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## Results Saved Results

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### 1. Uncontrolled hypertension increases risk of all-cause and cardiovascular disease mortality in US adults: the NHANES III Linked Mortality Study

**Authors** Zhou D.; Xi B.; Zhao M.; Wang L.; Veeranki S.P.  
**Source** Scientific reports; Jun 2018; vol. 8 (no. 1); p. 9418  
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**Publication Type(s)** Article  
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**Abstract** Clinical trials had provided evidence for the benefit effect of antihypertensive treatments in preventing future cardiovascular disease (CVD) events; however, the association between hypertension, whether treated/untreated or controlled/uncontrolled and risk of mortality in US population has been poorly understood. A total of 13,947 US adults aged  $\geq 18$  years enrolled in the Third National Health and Nutrition Examination Survey (1988-1994) were used to conduct this study. Mortality outcome events included all-cause, CVD-specific, heart disease-specific and cerebrovascular disease-specific deaths, which were obtained from linked 2011 National Death Index (NDI) files. During a median follow-up of 19.1 years, there were 3,550 all-cause deaths, including 1,027 CVD deaths. Compared with normotensives, treated but uncontrolled hypertensive patients were at higher risk of all-cause (HR=1.62, 95%CI=1.35-1.95), CVD-specific (HR=2.23, 95%CI=1.66-2.99), heart disease-specific (HR=2.19, 95%CI=1.57-3.05) and cerebrovascular disease-specific (HR=3.01, 95%CI=1.91-4.73) mortality. Additionally, untreated hypertensive patients had increased risk of all-cause (HR=1.40, 95%CI=1.21-1.62), CVD-specific (HR=1.77, 95%CI=1.34-2.35), heart disease-specific (HR=1.69, 95%CI=1.23-2.32) and cerebrovascular disease-specific death (HR=2.53, 95%CI=1.52-4.23). No significant differences were identified between normotensives, and treated and controlled hypertensives (all  $p > 0.05$ ). Our study findings emphasize the benefit of secondary prevention in hypertensive patients and primary prevention in general population to prevent risk of mortality later in life.

### 2. Untreated hypertension as predictor of in-hospital mortality in intracerebral hemorrhage: A multi-center study

**Authors** Hevesi M.; Jafari M.; Divani A.A.; Bershah E.M.; Mayer S.A.; Selim M.; Suarez J.I.  
**Source** Journal of Critical Care; Feb 2018; vol. 43 ; p. 235-239  
**Publication Date** Feb 2018  
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**PubMedID** 28934706  
**Database** EMBASE  
 Available at [Journal of critical care](#) from ScienceDirect Available to PHE and Local Authority staff  
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**Abstract** Purpose Hypertension is a significant risk factor for intracerebral hemorrhage (ICH). The importance of managing blood pressure to reduce the risk of ICH has been recognized. However, few studies have focused on ICH outcomes due to untreated hypertension. Materials and methods We conducted a 5-year, retrospective, multicenter study of 490 consecutive ICH patients with histories of untreated-hypertension (n = 56), treated-hypertension (n = 314), and normotension (n = 120). Demographics, symptom onset, vital signs, laboratory tests, and CT imaging were documented alongside in-hospital treatments, complications, and length of stay. Results Untreated-hypertension subjects were found to be significantly younger than treated-hypertension. They were found to have lower rates of anticoagulant use ( $p < 0.01$ ), antiplatelet use ( $p < 0.01$ ), and hyperlipidemia ( $p < 0.01$ ) than subjects with treated-hypertension. In a multivariate model, untreated-hypertension, age  $\geq 65$  years,  $\geq 3$  outpatient antihypertensive medications, and hematoma volumes  $\geq 30$  ml were all associated with significantly increased in-hospital mortality. In contrast, mortality was lower in patients receiving  $\geq 3$  antihypertensive medications while in-hospital. Conclusions Subjects with untreated-hypertension were younger and had fewer comorbidities when compared with treated-hypertension and were similar when compared to normotensive individuals. Once demographic and in-hospital factors were accounted for, untreated-hypertension subjects demonstrated significantly increased in-hospital mortality following ICH when compared with normotensive individuals.  
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### 3. Mortality patterns in hypertension.

**Authors** Arima ; Barzi, Federica; Chalmers, John

**Source** Journal of Hypertension; Dec 2011; vol. 29  
**Publication Date** Dec 2011  
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**PubMedID** NLM22157565  
**Database** CINAHL

Available at [Journal of hypertension](#) from Ovid (Journals @ Ovid)

**Abstract** Raised blood pressure (BP) is responsible for 7.6 million deaths per annum worldwide (13.5% of the total), more than any other risk factors. Around 54% of stroke and 47% of coronary heart disease are attributable to high BP. Over 80% of this burden occurs in low and middle income countries (LMIC). BP and cardiovascular mortality are rising rapidly in LMIC. Although age-specific BP and cardiovascular mortality are falling in developed nations, the overall number of cardiovascular death continues to rise in accord with the rapid aging of societies. Because of the continuous relationship between BP and cardiovascular deaths down to 115/75 mmHg, BP-related disease also contributes to cardiovascular death among people below the hypertensive threshold of 140/90 mmHg. Hypertension remains 'the silent killer'. Reductions in the burden of BP-related death require the parallel application of the population strategy at community level and the clinical strategy focusing on new and improved treatments for people with hypertension.

