5 | 3 | 1 | - | 2 | 2 | 3 |
| Females | | | | | | | | | |
| Three valid BP measurements | 61 | 70 | 66 | 72 | 69 | 76 | 85 | 76 | 73 |
| Ate, drank alcohol or smoked in the previous half hour | 20 | 24 | 22 | 25 | 28 | 22 | 12 | 21 | 21 |
| Not known if ate, drank, or smoked | - | 1 | 1 | - | 0 | - | - | 0 | 0 |
| Three valid readings not obtained | 6 | 0 | 3 | 1 | 3 | 2 | 3 | 2 | 3 |
| Refused, not obtained, not attempted | 13 | 4 | 9 | 2 | - | 1 | 1 | 1 | 3 |
| <i>Base (unweighted)</i> | | | | | | | | | |
| Males | 116 | 129 | 245 | 118 | 157 | 206 | 209 | 690 | 935 |
| Females | 143 | 154 | 297 | 339 | 377 | 273 | 395 | 1384 | 1681 |

- No observations.

Table 13.2

Systolic blood pressure (SBP), by sex and age

Aged 4 and over with valid blood pressure readings

| Systolic blood pressure (mmHg) | Age group | | | 19-34 | 35-49 | 50-64 | 65+ | Total adults |
|--------------------------------|-----------|-------|----------------|-------|-------|-------|------|--------------|
| | 4-10 | 11-18 | Total children | | | | | |
| Males | | | | | | | | |
| Mean | 102 | 114 | 109 | 127 | 125 | 132 | 140 | 133 |
| Standard deviation | 10.4 | 12.7 | 13.2 | 12.6 | 14.6 | 16.7 | 22.7 | 19.2 |
| 5th Percentile | 83 | 99 | 90 | 111 | 104 | 105 | 110 | 106 |
| 10th Percentile | 90 | 102 | 95 | 114 | 107 | 109 | 114 | 112 |
| Median | 105 | 113 | 108 | 126 | 127 | 133 | 137 | 130 |
| 90th Percentile | 111 | 128 | 126 | 147 | 145 | 157 | 171 | 158 |
| 95th Percentile | 121 | 133 | 129 | 153 | 154 | 163 | 186 | 167 |
| Females | | | | | | | | |
| Mean | 104 | 109 | 106 | 113 | 118 | 129 | 141 | 126 |
| Standard deviation | 10.4 | 9.9 | 10.4 | 11.1 | 13.3 | 16.5 | 22.0 | 20.5 |
| 5th Percentile | 92 | 97 | 93 | 96 | 99 | 104 | 109 | 99 |
| 10th Percentile | 94 | 97 | 95 | 99 | 103 | 109 | 116 | 104 |
| Median | 102 | 107 | 104 | 112 | 117 | 128 | 138 | 123 |
| 90th Percentile | 116 | 123 | 121 | 128 | 136 | 149 | 170 | 154 |
| 95th Percentile | 128 | 129 | 127 | 130 | 141 | 156 | 180 | 165 |
| <i>Base (unweighted)</i> | | | | | | | | |
| Males | 63 | 99 | 162 | 77 | 88 | 145 | 175 | 485 |
| Females | 90 | 117 | 207 | 222 | 245 | 208 | 325 | 1000 |

