

Evaluating nursing performance in heatwave simulations

Submission date 06/07/2026	Recruitment status Not yet recruiting	☒ Prospectively registered ☒ Protocol
Registration date 01/09/2026	Overall study status Ongoing	☒ Statistical analysis plan ☐ Results
Last Edited 01/09/2026	Condition category Other	☐ Individual participant data ☒ Record updated in last year

Plain English summary of protocol

Background and study aims

Many healthcare workers in the UK are now working in increasingly hot conditions due to climate change. Heatwaves are becoming more common, and many hospitals do not have full air conditioning. While the effects of heat on patients are well known, less is understood about how working in hot environments affects healthcare staff. High temperatures can increase fatigue and may affect the ability to carry out important clinical tasks safely.

This study aims to test a protocol developed to better understand how heat affects healthcare workers during everyday nursing activities. A specially controlled room (climatic chamber) will be used where temperature conditions can be safely adjusted. Participants will complete a series of simulated nursing tasks under different temperature conditions. Researchers will measure fatigue, physical strain and task performance.

The findings will help determine whether this protocol can be used to assess the impact of heat on healthcare workers and support the development of safer working environments and strategies to protect staff and patients during hot weather.

This research project has been reviewed and approved by the Faculty Research Ethics Committees and the Research Ethics and Governance Office, University of Southampton.

Who can participate?

Physically active volunteer qualified nurses aged 18 to 65 years.

What does the study involve?

Individuals who meet the study requirements, as determined through a screening health questionnaire, may be eligible to take part. The questionnaire contains general, non-intrusive questions, and all information provided will be treated confidentially. Participants will be asked to attend between three and five visits to the research laboratory in the Clinical Academic Facility (South Block) at Southampton General Hospital. Visits must be separated by at least 48 hours. Each testing session will last approximately 2 hours and 45 minutes, giving a total time commitment of around 9–14 hours.

Participants will be asked to complete three testing sessions and will then have the option of taking part in a further two sessions. Before taking part, participants will complete a consent form. Participation is voluntary and participants may withdraw from the study at any time.

First session

During the first visit, researchers will explain the study procedures and answer any questions. Participants who wish to take part will complete consent forms and health questionnaires. Height and weight will be recorded. The testing procedures will be explained in detail, and participants will have the opportunity to become familiar with the equipment before testing begins.

All sessions

All sessions will follow the same format. The only differences will be the environmental conditions in the climate chamber (18°C, 26°C or 34°C) and whether a cooling intervention, such as a fan, is available.

Three to four hours before arriving at the laboratory, participants will swallow a temperature-sensing pill to measure core body temperature.

At the start of each session, participants will be fitted with monitoring equipment, including:

- A soft heart-rate strap worn around the chest

- Four small sensors (approximately the size of a 1p coin) attached to the calf, thigh, shoulder and chest

Participants will then enter the climate chamber and complete two assessments of fatigue:

- A brief questionnaire about how tired they feel

- A 3-minute computer task measuring reaction time

Participants will then cycle on a stationary bike at a low, comfortable pace for 30 minutes.

During cycling, they will complete simple cognitive tasks, including basic mathematics and word-colour matching exercises.

Following this, participants will repeat the fatigue assessments before beginning a simulated nursing scenario.

The nursing simulation will take place in the climate chamber, which will be set up to resemble a hospital side room. During the simulation:

- A member of the research team will act as different patients

- Participants will receive a handover describing six patients

- Participants will complete a simulated ward round, including checking observations and administering medications

At two points during the scenario, participants will respond to a simulated cardiac arrest by performing CPR on a training manikin.

Performance during the simulation will be assessed by a researcher using an OSCE-style checklist.

After the simulation, participants will complete the two fatigue assessments again. Once all tasks have been completed, participants will leave the climate chamber and the monitoring equipment will be removed.

What are the possible benefits and risks of participating?

There are no direct benefits to participants. However, participation will contribute to research investigating how heat affects healthcare workers and may help inform the development of safer working environments and strategies to protect staff and patients during periods of hot weather.

Participants will be exposed to different temperature conditions in a climate chamber and may experience fatigue or physical strain associated with the study activities. Monitoring equipment

will be worn throughout testing sessions, and core temperature will be measured using an ingestible temperature-sensing pill.

Where is the study run from?

The study is being conducted at the research laboratory in the Clinical Academic Facility at Southampton General Hospital, University of Southampton, UK.

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

January 2027 to January 2030.

Who is funding the study?

National Institute for Health and Care Research (NIHR), UK.

Who is the main contact?

