Impact
Report

2023-24

Orthopaedic
Research UK

Introduction

This Impact Report should be read in parallel with our Trustees Report for 2023/24 which provides details on our investments, activities and strategic priorities.

We are a relatively small charity, but this Impact Report demonstrates how we have made a difference by focusing our investments, partnering with others and supporting the wider MSK research ecosystem through training, events and networking.

This Report provides a summary of our most important output and impact measures for our research, education, innovation and community activities, plus case studies on the research projects in which we have invested in the past year.

Our investment decisions

We apply a rigorous evaluation process for all our investment decisions that involves our trustees, co-optees, members of our Scientific Advisory Committee and external experts in accordance with the Association of Medical Research Charities principles. All our committees comprise eminent figures in their respective fields of expertise. We also expect all recipients of funding to provide regular reports on the results achieved and the impact that it will have on the lives of people. We use Researchfish to capture the outputs and impacts of the research we fund.

The results of research are generally readily available in the public domain through the publication of results in the media and the public presentation of research projects. These presentations and publications are always peer reviewed to ensure a consistently high quality of research. By adopting these measures, we are able to satisfy the public benefit funding requirements.

Details of our peer review process and policies on animal testing, sustainability and intellectual property are available on our website – https://oruk.org/research/information-for-researchers/

Details of our funded research projects are included in the appendix.

Our Research Impact

We are one of the most important funders of MSK research in the UK and the only charity to cover all MSK conditions.

We fund innovative research projects in the UK that expand knowledge, improve patient outcomes and pioneer new forms of MSK prevention, diagnosis, treatment and management. Clinical and scientific research is key to the advancement of knowledge and expertise within medical schools in universities and hospitals. Through our funding these institutions are able to provide academic research positions or research fellowships that may not otherwise be possible. This opens up new research areas and directly benefits students at all levels, up to Early Career Researchers. Surgeons also benefit from access to cutting-edge research and improved training, helping them to provide better treatment and outcomes to patients.

Our research strategy is based on:

1. Embracing all aspects of MSK health.

2. Broadening our remit beyond orthopaedic surgery to include the important surrounding ecosystem of MSK wellbeing, such as physiotherapy, podiatry and primary care.

3. Extending the impact of our investments by partnering with other sources of grant giving.

4. Supporting the work of MSK researchers (especially Early Career Researchers) including the direct funding of research projects and salaries.

5. Opening up longer-term opportunities and pathways for researchers by helping translate their research ideas into practice/process improvements or new products and services.

6. Encouraging medical students to consider a career in MSK research.

7. Supporting the development of a more equal, diverse and inclusive research culture.

8. Helping to make the case for increased research investment in MSK conditions.

Partnership Funding

We partner with other leading academic institutions, healthcare organisations, societies, charities and private companies to directly fund the most innovative MSK research projects. Over the past year we secured a record £2.2m in funding from partners including the NIHR, MRC, BOA, NJR, Versus Arthritis and other leading academic institutions and charities. Some of this money was invested in projects in 2023/24 with the balance allocated to research projects during 2024/25 and beyond.

Amount of partner funding received by ORUK

	£80,000	£653,543	£2,196,288
	2021–22	2022–23	2023–24
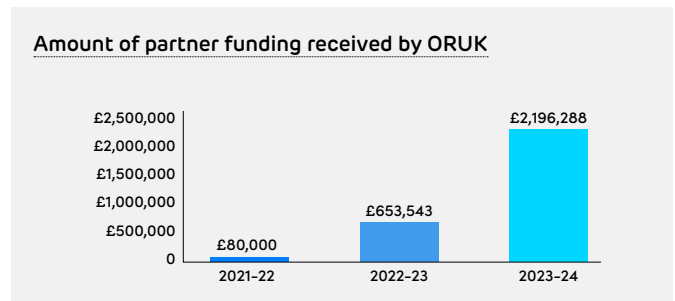
Our Research partnerships 2023/24

- Daphne Jackson Trust – Inspiration Fund Fellowship
- Versus Arthritis – AI in MSK Fellowship
- British Hip Society - MSK Grand Challenge Award
- British Association for Surgery of the Knee – Fellowship
- British Association of Spine Surgeons (BASS) & British Scoliosis Society (BSS) – Fellowship
- National Joint Registry and Royal College of Surgeons of England – Fellowship
- Royal College of Surgeons of Edinburgh – Fellowship
- National Institute for Health and Care Research – AI in MSK Product Development Award.

Research Figures

We funded 18 new research projects worth £2,039,224.00 in 2023/24. This included a direct contribution from our charity of £1,062,804, with the balance provided by partners.

The research funding was allocated to diagnosis, treatment, management and prevention, and a wide range of MSK conditions affecting all body parts including cell bone and soft tissue biology, biomechanics and prosthetics, osteoarthritis, bone fractures, spinal conditions, trauma, bone cancer, rehabilitation and fibromyalgia.

Equality, diversity and inclusivity

We are committed to providing equality of opportunity, eliminating discrimination, and developing a research community that reflects the diverse communities we serve at all levels. We appear to be achieving some success in encouraging more female clinicians to consider a career in MSK research – female researchers secured 56% of our awards (and 77% of funding) in 2023/24.

Our joint fellowship with The Daphne Jackson Trust to support individuals (in many cases, women) returning to research after a career break due to illness, caring or family responsibilities represented an important initiative in supporting gender equality in MSK research.

In addition to gender, in our next Impact Report we will monitor the ethnicity of research applicants. Evidence from this analysis will be used to inform future EDI initiatives.

We support initiatives to tackle inequalities in MSK health services and outcomes such as ARMA's Inquiry 'Act Now: Musculoskeletal Health Inequalities and Deprivation, March 2024'.
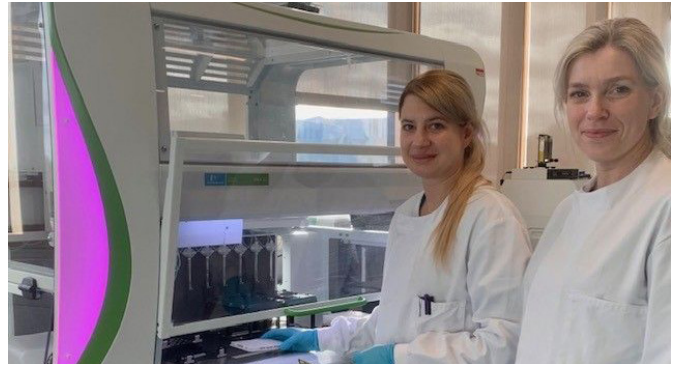
Celebrating the important work of female MSK researchers on International Women's Day

Our Education Impact

We are one of the leading providers of continuous learning in MSK education in the UK. We fund education for healthcare professionals primarily through workshops, training courses, lectures, virtual conferences and webinars, that will improve knowledge of prevention, diagnosis, treatment and the management of MSK conditions.

Our educational offer has broadened over the past few years to embrace primary care and allied healthcare professionals. Every time a healthcare professional applies their learning from one of our courses to a cohort of patients, it means we have delivered an immediate impact to many people in need and a benefit to society.

Highlights of past 12 months.

- AI in orthopaedics (pre-event training)
- London Shoulder Meeting 2023
- First primary care training
- BOMSA/BOTA webinar series to encourage medical students and foundation year doctors to undertake research
- Sustainability in Orthopaedic Surgery in partnership with BOTA

Our education partnerships

We have worked with a range of partners to deliver high quality professional training, including:

- Lets talk doctor
- BOTA
- BOMSA
- BOA
- BESS
- Royal College of Surgeons
- The London Shoulder Practice
- Quality Improvement for surgical teams
- BHR hospitals
- Leeds teaching hospitals
- Lewisham and Greenwich NHS trust
- Cambridge University Hospitals
- Bedfordshire Hospitals

Education Figures

(not including ESCAPE-pain which is reported separately)

Metrics	2022-23	2023-24
Number of events	56	53
Number of attendees educated	3,801	3,757

On average, 94% of participants rated our events as 'excellent' or 'good' in terms of educational value.

Income from events was £253,601 in 2023/24 compared to £284,366 in 2022/23.

Our educational work is supported by a publishing programme. We have two books in print which provide preparation aids for the FRCS (Orth) examinations and complement our training courses.

Our Innovation Impact

Our founder Ronald Furlong combined a highly successful career as an orthopaedic surgeon with an equally successful career as an entrepreneur. He was responsible for a revolution in artificial joint and implant design, dramatically transforming the long-term results of hip joint replacements and the lives of many patients. We are therefore following in his footsteps by being the first MSK charity to actively support start-ups and entrepreneurs.

To even come close to addressing the demand for MSK health services we need an even wider pipeline of innovation. We need our smartest clinicians, engineers and computer scientists to bring their brilliant minds together to solving MSK health challenges, especially those associated with ageing.

We partner with innovative businesses to accelerate the development of diagnostic techniques and new treatments. Our investments provide seed funding to enable entrepreneurial businesses to test and refine their innovations and attract additional commercial funding. Any revenue generated from our investments is reinvested in supporting our charitable activities and increasing our overall impact. Many of these investments involve the use of artificial intelligence (AI) which is already transforming the prevention, diagnosis, treatment and management of people with poor MSK health.

To accelerate translation of research ideas into new products or services, we work with our partners to provide Early Career Researchers (ECRs), who have successfully completed their PhD projects, with funding, education, mentoring and networking support.

This is why we also invest in start-up businesses that are active in the MSK field, through the appropriately named the Ronald Furlong Fund for Start-ups. Our aim is to commercialise and accelerate the roll-out of innovative ideas that can benefit patients as quickly as possible. We have investments in three start-up businesses:

Radii Devices

Deploys state-of-the-art AI and biomechanical modelling to help clinicians design better fitting prosthetic sockets.

Selected by the US Department for Veteran Affairs as a contractor in a project to embed digital technology into its workflow.

renovos®

Pioneering use of a nanoclay in injectable gel form that can carry biologic drugs capable of augmenting bone tissue regeneration.

In January 2024 the company received FDA Breakthrough Device Designation for its proprietary, synthetic nano clay bone fusion gel, RENOVITE.

NOVARA

Commercialising the world's first patented bio-specific solution for the targeted diagnosis and treatment of bone cancer.

We believe in the value of collaboration, working with innovators, funders, academics and clinicians across the whole MSK community. This is why we are delighted to be part of the NHS Clinical Entrepreneur Programme. We share the organisation's belief that clinicians are not only well placed to identify key problems and potential solutions, but many have the entrepreneurial ambition to bring their ideas to life. Orthopaedic and musculoskeletal specialists are already well represented among the clinicians attending the programme.

Our innovation partners

NIHR | National Institute for Health and Care Research

UKRI UK Research and Innovation

NHS CLINICAL ENTREPRENEUR PROGRAMME

MedTech SuperConnector™

EMBRYO VENTURES

impeller

SHIONOGI

Highlights of past 12 months:

- The first MSK Innovation Accelerator programme, hosted by MedTech SuperConnector, which was designed to accelerate the development of MSK innovation and thereby create and scale early-stage MSK ventures across the UK.

