

# What causes high blood pressure in young people: the heart or blood vessels?

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## Plain English summary of protocol

### Background and study aims

Around a third of the adult population suffers from high blood pressure (medically known as “hypertension”). If left untreated, hypertension is a major risk factor for having a heart attack or a stroke. More and more children are being diagnosed with high blood pressure with no obvious cause. This is partly because doctors are checking for it more, but also because it is a common problem that develops alongside being overweight. Not much is known about what causes hypertension in children. This research aims to address this gap by looking in detail at a group of hypertensive children and young adults and comparing them to a group with normal blood pressure. The study will use state-of-the-art blood pressure measurements and heart scans to measure the flow of blood in the heart and blood vessels of participants. The study will also manipulate some of the messages getting from the brain to control the heart and blood vessels and measure the effect of these.

### Who can participate?

Children and young adults with primary hypertension aged 10 to 35 years old and under the care of specialist teams at St Thomas’ Hospital and Evelina London Children’s Hospital. Children and young adults who are healthy with normal weight and normal blood pressure aged 10 to 35 years old.

### What does the study involve?

The study involves having two different types of heart scan: an echocardiogram and an MRI scan, plus some detailed blood pressure measurements including whilst doing a slow breathing exercise for about 15 minutes. The team will also collect blood and urine samples (optional for healthy participants).

### What are the possible benefits and risks of participating?

There are no direct benefits to you from taking part. You will be contributing to research that will improve understanding of high blood pressure which may benefit people of all ages with high blood pressure in the future.

There are no serious risks we anticipate in this study. The main drawbacks of taking part are the extra time and inconvenience for you to visit the hospital for the research study and the discomfort you may experience in the MRI scanner and having a blood test.

Where is the study run from?  
St Thomas' Hospital (UK)

When is the study starting and how long is it expected to run for?  
March 2022 to September 2026

Who is funding the study?  
The Medical Research Council (MRC) (UK)

Who is the main contact?  
Dr Emily Haseler, emily.haseler@kcl.ac.uk (UK)

## Contact information

### Type(s)

Principal investigator

### Contact name

Dr Manish Sinha

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**Additional identifiers**

**Clinical Trials Information System (CTIS)**

Nil known

**Integrated Research Application System (IRAS)**

306122

**ClinicalTrials.gov (NCT)**

Nil known

**Protocol serial number**

CPMS 55164, IRAS 306122

**Study information**

**Scientific Title**

Haemodynamic determinants of hypertension in Children and Young People and role of the sympathetic nervous system: HY CYP

**Acronym**

HY CYP

**Study objectives**

Primary hypertension in children results predominantly from cardiac overactivity (increased heart rate, cardiac output and aortic ejection velocity) and a secondary increase in proximal aortic stiffening rather than an increase in systemic vascular resistance. Cardiac overactivity activity in primary hypertension results from increased sympathetic nervous system activity, mediated through  $\beta$ -adrenergic receptors acting to increase heart rate, stroke volume, cardiac output and aortic ejection velocity.

### **Ethics approval required**

Ethics approval required

### **Ethics approval(s)**

approved 27/06/2023, South Birmingham Research Ethics Committee (2 Redman Place, Stratford, London, E20 1JQ , United Kingdom; None available; Southbirmingham.rec@hra.nhs.uk), ref: 23/WM/0122

### **Study design**

Observational cohort study (study 1) with an interventional substudy (study 2)

### **Primary study design**

Observational

### **Study type(s)**

Treatment

### **Health condition(s) or problem(s) studied**

Paediatrics and cardiology

### **Interventions**

#### **PARTICIPANTS**

Children and young adults with primary hypertension aged 10-35 years will be approached by a member of their direct clinical care team. We aim to recruit 50 patients, 50% under 18 years and 50% 18-35 years, with 50% female. Participants should not be on medication (i.e., are managing their hypertension with lifestyle modification measures). If they are on medication, they need to be able to stop their medication for a 2-week washout period before the study and stay off their medication until the collection of all data (up to 2 months), in the opinion of their lead clinician. For Study 2, we will seek to recruit 20 hypertensive patients from the original Study 1 cohort, at the point at which they will be commencing antihypertensive medication for clinical reasons.

50 control participants aged 10-35 years will be recruited from existing databases of healthy controls. These participants have previously participated in clinical studies with our group and have consented to be contacted about further studies in the future. We aim to recruit 50 patients, 50% under 18 years and 50% 18-35 years, with 50% female. They will need to be of normal blood pressure and healthy weight, i.e., not overweight, or obese.