#### 4. Socioeconomic inequalities in blood pressure: co-ordinated analysis of 147,775 participants from repeated birth cohort and cross-sectional datasets, 1989 to 2016.

**Authors** Bann ; Fluharty, Meg; Hardy, Rebecca; Scholes, Shaun  
**Source** BMC Medicine; Nov 2020; vol. 18 (no. 1)  
**Publication Date** Nov 2020  
**Publication Type(s)** Academic Journal  
**PubMedID** NLM33203396  
**Database** CINAHL

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Available at [BMC medicine](#) from Europe PubMed Central - Open Access

Available at [BMC medicine](#) from SpringerLink

Available at [BMC medicine](#) from ProQuest (Health Research Premium) - NHS Version

Available at [BMC medicine](#) from Unpaywall

**Abstract** Background: High blood pressure (BP) is a key modifiable determinant of cardiovascular disease and a likely determinant of other adverse health outcomes. While socioeconomic inequalities in BP are well documented, it remains unclear (1) how these inequalities have changed across time, given improvements over time in the detection and treatment of high BP (hypertension); (2) whether BP inequalities are present below and above hypertension treatment thresholds; and (3) whether socioeconomic position (SEP) across life has cumulative effects on BP. We sought to address these gaps using evidence from two complementary sources: birth cohort and repeated cross-sectional datasets. Methods: We used three British birth cohort studies-born in 1946, 1958, and 1970-with BP measured at 43-46 years (in 1989, 2003, and 2016), and 21 repeated cross-sectional datasets-the Health Survey for England (HSE), with BP measured among adults aged  $\geq 25$  years (1994-2016). Adult education attainment was used as an indicator of SEP in both datasets; childhood father's social class was used as an alternative indicator of (early life) SEP in cohorts. Adjusting for the expected average effects of antihypertensive medication use, we used linear regression to quantify SEP differences in mean systolic BP (SBP), and quantile regression to investigate whether inequalities differed across SBP distributions-below and above hypertension treatment thresholds. Results: In both datasets, lower educational attainment was associated with higher SBP, with similar absolute magnitudes of inequality across the studied period. Differences in SBP by education (Slope Index of Inequality) based on HSE data were 3.0 mmHg (95% CI 1.8, 4.2) in 1994 and 4.3 mmHg (2.3, 6.3) in 2016. Findings were similar for diastolic BP (DBP) and survey-defined hypertension. Inequalities were found across the SBP distribution in both datasets-below and above the hypertension threshold-yet were larger at the upper tail; in HSE, median SBP differences were 2.8 mmHg (1.7, 3.9) yet 5.6 mmHg (4.9, 6.4) at the 90th quantile. Adjustment for antihypertensive medication use had little impact on the magnitude of inequalities; in contrast, associations were largely attenuated after adjustment for body mass index. Finally, cohort data suggested that disadvantage in early and adult life had cumulative independent associations with BP: cohort-pooled differences in SBP were 5.0 mmHg (3.8, 6.1) in a score combining early life social class and own education, yet were 3.4 mmHg (2.4, 4.4) for education alone. Conclusion: Socioeconomic inequalities in BP have persisted from 1989 to 2016 in Britain/England, despite improved detection and treatment of high BP. To achieve future reductions in BP inequalities, policies addressing the wider structural determinants of high BP levels are likely required, particularly those curtailing the obesogenic environment-targeting detection and treatment alone is unlikely to be sufficient.

#### 5. Ethnic differences in blood pressure monitoring and control in south east London.

**Authors** Schofield ; Saka, Omer; Ashworth, Mark  
**Source** British Journal of General Practice; Apr 2011; vol. 61 (no. 585)  
**Publication Date** Apr 2011

**Publication Type(s)** Academic Journal  
**PubMedID** NLM21439177  
**Database** CINAHL  
 Available at [British Journal of General Practice](#) from Europe PubMed Central - Open Access  
 Available at [British Journal of General Practice](#) from HighWire - Free Full Text  
 Available at [British Journal of General Practice](#) from Unpaywall

**Abstract** Background: High blood pressure is the single most important risk factor worldwide for the development of cardiovascular disease, and has been shown to affect some ethnic minority groups disproportionately. Aim: To explore ethnic inequalities in blood pressure monitoring and control. Method: Data from Lambeth DataNet was used, based on case records from GP practices in one inner-city London borough. Blood pressure monitoring and control was compared using Quality and Outcomes Framework (QOF) targets for patients with: diabetes, coronary heart disease, stroke, hypertension, and chronic kidney disease. The study controlled for age, sex, social deprivation, and clustering within GP practices. Results: A total of 16 613 patients met the study criteria, with 5962 categorised as black/black British. Blood pressure monitoring was similar across ethnic groups and as good, if not better, for black patients compared to white. However, marked ethnic inequalities in blood pressure control were found, with black patients significantly less likely to achieve QOF targets than their white counterparts (odds ratio [OR] 0.73; 95% confidence interval [CI] = 0.64 to 0.82). Further inequalities were revealed in blood pressure control within disease groups and ethnic subgroups. In particular, blood pressure control was poor in African patients with diabetes (OR 0.63; 95% CI = 0.50 to 0.79) and Caribbean patients with coronary heart disease (OR 0.53; 95% CI = 0.37 to 0.77) when compared with white patients. Discussion: While black patients with chronic conditions are equally likely to have their blood pressure monitored, their blood pressure control is consistently poorer than that of their white counterparts. This may have important implications for cardiovascular risk management in black patients.

