# Can we reduce the environmental impact of nitrous oxide anaesthesia without affecting patient care?

Submission date	Recruitment status	[X] Prospectively registered
24/10/2024	Recruiting	☐ Protocol
Registration date	Overall study status	Statistical analysis plan
27/02/2025	Ongoing	Results
Last Edited	Condition category	Individual participant data
14/10/2025	Surgery	[X] Record updated in last year

#### Plain English summary of protocol

Background and study aims

Nitrous oxide is a gas used in anaesthesia. The way it is currently used leads to waste and may have an environmental impact too. The way nitrous oxide is delivered is changing in operating theatres. Currently, most hospitals use piped nitrous oxide, whereas in future nitrous oxide may come from a portable cylinder instead. The aim of this study is to check whether nitrous oxide from portable cylinders is as safe for patients and less wasteful than piped nitrous oxide.

#### Who can participate?

All patients undergoing surgery under general anaesthetic

#### What does the study involve?

Patients requiring nitrous oxide anaesthesia during their operation will be randomly allocated to receive it either via cylinder or pipeline. No trial-specific data will be collected from the patient, the collection of outcome data will be via hospital record review.

What are the possible benefits and risks of participating?

There will be no direct benefits to individual patients. The intervention (nitrous oxide delivered via cylinder) is in common clinical practice in the UK, therefore there are no specific risks relating to participation in the trial, however, the purpose of the study is to assess whether there is any difference in the safety profile of nitrous oxide delivered via cylinder or via pipeline.

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

When is the study starting and how long is it expected to run for? February 2024 to October 2026

Who is funding the study?
The National Institute for Health and Care Research (UK)

# Contact information

#### Type(s)

Principal investigator

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#### Type(s)

Public

#### Contact name

Ms Rachel Lillywhite

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#### Type(s)

Scientific

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Mr Bryar Kadir

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# Additional identifiers

#### Clinical Trials Information System (CTIS)

Nil known

#### Integrated Research Application System (IRAS)

347203

#### ClinicalTrials.gov (NCT)

Nil known

#### Protocol serial number

RG 24-084

# Study information

#### Scientific Title

A multi-centre non-inferiority cluster trial comparing outcomes related to nitrous oxide delivery by portable cylinder and pipeline in all patients undergoing surgery under general anaesthesia: Nitrous Oxide management to Balance healthcare and Environmental needs (NOBLE)

#### Acronym

**NOBLE** 

#### **Study objectives**

Nitrous oxide delivered via portable cylinder is as safe in terms of patient outcomes as nitrous oxide delivered via pipeline manifold.

# Ethics approval required

Ethics approval required

# Ethics approval(s)

approved 20/02/2025, East of England - Cambridge Central Research Ethics Committee (2 Redman Place , London , E20 1JQ, United Kingdom; +44 (0)207 104 8089; cambridgecentral. rec@hra.nhs.uk), ref: 24/EE/0268

# Study design

Pragmatic multi-centre non-inferiority cluster randomized cross-over trial

# Primary study design

Interventional

# Study type(s)

Safety

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

Method of nitrous oxide delivery in patients requiring surgery under general anaesthetic.

#### Interventions

The NOBLE trial will have two distinct phases each lasting 5 weeks. Hospitals will be randomised 1:1 either to a control phase (pipeline nitrous oxide supply) followed by an intervention phase (cylinder nitrous oxide supply), or to an intervention phase followed by a control phase. The total trial intervention period will last 10 weeks, with a further 30 days to complete the follow-up of the last included patient to undergo surgery. Hospitals will be allocated in randomised blocks of random length (4 or 6). The allocation list will be prepared by an independent statistician at BCTU, and uploaded to the randomisation module of the REDCap electronic data capture tools hosted at Birmingham University, to ensure allocation concealment when each hospital is randomised. Prior to randomisation, local investigators will ensure all necessary equipment has been procured and is ready for use and will plan the delivery of education and training to anaesthetists and relevant theatre staff.

#### Intervention Type

Other

#### Primary outcome(s)

Days Alive and At Home Within 30 Days after surgery (DAH30). The day of surgery is defined as day zero. Patients who die within 30 days after surgery will be given a value of zero. DAH30 data will be collected from routine data in patient health records by local investigators who are members of the direct care team.