- NIHR (National Institute for Health and Care Research) Invention for Innovation (i4i) programme with the aim of transforming MSK health outcomes through AI. The focus was on supporting the research and development of advanced AI solutions to improve operational efficiencies and clinical outcomes in people with poor MSK health.

Supporting talent

Many ECRs leave research on completion and/or cessation of funding of their projects. A Study by The Royal Society found that only 3.5% of research students who complete a PhD secure a permanent research position at a university.

Our support helps to encourage talented ECRs to continue working within the MSK research by opening up career pathways.

ESCAPE-pain Impact

We fund the training of healthcare professionals to deliver ESCAPE-pain. This group rehabilitation programme for people with chronic joint pain integrates educational self-management and coping strategies with an exercise regimen individualised for each participant.

Highlights of past 12 months:

- Expansion of MSK Hubs pilot programme, involving a collaboration between Good Boost, ukactive, Orthopaedic Research UK, ESCAPE-pain, and Arthritis Action to 100 sites.

- Paper evaluating the effectiveness of the ESCAPE-pain programme delivered in community centres.

- ITV Tonight spoke to Professor Mike Hurley for its programme 'New Knees and Hips: Britain's Biggest Queue?'

- Mentioned in the Government's sports and physical activity strategy.

ESCAPE-pain figures

Metrics	2023–24
Number of events	21
Number of attendees trained (ESCAPE-pain)	394

Income from ESCAPE-pain training was £92,399 in 2023/24 compared to £95,263 in 2022/23.

Networking Impact

One of the most effective ways in which we generate a wider impact from our investments is by mobilising the wider MSK network. We do this through regular communication, primarily using social media and email, and convening events on important MSK topics.

We have come to realise that our network and our skills as networkers can make a real difference to the ways in which MSK care is researched and funded. When we connect people with great ideas, with funders and delivery partners, we accelerate the adoption of those ideas. When we organise conferences to debate important topics within MSK health, we quickly share knowledge, highlight needs and start conversations.

Highlights of past 12 months:

- MSK for the workplace – Roundtable event for over 50 experts across government, NHS, health charities and the private sector.

- Research decline – Report plus presentation during the annual BOA conference.

- Environmental sustainability in orthopaedic surgery & MSK Health – whitepaper co-authored with The British Orthopaedic Trainees Association (BOTA).

- AI in orthopaedics – our second annual conference featuring AI experts from across the health sector.

Our ambition is to build an influencer network across the orthopaedic ecosystem including clinicians, academics, GPs, physiotherapists, specialist medical member associations, entrepreneurs, and investors. We measure the growth and vitality of our network by tracking:

- The growth of our LinkedIn followers and their level of engagement in our posts – our followers increased by 49% during the past year, with an average engagement rate (factoring in likes, comments, shares) of 5–6% (a 'good engagement rate' on LinkedIn is around 2%).

ORUK LinkedIn follower growth 2023/24
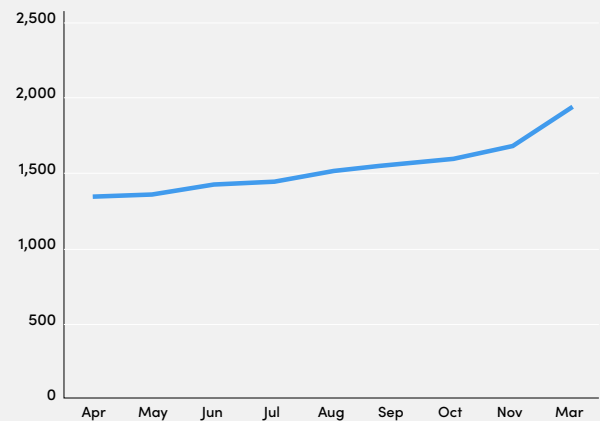
- The performance of our monthly email newsletter – beginning in December 2023 the email has achieved open rates of 44–49% (25-18% is considered 'good') and a click rate of 1.5 to 2.9% (2.5% is considered 'good'). After the cleaning-up of our data to ensure it is fully compliant with GDPR, our database contains over 4k records.

Being a Good Partner

As a relatively small charity, we can only deliver a meaningful impact on the work of clinicians and the lives of partners by partnering with others. During the past 12 months we have nurtured existing relationships and formed new partnerships with academic institutions, other charities, NHS bodies, government and the private sector. The outcome from these partnerships has been the co-funding of research, education events and policy activity.

Being a 'good partner' is therefore an important measure of our long-term success. We are delighted to share these testimonials from organisations with which we have partnered during some of the past year.

'We have been delighted with the response to the research partnership with ORUK which has attracted high quality applicants with interests across a wide variety of research areas. Working together has enabled us to maximise our research funds with the aim of developing a pipeline of research-active orthopaedic surgeons to drive the future of clinical research in the UK. We are also pleased to be able to strongly promote diversity within research by offering the grants on a flexible basis to encourage applicants who may wish to work less than full time. The partnership has widened our current research portfolio and complements our other activities.'

Justine Clarke,
Chief Operating Officer,
British Orthopaedic Association

British
Orthopaedic
Association

'The NJR is grateful to ORUK for agreeing to part-fund our NJR/ORUK/RCSEng research fellowship programme. We have now recruited to the first cycle of this and are looking forward to starting recruitment to the second in 2024-25. We have worked closely with ORUK colleagues to change this from a single-funder fellowship to the partnership arrangement, to promote the opportunity via various communications channels and to interview and recruit the candidates. We look forward to an ongoing partnership with ORUK in the future'.

Chris Boulton,
Deputy Director of Operations,
National Joint Registry

NJR **National Joint Registry**
Working for patients, committed to excellence

'The collaboration between the British Hip Society and Orthopaedics Research UK has been truly remarkable. This journey began some three years ago when we were looking for evidence to support and guide our revision hip network project. So far, we have appointed three fellows assigned to an array of hip related projects. All three have delivered and surpassed our expectations. We remain committed to this venture and have just agreed to a fourth fellow. Our hope is that the foundation laid down here sets the stage for a lasting and productive relationship for many years to come.'

Anil Gambhir,
President British Hip Society

BRITISH
HIP
SOCIETY

'As past president of BSS, I think the concept of a specialist society and a charity jointly funding research is an excellent concept. The spinal societies must do more to promote research and in spines there is a lot to do. I think partnerships like this will flourish and produce some important work, but perhaps more importantly, start to embed research as part of clinical life and not just for those pursuing an academic career. I hope this partnership persists for many years to come.'

Ashley Cole,
President, British Scoliosis Society

'The Daphne Jackson Trust is absolutely delighted to be working with ORUK, who are very generously co-funding one of our Fellows. ORUK have been very professional throughout the partnership. We particularly appreciated their input into our interview process, and it was invaluable to the candidate, who is thriving being back in a research environment. This would not have been possible without the support of ORUK. We are thrilled that they have agreed to sponsor again this year. Thank you!'

Dr Helen Marsh,
Trust Manager,
Daphne Jackson Trust

We are proud to partner with ORUK, and working closely with the team has been immensely rewarding. At BOMSA, our vision is to enhance exposure and opportunities in T&O surgery from a medical student level, and by collaborating with ORUK, we have made significant progress towards our goals. Together, we have established the first-of-its-kind OBB Research Fund for medical students undertaking orthopaedic research, while also delivering an online research webinar series, attending by hundreds internationally. These initiatives have significantly enhanced the education and professional development opportunities for aspiring orthopaedic surgeons across the UK. The benefits of partnering with ORUK are extensive. They bring a pragmatic, proactive approach to problem-solving and are always willing to mobilise resources to transform ideas into reality, benefiting the most junior members of the orthopaedic community. We look forward to further strengthening our partnership with ORUK and expanding the academic orthopaedic network, starting at the grassroots level. By creating an active network of ORUK grant recipients, from medical students and trainees to early career and post-doc researchers and clinical academics, we aim to foster a sense of community, support academic trainees and improve research quality that will ultimately benefit musculoskeletal patients. The future of orthopaedic research is bright, thanks to ORUK's unwavering support and dedication, and BOMSA is privileged to be part of this journey.

Dr Shivam Kolhe,
Co-Founder and Past President,
British Orthopaedic Medical Students Association (BOMSA)

Research Case Studies 2023/24

Ref	Institution	Title	Amount invested by ORUK & partners	Funding Stream	Duration (months)
564	NJR-RCSEng-ORUK: Queen Mary University of London	The effect of a Mental Health Disorder (MHD) on patient outcomes following Total knee arthroplasty (TKA), identification of risk factors using a large GP and Community database	£197,450	Early Career Fellowship	24
565	BASS-BSS-ORUK: Aston University	Modelling of the spinal cord within the vertebral column for the greater understanding of the aetiology and management of compressive spinal cord pathology	£60,000	Early Career Fellowship	24
566	BASK-ORUK: University of Manchester	Investigating the biomechanical and functional outcomes of autologous chondrocyte implantation: A multi-centre study	£112,838	Early Career Fellowship	24
567	DJT-ORUK: Keele University	Big data analyses of the long-term benefits of knee cartilage surgery	£110,000	Early Career Fellowship	36
568	BHS-ORUK: University of Bristol	Day case hip replacement in the NHS: a registry-based national cohort study	£110,000	Early Career Fellowship	24
569	RCSEd-ORUK: University Hospitals of Leicester	Surgical treatment of pathological posterior medial meniscal extrusion: A biomechanical study comparing centralization techniques	£60,000	Early Career Fellowship	12
570	BOA - ORUK: Cambridge University Hospitals	Mesenchymal stromal cells in cartilage regeneration: defining the immunomodulatory characteristics on macrophage populations	£60,000	Early Career Fellowship	9
571	BOA-ORUK: Royal Infirmary of Edinburgh (NHS Lothian)	Can a novel machine learning algorithm for analysis of pelvic radiographs improve the prediction of hip displacement in cerebral palsy?	£33,320	Early Career Fellowship	24
572	Northumbria University	Development and feasibility of a digital health intervention to encourage exercise maintenance after falls prevention exercise programmes end	£105,200	Early Career Fellowship	24
573	Cardiff University	Identifying objective measures of sex-specific pain in humans that can be used diagnostically to target treatment	£47,000	Inspiration Fund	9
574	University of Birmingham	Torque visuo-motor feedback training: A new way to manage patellar tendinopathy	£105,300	Early Career Fellowship	24
575	Royal Infirmary of Edinburgh (NHS Lothian)	Development of a diagnostic protocol to aid the investigation and management of posterior malleolus ankle fractures	£23,000	Inspiration Fund	24
576	University of Oxford	Improving Wrist Injury Pathways (I-WIP)	£45,000	Inspiration Fund	24
577	University of Exeter	Developing a core outcome set for studies of patients sustaining periprosthetic femoral fractures	£38,000	Inspiration Fund	8
578	Queen Mary University of London	Establishing the feasibility of real world surveillance of orthopaedic devices using routinely collected data	£50,000	Early Career Fellowship	12
579	University of Cambridge	A precision health approach to osteoarthritis: early diagnosis, stratification and risk prediction using state-of-the-art machine learning models	£100,000	Early Career Fellowship	24

NJR-RCSEng-ORUK; Queen Mary University of London

The effect of a Mental Health Disorder (MHD) on patient outcomes following Total knee arthroplasty (TKA), identification of risk factors using a large GP and Community database.