**6. Survival with treated and well-controlled blood pressure: Findings from a prospective cohort study**

**Authors** Lawlor D.A.; Kim L.; Amuzu A.; Ebrahim S.; Morris R.; Whincup P.  
**Source** PLoS ONE; 2011; vol. 6 (no. 4)  
**Publication Date** 2011  
**Publication Type(s)** Article  
**PubMedID** 21533232  
**Database** EMBASE  
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 Available at [PloS one](#) from ProQuest (MEDLINE with Full Text) - NHS Version  
 Available at [PloS one](#) from ProQuest (Health Research Premium) - NHS Version  
 Available at [PloS one](#) from Unpaywall

**Abstract** Aim: To compare survival and incident cardiovascular disease between normotensive, untreated hypertensive, treated and poorly-controlled hypertensive and treated and well-controlled hypertensive adults. Methods and Results: Data from the British Regional Heart Study (men) and British Women's Heart and Health Study (women) were used (N = 6476). Blood pressure and treatment were assessed at baseline (1998-2001) when participants were aged 60-79 years and participants were followed up for a median of 8 years. Date and cause of death were obtained from death certificates and non-fatal cardiovascular disease events were obtained from repeat detailed medical record reviews. Of the whole cohort 52% of women and 49% of men had untreated hypertension and a further 22% and 18%, respectively, had poorly treated hypertension. Just 3% of women and 4% of men had treated and well controlled hypertension and 23% and 29%, respectively, were normotensive. Compared to normotensive individuals, incident cardiovascular disease (fatal and non-fatal) was increased in those with poorly-controlled hypertension (Hazard Ratio (HR): 1.88; 95%CI: 1.53, 2.30), those with untreated hypertension (HR 1.46; 95%CI 1.22, 1.75) and those who were well-controlled hypertension (HR 1.38; 95%CI 0.94, 2.03). Adjustment for baseline differences in mean blood pressure between the groups resulted in attenuation of the increased risk in the poorly-controlled (1.52 (1.18, 1.97) and untreated groups (1.21 (0.97, 1.52), but did not change the association in the well-controlled group. All-cause mortality was also increased in all three hypertension groups but estimates were imprecise with wide confidence intervals. Conclusion(s): Half of women and men aged 60-79 in Britain had untreated hypertension and only a very small proportion of those with diagnosed and treated hypertension were well controlled. Those with hypertension, irrespective of whether this was treated and controlled or not, were at greater risk of future cardiovascular disease than those who are normotensive. © 2011 Lawlor et al.

**7. The burden of hypertension and associated risk for cardiovascular mortality in the UK biobank**

**Authors** Hammami I.; Lacey B.; Lewington S.  
**Source** European Heart Journal; Aug 2018; vol. 39 ; p. 636  
**Publication Date** Aug 2018  
**Publication Type(s)** Conference Abstract  
**Database** EMBASE

**Abstract**

Available at [European Heart Journal](#) from HighWire - Free Full Text  
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 Available at [European Heart Journal](#) from Unpaywall

Background/Introduction: In the UK, high blood pressure is a leading cause of cardiovascular disease (CVD). However, limited evidence is available on the prevalence and management of hypertension and its effect on mortality from CVD in the UK.

Purpose(s): To examine the prevalence, diagnosis, treatment, and control of hypertension and to assess the CVD mortality attributable to hypertension in the UK.

Method(s): Design, setting and participants: The UK Biobank is a prospective study of 0.5M participants aged 40-70 recruited from the general population in 2006-2010 with linkage to electronic records for hospital admissions and deaths. Self-reported diagnoses and electronic health records prior to recruitment were used to identify participants with previously diagnosed hypertension (systolic BP  $\geq$  140mmHg, diastolic BP  $\geq$  90mmHg, or receiving treatment for hypertension) and CVD. Blood pressure (BP) measurements were recorded as part of the baseline survey. 2 401 deaths due to CVD were recorded before March 31, 2015 (mean 7 years of follow-up). Exposures: Prevalence and diagnosis of hypertension and treatment and control rates, overall and in various population subgroups. Main outcome and measures: Cox regression analysis yielded age- and sex-specific rate ratios for deaths due to CVD comparing participants with and without hypertension, which were used to estimate the number of CVD deaths attributable to hypertension.

Result(s): The cohort included 228 606 men (46%) and 272 682 women (54%) with a mean (SD) age of 57 (8) years for both sexes. Overall, 52% of participants had hypertension; the prevalence increased with age (31% in those aged  $<$  50 to 72% in those aged  $\geq$  65 years). Of those with hypertension, 28% had received a diagnosis from a physician; of those with a diagnosis of hypertension, 69% were being treated; and of those treated, 35% had their hypertension controlled (i.e., systolic BP  $<$  140mmHg; diastolic BP  $<$  90mmHg), resulting in an overall control rate of 13%. Even among patients with hypertension and prior CVD, only 33% had their hypertension controlled. Uncontrolled hypertension was associated with CVD death rate ratios of 2.8 (95% CI, 2.3-3.3) and 1.6 (1.4- 1.8) in those aged  $<$  60, and  $\geq$  60 years, respectively, and accounted for about one-third of deaths due to CVD in the UK Biobank cohort.

Conclusion(s): About half of UK Biobank participants had hypertension. The levels of diagnosis, treatment, and control were much lower than in Canada or the US, and were associated with significant excess mortality.