Table 13.3

Diastolic blood pressure (DBP), by sex and age

Aged 4 and over with valid blood pressure readings

| Diastolic blood pressure (mmHg) | Age group | | | | | | | Total adults |
|---------------------------------|-----------|-------|----------------|-------|-------|-------|------|--------------|
| | 4-10 | 11-18 | Total children | 19-34 | 35-49 | 50-64 | 65+ | |
| Males | | | | | | | | |
| Mean | 62 | 64 | 63 | 71 | 77 | 77 | 71 | 74 |
| Standard deviation | 10.6 | 8.9 | 9.7 | 9.2 | 10.4 | 12.6 | 11.5 | 11.5 |
| 5th Percentile | 43 | 46 | 45 | 57 | 56 | 55 | 52 | 55 |
| 10th Percentile | 46 | 51 | 48 | 59 | 66 | 61 | 56 | 59 |
| Median | 63 | 64 | 64 | 72 | 77 | 77 | 71 | 75 |
| 90th Percentile | 77 | 75 | 75 | 83 | 89 | 96 | 86 | 89 |
| 95th Percentile | 78 | 76 | 77 | 87 | 94 | 100 | 90 | 95 |
| Females | | | | | | | | |
| Mean | 64 | 63 | 64 | 70 | 74 | 78 | 72 | 73 |
| Standard deviation | 12.1 | 9.9 | 11.1 | 10.6 | 11.6 | 12.1 | 11.2 | 11.5 |
| 5th Percentile | 50 | 47 | 50 | 53 | 56 | 60 | 55 | 56 |
| 10th Percentile | 52 | 53 | 52 | 58 | 59 | 64 | 58 | 59 |
| Median | 61 | 63 | 63 | 70 | 75 | 76 | 72 | 73 |
| 90th Percentile | 74 | 77 | 74 | 84 | 88 | 94 | 87 | 88 |
| 95th Percentile | 83 | 79 | 79 | 88 | 96 | 98 | 92 | 94 |
| <i>Base (unweighted)</i> | | | | | | | | |
| Males | 63 | 99 | 162 | 77 | 88 | 145 | 175 | 485 |
| Females | 90 | 117 | 207 | 222 | 245 | 208 | 325 | 1000 |

Table 13.4

Blood pressure level using 140/90 mmHg definition,^a adults, by sex and age

Aged 19 and over

| Adults aged 19 and over with valid blood pressure readings | Age group | | | | Total |
|--|-----------|-------|-------|-----|-------|
| | 19-34 | 35-49 | 50-64 | 65+ | |
| | % | % | % | % | % |
| Men | | | | | |
| Normotensive untreated | 82 | 80 | 51 | 38 | 58 |
| Hypertensive controlled | - | 6 | 10 | 17 | 10 |
| Hypertensive uncontrolled | - | 0 | 7 | 18 | 9 |
| Hypertensive untreated | 18 | 13 | 31 | 27 | 23 |
| <i>Total with hypertension</i> | 18 | 20 | 49 | 62 | 42 |
| Women | | | | | |
| Normotensive untreated | 93 | 85 | 49 | 37 | 65 |
| Hypertensive controlled | 2 | 5 | 19 | 15 | 10 |
| Hypertensive uncontrolled | 0 | 2 | 9 | 25 | 11 |
| Hypertensive untreated | 4 | 7 | 23 | 23 | 14 |
| <i>Total with hypertension</i> | 7 | 15 | 51 | 63 | 35 |
| <i>Base (unweighted)</i> | | | | | |
| Men | 77 | 88 | 145 | 175 | 485 |
| Women | 222 | 245 | 208 | 325 | 1000 |

- No observations.

^a Informants were considered hypertensive if their systolic blood pressure was 140 mmHg or over, or their diastolic blood pressure was 90 mmHg or over, or they were taking medicine to lower blood pressure.

Normotensive untreated: SBP<140mmHg and DBP<90mmHg and not taking medicine prescribed for high blood pressure.

Hypertensive controlled: SBP<140mmHg and DBP<90mmHg and taking medicine prescribed for high blood pressure.

Hypertensive uncontrolled: SBP≥140mmHg or DBP≥90mmHg and taking medicine prescribed for high blood pressure.

Hypertensive untreated: SBP≥140mmHg or DBP≥90mmHg and not taking medicine prescribed for high blood pressure.

