

Hypertension in adults: diagnosis and management

Clinical guideline

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Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The application of the recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

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This guideline replaces CG34 and CG18.

This guideline is the basis of QS28.

Introduction

This guidance updates and replaces NICE clinical guideline 34 (published in 2006). NICE clinical guideline 34 updated and replaced NICE clinical guideline 18 (published in 2004).

High blood pressure (hypertension) is one of the most important preventable causes of premature morbidity and mortality in the UK. Hypertension is a major risk factor for ischaemic and haemorrhagic stroke, myocardial infarction, heart failure, chronic kidney disease, cognitive decline and premature death. Untreated hypertension is usually associated with a progressive rise in blood pressure. The vascular and renal damage that this may cause can culminate in a treatment-resistant state.

Blood pressure is normally distributed in the population and there is no natural cut-off point above which 'hypertension' definitively exists and below which it does not. The risk associated with increasing blood pressure is continuous, with each 2 mmHg rise in systolic blood pressure associated with a 7% increased risk of mortality from ischaemic heart disease and a 10% increased risk of mortality from stroke. Hypertension is remarkably common in the UK and the prevalence is strongly influenced by age. In any individual person, systolic and/or diastolic blood pressures may be elevated. Diastolic pressure is more commonly elevated in people younger than 50. With ageing, systolic hypertension becomes a more significant problem, as a result of progressive stiffening and loss of compliance of larger arteries. At least one quarter of adults (and more than half of those older than 60) have high blood pressure.

The clinical management of hypertension is one of the most common interventions in primary care, accounting for approximately £1 billion in drug costs alone in 2006.

The guideline will assume that prescribers will use a drug's summary of product characteristics to inform decisions made with individual patients.

This guideline recommends drugs for indications for which they do not have a UK marketing authorisation at the date of publication, if there is good evidence to support that use. Where

recommendations have been made for the use of drugs outside their licensed indications ('off-label use'), these drugs are marked with a footnote in the recommendations.

Person-centred care

This guideline offers best practice advice on the care of adults with hypertension.

Treatment and care should take into account people's needs and preferences. People with hypertension should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If people do not have the capacity to make decisions, healthcare professionals should follow the [Department of Health's advice on consent](#) and the [code of practice that accompanies the Mental Capacity Act](#). In Wales, healthcare professionals should follow [advice on consent from the Welsh Government](#).

Good communication between healthcare professionals and people with hypertension is essential. It should be supported by evidence-based written information tailored to the person's needs. Treatment and care, and the information people are given about it, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

If the person agrees, families and carers should have the opportunity to be involved in decisions about treatment and care.

Families and carers should also be given the information and support they need.

Key priorities for implementation

The following recommendations have been identified as priorities for implementation.

Diagnosing hypertension

- If the clinic blood pressure is 140/90 mmHg or higher, offer ambulatory blood pressure monitoring (ABPM) to confirm the diagnosis of hypertension. [2011]
- When using ABPM to confirm a diagnosis of hypertension, ensure that at least two measurements per hour are taken during the person's usual waking hours (for example, between 08:00 and 22:00).

Use the average value of at least 14 measurements taken during the person's usual waking hours to confirm a diagnosis of hypertension. [2011]

- When using home blood pressure monitoring (HBPM) to confirm a diagnosis of hypertension, ensure that:
 - for each blood pressure recording, two consecutive measurements are taken, at least 1 minute apart and with the person seated and
 - blood pressure is recorded twice daily, ideally in the morning and evening and
 - blood pressure recording continues for at least 4 days, ideally for 7 days.