**8. Hypertension awareness, treatment and control among ethnic minority populations in Europe: A systematic review and meta-analysis**

**Authors** Van Der Linden E.L.; Van Den Born B.-J.H.; Agyemang C.; Couwenhoven B.N.; Beune E.J.A.J.; Daams J.G.  
**Source** Journal of Hypertension; Feb 2021; vol. 39 (no. 2); p. 202-213  
**Publication Date** Feb 2021  
**Publication Type(s)** Review  
**PubMedID** 32925300  
**Database** EMBASE

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 Available at [Journal of hypertension](#) from Unpaywall

**Abstract**

Objective: Ethnic minority populations (EMPs) are disproportionately affected by hypertension-mediated complications compared with European host populations (EHPs), which might be due to disparities in hypertension awareness, treatment and control. We conducted a systematic review and meta-analysis to compare awareness, treatment and control rates among EMPs with EHPs.

Method(s): MEDLINE, EMBASE and Web of Science were searched from inception to 29 January 2020. Critical appraisal was performed according to methods of Hoy et al. Pooled odds ratios with corresponding 95% confidence intervals were calculated for these rates, stratified by ethnic group, using either random or fixed effect meta-analysis based on I<sup>2</sup>-statistics. Study was registered in PROSPRO (CRD42020107897).

Result(s): A total of 3532 records were screened of which 16 were included in the analysis with data on 26 800 EMP and 57 000 EHP individuals. Compared with EHPs, African origin populations were more likely to be aware (odds ratio 1.26, 95% confidence interval 1.02-1.56) and treated (1.49, 1.18-1.88) for hypertension, but were less likely to have their blood pressure controlled (0.56, 0.40- 0.78), whereas South Asian populations were more likely to be aware (1.15, 1.02-1.30), but had similar treatment and control rates. In Moroccan populations, hypertension awareness (0.79, 0.62-1.00) and treatment levels (0.77, 0.60-0.97) were lower compared with EHPs, while in Turkish populations awareness was lower (0.81, 0.65- 1.00).

Conclusion(s): Levels of hypertension awareness, treatment and control differ between EMPs and EHPs. Effort should be made to improve these suboptimal rates in EMPs, aiming to reduce ethnic inequalities in hypertension-mediated complications.

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**9. Exploring socioeconomic inequalities in coronary heart disease prevention**

**Authors** Ahmed R.; O'Flaherty M.; Hawkins N.; Lucy J.; Capewell S.  
**Source** Circulation; Mar 2014; vol. 129

**Publication Date** Mar 2014  
**Publication Type(s)** Conference Abstract  
**Database** EMBASE  
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**Abstract**  
 Background: Between 2000 and 2007, coronary heart disease (CHD) mortality rates in England plummeted by one third. An important part of this substantial CHD mortality decline was achieved through reductions in major cardiovascular risk factors (primary prevention). However, the relative contributions from medications and from population-wide changes remains unclear, particularly the effects on health inequalities.  
 Method(s): Using a previously validated policy model, the fall in CHD mortality in England was analysed. The contributions from risk factor declines in asymptomatic individuals through medications and through population-wide changes were quantified. Data were stratified using the Index of Multiple Deprivation (IMD). Model outputs were quantified as deaths prevented or postponed (DPPs).  
 Result(s): Between 2000 and 2007, approximately 21,900 fewer CHD deaths were attributable to risk factor declines in systolic blood pressure and cholesterol in the English population. Some 7,100 of these 21,900 fewer deaths (DPPs) were attributed to medications (32%) and approximately 14,800 DPPs were attributed to secular changes in asymptomatic individuals (68%). Substantial declines in systolic blood pressure were responsible for approximately 14,300 fewer deaths. This comprised approximately 12,500 DPPs attributable to population-wide changes and some 1,800 DPPs attributable to hypertension medications. The hypertension medications resulted in approximately 350 fewer deaths in the most affluent quintile compared with 270 DPP in the most deprived. In contrast, the population-wide (secular) falls in blood pressure resulted in approximately 2400 fewer deaths in the most deprived quintile compared with only 1900 DPPs in the most affluent. Cholesterol falls resulted in approximately 7,700 fewer deaths. This comprised some 5,300 fewer deaths attributable to statin medications and approximately 2,400 fewer deaths attributable to population-wide changes (mostly diet). Statin medications prevented more deaths in the most affluent quintile (1050 DPPs) compared with the most deprived (770 DPPs). Population-wide changes in cholesterol prevented substantially more deaths in the most deprived quintile (820 DPPs) compared with the most affluent (260 DPPs).  
 Conclusion(s): Population-based declines in blood pressure and cholesterol resulted in much greater reductions in CHD deaths than did primary prevention medications. Mortality falls were greatest in the most deprived quintiles, mainly reflecting their bigger initial burden of disease. Future CHD prevention policies should prioritise healthier diets ahead of medications.