Table 13.5

Percentage with hypertension who were being treated and controlled, adults, by sex and age

Aged 19 and over with hypertension

| Treatment and control rates | Age group | | | | Total |
|--|-----------|-------|-------|-----|-------|
| | 19-34 | 35-49 | 50-64 | 65+ | |
| | % | % | % | % | % |
| Men | | | | | |
| Drug treatment rate ^a | [0] | [35] | 37 | 56 | 45 |
| Adequate control of BP ^b | - | [93] | [57] | 49 | 53 |
| Women | | | | | |
| Drug treatment rate ^a | [60] | 53 | 55 | 63 | 60 |
| Adequate control of BP ^b | [92] | [70] | 67 | 38 | 48 |
| <i>Base (unweighted)</i> | | | | | |
| <i>Men with hypertension</i> | 14 | 17 | 71 | 109 | 204 |
| <i>Men on treatment for hypertension</i> | - | 6 | 26 | 61 | 90 |
| <i>Women with hypertension</i> | 14 | 37 | 107 | 205 | 352 |
| <i>Women on treatment for hypertension</i> | 5 | 19 | 60 | 130 | 208 |

- No observations.

[] Fewer than 30 observations.

^a Percentage on drug treatment for hypertension as a proportion of those found in the survey to have hypertension (defined as a raised BP (SBP \geq 140mmHG or DBP \geq 90mmHg) and / or on treatment for hypertension).

^b Percentage on treatment with measured BP<140/90.

Table 13.6a

Observed systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition,^a men, by country/region
Men aged 19 and over with valid blood pressure readings

| SBP, DBP and blood pressure level | Country/region | | | | | | | Total |
|-------------------------------------|----------------|------------------|------------|-------------|-----------|-----------|------------------|------------|
| | England | | | | Scotland | Wales | Northern Ireland | |
| | North | Central/Midlands | South | All England | | | | |
| Men Observed | | | | | | | | |
| SBP | | | | | | | | |
| Mean | 136 | 133 | 131 | 133 | 129 | 138 | 139 | 133 |
| Standard deviation | 19.8 | 14.6 | 21.1 | 19.3 | 19.1 | 18.1 | 19.3 | 19.2 |
| 5th Percentile | 106 | 111 | 103 | 106 | 105 | 107 | 110 | 106 |
| 10th Percentile | 113 | 115 | 109 | 113 | 108 | 116 | 115 | 112 |
| Median | 134 | 130 | 127 | 130 | 131 | 139 | 136 | 130 |
| 90th Percentile | 160 | 154 | 160 | 157 | 155 | 165 | 176 | 158 |
| 95th Percentile | 170 | 158 | 178 | 166 | 170 | - | - | 167 |
| DBP | | | | | | | | |
| Mean | 75 | 75 | 73 | 74 | 74 | 74 | 78 | 74 |
| Standard deviation | 11.8 | 10.1 | 12.0 | 11.5 | 10.9 | 13.2 | 11.7 | 11.5 |
| 5th Percentile | 56 | 56 | 53 | 55 | 53 | 51 | 61 | 55 |
| 10th Percentile | 59 | 60 | 58 | 59 | 58 | 54 | 63 | 59 |
| Median | 75 | 76 | 72 | 74 | 77 | 74 | 77 | 75 |
| 90th Percentile | 89 | 86 | 89 | 88 | 86 | 96 | 99 | 89 |
| 95th Percentile | 95 | 90 | 100 | 95 | 94 | - | - | 95 |
| BP level | | | | | | | | |
| Normotensive untreated ^a | 55 | 50 | 67 | 59 | 61 | 40 | 53 | 58 |
| Hypertensive controlled | 10 | 16 | 6 | 10 | 14 | 8 | 3 | 10 |
| Hypertensive uncontrolled | 9 | 12 | 5 | 8 | 8 | 18 | 11 | 9 |
| Hypertensive untreated | 27 | 22 | 21 | 23 | 16 | 34 | 33 | 23 |
| Total with hypertension | 45 | 50 | 33 | 41 | 39 | 60 | 47 | 42 |
| <i>Base (unweighted)</i> | <i>146</i> | <i>68</i> | <i>111</i> | <i>325</i> | <i>52</i> | <i>48</i> | <i>60</i> | <i>485</i> |

- No observations.