Researcher: Ben Gabbott

Supervisor(s): N/A

University or Trust:
Queen Mary University of London

Award stream: NJR/ORUK/RCS England Research Fellowship

Award duration: 1 year

Amount rewarded: £197,450

Other funders: The National Joint Registry and the Royal College of Surgeons of England

Collaborations/ partners: N/A

Research activity area:
Treatment Evaluation, Aetiology

MSK focus area: Knee Joint

Research topic: AI / Big Data / Digital Technology, Computational Modelling / Knee Osteoarthritis / Co-morbidity

The MSK health issue the research project is trying to address

Patients with Mental Health (MH) disorders (MHD) are at higher risk of dissatisfaction, complications and chronic pain following knee arthroplasty (TKR). Chronic pain following knee arthroplasty alone costs the NHS £33,000,000/year. Despite MH disorders being common, they are overlooked in perioperative guidance.

Extensive literature has identified MHD as a risk factor for poor outcome. The next translational step, patient level prediction of individuals at high risk has proven to be difficult, predominantly due to lack of granular MH data. Little research has considered the importance of diagnosis, severity and chronicity of MHD.

Linking primary, secondary and arthroplasty data may provide the answer to this complex problem.

The main aims and objectives of the research study

Aim
To quantify the risk factors for poor outcomes in patients with MHD receiving a TKR, and to identify potential MH interventions.

Hypothesis
In patients undergoing TKR with a MHD, poor outcomes are associated with risk factors identifiable in primary health data. These risk factors can be identified pre-operatively and are modifiable through existing NHS services.

Research Questions

1. What is the prevalence of different MHD in patients undergoing TKR within the NHS?

2. How does the diagnosis, severity and chronicity of MHD effect patient outcomes following TKR?

3. What successful MH interventions have previously been used in patients undergoing orthopaedic surgery?

How this research is going to help address MSK health

Immediate

The results of the project will quantify the impact mental health(MH) has on poor outcomes following TKR. Furthermore, raising awareness of a large health inequity in an underserved population. This will set the ground-work for future treatment strategies to be tailored to address this unmet need.

The NHS already has MH services in all Trusts, which could improve outcomes without a substantial implementation barrier. Unfortunately, they are rarely used by orthopaedic services. Dissemination of my results will encourage individuals to be referred onto MH services prior to their operation.

Patient education will be achieved via the help of a Patient Advisory Group, to create advice leaflets. This will be disseminated via collaboration with related charities to raise awareness. Empowering patients to seek treatment for their MH with their arthroplasty.

Long-Term

To guide future RCTs of interventions for MH in the arthroplasty population. This will then subsequently inform NICE Guidelines (NG157). We will challenge the lack of recommendations regarding MH optimisation.

I believe high risk patients may be best served with a MDT approach. Specialist clinics combining extended physiotherapy, pain specialists and psychological support in tandem with the standard orthopaedic-care, can save a large NHS burden and financial costs.

The main research methods, or datasets being used

We will use 3 major routine healthcare databases

Discovery Data Service (DDS)

Holds linked patient data combining GP, Social service and Mental health records. It covers the population of North East London (approximately 2 million people).

National Joint Registry (NJR)

A database for any patient undergoing arthroplasty in the UK. Details include arthritis, surgery, and hospital data. It also has a linked Patient Reported Outcomes Score (PROMS) database, which patients answer at 6 months pre and post op.

Hospital Episode Statistics (HES)

Is linked to the NJR. Provides details about patients engagement with secondary health providers, and further inpatient data.

I have constructed a 4 stage research plan;

Stage 1 – Dataset Construction

Objective – To create a unique dataset of all patients undergoing TKR in North-East London in the past 10years, combining relevant MH related exposures and outcomes.

Stage 2 – Epidemiology

Objective – To describe the diagnosis, severity and chronicity of MHDs amongst people with arthritis undergoing a TKR.

Stage 3 – Outcomes

Objective – To describe association between diagnosis, severity and chronicity of MHDs and outcomes following Total Knee Replacement.

Stage 4 – Identifying interventions

Objective – To identify Mental Health Interventions which have previously improved outcomes following Orthopaedic Surgery.

Research results generated

1st Year Key Progress Points

- Bespoke Data Link Pipeline Constructed, approximately 9000 patient records linked via encrypted pseudonymised methodology
- Ethics Approval (Reference-24/WM/0040)
- Data extraction and statistical analysis plan completed
- Early Results of NJR data
  - 29,647 (9%) people self-report depression diagnosis before surgery
  - 113,572 (34.6%) report moderate or severe depression symptoms before surgery, but only 68,183 report symptoms post-operatively
  - Patients with depressive symptoms pre op have a 57% chance of improving their symptoms post-operatively.
- Conclusion
  - Depression is common with more people suffering from symptoms than are diagnosed
  - Patient Mental Health symptoms improve with surgery.

Next steps of this research project

Data analysis as described in the research methods section.

Publications and presentations related to this fellowship

[Harvard]

One paper written awaiting submission

New medical products, intellectual property, software or technical products resulting from this project

Not Applicable

Awards or recognition received related to this project

Not Applicable

Impact of this Orthopaedic Research UK fellowship on your research and career

My career aim is to lead national orthopaedic studies in the future, as a clinical academic based within a University and hospital partnership. My academic goal is to be a clinician who can bridge the gap between NHS routinely collected data and patient outcomes, allowing for resources to be redirected to those at highest risk of poor outcomes.

My PHD is investigating the interlinking relationship between surgical outcomes and mental health disorders, a topic often overlooked in an underserved populations. The ORUK has provided me funding allowing me to establish a perfect springboard to support my strive towards becoming an effective academic surgeon.

Whilst applying for my PHD, I have been exposed to critical experiences for researchers including proposal/grant applications, the importance of patient and public involvement and understanding the framework behind research funding

During my first 6 months of study I have acquired a multitude of technical and personal skills. From a technical perspective I'm now adept at data management and analysis, writing statistical analysis and data extraction plans, as well as applying for ethics and REC approval. On a personal level, working as a PHD student has re-enforced in me; self-guided learning, organisation of multiple tasks to strict timelines and collaboration amongst research groups.

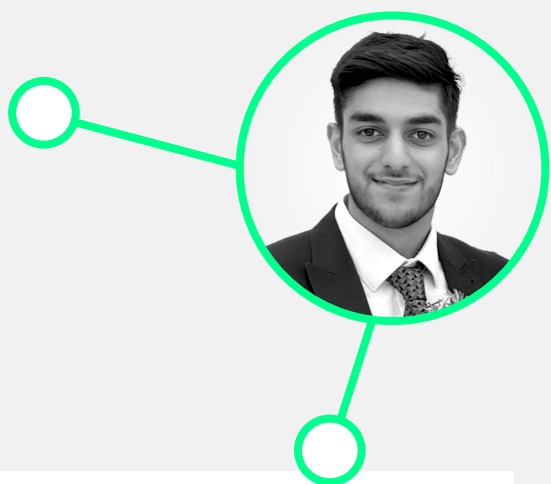The ORUK's support has been pivotal to gaining these personal, and technical skills.

Engagement with research users, special interest groups and the general public to inform them about the research

Not Applicable

Influence of research project on policy, practice or patients

Not Applicable

BASS-BSS-ORUK:
Aston University

Modelling of the spinal cord within the vertebral column for the greater understanding of the aetiology and management of compressive spinal cord pathology

Researcher: Rajan Vraitch

Supervisor(s): Dr. Jean-Baptiste R. G. Souppez, Dr. Eirini Theodosiou, Prof. Adrian Gardner, Dr. Francesco Giorgio-Serchi, Dr. Xianghong Ma

University or Trust: Aston University

Award stream: Spine Research Fellowship (ORUK,B ASS, BSS)

Award duration: 24 months

Amount rewarded: £60,000

Other funders: Aston University's College of Engineering and Physical Sciences.

Collaborations/ partners: Royal Orthopaedic Hospital

Research activity area: Treatment Development: translating basic research into experimental medicine in preclinical settings and/or model systems.

MSK focus area: Multiple Body Areas (Bones and Muscles)

Research topic: Spine / Back

The MSK health issue the research project is trying to address

The MSK health issue that this research is addressing is degenerative cervical myelopathy (DCM). Regarded as the most prevalent type of spinal cord injury, DCM is the compression of the spinal cord due to the degenerative changes within the vertebral column, leading to impaired spinal cord functionality. Consequently, this often leads to people struggling with hand dexterity issues, instability while walking, and difficulties performing everyday tasks.

The main aims and objectives of the research study

The aim of this study is to develop anatomically accurate, patient-specific models of the cervical spine that simulate various clinical presentation of spinal cord compression. These models aim to offer new insights into patient-specific management strategies while reducing the reliance of animal testing by providing an ethical and clinically relevant alternative. To achieve this, the objectives are:

- Manufacture full-scale, anatomically accurate spine models using 3D printing from MRI and CT scans.

- Integrate pneumatic, adjustable stiffness actuators to replicate natural spinal cord behaviour and compression.

- Apply uniaxial testing, dynamic mechanical analysis, and digital image correlation to validate spine models.

- Generate data-driven suggestions to guide future clinical research tailored to individual patients.

How this research is going to help address MSK health

This research will help address MSK health by developing accurate, patient-specific models of the spine to better understand spinal cord compression, improve diagnosis accuracy, and inform data-driven surgical interventions, ultimately enhancing patient-oriented care while also reducing reliance on animal testing within this field of research.

Research results generated

So far, this research has generated significant results that has advanced the project towards the final aim of this study. A full-scale cervical spinal model has been successfully manufactured using 3D printing, that enables the model to replicate the dynamic movements of the spine. Mechanical testing, specifically compression testing, has been conducted on a range of materials with a particular focus on VarioShore thermoplastic polyurethane (TPU), which is a foaming TPU that allows easy adjustment of the mechanical properties by changing the manufacturing parameters. The results from these mechanical tests have enabled the modelling of the intervertebral discs (IVDs) to be highly customisable depending on the patient's age. Additionally, the integration of thin McKibben muscles has resulted in the ability to fine-tune the spinal model's stiffness, effectively mimicking the stiffening effects inherent to DCM.

