

# Development of a new technology for the prevention of ulceration in the diabetic foot

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		<input type="checkbox"/> Protocol
<b>Registration date</b> 06/10/2022	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan
		<input type="checkbox"/> Results
<b>Last Edited</b> 20/02/2024	<b>Condition category</b> Nutritional, Metabolic, Endocrine	<input type="checkbox"/> Individual participant data
		<input type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

This study will test a new load monitoring system (LOMIS) to monitor pressure and shear forces under the foot during different physical activities at home and in daily life. Loads will be measured using novel sensors incorporated into a standard insole worn in the participant's own footwear or footwear provided by the podiatrist. Movement of the foot is also measured using a small hub which will be attached to the shoelaces or Velcro fastening of the footwear. This will help the researchers to understand which physical activities are most responsible for the excessive foot loading.

The LOMIS device is to be used to inform the wearer of increased pressure and highlight the risk of a blister on the bottom surface of the foot. The intended user will be a patient under the care of an NHS podiatry or orthotics team who has diabetes and has been identified by their clinician as at risk of foot ulceration. LOMIS is intended for use independently by the user at home, as well as carrying out research activity in laboratory and clinical settings.

The LOMIS orthotic insole will intend to offload at-risk regions of the foot by providing wider contact and support across the bottom surface of the foot. LOMIS will provide additional monitoring and record data to a mobile application. Notification of high-loading activities can be shown as lights on the device itself.

### Who can participate?

Patients aged between 18-85 years who have diabetes and who have regular podiatry and orthotics care within the NHS

### What does the study involve?

The study involves using a new insole device which measures the forces produced as you walk. This will include wearing the device during a daily routine and providing feedback on its use. The study will run for 3 months with an option to extend the use of the LOMIS device for up to 12 months. Participants will be provided with a LOMIS device for use in their own footwear and trained to use this. Participants will attend monthly review appointments over the first 3 months and then at 3 monthly intervals thereafter. Review appointments will include a foot assessment, a device use assessment and questionnaires about health and health service use.

What are the possible benefits and risks of participating?

Participants will receive an in-depth foot health check by a trained podiatrist/orthotist. There will be no additional direct benefit from taking part in this study; however, the results of this study aim to inform and improve the technology we use to help clinicians and people with diabetes prevent ulcers.

The systems used in this study are new which may mean some risks are unknown, although the systems used in this study have been tested previously in different studies without problems. Possible side effects associated with foot orthotics are pain, discomfort, blisters, calluses and skin irritation. These effects are more common when first starting to use foot orthotics and can be managed by gradually increasing the amount of time you use the orthotics for. A registered podiatrist/orthotist will perform a foot health check before and after the end of testing to ensure no harm occurs while using the LOMIS. Throughout the study, participants will receive standard clinical care, including podiatry assessment and treatment.

Participants' feet will be closely monitored throughout this trial. The incidence of at-risk episodes based on LOMIS data will be reviewed by researchers at regular intervals. If participants experience an unusual amount of notifications, they will be asked to visit a clinical team member, and after clinical assessment, they will be referred to potential intervention if the high-risk activity is identified.

Where is the study run from?

The study will be run in the Northwest of England at the North Manchester Diabetes Centre and at the University of Salford (UK)

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

January 2021 to December 2024

Who is funding the study?

The National Institute for Health and Care Research (NIHR) (UK)

Who is the main contact?

Dr Daniel Parker, d.j.parker1@salford.ac.uk

### **Study website**

<http://www.lomis.co.uk>

## **Contact information**

### **Type(s)**

Scientific

### **Contact name**

Dr Daniel Parker

### **Contact details**

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## Additional identifiers

### EudraCT/CTIS number

Nil known

### IRAS number

298091

### ClinicalTrials.gov number

Nil known

### Secondary identifying numbers

CPMS 50744, IRAS 298091

## Study information

### Scientific Title

Development of a 5 dimensions Load Monitoring and Intervention System (LOMIS) to monitor forces under the foot and physical activity profiles over time in a real-world setting which is capable of notifying service users of potentially high-risk activities

### Acronym

LOMIS

### Study objectives

To investigate the functionality of LOMIS for application in a daily living environment for the intended purpose of capturing pressure and shear in a range of activities akin to normal and expected use.