^a Informants were considered hypertensive if their systolic blood pressure was 140 mmHg or over, or their diastolic blood pressure was 90 mmHg or over, or they were taking medicine to lower blood pressure.

Normotensive untreated: SBP < 140 mmHg and DBP < 90 mmHg and not taking medicine prescribed for high blood pressure.

Hypertensive controlled: SBP < 140 mmHg and DBP < 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive uncontrolled: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive untreated: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and not taking medicine prescribed for high blood pressure.

Table 13.6b

Age-standardized systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition,^a men, by country/region
Men aged 19 and over with valid blood pressure readings

| SBP, DBP and blood pressure level | Country/region | | | | | | | Total |
|-------------------------------------|----------------|------------------|------------|-------------|-----------|-----------|------------------|------------|
| | England | | | | Scotland | Wales | Northern Ireland | |
| | North | Central/Midlands | South | All England | | | | |
| Men | | | | | | | | |
| Age-standardised | | | | | | | | |
| SBP | | | | | | | | |
| Mean | 136 | 133 | 131 | 133 | 130 | 135 | 142 | 133 |
| Standard deviation | 19.6 | 14.5 | 21.4 | 19.3 | 19.2 | 19.8 | 20.4 | 19.4 |
| 5th Percentile | 106 | 111 | 102 | 106 | 107 | 96 | 111 | 106 |
| 10th Percentile | 113 | 115 | 108 | 112 | 108 | 112 | 116 | 111 |
| Median | 134 | 130 | 127 | 130 | 130 | 138 | 145 | 131 |
| 90th Percentile | 160 | 154 | 160 | 157 | 153 | 162 | 177 | 158 |
| 95th Percentile | 169 | 157 | 179 | 166 | 170 | - | - | 167 |
| DBP | | | | | | | | |
| Mean | 74 | 75 | 73 | 74 | 73 | 74 | 78 | 74 |
| Standard deviation | 11.7 | 10.3 | 12.6 | 12 | 10.8 | 14.6 | 12.1 | 11.8 |
| 5th Percentile | 55 | 58 | 53 | 55 | 53 | 48 | 60 | 55 |
| 10th Percentile | 59 | 60 | 55 | 59 | 58 | 52 | 62 | 59 |
| Median | 75 | 76 | 72 | 75 | 76 | 74 | 81 | 75 |
| 90th Percentile | 89 | 88 | 89 | 89 | 85 | 98 | 99 | 89 |
| 95th Percentile | 94 | 92 | 100 | 97 | 90 | - | - | 96 |
| BP level | | | | | | | | |
| Normotensive untreated ^a | 52 | 49 | 65 | 57 | 53 | 42 | 45 | 56 |
| Hypertensive controlled | 11 | 15 | 6 | 10 | 17 | 6 | 3 | 11 |
| Hypertensive uncontrolled | 10 | 8 | 7 | 8 | 9 | 16 | 13 | 9 |
| Hypertensive untreated | 27 | 27 | 22 | 25 | 22 | 36 | 39 | 25 |
| Total with hypertension | 48 | 51 | 35 | 43 | 47 | 58 | 55 | 44 |
| <i>Base (unweighted)</i> | <i>146</i> | <i>68</i> | <i>111</i> | <i>325</i> | <i>52</i> | <i>48</i> | <i>60</i> | <i>485</i> |

- No observations.

^a Informants were considered hypertensive if their systolic blood pressure was 140 mmHg or over, or their diastolic blood pressure was 90 mmHg or over, or they were taking medicine to lower blood pressure.

Normotensive untreated: SBP < 140 mmHg and DBP < 90 mmHg and not taking medicine prescribed for high blood pressure.