Next steps of this research project

The next steps of this project include making the cervical spine models patient-specific by utilising medical imaging data, such as Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans, subject to ethical approval. Additionally, the project will quantify the achievable range of model of the spinal models to ensure they match existing literature. Further research will also include adding the complexity of axial rotation and validating these spinal models using finite element analysis (FEA) and digital image correlation (DIC).

Publications and presentations related to this fellowship

- Vraitch, R., Giorgio-Serchi, F., Ma, X., Theodosiou, E., Gardner, A., and Souppez, J-B., 2024. 'Modelling of the spinal cord within the vertebral column for the greater understanding of the aetiology and management of compressive spinal cord pathology'. Presented at ARCHA Research Showcase, Conference Aston, 10 January 2024, Aston University, UK.

- Vraitch, R., Smithies, J., Obunike, P., Geoghegan, P., Giorgio-Serchi, F., Ma, X., Theodosiou, E., Gardner, A., and Souppez, J-B., 2024. "Advancing Degenerative Cervical Myelopathy Management: Development of an Actuated Cervical Spine Model." Presented at BASS 2024, 20-22 March, Bournemouth, United Kingdom.

- Vraitch, R., 2024. 'A Sustainable Future in Healthcare: Ethically Tailored Patient-Specific Innovations for Degenerative Cervical Myelopathy Treatment', presented at EAN Congress, 9-11 June, Cardiff University, United Kingdom.

Awards or recognition received related to this project

- EPC Hammermen David K. Harrison Student Award finalist

"A Sustainable Future in Healthcare: Ethically Tailored Patient-Specific Innovations for Degenerative Cervical Myelopathy Treatment"

Impact of this Orthopaedic Research UK fellowship on your research and career

The Orthopaedic Research UK fellowship has enabled me to pursue a PhD while collaborating closely with a hospital, allowing me to apply my academic research and engineering knowledge to address real-world problems and create engineered solutions within the medical field. Additionally, this fellowship has provided me with invaluable opportunities to conduct novel research and present at conferences, engaging with patients, healthcare professionals, and other researchers. It has also solidified my future career aspirations by confirming my desire to use my engineering expertise to advance the medical industry and improve patient outcomes.

Engagement with research users, special interest groups and the general public to inform them about the research

- Vraitch, R., Giorgio-Serchi, F., Ma, X., Theodosiou, E., Gardner, A., and Souppez, J-B., 2024. 'Modelling of the spinal cord within the vertebral column for the greater understanding of the aetiology and management of compressive spinal cord pathology'. Presented at ARCHA Research Showcase, Conference Aston, 10 January 2024, Aston University, UK.

Influence of research project on policy, practice or patients

It is anticipated that the findings arising from this fellowship will inform the future management of DCM, ensuring the best possible patient outcomes. The knowledge gained from this research hopes to influence the clinical practices and policies, promoting patient-centred care and directly contributing to healthier ageing.

BASK-ORUK:
University of Manchester

Investigating the biomechanical and functional outcomes of autologous chondrocyte implantation: A multi-centre study.

Researcher: Gwenllian Tawy

Supervisor(s): Leela Biant

University or Trust:
University of Manchester

Award stream:
BASK/ORUK Research Fellowship 2023

Award duration: 24 months

Amount rewarded: £112,838

Other funders: N/A

Collaborations/ partners: Professor Leela Biant & Mr Michael McNicholas (Manchester University NHS Foundation Trust); Mr Martyn Snow (Royal Orthopaedic Hospital NHS Trust); Mr Ram Venkatesh (Leeds Teaching Hospitals NHS Trust); Mr Chethan Jayadev (Royal National Orthopaedic Hospital NHS Trust); Mr Gorav Datta & Mr Amir Qureshi (University Hospital Southampton NHS Trust); Mr Wasim Khan (Cambridge University Hospitals NHS Foundation Trust); Mr Varun Dewan (The Royal Wolverhampton NHS Trust).

Research activity area:
Treatment Evaluation

MSK focus area: Joints

Research topic: Biomaterials, Biomechanics, prosthetic and surgical devices / Knee / Trauma and Orthopaedic Surgery

The MSK health issue the research project is trying to address

Knee injuries are common. Sometimes, knee injuries can damage the lining of the knee's bones, called cartilage. Cartilage injuries cause pain and limit movement, making activities like walking, playing sports, and working difficult.

Cartilage cannot repair itself well, so surgery is sometimes needed to repair the injury. People who have cartilage repair surgery want to return to normal activities after their operation, like working and playing sports. Doctors and scientists know that cartilage repair surgery can reduce pain, but they do not fully understand how it affects movement.

This research will help us understand if knee function gets better after a certain type of cartilage repair surgery called autologous chondrocyte implantation (ACI). The results will help doctors and patients understand what to expect after ACI. It could also uncover common weaknesses in the knee after surgery that could be avoided in future by updating the current physiotherapy programmes for ACI patients.

The main aims and objectives of the research study

The main aim of this study is to measure changes to knee movement and walking ability 6 months after ACI surgery. The objective is to understand how knee function changes in the early months following ACI surgery.

How this research is going to help address MSK health

This project will improve our understanding of how ACI, a cartilage repair surgery, impacts knee function and mobility (biomechanics).

Understanding the impact of ACI on biomechanics is vital for patient satisfaction and long-term treatment success.

If this study finds common weaknesses in the knee after surgery, it will be important to share this with future patients. This will help them decide whether or not to have the surgery. It will also help future patients set realistic expectations for their surgery.

This research will also be valuable to healthcare professionals. Firstly, it could improve the way they select and prepare patients for surgery. But most importantly, it could help them plan effective physiotherapy programmes for ACI patients, to make sure that their patients get the most out of their surgery.

Normal knee function is important to enable patients to do all the things they used to be able to do before their injury, as well as return to an independent and mobile lifestyle. Because of this, this research may have indirect benefits too. Patients with better function after surgery are less likely to need follow-on surgery, and are more likely to be able to continue working. They may also be less likely to develop arthritis and long-term illnesses that are linked to inactive lifestyles.

The main research methods, or datasets being used

Adult patients who are waiting to have ACI surgery at one of 7 hospitals in England will be invited to take part in this study. Patients who decide to take part will be invited to two appointments at their own hospital, where tests of their knee function and walking ability will take place. The first test will measure how much the individual can bend and straighten both knees. The second test will involve walking over a platform to record detailed biomechanical information on their walking pattern. Participants will also be asked to stand on the platform to assess their balance. Finally, participants at the main research site in Manchester will be asked to walk on a treadmill to record more information about the knee's movement.

The first research appointment will take place before the participant's operation, and the second and final appointment will take place 6-months after surgery. The results from both appointments will be compared to see how function and walking ability has changed.

At the same time, the researchers will also run another study with healthy adults with no knee injuries. The same tests will be carried out. The results of this study will help us understand if the people in the patient group have similar results to the people without knee injuries after their surgery.

Research results generated

Since this study started in January 2024, the researchers have been getting approvals from all the hospitals to start recruiting participants. They are now open to recruitment at 5 of the 7 hospitals. So far, 5 patients have been recruited into the study.

The project has been given approval by the University of Manchester to start the second study with adults with no knee injuries. So far, they have recruited 9 people into this study.

They hope to be able to share early findings from this research with the participants and general public once the first patients have returned for their 6-month post-surgery visit.

Next steps of this research project

The next step is to continue recruiting participants into both studies, and carry on collecting data. They are looking to recruit 47 participants into each study.

In January 2024 the project will run an online Public Engagement event to share our early findings with the participants and members of the public.

Towards the end of the year, they will also start applying for more funding to expand this project. One thing they would like to do is see how ACI impacts knee function beyond 6 months.

Publications and presentations related to this fellowship

Tawy G., Timme, B., McNicholas, M., Biant., L. Gait characteristics of patients with symptomatic cartilage lesions of the knee. Journal of Cartilage & Joint Preservation (2024) Available online: https://doi.org/10.1016/j.jcjp.2024.100175

Smith, L., Jakubiec, A., Biant, L., Tawy, G (2023). The biomechanical outcomes of Autologous Chondrocyte Implantation for articular cartilage defects of the knee: A systematic review. Knee Oct: 44:31-42. DOI: 10.1016/j.knee.2023.07.004

Awards or recognition received related to this project

Gwenllian Tawy received recognition for this work at a Fellowship Inaugural Lecture on 12th June 2024 at the University of Manchester.

Impact of this Orthopaedic Research UK fellowship on your research and career

"As a new Fellow, I am now recognised as an independent researcher at my university. This has led to more teaching opportunities, and will hopefully lead to a permanent lectureship. Becoming a lecturer is my next career goal."

Engagement with research users, special interest groups and the general public to inform them about the research

The researchers have been regularly updating the public about this research on our website (https://personalpages.manchester.ac.uk/staff/gwenllian.tawy/) and LinkedIn accounts. The study's Patient Contributor, Tamsen Lesko, works to make sure that everything shared with the public is written for patients and the general public.

Gwenllian Tawy has been invited to present this research to local healthcare professionals and at national conferences.

Influence of research project on policy, practice or patients

The results from this research may result in changes to practice, particularly to physiotherapy protocols after ACI surgery. This could lead to improvements in knee function in patients who have had ACI.

DJT-ORUK:
Keele University

Big data analyses of the long-term benefits of knee cartilage surgery.

Researcher: Dr Nikki Kuiper

Supervisor(s): Professor Karina Wright

University or Trust: Based at the RJAH Orthopaedic NHS Hospital, Oswestry and hosted by Keele University

Award stream: Joint Partnership Funds

Award duration:
2.5 days/wk for 3 years

Amount rewarded: £128,712.10

Other funders:
Daphne Jackson Trust and MRC

Collaborations/ partners: N/A

Research activity area:
Prevention and treatment evaluation

MSK focus area:
Articular cartilage in the knee joint

Research topic: Knee, osteoarthritis, trauma and orthopaedic surgery

The MSK health issue the research project is trying to address

The researchers hope to relate health records of patients who have undergone knee articular cartilage surgery at the RJAH Orthopaedic NHS Hospital, Oswestry to nationwide patient populations to find out the period of time from last knee cartilage surgery to joint replacement. This will help clinicians predict when and to whom cartilage repair may be successfully applied.

The main aims and objectives of the research study

The project hypothesises that cartilage repair techniques performed in the knees of middle-aged patients delays the progression of osteoarthritis (OA) and the need for joint replacement. Our aims are to:

- Track cartilage repair patients over long periods of time by linking their RJAH Orthopaedic NHS Hospital research records to data in the National Joint Registry and extract relevant data from the UK Biobank.

- Use the National Joint Registry to analyse time to joint replacement and determine whether it is possible to predict when and to whom cartilage repair may be successfully applied.

- Use the UK Biobank to determine whether cartilage surgery delays the progression of OA in patients with a genetic architecture predisposing them to OA.

How this research is going to help address MSK health

If the research provide better information for patients to help them weigh up the benefits of having knee articular cartilage surgery then this will improve their quality of life and reduce the need for knee replacements, both of which represent health-economic benefits.