### Ethics approval required

Old ethics approval format

### Ethics approval(s)

Approved 06/12/2021, West Midlands - Edgbaston Research Ethics Committee (3rd Floor Barlow House, Minshull Street, Manchester, M1 3DZ, UK; +44 (0)207 104 8070; edgbaston.rec@hra.nhs.uk), ref: 21/WM/0239

### Study design

Non-randomized; Interventional; Design type: Treatment, Prevention, Device, Active Monitoring

### Primary study design

Interventional

### Secondary study design

Non randomised study

**Study setting(s)**

Home, Hospital, University/medical school/dental school, Other

**Study type(s)**

Treatment, Safety, Efficacy

**Participant information sheet**

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

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

Diabetes

**Interventions**

The LOMIS study is divided into three parts to allow safe and controlled development of a novel device to measure forces under the foot during footwear use in routine daily activities. Participants are recruited from within the podiatry and orthotics department and must have ongoing podiatry care in place. To ensure safe management of participants during the study their local podiatry team will be informed of their involvement and use of the LOMIS device. In all cases a baseline assessment will occur which will include a diabetic foot health screening by a podiatrist and a review of relevant medical records associated with podiatry appointments and diabetes care to build up a picture of each participants risk of ulceration.

LOMIS Study 1 is a gait laboratory study and will include 30 participants. The LOMIS System will be assessed during a range of activities typical of daily living (walking, standing, stair climbing) at different speeds (slow, normal, fast). This assessment will take approximately 3 hours. This will allow us to understand how well the device works or if there are any faults/issues during these activities.

LOMIS Study 2 is a 5 day wear trial and will include 5 participants. The participants will be trained on safe use of the LOMIS device and asked to wear the device during their daily activities over a week. Participants will return for foot health and device usability assessments at day 1, 3 and 5. Following the completion of day 5 the device will be returned to the LOMIS Study team. This study will allow us to understand how well the device functions over this extended period of use and also allow us to identify challenges with the use of the device prior to longer duration trials.

LOMIS Study 3 is a longitudinal study lasting between three months and one year, this will recruit 50 participants. Participants will receive training and a LOMIS device to take home and use throughout the trial, the device can be replaced during the study if needed but will be returned to the LOMIS Study team at the end. Over the first 3 months participants will return for follow up assessments on a monthly basis with short telephone check ins on a weekly basis. If participants choose to continue using the device further follow ups will take place at months 6, 9 and 12 with monthly telephone check ins. Follow up assessments will include a foot health screening, questionnaires about health and wellbeing, questionnaires about the device and usability. Further to this data will be exported from the device to allow assessment of the forces generated under the foot during daily activities and to identify any faults in the device during use.

For all studies we will also invite participants to take part in an optional 30minute recorded follow-up interview about the device to explore how easy it is to use and identify any thing which could be improved.

## **Intervention Type**

Device

## **Phase**

Not Applicable

## **Drug/device/biological/vaccine name(s)**

LOMIS - Load Monitoring and Intervention System

## **Primary outcome measure**

Device functionality for application in a daily living environment for the intended purpose of capturing pressure and shear in a range of activities akin to normal and expected use will be assessed through gait lab assessment, and controlled dynamic activity at baseline. This will be further assessed through physical activity logs and device fault at 1, 2, 3, 6, 9 and 12 months

## **Secondary outcome measures**

1. Device functionality for real-time feedback is measured through a digital fault log captured by the LOMIS system and a fault log captured in assessment appointments at 1, 2, 3, 6, 9 and 12 months
2. Functionality for footwear fit is assessed through a footwear record, physical activity log, and device fault log at 1, 2, 3, 6, 9 and 12 months. Additionally, this will be assessed within an optional qualitative feedback interview
3. Safety of the LOMIS device is assessed through adverse event logs, device fault logs, clinical assessment at 1, 2, 3, 6, 9 and 12 months. Additional telephone reviews will occur at weeks 1, 2, 3, 5, 6, 7, 9, 10 and 11 and then monthly at months 4, 5, 7, 8, 10 and 11
4. Data validity will be assessed against force plate data within a gait lab assessment at baseline and by comparison of physical activity log and device data at 1, 2, 3, 6, 9 and 12 months
5. Feasibility of LOMIS device for application in daily living will be assessed by study recruitment /retention, device fault logs, physical activity logs, device usability questionnaire (QUEST) and mobility questionnaire at 1, 2, 3, 6, 9 and 12 months. Additionally, this will be assessed within an optional qualitative feedback interview
6. Usability of the LOMIS Device for application in daily living will be assessed by the device usability questionnaire (QUEST), mobility questionnaire, and device fault log at 1, 2, 3, 6, 9 and 12 months. Additionally, this will be assessed within an optional qualitative feedback interview

## **Overall study start date**

01/01/2021

## **Completion date**

31/12/2024

## **Eligibility**

### **Key inclusion criteria**

Current inclusion criteria as of 20/02/2024:

1. Have diabetes diagnosed by a medical practitioner
2. Are capable of providing informed consent to participate
3. Are aged between 18-85 years
4. Feet classified as a "low, moderate or high risk" by IWGDF Risk Stratification System
5. Have the self-reported capability to walk unaided and without stopping for 25 m

