Using surface neuromuscular electrical stimulation for lower limb weakness early after stroke: A randomised controlled feasibility study

STIM-STROKE

(Lay Title – A randomised controlled feasibility study to look at using electrical stimulation for leg weakness early after stroke)

Sponsor: University Hospitals Dorset NHS Foundation Trust

Funder: National Institute for Health Research, Research for Patient Benefit

UHD Study ID: UHD51835

REC Reference: 25/NW/0208

IRAS Number: 332116

Trial Registry Number(s): to be completed upon ethical approval

Funder Number: NIHR206227

Protocol Version Number and Date: *Version 1.0 30-4-2025*

The protocol has regard for the HRA guidance and order of content.

i. SIGNATURE PAGE

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the trial in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Sponsor's SOPs, and other regulatory requirements.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor

I also confirm that I will make the findings of the trial publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the trial will be given; and that any discrepancies from the trial as planned in this protocol will be explained.

For and on behalf of the Trial Sponsor:

Signature: ..... Date: 26/06/25

Name (please print):
..... louise Bell .....

Position: Head of Research

Chief Investigator:

Signature: ..... Date: 30/05/25

Name: (please print):

.Kathryn Collins

KEY TRIAL CONTACTS

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Trial Committees:	Trial Management Group Trial Steering Committee Public Advisory Group

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ii. LIST OF ABBREVIATIONS

30 SCSST	*30 Second Chair Sit-to-Stand Test*
AE	*Adverse Event*
AR	*Adverse Reaction*
CI	*Chief Investigator*
CRF	*Case Report Form*
EQ-5D-5L	*Euroqual 5 Dimensions*
GCP	*Good Clinical Practice*
ISF	*Investigator Site File (This forms part of the TMF)*
ISRCTN	*International Standard Randomised Controlled Trials Number*
MRS	*Modified Rankin Scale*
NIHSS	*National Institute of Health Stroke Scale*
NHS R&D	*National Health Service Research & Development*
NPRS	*Numerical Pain Rating Scale*
PI	*Principal Investigator*
PIS	*Participant Information Sheet*
PAG	*Public Advisory Group*
QA	*Quality Assurance*
QC	*Quality Control*
RCT	*Randomised Control Trial*
REC	*Research Ethics Committee*
SAE	*Serious Adverse Event*
SAR	*Serious Adverse Reaction*
SNMES	*Surface Neuromuscular Electrical Stimulation*
SOP	*Standard Operating Procedure*
SUSAR	*Suspected Unexpected Serious Adverse Reaction*
TMF	*Trial Master File*
TMG	*Trial Management Group*
TSC	*Trial Steering Committee*
TUG	*Timed up and Go*
UHD	*University Hospitals Dorset NHS Foundation Trust*
VAS	*Visual Analogue Scale (pain)*

iii. TRIAL SUMMARY

Full Trial Title:	Using surface neuromuscular electrical stimulation for lower limb weakness early after stroke: A randomised controlled feasibility study	
Short Trial Title/Acronym:	STIM-Stroke	
Trial Design:	Mixed methods randomised controlled feasibility study with nested qualitative component (interviews and focus group)	
Trial Participants:	Patients within 2-weeks of stroke (n=60) Caregiver/significant other to person with stroke who was randomised to the experimental group (n=10) Clinicians supporting the trial (n=10)	
Planned Size of Sample:	Patients: We intend to recruit 60 participants over 12-months across two hospital sites, with a 2-month contingency if needed. Sample size estimation is based on feasibility parameters of recruitment uptake to a 10% margin of error for 90% 2-sided and 95% 1-sided CI estimation and adequate precision for estimation of standard deviation (SD) for numerical scales, i.e. allows for a sufficiently precise x 1.1 inflation factor for >80% 1-sided CI estimation of the SD. A purposeful sub-sample (with a representation of ages, gender and stroke severity) of people with stroke from both the experimental group (n=12) and control group (n=8) will be invited to take part in an interview exploring their experience of the study and using the surface neuromuscular electrical stimulation (SNMES) (experimental group). Carers: A purposeful sub-sample of caregivers/significant others to participants in the experimental group will be invited to take part in an interview exploring their experience of supporting the person with stroke to use the electrical stimulation. Clinicians: A purposeful sub-sample of clinicians who suppored the research will be invited to take part in a focus group discussion. There will be around 4-5 participants in each focus group discussion.	
Treatment Duration:	12 weeks	
Follow Up Duration:	Last assessment at 6 months	
Planned Trial Period:	24 months	
	Objectives	Outcome and measurement of Outcome

Primary:	Assess the feasibility and acceptability of lower limb surface neuromuscular electrical stimulation (SNMES) started within 2 weeks after stroke. The feasibility and acceptability objectives are described below. 1. Determine the feasibility and acceptability of the SNMES intervention post stroke, initiated in the first 2 weeks post admission and continued for 12 weeks. 2. Estimate screening, recruitment and attrition rates, and reasons for declining participation or leaving the study early (where possible). 3. Estimate adherence/engagement to the SNMES protocol, including number of sessions completed/total sessions in treatment protocol 4. Determine the acceptability of the outcome measures, data collection methods and data completeness	Inform the development of a definitive trial using the RAG (red, amber, green) methodology exploring recruitment rates, intervention adherence, and completeness of data collected/attrition). The outcomes below are aligned to the study objectives to the left. 1. Interviews with people with stroke and their caregivers as well as focus groups with clinicians to explore their experience and acceptability of the SNMES intervention. Furthermore exploring/tracking adverse events and adverse reactions to treatment with SNMES (a common side effect of electrical stimulation is skin irritation from the electrode pads) will contribute to the feasibility and acceptability of the intervention. 2. Study enrolment rates (the number of patients who agree to take part of those eligible). Where possible reasons for not taking part will be recorded to help plan the definitive trial. Data will be collected on the time duration between hospital admission and randomisation. 3. Through a participant diary, records within the electrical stimulation machine, and participant/caregiver interviews - estimate fidelity to the protocol and reasons why fidelity wasn't achieved. This will help the team to identify if the suggested dose is feasible and acceptable on a larger scale. 4. Through participant/caregiver interviews, therapist focus groups, and completeness of collected data explore the feasibility and acceptability of the outcome measures used. Acceptability of candidate outcomes measures and their variability to inform the selection of outcomes, including

	5. Collect data to inform sample size for a definitive trial 6. Determine whether the protocol can be incorporated within routine clinical practice *7.* Assess the feasibility of delivering SNMES in a range of settings eg. hospital, rehabilitation, home. *8.* Determine if the participant sample is representative of the local areas of recruitment and of national stroke survivors to develop and implement an inclusive recruitment strategy for the next stage. 9. Identify, measure, and value resources required to deliver the SNMES intervention *10.* Pilot data collection tools to measure resource use in the follow-up period to inform the design of a future within-trial economic evaluation.	the primary outcome, for a definitive trial, likely to be the 10 Metre Walk Test. 5. The data collected and outcome measures collected will inform the sample size estimation for the definitive trial. 6. Through participant/caregiver interviews and clinician focus groups explore the practicality of delivering the intervention in the proposed settings (such as the ability for people after stroke to carry out the SNMES intervention, if they need support, the level of caregiver or health care worker) support needed, and the ability to complete SNMES in a variety of settings. This will inform the methods of the definitive trial and if the stimulation protocol can be incorporated into routine practice. 7. Exploring how participants and caregiver experienced using SNMES in the different environments e.g. hospital, home, care home through the interviews *8.* Exploring the diversity of the recruited sample and estimating if this is representative of the wider population of people with stroke will help to inform the development and implementation of an inclusive recruitment strategy for the next stage (definitive trial). *9.* (addressing aim 9 and 10) Through the health economics and resource use questionnaire explore health resources used, costs of health resources, and costs of the interventions to inform the development of the health economics in the future trial. *10.* Through the health economics and resource use questionnaire explore health resources used, costs of health resources, and costs of the interventions to

		inform the development of the health economics in the future trial.
Secondary:	1. Lower Limb Strength 2. Muscle bulk 3. Functional ability 4. Walking ability 5. Quality of life 6. Resource use 7. Disability 8. Pain 9. Sensation	1. Dynamometer, 30 Second Sit-Stand Test, NIHSS Stroke Scale (total score) 2. Limb circumference 3. Barthel Index, 10 Metre Walk Test, 30 Second Sit-Stand Test, Trunk Control Test 4. 10 Metre Walk Test 5. EQ-5D-5L 6. Health Economics Resource Use Questionnaire 7. Modified Rankin Scale 8. Numerical Pain Rating Scale, and the Pain Visual Analogue Scale 9. Sensation testing – Nottingham Sensory Assessment, Tactile Sensation Only
Intervention:	**Treatment Intervention Group:** SNMES to the stroke affected leg for 12 weeks + usual care **Control Group:** Usual care for 12 weeks **Treatment intervention group stimulation process**: SNMES delivers an electrical current via two independent channels. The motor points for stimulation are already known. The clinician will teach the participant and their family/caregivers how to apply, use, and remove the electrode pads and stimulation devices. The general procedure is described below. 1. Treatment with SNMES is provided using a 2 Channel battery operated device. 2. The motor points for the appropriate muscle is identified by the therapist. The clinician will mark this spot with a permanent marker for future sessions. 3. The electrode is placed on the muscle motor point. 4. The stimulator leads are connected to electrodes.	

	5. The limb is positioned in the splint/brace (if using) in a comfortable position to prevent the leg from moving during the stimulation. 6. The stimulator is set at a frequency of 50Hz, Pulse duration: 450 µs; ON:OFF time: 5:10 seconds and an intensity that produces a visible muscle contraction that is comfortable for the participant. The intensity is determined at each individual session. 7. The stimulation will continue for 45 contractions of each muscle group (12 minutes each muscle group – thigh and lower leg), which is around 30 minutes in total including set up and take off time. The muscles at the front and back of the thigh still be stimulated together, the muscles at the front and the back of the calf will be stimulated together. 8. When stimulation is complete the stimulator leads are removed from the electrodes. 9. The electrodes are removed from the skin and stored in their packaging for the next session. This process is repeated for each muscle group. **Control group:** Participants in the control group will not receive the electrical stimulation therapy intervention but will continue to receive all of their usual care.

iv. FUNDING AND SUPPORT IN KIND

Funder(s)	Financial and Non-Financial Support Given
National Institute for Health Research Research for Patient Benefit	Research grant, total value: £247,822

v. ROLE OF TRIAL SPONSOR AND FUNDER

University Hospitals Dorset NHS Foundation Trust will act as the sponsor for this trial and retain all roles and responsibilities this entails. This includes trial design, conduct, data analysis, interpretation, manuscript writing and dissemination of results.

The project is funded by the National Institute for Health Research (NIHR) Research for Patient Benefit (RfPB) funding stream.

vi. ROLES & RESPONISBILITIES OF TRIAL MANAGEMENT COMMITTEES / GROUPS

Trial Management Committees

- Trial Management Group

  - The Trial Management Group (TMG) will have regular meetings to review the study progress, recruitment and data collection.
  - The TMG will ensure all practical details of the trial are progressing well and working well and everyone within the trial understands them.
  - TMG membership will incorporate the CI, co-investigators, public members, and a representative of the sponsor.
- Trial Steering Committee
  - The TSC (Trial Steering Committee) will be a majority independent representation from outside the research project including members of the public.
  - The TSC will meet regularly and send reports to the sponsor.
  - The TSC members will be detailed in a separate Terms of Reference document.
- Public Advisory Group
  - The public advisory group (PAG) is comprised of people with stroke, caregivers to people with stroke.
  - The PAG has contributed to the development of the participant information sheets and participant documents as well as study methods such as recruitment and outcome measures used.
  - The PAG will have regular meetings to discuss the study progress and provide insight into any challenges the study is facing.
  - The PAG will be involved throughout the project regarding study methods, data collection, and dissemination.

vii. PROTOCOL CONTRIBUTORS

Decisions will be made by the TMG but will require approval of the sponsor.

Name	Contribution to the Protocol
Kathryn Collins	Protocol development, research methodology, research background, dissemination, patient and public involvement strategy
Sarah Thomas	Protocol development, research methodology, background, dissemination, patient and public involvement strategy
Louise Johnson	Protocol development, research methodology, dissemination
Dermot McCarthy	Research methodology, development of health economics
Joanne Hosking	Research methodology, development of statistical approach
Anand Pandyan	Protocol development, research methodology, research background, dissemination
Mel Hughes	Patient and public involvement strategy

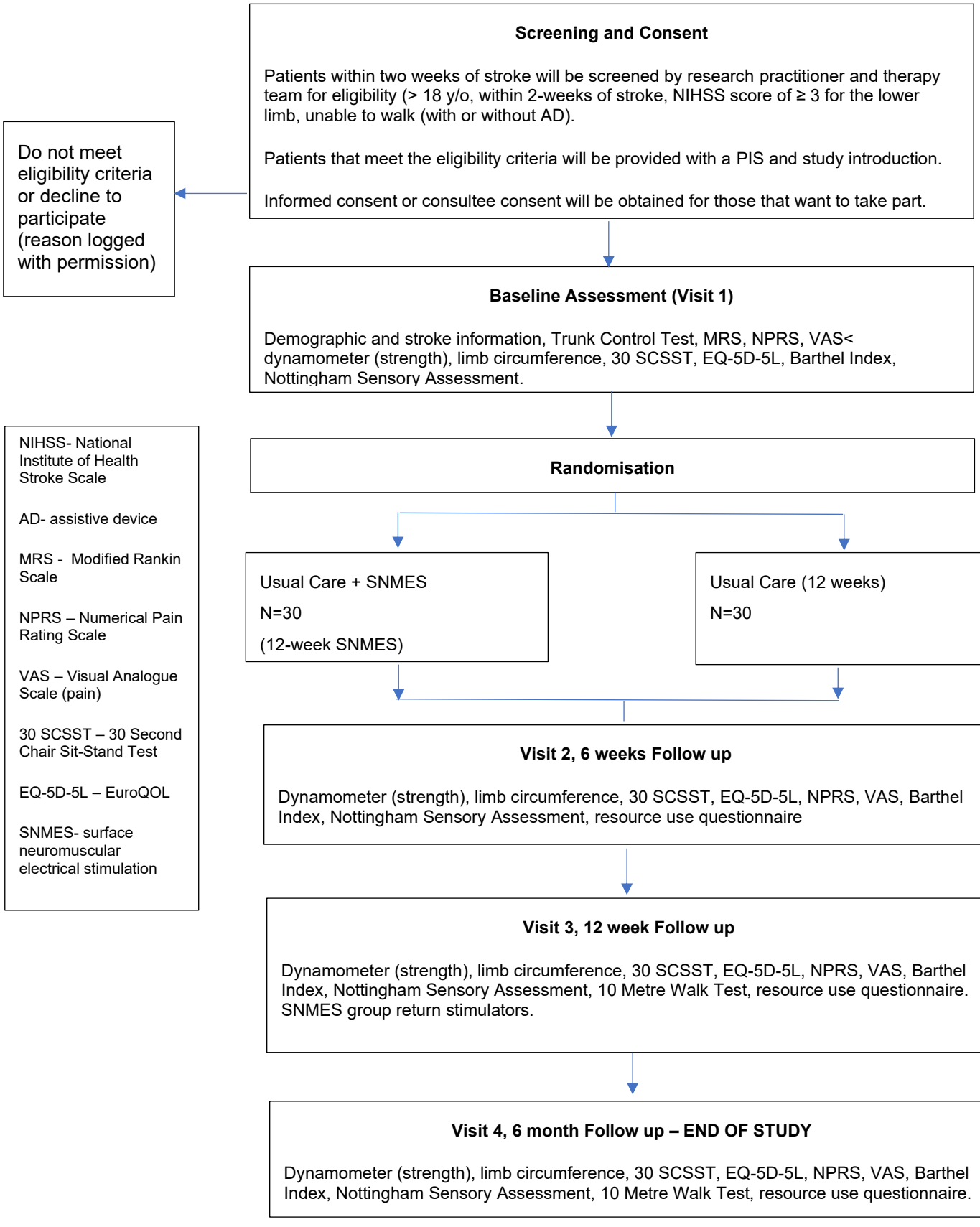
viii. KEY WORDS

Stroke, electrical stimulation, motor recovery, lower limb,

ix. TRIAL FLOW CHART

Patient flow through the trial is described in Figure 1 below.

