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Under stress: Why women of black African-Caribbean heritage are at elevated risk of stroke

Submission date 03/03/2025	**Recruitment status** Recruiting	[ ] Prospectively registered [ ] Protocol
Registration date 06/03/2025	**Overall study status** Ongoing	[ ] Statistical analysis plan [ ] Results
Last Edited 01/04/2025	**Condition category** Circulatory System	[ ] Individual participant data [ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Black African and Caribbean women are three times more likely to experience stroke and are more likely to have a stroke at a young age. What causes this is unknown, but stress appears to play an important role. High levels of daily stress may increase the risk of stroke in Black African Caribbean women. This is because Black women often have bigger spikes in blood pressure during stress. These large and frequent blood pressure spikes may cause damage to the brain over time. Therefore, we want to understand how the brain responds to these spikes in blood pressure and explore whether the blood vessels in the brain are less able to protect against these blood pressure spikes in Black African Caribbean women.

Who can participate?
Women of Black African and Black Caribbean heritage and women of White European heritage, between 18 and 75 years old.

What does the study involve?
Taking part involves two visits: one visit to the Clinical Research Facility in Bristol, which will take about 3 hours and one visit to the Cardiff University Brain Imaging Research Centre in Cardiff, which will take around 2 hours.

Visit 1: Screening tests to ensure eligibility. Completion of questionnaires assessing social determinants of health and health behaviours including physical activity levels, diet, sleep quality, experience of discrimination, and stress levels.
Non-invasive assessment of blood pressure and leg blood flow responses to a math task. Venous blood sample to determine stress hormone levels at rest and during a math task.

Visit 2: Non-invasive assessment of large artery stiffness.
Participants will then undergo a brain MRI. Scans will be taken at rest, during a mental math task and during occlusion of the forearm with a blood pressure cuff pumped to a high pressure (i.e., metaboreflex test).

What are the possible benefits and risks of participating?
This study is testing the impact of stress on blood pressure and brain function. Taking part will

help us understand why high levels of stress increase the risk of stroke in Black women. This can also help identify preventative treatments. You will get a full blood pressure screen, which may be of some benefit to you from a health check-up perspective. You will also get information on your cholesterol levels and diabetes risk
This study involves minimal risks
Venous blood sample and cannulation: mild discomfort during venepuncture/cannulation and mild swelling or bruising at the site.
Monitoring heart rate, blood pressure and breathing: mild discomfort from the inflation of the blood pressure cuff around the finger.
Mental math test: the task may cause some stress, however, this will stop when the task stops.
Metaboreflex test: mild arm discomfort with the blood pressure cuff being inflated to stop blood from leaving your arm.
Brain MRI: MRI is a safe, non-invasive and painless procedure. However, some people find being inside the scanner claustrophobic. Some people may experience discomfort from lying down in the scanner for 1 hour.

Where is the study run from?
University of Bristol (UK)

When is the study starting and how long is it expected to run for?
April 2024 to January 2028

Who is funding the study?
British Heart Foundation (UK)

Who is the main contact?
Dr Lydia Simpson, Lydia.simpson@bristol.ac.uk

Contact information

Type(s)
Public, Scientific, Principal investigator

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Additional identifiers

Integrated Research Application System (IRAS)
347113

Central Portfolio Management System (CPMS)
64223

Protocol serial number
Sponsor Ref: 2024 - 4520

Study information

Scientific Title
Under stress: Why women of black African-Caribbean heritage are at elevated risk of stroke

Study objectives
Primary hypothesis 1: There will be a difference in the increase in large and small vessel pulsatility during mental stress in normotensive Black African-Caribbean women versus normotensive White European women.

Primary hypothesis 2: There will be a difference in the increase in large and small vessel pulsatility during mental stress in hypertensive Black African-Caribbean women versus hypertensive White European women

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 05/02/2025, North East - Newcastle & North Tyneside 2 Research Ethics Committee (2 Redman Place, Stratford, London, E20 1JQ, United Kingdom; +44 (0)207 104 8086; newcastlenorthtyneside2.rec@hra.nhs.uk), ref: 24/NE/0209

Primary study design
Observational

Study design
Observational cross-sectional study

Study type(s)
Other

Health condition(s) or problem(s) studied
Hypertension

Interventions
This study will be a cross-sectional study of four groups: normotensive Black African and Black Caribbean women, normotensive White European women, hypertensive Black African and Black Caribbean women and hypertensive White European women.

Two study visits:
Visit 1: Consent and screening visit and determination of hemodynamic and sympathetic responses to mental stress.
Visit 1 will be undertaken at the NIHR Clinical Research Facility, Bristol. First, consent will be obtained, and participants' eligibility will be determined. Following screening, several

questionnaires will be completed to assess social determinants of health and health behaviours. Venous blood samples will be taken at rest to measure catecholamines and cortisol. BP, heart rate, respiratory activity and vascular ultrasound will be measured at rest and during a mental arithmetic task, used to induce mental stress. A second blood sample will be taken during the mental arithmetic task to determine changes in catecholamines and cortisol, from rest.