**10. Analysing recent socioeconomic trends in coronary heart disease mortality in England, 2000-2007: a population modelling study**

**Authors** Bajekal M.; Scholes S.; Love H.; Hawkins N.; O'Flaherty M.; Raine R.; Capewell S.  
**Source** PLoS medicine; 2012; vol. 9 (no. 6)  
**Publication Date** 2012  
**Publication Type(s)** Article  
**PubMedID** 22719232  
**Database** EMBASE  
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 Available at [PLoS medicine](#) from ProQuest (Health Research Premium) - NHS Version  
 Available at [PLoS medicine](#) from Unpaywall

**Abstract** Coronary heart disease (CHD) mortality in England fell by approximately 6% every year between 2000 and 2007. However, rates fell differentially between social groups with inequalities actually widening. We sought to describe the extent to which this reduction in CHD mortality was attributable to changes in either levels of risk factors or treatment uptake, both across and within socioeconomic groups. A widely used and replicated epidemiological model was used to synthesise estimates stratified by age, gender, and area deprivation quintiles for the English population aged 25 and older between 2000 and 2007. Mortality rates fell, with approximately 38,000 fewer CHD deaths in 2007. The model explained about 86% (95% uncertainty interval: 65%-107%) of this mortality fall. Decreases in major cardiovascular risk factors contributed approximately 34% (21%-47%) to the overall decline in CHD mortality: ranging from about 44% (31%-61%) in the most deprived to 29% (16%-42%) in the most affluent quintile. The biggest contribution came from a substantial fall in systolic blood pressure in the population not on hypertension medication (29%; 18%-40%); more so in deprived (37%) than in affluent (25%) areas. Other risk factor contributions were relatively modest across all social groups: total cholesterol (6%), smoking (3%), and physical activity (2%). Furthermore, these benefits were partly negated by mortality increases attributable to rises in body mass index and diabetes (-9%; -17% to -3%), particularly in more deprived quintiles. Treatments accounted for approximately 52% (40%-70%) of the mortality decline, equitably distributed across all social groups. Lipid reduction (14%), chronic angina treatment (13%), and secondary prevention (11%) made the largest medical contributions. The model suggests that approximately half the recent CHD mortality fall in England was attributable to improved treatment uptake. This benefit occurred evenly across all social groups. However, opposing trends in major risk factors meant that their net contribution amounted to just over a third of the CHD deaths averted; these also varied substantially by socioeconomic group. Powerful and equitable evidence-based population-wide policy interventions exist; these should now be urgently implemented to effectively tackle persistent inequalities.

**11. Income-based inequalities in hypertension and in undiagnosed hypertension: analysis of Health Survey for England data.**

**Authors** Scholes, Shaun; Conolly, Anne; Mindell, Jennifer S  
**Source** Journal of hypertension; May 2020; vol. 38 (no. 5); p. 912-924  
**Publication Date** May 2020  
**Publication Type(s)** Research Support, Non-u.s. Gov't Journal Article  
**PubMedID** 31913219  
**Database** Medline  
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**Abstract** OBJECTIVE To quantify income-based inequalities in hypertension and in undiagnosed hypertension. METHODS We used nationally representative data from 28 002 adults (aged 16 years and older) living in private households who participated in the cross-sectional Health Survey for England 2011-2016. Using bivariate probit regression modelling, we jointly modelled hypertension and self-reported previous diagnosis of hypertension by a doctor or nurse. We then used the model estimates to quantify inequalities in undiagnosed hypertension. Inequalities, using household income tertiles as an indicator of socioeconomic status, were quantified using average marginal effects (AMEs) after adjustment for confounding variables. RESULTS Overall, 32% of men and 27% of women had survey-defined hypertension (measured blood pressure  $\geq 140/90$  mmHg and/or currently using medicine to treat high blood pressure). Higher proportions (38% of men and 32% of women) either self-reported previous diagnosis or had survey-defined hypertension. Of these, 65% of men and 70% of women had diagnosed hypertension. Among all adults, participants in low-income versus high-income households had a higher probability of being hypertensive [AMEs: men 2.1%; 95% confidence interval (CI): -0.2, 4.4%; women 3.7%; 95% CI: 1.8, 5.5%] and of being diagnosed as hypertensive (AMEs: men 2.0%; 95% CI: 0.4, 3.7%; women 2.5%; 95% CI: 1.1, 3.9%). Among those classed as hypertensive, men in low-income households had a marginally lower probability of being undiagnosed than men in high-income households (AME: -5.2%; 95% CI: -10.5, 0.1%), whereas no difference was found among women. CONCLUSION Our findings suggest that income-based inequalities in hypertension coexist with equity in undiagnosed hypertension.

**12. Racial inequities in hypertension diagnosis: Non-whites more likely to have undiagnosed hypertension**

**Authors** Gleason K.; Henry K.; Abshire M.; Himmelfarb C.D.  
**Source** Circulation; 2019; vol. 140  
**Publication Date** 2019  
**Publication Type(s)** Conference Abstract  
**Database** EMBASE  
 Available at [Circulation](#) from HighWire - Free Full Text  
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**Abstract** Introduction: Despite established guidelines for diagnosis and treatment, almost 20 million adults with hypertension (HTN) in the US remain undiagnosed and untreated. Racial disparities exist in HTN care and outcomes, highlighting the need to ensure timely HTN diagnosis. Hypothesis: We hypothesized that 1) documentation of blood pressures (BPs) meeting the criteria for HTN diagnosis would have poor agreement with presence of HTN diagnosis in the electronic medical record (EMR), and 2) Non-whites would be more likely to have documentation of BPs meeting criteria for HTN diagnosis but no documented HTN diagnosis. Method(s): We extracted EMR documented BPs from 2014-2017 and HTN diagnosis (ICD 10 code 110) from a cohort of 81,348 individuals across 4 academic medical centers in the PaTH Clinical Data Research Network. BPs (met criteria for HTN diagnosis according to JNC-7 guidelines (SBP>140 or DBP>90 at two or more outpatient visits). Level of agreement was determined through Cohen's Kappa coefficients. We then conducted multivariate logistic regression to determine if race was associated with undiagnosed HTN in presence of BPs indicating HTN. Result(s): Of the 81348 individuals, 87% (n=70773) were white, and of the 13% non-white individuals the majority (n=6204) were black. One third had disagreement in BP meeting criteria for diagnosis of HTN, and HTN diagnosis (Kappa 0.27). Agreement was 67% among whites, and 63% among non-whites. Multivariate logistic regression demonstrated that non-whites were more likely to have undiagnosed HTN (OR 1.18, 95% CI: 1.01, 1.38), and this remained after adjusting for sex and age. Conclusion(s): Despite EMR documentation of BPs meeting the criteria for HTN, diagnosis of HTN was low. Moreover, the rate of diagnosis was significantly lower among non-whites. Prompt diagnosis of HTN is essential to initiating treatment to control BP and reduce risk for cardiovascular disease and stroke. Effective strategies, including EMR-based system-level interventions, are needed to improve the timeliness of HTN diagnosis, particularly among non-whites, to reduce disparities in HTN care and outcomes.