Figure 1 Trial Flow Chart


Screening and Consent
Patients within two weeks of stroke will be screened by research practitioner and therapy team for eligibility (> 18 y/o, within 2-weeks of stroke, NIHSS score of ≥ 3 for the lower limb, unable to walk (with or without AD).
Patients that meet the eligibility criteria will be provided with a PIS and study introduction.
Informed consent or consultee consent will be obtained for those that want to take part.
Do not meet eligibility criteria or decline to participate (reason logged with permission)
Baseline Assessment (Visit 1)
Demographic and stroke information, Trunk Control Test, MRS, NPRS, VAS< dynamometer (strength), limb circumference, 30 SCSST, EQ-5D-5L, Barthel Index, Nottingham Sensory Assessment.
Randomisation
Usual Care + SNMES
N=30
(12-week SNMES)
Usual Care (12 weeks)
N=30
Visit 2, 6 weeks Follow up
Dynamometer (strength), limb circumference, 30 SCSST, EQ-5D-5L, NPRS, VAS, Barthel Index, Nottingham Sensory Assessment, resource use questionnaire
Visit 3, 12 week Follow up
Dynamometer (strength), limb circumference, 30 SCSST, EQ-5D-5L, NPRS, VAS, Barthel Index, Nottingham Sensory Assessment, 10 Metre Walk Test, resource use questionnaire. SNMES group return stimulators.
Visit 4, 6 month Follow up – END OF STUDY
Dynamometer (strength), limb circumference, 30 SCSST, EQ-5D-5L, NPRS, VAS, Barthel Index, Nottingham Sensory Assessment, 10 Metre Walk Test, resource use questionnaire.
NIHSS- National Institute of Health Stroke Scale
AD- assistive device
MRS - Modified Rankin Scale
NPRS – Numerical Pain Rating Scale
VAS – Visual Analogue Scale (pain)
30 SCSST – 30 Second Chair Sit-Stand Test
EQ-5D-5L – EuroQOL
SNMES- surface neuromuscular electrical stimulation

1. BACKGROUND

Stroke is one of the leading causes of disability in the UK and around the world.[1] In the UK there are around 100,000 strokes per year, increasingly occurring at an earlier age.[2] Advances in the medical management of stroke have reduced mortality but have had little impact on ongoing disability.[3,4] Lower limb weakness is a common stroke-related impairment; around 41% of stroke survivors have lower limb weakness and 46% are unable to walk five days after stroke.[5] As part of the normal ageing process older adults experience muscle wasting called sarcopenia, which can lead to a deterioration in muscle size and strength.[6] Sarcopenia, along with stroke related muscle weakness, can contribute to a greater loss in muscle strength and function such as the ability to stand. Individuals who have lost independent functional movement post-stroke have limited ability to participate in exercises and activities to improve strength and function. [7] The inability to take part in active exercises can lead to a progressive cycle of limited movement which can contribute to further deterioration and poorer functional outcomes. Muscles and joints that are not moved or exercised are also at risk of developing joint contractures.[8,9]

Active exercise can prevent deterioration in muscle size and function; [10] however, people with severe weakness have difficulty taking part. Emerging evidence suggests stimulating muscles with surface neuromuscular electrical stimulation (SNMES) can preserve and improve muscle size and strength in healthy adults [11,12] and in people after stroke.[13] SNMES can increase type I & II muscle fibres,[14,15] muscle fibre diameter [16] and muscle size [17] which are associated with functional improvements in both healthy adults and stroke survivors.[16-21] However, most current SNMES protocols in stroke rehabilitation are aimed at helping muscles to activate during a functional activity [21,22] such as during reaching, walking, or cycling rather than maintaining muscle size and function. This suggests that the current protocols need refinement and extension to individuals unable to take part in active exercise due to muscle weakness.

This project builds on earlier research demonstrating the acceptability of using SNMES in unimpaired adults and people after stroke.[13] SNMES was well-tolerated, with no reported adverse events. It is feasible to use in a clinical setting. Following SNMES, muscle size increased in people after stroke and unimpaired adults, along with spasticity reduction, increased activity and improved gait.[13] This aligns with recent a review and NICE guideance indicating that, when used with functional activities, SNMES/FES (functional electrical stimulation) can improve weakness, coordination and spasticity, shoulder subluxation and walking/gait.[21,23] The evidence is unequivocal that progressive strength training is beneficial after stroke.[24] The updated 2023 National Clinical Guideline for Stroke recommends a minimum of 3 hours of therapist directed therapy per day and that people after stroke are active for 6 hours a day.[25] This intervention will help contribute to those activity and rehabilitation goals. We are proposing to provide SNMES as a treatment for people who cannot actively engage in progressive strength training.

People with severe weakness after stroke who cannot participate in strengthening exercises will continue to have muscle wastage, making the muscles difficult to use when, and if, neuroplasticity (brain's ability to change in response to learning or rehabilitation) occurs. Using SNMES to prevent muscle wasting and maintain muscle size and function may help keep a muscle primed for when the individual is able to actively contract the muscle and participate in exercise and rehabilitation.[13] The proposed SNMES protocol could contribute to an increase in rehabilitation input (minutes), inline with new Clinical Stroke Guidelines [25] and provide a new intervention for people for whom there are few interventions available. Improving muscle size and function early after stroke may lead to an increased likelihood of

return to functional mobility (standing, transferring and walking), improved function, and quality of life.

Aim: The aims of this feasibility study are to i. assess the feasibility and acceptability of SNMES started within 2 weeks after stroke and ii.to provide necessary data to inform the design of a future definitive RCT testing whether SNMES started within one week after stroke prevents muscle wastage and improves recovery of strength, walking and quality of life in people with severe lower extremity weakness.

1.1. Assessment and management of risk

Electrical stimulation is currently being used in routine care physiotherapy practice with minimal reports of adverse events. Electrical stimulation has been incorporated into best practice guidelines for people with stroke as well as people with Multiple Sclerosis. The risk associated with using electrical stimulation within this study is not different to using electrical stimulation within routine clinical practice.

Previous study of electrical stimulation report few adverse events. Common adverse events when they occur are skin irritation at the electrode site, muscle fatigue and soreness following electrical stimulation and joint pain.

Participants will be instructed to let the research team know if they experience any adverse events, these will be monitored as per Section 8 Safety Measures. If participants experience muscle soreness, muscle fatigue, joint pain, or skin irritation they will be supported by the research team to manage this to be able to continue in the study.

The benefits of using electrical stimulation are maintaining muscle bulk and size which will help to prevent atrophy, improved circulation at the stimulation site, and the time doing the stimulation will contribute to additional minutes of exercise which is recommended in the new Clinical Stroke Guidelines.

2. OBJECTIVES AND OUTCOME MEASURES/ENDPOINTS

2.1. Primary objective

The primary aims of this feasibility study are to i. assess the feasibility and acceptability of SNMES started within 2-weeks after stroke and applied for 12-weeks to the weakened lower limb muscles and ii.to provide necessary data to inform the design of a future definitive RCT testing whether SNMES started within two weeks after stroke prevents muscle wastage and improves recovery of strength, walking and quality of life in people with severe lower extremity weakness.

The primary feasibility and acceptability objectives are described below.

1. Determine the feasibility and acceptability of the SNMES intervention started within 2-weeks in people after stroke.
2. Estimate screening, recruitment and attrition rates, and reasons for declining participation or leaving the study early (where possible).

3. Estimate adherence/engagement to the SNMES protocol, including number of sessions completed/total sessions in treatment protocol

4. Determine the acceptability of the outcome measures, data collection methods, and data completeness
5. Collect data to inform sample size for a definitive trial
6. Determine whether the protocol can be incorporated within routine clinical practice
7. Assess the feasibility of delivering SNMES in a range of settings eg. hospital, rehabilitation, home.
8. Determine if the participant sample is representative of the local areas of recruitment and of national stroke survivors to develop and implement an inclusive recruitment strategy for the next stage
9. Through the health economics component we will pilot data collection tools for resource use, will gather costs associated with delivering the intervention and will undertake an exploratory analysis of measured resource use and health-related quality of life. This will help inform the design of an economic evaluation for a future definitive trial including the perspective form which it should be carried out.
10. Pilot data collection tools to measure resource use in the follow-up period to inform the design of a future within-trial economic evaluation.

2.2. Secondary objectives

The secondary objectives of the study are the following:

1. Explore lower limb strength through dynamometer strength testing, functional testing such as the 30 Second Chair Sit-Stand Test, and the 10 Metre Walk test.

2. Explore lower limb muscle bulk through limb circumference measurements, this will help the better understand muscle atrophy related to stroke, muscle weakness, and non-use.

3. Explore functional ability through the Barthel Index, 30 Second Chait Sit-Stand Test, and the 10 Metre Walk test.

4. Explore walking ability through the Barthel Index and the 10 Metre Walk test.

5. Explore sensation through the Nottingham Sensation Scale (tactile stimulation section only).

6. Explore quality of life through the EQ-5D-5L.

7. Explore health resource use through the health resource use questionnaire.

2.3. Outcome measures/endpoints

Feasibility and feasibility measurement

As this is a feasibility study the primary outcomes of interest relate to aspects of feasibility and acceptability. A red, amber, green (RAG) system will be used to identify if the feasibility study should progress to a definitive trial. Section 7.3 Statistical Analysis Plan specifies the RAG system in more detail. The aspects of feasibility and acceptability that will be explored are:

1. Interviews with people with stroke and their caregivers as well as focus groups with clinicians to explore their experiences and views about the acceptability of the SNMES intervention. Furthermore exploring/tracking adverse events and adverse reactions to treatment with SNMES (a common side effect of electrical stimulation is skin irritation from the electrode pads) will contribute to the determining the feasibility and acceptability of the intervention.
2. Study enrolment rates and screening (the number of patients who agree to take part of those eligible). Where possible reasons for not taking part will be recorded to help plan the definitive trial. Additionally. data will be collected on the time duration between hospital admission and randomisation.
3. Through a participant diary, records within the electrical stimulation machine, and participant/caregiver interviews we will estimate engagement with the protocol and explore reasons for low or non-engagement with the protocol/not achieving recommended dose. This will help the team to identify if the suggested dose is feasible and acceptable on a larger scale.
4. Through participant/caregiver interviews, therapist focus groups, and completeness of collected data explore the feasibility and acceptability of the outcome measures used. Acceptability of candidate outcomes measures and their variability to inform the selection of outcomes, including the primary outcome, for a definitive trial, likely to be the 10-Metre Walk Test.
5. The data collected (including those from the outcome measures and participant interviews, data completeness, and standard deviation estimates) will inform the sample size considerations and primary outcome measure for the definitive trial.
6. Through participant/caregiver interviews and clinician focus groups explore the practicality of delivering the intervention in the proposed settings (such as the ability for people after stroke to carry out the SNMES intervention, if they need support, the level of caregiver or health care worker) support needed, and the ability to complete SNMES in a variety of settings. This will inform the methods of the definitive trial and if the stimulation protocol can be incorporated into routine practice.
7. Exploring the diversity of the recruited sample and estimating if this is representative of the wider population of people with stroke will help to inform the development and implementation of an inclusive recruitment strategy for the next stage (definitive trial).
8. Through the health economics and resource use questionnaire explore health resources used, costs of health resources, and costs of the interventions to inform the development of the health economics in the future trial.
9. (To meet aims 9 and 10) Pilot data collection tools to measure resource use in the follow-up period to inform the design of a future within-trial economic evaluation.

2.4. Feasibility Outcomes

The feasibility outcome will be explored at the end of the study. Feasibility data will be collected over the study period at Visit 1 (baseline), Visit 2 (6 weeks), Visit 3 (12-weeks) and Visit 4 (6 months). The final visit at 6 months will provide evidence of if there are any longer-term impacts of electrical stimulation on muscle size, strength, and function. Follow up at the 6-months timepoint is in line with recommendations by the Stroke Recovery Rehabilitation Roundtable as a key timepoint for assessment in stroke research and recovery.[26]

The final analysis will help to inform and develop the definitive trial based on pre-specified RAG (red, amber, green) criteria described in Section 7.3 Statistical Analysis Plan.

