

Article

Risk factors for undiagnosed high blood pressure in England: 2015 to 2019

Analysis of risk factors for undiagnosed high blood pressure among adults living in private households, using the Health Survey for England 2015 to 2019.

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Release date:
27 April 2023

Next release:
To be announced

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1 . Main points

- An estimated 32% of adults living in private households in England had high blood pressure (hypertension) and 3 in 10 of those (29%) were undiagnosed; this equates to approximately 4.2 million adults with undiagnosed hypertension.
- Hypertension is defined in this analysis as having a measured blood pressure of 140 over 90 millimetres of mercury (mmHg) or above, or self-reporting a hypertension diagnosis; this definition produces a slightly higher estimate of hypertension prevalence compared with official estimates published by NHS Digital in 2019.
- Adults who were the least likely to have hypertension (such as younger adults, those whose general health was good, and those who were not overweight or obese) were the most likely to be undiagnosed if they did have hypertension.
- Younger males with hypertension were particularly likely to be undiagnosed; 66% of males and 26% of females aged 16 to 24 years, and 55% of males and 44% of females aged 25 to 34 years who had hypertension were undiagnosed, compared with 17% of males and 21% of females aged 75 years and over.
- Although younger adults with hypertension were proportionately more likely to be undiagnosed than older adults, the highest total estimated number of cases of undiagnosed hypertension in the population were among males aged 55 to 64 years (500,000 males in this age group with undiagnosed hypertension) and females aged 65 to 74 years (460,000 females in this age group with undiagnosed hypertension).
- Other groups who were most likely to be undiagnosed included males living in rural areas, living in regions other than London, or who had never regularly smoked, and females who were married or in a civil partnership, had degree-level or equivalent qualifications, or who worked for small employers or own account workers.

Statistician's Comment

“Our analysis found that while the prevalence of hypertension increased with age and other known risk factors such as high BMI and poor general health, there are considerable numbers of younger, healthier people who are undiagnosed. This analysis will provide valuable insight for health services and those who work to improve health outcomes. It may also raise awareness among the general population, leading to more timely diagnoses in the future.”

Chris Shine, Analytical Hub, Office for National Statistics

In 2019, [official statistics from NHS Digital](#) showed that 28% of adults had hypertension, which is lower than the estimate presented in this article (32%). This is because of differences in the way hypertension is defined; more information can be found in [Section 7: Data sources and quality](#).

2 . Hypertension and undiagnosed hypertension by age and sex

High blood pressure (hypertension) is a condition that affects the blood vessels. It is the number one risk factor for cardiovascular disease, is responsible for around half of all heart attacks and strokes, and has [an estimated annual cost to the NHS of over £2 billion](#).

Hypertension can be screened for using blood pressure monitors, which are accessible and inexpensive, but official estimates show that around one-third of adults with hypertension in England are undiagnosed. The analysis in this article investigates which groups of the population are most at risk for undiagnosed hypertension.

The prevalence of hypertension increased with age for both sexes; 7% of males and 4% of females aged 16 to 24 years had hypertension, rising to 66% of males and 71% of females aged 75 years and over. However, among those with hypertension, younger adults were more likely to be undiagnosed; 66% of males and 26% of females aged 16 to 24 years, and 55% of males and 44% of females aged 25 to 34 years who had hypertension were undiagnosed. This compared with 17% of males and 21% of females aged 75 years and over.

Figure 1: Younger adults with hypertension were more likely to be undiagnosed than older adults

Proportion of adults with hypertension who were undiagnosed, by age and sex, England, 2015 to 2019

Notes:

1. Base population: adults with hypertension.
2. Data weighted following methods described in Health Survey for England 2019 methods report.

Download the data

[.xlsx](#)

When these proportions are applied to the population of adults living in private households in England, an estimated 140,000 males and 30,000 females aged 16 to 24 years had undiagnosed hypertension, compared with 220,000 males and 380,000 females aged 75 years and over. The age groups with the highest total estimated number of cases of undiagnosed hypertension in the population were males aged 55 to 64 years (500,000 males in this age group with undiagnosed hypertension) and females aged 65 to 74 years (460,000 females in this age group with undiagnosed hypertension).

Figure 2: The estimated number of adults with undiagnosed hypertension in England varied by sex and age group

Population estimates for undiagnosed hypertension, adults living in private households, England, 2015 to 2019

Note:

1. Population estimates calculated following the method described in the Health Survey for England 2019 Methods report, which involves applying weighted estimated proportions to the Office for National Statistics (ONS) mid-year population estimate for each age and sex group, adjusted to represent adults living in private households.

