

# The relevance of evolving grey and white matter pathology to the development of neurodegeneration and disability in multiple sclerosis

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<b>Registration date</b> 09/09/2022	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 09/09/2022	<b>Condition category</b> Nervous System Diseases	<input type="checkbox"/> Individual participant data <input type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

About 130,000 people in the UK have multiple sclerosis (MS) and, other than head injuries, it is the commonest cause of neurological disability in young adults. MS is highly variable and unpredictable: some people with MS develop few neurological problems over decades, while others develop significant progressive disability. Overall, it is thought that the loss of nerve cells determines irreversible disability in MS, but we do not know what the main cause of nerve cell damage is. On magnetic resonance imaging (MRI) scans the most obvious sign of MS is the presence of lesions in brain white matter, and nearly all people with MS have an MRI scan looking for these lesions to help establish a diagnosis. However, these lesions appear to explain only a small amount of overall disability and nerve damage due to MS.

About a decade ago we undertook a research study investigating grey matter (the part of the brain which contains nerve cells) abnormalities in MS. The study provided much-needed insights into previously overlooked aspects of MS, and in particular, highlighted that grey matter changes in some people with MS could be substantial and associated with neurological function, memory, and thinking. Practically, it has led to at least one new MRI method being used in trials of treatments for MS.

Building on our previous study, we now aim to see if any of the MRI scan measures we previously looked at can predict how people with MS are now, and how these MRI features have changed over a decade. We hope that this work will help us to identify targets for treatment long before they have had a chance to cause disability.

### Who can participate?

Adult patients with MS and healthy adults with no known neurological disease who were included in the original research study will be invited to participate in the study.

What does the study involve?

The study will follow up a cohort of patients with MS from the original research study, a little over a decade after their initial assessments. The study will involve a single visit to the UCL Queen Square Institute of Neurology, London, or, if some participants are unable to attend the UCL Institute of Neurology, a brief medical interview will be conducted by telephone to evaluate their disease status and current levels of disability.

During the visit, the participants will complete a 30-minute clinical assessment (30 min) which will include the collection of a brief medical history, a neurological examination, a walking assessment, and tests of walking speed, upper limb function, attention, and speed of information processing. There will also be a 15-minute cognitive assessment, to measure attention and speed of information processing, verbal memory immediate recall, and visual memory immediate recall. Participants will also have an MRI scan which will take around 90 minutes.

What are the possible benefits and risks of participating?

This study will not directly affect participant care or treatment. We hope that participants will be able to learn more about current MS research and will also gain some satisfaction from knowing that they are helping with research that may eventually contribute towards the development of better treatments for MS.

There are only minor risks to participants associated with this study. MRI is a safe imaging technology which uses a strong magnetic field and radio waves to create images of part of the inside of the body. There is no ionising radiation (such as X-rays) involved in MRI. Some people may feel a little claustrophobic when they are in the scanner, however participants will always be able to speak to the person controlling the scanner via an intercom, and they will stop the scanning session at any time if you ask them to do so. Participants will also have a buzzer that they can squeeze to attract attention. Very occasionally during scans people also experience a mild tingling or twitching feeling in their body, arms, or legs. This is harmless, but if it happens and causes participants any distress, participants can ask for the scanning session to be stopped.

Where is the study run from?

University College London (UK)

When is the study starting and how long is it expected to run for?

From May 2021 to May 2025

Who is funding the study?

Medical Research Council (UK)

Who is the main contact?

Dr Nitin Sahi, n.sahi@ucl.ac.uk

## Contact information

**Type(s)**

Scientific

**Contact name**

Dr Nitin Sahi

**ORCID ID**

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### **Contact details**

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## **Additional identifiers**

### **EudraCT/CTIS number**

Nil known

### **IRAS number**

310565

### **ClinicalTrials.gov number**

Nil known

### **Secondary identifying numbers**

IRAS 310565, CPMS 52645, Grant Codes: MR/W019906/1

## **Study information**

### **Scientific Title**

The dynamics and clinical relevance of grey matter and periventricular white matter pathology in multiple sclerosis

### **Acronym**

GML03

### **Study objectives**

1. Cortical grey matter atrophy is essentially unrelated to grey matter lesion formation
2. White matter tract-mediated abnormalities lead to regional grey matter atrophy
3. Gradients in cortical grey and periventricular white matter abnormalities predict future cortical atrophy
4. Iron deposition and hypo-perfusion promote cortical atrophy
5. Grey matter compared with white matter MRI features better predict a transition from relapsing-remitting to secondary progressive MS and better predict disability accrual
6. Early gradients in cortical grey matter and periventricular white matter abnormalities predict a transition from relapsing-remitting to secondary progressive MS, and disability accrual, and do so independently of grey matter and white matter lesions

### **Ethics approval required**

Old ethics approval format

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

Approved 24/05/2022, NHS/HRA London - Queen Square Research Ethics Committee (HRA NRES Centre Bristol, 3rd floor, Block B, Whitefriars, Lewins Mead, Bristol BS1 2NT; +44 (0)2071048225, +44 (0)2071048284; queensquare.rec@hra.nhs.uk), ref 22/PR/0410

## **Study design**

Observational cohort study

## **Primary study design**

Observational

## **Secondary study design**

Cohort study

## **Study setting(s)**

Hospital

## **Study type(s)**

Other

## **Participant information sheet**

Not available in web format, please use the contact details to request a participant information sheet.