Discard the measurements taken on the first day and use the average value of all the remaining measurements to confirm a diagnosis of hypertension. [2011]

Initiating and monitoring antihypertensive drug treatment, including blood pressure targets

Initiating treatment

- Offer antihypertensive drug treatment to people aged under 80 years with stage 1 hypertension who have one or more of the following:
 - target organ damage
 - established cardiovascular disease

- renal disease
 - diabetes
 - a 10-year cardiovascular risk equivalent to 20% or greater. [2011]
- Offer antihypertensive drug treatment to people of any age with stage 2 hypertension. [2011]
- For people aged under 40 years with stage 1 hypertension and no evidence of target organ damage, cardiovascular disease, renal disease or diabetes, consider seeking specialist evaluation of secondary causes of hypertension and a more detailed assessment of potential target organ damage. This is because 10-year cardiovascular risk assessments can underestimate the lifetime risk of cardiovascular events in these people. [2011]

Monitoring treatment and blood pressure targets

- For people identified as having a 'white-coat effect'^[1], consider ABPM or HBPM as an adjunct to clinic blood pressure measurements to monitor the response to antihypertensive treatment with lifestyle modification or drugs. [2011]

Choosing antihypertensive drug treatment

- Offer people aged 80 years and over the same antihypertensive drug treatment as people aged 55–80 years, taking into account any comorbidities. [2011]

Step 1 treatment

- Offer step 1 antihypertensive treatment with a calcium-channel blocker (CCB) to people aged over 55 years and to black people of African or Caribbean family origin of any age. If a CCB is not suitable, for example because of oedema or intolerance, or if there is evidence of heart failure or a high risk of heart failure, offer a thiazide-like diuretic. [2011]
- If diuretic treatment is to be initiated or changed, offer a thiazide-like diuretic, such as chlortalidone (12.5–25.0 mg once daily) or indapamide (1.5 mg modified-release or 2.5 mg once daily) in preference to a conventional thiazide diuretic such as bendroflumethiazide or hydrochlorothiazide. [2011]
- For people who are already having treatment with bendroflumethiazide or hydrochlorothiazide and whose blood pressure is stable and well controlled, continue treatment with the bendroflumethiazide or hydrochlorothiazide. [2011]

Step 4 treatment

- For treatment of resistant hypertension at step 4:
 - Consider further diuretic therapy with low-dose spironolactone (25 mg once daily)^[2] if the blood potassium level is 4.5 mmol/l or lower. Use particular caution in people with a reduced estimated glomerular filtration rate because they have an increased risk of hyperkalaemia.
 - Consider higher-dose thiazide-like diuretic treatment if the blood potassium level is higher than 4.5 mmol/l. [2011]

^[1] A discrepancy of more than 20/10 mmHg between clinic and average daytime ABPM or average HBPM blood pressure measurements at the time of diagnosis.

^[2] At the time of publication (August 2011), spironolactone did not have UK marketing authorisation for this indication. Informed consent should be obtained and documented.

1 Guidance

The following guidance is based on the best available evidence. The [full guideline](#) gives details of the methods and the evidence used to develop the guidance.

Definitions

In this guideline the following definitions are used.

- **Stage 1 hypertension** Clinic blood pressure is 140/90 mmHg or higher and subsequent ambulatory blood pressure monitoring (ABPM) daytime average or home blood pressure monitoring (HBPM) average blood pressure is 135/85 mmHg or higher.
- **Stage 2 hypertension** Clinic blood pressure is 160/100 mmHg or higher and subsequent ABPM daytime average or HBPM average blood pressure is 150/95 mmHg or higher.
- **Severe hypertension** Clinic systolic blood pressure is 180 mmHg or higher or clinic diastolic blood pressure is 110 mmHg or higher.

1.1 *Measuring blood pressure*

- 1.1.1 Healthcare professionals taking blood pressure measurements need adequate initial training and periodic review of their performance. [2004]
- 1.1.2 Because automated devices may not measure blood pressure accurately if there is pulse irregularity (for example, due to atrial fibrillation), palpate the radial or brachial pulse before measuring blood pressure. If pulse irregularity is present, measure blood pressure manually using direct auscultation over the brachial artery. [2011]
- 1.1.3 Healthcare providers must ensure that devices for measuring blood pressure are properly validated, maintained and regularly recalibrated according to manufacturers' instructions. [2004]
- 1.1.4 When measuring blood pressure in the clinic or in the home, standardise the environment and provide a relaxed, temperate setting, with the person quiet and seated, and their arm outstretched and supported. [2011]
- 1.1.5 If using an automated blood pressure monitoring device, ensure that the device is validated^[3] and an appropriate cuff size for the person's arm is used. [2011]

