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# DRAGON: Are reusable surgical drapes and gowns as good as disposable surgical drapes and gowns at increasing days alive and at home after surgery?

**Submission date**
19/11/2025

**Recruitment status**
Recruiting

**Registration date**
24/04/2026

**Overall study status**
Ongoing

**Last Edited**
24/04/2026

**Condition category**
Infections and Infestations

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

## Plain English summary of protocol

Background and study aims
This study looks at developing environmentally sustainable operating theatres. Operating theatres contribute about one quarter of a hospital's carbon footprint. The UK government wants the NHS to reach a "net-zero" carbon footprint by 2045. This cannot happen without patients, theatre teams and researchers working together to make surgery more environmentally friendly, while keeping patients safe. Changing long-standing practices is challenging, particularly when staff worry about infection risk, anaesthetic safety and theatre flow.

The study team have already reviewed published research, surveyed 5,734 theatre staff and 91 patients, held several Patient Advisory Group (PAG) meetings and listened carefully to Stage 1 reviewers. Together, this work identified three big contributors to theatre emissions that frontline teams can realistically change. These were showcased in the world's first 'net-zero' operation, which was covered by BBC News (https://www.bbc.com/news/uk-england-birmingham-61562741). These included reducing polluting gases and wasted oxygen during anaesthesia, routinely using reusable sterile gowns and drapes, and improving recycling of paper and plastic. That development work showed that, in practice, these three areas are often handled through separate contracts and systems, so many hospitals cannot change all of them at once. Therefore, research has been designed to address these themes in different ways. This research now proposes a coherent programme with four connected work streams. First, this DRAGON trial will compare reusable surgical drapes and gowns with the single-use versions currently used in many NHS operating theatres. Second, the NOBLE trial will compare two ways of supplying nitrous oxide, a powerful greenhouse gas used in anaesthesia. The study will test traditional piped systems against portable cylinders in 24 hospitals, including around 14,400 patients having surgery under general anaesthesia. Again, this will use DAH30 to check that changing gas systems does not harm patient recovery, while also measuring gas use, costs and environmental impact. Third, a mixed-methods study will examine waste management in operating theatres, including how waste is sorted, recycled and disposed of. By combining two

large national clinical trials with a detailed evaluation of waste and a strong PPIE programme, this research will provide the evidence the NHS needs to make operating theatres more sustainable without compromising safety. It will generate new knowledge that can be shared across the NHS and help move surgical care towards net-zero.

Who can participate?
Adult surgical patients in 32 hospitals

What does the study involve?
The study will measure recovery using “Days Alive and At Home at 30 days” (DAH30), a patient-centred outcome that captures both survival and time spent out of hospital.

What are the possible benefits and risks of participating?
There are no direct benefits from this research, but if it is found that reusable drapes and gowns are just as good at preventing infections compared to disposable ones, this might be better for the environment and might reduce the costs of surgery.

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?
April 2025 to May 2027.

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

Who is the main contact?
dragon@trials.bham.ac.uk

# Contact information

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Principal investigator

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# Additional identifiers

**ClinicalTrials.gov (NCT)**
NCT06164444

**Integrated Research Application System (IRAS)**
330822

**Central Portfolio Management System (CPMS)**
62423

**Protocol number**
RG_22-181

# Study information

**Scientific Title**
DRAGON: a cluster RCT of reusable versus single-use drapes and gowns in NHS operating theatres

**Acronym**
DRAGON

**Study objectives**

The primary outcome is Days Alive and At Home at 30 days (DAH30), with secondary outcomes including surgical site infection, length of stay, environmental impact and cost-effectiveness.

### Ethics approval required
Ethics approval required

### Ethics approval(s)
approved 21/06/2024, East of England - Cambridge Central Research Ethics Committee (2 Redman Place, London, E20 1JQ, United Kingdom; +44 02071048285; cambridgecentral.rec@hra.nhs.uk), ref: 24/EE/0105

### Primary study design
Interventional

### Allocation
Randomized controlled trial

### Masking
Open (masking not used)

### Control
Active

### Assignment
Parallel

### Purpose
Health services research

### Study type(s)

### Health condition(s) or problem(s) studied
Patients (adults) undergoing elective or emergency surgery with at least one incision ≥5 cm in adults and a clean-contaminated, contaminated or dirty wound, in NHS hospitals where there is equipoise to use either disposable or reusable drapes and gowns.