The main research methods, or datasets being used: The RJAH Orthopaedic NHS Hospital specialises in bone and joint disorders. Uniquely, it has health records from different types of knee cartilage surgery spanning more than 20 years. The research will relate these knee cartilage surgery records to nationwide patient populations held in the National Joint Registry (results from joint replacements and the UK Biobank registry (health records and risk factors for the major diseases of middle and old age).

Next steps of this research project

At the end of the study, the researchers will have several independent variables e.g., age, gender, details of other related health conditions, type of knee injury, type of cartilage surgery and genetic risk score to help orthopaedic surgeons tailor treatment for their patients. With the information they can create an algorithm which would be incorporated into an online app for orthopaedic surgeons to use in outpatient clinics.

Impact of this Orthopaedic Research UK fellowship on your research and career

I am hugely grateful to the Daphne Jackson Trust and ORUK for joining forces to provide me with this unique opportunity to re-establish my research career after a significant career break due to ill health. Currently, I am focused on retraining and reskilling in healthcare research, technical programming languages, bigdata analytics and predictive modelling.

Engagement with research users, special interest groups and the public to inform them about the research

The RJAH Orthopaedic NHS Hospital held an Annual Research Day on Friday 7th June 2024. There is a mix of science and clinical talks/posters highlighting work within the hospital. The event encourages closer working within the Trust and an opportunity for networking with representatives from key academic partners. I presented a poster (awarded 3rd prize out of 30 posters) despite only being in post for a short time. Posters are viewed by the public after the research day event.

Influence of research project on policy, practice or patients

Our long-term goal is to provide better information for patients to help them weigh up the benefits of having knee articular cartilage surgery.

BHS-ORUK:
University of Bristol

Day case hip replacement in the NHS: a registry-based national cohort study

Researcher: Jonathan French

Supervisor(s): Kevin Deere, Adrian Sayers, Katie Whale, Michael Whitehouse

University or Trust:
University of Bristol

Award stream:
MSK Grand Challenge Award

Award duration: 2 years

Amount rewarded: £110,000

Other funders: British Hip Society

Collaborations/ partners:
British Hip Society

Research activity area:
Treatment Evaluation

MSK focus area: Joints

Research topic:
Hip, Knee, Osteoarthritis, Trauma and orthopaedic surgery, Big data

The MSK health issue the research project is trying to address

Osteoarthritis of the hip will affect around a quarter of people in their lifetimes, causing severe pain and disability. It can be successfully treated with a hip replacement, which show excellent results and last around 25 years.

However, in the last few years, NHS waiting lists have reached record levels, made worse by the COVID-19 pandemic. This has led to a large number of patients waiting for hip replacement enduring unnecessary pain, disability, and decline in mental and physical health.

One of the potential ways to increase the number of hip replacements we can do is to do more as a "day case". This means that patients don't stay overnight in hospital after the operation, but instead go home on the same day. Not everyone is suitable for a day case hip replacement – patients need to be chosen carefully.

Day case hip replacement first started in the USA, becoming more popular recently in the UK after the COVID-19 pandemic, where overnight hospital beds were limited. Small studies show that it appears to be safe, and patients seem satisfied with the process. However, with plans to rapidly expand how many day case joint replacements we are doing in the NHS, we need to look at the outcomes on a larger scale.

The main aims and objectives of the research study

1. Describe trends in day case joint replacement in England
2. Analyse patient outcomes after day case hip replacement compared to traditional hip replacement

How this research is going to help address MSK health

Recovering from the current backlog of orthopaedic procedures is likely to be one of the challenges of our generation. There is growing evidence from the US, Canada and Europe that hip replacement can be safely done as a day case operation. However, the healthcare systems of these countries are different to the NHS, and we cannot assume the results will be the same.

With all significant changes in the way that we practice, research is required to ensure that the changes are safe. The ambition of this project is to answer this important question by using data that is routinely collected by all hospitals in England. This will give us data on a National level.

If the results following day case surgery are worse, then the practice will need to change based on what we find. This could be who we are selecting for day case surgery, for example. If results are the same or better, then increasing how much day case surgery we are offering might be one of the ways we are able to reduce waiting times.

The main research methods, or datasets being used

The National Joint Registry (NJR) is the largest joint replacement registry in the world. It records data on all hip replacements done in England, Wales, Northern Ireland, the Isle of Man and Guernsey.

Data from the NJR can be linked to Hospital Episode Statistics (HES). HES records information on all NHS hospital admissions in England. Combining these two datasets together gives us far more detail and allows us to identify all day case hip replacements done in England.

We will describe demographic data i.e. the characteristics of people who are able to undergo day case hip replacement, including age, sex, medical conditions, frailty, socioeconomic factors, as well as surgical factors such as the approach to the hip joint, use of cement, hip replacement materials, and type of anaesthetic.

Patients who are readmitted after surgery to any NHS hospital in England will be picked up by the HES dataset. Readmissions for day case patients will be compared with those who stayed in hospital for one to two days. Any differences in patient and surgical characteristics will be adjusted for in the statistical analysis to ensure comparisons are as fair as possible.

As well as readmissions, we will look for differences in reoperations between the two groups. These will include operations not typically picked up in the NJR data such as closed reduction of dislocations, and fixation for peri-prosthetic fracture (where the bone breaks around the artificial hip).

In a similar manner, to assess safety we will also compare the rate of serious medical events between the two groups, such as heart attack, stroke, deep vein thrombosis and pulmonary embolism, pneumonia, and death.

Research results generated

We are still in the analysis stage and have no firm results from the main analysis yet.

Next steps of this research project

The background work to this project involved systematically searching for all studies that have been done before on day case joint replacement. The results of these were analysed together (meta-analysis) showing that day case joint replacement appears to be safe, but there is a lack of NHS studies. This paper is currently under review having been accepted with changes.

NJR data has been analysed to show the number of joint replacements we have lost as a result of the COVID-19 pandemic, and whether we are on the road to recovery. This article is in press with the Bone & Joint Journal.

HES data is routinely collected primarily for NHS Hospitals to receive funding for services provided. It therefore needs to be carefully "cleaned" before it can be used for research. This is a long process which is currently underway.

Once the cleaning process is completed, the main analysis can begin. This will consist of fitting and testing statistical models of increasing complexity to answer the questions described.

Impact of this Orthopaedic Research UK fellowship on your research and career

This fellowship has been invaluable in allowing me to pause my usual clinical practice and focus on answering this important clinical question full-time.

RCSEd-ORUK: University Hospitals of Leicester

Surgical treatment of pathological posterior medial meniscal extrusion: A biomechanical study comparing centralization techniques.
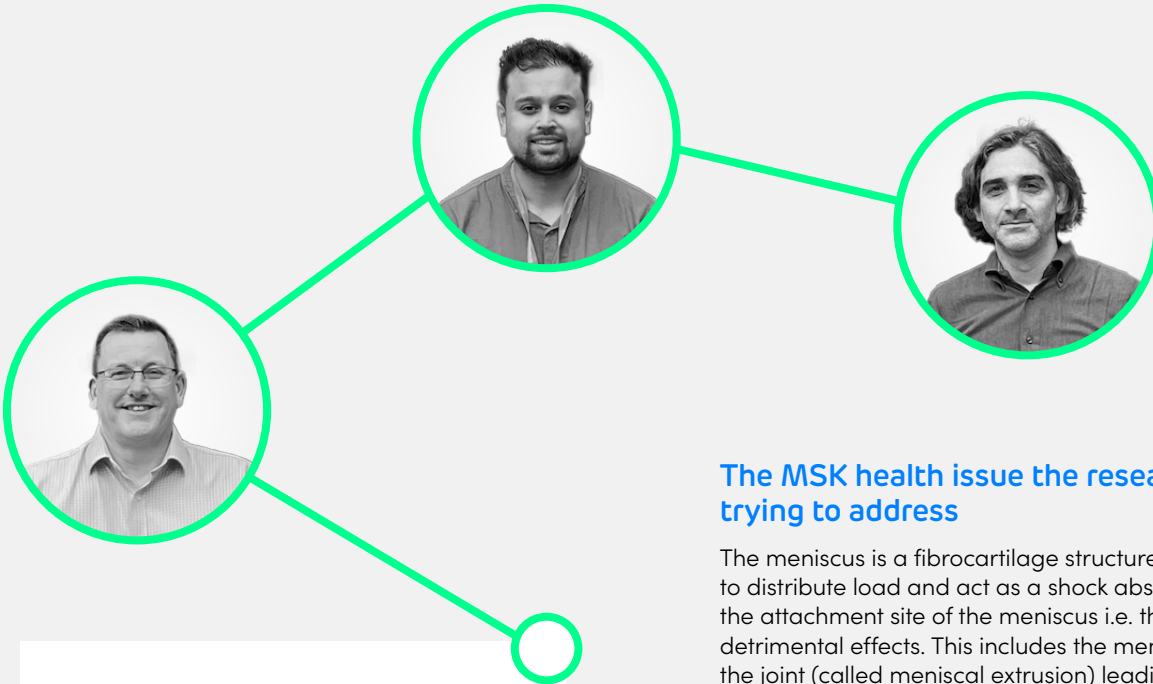
Researcher: Khalis Boksh

Supervisor(s):
Prof. Duncan Shepherd, Dr. Daniel Espino and Mr. Tarek Boutefnouchet

University or Trust:
University of Birmingham

Award stream:
ORUK–RCSEd Research Fellowship

Award duration: 12 months

Amount rewarded: £60,000

Other funders: N/A

Collaborations/ partners: N/A

Research activity area:
Underpinning / Treatment Evaluation

MSK focus area: Multiple body areas

Research topic: Biomechanics / Knee / Soft tissue biology

The MSK health issue the research project is trying to address

The meniscus is a fibrocartilage structure of the knee. It helps to distribute load and act as a shock absorber. When you tear the attachment site of the meniscus i.e. the root, this can have detrimental effects. This includes the meniscus moving out of the joint (called meniscal extrusion) leading to the tibia and femur rubbing against each other and subsequently arthritis.

Knee surgeons tend to fix the meniscal root, so that we can delay or even prevent this from happening. However, despite this, research has found that the meniscus can still extrude, leading to the detrimental pathology described.

Over the last ten years, surgeons have come up with newer techniques where they add in a procedure in addition to fixing the root to prevent this from happening. This procedure is called centralization, where the meniscus is held down at its periphery, and has nowhere to move.

There are many different types of centralization described in the literature. One includes the insertion of suture anchors, whilst the other involves pulling the sutures down a tunnel within the tibial bone and tied over a 'button'. However, they have never been compared to one another, and so we are unsure which is the best to perform and vital for knee surgeons to be trained in.

The main aims and objectives of the research study

We aim to compare the commonest centralization techniques biomechanically on animal knee joints. Our goal is to see which technique is the most effective in keeping both the meniscus rooted down at its periphery and the kinematics of the knee as close to a healthy one.