1.1.6 In people with symptoms of postural hypotension (falls or postural dizziness):

- measure blood pressure with the person either supine or seated
- measure blood pressure again with the person standing for at least 1 minute prior to measurement. [2004, amended 2011]

1.1.7 If the systolic blood pressure falls by 20 mmHg or more when the person is standing:

- review medication
- measure subsequent blood pressures with the person standing
- consider referral to specialist care if symptoms of postural hypotension persist. [2004, amended 2011]

1.2 *Diagnosing hypertension*

1.2.1 When considering a diagnosis of hypertension, measure blood pressure in both arms.

- If the difference in readings between arms is more than 20 mmHg, repeat the measurements.
- If the difference in readings between arms remains more than 20 mmHg on the second measurement, measure subsequent blood pressures in the arm with the higher reading. [2011]

1.2.2 If blood pressure measured in the clinic is 140/90 mmHg or higher:

- Take a second measurement during the consultation.
- If the second measurement is substantially different from the first, take a third measurement.

Record the lower of the last two measurements as the clinic blood pressure. [2011]

1.2.3 If the clinic blood pressure is 140/90 mmHg or higher, offer ambulatory blood pressure monitoring (ABPM) to confirm the diagnosis of hypertension. [2011]

- 1.2.4 If a person is unable to tolerate ABPM, home blood pressure monitoring (HBPM) is a suitable alternative to confirm the diagnosis of hypertension. [2011]
- 1.2.5 If the person has severe hypertension, consider starting antihypertensive drug treatment immediately, without waiting for the results of ABPM or HBPM. [2011]
- 1.2.6 While waiting for confirmation of a diagnosis of hypertension, carry out investigations for target organ damage (such as left ventricular hypertrophy, chronic kidney disease and hypertensive retinopathy) (see recommendation 1.3.3) and a formal assessment of cardiovascular risk using a cardiovascular risk assessment tool (see recommendation 1.3.2). [2011]
- 1.2.7 If hypertension is not diagnosed but there is evidence of target organ damage such as left ventricular hypertrophy, albuminuria or proteinuria, consider carrying out investigations for alternative causes of the target organ damage. [2011]
- 1.2.8 If hypertension is not diagnosed, measure the person's clinic blood pressure at least every 5 years subsequently, and consider measuring it more frequently if the person's clinic blood pressure is close to 140/90 mmHg. [2011]
- 1.2.9 When using ABPM to confirm a diagnosis of hypertension, ensure that at least two measurements per hour are taken during the person's usual waking hours (for example, between 08:00 and 22:00). Use the average value of at least 14 measurements taken during the person's usual waking hours to confirm a diagnosis of hypertension. [2011]
- 1.2.10 When using HBPM to confirm a diagnosis of hypertension, ensure that:
- for each blood pressure recording, two consecutive measurements are taken, at least 1 minute apart and with the person seated and
 - blood pressure is recorded twice daily, ideally in the morning and evening and
 - blood pressure recording continues for at least 4 days, ideally for 7 days.

Discard the measurements taken on the first day and use the average value of all the remaining measurements to confirm a diagnosis of hypertension. [2011]

1.2.11 Refer the person to specialist care the same day if they have:

- accelerated hypertension, that is, blood pressure usually higher than 180/110 mmHg with signs of papilloedema and/or retinal haemorrhage or
- suspected pheochromocytoma (labile or postural hypotension, headache, palpitations, pallor and diaphoresis). [2004, amended 2011]

1.2.12 Consider the need for specialist investigations in people with signs and symptoms suggesting a secondary cause of hypertension. [2004, amended 2011]

1.3 *Assessing cardiovascular risk and target organ damage*

For NICE guidance on the early identification and management of chronic kidney disease see '[Chronic kidney disease](#)' (NICE clinical guideline 73, 2008).