### 13. Underdiagnosis of hypertension in adults

**Authors** Anyanwu E.C.; Kaelber D.  
**Source** Journal of General Internal Medicine; Apr 2014; vol. 29  
**Publication Date** Apr 2014  
**Publication Type(s)** Conference Abstract  
**Database** EMBASE  
**Abstract** BACKGROUND: Nearly a third of adults in the US are known to be hypertensive. Even after diagnosis, many go on to develop sequelae of hypertension in multiple organ systems. We posit there exists a sizable population of adults that meet the criteria of diagnosis for hypertension that remain undiagnosed despite already having presented with qualifying blood pressure measurements. For these adults complications of hypertension are likely to occur if they continue to go undiagnosed. Furthermore we suspect that there are sociodemographic characteristics that predispose one to go undiagnosed. The objective of this study is to determine the rate of underdiagnosis of hypertension in adults as well as the patient characteristics associated with the underdiagnosis of adult hypertension. METHOD(S): We examined all blood pressures in our electronic health record (EpicCare, Epic Corporation, Verona, WI) from patients 18 years and older seen at least two times for a primary care or specialty care outpatient visit between 2010 and 2012 at large academic urban medical system in northeast Ohio. Patients were considered hypertensive, as per the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, if the average of at least two blood pressures on two separate visits was greater than 130 mmHg systolic or greater than 90 mmHg. Patients were considered to be undiagnosed if they did not have an ICD-9 code associated with hypertension (401.xx-essential hypertension, 402.9-elevated blood pressure reading without diagnosis of hypertension and 997.91-hypertension) in their EHR problem list, past medical history, or encounter diagnoses list during the study period. Patient age, gender, self-reported ethnicity, insurance type, height, weight were also obtained. RESULT(S): 48,712 patients met inclusion criteria for blood pressures consistent with hypertension. Of these only 32,328 (66.3 %) had a diagnosis of hypertension. Logistical regression demonstrated that patients with commercial insurance (OR 1.71 CI 1.65-1.79), of majority ethnicity (Caucasian) (OR 1.88 CI 1.81-1.96), and non-English-speaking (OR 1.13 CI 1.07-1.19) were all more likely to have undiagnosed hypertension, based on blood pressures recorded in their EHR. In contrast, the prevalence of undiagnosed hypertension decreased per 1-y increase over age 18 (OR 0.95 CI 0.95-0.95), with each elevated blood pressure reading (OR 0.79 CI 0.78-0.79), and with each visit during the two year study period (OR 0.96 CI 0.96-0.96). Gender, height, and weight were not associated with an increase or decrease in hypertension diagnosis. CONCLUSION(S): Up to a third of adults with hypertension, based on data in EHRs, have not had their hypertension diagnosed. Disparities in the underdiagnosis of hypertension exist based on age, insurance, and ethnicity. This study highlights demographics for whom physicians might provide better diagnosis and treatment.