Table 1 – Table of Feasibility Outcome Collection

Objectives	Outcome Measures	Timepoint(s) of evaluation of this outcome measure (if applicable)
Primary Objective Assess the feasibility and acceptability of SNMES for 12-weeks to the weakened lower limb muscles started within 2 weeks after stroke. This will be achieved through the following: 1. Estimate screening, recruitment and attrition rates, and reasons for declining participation or leaving the study early (where possible). 2. Estimate adherence and engagement to the SNMES protocol, including number of sessions completed/total sessions in treatment protocol 3. Acceptability of the outcome measures, data collection methods and data completeness 4. Collect data to inform sample size for a definitive trial 5. Determine whether the protocol can be incorporated within routine clinical practice 6. Assess the feasibility of delivering SNMES in a range of settings eg. hospital, rehabilitation, home. 7. Determine if the participant sample is representative of the local areas of	1. Screening logs, recruitment, reasons for declining participation where give, and willingness to be randomised 2. Participant diary of stimulation sessions, data within the electrical stimulation unit, and participant/caregiver interviews 3. Participant/caregiver interviews, therapist focus groups, completeness of collected data 4. Screening rates (reasons for declining), recruitment rates, attrition rates, outcome measures – 10 Metre Walk Test 5. Therapist focus groups, participant/caregiver interviews, protocol engagement and adherence (diary and data in electrical stimulation unit) 6. Participant and caregiver interviews, therapist focus groups, protocol engagement and adherence across settings –diary and data in electrical stimulation unit 7. Diversity of recruited participants compared to the local area and national statistics of people with stroke	1. Screening, 6 week follow up,12 week follow up, and 6 months follow up 2. 6 weeks, and 12 weeks 3. 6 weeks, 12 weeks, and 6 months 4. Screening, 6 weeks, 12 weeks, and 6 months 5. 6 weeks, and 12 weeks, 6 months 6. 6 weeks, and 12 weeks, 6 months 7. 6 months 8. 6 weeks, 12 weeks, 6 months 9. 6 weeks, 12 weeks, and 6 months

recruitment and of national stroke survivors to develop and implement an inclusive recruitment strategy for the next stage 8. Identify, measure, and value resources required to deliver the SNMES intervention 9. Pilot data collection tools to measure resource use in the follow-up period to inform the design of a future within-trial economic evaluation.	8. Resource use questionnaire and therapist focus group 9. Resource use questionnaire	
Secondary Objective 1 Lower limb strength	Dynamometer and MRC Grading	Baseline (visit 1) 6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)
Secondary Objective 2 Functional ability	Barthel Index 30 Second Sit-Stand Test 10 Metre Walk test (visit 3 and 4 only)	Baseline (visit 1) 6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)
Secondary Objective 3 Walking ability	10 Metre Walk Test	12 weeks (Visit 3) 6 months (Visit 4)
Secondary Objective 4 Quality of Life	EQ-5D-5L	Baseline (visit 1) 6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)
Secondary Objective 5 Limb circumference	Tape measure to measure the circumference of the thigh and calf	Baseline (visit 1) 6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)
Secondary Objective 6 Pain in the stroke affected lower limb	Numerical Pain Rating Scale or the Pain Visual Analogue Scale to measure pain in the lower limb that is affected by the stroke.	Baseline (visit 1) 6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)

Secondary Objective 7 *Sensation in the lower limbs*	Nottingham Sensory Assessment, Tactile Subscale only	Baseline (visit 1) 6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)
Secondary Objective 8 Resource use	Resource use questionnaire	6 weeks (Visit 2) 12 weeks (Visit 3) 6 months (Visit 4)

3. STUDY DESIGN

A parallel arm randomised controlled feasibility study with a nested qualitative and health economic component. A feasibility study is being used to explore recruitment, data collection methods, outcome measures, acceptability and feasibility of an SNMES protocol for people with leg weakness within 2 weeks after stroke.

This design will provide necessary data to inform the design of a future definitive RCT testing whether SNMES started within two weeks after stroke prevents muscle wastage and improves recovery of strength, walking and quality of life in people with severe lower extremity weakness.

The study design includes:

1. An RCT comparing a control group of usual care (n=30) versus an intervention group receiving usual care plus SNMES to the weakened leg muscles after stroke (n=30).
2. Nested qualitative component which includes:
    a. Semi-structured interviews with participants with stroke, control group (n=8), intervention group (n=12).
    b. Semi-structured interviews with caregivers to the participants in the SNMES intervention group (n=10)
    c. Focus groups with clinicians who have helped to support the study and participants to use the SNMES (n=10).

4. STUDY SETTING

This is a multicentre study is across two acute trusts, University Hospitals Dorset (UHD) and a second site to be identified. The therapy teams at both sites will be supporting the intervention delivery. The therapy teams will be provided with an in-person training session of the electrical stimulation machines, troubleshooting, setup, removing electrodes at the end, and stimulation machine/electrode storage. The project manager will be available for support if needed.

4.1. Inclusion Criteria

The inclusion criteria for the participants with stroke are:

1. Adults ≥ 18 years of age within two-weeks of diagnosis of acute stroke
2. Sufficiently medically stable to participate in rehabilitation/trial interventions
3. National Institutes of Health Stroke Scale (NIHSS) score of ≥ 3 for the lower limb (limb weakness)
4. Unable to walk or transfer independently (with/without a walking aid)

Inclusion criteria for caregivers to people with stroke

1. Caregiver or family member to participant with stroke this is defined as:

    An informal caregiver (hereafter referred to as caregivers) who is a family member or a close friend in a good relationship with the person with stroke. The caregiver will be older than 18 years of age, and able to communicate and assist the stroke survivor.

2. Participant with stroke they support was in the intervention group (SNMES)

3. Caregiver or family member has the communication skills to be able to participate in an interview

Inclusion criteria for clinicians

1. Health care worker (e.g. but not limited to physiotherapist, occupational therapist, therapy technician/aid, nurse, healthcare assistant)
2. Supported the participants with stroke to use the SNMES during the study period

4.2. Exclusion Criteria

The exclusion criteria for the participants with stroke are:

1. Inability to gain informed consent from the patient or a consultee
2. Inability to walk independently prior to the stroke (with or without a walking aid)
3. Peripheral nerve injury to lower limb muscles
4. Pregnancy
5. Lower limb joint contractures
6. Contraindications to SNMES (DVT, uncontrolled epilepsy, malignancy at site of electrode placement, unstable fracture).
7. Poor skin condition and integrity at electrode sites (e.g. skin infection)
8. Previous stroke with residual lower limb weakness from first stroke
9. Impaired circulation in lower extremities
10. Additional underlying neurological condition e.g. Multiple Sclerosis or Parkinson's Disease
11. Cardiac pacemaker (the number of participants that have a cardiac pacemaker will be collected during screening, this will help to inform the development of the definitive trial and the inclusion and exclusion criteria)

5. TRIAL PROCEDURES

Following completion of the baseline measures, individual participant randomisation will take place. Participants will be randomised to either the intervention group to receive SNMES alongside their usual care or to the control group to receive usual care alone. Participants in both groups will continue to receive their usual care and both will take part in study assessments.

Intervention group

SNMES treatment will be started within two weeks of stroke, and within 4 days of randomisation, to account for randomisation on a Friday and starting the intervention the following week. SNMES will be targeting only the weakened stroke-affected leg muscles of the thigh (hamstring, quadriceps, triceps surae) and calf (anterior tibialis, gastroc soleus). The SNMES intervention will be delivered alongside and in addition to usual care.

Treatment with SNMES is provided using a commercial constant current 2-channel battery operated electrical stimulation device and is designed in line with previous evience. [13]

Participants receiving SNMES will be provided with

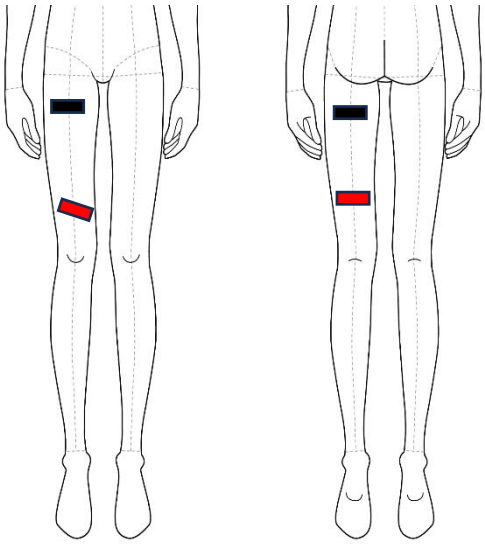
- SNMES stimulator unit
- Knee immobiliser brace
- Ankle foot orthosis

- 4 large electrode pads
- 4 small electrode pads
- An extra 9 volt battery
- SNMES diary (in the format of their choice, written or digital)

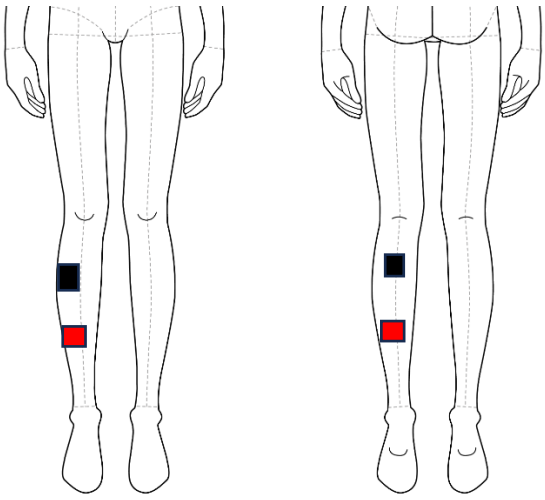
The treating clinician will teach the participant and their family/caregivers how to use the knee and ankle braces, apply the electrodes, set up the stimulator, carry out stimulation, remove the electrode pads, and storage of the electrode pads and stimulation devices. Participants and caregivers will be provided with an instructional booklet containing written information and videos about how to use the electrical stimulation unit, electrodes, trouble shooting, and when to stop electrical stimulation. Participants and caregivers will also be provided with a diary to track their stimulation sessions and reasons for not doing a session.

The general procedure that will be used on each muscle/joint is described below.

1. The motor points for the appropriate muscle will be identified by the therapist. The therapist will mark this spot on the skin with a permanent marker for future sessions. This will help to ensure consistent stimulation.
2. The gel electrode is placed on the muscle motor point of the weak leg (stroke affected leg). Please see the images below.



This picture demonstrates electrode placement on the muscles of the thigh. The picture on the left is the anterior thigh muscles (quadriceps) and the picture on the right is the posterior leg muscles the hamstrings.



This picture demonstrates electrode placement on the muscles of the calf. The picture on the left is the anterior thigh muscles, the anterior tibialis and the picture on the right is the posterior leg muscles the gastrocnemius and soleus.

3. The stimulator leads are connected to electrodes.
4. For participants using the braces, the limb is positioned into a standard lower limb (thigh and calf) brace/splint and ankle foot orthosis (AFO) in a comfortable position. This is to prevent limb movement during the stimulation. Use of the brace will be optional, depending on patient preference and achieving a good limb position.
5. The stimulator is turned on and programmed at the following settings:
    a. Frequency of 50Hz
    b. Pulse duration: 450 µs
    c. ON:OFF time: 5:10 seconds

   d. Intensity is increased until a visible muscle contraction (this is when you can see the muscle move and contract) is produced of the muscle of interest. The intensity is then increased to participant tolerance. The intensity is determined at each individual session.
6. Each muscle will be stimulated for 45 contractions, this is around 30 minutes in total for all four leg muscles (12 minutes for the thigh, 12 minutes for the calf, and 6 minutes for attaching the stimulator to the electrodes and for programming the session).
7. When the stimulation is complete the stimulator leads are removed from the electrodes.
8. The electrodes are removed from the skin and stored in their packaging for the next session.
9. The stimulator and electrode leads are stored in the stimulator box until the next session.

This process is repeated for each muscle group (quads/hamstring, gastroc soleus/anterior tibilais).

SNMES will be carried out three times a week for 12 weeks.

Participants will use the SNMES to create a co-contraction of the anterior and posterior muscles, the muscles at the front and back of the thigh as well as the front and back of the cal. For example, the quadriceps and hamstrings will be stimulated together, and the gastrocnemius, soleus, and anterior tibialis will be stimulated together. This will reduce the treatment time and participant burden. Some participants may find it more comfortable to use without the knee or ankle brace which will make it easier for caregivers to support when the participant is discharged. Some participants may experience incontinence due to their stroke or co-morbidities, not needing to use a knee brace would help with hygiene. Participants will be offered a knee and ankle brace to use if they wish. The research team will collect data around the use of the knee and ankle brace to inform a future trial.

As this is a feasibility and pragmatic trial is it useful to collect data of how participants used the electrical stimulation and braces, what was helpful and what was a hinderance.

Participants will use the SNMES while laying or semi-laying in bed. Position during use of the SNMES will be collected and used to inform a future trial.

The SNMES treatment will be integrated into the rehabilitation of the patient after stroke.

Training and Education on how to use SNMES

The Project Manager or another member of the research team with expertise in electrical stimulation will provide in-person education and training to the therapy (physiotherapists, occupational therapists, and therapy assistants) and nursing teams (including health care assistants) who will be supporting the participants to carry out the SNMES protocol. The education and training will encompass:

- how to use the stimulation unit – setting up the stimulator unit, carrying out the stimulation, turning off the stimulator unit
- electrode placement (finding the motor point on the muscle)
- putting on and taking off the leg brace and AFO
- electrode and stimulator unit storage
- technical support/trouble shooting.

Following the training, the NHS staff will help to facilitate the SNMES intervention. Following the training session, the NHS staff will complete a competency sign off with the project manager or local trust PI to ensure the team are using the stimulation in line with the protocol. The Project Manager and research team will be available for support and questions, as needed.

Education (written and video/audio formats) on SNMES use, putting on/taking off the leg brace, applying the electrodes, connecting the stimulator lead wires, expectations of SNMES, how to use the stimulation, tips for managing common problems, and technical support will be privided to both the participants with stroke, their family/caregivers, as well as to the health care staff on the stroke ward supporting the intervention. The research team contact details will be provided to the therapy teams, participant, their family and significant others supporting them.

Participants in the SNMES intervention group will have an initial treatment session with a qualified therapist who will locate the correct electrode placement for the individual mark this with a skin marker for future sessions. The mark will be updated as needed if it fades. The therapist will educate the patient on the SNMES, troubleshooting, and SNMES current parameters. Following the initial treatment, clinical staff on the ward (including healthcare assistants, nursing staff, and rehabilitation staff band 3 and above) will assist the participant to use the SNMES device 3 times a week for 12 weeks as described above. During this time the therapists will continue to show the patient and their carers how to apply the electrodes and switch on the device to the pre-determined treatment setting so that the patient and family can self-manage the treatment upon discharge where possible. When the participant or their caregiver/family can apply the SNMES on their own they will be able to initiate the treatment sessions independently.

Once set up, SNMES is self-administered and does not require health care staff supervision. Set up and removal of the SNMES stimulators and brace will take around 5-10 minutes for the health care professional, family member, or participant.

When participants are discharged from the hospital, the stimulator and leg braces will go with them to continue the intervention at home, in rehabilitation, or in a care home. The research assistant will work closely with the rehabilitation teams to track where participants are discharged for seamless continuation with the SNMES protocol, data collection, and return of the stimulator when the intervention is complete. If the participant is discharged to a care home or further rehabilitation, or community rehabilitation, the Project Manager or another member of the research team on the delegation log will orient the respective rehabilitation team to the research study. If the team is outside the trust in which the research is taking place, the staff at the care home or other community teams will also complete the skills competency after training and be added to the delegation log. SNMES protocol, and how to do the SNMES intervention (how to position the electrodes, put on and take off the brace, use the stimulator and seek technical support/trouble shooting). This will help to ensure the intervention can continue after discharge from the hospital.