1.3.1 Use a formal estimation of cardiovascular risk to discuss prognosis and healthcare options with people with hypertension, both for raised blood pressure and other modifiable risk factors. [2004]

1.3.2 Estimate cardiovascular risk in line with the recommendations on [Identification and assessment of CVD risk](#) in 'Lipid modification' (NICE clinical guideline 67)^[4]. [2008]

1.3.3 For all people with hypertension offer to:

- test for the presence of protein in the urine by sending a urine sample for estimation of the albumin:creatinine ratio and test for haematuria using a reagent strip
- take a blood sample to measure plasma glucose, electrolytes, creatinine, estimated glomerular filtration rate, serum total cholesterol and HDL cholesterol
- examine the fundi for the presence of hypertensive retinopathy
- arrange for a 12-lead electrocardiograph to be performed. [2004, amended 2011]

1.4 *Lifestyle interventions*

For NICE guidance on the prevention of obesity and cardiovascular disease see '[Obesity](#)' (NICE clinical guideline 43, 2006) and '[Prevention of cardiovascular disease at population level](#)' (NICE public health guidance 25, 2010).

- 1.4.1 Lifestyle advice should be offered initially and then periodically to people undergoing assessment or treatment for hypertension. [2004]
- 1.4.2 Ascertain people's diet and exercise patterns because a healthy diet and regular exercise can reduce blood pressure. Offer appropriate guidance and written or audiovisual materials to promote lifestyle changes. [2004]
- 1.4.3 Relaxation therapies can reduce blood pressure and people may wish to pursue these as part of their treatment. However, routine provision by primary care teams is not currently recommended. [2004]
- 1.4.4 Ascertain people's alcohol consumption and encourage a reduced intake if they drink excessively, because this can reduce blood pressure and has broader health benefits. [2004]
- 1.4.5 Discourage excessive consumption of coffee and other caffeine-rich products. [2004]
- 1.4.6 Encourage people to keep their dietary sodium intake low, either by reducing or substituting sodium salt, as this can reduce blood pressure. [2004]
- 1.4.7 Do not offer calcium, magnesium or potassium supplements as a method for reducing blood pressure. [2004]
- 1.4.8 Offer advice and help to smokers to stop smoking. [2004]
- 1.4.9 A common aspect of studies for motivating lifestyle change is the use of group working. Inform people about local initiatives by, for example, healthcare teams or patient organisations that provide support and promote healthy lifestyle change. [2004]

1.5 *Initiating and monitoring antihypertensive drug treatment, including blood pressure targets*

Initiating treatment

- 1.5.1 Offer antihypertensive drug treatment to people aged under 80 years with stage 1 hypertension who have one or more of the following:
- target organ damage
 - established cardiovascular disease
 - renal disease
 - diabetes
 - a 10-year cardiovascular risk equivalent to 20% or greater. [2011]
- 1.5.2 Offer antihypertensive drug treatment to people of any age with stage 2 hypertension. [2011]
- 1.5.3 For people aged under 40 years with stage 1 hypertension and no evidence of target organ damage, cardiovascular disease, renal disease or diabetes, consider seeking specialist evaluation of secondary causes of hypertension and a more detailed assessment of potential target organ damage. This is because 10-year cardiovascular risk assessments can underestimate the lifetime risk of cardiovascular events in these people. [2011]

Monitoring treatment and blood pressure targets

- 1.5.4 Use clinic blood pressure measurements to monitor the response to antihypertensive treatment with lifestyle modifications or drugs. [2011]
- 1.5.5 Aim for a target clinic blood pressure below 140/90 mmHg in people aged under 80 years with treated hypertension. [2011]
- 1.5.6 Aim for a target clinic blood pressure below 150/90 mmHg in people aged 80 years and over, with treated hypertension. [2011]

- 1.5.7 For people identified as having a 'white-coat effect'^[5], consider ABPM or HBPM as an adjunct to clinic blood pressure measurements to monitor the response to antihypertensive treatment with lifestyle modification or drugs. [2011]
- 1.5.8 When using ABPM or HBPM to monitor response to treatment (for example, in people identified as having a 'white coat effect'^[5] and people who choose to monitor their blood pressure at home), aim for a target average blood pressure during the person's usual waking hours of:
- below 135/85 mmHg for people aged under 80 years
 - below 145/85 mmHg for people aged 80 years and over. [2011]