Hypertensive controlled: SBP < 140 mmHg and DBP < 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive uncontrolled: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive untreated: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and not taking medicine prescribed for high blood pressure.

Table 13.6c

Observed systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition,^a women, by country/region
Women aged 19 and over with valid blood pressure readings

| SBP, DBP and blood pressure level | Country/region | | | | | | | Total |
|-------------------------------------|----------------|------------------|------------|-------------|-----------|------------|------------------|-------------|
| | England | | | | Scotland | Wales | Northern Ireland | |
| | North | Central/Midlands | South | All England | | | | |
| Women Observed | | | | | | | | |
| SBP | | | | | | | | |
| Mean | 130 | 127 | 122 | 126 | 131 | 125 | 123 | 126 |
| Standard deviation | 21.9 | 20.1 | 18.9 | 20.5 | 21.1 | 20.9 | 15.9 | 20.5 |
| 5th Percentile | 100 | 101 | 97 | 99 | 103 | 99 | 101 | 99 |
| 10th Percentile | 105 | 104 | 102 | 104 | 109 | 102 | 105 | 104 |
| Median | 126 | 124 | 120 | 123 | 127 | 120 | 123 | 123 |
| 90th Percentile | 162 | 153 | 149 | 154 | 170 | 154 | 147 | 154 |
| 95th Percentile | 172 | 165 | 158 | 165 | 177 | 174 | 162 | 165 |
| DBP | | | | | | | | |
| Mean | 74 | 73 | 72 | 73 | 76 | 71 | 74 | 73 |
| Standard deviation | 10.7 | 10.3 | 12.0 | 11.3 | 13.0 | 12.5 | 11.0 | 11.5 |
| 5th Percentile | 58 | 56 | 54 | 56 | 52 | 53 | 58 | 56 |
| 10th Percentile | 61 | 60 | 58 | 60 | 58 | 56 | 60 | 59 |
| Median | 75 | 73 | 72 | 73 | 77 | 69 | 73 | 73 |
| 90th Percentile | 86 | 87 | 87 | 87 | 94 | 90 | 93 | 88 |
| 95th Percentile | 93 | 90 | 94 | 93 | 96 | 97 | 98 | 94 |
| BP level | | | | | | | | |
| Normotensive untreated ^a | 60 | 68 | 72 | 67 | 44 | 68 | 64 | 65 |
| Hypertensive controlled | 11 | 7 | 8 | 9 | 18 | 9 | 17 | 10 |
| Hypertensive uncontrolled | 12 | 13 | 8 | 10 | 17 | 11 | 8 | 11 |
| Hypertensive untreated | 17 | 12 | 12 | 14 | 21 | 11 | 10 | 14 |
| Total with hypertension | 40 | 32 | 28 | 33 | 56 | 32 | 36 | 35 |
| <i>Base (unweighted)</i> | <i>282</i> | <i>122</i> | <i>271</i> | <i>675</i> | <i>98</i> | <i>107</i> | <i>120</i> | <i>1000</i> |

^a Informants were considered hypertensive if their systolic blood pressure was 140 mmHg or over, or their diastolic blood pressure was 90 mmHg or over, or they were taking medicine to lower blood pressure.

Normotensive untreated: SBP < 140 mmHg and DBP < 90 mmHg and not taking medicine prescribed for high blood pressure.

Hypertensive controlled: SBP < 140 mmHg and DBP < 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive uncontrolled: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive untreated: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and not taking medicine prescribed for high blood pressure.