We will ask participants/caregivers to maintain a treatment diary to track treatment sessions. Participants will log when and where they completed an SNMES session, how they felt during the sessions, any barriers or facilitators to the sessions, and reasons for not completing a session. The treatment diary will be available either in a paper or online format participants' preference, having these options was supported by our PPI work. This will help the team to identify what diary format(s) to use in the definitive trial. Furthermore, the number and duration of sessions recorded in the diary will be cross-checked with data logged by the stimulator.

Control Group

Participants in the control group will continue to receive their usual care. Control group participants will take part in all study assessments. A subgroup of 8 participants from the control group will be invited to take part in an interview at the end of the intervention period to explore their experience of taking part in the study.

All participants will complete follow up assessments at 6-weeks (Visit 2), 12-weeks (Visit 3) and 6 months (Visit 4) after randomisation. These assessments will be administered by research practitioners and take place at the trust in which the participant was admitted for their stroke (UDH or the second site). If the participant is not able to walk or completes transfers by hoist the assessment can be carried out in the community at their place of residence. Research team members that undertake assessments in the participant's place of residence and will follow lone working policies associated with the trust.

Follow up Assessments

A summary of the study baseline and follow up assessments are in Section 5.5 and 5.6 as well as in Table 2 in Section 5.6.

5.1. Participant Identification, Screening, and Recruitment

Participants with stroke

The recruitment strategy has been developed in collaboration with the Public Advisory Group (PAG).

Screening and recruitment will be from the acute stroke unit. Eligible participants will be identified through screening of all new and current stroke admissions to the trust. Screening will be completed by a research practitioner (RP); e.g. (but not limited to) research nurse (RN), or research physiotherapist (RPT) as well as clinicians working on the stroke units. The RP will screen new admissions of people with stroke against the eligibility criteria as well as attend ward rounds to facilitate identification of patients that meet the screening/eligibility criteria. Clinical teams that identify someone that meets the eligibility criteria will notify the research team and research practitioners. At both sites, either clinicians in the therapy team or research staff involved in screening are employed by the participating site's R&D team (e.g. research nurses or research physios) routinely have access to patient data as part of their role.

When a RP identifies a patient with stroke who meets the eligibility criteria, they will provide the patient with the participant information sheet. If it is unclear from the chart or ward rounds if the patient is eligible, the RP will refer to the treating therapist to confirm the person with stroke meets the eligibility criteria (e.g. strength and walking ability) prior to providing the participant information sheet.

A detailed screening log will be kept detailing stroke admissions, those meeting the screening eligibility criteria, those that do not meet the criteria and why (which criteria they do not meet), those approached about the study, and reasons for declining if the participant is willing to provide a reason, they do not have to.

If a patient is screened and is meets all eligibility criteria except they are not medically or neurologically stable, they will continue to remain on the screening log and checked on for

10 days. If at 10 days the patient is medically/neurologically stable and meets all inclusion criteria they will be provided information about the study, if they do not meet the eligibility criteria then they will be excluded.

The RP will provide the patients that meet the screening criteria with a participant information sheet (PIS) about the study. The PIS will be in multiple formats to meet the needs of all people after stroke. PIS formats include, written, written easy read, and a video version. The various formats were recommended by our patient and public involvement work to meet the diverse needs of people after stroke (and their caregivers/significant others) this will provide a more equal opportunity for understanding the information and participation.

It will be explained to the potential participant that entry into the trial is entirely voluntary and that their treatment and care will not be affected by their decision. It will also be explained that they can withdraw at any time. In the event of their withdrawal, it will be explained that their data collected thus far (prior to withdrawal) cannot be erased and we will seek consent to use the data in the final analyses where appropriate.

When participants provide consent they will be providing consent to the RCT as well as to the qualitative study which are semi-structured interviews. A subgroup of participants in the SNMES group (n=12) and in the control group (n=8) will take part in a semistructured interview. The subgroup will reflect the range of functional ability in the study, to understand participant experiences.

Clinician and Health Care Professional Participants

Clinicians (therapists, nurses, health care assistants) who have supported the participants with stroke to carry out the SNMES intervention will be invited to take part in a clinician focus group discussion. They will be recruited from participating NHS sites via announcements at team meetings and research project updates in which participant information sheets will be provided to those that are interested in taking part. It will be made clear that taking part or not taking part will have no impact on their job within the NHS or their ability to continue to support the study.

Those that are interested in taking part will contact the project manager or research team and complete a form giving their permission to share their contact details with the research team to allow them to discuss the focus group discussion.

The focus group discussions will take place after the the completion of the study intervention period.

Caregiver Participants

A convenience sample of caregivers/family members who supported the participants with stroke to use the SNMES will be invited to take part. To understand a range of experiences the team will aim to purposively sample caregivers to participants with stroke with a range of functional abilities.

Caregivers will be provided with brief explanation of the interviews and study and will be given a caregiver PIS at the baseline assessment (Visit 1). Caregivers that are not present at the baseline assessment the caregiver PIS will be left for them with the person with stroke. Those that are interested will be able to contact the project manager or research

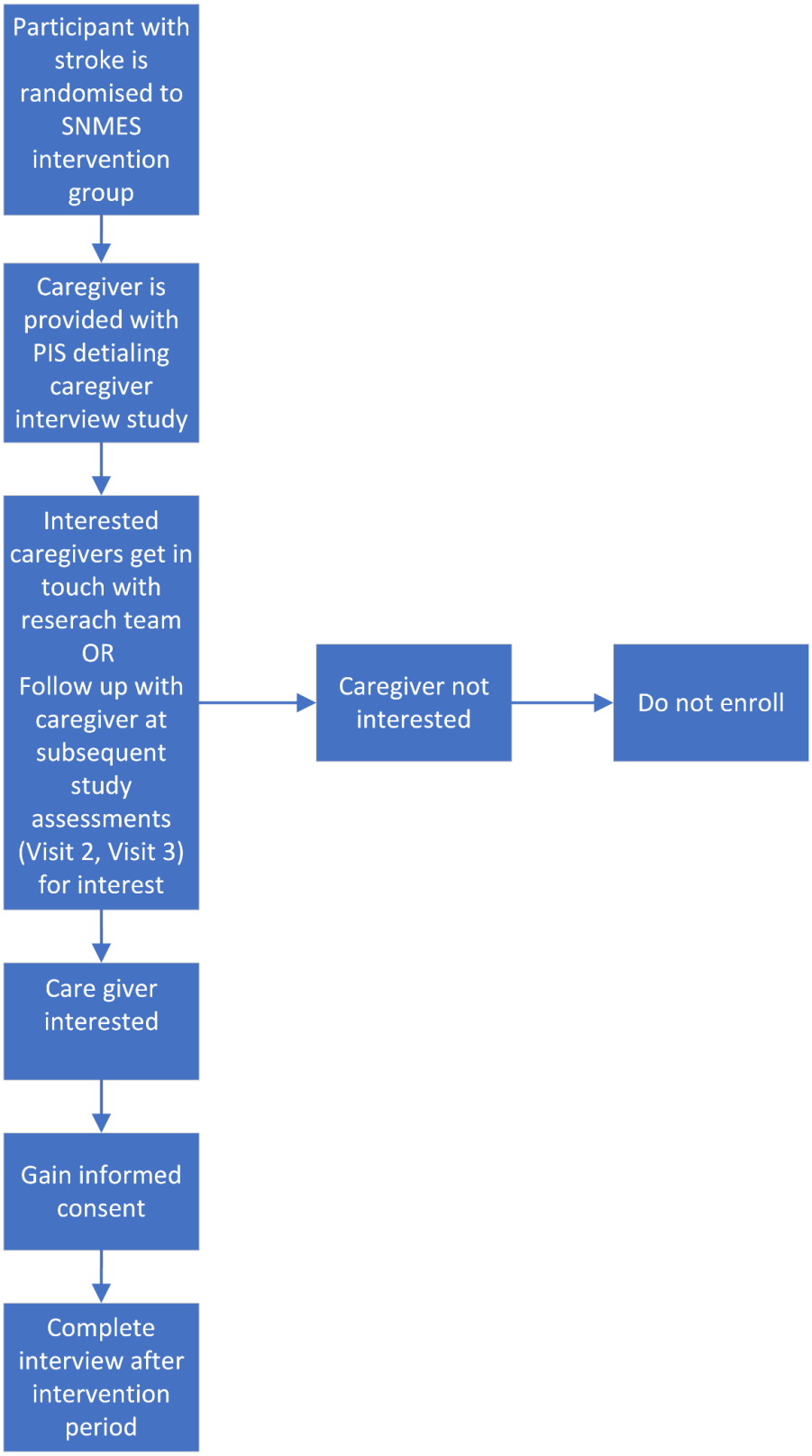
team via phone or email to let them know of their interest. The research team will follow-up with the caregiver at Visit 2 and Visit 3 to explore their interest in the interviews if they have not been in touch with the research team.

Interested caregivers will complete a form giving their permission to share their contact details with the research team to discuss the study and potential qualitative interview.

The interviews will take place after the intervention period around Visit 3 (12-week follow-up).

It will be made clear that the team are not able to interview everyone who responds that is interested but that a subgroup of those willing to take part in an interview will be interviewed.

. Figure 2 Caregiver Study Flow Chart



5.1.1. Payment

Participants are not paid to take part in the research. Participants and caregivers will be reimbursed for travel expenses to the follow up assessments if they have been discharged from the hospital e.g. Visit 2 (6-week), Visit 3 (12-week), and Visit 4 (6-month) follow-up assessments as well as interviews if completed in person.

5.2. Consent

The process of recruitment and receiving consent will be led by members of the research team at participating sites who have been trained in informed consent, the study methods, the principles of Good Clinical Practice (GCP) and the Declaration of Helsinki. The individuals recieving consent will be included on the delegation log.

Participants in the study are the person with stroke, caregivers to the people with stroke if they are taking part in a caregiver interview, and the clinicians working on the stroke units.

5.2.1 Patients with Stroke

Individuals that meet the inclusion criteria will be provided with verbal and written information including a PIS (described above) in the format(s) of their choice. Potential participants will be given at least 24 hours to consider if they want to take part. Patients will be encouraged to speak to their family and friends about the study and ask any questions they may have.

Individual participant informed consent will be taken for participation in the study (both the quantitative aspects and qualitative aspects). Individuals will be made aware that a subgroup of participants will be included in the qualitative study and they may or may not take part in the qualitative component.

5.2.1.1 Consent for participants with stroke deemed to not have capacity

Following stroke, is it likely that a proportion of potential participants will be unable to independently make a decision about taking part in the trial (i.e. lack capacity), but otherwise meet the inclusion criteria. This is particularly relevant in the early phase following stroke, where capacity may be borderline or fluctuating, but the person is otherwise engaging in their rehabilitation. For example, an individual may be able to understand the general nature of the research and what participation would involve but may not fully understand that their data will be used for a research study.

To maintain relevance and ensure generalisability of the findings, it is important to be inclusive when inviting people to take part, additionally the PPI group felt all patients should be given the opportunity to take part. The trial will therefore include participants who do not have capacity to consent to participation. This is deemed appropriate given that:

- Risks associated with the study intervention are negligible
- Electrical stimulation is used in routine physiotherapy practice; we are using it in a new and different way

5.2.1.2 Process for assessing capacity

If the approaching clinician/research practitioner expresses doubt about the person's ability to provide informed consent for the study they will conduct a capacity assessment. If the

patient meets the criteria laid out in the Mental Capacity Act,[26] a capacity assessment will be completed.

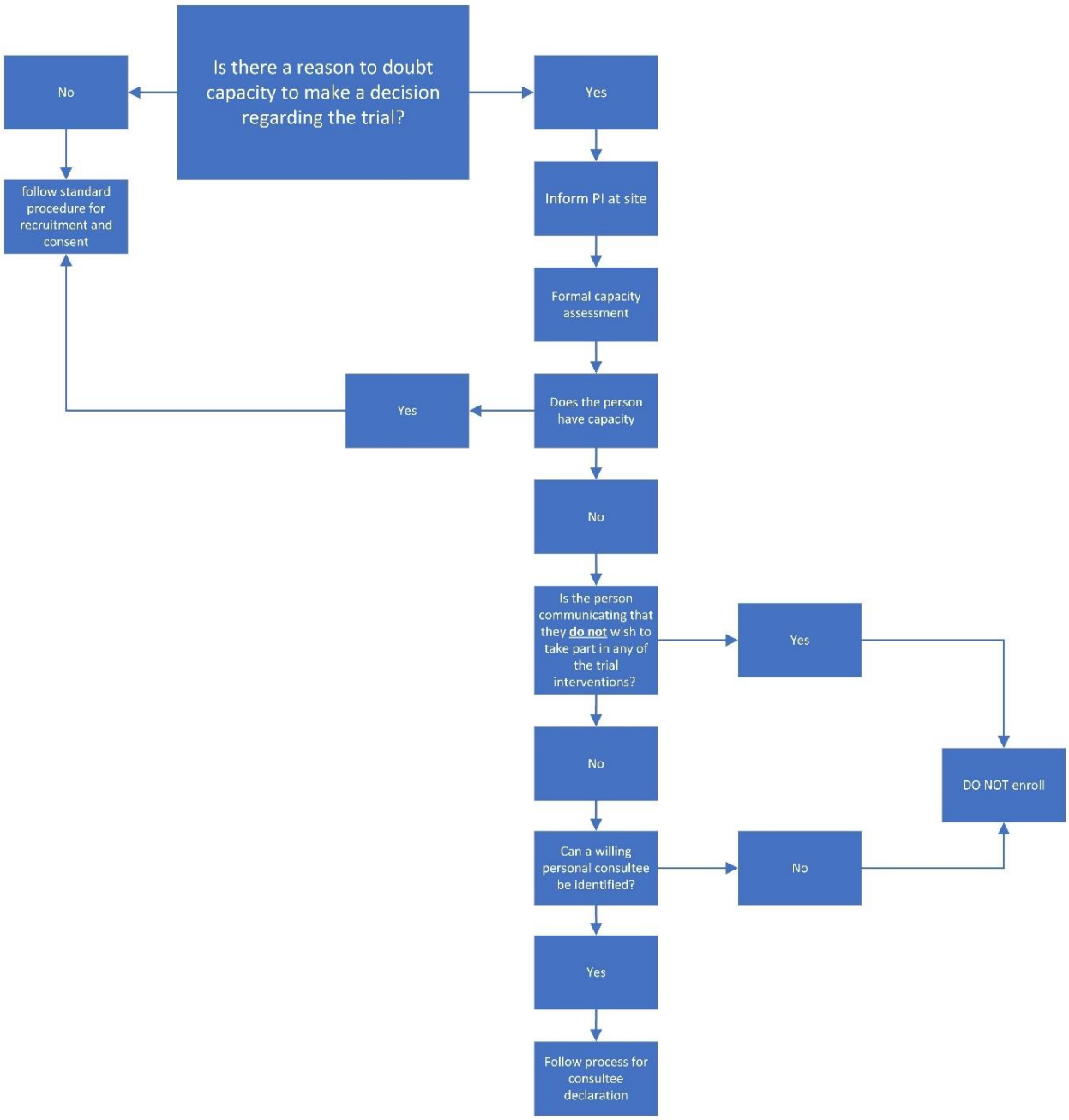
The capacity assessment will be completed by a member of the clinical/research team who are trained in capacity assessment, understand the detail of the research study, and have delegated responsibility (such as a Research Practitioner or clinician) on the delegation log. The trusts will follow their local procedures for capacity assessment using their local forms and documentation to document the capacity assessment in the patient's medical notes.