1.6 *Choosing antihypertensive drug treatment*

- 1.6.1 Where possible, recommend treatment with drugs taken only once a day. [2004]
- 1.6.2 Prescribe non-proprietary drugs where these are appropriate and minimise cost. [2004]
- 1.6.3 Offer people with isolated systolic hypertension (systolic blood pressure 160 mmHg or more) the same treatment as people with both raised systolic and diastolic blood pressure. [2004]
- 1.6.4 Offer people aged 80 years and over the same antihypertensive drug treatment as people aged 55–80 years, taking into account any comorbidities. [2011]
- 1.6.5 Offer antihypertensive drug treatment to women of child-bearing potential in line with the recommendations on [Management of pregnancy with chronic hypertension](#) and [Breastfeeding](#) in 'Hypertension in pregnancy' (NICE clinical guideline 107). [2010]

Step 1 treatment

- 1.6.6 Offer people aged under 55 years step 1 antihypertensive treatment with an angiotensin-converting enzyme (ACE) inhibitor or a low-cost angiotensin-II receptor blocker (ARB). If an ACE inhibitor is prescribed and is not tolerated (for example, because of cough), offer a low-cost ARB.^[6] [2011]

- 1.6.7 Do not combine an ACE inhibitor with an ARB to treat hypertension.^[6] [2011]
- 1.6.8 Offer step 1 antihypertensive treatment with a calcium-channel blocker (CCB) to people aged over 55 years and to black people of African or Caribbean family origin of any age. If a CCB is not suitable, for example because of oedema or intolerance, or if there is evidence of heart failure or a high risk of heart failure, offer a thiazide-like diuretic. [2011]
- 1.6.9 If diuretic treatment is to be initiated or changed, offer a thiazide-like diuretic, such as chlortalidone (12.5–25.0 mg once daily) or indapamide (1.5 mg modified-release once daily or 2.5 mg once daily) in preference to a conventional thiazide diuretic such as bendroflumethiazide or hydrochlorothiazide. [2011]
- 1.6.10 For people who are already having treatment with bendroflumethiazide or hydrochlorothiazide and whose blood pressure is stable and well controlled, continue treatment with the bendroflumethiazide or hydrochlorothiazide. [2011]
- 1.6.11 Beta-blockers are not a preferred initial therapy for hypertension. However, beta-blockers may be considered in younger people, particularly:
- those with an intolerance or contraindication to ACE inhibitors and angiotensin II receptor antagonists or
 - women of child-bearing potential or
 - people with evidence of increased sympathetic drive. [2006]
- 1.6.12 If therapy is initiated with a beta-blocker and a second drug is required, add a calcium-channel blocker rather than a thiazide-like diuretic to reduce the person's risk of developing diabetes. [2006]

Step 2 treatment

- 1.6.13 If blood pressure is not controlled by step 1 treatment, offer step 2 treatment with a CCB in combination with either an ACE inhibitor or an ARB.^[6][7] [2011]

- 1.6.14 If a CCB is not suitable for step 2 treatment, for example because of oedema or intolerance, or if there is evidence of heart failure or a high risk of heart failure, offer a thiazide-like diuretic. [2011]
- 1.6.15 For black people of African or Caribbean family origin, consider an ARB in preference to an ACE inhibitor, in combination with a CCB.^[6] [2011]

Step 3 treatment

- 1.6.16 Before considering step 3 treatment, review medication to ensure step 2 treatment is at optimal or best tolerated doses. [2011]
- 1.6.17 If treatment with three drugs is required, the combination of ACE inhibitor or angiotensin II receptor blocker, calcium-channel blocker and thiazide-like diuretic should be used. [2006]