Download the data

[.xlsx](#)

3 . Risk factors for hypertension and undiagnosed hypertension

We investigated the proportion of adults with hypertension and undiagnosed hypertension by the following characteristics:

- self-reported general health
- body mass index (BMI)
- smoking status
- rural-urban classification
- region
- ethnicity
- educational qualifications
- National Statistics Socio-economic Classification (NS-SEC)
- relationship status

This section reports age-standardised estimates, which account for differences in the age structure of different groups. Main findings are summarised and all results can be found in our [accompanying dataset](#).

Hypertension was more common among adults whose self-reported general health was “bad or very bad” (males 56%, females 45%) compared with “fair” (males 46%, females 40%) or “very good or good” (males 34%, females 25%). Hypertension was also more common among adults who were classified as obese (males 53%, females 44%) compared with those who were overweight (males 35%, females 27%) or not overweight or obese (males 24%, females 18%).

However, adults with hypertension were more likely to be undiagnosed if their self-reported general health was “very good or good” (males 41%, females 28%) compared with “fair” (males 21%, females 14%) or “bad or very bad” (males 18%, females 14%). Among males with hypertension, those who were not overweight or obese were also more likely to be undiagnosed (44%) compared with those who were obese (30%), and those who had never regularly smoked were more likely to be undiagnosed (36%) than ex-regular smokers (30%). There was no evidence for differences in the proportion of females with undiagnosed hypertension by BMI or smoking status.

Figure 3: Adults with hypertension reporting very good or good general health were more likely to be undiagnosed than those reporting worse general health

Age-standardised proportion of adults with hypertension who were undiagnosed, by sex and health characteristics, England, 2015 to 2019

Notes:

1. Base population: adults with hypertension.
2. Respondents with body mass index (BMI) below 25 classified as “not overweight or obese”, respondents with a BMI between 25 and 29 classified as “overweight”, respondents with a BMI of 30 or above classified as “obese”.

Download the data

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Hypertension prevalence for males was highest in the North West (44%) and lowest in the South East (33%) and East of England (36%). Hypertension prevalence for females was highest in the East Midlands (33%) and lowest in the South East (27%). However, for those with hypertension, males living in London were the least likely to be undiagnosed (26%) and those living in the East Midlands were the most likely (40%).

Males with hypertension who lived in rural areas were also more likely to be undiagnosed (42%) than males living in urban areas (32%). There was no evidence of differences in the proportion of females with hypertension who were undiagnosed by region or rural-urban classification.

Figure 4: Males with hypertension living in rural areas were more likely to be undiagnosed than males living in urban areas

Age-standardised proportion of adults with hypertension who were undiagnosed, by sex and rural-urban classification, England, 2015 to 2019

Notes:

1. Base population: adults with hypertension.
2. Rural areas include towns, fringe areas, villages, hamlets and isolated dwellings.

Download the data

[.xlsx](#)

Hypertension prevalence was highest among adults who came from a Black ethnic group, who had no educational qualifications, who worked in semi-routine occupations, and whose relationship status was single. However, among those with hypertension, females were more likely to be undiagnosed if they had a degree-level or equivalent qualification (26%) compared with no qualifications (19%), if they worked for small employers or own account workers (27%) compared with semi-routine occupations (19%), and if they were married or in a civil partnership (24%) compared with single (17%).

There was no evidence of differences in undiagnosed hypertension by educational qualifications, NS-SEC, or relationship status for males, and no evidence of differences in undiagnosed hypertension by ethnicity for either males or females.

Figure 5: Females with hypertension who had degree-level or equivalent qualifications were more likely to be undiagnosed than those with no qualifications

Age-standardised proportion of adults with hypertension who were undiagnosed, by sex and educational qualifications, England, 2015 to 2019

Notes:

1. Base population: adults with hypertension.
2. Degree or equivalent includes National Vocational Qualification (NVQ) levels 4 and 5.

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4 . Characteristics independently associated with undiagnosed hypertension

We fitted logistic regression models to examine which characteristics were independently associated with undiagnosed hypertension (among those with hypertension) after accounting for other factors, using odds ratios (ORs) to compare groups. Fully adjusted models were adjusted for:

- age
- ethnicity
- region
- rural-urban classification
- highest educational qualification
- relationship status
- National Statistics Socio-economic Classification (NS-SEC)

Results from the logistic regression models were generally consistent with the descriptive results presented in [Section 2: Hypertension and undiagnosed hypertension by age and sex](#) and [Section 3: Risk factors for hypertension and undiagnosed hypertension](#). The main findings are summarised in this section and all results can be found in our [accompanying dataset](#).