### Interventions
Intervention: Reusable drapes and gowns
Comparator: Disposable (single-use) drapes and gowns

This study is designed as a pragmatic, multicentre cluster-randomised controlled trial of reusable versus disposable drapes and gowns to quickly provide evidence. Clusters will be randomly allocated to reusable drapes and gowns (intervention group) or disposable drapes and gowns (control group). Within a hospital, multiple theatres can be randomised in parallel, only if each is acting as its own cluster and includes consecutive patients separately. New theatres cannot join an already randomised theatre, as the new theatre will not be blind to allocation. Hospital sites will be informed of their random allocation before any patients are assessed for eligibility. Theatres that have completed their participation in DRAGON are then eligible for re-randomisation if they wish.

A cluster randomised design is the most appropriate design to minimise the risk of contamination in the control arm of the trial. Once theatre staff are trained to implement the intervention (of using reusable drapes and gowns), it is likely to become routine practice, making individual randomisation unfeasible.

To produce generalisable evidence, common operations will be included from across our network, as well as including children. The FALCON, CHEETAH, and ROSSINI networks are established collaborations focusing on abdominal surgery. A simple design was chosen to ensure that the trial is delivered in a timely way, as the design can be rapidly approved and opened across this network.

Clusters can take part where there is clinical and organisational equipoise to randomise between disposable and reusable drapes and gowns. The theatres taking part within a cluster will be formed differently at different hospitals, as every hospital around the world is different. It may include selected theatres within a hospital or selected surgical teams who use various theatres, in each case where equipoise exists and the patient inclusion criteria match. Sites must predefine their cluster (i.e. theatres or teams taking part), and this will record this at the point of randomisation.

All patients in DRAGON theatres will be assessed for eligibility at the time of surgery. Once the theatre team has confirmed that a patient meets the eligibility criteria, the patient will be registered into the trial. Once registered in the DRAGON trial, participants will be followed up at postoperative day 30.

In the UK, as patients are not routinely followed up in clinic at 30 days, and it would not be feasible to consent patients, registered participants will be followed up for periods spent in hospital up to 30 days of surgery, based on patient record review only.

In selected UK sites, a PROCESS EVALUATION of the DRAGON trial will be completed to assess the barriers and facilitators to delivering the intervention during the trial, therefore optimising trial delivery. This process evaluation aims to report how the DRAGON intervention was planned, delivered and received at the cluster (hospital) and surgical team level. The PROCESS EVALUATION will involve hospital staff ONLY and will involve interviews and focus groups with members of staff involved in the procurement and the delivery of the trial, for example, hospital managers and peri-operative professionals. Participating staff members will sign the latest version of the informed consent form and will be able to withdraw at any time.

Design of research:
Patient survey done through Bowel Research UK (n=63) during the inception of the research problem. 97% of respondents wanted an environmentally friendly operation and 95% felt that the topic of sustainable surgery is an important community priority. Patients found the proposed ideas acceptable, but raised concerns about balancing safety with reducing carbon output.

PPI representatives advised us to emphasise in public-facing materials that the two tested interventions (disposable and reusable drapes and gowns) are both already routinely used in NHS Trusts, so the trial is not a deviation from standard of care. This should be mentioned to allay fears of trial participants. They also suggested producing videos and posters that explained the trial in simple, lay language.

A patient raised the challenge of getting theatre staff to switch to certain interventions without considering the survey. The patient suggested that a survey be done on NHS Trusts to determine the current proportion of disposable versus reusable drapes and gowns currently in use.

PPI reps emphasised that safeguards need to be in place if patients are randomised into a group where outcomes are not favourable.

PPI representatives suggested appropriate wording of the lay summary. For example:

o Removing the term "cluster randomised trial" and just saying that blanket consent will be obtained from participating NHS trusts and patients will not be individually consented.

o Adding statistics on the percentage of solid waste coming from operating theatres to highlight the problem.

o Adding a statement emphasising patient safety that if outcomes for patients on trial become worse, the trial may be paused or stopped.