Where appropriate, the person completing the capacity assessment may request assistance from a member of the clinical team, such as a Speech and Language Therapist (SLT) or Psychologist, to aid assessment. SLT will provide particular expertise to ensure that people with a language impairment as a result of their stroke are given appropriate and individualised support to understand the information that is presented to them, and to communicate their thoughts and wishes. The Easy Read PIS version, or the video PIS version will be used to support this process.

Irrespective of whether or not someone has capacity, the views expressed by the person will be given precedence when deciding whether or not to proceed. In people who are deemed to lack capacity, any views that are expressed through the facilitated conversation will be given priority when deciding whether or not to pursue a consultee declaration. For example, if the patient expresses anxiety about any part of research process, such as using electrical stimulation, then we will not proceed with seeking a consultee declaration. We will not enrol anyone in the trial who communicates that they do not wish to participate in any aspect of the study. Participants are free to withdraw from the study at any time without giving a reason. Withdrawing from the study will have no effect on their usual rehabilitation.

The process for assessing capacity is described below in Figure 3.

Figure 3 Process for Capacity Assessment



Process for gaining a consultee declaration for the participant with stroke

If a potential participant is deemed unable to consent to the study (i.e. they lack capacity), then a personal consultee (usually the next of kin or close friend/relative) will be asked to consider whether they would be willing to provide consent on their behalf, based on the presumed wishes of the potential participant. The personal consultee will be identified through collaboration with the clinical team working with the person with stroke.

The full version of the Consultee Participant Information Sheet will be shared with the identified consultee as well as the Easy Read PIS, or video PIS if requested. If the consultee feels that joining the study would be something the person with stroke would want to do, they will be asked to sign the consultee declaration form, on behalf of their relative/friend.

In the event that a personal consultee cannot be found for someone who is deemed to lack capacity, the person lacking capacity would not be able to participate in the study.

At all times, the wishes of the participant will be upheld. If the participant does not want to continue with the study, they are able to withdraw at any time without giving a reason. Leaving the study will have no impact on their usual rehabilitation or medical care.

Process if a participant with stroke gains capacity during the study

It is feasible that a participant who did not have capacity to provide informed consent at the beginning of the study, regains the ability to do so at some point during the study. The therapists who are delivering the treatment interventions, as well as the research team, will be briefed with regards to this. The participant's mental capacity will be reassessed. If, at this point, the person is deemed to have capacity to make a decision regarding participation in the research, they will be provided with the study information (PIS in the format of their choice) and will be supported to make this decision. If they opt to withdraw from the study, they can do so, without consequence.

Therefore, the Consultee Declaration only applies for as long as the participant lacks capacity. Data collected up to this point will be included in the final analysis, unless the individual explicitly asks for it not to be.

Stroke teams manage issues relating to capacity on a frequent basis and are therefore typically very aware of the principles of the Mental Capacity Act, capacity assessments and informed consent.

Process if a participant with stroke loses capacity during the study

Although unlikely, a participant who gave informed consent at the point of recruitment, may lose capacity during the course of the study. It is likely that any loss of capacity at this stage reflects medical instability - such as a further stroke, infection, or other medical event.

The study will adhere to the principles, as laid out and defined in the Mental Capacity Act (2005). At the time of the person consenting to the trial, they have expressed a wish to participate. Therefore, the person will remain in the study, as long as it is appropriate clinically, and there is no observable or communicated evidence that they do not wish to continue.

If the individual has had a change in medical status is communicating that they do not wish to continue in the trial, or are demonstrating an unwillingness to participate in any of the trial interventions (e.g. electrical stimulation or assessments), then the trial intervention/follow-up would be paused for 7 days. Furthermore, participants that have a change in medical status during the trial will have the trial interventions (e.g. SNMES) and follow up assessments

paused for up to 7 days (less if medical status improves sooner). During this time the research team and clinical team will monitor the participants medical situation and a member of the research team will re-evaluate if they are stable to continue with the trial with the following outcomes:

- Participants who are medically stable and want to continue will continue with the trial.
- Participants that are medically stable but do not want to continue with the trial will be withdrawn.
- If the participant is identified to not be medically or neurologically stable irrespective of capacity the person will not be clinically appropriate to remain in the trial and will be withdrawn.

Consent process for clinicians

Clinicians who have been involved in supporting participants in the study will be invited to take part in a focus group discussion with other clinicians at the end of the intervention period. Clinicians will have an opportunity to decide if they would like to take part and have all their questions answered.

It will be made clear that their decision to take part or not take part in the focus group discussion will have not impact on their job role in the NHS or their ability to continue to support this research project. They are able to withdraw their consent and participation at any time without giving a reason which will also have no impact on their job.

Clinicians providing informed consent are consenting to take part in one focus group discussion. Consent will be obtained either through electronic consent via REDCap or via paper consent depending on their preference.

Consent process for caregivers

A subgroup of caregivers and significant others who have supported the person with stroke in the SNMES intervention group will be invited to take part in a semi-structured interview after the intervention period. The caregivers will be provided a PIS, be given time to review the information and have all of their questions answered. It will be made clear their participating or not participating will have no impact on the person with stroke continuing in the study or impact on their care in any way.

Caregiver will be consenting to take part in a semi-structured interview that will last around 30-45 minutes. Caregivers will provide either electronic consent via REDCap or paper consent depending on their preference.

Caregivers are free to withdraw at any time without giving reason. Withdrawal or not consenting to take part will have no impact on the person the caregiver supports to continue in the study or the health care they receive.

5.3. Randomisation

Once individuals/their consultees have consented to take part in the study and their baseline outcome measures have been completed the participant will be randomised in a 1:1 ratio, stratified by site to receive either SNMES or usual care via REDCap.

The randomisation sequence using random permuted blocks will be generated by a statistician outside of the trial team and implemented using a centralised independent web-based randomisation system set up within REDCap.

The PI at the respective site or other trained clinician (on the delegation log) will undertake randomisation. This will allow the research practitioner doing the study assessments every attempt to be blinded to group allocation.

5.4. Blinding

Participants will not be blinded to group allocation as they will know if they are receiving SNMES or usual care on its own. Participants will be educated to not disclose their intervention group to the individual who is doing their study assessments,

Clinical teams will not be blinded to the participants group allocation as the clinicians will be supporting the participants to use SNMES.

Every attempt will be made to blind research practitioners doing the outcome assessments. To explore blinding, research practitioners doing the outcome assessments will make a guess as to which group the participant was in at Visit 3 (described below). Research practitioners will record if they were unblinded to group allocation and how this happened (e.g. saw the equipment, participant told them). The findings from this feasibility study will inform the design and blinding strategy of the subsequent definitive trial.

Have you been unblinded? Yes, No

If yes

Disclosed

Observed equipment

Other

Guess which group the participant was in – control or intervention

Rationale – free text

5.5. Baseline data

At baseline standardised outcome measures as well as demographic data will be collected. Demographic data collected from participants is based on research recommendations from Kwakkel and colleagues (2017) “Standardized Measurement of Sensorimotor Recovery in Stroke Trials: Consensus-Based Core Recommendations from the Stroke Recovery and Rehabilitation Roundtable. [27] The demographic data collected is outlined below:

- Age
- Sex (assigned at birth)
- Ethnicity

- Medical history
- Premorbid function (Modified Rankin Scale)
- Education level
- Socioenonomic status via postcode
- Pre-stroke walking ability
- Pre-stroke living arrangements
- Stroke severity (NIHSS total score along with leg score)
- Active hand movement at stroke onset
- Stroke type (ischaemic/haemorrhagic), subtype (e.g. lacunar, large artery, other-carotid dissection) and location (e.g. internal capsule, middle cerebral artery)
- Thrombolysis or re-perfusion therapy
- Imaging -stroke confirmed on imaging (CT/MRI)

The data will be collected via chart review and through participant interview that the research practitioner will complete. This data will help the team to identify if the people recruited to the study are representative of the wider population of people with stroke.

The outcome measures are briefly described in the next section 5.6 and in Table 2. Appendix 3 details how the outcome measures will be completed.

5.6. Trial assessments

Trial assessments will take place at baseline (Visit 1), 6-weeks after baseline (visit 2), 12-weeks after baseline (Visit 3), and 6-months after baseline (Visit 4). Please refer to Table 2 below for details regarding what data is collected at each visit.

Data at each visit will be collected by the research practitioner who is trained in carrying out each assessment and is documented in the delegation log.

The assessment window for Visit 2 is +/- 3 days to account for the weekend in which research practitioners would not be working. The assessment window for Visit 3 and visit 4 is +/- 7 working days. It is not expected that at Visit 3 or Visit 4 there will be rapid changes in function thus the longer assessment window.

Please see Appendix 3 for complete details and instructions for how to complete each assessment.

Table 2 Schedule and Rationale of Assessments

Measure	**Brief Description**	**Screening**	**Visit 1 (baseline)**	**Visit 2 (6-weeks)** **(+/- 3 days)**	**Visit 3 (12 -weeks)** **(+/- 7 days)**	**Visit 4 (6 months)** **(+/- 7 days)**
NIH Stroke Scale (NIHSS)	Assess leg strength and ability of the stroke affected leg.	X				
Trunk Control Test (unsupported sit)	Assesses trunk control, trunk strength, and unsupported sitting balance. There is evidence that better trunk control/sitting balance is associated with return to walking.		X			
Walking ability	Assessment of if the person can walk without support. Participants will be included if they need support and help to walk.	X				
Modified Rankin Scale	Assesses function and ability/disability after stroke.		X			
Numerical Pain Rating Scale	Assessment of pain, rating scale from 0 no pain to 10 extreme pain in the stroke affected leg.		X	X	X	X

Measure	Brief Description	Screening	Visit 1 (baseline)	Visit 2 (6-weeks) (+/- 3 days)	Visit 3 (12 -weeks) (+/- 7 days)	Visit 4 (6 months) (+/- 7 days)
Dynamometer	Assess the strength of muscles of the thigh and calf (Quadriceps, hamstrings, gastroc soleus, and anterior tibialis).		X	X	X	X
Oxford Grading Scale/Medical Research Council Scale	Measure of strength of the lower limb rating from 0/5 no muscle activity to 5/5 full strength against resistance.		X	X	X	X
30 second chair sit-stand test	Number of sit-to stands and stand-to sits in 30 seconds, this assesses functional ability, lower extremity muscle power, and muscles endurance.		X	X	X	X
Limb circumference	This is to assess muscle bulk and track potential muscle atrophy (muscle wasting) through measuring the circumference of thigh and calf with a tape measure.		X	X	X	X
EQ-5D-5L	Assessment of health-related quality of life.		X	X	X	X

Measure	Brief Description	Screening	Visit 1 (baseline)	Visit 2 (6-weeks) (+/- 3 days)	Visit 3 (12 -weeks) (+/- 7 days)	Visit 4 (6 months) (+/- 7 days)
Barthel Index	Assesses the ability to perform everyday activities e.g. dressing, bathing, walking, toileting.		X	X	X	X
Nottingham Sensory Assessment – Tactile Sensation Subsection	Assesses the participants sensation to light touch on the lower limbs.		X	X	X	X
10 Metre Walk Test	Assesses walking ability and function. Measurement of the time it takes to walk 10 meters (with or without an assistive device).		(not completed due to inclusion criteria not being able to walk)	(not completed due to inclusion criteria not being able to walk)	X	X
Resource use Questionnaire	Health resources and therapy accessed (e.g. travel costs to appointments, number and length of healthcare visits, support at home) over the course of the study.			X	X	X

Measure	Brief Description	Screening	Visit 1 (baseline)	Visit 2 (6-weeks) (+/- 3 days)	Visit 3 (12 - weeks) (+/- 7 days)	Visit 4 (6 months) (+/- 7 days)
Semi-structured Interview participants with stroke and their caregivers.	Interviews with participants and their caregivers to explore their experience of the research, using SNMES, and their acceptability of SNMES. There will be n=12 participants interviewed from the intervention group, n=8 from the control group, and n=10 caregivers to the person with stroke in the intervention group.				X (convenience sample of participants with strokes will be interviewed) And (convivence sample of caregivers to participants with stroke receiving SNMES will be interviewed)	
Clinician Focus Group	Focus group with clinicians (n=10) will explore their perspectives on the feasibility and acceptability of the intervention and research processes.					X (convivence sample of clinicians supporting the intervention will take part in a focus group; at

Measure	Brief Description	Screening	Visit 1 (baseline)	Visit 2 (6-weeks) (+/- 3 days)	Visit 3 (12 - weeks) (+/- 7 days)	Visit 4 (6 months) (+/- 7 days)
						the end of the intervention period)

Modified Rankin Score

The Modified Rankin Score (MRS) is a standardised outcome measure assessing disability after stroke. The MRS has demonstrated reliability (e.g. kappa ranging from 0.56 to 0.78).[28] The MRS score ranges from 1 no symptoms at all to 6 dead.