This will then lead to future studies where we can examine these on patients and monitor their progress.

How this research is going to help address MSK health

Much of the research in centralization involves the proposal of surgical techniques, with the current clinical body of literature devoid of long-term studies with high methodological quality.

Despite its evolving practice, there is no standardized technique. It is imperative one explores which of the commonest centralization procedures produces the best results in bringing the knee kinematics as close to normal. Consequently, this will reduce tibiofemoral contact pressures, cartilage degeneration and delay/prevent knee osteoarthritis. By fulfilling this gap in the literature, can one subsequently perform novel clinical trials to evaluate patient outcomes using the biomechanically optimum centralization technique in combination with root repair to fully determine its efficacy. This would be of immense benefit to surgeons as it would enable the provision of alternative treatment options to salvage the native joint.

The main research methods, or datasets being used

We aim to compare 5 testing situations in porcine knee joints. These are:

a. Normal meniscus

b. Torn meniscal root

c. Meniscal root repair

d. Meniscal root repair + transtibial stitch centralization

e. Meniscal root repair + suture anchor centralization

The main outcomes we are looking at are:

a. Loading profile within the knee (tibiofemoral contact mechanics) and whether the repair brings it close to that of a normal meniscus

b. The degree of extrusion with the different techniques and which one brings it closer to the native state

Loading profile is being measured with pressure sensors which are then calibrated on a mathematic software. Extrusion is measured with sophisticated markers, also calibrated on software

Research results generated

Meniscal root repair + transtibial stitch restores the loading profile and extrusion closest to the native state compared to root repair alone

Next steps of this research project

To complete the testing with anchor centralization and whether this improves/worsens/creates no difference to the outcomes when compared to transtibial stitch

Publications and presentations related to this fellowship

Three systematic reviews generated on this topic, providing both a background basis, and improvements in research methodology in laboratory testing. All currently under review in PubMed ID Journals.

Impact of this Orthopaedic Research UK fellowship on your research and career

"Much of soft tissue disease in musculoskeletal surgery is underpinned by alterations in the kinematics of a normal joint. Its biomechanical restoration provides a pathway to reducing the rate of advanced disease.

As a prospective knee surgeon with a strong academic interest, I would like to ensure patients are able to make the most out of their native joints for as long as possible (and with satisfaction) prior to the introduction of 'implanted' materials i.e. arthroplasty and transplantation, all of which have their own potential pitfalls.

If the current research identifies an optimum centralization technique to restore native joint biomechanics to delay OA, then further in vivo clinical trials will be undertaken to determine its true clinical efficacy. Potentially this may improve patient reported outcome measures, reduce the conversion to total knee arthroplasties and ultimately decrease healthcare costs."

Influence of research project on policy, practice or patients

The key objective of the study is to encourage breakthrough research to reduce the burden of poor musculoskeletal health in the population. Pioneering new treatments can delay the pathological sequelae of events that can occur with ageing, trauma and disability to the knee. If the biomechanical study on centralization proves to show one technique to be superior, then this will be translated to clinical studies. If subsequently proven to delay/prevent knee osteoarthritis from extrusion, then this will prove beneficial in reducing the pain and immobility patients may suffer, whilst improving their physical and psychological well-being. Furthermore, this can reduce the economic burden on the NHS, particularly in number of outpatient clinics, physiotherapy sessions and need for TKAs in patients whose progression has stagnated. Ultimately, the release of financial constraints would provide the UK healthcare system with the potential for funding further treatment options, creating a positive impact on the national population.

BOA - ORUK: Cambridge University Hospitals

Mesenchymal stromal cells in cartilage regeneration: defining the immunomodulatory characteristics on macrophage populations

Researcher: Alexandra Macmillan

Supervisor(s):
Professor Andrew McCaskie

University or Trust:
University of Cambridge

Award stream: BOA/ORUK Joint Research Fellowship 2023

Award duration: 1 year

Amount rewarded: £60,000

Other funders:
British Orthopaedic Association

Collaborations/ partners: N/A

Research activity area: Underpinning; Treatment Development

MSK focus area: Cartilage, joints

Research topic: Cell, bone and soft tissue biology

The MSK health issue the research project is trying to address

Arthritis affects huge numbers of people in the UK, leading to pain and disability.

We currently lack treatments for injury to joint cartilage and unfortunately many patients go on to develop arthritis.

If we can address the cartilage injury early on, we can prevent the arthritis developing.

This research seeks to understand cell behaviour in order to develop new treatments for joint cartilage injury.

The main aims and objectives of the research study

Our aim was to understand how cells involved in cartilage healing interact and influence each other.

The objectives were to:

1. Combine human inflammatory cells commonly seen in the joint in a dish in the laboratory to understand how they interact and influence each other.

2. Understand how these inflammatory cells influence human cartilage cells using the same approaches.

How this research is going to help address MSK health

By understanding the cell behaviour, we anticipate these findings will help us develop a new biological treatment for early cartilage injury.

The main research methods, or datasets being used

This project used human cartilage cells and other human inflammatory cells grown alone and together in a dish in order to understand how these cell types interact and influence each other. Techniques used included cell culture (growing cells in dishes), and assessing which genes the cells are expressing to understand their behaviour as well as understanding the proteins that are on the surface of cells. We also used microscopes to visualise the cells by adding fluorescent markers to see certain structures within the cells. This way we could see their shape and how they relate to each other in different environments.

Research results generated

We have found that different types of inflammatory cells do have an impact on cartilage cells. They can influence whether the cartilage cells behave more like cells we see in a healthy joint, or like cells in a diseased arthritic joint. This means that hopefully we can replicate these findings in the future in patients with joint injuries to help cartilage cells behave more like a those in a healthy joint in order to achieve proper cartilage healing after injury.

Next steps of this research project

We now aim to develop 3D models of these cells in the laboratory to more closely replicate how they exist in the body and to understand how they behave when exposed to different inflammatory cell populations in this environment.

We also aim to understand in more detail what the 'best' kind of biological therapy would be for cartilage injury and test this out in the laboratory environment.

Publications and presentations related to this fellowship

Two International Presentations:

1. Can we use MSC-polarised macrophages to influence chondrocyte cell behaviour and improve cartilage repair? Poster Presentation, Osteoarthritis Research Society International conference, Vienna, 2024.

2. Can we use MSC-polarised macrophages to influence chondrocyte cell behaviour and improve cartilage repair? Oral Presentation, European Orthopaedic Research Society Conference, Porto, 2023.

Impact of this Orthopaedic Research UK fellowship on your research and career

This fellowship has allowed me to conduct a full-time year-long MPhil research Master's degree at the University of Cambridge, Department of Surgery. It has allowed me to spend dedicated time in the laboratory understanding how cells involved in cartilage repair interact and influence each other. This would not have been possible without the support of Orthopaedic Research UK and the British Orthopaedic Association. This has been a critical step to my personal development as a researcher and orthopaedic surgeon and will allow me to apply for further funding to complete a doctoral degree (PhD). I believe I will be a better surgeon for having had this supported research time, allowing me to understand how to investigate and address gaps in treatment at the fundamental level in the laboratory, and considering the all-important steps to translate this into the clinical arena.

BOA-ORUK:
Royal Infirmary of Edinburgh (NHS Lothian)

Can a novel machine learning algorithm for analysis of pelvic radiographs improve the prediction of hip displacement in cerebral palsy?

Researcher: Katie Hughes

Supervisor(s): Mark Gaston, Hamish Simpson, Alex Aarvold & Daniel Perry

University or Trust:
The University of Edinburgh

Award stream: ORUK / BOA

Award duration: 24 months

Amount rewarded: £65,000

Other funders: N/A

Collaborations/ partners:
Claudia Linder & Timothy Cootes at The University of Manchester

Research activity area:
Detection and Diagnosis

MSK focus area: Bones

Research topic:
AI / Big data / Digital technology / Computational modelling, Paediatric care, Hip

The MSK health issue the research project is trying to address

Cerebral palsy is the name for a group of life-long conditions that affect movement and co-ordination. It's caused by a problem with the brain that develops before, during or soon after birth.

Children with cerebral palsy sometimes develop problems with their hip joints. The 'ball' of the hip can start to move out of the 'socket'. This causes pain and stiffness. It also can make washing, dressing, walking and sitting difficult.

In Scotland, we have a national surveillance programme for children with cerebral palsy called Cerebral Palsy Integrated Pathway Scotland (CPIPS). This was set up in 2013. Children have lots of clinical checks by specialist clinicians (physiotherapists and doctors) and x-rays taken of their hips to check they are not developing problems.

Although CPIPS has been great for kids and their families, it creates a lot of x-ray pictures. These pictures need to be 'looked' at and certain measurements need to be calculated by a specialist clinician (like a radiology doctor or orthopaedic surgeon). This takes up a lot of time and can delay treatment. This research project is trying to find out if we can improve this process using something called machine learning.

Machine learning is a type of computer programming which helps a computer learn from provided information and make a decision without a human being telling it what to do. BoneFinder® is a machine learning computer programme that can 'look' at an x-ray and calculate the same measurements that clinicians currently do. The programme does this fully automatically – potentially saving human beings a lot of work!

Machine learning also has the potential to 'predict' the future – it could help us pick up children who might develop hip problems so we can monitor them more closely.

However, we need to check that BoneFinder® actually works as well as a human being and doesn't make any mistakes or errors.

The main aims and objectives of the research study

To find out if the machine learning tool BoneFinder® is as good as human beings at taking measurements from the x-rays of hips of children affected by cerebral palsy.

How this research is going to help address MSK health

If BoneFinder® works well, it has the potential to save a lot of time and money for cerebral palsy hip surveillance programmes like CPIPS. This would hopefully mean that children and families avoid any delays in treatment and get better quality care. It also could allow us to start up surveillance programmes in other countries that would currently struggle to afford funding a programme like CPIPS.

The main research methods, or datasets being used

The main dataset being used is the CPIPS dataset 2013 – 2023.

Research results generated

So far, we have done a pilot project looking at 109 x-ray pictures. This showed that BoneFinder® works similarly well to specialist clinicians.

However, BoneFinder® does seem to find some x-ray pictures difficult to analyse – such as those which have metalwork around the hips from previous surgery. We are constantly teaching BoneFinder® new things so it doesn't get confused when it 'sees' unexpected things like that!

Next steps of this research project

The next step is to analyse more x-ray pictures – 510 in total - to see how BoneFinder® performs compared to human clinicians.

We can then start to explore the ability of BoneFinder® to predict which children may start to develop hip problems.

Publications and presentations related to this fellowship

This work has been presented at the ORUK Artificial Intelligence in Orthopaedics Conference 2023, British Society for Surgery in Cerebral Palsy Conference 2023 and the British Society of Children's Orthopaedic Surgery (BSCOS) Conference 2024 and the South East Scotland Orthopaedic Research Conference 2024.