Proposed management of research:
Public members to be present in various governance roles within the trial.

o Two (2) public members on the trial management group (TMG)

o One (1) public member to be on the trial steering committee (TSC)

o One (1) public member to be on the external advisory board (EAB) for the wider program (GREENSURG) where the trial DRAGON sits

Dissemination of Findings
A wider general, community PPI group will be formed to support us in a more public-facing capacity (e.g., planning public events and fora, feedback on patient videos and posters)

Suggestions to have public forums to explain the relevance of the trial and the Green Surgery programme in general to communities in an informal venue.

Regarding the PROCESS EVALUATION sub-study
A scoping exercise was performed before the DRAGON trial set up to identify the barriers to implementation of sustainable interventions, including the use of reusable drapes and gowns. Through surveys, peri-operative professionals were asked to provide free-text responses about barriers to implementing sustainable interventions in their local hospital. The free-text responses provided by peri-operative professionals were analysed through domain analysis to identify common barriers to implementing the intervention.

## Intervention Type
Procedure/Surgery

## Primary outcome(s)
1. Days Alive and At Home at 30 days (DAH30) measured using routine hospital record review at 30 days post-operatively

## Key secondary outcome(s))

1. Mortality (and likely cause) measured using routine hospital record review at within 30 days of surgery

2. Unplanned wound opening measured using routine hospital record review at within 30 days of surgery

3. Antibiotic prescribing for SSI measured using routine hospital record review at within 30 days of surgery

4. Reattendance at emergency department measured using routine hospital record review at within 30 days of surgery

5. Readmission to hospital measured using routine hospital record review at within 30 days of surgery

6. Reoperation for surgical site infection (SSI) measured using routine hospital record review at within 30 days of surgery

7. Total length of hospital stay measured using routine hospital record review at within 30 days of surgery

### Completion date
01/05/2027

# Eligibility

### Key inclusion criteria
1. Patients with at least one incision that is ≥5cm in adults and ≥3cm in children aged under 16 years. This can include both open and minimally-invasive surgery providing at least one incision meets this criteria.
2. Patients with a clean-contaminated, contaminated, or dirty surgical wound.
3. Patients undergoing emergency (surgery on an unplanned admission) or elective (surgery on a planned admission) surgery.
4. Any operative indication (including caesarean section).
5. Patients aged 5 years and over.

### Healthy volunteers allowed
No

### Age group
Mixed

### Lower age limit
5 years

### Upper age limit
100 years

### Sex
All

### Total final enrolment
0

### Key exclusion criteria
1. Adults with an incision <5 cm and incision <3cm in children aged under 16 years.
2. Patients undergoing procedures with a clean surgical wound only.

### Date of first enrolment
07/04/2025

### Date of final enrolment
31/03/2027

## Locations

### Countries of recruitment
United Kingdom

England

Scotland

Wales

### Study participating centre
**University Hospitals Birmingham NHS Foundation Trust**
Queen Elizabeth Hospital
Mindelsohn Way
Edgbaston
Birmingham
England
B15 2GW

### Study participating centre
**Solihull Hospital**
Lode Lane
Solihull
England
B91 2JL

### Study participating centre
**Heartlands Hospital**
Bordesley Green East
Bordesley Green
Birmingham

England
B9 5SS

**Study participating centre**
**Good Hope Hospital**
Rectory Road
Sutton Coldfield
England
B75 7RR

**Study participating centre**
**Guy's and St Thomas' NHS Foundation Trust**
St Thomas' Hospital
Westminster Bridge Road
London
England
SE1 7EH

**Study participating centre**
**University Hospitals Coventry and Warwickshire NHS Trust**
Walsgrave General Hospital
Clifford Bridge Road
Coventry
England
CV2 2DX

**Study participating centre**
**George Eliot Hospital**
Lewes House
College Street
Nuneaton
England
CV10 7DJ

**Study participating centre**
**South Warwickshire University NHS Foundation Trust**
Warwick Hospital
Lakin Road
Warwick
England
CV34 5BW

**Study participating centre**
**Sherwood Forest Hospitals NHS Foundation Trust**
Kings Mill Hospital
Mansfield Road
Sutton-in-ashfield
England
NG17 4JL

**Study participating centre**
**Countess of Chester Hospital**
Countess of Chester Health Park
Liverpool Road
Chester
England
CH2 1UL