Trunk Control Test

The unsupported sit, item 3, of the Trunk Control Test will be used to assess sitting balance, trunk control, and trunk muscle strength. The Trunk Control Test has demonstrated reliability (e.g. r=0.76) in people with stroke.[29]

Numerical Pain Rating Scale

Participants will rate their pain in their hemiparetic (stroke affected) limb using the Numerical Pain Rating Scale (NPRS). The NPRS scoring is from 0 no pain to 10 extreme pain. The NPRS has demonstrated reliability and validity.[30]

Pain Visual Analogue Scale

Participants with changes to cognition or communication will rate their pain on the visual analogue scale (VAS) which is a 10-centimetre line. The left side of the line represents no pain (0 cm) and the right side of the line represents extreme pain (10 cm). The participant will point to their pain along the line, the distance is measured from the left (0 cm) to where the finger, this is the participants pain out of 10. The VAS has reported validity and reliability [30]

Handheld Dynamometry

Handheld dynamometry will be used to evaluate muscle strength of bilateral lower limbs. Handheld dynamometry has demonstrated inter-rater and intra-rater reliability in acute stroke ICC=0.99 and ICC-0.85 respectively.[31]

Medical Research Council (MRC) Manual Muscle Testing

The MRC scale, also called the Oxford Grading scale is a standardised outcome measure used to assess muscle strength. Muscle strength is graded on a numerical rating scale from 0 no detectable contraction to 5 normal strength. [32]

30 Second Chair Stand Test

The 30 second Chair Stand test (30s CST) is a measure of function and lower extremity power. The test measures how many times a person can stand from a chair 43 cm high with their arms crossed in 30 seconds. The 30s CST has demonstrated interrater and intrarater reliability in people after acute stroke ICC= 0.88-0.94 and ICC=0.87-0.91 respectively.[33]

Limb circumference measurement

Muscle size (bulk) will be assessed using limb circumference measurements measured in mm of the thigh and calf of bilateral lower extremities. Limb circumference has demonstrated reliability and validity.[34,35]

Nottingham Sensory Assessment

Sensation in the lower limbs will be assessed using the Nottingham Sensory Assessment, Tactile Sensation subscale. There is demonstrated reliability of the tactile subsection in people with intracranial disorders. [36]

EuroQol – 5 Dimensions-5 Levels

EQ-5D-5L (EuroQol) is a patient-reported quality of life measure evaluating 5 domains mobility, self-care, usual activities, anxiety/depression, pain/discomfort. The EQ-5D-5L has demonstrated good reliability (k between 0.63- 0.80)34 responsiveness, and minimal clinically important difference in people following stroke.[37,38] The EQ-5D-5L is available both in paper format and an online format.

For participants who have changes to cognition or communication who are not able to complete the EQ-5D-5L proxy completion will be used. The proxy completion will be by a family member, caregiver, or significant other who can report on the person's function and quality of life. Proxy report for people with stroke demonstrates greater agreement for more observable questions e.g. mobility and self-care as well as greater agreement 6 months after stroke versus within 2-3 weeks after stroke.[39]

Barthel Index

The Barthel Index is a patient-reported measure of function and activities of daily living. The Barthel Index has 10 items/questions around activities of daily living including: feeding, bathing, grooming, dressing, bowel control, bladder control, toileting, chair transfer, ambulation and stair climbing. Each item is rated from 0 dependent, 5 needs some assistance, to 10 independent. The Barthel Index has demonstrated good reliability and validity in people following stroke.[40,41]

10-Metre Walk Test

The 10-Metre Walk Test is a measure of functional ability in which an individual is timed walking at a comfortable speed for 10 metres. When used in people after stroke, the 10-metre walk test is reliable (ICC=0.83) and has demonstrated minimal detectable change.[42] If this study progresses to a definitive trial the 10 Metre Walk Test will be the primary outcome measure.

Resource Use Questionnaire

The resource use questionnaire will track the participants use of health care services such as number of physiotherapy or occupational therapy appointments, nurse appointments, GP appointments, any support at home from a carer, support for cooking and clearing at home, and costs to travel to appointments etc.

Semi-structured interview

Please see section 5.8 Qualitative Assessments for complete details. A brief description of the semi-structured interviews and focus group discussions are below.

Participants with stroke

A convenience sample of eight participants from the control group and 12 participants from the intervention group will be invited to take part in a semi-structured interview. The sample will be representative of the participants that took part in the study e.g. level of functional ability.

The semi-structured interview will explore the participants experience of the study, recruitment methods, randomisation, data collection, and SNMES if they were in the experimental group. The semi-structured interview will be between 30-45 minutes. People with communication difficulties will be supported to take part.

Caregivers

A convenience sample of 10 caregivers who supported participants with stroke in the SNMES group will be invited to take part in a semi-structured interview. The sample will be representative of the participants that took part in the study e.g. level of functional ability.

The semi-structured interview will explore the caregivers experience of the study, the study methods, and supporting the person with stroke to use the SNMES. The semi-structured interview will be between 30-45 minutes.

Clinicians

A convenience sample of 10 clinicians will be invited to take part in a focus group discussion.

The focus group will explore the clinicians' experience of the study, recruitment methods, data collection, SNMES. The focus group will be between 45 minutes and 1 hour.

5.7. Long term follow-up assessments

The intervention period is 12 weeks. Participants will have an assessment at the end of the follow up period, Visit 3 at 12-weeks, and one follow-up assessment after the end of the intervention period, this is Visit 4 and is 6 months after randomisation. The table below outlines the assessments that will be undertaken at Visit 4 and the rationale. Please refer to the previous section 5.6 Trial Assessments and Table 2 for details and rationale for each assessment, and Appendix 3 for details of how to carry out each assessment.

5.8. Qualitative assessments

Participants with Stroke

A subgroup of participants from the intervention group (n=12) and control group (n=8) will take part in a semi-structured interview which will be offered online, in-person or over the phone depending on the participant preference. The process of recruitment is in section 5.1. Interviews will be audio recorded for transcription. The interviews will be between 30-45 minutes and will take place after completing the 12-week intervention. The interviews will be conducted by a member of the research team who has experience in and has been trained in interviews and is on the delegation log, they will be supported by the team.

The sample size in the nested qualitative component (n=20) will be adequate to reach data saturation based on recent research around code and meaning saturation in qualitative research.[43]

A convenience sample of participants will be sought to take part in the interviews. The convenience sample will be representative of the participants with stroke recruited to the trial e.g. functional level, other associated impairments. Participants with communication difficulties will be supported to take part; their views and experiences are important and valued.

Participants with stroke interviews will explore their experiences of the study, recruitment, randomisation, data collection methods, acceptability of taking part in the research, and suggestions for future improvement. Participants from the SNMES group will further explore the recommended SNMES protocol, engagement with the SNMES sessions, ease of using the leg brace, ease of using the stimulator and suggestions for future improvement. The interview topic guide will be informed by the Theoretical Framework of Acceptability.[44] The

topic guide will also be developed with input from the public advisory group (PAG) input and will be iteratively refined during the interviews.

Clinician Participants

A convenience sample of clinicians(e.g. therapists, nurses, health care assistants) who have supported the participants with stroke to carry out the SNMES intervention will be invited to take part in a focus group. Please see above Section: Screening, Identification, and Recruitment above for details on the identification and recruitment process.

Focus groups (n=2) will include between 4-5 clinicians, take place at the trust they are working in, or online depending on the group preference and will last around 45 minutes.[45] Focus groups will be audio recorded for transcription. Focus groups have the advantage of social interaction between participants and allow for consensus or debate around a topic providing rich meaningful data to help to develop the SNMES intervention and future research methods.[46] The focus group will be conducted by a member of the research team who has experience in and has been trained in interviews (qualitative methods) and is on the delegation log, they will be supported by the team.

The clinician focus groups will explore recruitment methods, ease of using the stimulator, ease of donning and doffing the knee and ankle brace, participant adherence from their perspective (barriers and facilitators), study methods, and their thoughts and attitudes. attitudes towards the intervention. If the intervention is successful, the goal would be adoption into practice. The interview topic guide will be informed by the Theoretical Framework of Acceptability.[44] The topic guide will also be developed with input from the public advisory group (PAG) input and will be iteratively refined during the interviews.

Caregiver Participants

A convenience sample of caregivers/family members who supported the participants with stroke to use the SNMES will be invited to take part in a semi-structured interview. To understand a range of experiences the team will aim to purposively sample caregivers to participants with stroke with a range of functional abilities and impairments.

Interviews will be offered online, in-person or over the phone depending on the caregiver participant preference. Interviews will be audio recorded for transcription at a later date. The interviews will be between 30-45 minutes and will take place after the participant with stroke has completed the 12-week intervention period. The interviews will be conducted by a member of the research team who has experience in and has been trained in interviews (qualitative methods) and is on the delegation log, they will be supported by the team.

Caregiver participant interviews will explore their experiences of the study, supporting the person with stroke to use the SNMES, the ease of using the SNMES and braces if used, data collection methods, any perceived barriers or facilitators to using the SNMES and suggestions for future improvement in the research and SNMES intervention. The interview topic guide will be informed by the Theoretical Framework of Acceptability.[41] The topic guide will also be developed with input from the public advisory group (PAG) input and will be iteratively refined during the interviews.

Data from all interviews and focus groups will help to inform design aspects related to participant, caregiver, and therapist involvement in the next phase of the research as well as to develop robust methodology.

5.9. Withdrawal criteria

Participants with Stroke

It will be explained to the potential participant that entry into the study is entirely voluntary and that their treatment and care will not be affected by their decision. Participants will be informed that they can withdraw from the study at any given point and that this will not affect their rehabilitation or healthcare provision. Should participants withdraw the data collected so far will not be destroyed and will be used in the analysis. All data will be anonymous and identification will not be possible.

Participants may discontinue their allocated intervention or withdraw from the study for the following reasons:

- withdrawal of consent,
- changes to their health status preventing their continued participation,
- failure to adhere to protocol requirements.
- Participant re-gains capacity and they choose to withdraw from the study

Caregivers

It will be explained to the potential participant that entry into the study is entirely voluntary and that their or the person with stroke they support's treatment and care will not be affected by their decision. The caregiver can decline to take part with no impact on the participant with stroke continuing with the study. Participants will be informed that they can withdraw from the study at any given point and that this will not affect their care or the rehabilitation or healthcare provision of the participant with stroke. Should participants withdraw the data collected so far will not be destroyed and will be used in the analysis. All data will be anonymous, and identification will not be possible.

Clinicians

It will be explained to the potential participant that entry into the study is entirely voluntary and that their ability to continue to support participants with stroke to use the SNMES will not be impacted nor will their decision impact on their job role/employment. Participants will be informed that they can withdraw from the study at any given point and that this will not affect their ability to continue to support participants with stroke to use the SNMES will not be impacted nor will their decision impact on their job role/employment. Should participants withdraw the data collected so far will not be destroyed and will be used in the analysis. All data will be anonymous, and identification will not be possible.

All Participants

Participants may be withdrawn from the trial either at their own request or at the discretion of the Investigator. The participants will be made aware that this will not affect future care, care of their loved one, or their job role/employment. Participants will be made aware (via the information sheet and consent form) that should they withdraw the data collected to date cannot be erased and may still be used in the final analysis.

However, if a participant indicates a wish to withdraw attempts should be made to see if the participant would permit at least primary outcome data to be collected (ideally at the end of the participant's follow-up period), ensuring that enough data are recorded to support the

planned analysis. Participants should not be accepted as lost to follow-up unless phone calls, letters or visits to the participant and next of kin have been fruitless.

Enrolled participants who withdraw and were not yet randomised will be replaced (though the withdrawn participant will keep their trial ID). Participants who withdraw after randomisation will not be replaced.

5.10. End of trial

The activity used to define the end of the study will be the end of the analysis for the quantitative and qualitative study work packages.

6. SAFETY REPORTING

6.1. Definitions

6.1.1. Adverse Event

An AE (Adverse Event) is any untoward medical occurrence in a subject, including occurrences which are not necessarily caused by or related to the study intervention. An AE can therefore be any unfavourable and unintended sign (including an abnormal laboratory finding), symptom or disease temporally associated with study activities.

Examples of adverse events that can occur due to electrical stimulation are:

- Skin redness, irritation, or rash at electrode site or from the brace
- Muscle soreness
- Muscle spasm
- Musculoskeletal injury
- Fatigue
- Muscle strain
- Joint paint

6.1.2. Serious Adverse Event (SAE) and Serious Adverse Device Effect (SADE)

An SAE is any untoward medical occurrence that fulfils at least one of the following criteria:

- Is fatal – results in death (NOTE: death is an outcome, not an event)
- Is life-threatening (an event in which the participant was at risk of death at the time of the event; not refer an event which hypothetically might have caused death if it were more severe)
- Requires inpatient hospitalisation or prolongation of existing hospitalisation
- Results in persistent or significant disability/incapacity
- Is a congenital anomaly/birth defect
- Is otherwise considered medically significant by the Investigator (either jeopardising the participant or requiring an intervention to prevent one of the above consequences)

The following cases of hospitalisation are not considered ‘serious’:

- Routine treatment or monitoring of the studied indication not associated with any deterioration in condition.
- Treatment, which was elective or pre-planned, for a pre-existing condition not associated with any deterioration in condition, e.g., pre-planned hip replacement operation which does not lead to further complications.
- Any admission to hospital or other institution for general care where there was no deterioration in condition.
- Treatment on an emergency, outpatient basis for an event not fulfilling any of the definitions of serious as given above and not resulting in hospital admission

Examples of Serious Adverse Events

- Myocardial infarction
- Additional Stroke
- TIA
- Deep Vein Thrombosis
- Pulmonary Embolism
- Chest infection
- Pressure sores/skin breakdown related to the leg brace or using the electrical stimulation
- Falls
- Seizures

6.1.3. Suspected Unexpected Serious Adverse Reaction (SUSAR)

An Adverse Event that fulfils at least one of the criteria of Serious and is possibly related to the conduct of the trial and/or use of either of the devices. No such events are anticipated and, therefore, all will be considered unexpected.

6.1.4. Investigators Assessment

Medical judgement should be exercised in deciding whether an AE is serious in other situations. Important AEs that are not immediately life-threatening or do not result in death or hospitalisation but may jeopardise the subject or may require intervention to prevent one of the other outcomes listed in the definition above, should also be considered serious.

6.1.5. Seriousness

An appropriately delegated member of the research team is responsible for assessing whether the event is serious according to the definitions given in section 6.1.2.

6.1.6. Causality

The Investigator must assess the causality of adverse events using their clinical judgement of the event. This may take into account the safety information that was provided, timing, mechanism and factors considered relevant. A ‘relatedness’ assessment will be made against

This will be assigned to one of the following categories:

- **Unrelated**: the AE is not considered to be related to the device or study conduct.

- **Possibly**: although a relationship to the device or study conduct cannot be completely ruled out, the nature of the event, the underlying disease, concomitant medication, or temporal relationship make other explanations possible.
- **Probably**: the temporal relationship and absence of a more likely explanation suggest the event could be related to the device or study conduct.
- **Definitely**: the known effects of the stent/procedure suggest that the device or study conduct is the most likely cause.