New medical products, intellectual property, software or technical products resulting from this project

This project will lead to further refinement of the BoneFinder® paediatric hip searcher model.

Awards or recognition received related to this project

Awarded "Best Out of Programme Research" Prize at the South East Scotland Orthopaedic Research Conference 2024.

Impact of this Orthopaedic Research UK fellowship on your research and career

Being awarded the ORUK / BOA fellowship has been invaluable for developing my research skills and future career. It has allowed me to take a dedicated period out of clinical training for research and enroll in a M.D. at the University of Edinburgh. I have developed my skills of critical appraisal, literature review, research analysis and presentation. I've been fortunate enough to present my work at conferences across the UK and hopefully abroad in the future.

It is a privilege to be contributing to the ORUK research portfolio and helping to improve the care of patients with orthopaedic conditions. Children with cerebral palsy have historically been a vulnerable, under-researched group. This project has the potential to directly improve their care and outcomes, benefiting both children and their families.

Engagement with research users, special interest groups and the general public to inform them about the research

We have been able to engage with clinicians throughout the UK when presenting this work at the British Society for Surgery in Cerebral Palsy Conference 2023 and the British Society of Children's Orthopaedic Surgery (BSCOS) Conference 2024.

There has been lots of enthusiasm for the project and we have received a lot of helpful feedback on how we could integrate this technology into hip surveillance programmes to solve the common challenges that clinicians face.

Influence of research project on policy, practice or patients

There is potential for a machine learning tool such as BoneFinder® to be integrated into national cerebral palsy hip surveillance programmes. This would be transformative – saving clinician time, reducing inaccuracies, reducing regional variations in care and improving outcomes for patients and families.

Northumbria University

Development and feasibility of a digital health intervention to encourage exercise maintenance after falls prevention exercise programmes end.

Researcher: Dr Sarah Audsley

Supervisor(s): Dr Gill Barry

University or Trust:
Northumbria University

Award stream:
Early Career Research Fellowship

Award duration: 2 years

Amount rewarded: £105,200

Other funders: N/A

Collaborations/ partners:
Northumbria University (Dr Gill Barry, Professor Nicola Adams, Dr Sarah Moore, Dr Alasdair Odoherty), Glasgow Caledonian University (Prof Dawn Skelton), The University of Manchester (Dr Emma Stanmore). Working in partnership with HealthWorks (Mr Paul Court) and KOKU Health.

Research activity area:
Prevention / Treatment Development / Treatment Evaluation.

MSK focus area: Multiple body areas

Research topic:
Rehabilitation and Exercise / General MSK health awareness

The MSK health issue the research project is trying to address

One third of adults aged over 65 years old, and half of adults aged over 80 years, fall each year. Approximately, 20% of older adult falls result in hospitalisation and 5% lead to bone fractures which costs the NHS over £6.7 billion in falls and fracture related treatments per year. The human cost of falls includes reduced confidence, painful injuries, disability, loss of independence and premature mortality.

Completion of group-based, in-person, Falls Management Exercise (FaME) programmes lasting 24 weeks or more, significantly improves muscle strength and balance, functional status and reduces falls rates and injury incidence in older adults. Physical activity engagement needs to continue after FaME programmes end to maintain the health benefits gained, but often wanes between 6 to 24-months after programmes end. The demand for in-person FaME programmes vastly outweighs clinical capacity, meaning that patients cannot attend programmes indefinitely. Therefore, this research will develop and investigate the feasibility of a digitally supported exercise maintenance programme that aims to maintain exercise participation when FaME programmes end.

The main aims and objectives of the research study

Study aim:
To design and investigate the feasibility, acceptability, and safety of a digitally supported exercise maintenance intervention to Falls Management Exercise (FaME) programme service-users.

Study objectives:
1. Co-design a digitally supported exercise maintenance intervention with a Community of Practice (COP) Group and Patient and Public Involvement (PPI) group.

2. Investigate the acceptability of the digitally supported exercise maintenance intervention to FaME programme service-users.

3. Assess the feasibility of the research methods and key parameters needed to conduct future clinical trials.

How this research is going to help address MSK health

Based on evidence within the team's combined research portfolio, they predict the digitally supported exercise maintenance intervention developed will have good potential to encourage older adults to continue exercising when face to face FaME programmes end. Maintaining physical activity when FaME programmes end will help to improve the long-term patient outcomes relating to functional status and falls and injury risk and incidence. As such, this will augment the cost effectiveness of falls prevention exercise programmes and reduce the burden falls has on individual lives and NHS resources.

The main research methods, or datasets being used

Study design:

The project will be conducted in two separate phases, as interdependency exists between the research objectives.

Methods:

Phase 1: Intervention Development and acceptability testing. Intervention Development will be informed by the Normalisation Process Theory and Theoretical Framework of Acceptability. In consultations, the research team will work with a group of diverse PPI members and key stakeholders to define a digitally supported exercise maintenance intervention and procedures. Digital intervention components may include self-monitoring physical activity via wearables, digital peer support and home exercise delivered via an evidence-based Falls Prevention App.

Phase 2: Mixed methods single arm, multi-site Feasibility Study. A mixed methods single-arm multi-site feasibility study will be conducted to investigate the feasibility, acceptability and safety of the exercise maintenance intervention (optimised in phase 1) and the feasibility of the research methods. We will recruit and deliver the exercise maintenance intervention for up to 6 months in 30 FaME class attendees.

Feasibility data will be collected and measured over 6 months via:

- Recruitment and retention rates.
- Feasibility of collecting self-reported quality of life, falls incidence, and confidence data
- Adverse event data
- Intervention adherence

A priori progression criteria will be set on feasibility outcomes to help determine future progression to a larger-scale clinical trial.

Participant data is routinely collected by HealthWorks, a Community Health Charity, delivering FaME classes to people in deprived areas of Newcastle, for service purposes.

Sample & setting:

We are working in collaboration with HealthWorks. To ensure people experiencing health inequalities are represented in the study, we will recruit a sample of culturally diverse older adults from four HealthWorks hubs and deliver the intervention in these venues.

Eligibility criteria:

- Community dwelling older adults
- Independently mobile
- Enrolled on a FaME programme delivered by HealthWorks.
- Able to provide written informed consent.

Exclusion criteria:

Has been advised by a GP or consultant not to exercise or has a medical, cognitive or physical condition that prevents safe engagement with unsupervised exercise.

Sample size:

During the intervention development phase, a phenomenological approach will be adopted to investigate the participants' views on their experience of engaging with the intervention. We will recruit 10 participants to test and make recommendations to optimise the exercise maintenance intervention in phase 1.

Cardiff University

Identifying objective measures of sex-specific pain in humans that can be used diagnostically to target treatment.

Researcher: Prof Deborah Mason

Supervisor(s): N/A

University or Trust: Cardiff University

Award stream: Inspiration Fund

Award duration: 1 year

Amount rewarded: £47,000

Other funders: N/A

Collaborations/ partners: Ryan Jones (University of Cardiff) and NHS Consultant Orthopaedic Surgeons Mr Chris Wilson, Mr Rhys Williams, and Mr Rhydian Morgan- Jones. The Biomechanics and Bioengineering Research Centre Versus Arthritis, Cardiff and Vale University Health Board (C&VUHB), and Cardiff and Vale Orthopaedic Centre (CAVOC). In kind support from bit.bio.

Research activity area: Underpinning, Detection and diagnosis, Treatment Development

MSK focus area: Bones and Joints

Research topic:
Osteoarthritis / Pain

The MSK health issue the research project is trying to address

Osteoarthritis, a painful disease that causes joint destruction, affects 530 million people worldwide and 10 million in the UK. No treatments stop osteoarthritis or manage pain. Pain reduces patient's quality of life, causing immobility and isolation. Changes in bone structure in osteoarthritis correlate with pain severity, possibly because the bone contains many nerves.

Osteoarthritic pain affects nearly twice as many females than males, with pain being particularly common in post-menopause females. Females have higher osteoarthritis prevalence, clinical pain and inflammation than males, but molecular mechanisms explaining sex differences are lacking.

The main aims and objectives of the research study

The pilot work shows that joint fluids from patients with knee osteoarthritis contain signals that affect nerve growth and function and that these signals correlate with indicators of bone changes.

The project aims to identify signals that drive pain and bone remodelling in human osteoarthritis and determine how these differ between males and females and pre and post menopause.

The objectives are:

1. To analyse stored synovial fluids from 41 female and 30 male osteoarthritis patients for signals that influence nerve invasion, bone changes and pain and combine it with the researchers' existing data (31 males and 3 females) to determine sex-specific and menopause-specific differences in neuronal signals.

2. To apply joint fluids from osteoarthritic male, and pre- and post-menopausal females, onto the researchers' human cell models of bone and nerve and measure responses.

3. To compare patient synovial fluid biomarker patterns with osteocyte and neuronal responses and identify sex specific mechanisms that link bone remodelling to pain.

How this research is going to help address MSK health

The research will identify important mediators that drive pain processes and define the variability across male and female patients. The data will indicate which patients are predisposed to nerve growth, bone structural changes and therefore increased pain, and define how this varies between males and females, and post-menopause. This not only provides potential diagnostic biomarkers, but also mechanistic understanding, that could identify new interventions using drugs repurposed from osteoporosis or nervous system diseases such as epilepsy and migraine. The project will provide an objective measure of sex-specific pain that can be used diagnostically to tailor targeted treatments more appropriately to individual patients.

The main research methods, or datasets being used

This project will use human osteoarthritic patients' blood and joint fluids, with matched clinical and functional data, obtained by the Biomechanics and Bioengineering Research Centre Versus Arthritis.

Biochemical analysis using multiplex and targeted ELISAs will quantify the neuronal and bone remodelling proteins present in osteoarthritic joint fluids. Menopausal status will be determined by measuring Follicle Stimulating Hormone and oestrogen concentrations in matched blood samples.

Bone and nerve cell models will be used to define differences in response to joint fluids from males and females by comparing gene and protein expression, assessing nerve branching microscopically, and nerve function using calcium-imaging and micro electrode array analysis.

Sex-specific differences in neuronal factors will be determined using multivariate analysis including principal component analysis and multiple linear regression. Models will consider age, sex, weight, BMI, VAS score, KL grade and mediator concentration.

University of Birmingham

Torque visuo-motor feedback training:
A new way to manage patellar
tendinopathy.

Researcher:
Dr Eduardo Martinez Valdes

Supervisor(s):
Professor Francesco Negro

University or Trust:
University of Birmingham

Award stream:
Early Career Research Fellowship

Award duration: 2 years

Amount rewarded: £105,300

Other funders: N/A

Collaborations/ partners:
Professor Francesco Negro (the
University of Brescia, Italy) and Dr
Patricio Pincheira (the University of
Southern Queensland, Australia)

Research activity area:
Treatment Development

MSK focus area: Joints

Research topic: Knee

The MSK health issue the research project is trying to address

This project aims to enhance the management of Patellar Tendinopathy, a persistent degenerative condition affecting the patellar tendon. It is characterized by structural changes within the tendon, leading to pain and diminished functional performance. While prevalent in the athletic community (with a prevalence ranging from 7% to 18.3%), Patellar Tendinopathies also frequently occur in the general population, with an incidence of approximately 1.6 per 1000 person-years.