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

Multiple Sclerosis

## **Interventions**

We plan to follow up a cohort of patients with Multiple Sclerosis (MS), clinically isolated syndrome (CIS), and healthy controls for a little over a decade after their initial assessments, n=140 out of 209 (We originally recruited 148 people with MS [69 with Relapsing Remitting MS (RRMS), 48 with Secondary Progressive MS (SPMS), and 31 with Primary Progressive MS (PPMS)], 9 with a CIS, and 52 healthy controls). The study will involve a single visit to the UCL Queen Square Institute of Neurology, London. After obtaining informed consent the participants will complete the following assessments during the visit:

1. Clinical assessment (30 min):

1.1. Brief medical history

1.2. Neurological examination

1.3. Expanded Disability Status Scale (EDSS) assessment scored using the results of the neurological exam and a walking assessment

1.4. Multiple Sclerosis Functional Composite Scale (MSFC) based on a test of walking speed, a 9-hole peg test for upper limb function and the Paced Auditory Serial Addition Test (PASAT) which measures attention and speed of information processing

2. Brief International Cognitive Assessment for MS (BICAMS) (15 min) which includes the Symbol Digit Modalities Test (SDMT) which measures attention and speed of information processing, the California Verbal Learning Test (verbal memory immediate recall), and the Brief Visuospatial Memory Test (visual memory immediate recall).

3. MRI scanning (90 min). A combination of standard and novel MRI techniques will be used, including proton density/T2/FLAIR, PSIR sequences, 3D T1 weighted imaging, magnetisation transfer ratio (MTR) imaging, diffusion-weighted imaging (DWI), macromolecular tissue volume (MTV), quantitative susceptibility mapping (QSM), and arterial spin labelling (ASL).

Some participants may wish to be part of the study but be unable to attend the UCL Institute of Neurology. In this situation, after obtaining consent a brief medical interview will be conducted by telephone to evaluate disease status and current levels of disability.

### **Intervention Type**

Other

### **Primary outcome measure**

1. Cortical grey matter atrophy measured using 3D T1-weighted volumetric MRI scans at the single study visit
2. Transition to secondary progressive MS measured using clinical assessment based on history and examination at the single study visit
3. Disability accrual measured using the Expanded Disability Status Scale (EDSS), Multiple Sclerosis Functional Composite (MSFC), and cognitive measures at the single study visit

### **Secondary outcome measures**

There are no secondary outcome measures

### **Overall study start date**

25/05/2021

### **Completion date**

04/05/2025

## **Eligibility**

### **Key inclusion criteria**

1. Included in the original research study (ref: 917/09).
2. Aged 18-65 years (at time of original study)
3. Able to undertake written informed consent in English
4. Diagnosis of clinically definite MS or were healthy controls with no known neurological disease

### **Participant type(s)**

Patient

### **Age group**

Adult

### **Lower age limit**

18 Years

### **Upper age limit**

65 Years

### **Sex**

Both

### **Target number of participants**

Planned Sample Size: 140; UK Sample Size: 140

## **Key exclusion criteria**

1. Involvement in other research studies or medical interventions which might have contraindications for this study
2. Neurological disease other than CIS and MS that impedes study interpretation
3. Contraindication to MRI scanning is not an exclusion criteria for the study, however participants must meet safety criteria to take part in this element of the study. Participants will be asked to complete the NMR Research Unit's MRI safety checklist to determine whether or not it is safe to proceed with MRI scanning.

## **Date of first enrolment**

01/05/2022

## **Date of final enrolment**

31/01/2025

## **Locations**

### **Countries of recruitment**

United Kingdom

### **Study participating centre**

**UCL Queen Square Institute of Neurology**

Queen Square

London

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## **Sponsor information**

### **Organisation**

University College London

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### **Sponsor type**

University/education

### **Website**

<http://www.ucl.ac.uk/>

**ROR**

<https://ror.org/02jx3x895>

## Funder(s)

**Funder type**

Government

**Funder Name**

Medical Research Council

**Alternative Name(s)**

Medical Research Council (United Kingdom), UK Medical Research Council, MRC

**Funding Body Type**

Government organisation

**Funding Body Subtype**

National government

**Location**

United Kingdom

## Results and Publications

**Publication and dissemination plan**

Planned publication of results in a high-impact peer-reviewed journal. As per MRC policy for open research data the study protocol, including analysis plan and all relevant statistical analyses will be made available.

**Intention to publish date**

04/05/2026

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

The datasets generated during and/or analysed during the current study are/will be available upon request from the Principle Investigator (Declan Chard, [d.chard@ucl.ac.uk](mailto:d.chard@ucl.ac.uk)).

We will collect demographic, clinical assessment (including neurological and cognitive test score), and MRI data. Data will only be available from participants who have consented for their data to be shared anonymously or pseudo-anonymously with other researchers.

Where needed, data sharing will be authorised by the Principal Investigator (or their successor) for this study. Data sharing agreements are subject to review by UCL Business (<https://www.uclb.>

com/for-researchers/material-transfer-agreements/). Data sharing is subject to the UCL Information Security Policy (<https://www.ucl.ac.uk/information-security/informationsecurity-policy>).

## IPD sharing plan summary

Available on request

## Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Protocol file</a>	version 2.0	10/05/2022	16/08/2022	No	No
<a href="#">HRA research summary</a>			26/07/2023	No	No