Step 4 treatment

- 1.6.18 Regard clinic blood pressure that remains higher than 140/90 mmHg after treatment with the optimal or best tolerated doses of an ACE inhibitor or an ARB plus a CCB plus a diuretic as resistant hypertension, and consider adding a fourth antihypertensive drug and/or seeking expert advice.^[6] [2011]
- 1.6.19 For treatment of resistant hypertension at step 4:
- Consider further diuretic therapy with low-dose spironolactone (25 mg once daily)^[8] if the blood potassium level is 4.5 mmol/l or lower. Use particular caution in people with a reduced estimated glomerular filtration rate because they have an increased risk of hyperkalaemia.
 - Consider higher-dose thiazide-like diuretic treatment if the blood potassium level is higher than 4.5 mmol/l. [2011]
- 1.6.20 When using further diuretic therapy for resistant hypertension at step 4, monitor blood sodium and potassium and renal function within 1 month and repeat as required thereafter. [2011]
- 1.6.21 If further diuretic therapy for resistant hypertension at step 4 is not tolerated, or is contraindicated or ineffective, consider an alpha- or beta-blocker. [2011]

- 1.6.22 If blood pressure remains uncontrolled with the optimal or maximum tolerated doses of four drugs, seek expert advice if it has not yet been obtained. [2011]

1.7 *Patient education and adherence to treatment*

- 1.7.1 Provide appropriate guidance and materials about the benefits of drugs and the unwanted side effects sometimes experienced in order to help people make informed choices. [2004]
- 1.7.2 People vary in their attitudes to their hypertension and their experience of treatment. It may be helpful to provide details of patient organisations that provide useful forums to share views and information. [2004]
- 1.7.3 Provide an annual review of care to monitor blood pressure, provide people with support and discuss their lifestyle, symptoms and medication. [2004]
- 1.7.4 Because evidence supporting interventions to increase adherence is inconclusive, only use interventions to overcome practical problems associated with non-adherence if a specific need is identified. Target the intervention to the need. Interventions might include:

- suggesting that patients record their medicine-taking
- encouraging patients to monitor their condition
- simplifying the dosing regimen
- using alternative packaging for the medicine
- using a multi-compartment medicines system.

(This recommendation is taken from [Medicines adherence](#) [NICE clinical guideline 76].) [2009]

^[3] A list of validated blood pressure monitoring devices is available on the [British Hypertension Society's](#) website. The British Hypertension Society is an independent reviewer of published work. This does not imply any endorsement by NICE.

^[4] Clinic blood pressure measurements must be used in the calculation of cardiovascular risk.

^[5] A discrepancy of more than 20/10 mmHg between clinic and average daytime ABPM or average HBPM blood pressure measurements at the time of diagnosis.

^[6] In 2007 the MHRA issued a drug safety update on [ACE inhibitors and angiotensin II receptor antagonists: not for use in pregnancy](#) that states 'Use in women who are planning pregnancy should be avoided unless absolutely necessary, in which case the potential risks and benefits should be discussed'. There is also a 2009 MHRA safety update for [ACE inhibitors and angiotensin II receptor antagonists: use during breast feeding and related clarification: ACE inhibitors and angiotensin II receptor antagonists](#).

^[7] Choose a low-cost ARB.

^[8] At the time of publication (August 2011), spironolactone did not have UK marketing authorisation for this indication. Informed consent should be obtained and documented.

2 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future.

2.1 *Out-of-office monitoring*

In adults with primary hypertension, does the use of out-of-office monitoring (HBPM or ABPM) improve response to treatment?

Why this is important

There is likely to be increasing use of HBPM and for the diagnosis of hypertension as a consequence of this guideline update. There are, however, very few data regarding the utility of HBPM or ABPM as means of monitoring blood pressure control or as indicators of clinical outcome in treated hypertension, compared with clinic blood pressure monitoring. Studies should incorporate HBPM and/or ABPM to monitor blood pressure responses to treatment and their usefulness as indicators of clinical outcomes.

2.2 *Intervention thresholds for people aged under 40 with hypertension*

In people aged under 40 years with hypertension, what are the appropriate thresholds for intervention?