Study visit 2: MRI visit and determination of cerebrovascular responses to mental stress.
Visit 2 will be undertaken at Cardiff University Brain Research Imaging Centre (CUBRIC). Participants will be familiarised using a mock MRI scanner. Resting pulse wave velocity will be assessed. BP, peripheral oxygen saturation, respiratory activity, and end-tidal partial pressure of CO2 and O2 will be measured, and MRI imaging will be completed at rest and during 1) mental arithmetic task and 2) during metaboreflex testing.

Intervention Type
Other

Primary outcome(s)
Cerebral pulsatility index measured from MRI at rest and during Paced Auditory Serial Addition Task (PASAT)

Key secondary outcome(s)
1. White matter hyperintensities measured using MRI at rest
2. Blood-brain barrier integrity measured using MRI at rest
3. Grey matter perfusion measured using MRI at rest
4. Cardiovascular hemodynamics measured continuously during a 10-minute resting period and during the PASAT:
4.1. Heart rate measured continuously via ECG
4.2. Beat-to-beat blood pressure measured via finger photoplethysmography
4.3. Continuous femoral blood flow measured via Doppler ultrasound
5. Stress hormones (cortisol and catecholamines) during mental stress measured from venous blood samples taken at rest and during the PASAT
6. Systemic arterial stiffness measured using carotid-femoral pulse wave velocity at rest
7. Cerebral arterial stiffness measured from MRI at rest

Completion date
01/01/2028

Eligibility

Key inclusion criteria
All participants:
1. Female
2. 18-75 years of age
3. Non-obese (BMI <35 kg/m2)

Normotensive participants:
1. Office BP < 140/90 mmHg and daytime ambulatory BP <135/85 mmHg
2. No medications except oral contraceptives

Hypertensive participants:
1. Office BP > 140/90 mmHg and daytime ambulatory BP > 135/85 mmHg or diagnosis of

hypertension
2. No medications except treatment for hypertension and/or oral contraceptives

Participant type(s)
Healthy volunteer, Patient

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 Years

Upper age limit
75 Years

Sex
Female

Key exclusion criteria
All participants:
1. Body mass index ≥35 kg/m2
2. Major illness e.g. cancer, inflammatory disease (including vasculitis) or receiving palliative care
3. Medical history of respiratory, cardiovascular (excluding hypertension), cerebrovascular, metabolic, renal or endocrine disorders (i.e. severe cardiac electrical conduction abnormalities, chronic heart failure, Chronic Obstructive Pulmonary disease, diabetes, polycystic ovary syndrome)
4. Inherited disorders e.g., sickle cell anaemia
5. Pregnancy/breastfeeding women
6. Taking nitrate, steroid, anti-coagulant or immunosuppressant medication or medication as part of a clinical trial
7. Diagnosed cardiovascular (including arrhythmia), respiratory (including asthma), renal or ophthalmic disease
8. Congenital or acquired neurological conditions (including dementia), language disorders, repeated or chronic pain conditions (excluding menstrual pain and minor sporadic headaches)
9. Diabetes or HbA1c >6.5%
10. Symptoms of febrile illness within two weeks of participation
11. Excessive alcohol consumption (exceeding 28 units/week) or intravenous drug use
12. Needle phobia
13. History of panic attacks
14. Inability to understand instructions given in English
15. Current smoker
16. Pacemaker, implantable cardiac defibrillator, cerebral metallic clips or other implanted metallic devices/structures
17. Unable to tolerate scanner or history of claustrophobia
18. Learning disability or significant hearing and/or visual impairment, which may affect participants ability to communicate from within the MRI scanner
19. Inability to understand English

Normotensive:
1. Women with a history of hypertension, including hypertension in pregnancy

Hypertensive participants:
2. Secondary causes of hypertension

Date of first enrolment
18/02/2025

Date of final enrolment
01/10/2027

Locations

Countries of recruitment
United Kingdom

England

Wales

Study participating centre
NIHR Bristol Clinical Research Facility
60 St Michael's Hill
Bristol
United Kingdom
BS2 8DX

Study participating centre
Cardiff University Brain Imaging Centre
Maindy Road
Cardiff
United Kingdom
CF24 4HQ

Sponsor information

Organisation
British Heart Foundation

ROR
https://ror.org/02wdwnk04

Funder(s)

Funder type
Charity

Funder Name
British Heart Foundation

Alternative Name(s)
The British Heart Foundation, the_bhf, BHF

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated and/or analysed during the current study will be available upon request from Dr Lydia Simpson (Lydia.simpson@bristol.ac.uk)

IPD sharing plan summary
Available on request