### 14. First-line drugs for hypertension.

**Authors** Wright, James M; Musini, Vijaya M; Gill, Rupam  
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**Abstract**  
BACKGROUND This is the first update of a review published in 2009. Sustained moderate to severe elevations in resting blood pressure leads to a critically important clinical question: What class of drug to use first-line? This review attempted to answer that question. OBJECTIVES To quantify the mortality and morbidity effects from different first-line antihypertensive drug classes: thiazides (low-dose and high-dose), beta-blockers, calcium channel blockers, ACE inhibitors, angiotensin II receptor blockers (ARB), and alpha-blockers, compared to placebo or no treatment. Secondary objectives: when different antihypertensive drug classes are used as the first-line drug, to quantify the blood pressure lowering effect and the rate of withdrawal due to adverse drug effects, compared to placebo or no treatment. SEARCH METHODS The Cochrane Hypertension Information Specialist searched the following databases for randomized controlled trials up to November 2017: the Cochrane Hypertension Specialised Register, the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE (from 1946), Embase (from 1974), the World Health Organization International Clinical Trials Registry Platform, and ClinicalTrials.gov. We contacted authors of relevant papers regarding further published and unpublished work. SELECTION CRITERIA Randomized trials (RCT) of at least one year duration, comparing one of six major drug classes with a placebo or no treatment, in adult patients with blood pressure over 140/90 mmHg at baseline. The majority (over 70%) of the patients in the treatment group were taking the drug class of interest after one year. We included trials with both hypertensive and normotensive patients in this review if the majority (over 70%) of patients had elevated blood pressure, or the trial separately reported outcome data on patients with elevated blood pressure. DATA COLLECTION AND ANALYSIS The outcomes assessed were mortality, stroke, coronary heart disease (CHD), total cardiovascular events (CVS), decrease in systolic and diastolic blood pressure, and withdrawals due to adverse drug effects. We used a fixed-effect model to to combine dichotomous outcomes across trials and calculate risk ratio (RR) with 95% confidence interval (CI). We presented blood pressure data as mean difference (MD) with 99% CI. MAIN RESULTS The 2017 updated search failed to identify any new trials. The original review identified 24 trials with 28 active treatment arms, including 58,040 patients. We found no RCTs for ARBs or alpha-blockers. These results are mostly applicable to adult patients with moderate to severe primary hypertension. The mean age of participants was 56 years, and mean duration of follow-up was three to five years. High-quality evidence showed that first-line low-dose thiazides reduced mortality (11.0% with control versus 9.8% with treatment; RR 0.89, 95% CI 0.82 to 0.97); total CVS (12.9% with control versus 9.0% with treatment; RR 0.70, 95% CI 0.64 to 0.76), stroke (6.2% with control versus 4.2% with treatment; RR 0.68, 95% CI 0.60 to 0.77), and coronary heart disease (3.9% with control versus 2.8% with treatment; RR 0.72, 95% CI 0.61 to 0.84). Low- to moderate-quality evidence showed that first-line high-dose thiazides reduced stroke (1.9% with control versus 0.9% with treatment; RR 0.47, 95% CI 0.37 to 0.61) and total CVS (5.1% with control versus 3.7% with treatment; RR 0.72, 95% CI 0.63 to 0.82), but did not reduce mortality (3.1% with control versus 2.8% with treatment; RR 0.90, 95% CI 0.76 to 1.05), or coronary heart disease (2.7% with control versus 2.7% with treatment; RR 1.01, 95% CI 0.85 to 1.20). Low- to moderate-quality evidence showed that first-line beta-blockers did not reduce mortality (6.2% with control versus 6.0% with treatment; RR 0.96, 95% CI 0.86 to 1.07) or coronary heart disease (4.4% with control versus 3.9% with treatment; RR 0.90, 95% CI 0.78 to 1.03), but reduced stroke (3.4% with control versus 2.8% with treatment; RR 0.83, 95% CI 0.72 to 0.97) and total CVS (7.6% with control versus 6.8% with treatment; RR 0.89, 95% CI 0.81 to 0.98). Low- to moderate-quality evidence showed that first-line ACE inhibitors reduced mortality (13.6% with control versus 11.3% with treatment; RR 0.83, 95% CI 0.72 to 0.95), stroke (6.0% with control versus 3.9% with treatment; RR 0.65, 95% CI 0.52 to 0.82), coronary heart disease (13.5% with control versus 11.0% with treatment; RR 0.81, 95% CI 0.70 to 0.94), and total CVS (20.1% with control versus 15.3% with treatment; RR 0.76, 95% CI 0.67 to 0.85). Low-quality evidence showed that first-line calcium channel blockers reduced stroke (3.4% with control versus 1.9% with treatment; RR 0.58, 95% CI 0.41 to 0.84) and total CVS (8.0% with control versus 5.7% with treatment; RR 0.71, 95% CI 0.57 to 0.87), but not coronary heart disease (3.1% with control versus 2.4% with treatment; RR 0.77, 95% CI 0.55 to 1.09), or mortality (6.0% with control versus 5.1% with treatment; RR 0.86, 95% CI 0.68 to 1.09). There was low-quality evidence that withdrawals due to adverse effects were increased with first-line low-dose thiazides (5.0% with control versus 11.3% with treatment; RR 2.38, 95% CI 2.06 to 2.75), high-dose thiazides (2.2% with control versus 9.8% with treatment; RR 4.48, 95% CI 3.83 to 5.24), and beta-blockers (3.1% with control versus 14.4% with treatment; RR 4.59, 95% CI 4.11 to 5.13). No data for these outcomes were available for first-line ACE inhibitors or calcium channel blockers. The blood pressure data were not used to assess the effect of the different classes of drugs as the data were heterogeneous, and the number of drugs used in the trials differed. AUTHORS' CONCLUSIONS First-line low-dose thiazides reduced all morbidity and mortality outcomes in adult patients with moderate to severe primary hypertension. First-line ACE inhibitors and calcium channel blockers may be similarly effective, but the evidence was of lower quality. First-line high-dose thiazides and first-line beta-blockers were inferior to first-line low-dose thiazides.