#### **STUDY 1 (all 100 participants)**

Data to be collected is as follows, with no specific order necessary:

1. Height, weight, BMI, and measures of adiposity. Pubertal status for those who have not yet completed puberty.
2. Standardised depression and anxiety questionnaire
3. Blood test: kidney function, measures of sympathetic nervous system activity, measures of heart function, metabolic markers

4. Urine test: sodium (salt) levels, measures of sympathetic nervous system activity
5. Cardiac MRI: 40-minute MRI scan of the heart with blood pressure measured before and after the scan
6. Blood pressure, heart rate variability and arterial applanation tonometry measurements: these are non-invasive and require inflation of a blood pressure cuff, placement of electrode (ECG) stickers on the chest and/or limbs and placing a probe over the pulse points in the neck, groin and wrist respectively.
7. Echocardiogram: a 30-minute ultrasound scan of the heart. This is clinically indicated for all hypertensive participants however some more detailed images will be captured for research, lengthening the scan by 10 minutes.
8. Device-guided breathing: participants will be asked to listen to an audio track which helps them slow their breathing. This has the effect of inhibiting the sympathetic nervous system and lowering blood pressure. Limited echocardiogram and haemodynamic measurements as listed in (6) will be performed. This is likely to take 10-20 minutes depending on how long each participant takes to achieve a steady state with their breathing.

We anticipate that all investigations in Study 1 may be completed in two visits, at least one of which could be on the same day as a clinical visit.

STUDY 2 (a subgroup of 20 hypertensive participants):

1. Administration of antihypertensive agent 1 (bisoprolol): participants will take this medication for 10-14 days at a clinically effective dose. A limited echocardiogram and haemodynamic measurements as listed above in (6) will be performed. This visit will take 15-30 minutes.
2. Administration of antihypertensive agent 2 (amlodipine): participants will take this medication for 10-14 days at a clinically effective dose. Echocardiogram and haemodynamic measurements as listed above in (6) will be performed. This visit will take 15-30 minutes. The order in which participants receive antihypertensive agents 1 and 2 will be randomised.

### **Intervention Type**

Mixed

### **Primary outcome(s)**

1. Cardiac output measured MRI at baseline in hypertensive participants compared to healthy controls
2. Aortic ejection velocity measured using MRI at baseline in hypertensive participants compared to controls

### **Key secondary outcome(s)**

1. Cardiac output measured using an echocardiogram before and after i) slow breathing exercise, ii) amlodipine administration and iii) bisoprolol administration
2. Aortic ejection velocity measured using echocardiogram before and after i) slow breathing exercise, ii) amlodipine administration and iii) bisoprolol administration
3. Pulse wave velocity measured using applanation tonometry before and after i) slow breathing exercise, ii) amlodipine administration and iii) bisoprolol administration
4. Systemic vascular resistance, heart rate, stroke volume and pulse wave velocity measured using MRI at baseline in hypertensive participants compared to controls

### **Completion date**

30/09/2026

## **Eligibility**

**Key inclusion criteria**

1. Aged 10-35 years old
2. Primary hypertension (intervention group) or BP < 90th centile (control group)
3. Able to tolerate the planned investigations
4. Not currently on anti-hypertensive medication/s or able to stop anti-hypertensive medications for 2 weeks prior to any research-related assessments.

Additional inclusion criteria control participants:

5. BMI in the "normal" range for age

**Participant type(s)**

Patient

**Healthy volunteers allowed**

No

**Age group**

Mixed

**Lower age limit**

10 years

**Upper age limit**

35 years

**Sex**

All

**Key exclusion criteria**

1. Secondary hypertension
2. Clinical urgency to commence anti-hypertensive or unable to stop anti-antihypertensives for 2 week washout period
3. Unable to obtain adequate quality of planned cardiovascular investigations
4. Congenital heart disease
5. Cardiac dysrhythmias
6. Pregnancy or lactating mothers

Additional exclusion criteria for medication 1 (bisoprolol challenge):

7. Asthma currently treated with medication
8. Cardiac conduction abnormalities
9. Known intolerance to bisoprolol

Additional exclusion criteria for medication 2 (amlodipine challenge):

10. History of angina or myocardial infarction
11. Known intolerance to amlodipine

**Date of first enrolment**

01/09/2023

**Date of final enrolment**

31/08/2026

## Locations

### Countries of recruitment

United Kingdom

England

### Study participating centre

#### St Thomas' Hospital

Westminster Bridge Road

London

United Kingdom

SE1 7EH

## Sponsor information

### Organisation

King's College London

### ROR

<https://ror.org/0220mzb33>

## Funder(s)

### Funder type

Government

### Funder Name

Medical Research Council

### Alternative Name(s)

Medical Research Council (United Kingdom), UK Medical Research Council, Medical Research Committee and Advisory Council, MRC

### Funding Body Type

Government organisation

### Funding Body Subtype

National government

**Location**

United Kingdom

## **Results and Publications**

**Individual participant data (IPD) sharing plan**

The datasets generated during and/or analysed during the current study are/will be available upon request from Dr Manish Sinha, manish.sinha@gstt.nhs.uk. These datasets include haemodynamic baseline data from echocardiograms and cardiac MRI, available from approximately September 2027, patients will be consented for sharing of anonymised data.

**IPD sharing plan summary**

Available on request