**Study participating centre**
**North Cumbria Integrated Care NHS Foundation Trust**
Pillars Building
Cumberland Infirmary
Infirmary Street
Carlisle
England
CA2 7HY

**Study participating centre**
**Liverpool Heart and Chest Hospital NHS Foundation Trust**
Thomas Drive
Liverpool
England
L14 3PE

**Study participating centre**
**North Tees and Hartlepool Ft**
Hardwick Road
Stockton-on-tees
England
TS19 8PE

**Study participating centre**
**Northumbria Healthcare NHS Foundation Trust**
North Tyneside General Hospital
Rake Lane
North Shields
England
NE29 8NH

**Study participating centre**
**Musgrove Park Hospital**
Musgrove Park Hospital
Taunton
England
TA1 5DA

**Study participating centre**
**University Hospitals of Morecambe Bay NHS Foundation Trust**
Westmorland General Hospital
Burton Road
Kendal
England
LA9 7RG

**Study participating centre**
**Arrowe Park Hospital (site)**
Arrowe Park Hospital
Arrowe Park Road
Wirral
England
CH49 5PE

**Study participating centre**
**Barts Health NHS Trust**
The Royal London Hospital
80 Newark Street
London
England
E1 2ES

**Study participating centre**

**Cardiff & Vale University Lhb**
Woodland House
Maes-y-coed Road
Cardiff
Wales
CF14 4HH

**Study participating centre**
**County Durham and Darlington NHS Foundation Trust**
Darlington Memorial Hospital
Hollyhurst Road
Darlington
England
DL3 6HX

**Study participating centre**
**East Lancashire Hospitals NHS Trust**
Royal Blackburn Hospital
Haslingden Road
Blackburn
England
BB2 3HH

**Study participating centre**
**Forth Valley Royal Hospital**
Stirling Road
Larbert
Scotland
FK5 4WR

**Study participating centre**
**Frimley Health NHS Foundation Trust**
Portsmouth Road
Frimley
Camberley
England
GU16 7UJ

**Study participating centre**
**NHS Greater Glasgow and Clyde**
J B Russell House

Gartnavel Royal Hospital
1055 Great Western Road Glasgow
Glasgow
Scotland
G12 0XH

**Study participating centre**
**Kings College Hospital**
Mapother House
De Crespigny Park
Denmark Hill
London
England
SE5 8AB

**Study participating centre**
**Royal Infirmary of Edinburgh at Little France**
51 Little France Crescent
Old Dalkeith Road
Edinburgh
Lothian
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EH16 4SA

**Study participating centre**
**Royal Liverpool University Hospital**
Prescot Street
Liverpool
England
L7 8XP

**Study participating centre**
**Sandwell and West Birmingham Hospitals NHS Trust**
Midland Metropolitan University Hos
Grove Lane
Smethwick
England
B66 2QT

**Study participating centre**

**The Shrewsbury and Telford Hospital NHS Trust**
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England
SY3 8XQ

**Study participating centre**
**St George's University Hospitals NHS Foundation Trust**
St. Georges Hospital
Cranmer Terrace
London
England
SW17 0RE

**Study participating centre**
**Swansea Bay University Local Health Board**
Tonna Hospital
Tonna Uchaf
Tonna
Neath
Wales
SA11 3LX

**Study participating centre**
**The Dudley Group NHS Foundation Trust**
Russells Hall Hospital
Pensnett Road
Dudley
England
DY1 2HQ

**Study participating centre**
**The Newcastle upon Tyne Hospitals NHS Foundation Trust**
Freeman Hospital
Freeman Road
High Heaton
Newcastle upon Tyne
England
NE7 7DN

**Study participating centre**

**University College London Hospitals NHS Foundation Trust**
250 Euston Road
London
England
NW1 2PG

**Study participating centre**
**University Hospitals of Leicester NHS Trust**
Leicester Royal Infirmary
Infirmary Square
Leicester
England
LE1 5WW

**Study participating centre**
**Worcestershire Acute Hospitals NHS Trust**
Worcestershire Royal Hospital
Charles Hastings Way
Worcester
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WR5 1DD

# Sponsor information

**Organisation**
University of Birmingham

**ROR**
https://ror.org/03angcq70

# Funder(s)

**Funder type**

**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

**IPD sharing plan summary**
Data sharing statement to be made available at a later date