Previous inclusion criteria:

1. Have diabetes diagnosed by a medical practitioner
2. Are capable of providing informed consent to participate
3. Are aged between 18-85 years
4. Have the self-reported capability to walk unaided and without stopping for 100 m
5. Have the self-reported capability to be physically active (either aided or unaided with breaks) for 2.5 hours per day
6. Can use a smartphone and its applications.
7. Have received two COVID-19 vaccinations

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

Patient

### **Age group**

Adult

### **Lower age limit**

18 Years

### **Upper age limit**

85 Years

### **Sex**

Both

### **Target number of participants**

Planned Sample Size: 80; UK Sample Size: 80

### **Key exclusion criteria**

Current exclusion criteria as of 20/02/2024:

1. Are pregnant
2. Have active foot or leg ulceration
3. Have foot infection
4. Have active Charcot joint
5. Have prior major injuries to lower limb (e.g. fractures requiring internal fixation, skin grafts)
6. Have clinically relevant foot deformity which prevents orthotic provision (eg. Rigid plantarflexed heel)
7. Have major amputation of the lower limbs and foot, this does not include minor amputation of lesser toes
8. Have severe lower extremity artery disease (Peripheral Arterial Disease or Critical Limb Ischaemia)
9. Have any pathologic conditions limiting the participant's ability to walk unaided and without stopping for 25m (eg, cerebrovascular diseases, cardiopulmonary, or other systemic diseases).
10. Have major vascular complications (e.g. Critical Limb Ischaemia)
11. Have severe retinopathy
12. Use walking aids that offload the foot (e.g. Aircast Boot)
13. Use lower limb orthosis during the intervention period which limit ankle movement (e.g. Ankle Foot Orthoses)
14. Have visual impairment that limits normal use of smartphones
15. Have dementia
16. Have uncorrected psychological impairment; psychiatric illnesses or social situations limiting

compliance with the study

17. Have inner ear pathology or other serious underlying balance dysfunction

18. Have current participation in another clinical investigation of a medical device or a drug

19. Have a Body-mass index (BMI) of more than 50 kg/m<sup>2</sup>

Previous exclusion criteria:

1. Have any of the symptoms related to COVID-19

2. Are pregnant

3. Have active foot or leg ulceration

4. Have foot infection

5. Have active Charcot joint

6. Have prior major injuries to lower limb (e.g., fractures requiring internal fixation, skin grafts)

7. Have clinically relevant foot deformity which prevents orthotic provision (e.g. rigid plantarflexed heel)

8. Have amputation of the lower limbs

9. Have severe lower extremity artery disease (Intermittent claudication or rest pain)

10. Have any pathologic conditions limiting the participant's ability to walk unaided and without stopping for 100 m (e.g., cerebrovascular diseases, cardiopulmonary, or other systemic diseases)

11. Have major vascular complications

12. Have severe retinopathy

13. Use walking aids that offload the foot

14. Use lower limb orthosis during the intervention period

15. Have visual impairment that limits normal use of smartphones

16. Have dementia

17. Have uncorrected psychological impairment; psychiatric illnesses or social situations limiting compliance with the study

18. Have inner ear pathology or other serious underlying balance dysfunction

19. Have current participation in another clinical investigation of a medical device or a drug

20. Have a body mass index (BMI) of more than 40 kg/m<sup>2</sup>

**Date of first enrolment**

01/05/2022

**Date of final enrolment**

31/07/2024

## **Locations**

**Countries of recruitment**

England

United Kingdom

**Study participating centre**

**The University of Salford**

School of Health and Society

Fredrick Road Campus

Salford  
United Kingdom  
M6 6PU

**Study participating centre**  
**North Manchester Healthcare NHS Trust**  
North Manchester General Hospital  
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**Study participating centre**  
**Salford Royal Hospital**  
Stott Lane  
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M6 8HD

## **Sponsor information**

**Organisation**  
University of Salford

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**Sponsor type**  
University/education

**Website**  
<http://www.salford.ac.uk/>

**ROR**



https://ror.org/01tmqtf75

## Funder(s)

### Funder type

Government

### Funder Name

NIHR Central Commissioning Facility (CCF); Grant Codes: NIHR201315

## Results and Publications

### Publication and dissemination plan

Planned publication in a high-impact peer-reviewed journal with an intention to publish findings by December 2024

### Intention to publish date

### Individual participant data (IPD) sharing plan

The data sharing plans for the current study are unknown and will be made available at a later date

### IPD sharing plan summary

Data sharing statement to be made available at a later date

### Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">HRA research summary</a>			26/07/2023	No	No