Causality should be determined by the PI in the first instance.

6.1.7. Expectedness

No Serious Adverse Events are anticipated therefore any that occur should be reported as Unexpected.

6.1.8. Severity

The Investigator must assess the severity of Serious Adverse Events according to the following terms and assessments. The intensity of an event should not be confused with the term “serious” which is a regulatory definition based on patient/event outcome criteria.

- **Mild:** Some discomfort noted but without disruption of daily life;
- **Moderate:** Discomfort enough to affect/reduce normal activity;
- **Severe:** Complete inability to perform daily activities and lead a normal life.

6.2. Pregnancy reporting

If a participant becomes pregnant during the study, they will notify a member of the research team who will report it to the PI and note it on a CRF.

All pregnancies within the trial should be reported to the Chief Investigator and the Sponsor using the relevant Pregnancy Reporting Form within 24 hours of notification.

- Pregnancy is not considered an AE unless a negative or consequential outcome is recorded for the mother or child/foetus. If the outcome meets the serious criteria, this would be considered an SAE.
- If a participant becomes pregnant during the study and they are in the SNMES intervention group, they will stop using the SNMES for the remainder of their time in the study. Follow-up data will continue to be collected.

6.3. Device Deficiencies

A log will be kept of all of the issues and deficiencies with the electrical stimulation units, electrodes, and leg braces (knee immobiliser and AFO).

Deficiencies and issues will be fed back to the company that designed the electrical stimulator, electrodes, knee immobiliser, or AFO.

6.4. Overview of the Safety Reporting Process

The CI has the overall safety reporting oversight responsibility. The CI has a duty to ensure that safety monitoring and reporting is conducted in accordance with the sponsor’s requirements.

6.5. Responsibilities

Process for SAE

1. SAE identified
2. SAE CRF completed by a member of the research team
3. SAE CRF is sent to the local PI
4. Local PI will assess SAE for severity and causality and notify the CI of the SAE
5. The Sponsor will be made aware of the SAE within 24 hours of knowledge of the event via a member of the research team

Research practitioner

- Collecting data at study visit (Visit 2, 3, 4) regarding AE, AR, and SAE
- Reporting any AE, AR, SAE on the respective CRF
- Sending SAE CRF to local PI for evaluation

Principal Investigator (PI):

- Checking for SAEs when participants attend the study visit.
- Using medical judgement in assigning seriousness and causality.
- Ensuring that all SUSARs are recorded and reported to the sponsor within 24 hours of becoming aware of the event and provide further follow-up information as soon as available.
- Ensuring that SUSARs are chased with Sponsor if a record of receipt is not received within 2 working days of initial reporting.

Chief Investigator (CI):

- Clinical oversight of the safety of study participants, including an on-going review of the risk / benefit.
- Immediate review of all SUSARs.

Sponsor:

- Central data collection and verification of adverse events according to the trial protocol onto a database.
- Using medical judgement to assign the SAE's seriousness and causality where it has not been possible to obtain local medical assessment – UHD Clinical Director for Research.
- Reporting safety information to Research Steering Group.
- Expedited reporting of SUSARs to the REC within required timelines.

6.6. Final Report

A final report on the research will be submitted to the REC within 12 months of the end of the study.

6.7. Urgent Safety Measures

The CI may take urgent safety measures to ensure the safety and protection of the clinical trial subjects from any immediate hazard to their health and safety.

The measures should be taken immediately. In the event of an urgent safety measure, regulatory approval is not required prior to implementation, however, it is the responsibility of the CI to inform the sponsor and Research Ethics Committee (via telephone) of this event immediately.

The CI has an obligation to inform both the Ethics Committee in writing within 3 days, in the form of a substantial amendment. The Sponsor must be sent a copy of the correspondence with regards to this matter.

7. STATISTICS AND DATA ANALYSIS

7.1. Sample size calculation

Quantitative Sample Size

We intend to recruit 60 participants with stroke over 12-months across two hospital sites, with a 2-month contingency if needed. Sample size estimation is based on feasibility parameters of recruitment uptake to a 10% margin of error for 90% 2-sided and 95% 1-sided CI estimation and adequate precision for estimation of standard deviation (SD) for numerical scales, i.e. allows for a sufficiently precise x 1.1 inflation factor for >80% 1-sided CI estimation of the SD.[47]

Nested Qualitative Study Sample Size

The sample size in the nested qualitative component (participants with stroke SNMES n=12, participants with stroke control n=8 caregivers n=10, clinicians n=10) was based on recent research around code and meaning saturation in qualitative research for semi-structured interviews and focus groups.[43,45] The sample size will be adequate to reach data and meaning saturation.

7.2. Planned recruitment rate

The combined stroke admissions from both hospital sites are around 2000 strokes per year and 35% are likely to be eligible for this study. For example, UHD has around 1171 stroke admission per year. Of the 1171 admissions from Sept 2021-Aug 2022, 298 had a NIH lower limb motor score of 3 or 4, meeting our inclusion criteria (NIH lower limb motor score of ≥3). It is estimated around 50% of patients will be eligible as around 46% of people are not able to walk within 5 days after stroke which meets our inclusion criteria.

Around 149 people after stroke will be approached to join the study over the recruitment period. The team estimates it will be feasible to recruit 2-3 patients monthly over 12- months meeting the recruitment target. We have built in a two-month contingency for recruitment, if needed.

7.3. Statistical analysis plan

Quantitative data

A detailed statistical analysis plan (SAP) will be drafted by the trial statistician and the trial will be reported in accordance with the CONSORT 2010 statement extension to pilot and feasibility trials.[48]

No statistical comparisons between treatment groups will be undertaken on baseline or follow-up data as the trial is not designed to test effectiveness. Iinstead the focus will be on presenting summary statistics with appropriate confidence intervals, to meet listed study objectives.

The flow of participants through the study will be presented in a CONSORT-style diagram with reasons for discontinuation or withdrawal given where available. Descriptive statistics will be reported for the feasibility outcomes: recruitment, retention rate, adherence rates, quality of data collection, intervention delivery and fidelity. Additionally, descriptive statistics will be used to describe the outcome measures collected at Visits 1-4.

Data will inform a potential definitive study with variability in candidate primary and secondary measures calculated to inform size (power calculation) for the definitive trial.

Adverse events will be summarised descriptively.

Data management will be undertaken using REDCap and Microsoft Excel. Statistical analysis will be undertaken using STATA version 16 or later, supplemented where required by R.

Qualitative and quantitative data will be used in combination to inform the future definitive trial design. The intervention and methodology will also be iteratively mapped to the TIDieR checklist, APPEASE framework and Health Inequalities Assessment toolkit.

Qualitative data

Interviews/focus groups will be recorded and transcribed verbatim using an approved transcription service that complies with GDPR. All identifying features of the recording and transcription will be anonymised.

Thematic analysis using the framework method will be used to explore common themes taking a deductive approach and considering emergent themes involving inter-researcher and PPI interpretation [44,49] Data management and data analysis may be undertaken using NVivo software.

Qualitative data from participants with stroke, caregivers, and clinicians will be analysed separately and where appropriate, we will synthesise experiences ensuring the recognition of the respective group voices. Findings will be mapped to the TFA and be used to inform study strategies for facilitating recruitment, retention, adherence and communication in a future trial.

Feasibility progression criteria

RAG (Red/amber/green) progression criteria [50] will be used to assess the key feasibility objectives of recruitment, intervention adherence and retention to inform whether a main trial is possible and whether aspects of the design or other issues need modification in order to conduct the research successfully (Table 3).

Process data will be used to describe interpreted timelines to identify “fixable”, “manageable” and “insurmountable” challenges to site opening, training, data collection and intervention fidelity, with regard to both the future main trial and clinical implementation in the event of a positive trial.

Table 3 RAG Criteria for Study Progression

Outcome	Green (feasible with minimal or no modifications)	Amber (feasible with moderate modification)	Red (major modification required, limited feasibility)
Recruitment (target n=60)	≥ 50 participants	30-49 participants	< 30 participants
Incomplete follow up at 6 months	< 20%	20-40%	>40%
Intervention adherence	≥75% (≥27 sessions completed)	50-75% (18-26 sessions completed)	<50% (<18 sessions completed)

7.3.1. Summary of baseline data and flow of patients

Baseline data for comparability of randomised groups are:

- age
- stroke location
- NIHSS stroke score (overall score)
- Trunk control test score (30 second sit)

7.3.2. Secondary outcome analysis

Descriptive statistics will be used to explore participants strength (dynamometer, MRC Grading Scale), function (Barthel Index, 10 Metre Walk Test, 30 Second Chair Sit-to-Stand Test), limb circumference, Quality of life (EQ-5D-5L) and sensation.

7.3.3. Economic evaluation

The health economic analysis will inform the design of an economic evaluation to be conducted alongside a definitive randomised controlled trial. This feasibility study will use individual level data and will be conducted from a health system perspective over the study's 6-month follow-up period. Data collection methods for resource and service use associated with delivering the intervention (e.g. staff time, training, equipment) will be defined and refined. Summary statistics will be derived for all categories of measured resource use and health-related quality of life outcomes in an exploratory analysis. Results will be assessed in terms of completion rates, errors and missing data. Resource data collection priorities will be identified to inform the data collection methods in a definitive trial, including any necessary adaptation of existing resource use instruments and assessment of the need for data collection from other sources. We will also assess the appropriateness of using the cost per quality-adjusted life year framework in the future definitive trial.

8. DATA MANAGEMENT

8.1. Data collection tools and source document identification

Data will be collected via paper and/or electronic case report forms. Both formats are being used to explore ease of data collection, data completeness, and preferred format to inform the next stage of the research.

All documents and information are confidential and will be handed and safeguarded to ensure privacy and confidentiality of the participant's personal information. All data will be handed and stored in compliance with the Data Protect Act (2018).

Data will be collected in both paper and digital formats in Case Report Forms (CRF). Redcap will be used for CRF data collection and storage. Data that is collected on a paper CRF will be entered into Redcap to be stored in a digital format (Digital CRF). Data entered directly into recap will only be stored in a digital format. Data in a digital format helps to ensure legibility of the information for accurate analysis. CRFs (paper ad digital will be designed to ensure adequate data collection and have clear audit trails for validity of the trial.

Each participant will be assigned a trial identity code number, allocated at randomisation for use on CRFs other trial documents and the electronic database. The documents and database will also use their initials (of first and last names separated by a hyphen or a middle name initial when available) and date of birth (dd/mm/yy). The identifiers will allow sufficient identification to prove a person exists, matches the consent obtained and allows identification of the participant when chasing data queries.

CRFs will be treated as confidential documents and held securely in accordance with regulations. The investigator will make a separate confidential record of the participant's name, date of birth, local hospital number or NHS number, and Participant Trial Number (the Trial Recruitment Log), to permit identification of all participants enrolled in the trial, in accordance with regulatory requirements and for follow-up as required.

CRFs shall be restricted to those personnel approved by the Chief or local Principal Investigator and recorded on the 'Trial Delegation Log.'

All paper forms shall be filled in using black ballpoint pen. Good Clinical Practice guidelines will be followed for completion of paper forms and correction of errors.

The Chief or local Principal Investigator shall sign a declaration ensuring accuracy of data recorded in the CRF.

Source documents for baseline data around demographic and stroke information as well as the participants medical history will be sought from the participant their caregiver and the participants' medical notes.

Data collected will be a mixture of a standardised tool e.g. EQ-5D-5L and tools designed by the research team e.g. health resource use questionnaire. The reliability and validity of the standardised tools can be found above in Section 5.6 Trial Assessments.

8.2. Data handling and record keeping

This data management plan was developed to ensure that the data collected during this research is managed and shared in a robust and professional manner. The plan was formulated with adherence to University Hospitals Dorset Trust policy on data handling and record keeping, Bournemouth University's policy on data handling and storage, and the Data Protection Act (2018). All forms, documents, and templates will be stored at the local research sites in lockable filing cabinets in a room that locks. Electronic data will be stored on a password protected computer with 2-factor authentication. Building and room access is

restricted by lockable doors with key codes or card access. University of Plymouth will have access to anonymised data, Bournemouth University will have data related to the individuals taking part in the qualitative part of the study. Individuals consent to have their contact details shared with Bournemouth University to arrange the interview or focus group.

Once the study is concluded, all appropriate paper-based forms of participants will be retained for 10 years, then they will be destroyed after permission from UHD Research Department, as the study sponsor. Confidentiality and anonymity will be maintained for all participants. Any identifying information provided (e.g. names and addresses) will be held in the strictest confidence and stored in a confidential, password protected database accessible by only those with permission who are part of the research team.

All data used for analysis will be kept separate from participant personal data. Hard copy material (e.g. signed consent forms) will be stored securely for a minimum period of 10 years after the study has been completed. After that period all hard copy material will be reviewed, and approval for destruction from the sponsor will be sought. All study participants will be allocated a unique identification number, therefore, making it possible to anonymise research data. All sensitive datasets will be retained on a secure server and access restricted to the study team. Access to all research datasets is controlled by password protection and additional permissions specific to folders.

All confidentiality arrangements adhere to relevant regulations and guidelines (General Data Protection Regulation 2018, Data Protection Act 2018, General Medical Council (GMC), Medical Research Council (MRC), Research Governance Framework) and the chief investigator has a responsibility to ensure the integrity of the data and that all confidentiality procedures are followed.

8.3. Access to data

Direct access will be granted to authorised representatives from the Sponsor, host institution and the regulatory authorities to permit trial-related monitoring, audits, and inspections- in line with participant consent.

Members of the both the care and research teams will have access to the participants personal data for the duration of the study. The principal investigators at each site are already part of the direct healthcare team on-site. Members of staff from the sponsor and/or regulatory bodies may also require access to study participant's data to carry out audits. All these staff work to robust data security procedures.

The raw data will be generated and stored electronically on Redcap on a secure computer. Please see section 8.2 Data Handling and Record Keeping regarding participant data relating to interviews and focus groups. Paper-based data will be stored at the respective study sites in a locked cabinet in a locked room that only the research team have key access to. Electronic data will be stored on the sponsor and Bournemouth University servers, which have restricted access by a two-way authentication procedure. Paper-based data will be kept on-site for 10 years and will be destroyed after UHD approval. Anonymised electronic data will be put onto Bournemouth University's BORDaR, which is the Bournemouth Online Research Data Repository.

8.4. Archiving

All documents and data generated by this study are the responsibility of the Chief Investigator. The Sponsor and the Chief Investigator shall ensure that the documents contained, or which have been contained, in the Trial Master File are retained in accordance with the Sponsor's standard operating procedure (SOPs). The Trial Master File will be retained in accordance with applicable legislation for a minimum of 10 years as per University Hospitals Dorset NHS Foundation Trust archiving policy. The second site will maintain and keep their ISF and follow their trusts' archiving standard operating procedure. The data can only be destroyed once permission is given by UHD as the sponsor. The documents can be retained for a longer period, however, if required by the applicable regulatory requirements or by agreement with the Sponsor. No trial-related records should be destroyed unless or until the Sponsor gives authorisation to do so.