#### Key secondary outcome(s))

- 1. Use of nitrous oxide anaesthesia during surgery (Y/N)
- 2. Mortality within 30 days after surgery
- 3. Major complications during surgery (Clavien-Dindo grade ≥III)
- 4. Duration of hospital stay (days)
- 5. NHS costs of nitrous oxide provision

All secondary outcome measures will be collected from routine hospital records at 30 days after surgery

# Completion date

31/10/2026

# **Eligibility**

#### Key inclusion criteria

All patients (adults and children) undergoing surgery under general anaesthesia in participating hospitals (regardless of exposure to nitrous oxide anaesthesia)

# Participant type(s)

Patient

# Healthy volunteers allowed

No

#### Age group

All

#### Sex

All

#### Key exclusion criteria

Patients who have opted out of anonymous data sharing Patients undergoing repeat surgery within 30 days after a procedure recorded in the NOBLE trial

#### Date of first enrolment

01/04/2025

#### Date of final enrolment

01/10/2026

# Locations

#### Countries of recruitment

United Kingdom

England

Scotland

Wales

#### Study participating centre Barts Health NHS Trust

The Royal London Hospital 80 Newark Street London United Kingdom E1 2ES

#### Study participating centre Medway NHS Foundation Trust

Medway Maritime Hospital Windmill Road Gillingham United Kingdom ME7 5NY

#### Study participating centre Royal Free London NHS Foundation Trust

Royal Free Hospital Pond Street London United Kingdom NW3 2QG

# Study participating centre Barking Havering & Redbridge Hospitals NHS Trust

Queens Hospital Romford United Kingdom RM7 0AG

# Study participating centre United Lincolnshire Hospitals NHS Trust

Lincoln County Hospital Greetwell Road Lincoln United Kingdom LN2 5QY

# Study participating centre

University Hospital Southampton NHS Foundation Trust

Southampton General Hospital Tremona Road Southampton United Kingdom SO16 6YD

# Study participating centre

Norfolk and Norwich University Hospitals NHS Foundation Trust

Colney Lane Colney Norwich United Kingdom NR4 7UY

# Study participating centre

Royal Surrey County Hospital NHS Foundation Trust

Egerton Road Guildford United Kingdom GU2 7XX

#### Study participating centre University Hospitals Plymouth NHS Trust

Derriford Hospital Derriford Road Derriford Plymouth United Kingdom PL6 8DH

# Study participating centre Kingston Hospital NHS Foundation Trust

Galsworthy Road Kingston upon Thames United Kingdom KT2 7QB

# Study participating centre Mid and South Essex NHS Foundation Trust

Nether Mayne Basildon United Kingdom SS16 5NL

### Study participating centre Kings College Hospital NHS Foundation Trust

Princess Royal University Hospital Farnborough Common Orpington United Kingdom BR6 8ND

# Study participating centre

County Durham and Darlington NHS Foundation Trust

Darlington Memorial Hospital Hollyhurst Road Darlington United Kingdom DL3 6HX

# Study participating centre

Nottingham University Hospitals NHS Trust - Queen's Medical Centre Campus

Nottingham University Hospital Derby Road Nottingham United Kingdom NG7 2UH

# Study participating centre East Kent Hospitals University NHS Foundation Trust

Queen Elizabeth The Queen Mother Hospital Margate Ramsgate Rd Margate United Kingdom CT9 4AN

# Study participating centre East Kent Hospitals University NHS Foundation Trust

William Harvey Hospital
Kennington Rd
Willesborough
Ashford
United Kingdom
TN24 0LZ

# Study participating centre Barnet Hospital

Wellhouse Lane Barnet United Kingdom EN5 3DJ

#### Study participating centre Chase Farm Hospital

127 the Ridgeway Enfield United Kingdom EN2 8JL

#### Study participating centre

#### Royal Cornwall Hospitals NHS Trust

Royal Cornwall Hospital Treliske Truro United Kingdom TR1 3LJ

# Sponsor information

#### Organisation

University of Birmingham

#### **ROR**

https://ror.org/03angcq70

# Funder(s)

#### Funder type

Government

#### Funder Name

National Institute for Health and Care Research

#### Alternative Name(s)

National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

#### **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 will be available upon request from Rachel Lillywhite (NOBLE@trials.bham.ac.uk)

# **IPD sharing plan summary** Available on request