Why this is important

There is uncertainty about how to assess the impact of blood pressure treatment in people aged under 40 years with stage 1 hypertension and no overt target organ damage or cardiovascular disease (CVD). In particular, it is not known whether those with untreated hypertension are more likely to develop target organ damage and, if so, whether such damage is reversible. Target organ damage and CVD as surrogate or intermediate disease markers are the only indicators that are likely to be feasible in younger people because traditional clinical outcomes are unlikely to occur in sufficient numbers over the timescale of a typical clinical trial. The data will be important to inform treatment decisions for younger people with stage 1 hypertension who do not have overt target organ damage.

2.3 *Methods of assessing lifetime cardiovascular risk in people aged under 40 years with hypertension*

In people aged under 40 years with hypertension, what is the most accurate method of assessing the lifetime risk of cardiovascular events and the impact of therapeutic intervention on this risk?

Why this is important

Current short-term (10-year) risk estimates are likely to substantially underestimate the lifetime cardiovascular risk of younger people (aged under 40 years) with hypertension, because short-term risk assessment is powerfully influenced by age. Nevertheless, the lifetime risk associated with untreated stage 1 hypertension in this age group could be substantial. Lifetime risk assessments may be a better way to inform treatment decisions and evaluate the cost effectiveness of earlier intervention with pharmacological therapy.

2.4 *Optimal systolic blood pressure*

In people with treated hypertension, what is the optimal systolic blood pressure?

Why this is important

Data on optimal blood pressure treatment targets, particularly for systolic blood pressure, are inadequate. Current guidance is largely based on the blood pressure targets adopted in clinical trials but there have been no large trials that have randomised people with hypertension to different systolic blood pressure targets and that have had sufficient power to examine clinical outcomes.

2.5 *Step 4 antihypertensive treatment*

In adults with hypertension, which drug treatment (diuretic therapy versus other step 4 treatments) is the most clinically and cost effective for step 4 antihypertensive treatment?

Why this is important

Although this guideline provides recommendations on the use of further diuretic therapy for treatment at step 4 (resistant hypertension), they are largely based on post-hoc observational data from clinical trials. More data are needed to compare further diuretic therapies, for example a potassium-sparing diuretic with a higher-dose thiazide-like diuretic, and to compare diuretic

therapy with alternative treatment options at step 4 to define whether further diuretic therapy is the best option.

2.6 *Automated blood pressure monitoring in people with atrial fibrillation*

Which automated blood pressure monitors are suitable for people with hypertension and atrial fibrillation?

Why this is important

Atrial fibrillation may prevent accurate blood pressure measurement with automated devices. It would be valuable to know if this can be overcome.

More information

You can also see this guideline in the NICE pathway on [hypertension](#).

To find out what NICE has said on topics related to this guideline, see our web page on [cardiovascular conditions](#).

See also the guideline committee's discussion and the evidence reviews (in the [full guideline](#)), and information about [how the guideline was developed](#), including details of the committee.

Update information

November 2016: A footnote about 2 MHRA drug safety alerts was added to recommendations in section 1.6 covering angiotensin-converting enzyme (ACE) inhibitors. These alerts cover ACE inhibitor use during pregnancy and breastfeeding.

This guideline updates and replaces NICE clinical guideline 34 (published June 2006). NICE clinical guideline 34 updated and replaced NICE clinical guideline 18 (published in 2004).

Recommendations are marked as [2004], [2004, amended 2011], [2006], [2008], [2009], [2010] or [2011].

- [2004] indicates that the evidence has not been updated and reviewed since 2004
- [2004, amended 2011] indicates that the evidence has not been updated and reviewed since 2004 but a small amendment has been made to the recommendation
- [2006] indicates that the evidence has not been updated and reviewed since 2006
- [2008] applies to recommendations from 'Lipid modification' (NICE clinical guideline 67), published in 2008
- [2009] applies to recommendations from 'Medicines adherence' (NICE clinical guideline 76), published in 2009
- [2010] applies to recommendations from 'Hypertension in pregnancy' (NICE clinical guideline 107), published in 2010
- [2011] indicates that the evidence has been reviewed and the recommendation has been updated or added.

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Accreditation