Age, self-reported general health and body mass index (BMI) were independently associated with undiagnosed hypertension for both males and females. After adjusting for other factors, males aged 16 to 24 years had 8.5 times the odds of being undiagnosed compared with males aged 75 years and over. Females aged 25 to 34 years had 2.7 times the odds of being undiagnosed compared with females aged 75 years and over.

Among those whose self-reported general health was “very good or good”, males had 3.5 times the odds, and females had 2.2 times the odds of being undiagnosed compared with those whose self-reported general health was “bad or very bad”.

Males who were not overweight or obese had 1.9 times the odds of being undiagnosed, and males who were overweight had 1.3 times the odds of being undiagnosed, compared with males who were obese. Females who were not overweight or obese and those who were overweight both had 1.2 times the odds of being undiagnosed compared with those who were obese.

Figure 6: Age was independently associated with undiagnosed hypertension for males and females

Fully adjusted odds of having undiagnosed hypertension by age, England, 2015 to 2019

Notes:

1. Base population: adults with hypertension.
2. An odds ratio indicates the relative likelihood of having undiagnosed hypertension given a particular characteristic when compared with a reference group.

Download the data

[.xlsx](#)

Figure 7: Self-reported general health and body mass index (BMI) were independently associated with undiagnosed hypertension for males and females

Fully adjusted odds of having undiagnosed hypertension by self-reported general health and BMI, England, 2015 to 2019

Notes:

1. Base population: adults with hypertension.
2. Respondents with body mass index (BMI) below 25 classified as “not overweight or obese”, respondents with a BMI between 25 and 29 classified as “overweight”, respondents with a BMI of 30 or above classified as “obese”.
3. An odds ratio indicates the relative likelihood of having undiagnosed hypertension given a particular characteristic when compared with a reference group.

Download the data

[.xlsx](#)

For males, other characteristics that were independently associated with undiagnosed hypertension were:

- rural-urban classification (males in rural areas had 1.5 times the odds of being undiagnosed compared with those in urban areas)
- region (males living in London and the East of England had 0.6 times the odds of being undiagnosed compared with those in the East Midlands)
- smoking status (males who were ex-regular smokers had 0.7 times the odds of being undiagnosed compared with males who were current smokers)

For females, other characteristics that were independently associated with undiagnosed hypertension were:

- NS-SEC (females working for small employers and own account workers had 1.5 times the odds of being undiagnosed compared with those in semi-routine occupations)
- educational qualifications (females with a degree-level qualification or equivalent had 1.4 times the odds of being undiagnosed compared with those with no qualifications)
- marital status (females who were married or in a civil partnership had 1.4 times the odds of being undiagnosed compared with those who were single)

5 . Risk factors for undiagnosed high blood pressure data

[Risk factors for undiagnosed high blood pressure](#)

Dataset | Released 27 April 2023

Analysis of risk factors for high blood pressure and undiagnosed high blood pressure among adults in England, using the Health Survey for England 2015 to 2019.

6 . Glossary

95% confidence intervals

A [confidence interval](#) is a measure of the uncertainty around an estimate. It specifies a range of values likely to contain the true population value. If a confidence interval is calculated at the 95% level, it is expected that the interval will contain the true value on 95 out of every 100 occasions. Wider confidence intervals indicate a greater degree of uncertainty about where the true value lies. We use 95% confidence intervals to assess the [statistical significance](#) of differences between groups. Where confidence intervals do not overlap, we can conclude there is a statistically significant difference between groups at the 5% level.

Age-standardised estimates

Age-standardised estimates allow comparisons between groups that may contain different proportions of people of different ages. To calculate age-standardised estimates, three logistic regression models were fitted for each risk factor, as follows:

- outcome total hypertension, base population all adults
- outcome undiagnosed hypertension, base population all adults
- outcome undiagnosed hypertension, base population adults with hypertension

All models were adjusted for age and fitted separately for males and females. Marginal means were then used to estimate the percentage in each risk factor group (and 95% confidence intervals) with hypertension and undiagnosed hypertension after adjusting for the weighted age distribution of the sample.

Hypertension and undiagnosed hypertension

Blood pressure is measured with two numbers. The first is systolic pressure, which is the force at which the heart pumps blood around the body. The second is diastolic pressure, which is the resistance to blood flow in the blood vessels. They are both measured in millimeters of mercury (mmHg). As a general guide, [as shown on the NHS website](#), blood pressure is considered high if it is 140 over 90 mmHg or above.

In our analysis, individuals were classified as having hypertension if their measured blood pressure showed a systolic value of 140 or higher or a diastolic value of 90 or higher, or they responded “yes” to a survey question about ever having been told by a doctor or nurse that they have high blood pressure or hypertension. Individuals were classified as having undiagnosed hypertension if their measured blood pressure was high, but they answered “no” to ever having been told that they had high blood pressure or hypertension.