Table 13.6d

Age-standardized systolic and diastolic blood pressure, and blood pressure level using 140/90 mmHg definition,^a women, by country/region
Women aged 19 and over with valid blood pressure readings

| SBP, DBP and blood pressure level | Country/region | | | | | | | Total |
|-------------------------------------|----------------|----------------------|-------|----------------|----------|-------|------------------|-------|
| | England | | | | Scotland | Wales | Northern Ireland | |
| | North | Central/ Midlands | South | All England | | | | |
| Women | | | | | | | | |
| Age-standardised | | | | | | | | |
| SBP | | | | | | | | |
| Mean | 129 | 127 | 124 | 126 | 130 | 125 | 125 | 127 |
| Standard deviation | 21.2 | 19.5 | 19.4 | 20.2 | 20.3 | 21.5 | 16.4 | 20.2 |
| 5th Percentile | 101 | 101 | 97 | 99 | 103 | 100 | 101 | 100 |
| 10th Percentile | 105 | 104 | 103 | 104 | 109 | 102 | 105 | 104 |
| Median | 126 | 124 | 121 | 124 | 127 | 120 | 125 | 124 |
| 90th Percentile | 162 | 152 | 150 | 154 | 164 | 156 | 148 | 154 |
| 95th Percentile | 169 | 163 | 159 | 165 | 174 | 173 | 163 | 165 |
| DBP | | | | | | | | |
| Mean | 75 | 73 | 73 | 73 | 76 | 70 | 74 | 73 |
| Standard deviation | 10.6 | 10.4 | 12.2 | 11.4 | 13.1 | 12.1 | 11.2 | 11.6 |
| 5th Percentile | 58 | 56 | 54 | 56 | 52 | 53 | 57 | 56 |
| 10th Percentile | 61 | 62 | 58 | 60 | 58 | 56 | 60 | 60 |
| Median | 75 | 73 | 73 | 74 | 77 | 69 | 73 | 74 |
| 90th Percentile | 87 | 87 | 89 | 88 | 94 | 90 | 96 | 89 |
| 95th Percentile | 94 | 90 | 96 | 94 | 96 | 95 | 98 | 94 |
| BP level | | | | | | | | |
| Normotensive untreated ^a | 61 | 68 | 69 | 66 | 44 | 65 | 59 | 64 |
| Hypertensive controlled | 12 | 8 | 9 | 10 | 19 | 9 | 18 | 11 |
| Hypertensive uncontrolled | 11 | 13 | 8 | 10 | 16 | 15 | 9 | 11 |
| Hypertensive untreated | 17 | 11 | 14 | 15 | 20 | 10 | 14 | 15 |
| Total with hypertension | 39 | 32 | 31 | 34 | 56 | 35 | 41 | 36 |
| <i>Base (unweighted)</i> | 282 | 122 | 271 | 675 | 98 | 107 | 120 | 1000 |

- No observations.

^a Informants were considered hypertensive if their systolic blood pressure was 140 mmHg or over, or their diastolic blood pressure was 90 mmHg or over, or they were taking medicine to lower blood pressure.

Normotensive untreated: SBP < 140 mmHg and DBP < 90 mmHg and not taking medicine prescribed for high blood pressure.

Hypertensive controlled: SBP < 140 mmHg and DBP < 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive uncontrolled: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and taking medicine prescribed for high blood pressure.

Hypertensive untreated: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg and not taking medicine prescribed for high blood pressure.

Table 13.7

Blood pressure levels in national surveys, adults, by sex and country

Adults with valid blood pressure readings

| Blood pressure level | Survey and country | | | | | |
|---|----------------------------|------|------------------|-----------------------------|------|------------------|
| | LIDNS England ^a | | HSE ^b | LIDNS Scotland ^a | | SHS ^b |
| | 19+ | 16+ | 19+ | 19+ | 16+ | |
| Men | | | | | | |
| Mean SBP (mmHg) | 133 | 131 | 130 | 130 | 132 | |
| Mean DBP (mmHg) | 74 | 74 | 73 | 73 | 75 | |
| Prevalence of hypertension (%) ^c | 43 | 32 | 47 | 47 | 33 | |
| Women | | | | | | |
| Mean SBP (mmHg) | 126 | 126 | 130 | 130 | 127 | |
| Mean DBP (mmHg) | 73 | 73 | 76 | 76 | 74 | |
| Prevalence of hypertension (%) ^c | 34 | 30 | 56 | 56 | 32 | |
| <i>Base (unweighted)</i> | | | | | | |
| Men | 325 | 4108 | 52 | 52 | 1933 | |
| Women | 675 | 5075 | 98 | 98 | 2538 | |