**15. Invited Commentary: Fundamental Causes, Social Context, and Modifiable Risk Factors in the Racial/Ethnic Inequalities in Blood Pressure and Hypertension.**

**Authors** Hicken, Margaret T  
**Source** American journal of epidemiology; Aug 2015; vol. 182 (no. 4); p. 354-357  
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Available at [American journal of epidemiology](#) from Oxford Journals A - Z Available to PHE and Local Authority staff  
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**Abstract** Racial and ethnic inequalities in blood pressure and hypertension have been well documented, but their causes remain unclear, making efforts to reduce these inequalities challenging. In this issue of the Journal, Basu et al. (Am J Epidemiol. 2015;182(4):345-353) address this gap in our knowledge by using an econometric approach to examine the role of 4 conventional risk factors for hypertension. Their results suggest that targeting certain risk factors will reduce racial inequalities in the prevalence of hypertension. However, racial differences in modifiable risk factors are enmeshed within disparate socioenvironmental contexts which are in turn determined by inequalities in the distribution of social, economic, and political resources and constraints. A small but growing body of literature suggests that targeting the intermediate risk factors that link racial group membership to hypertension, rather than the context or the inequalities in the distribution of resources and constraints, will ultimately result in little change in hypertension inequalities, increase these inequalities, or even create inequalities in poor mental health.

**16. Wealth and cardiovascular health: a cross-sectional study of wealth-related inequalities in the awareness, treatment and control of hypertension in high-, middle- and low-income countries.**

**Authors** Palafox, Benjamin; McKee, Martin; Balabanova, Dina; AlHabib, Khalid F; Avezum, Alvaro Jr; Bahonar, Ahmad; Ismail, Noorhassim; Chifamba, Jephath; Chow, Clara K; Corsi, Daniel J; Dagenais, Gilles R; Diaz, Rafael; Gupta, Rajeev; Iqbal, Romaina; Kaur, Manmeet; Khatib, Rasha; Kruger, Annamarie; Kruger, Iolante Marike; Lanas, Fernando; Lopez-Jaramillo, Patricio; Minfan, Fu; Mohan, Viswanathan; Mony, Prem K; Oguz, Aytekin; Palileo-Villanueva, Lia M; Perel, Pablo; Poirier, Paul; Rangarajan, Sumathy; Rensheng, Lei; Rosengren, Annika; Soman, Biju; Stuckler, David; Subramanian, S V; Teo, Koon; Tsolekile, Lungiswa P; Wielgosz, Andreas; Yaguang, Peng; Yeates, Karen; Yongzhen, Mo; Yusoff, Khalid; Yusuf, Rita; Yusufali, Afzalhussein; Zatońska, Katarzyna; Yusuf, Salim  
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**Abstract**

**BACKGROUND** Effective policies to control hypertension require an understanding of its distribution in the population and the barriers people face along the pathway from detection through to treatment and control. One key factor is household wealth, which may enable or limit a household's ability to access health care services and adequately control such a chronic condition. This study aims to describe the scale and patterns of wealth-related inequalities in the awareness, treatment and control of hypertension in 21 countries using baseline data from the Prospective Urban and Rural Epidemiology study. **METHODS** A cross-section of 163,397 adults aged 35 to 70 years were recruited from 661 urban and rural communities in selected low-, middle- and high-income countries (complete data for this analysis from 151,619 participants). Using blood pressure measurements, self-reported health and household data, concentration indices adjusted for age, sex and urban-rural location, we estimate the magnitude of wealth-related inequalities in the levels of hypertension awareness, treatment, and control in each of the 21 country samples. **RESULTS** Overall, the magnitude of wealth-related inequalities in hypertension awareness, treatment, and control was observed to be higher in poorer than in richer countries. In poorer countries, levels of hypertension awareness and treatment tended to be higher among wealthier households; while a similar pro-rich distribution was observed for hypertension control in countries at all levels of economic development. In some countries, hypertension awareness was greater among the poor (Sweden, Argentina, Poland), as was treatment (Sweden, Poland) and control (Sweden). **CONCLUSION** Inequality in hypertension management outcomes decreased as countries became richer, but the considerable variation in patterns of wealth-related inequality - even among countries at similar levels of economic development - underscores the importance of health systems in improving hypertension management for all. These findings show that some, but not all, countries, including those with limited resources, have been able to achieve more equitable management of hypertension; and strategies must be tailored to national contexts to achieve optimal impact at population level.

**Strategy** 1107978

#	Database	Search term	Results
1	EMBASE	exp HYPERTENSION/	802460
2	EMBASE	(untreated OR undiagnosed).ti,ab	283180
3	EMBASE	(undiagnosed OR untreated).ti,ab	283180
4	EMBASE	(1 AND 3)	15912
5	EMBASE	exp MORTALITY/	1203305
6	EMBASE	(4 AND 5)	1269
7	EMBASE	6 [DT 2015-2021]	529
8	Medline	exp HYPERTENSION/	335181
9	Medline	(untreated OR undiagnosed).ti,ab	203209
10	Medline	(8 AND 9)	7281
11	Medline	exp MORTALITY/	410679
12	Medline	(10 AND 11)	128
13	Medline	12 [DT 2015-2021]	36
14	AMED, BNI, CINAHL, EMBASE, EMCARE, HMIC, Medline, PsycINFO, PubMed	("mortality pattern*" AND hypertension).ti,ab	127
15	EMBASE	((hypertension AND mortality) AND inequalities).ti,ab	91
16	EMBASE	((("untreated hypertension" OR "undiagnosed hypertension") AND mortality) AND (inequalities OR disparit*)).ti,ab	8
22	EMBASE	((("untreated hypertension" OR "undiagnosed hypertension") AND treatment) AND (inequalities OR disparit*)).ti,ab	16
20	Medline	((("untreated hypertension" OR "undiagnosed hypertension") AND treatment) AND (inequalities OR disparit*)).ti,ab	10
21	Medline	((("untreated hypertension" OR "undiagnosed hypertension") AND mortality) AND (inequalities OR disparit*)).ti,ab	3