9. MONITORING, AUDIT, AND INSPECTION

A trial monitoring plan will be developed by the Sponsor and CI based on the trial risk assessment which may include on site monitoring. This will be dependent on a documented risk assessment of the trial. The processes reviewed can relate to participant enrolment, consent, eligibility, and allocation to trial groups; adherence to trial interventions and policies to protect participants, including reporting of harm and completeness, accuracy, and timeliness of data collection. Additional monitoring will include data storage and data transfer procedures; local quality control checks and procedures, back-up and disaster recovery of any local databases and validation of data manipulation.

Monitoring will be done by exploring the trial dataset, trial documentation including the trial site file, or performing site visits. Sites will be expected to maintain any obligations that will help to to assist the sponsor in monitoring the trial. The sponsor may require sites to host site visits, provide information for remote monitoring, or put procedures in place to monitor the trial internally. Monitoring will be initially conducted across all sites and subsequently conducted using a risk-based approach. Entries on CRFs will be verified by inspection against the source data.

Trial data and evidence of monitoring and systems audits will be made available for inspection by REC as required.

10. ETHICAL AND REGULATORY CONSIDERATIONS

10.1. Research Ethics Committee (REC) review and reports

The trial will not be initiated before the protocol, informed consent forms and participant information sheets (person with stroke, caregiver/significant other, and therapist) have received approval / favourable opinion from the Research Ethics Committee (REC), and the respective National Health Service (NHS) Research & Development (R&D) department.

Should a protocol amendment be made that requires REC approval, the changes in the protocol will not be instituted until the amendment and revised informed consent forms and participant and GP information sheets (if appropriate) have been reviewed and received approval / favourable opinion from the REC and R&D departments. A protocol amendment intended to eliminate an apparent immediate hazard to participants may be implemented immediately providing that the REC are notified as soon as possible and an approval is requested. Minor protocol amendments only for logistical or administrative changes may be implemented immediately; and the REC will be informed.

The trial will be conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki 1996;[51] the principles of Good Clinical Practice,[52] and the Department of Health Research Governance Framework for Health and Social care 2005.[53]

10.2. Peer review

The study has received multiple scientific peer reviews. Peer reviews were via the NIHR RfPB's funding review panel and the Project Review Committee consisting of both academic and lay reviewers which is part of the Clinical Research Network. The feedback from the NIHR and the Project Review Committee have been incorporated into the protocol and research methods. All participant facing documents have been reviewed by our Public Advisory Group and their feedback incorporated into the documents.

10.3. Public and patient involvement

PPIE Involvement in the development of the research.

Stroke survivor and PAG member (WL) contributed to the development of all stages of the study including that the priority for research looking at interventions for people with severe weakness in the early phase of rehabilitation following stroke. They would have liked the opportunity to have been offered SNMES in this way after their stroke. Using the VOICE Global online public involvement platform, the CI supported by BU PIER officer (KJ) facilitated an online PPI workshop funded by the RDS-SW Public Involvement Fund.

The workshop included the 3 people with lived experience of stroke and 3 caregivers for people who have had a stroke. Those attending the workshop were geographically dispersed around England (rural, coastal and urban) with a range of cultural backgrounds (including white British, Indian, and Asian Bangladeshi) and ages, providing a diverse range of lived experience expertise to help shape the study design.

The public involvement workshop gave the opportunity for those with lived experience of stroke or caring for someone living with a stroke to share their thoughts and experience and influence the study design. The development of an intervention aimed at improving recovery of strength, walking and quality of life in people with severe lower extremity weakness resonated with all members of the group as an important research priority.

The group helped identify the study outcome measures that were most meaningful and accessible in terms of ease of completion for inclusion in the study (EQ-5D-5L and Barthel Index). The group also identified and highlighted the importance of providing participants with a choice of ways to complete the forms (eg. online, paper, or in-person with or without support). The group highlighted the importance of having people with lived experience expertise to work in partnership with the academic researchers and clinicians throughout the study duration so that all areas of expertise had equity of opportunity, influence, and impact on the study.

The group strongly endorsed the importance of the public co-applicant (WL) role in giving them confidence to contribute and supporting their voice to be heard, the essential link with the wider research team.

Ongoing PPIE Involvement

Our Public Advisory Group (PAG), evolved from the Stage 1 PPI workshop and comprises 6 people with lived experience expertise (3 stroke survivors and 3 carers) and includes a wide

range of voices. Our PPI approach is inclusive, strengths-based and collaborative aligning with the UK National Standards for Public Involvement. The PPI Lead (MH) and PIER Officer (KJ) will provide a consistent and familiar point of contact for PAG members and the public co-applicant.

A PPI group charter and strategy will be co-developed at the outset and revisited throughout, enabling a reflective and reflexive approach to how the public contributors will be involved; values, principles and expectations of involvement, identifying communication preferences and any individual access/support needs.

Together with MH/KJ the PAG will meet online (given members' geographical dispersity) with ad-hoc meetings/communications as needed in preferred formats.

The PAG have contributed to the development of the participant information sheets. A member of the PAG and stroke survivor (WL) have co-created a video PIS which reflects a discussion between the CI and WL based around the easy-read PIS that was edited into three short videos about the study. The video PIS will be helpful for people with communication and cognitive changes after stroke to have a more accessible format to understand the study and opportunity to be involved. Providing the opportunity to all people after stroke was an important theme from the PPI workshop and PAG group.

The PAG will be represented at SMG and SSG meetings. The PPIE lead will ensure all PPI members are kept up-to date on the project's status. A study PPI impact log will be kept throughout the project with inputs/reflections from PPI members. We will report on PPI using the GRIPP-2 checklist.[54]

The PAG will also contribute to dissemination through the development of a study summary for the participants involved as well as conferences and knowledge exchange events.

10.4. Protocol compliance

- Prospective, planned deviations or waivers to the protocol are not allowed under the UK regulations on Clinical Trials and must not be used e.g., it is not acceptable to enrol a participant if they do not meet the eligibility criteria or restrictions specified in the trial protocol
- Accidental protocol deviations can happen at any time. They must be adequately documented on the relevant forms and reported to the Chief Investigator and Sponsor immediately.
- Deviations from the protocol which are found to frequently recur are not acceptable, will require immediate action and could potentially be classified as a serious breach.

10.5. Notification of Serious Breaches to GCP and/or the protocol

A "serious breach" is a breach which is likely to effect to a significant degree:

- the safety or physical or mental integrity of the participants of the trial; or
- the scientific value of the trial

In the event of a "serious breach"

- the sponsor will be notified immediately of any case where the above definition applies during the trial conduct phase
- the sponsor of a clinical trial will notify the licensing authority in writing of any serious breach of
    - the conditions and principles of GCP in connection with that trial; or
    - the protocol relating to that trial, as amended from time to time, within 7 days of becoming aware of that breach

10.6. Data protection and patient confidentiality

All trial staff and investigators will endeavour to protect the rights of the trial's participants to privacy and informed consent, and will adhere to the Data Protection Act, 1998. The CRF will only collect the minimum required information for the purposes of the trial. CRFs will be held securely, in a locked room, or locked cupboard or cabinet. Access to the information will be limited to the trial staff and investigators and relevant regulatory authorities (see above). Computer held data including the trial database (Redcap) will be held securely and password protected on a lap-top with two-way authentication procedure. All data will be stored on a secure dedicated web server. Access will be restricted by user identifiers and passwords (two-way authentication procedure).

Information about the trial in the participant's medical records / hospital notes will be treated confidentially in the same way as all other confidential medical information.

Electronic data will be backed up every 24 hours to both local and remote media in encrypted format.

The data custodian is the Research Quality and Improvement Manager at UHD, Heather Scott, please see their contact details below.

Steven Williams and Heather Scott
Research Quality & Improvement Manager
Research & Development Department
University Hospitals Dorset NHS Foundation Trust
Tel: 0300 019 3120
Email: heather.scott@uhd.nhs.uk

Data will be stored for 10 years in line with trust policy. The anonymised data set will be stored on BU BORDaR, which is the Bournemouth Online Research Data Repository.

10.7. Financial other competing interests for the CI, PI's, and committee members

Not applicable

10.8. Indemnity

UHD, as sponsor, will be responsible for insurance and indemnity to meet the potential legal liability for harm to participants arising from the management of the research, the design of the research, and the conduct of the research; this is covered under the UHD insurance for clinical trials.

10.9. Amendments

Should a protocol amendment be made that requires REC approval, the changes in the protocol will not be instituted until the amendment and revised informed consent forms and participant and GP information sheets (if appropriate) have been reviewed and received approval / favourable opinion from the REC and R&D departments. A protocol amendment intended to eliminate an apparent immediate hazard to participants may be implemented immediately providing that the REC are notified as soon as possible and an approval is requested. Minor protocol amendments only for logistical or administrative changes may be implemented immediately; and the REC will be informed.

For any amendment to the study, the Chief Investigator, in agreement with the sponsor will submit information to the appropriate body in order for them to issue approval for the amendment. The Chief Investigator will work with sites so they can put the necessary arrangements in place to implement the amendment and to confirm their support for the study as amended. Substantial amendments that require review by NHS REC will not be implemented until that review is in place and HRA approval obtained for the amendment. Access to the final trial dataset

After completion of the trial the final anonymised trial data set will be available upon request (e.g. via BORDAR, Bournemouth Online Research Data Repository).

11. DISSEMINATION POLICY

The findings of this study will be published in academic journals and presented at a national and an international conference. The first publication will be the research protocol. The CI and Project Manager and/or member of the research team will meet with the therapy teams and RNs at the collaborating trusts to share the research and for the teams get familiar with the study.

Annual reports will be sent to the collaborating trusts regarding the progress of the study. We will work with the PAG and public co-applicant to develop a public dissemination strategy including a plain English summary of the study findings and a video/audio version of the study findings.

The findings will be shared in collaboration with the PAG at the at the UK Stroke Forum, through the Stroke Association/local stroke groups, and social media (eg. Twitter). After completion of the study, the team will host an event with the public co-applicant for participants and their families to feed back the findings of the study.

If findings from this feasibility study warrant a full-scale trial we will submit an application to NIHR Health Technology Assessment programme. The findings will help to inform the develop and protocol of a definitive trial to explore if using SNMES on stroke-affected leg muscles in acute and subacute stroke contributes to earlier and improved walking and can slow or prevent muscle atrophy. If it is found that SNMES does contribute to earlier and improved walking and helps to maintain muscle bulk, it will be an intervention for individuals for whom there are currently few interventions early after stroke. Using SNMES in this way could be incorporated into the Stroke Guidelines which would lead to changes in practice and education. Earlier and improved walking would contribute to improved quality of life for people after stroke. Furthermore, if found to be effective this intervention could result in increased therapy time which aligns with the new National Clinical Stroke Guidelines [25]

recommending 3 hours of rehabilitation and 6 hours of activity per day for people following stroke during the recovery phase.

11.1. Authorship eligibility guidelines

Authorship will be determined in accordance with the International Committee of Medical Journal Editors (ICMJE) guidelines, and other contributors will be acknowledged.

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13. APPENDICIES

13.1. Appendix 1: Risk

Risks associated with trial interventions

☒ *A ≡ Comparable to the risk of standard medical care*

☐ *B ≡ Somewhat higher than the risk of standard medical care*

☐ *C ≡ Markedly higher than the risk of standard medical care*

Electrical stimulation is commonly used as part of standard or usual practice in physiotherapy and occupational therapy. The use of electrical stimulation has been recommended as best practice and has been incorporated into clinical guidelines e.g. NICE guidelines such as Interventional procedures guidance IPG278 "Functional electrical stimulation for drop foot of central neurological origin" published in 2009 and the "National Clinical Guideline for Stroke" published in 2023.

What are the key risks related to therapeutic interventions you plan to monitor in this trial?		How will these risks be minimised?		
IMP/Intervention	Body system/Hazard	Activity	Frequency	Comments
Skin irritation at electrode site	Integumentary system	Participant and health care team education on monitoring skin integrity and to report any changes in skin integrity to the research team. The research team will assess the skin integrity and act accordingly to the participants. Hypoallergenic electrodes can be provides if a participant has a skin irritation as well as using a larger electrode.	Healthcare team education session. Initial session of SNMES, check at Visit 2 (week 6) and Visit 3 (week 12)	
Muscle fatigue	Musculoskeletal system	Participant and health care team education on muscle fatigue signs and symptoms. Participants will be instructed to report any muscle fatigue to the research team. The research team will assess the muscle fatigue and act accordingly to the participants symptoms. The intensity of the stimulation can be reduced which will reduce the workload on the muscle.	Healthcare team education session. Initial session of SNMES, check at Visit 2 (week 6) and Visit 3 (week 12)	
Delayed onset muscle	Musculoskeletal system	Participant and health care team education on DOMS signs and symptoms. Participants will be instructed to report any DOMS	Healthcare team education session.	

soreness (DOMS)		to the research team. The research team will assess the DOMS and act accordingly to the participants symptoms. The intensity of the stimulation can be reduced which will reduce the workload on the muscle.	Initial session of SNMES, check at Visit 2 (week 6) and Visit 3 (week 12)	
New Joint pain	Musculoskeletal system	Participant and health care team education on joint pain signs and symptoms. Participants will be instructed to report any new joint pain to the research team. The research team will assess the joint pain and act accordingly to the participants symptoms, for example, reducing the intensity of the stimulation.	Healthcare team education session. Initial session of SNMES, check at Visit 2 (week 6) and Visit 3 (week 12)	
Pain at stimulation site	Neuromuscular System	Participants and the healthcare team will receive education on recognising signs and symptoms of pain at the site of stimulation. Participants will be instructed to report any pain at the stimulation site to the research team, who will act accordingly to the participants' symptoms. For example, reducing the intensity of the stimulation reducing muscle workload, changing the electrodes, or using larger electrodes.	Healthcare team education session. Initial session of SNMES, check at Visit 2 (week 6) and Visit 3 (week 12)	
The research and clinical teams will be educated in the potential risks associated with electrical stimulation as well as how to mitigate the risk and when to refer on for additional assessment or treatment. Participants and their caregivers will also be educated on the potential risks associated with electrical stimulation and instructed to contact a member of the research team as soon as something is not right.				

13.2. Appendix 2: Amendment History

Amendment No.	Protocol version no.	Date issued	Author(s) of changes	Details of changes made