^a Age-standardised to the LIDNS age distribution.^b HSE: Health Survey for England 2003; SHS: Scottish Health Survey 2003.^c Hypertension defined as BP \geq 140/90 and/or on medication to lower blood pressure.

Table 13.8

Percentage with hypertension who were being treated or controlled in national surveys, adults aged 65 and over, by sex and country

Adults aged 65 and over with hypertension

| Treatment and control rates | Survey | | | | |
|-------------------------------------|--------|------------------|------------------|------------------|------------------|
| | LIDNS | HSE ^a | HSE ^a | HSE ^a | SHS ^a |
| | 65+ | 65+ | 65-74 | 75+ | 65+ |
| | % | % | % | % | % |
| Men | | | | | |
| Drug treatment rate ^b | 56 | 50 | 51 | 49 | 51 |
| Adequate control of BP ^c | 49 | d | 48 | 33 | 44 |
| Women | | | | | |
| Drug treatment rate ^b | 63 | 55 | 55 | 55 | 60 |
| Adequate control of BP ^c | 38 | d | 45 | 30 | 45 |
| <i>Base (unweighted)</i> | | | | | |
| Men with hypertension | 109 | 604 | 370 | 234 | 182 |
| Men on treatment for hypertension | 61 | 304 | 189 | 115 | 93 |
| Women with hypertension | 205 | 804 | 397 | 407 | 239 |
| Women on treatment for hypertension | 130 | 442 | 218 | 224 | 143 |

^a HSE: Health Survey for England 2003, SHS: Scottish Health Survey 2003.^b Percentage on drug treatment for hypertension as a proportion of those found in the survey to have hypertension (defined as a raised BP (SBP \geq 140mmHG or DBP \geq 90mmHg) and / or on treatment for hypertension).^c Percentage on treatment with measured BP $<$ 140/90.^d Results not available for this age group.

Table 13.9

Blood pressure levels in national surveys, children, by sex, age and country

Children with valid blood pressure readings

| Blood pressure level | LIDNS England | | HSE 2001/02 ^a | | LIDNS (all) ^b | | SHS 2003 ^b | |
|--------------------------|---------------|-------|--------------------------|-------|--------------------------|-------|-----------------------|-------|
| | 4-10 | 11-18 | 5-9 | 10-15 | 4-10 | 11-18 | 5-9 | 10-15 |
| | mmHg | mmHg | mmHg | mmHg | mmHg | mmHg | mmHg | mmHg |
| Boys | | | | | | | | |
| Mean SBP | 103 | 115 | 104 | 113 | 102 | 114 | 104 | 112 |
| Mean DBP | 62 | 64 | 61 | 62 | 62 | 64 | 63 | 61 |
| Girls | | | | | | | | |
| Mean SBP | 104 | 108 | 103 | 110 | 104 | 109 | 104 | 108 |
| Mean DBP | 64 | 64 | 63 | 64 | 64 | 63 | 66 | 64 |
| <i>Base (unweighted)</i> | | | | | | | | |
| Boys | 46 | 62 | 1238 | 1580 | 63 | 99 | 229 | 307 |
| Girls | 69 | 65 | 1243 | 1576 | 90 | 117 | 239 | 336 |

^a HSE: Health Survey for England 2001/02 (the most recent BP measurement in children in England before LIDNS); SHS: Scottish Health Survey 2003. HSE 2001/02 Dinamap measurements of BP were converted to Omron-equivalent readings.^b Bases were too small to permit analysis of results from LIDNS children in Scotland alone.