Odds ratio

An odds ratio is a measure of the relative likelihood of experiencing the outcome of interest (undiagnosed hypertension) in one group compared with a different group (the “reference” group). When a group has an odds ratio of one, there is neither an increase nor a decrease in the likelihood of experiencing the outcome compared with the reference group. An odds ratio of more than one indicates an increased likelihood of experiencing the outcome compared with the reference group. An odds ratio of less than one indicates a decreased likelihood compared with the reference group.

Population estimates

Population estimates describe the prevalence trends found in the data as estimates of the numbers of people in the population in England that they represent. Population estimates were calculated following the method described in the [Health Survey for England 2019 Methods report](#). This involved applying weighted estimated proportions to the Office for National Statistics (ONS) mid-year population estimate for each age and sex group, adjusted to represent adults living in private households.

7 . Data sources and quality

Health Survey for England

The [Health Survey for England](#) (HSE) is an annual survey of people living in private households in England. All participants complete a health interview, and a proportion of participants are eligible for a nurse visit, during which measurements such as blood pressure are taken. Blood pressure is measured three times, and we used an average of the second and third readings for our analysis. This helps to reduce the impact of environmental, psychological, and physiological factors on the validity of the measurement.

Sampling

The HSE is designed to be representative of the population living in private households in England. It uses multi-stage stratified random probability sampling, first drawing a random sample of primary sampling units (PSU) based on postcode sectors and then a random sample of postal addresses within each PSU. To boost sample size, we combined data from the 2015 to 2019 surveys. We restricted the analytical sample to adults aged 16 years and over who were not pregnant and who had valid blood pressure data, providing a total sample size of 21,476 adults. This analysis was based on data collected before the coronavirus (COVID-19) pandemic and we do not know how the prevalence or patterns of undiagnosed hypertension may have changed since the pandemic.

Weighting

The analysis in this article accounts for the complex survey design and uses weights that make estimates representative of the target population. These adjust for differential probabilities of household selection and are calibrated to ensure the weighted distribution of participants match the Office for National Statistics (ONS) mid-year population estimates for sex and age groups and region. Weights are then additionally adjusted for non-response bias introduced if participants do not allow nurse visits. Full details of the sampling and weighting methods are available [on the resources section of NHS Digital](#).

Definitions and comparability with other sources

In the HSE blood pressure is measured in a nurse-led interview of adult participants. This is not a clinical diagnosis of hypertension, which requires 24-hour ambulatory or at-home blood pressure monitoring, as outlined in the [National Institute for Health and Care Excellence \(NICE\) hypertension guideline](#). Nurse visits typically take place a few days after the initial health interview, meaning that self-reports of diagnosis and blood pressure measurements are not recorded on the same day.

The definitions used in this analysis rely on respondents reporting whether they have ever been told by a doctor or nurse that they had high blood pressure or hypertension, rather than clinical records of diagnosis, and we do not know what proportion of those who self-report a diagnosis have a clinical diagnosis. Official [statistics on hypertension published by NHS Digital](#) use the following definition: adults with self-reported drug treatment for high blood pressure and adults with recorded high blood pressure but no prescribed medication. The definition used in our analysis results in a higher estimate of total hypertension prevalence (32%) compared with this alternative definition (28%). We used self-reported diagnosis of hypertension instead of self-reported medication use because not all individuals who have hypertension are prescribed medication. However, there are strengths and weaknesses with both definitions, and neither will match perfectly with clinical records of hypertension diagnosis.

Sample size

We combined data from the 2015 to 2019 surveys to increase the sample size, however, in some instances low sample counts were still present, for example in the breakdowns by ethnicity. This affects the level of granularity possible in the analysis and increases the width of the confidence intervals around estimates. A limitation of combining data from the 2015 to 2019 surveys is that we cannot be certain that trends in undiagnosed hypertension did not change over that time.

8 . Related links

[Health Survey for England – Health, social care and lifestyles](#)

Web page | Updated 20 February 2023

Overview of the Health Survey for England published by NHS Digital.

[Health Survey for England 2019 – NHS Digital](#)

Survey Findings | Released 15 December 2020

A summary of findings from the 2019 Health Survey for England.

[Hypertension in adults: diagnosis and management](#)

Guidance | Released 28 August 2019

National Institute for Health and Care Excellence (NICE) guidance for healthcare professionals for the identification and treatment of hypertension in adults.

9 . Cite this article

Office for National Statistics (ONS), released 27 April 2023, ONS website, article, [Risk factors for undiagnosed high blood pressure in England: 2015 to 2019](#)