Prof Davide Filingeri, D.Filingeri@soton.ac.uk

Contact information

Type(s)

Public, Scientific, Principal investigator

Contact name

Prof Davide Filingeri

ORCID ID

<https://orcid.org/0000-0001-5652-395X>

Contact details

Clinical Academic Facility

Tremona Road

Southampton

United Kingdom

SO16 6YD

+44 07837073065

D.Filingeri@soton.ac.uk

Additional identifiers

Study information

Scientific Title

Evaluating nursing performance under environmental stress: a repeated measures cohort study

Study objectives

This study seeks to identify temperature thresholds associated with declines in healthcare worker productivity and patient care quality.

It also aims to investigate the efficacy of cooling interventions (fans or air-conditioning) at keeping staff cool and improving care quality.

Ethics approval required

Ethics approval required

Ethics approval(s)

Submitted 06/07/2026, Ethics and Research Governance Online (University of Southampton, University Road, Southampton, SO17 1BJ, United Kingdom; +44 023 8059 5000; rgoinfo@soton.ac.uk), ref: 114314

Primary study design

Interventional

Allocation

N/A: single arm study

Masking

Open (masking not used)

Control

Uncontrolled

Assignment

Repeated-measures crossover experimental study

Purpose

Health services research, Supportive care

Study type(s)

Health condition(s) or problem(s) studied

The impact of heat stress on nursing performance and physiology in different environmental conditions.

Interventions

Participants will attend the laboratory within the Clinical Academic Facility located at Southampton General Hospital (Southampton, UK) to complete five experimental sessions separated by a minimum of 48 hrs. During the sessions, participants will undertake a simulated nursing ward round whilst exposed to different thermal conditions and with access to different cooling interventions. The study will be a randomised cross-over design, involving three environmental temperature exposures, which will be set to either 18°C (thermoneutral - control), 26°C (hot), or 34°C (very hot), as well as between 2 exposures to the hot (26°C) and very hot (34°C) conditions with the addition of a fan to provide cooling. Sessions will be performed in a counterbalanced order. The order of experimental sessions will be randomised for each participant using a computer-generated allocation schedule. Session order will be balanced across participants as far as possible to minimise order and learning effects.

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Intervention Type

Other

Primary outcome(s)

1. Core temperature measured using the gastrointestinal pill at continuously recorded timepoints

2. Nursing performance measured using Objective Structured Clinical Examination (OSCE) style assessment at continuous timepoints during the assessment

Key secondary outcome(s)

1. Skin Temperature measured using a skin surface wireless thermistor (iButton) at continuously recorded timepoints

2. Heart Rate measured using a POLAR heart rate strap at continuously recorded timepoints

3. Whole Body Sweat Loss measured using a weight change measurement at Pre and Post simulation

4. Fatigue measured using the Occupational Fatigue Exhaustion Recovery (OFER) Scale at before and immediately after the fatigue-induction protocol, and following completion of the simulated nursing shift

5. Vigilance measured using the Brief Psychomotor Vigilance Task (PVT-B) at before and immediately after the fatigue-induction protocol, and following completion of the simulated nursing shift

Completion date

07/01/2030

Eligibility

Key inclusion criteria

1. Capable of providing informed consent
2. Willing and able to attend all visits
3. Healthy human volunteers
4. Aged 18-65 years
5. Physically active (i.e. performing 30 minutes regular exercise of moderate intensity, physical activity on at least 3 days each week for at least 3 months)
6. Qualified nurse

Healthy volunteers allowed

Yes

Age group

Mixed

Lower age limit

18 Years

Upper age limit

65 Years

Sex

All

Total final enrolment

0

Key exclusion criteria

1. Female participant is pregnant
2. Family history of cardiovascular disease
3. Suffering from neurological conditions
4. Suffering from skin conditions (e.g. eczema)
5. Presence of conditions altering thermoregulation and blood flow (e.g. Raynaud's disease)

- 6. Smoker or vaper
- 7. Allergic to adhesives
- 8. History of gastrointestinal obstruction, dysphagia, swallowing difficulties

Date of first enrolment

04/01/2027

Date of final enrolment

15/12/2028

Locations

Countries of recruitment

United Kingdom

England

Study participating centre

University Hospital Southampton NHS Foundation Trust

Southampton General Hospital

Tremona Road

Southampton

England

SO16 6YD

Sponsor information

Organisation

University of Southampton

ROR

<https://ror.org/01ryk1543>

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

Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol file			21/07/2026	No	No
Statistical Analysis Plan			21/07/2026	No	No