Dealing with Patellar Tendinopathy poses a significant challenge, as traditional exercise interventions have shown limited effectiveness, with only up to 50% improvement in clinical symptoms at three to six months. Consequently, a considerable number of patients fail to respond favourably to conventional treatments, contributing to the persistence of chronic symptoms. This project strives to address these limitations and introduce more effective strategies for managing Patellar Tendinopathy, with the ultimate goal of improving patient outcomes and quality of life.

The main aims and objectives of the research study

This project encompasses two primary objectives.

Objective 1:

To evaluate the efficacy of a novel intervention involving slow-speed visuo-motor torque feedback training on various aspects of patellar tendinopathy, including changes in pain levels, functional abilities, quadriceps neuromuscular activity, and the mechanical and structural properties of the patellar tendon. A comparative analysis will be conducted between the outcomes of this intervention and the conventional patellar tendinopathy management provided by the NHS, which primarily consists of home-based eccentric exercises. The proposed intervention aims to enhance rehabilitation outcomes for patellar tendinopathy and the proposed measurements aim to contribute novel evidence regarding the neuromechanical changes induced by this innovative approach.

Objective 2:

A comparison of morphomechanical properties of the patellar tendon and the firing properties of quadriceps motor units between individuals with patellar tendinopathy and healthy controls. The overarching goal is to identify novel mechanisms contributing to declines in strength, reductions in the control of knee-extension muscle force, and increased pain in individuals with patellar tendinopathy. This comparative analysis aims to deepen our understanding of the underlying factors associated with patellar tendinopathy, paving the way for more targeted and effective interventions.

How this research is going to help address MSK health

This research aims to evaluate the effectiveness of a novel training intervention for managing patellar tendinopathy and seeks to identify the underlying mechanisms that contribute to motor function impairments to determine whether these can be ameliorated through the proposed treatment. The successful implementation of this intervention will have direct benefits for both patients suffering from patellar tendinopathy and clinicians involved in prescribing therapeutic exercises. Additionally, the findings from this research could have implications for the management of other tendinopathies, as the proposed approach can be adapted to different joints.

The utilisation of state-of-the-art methods, such as Shearwave elastography and high-density surface electromyography (HDsEMG), will also provide valuable insights for other researchers investigating the neural and mechanical interactions involved in the development of tendinopathies. Furthermore, the results of this research will lay the groundwork for the development of a cost-effective device, enabling a more affordable implementation of the proposed therapeutic approach in clinical settings.

The main research methods, or datasets being used

The researchers will systematically gather data on alterations in clinical symptoms, specifically pain, and perceived disability using specialized questionnaires such as the Victorian Institute of Sport Assessment-Patella (VISA-P). To assess muscle strength and control in quadriceps muscle force, we will employ an isokinetic dynamometer. Additionally, they will track changes in tendon morphology and estimate Patellar tendon stiffness through b-mode ultrasound imaging and shearwave elastography. Additionally, high-density surface electromyography (HDsEMG) will be utilized to measure motor unit activity in the quadriceps muscles, employing state-of-the-art signal processing methods based on blind source separation. These comprehensive parameters will be continuously monitored throughout the proposed intervention, providing a thorough and multifaceted evaluation of its impact.

Royal Infirmary of Edinburgh (NHS Lothian)

Development of a diagnostic protocol to aid the investigation and management of posterior malleolus ankle fractures.

The MSK health issue the research project is trying to address

Ankle fractures account for 10% of all adult fractures presented to the emergency department. In the researchers' NHS Lothian unit, covering a population of 800,000 people, they see over 900 ankle fractures per year, 450 of which are unstable and require an operation., Around 250 patients with unstable ankle fractures have a fracture at the back of the ankle (posterior malleolus fractures). A simple calculation of the incidence of ankle fractures in the NHS Lothian unit, relative to the 67 million United Kingdom population, reveals that almost 21,000 posterior malleolus fractures occur per year countrywide.

A recent systematic review concluded that no classification system has established itself in the literature and they do not help in predicting outcomes post injury.

Data published on posterior malleolus fractures has increased over the last decade, with a debate surrounding appropriate imaging modalities to determine the optimal surgical management and improve patient outcomes. One theory is ankle fractures can be assessed sufficiently using standard x-rays (2D images).

Current British Orthopaedic Association Standards for Orthopaedics and Trauma (BOAST guidelines) advise that complex patterns, particularly involving posterior malleolus, should undergo pre-operative computed tomography (CT) scan to gain a 3D image of the ankle fracture. This has become standard practice in the United Kingdom, and the researchers have noted a large rise in the number of pre-operative CT scans in their centre.

CT scans can lead to delays in surgery and unnecessary radiation. Acquisition of CT scans pre-operatively have also shown to change surgical planning to a more aggressive, larger, less practiced approach into the posterior ankle joint, associated with overtreatment and an increased risk of complications (23% complication rate), including posterior ankle pain, stiffness and nerve injury.

Researcher: Mr Nicholas Heinz

Supervisor(s): Mr Andrew Duckworth and Mr Time White

University or Trust:
Lothian Health Board

Award stream: Inspiration Fund

Award duration: 2 years

Amount rewarded: £23,000

Other funders: N/A

Collaborations/ partners:
Mr Anish Amin. The University of Edinburgh and NHS Lothian Research and Development department

Research activity area:
Treatment Evaluation

MSK focus area: Bone

Research topic: Foot and Ankle

The main aims and objectives of the research study

Primary Objective:

The aim of this study is to develop and validate an imaging protocol that identifies which posterior malleolus fractures, based on plain film x-rays, require CT scanning pre-operatively.

Secondary Objectives:

- To understand the risk factors for osteoarthritis between different types of posterior malleolus fracture.

- To understand the functional impact of patients with posterior malleolus fractures.

- Assessment of a patients' return to pre-injury work and sport after a posterior malleolus ankle fracture.

- Assess whether the 'Normal Ankle Score' is a good representation of the already validated foot and ankle functional outcome scores.

- Assessment of the complication and re-operation rates following operative management of posterior malleolus ankle fractures.

- Assess whether better utilisation of CT scanning of posterior malleolus ankle fractures allows for reduced costs per patient.

How this research is going to help address MSK health

The project aims to improve patient outcomes and reduce the cost of investigating and treating these fractures by developing a diagnostic protocol to help surgeons manage such a complex ankle fracture.

The researchers' protocol would safely decrease the number of CT scans by around 90%, with the grounds that only one specific ankle fracture type requires a CT scan (this would be around 25 of 250 patients in their unit). This would reduce the cost of CT scans from around £5.2M to £0.5M per year (at £250 per CT scan).

The main research methods, or datasets being used

Study Design

The project is a prospective, single study centre cohort study. Recruitment will be over a one-year period. Patients will be followed up at the Royal Infirmary of Edinburgh, a tertiary orthopaedic centre. The Royal Infirmary of Edinburgh surgically operates on around 300 ankle fractures per year. It is likely that the researchers will see and recruit between 120 and 140 patients to the study, as 40-50% of unstable ankle fractures will have a posterior malleolus fracture.

There will be no changes to a patients' routine investigation and management plan. However, prospective clinical data and Patient Reported Outcome Measures (PROMs) will be collected over the follow-up period. Routine pre-operative and post-operative images will be analysed where carried out.

Study Population

The study will include adult patients (≥16 years) presenting to a single centre, with an unstable ankle fracture involving the posterior malleolus requiring surgical intervention. The study has received favourable outcomes from the NHS Research Ethics Committee (REC) and the NHS Research and Development Management. Approximately 125 participants are expected to be enrolled in the study over a one-year recruitment period.

All patients will be treated as per the standard practice of the receiving on-call Trauma and Orthopaedic Consultant from presentation to surgical intervention. The research team will then be able to carry out clinical reviews as well as carry out study questionnaires to validate a pre-determined imaging protocol.

Research results generated

So far 97 patients have been recruited. Results are yet to be collated and analysed.

Next steps of this research project

Complete enrolment in September 2024 (1 year after study commenced). Complete data collection over the next year (study completion data is September 2025).

University of Oxford

Researcher: Ben Dean

Supervisor(s): Prof Matt Costa

University or Trust:
University of Oxford

Award stream: Inspiration Fund

Award duration: 2 years

Amount rewarded: £45,000

Other funders: N/A

Collaborations/ partners:
- Researchers: Tim Stephens (Queen Mary University of London), Amy Grove (University of Warwick) and Ashley Scrimshire (University of York).
- Industry collaboration with PRO-MAPP.
- 10 NHS centres.
- Expert group consisting of patient representative (Liz Baird), clinical triallists, clinicians, experienced qualitative researchers and experts in implementation science, quality improvement and complex intervention development.

Research activity area:
Health Services / Treatment Development

MSK focus area: Joints / Bones

Research topic:
Hand and wrist / Pain / Bone fractures.

Improving Wrist Injury Pathways (I-WIP).

The MSK health issue the research project is trying to address

The implementation of early MRI scans for patients with wrist injuries who have normal x-rays. Around 70,000 patients a year in the UK go to hospitals with wrist pain after an injury with normal initial x-rays.

The main aims and objectives of the research study

The project consists of two parts. The first part aims to understand the problem better, the second part aims to then develop a way of tackling this implementation problem.

The aims of the first part of this project are to find out:

- What helps staff to provide good treatment for patients with wrist injuries
- What makes it challenging to provide best quality care
- What is most important to patients who have wrist injury.

How this research is going to help address MSK health

The research will develop a complex intervention to tackle this implementation gap, in doing so the researchers seek to improve care for patients with wrist injuries by helping NHS hospitals introduce early MRI more effectively.

The main research methods, or datasets being used

This first part of the study shall consist of mixed methods, including case study focused ethnography, pathway mapping, and qualitative interviews. This component shall also include the development and piloting of a data platform (including bespoke front end and dashboard) with our project partners PRO-MAPP. This shall enable local clinical teams to easily gather data and monitor their performance in real time. Improved situational awareness provided by these data together with training and implementation components in our complex intervention will support frontline teams to improve time to MRI and definitive treatment for patients.

This study will then lead to a second project which will consist of an iterative series of 6 co-design workshops. Firstly, the group will develop a theory of change and driver diagrams as informed by the gathered data. Secondly, the group will co-produce the complex intervention. The complex intervention developed by this project will then enable us to apply for funding to firstly, test the feasibility of this intervention in the NHS and then secondly, to assess the effectiveness of our complex intervention compared to that of a robust comparator in a pragmatic randomised controlled trial.

# Royal Devon University Healthcare NHS Foundation Trust

'The Conor Jones Inspiration Fund'
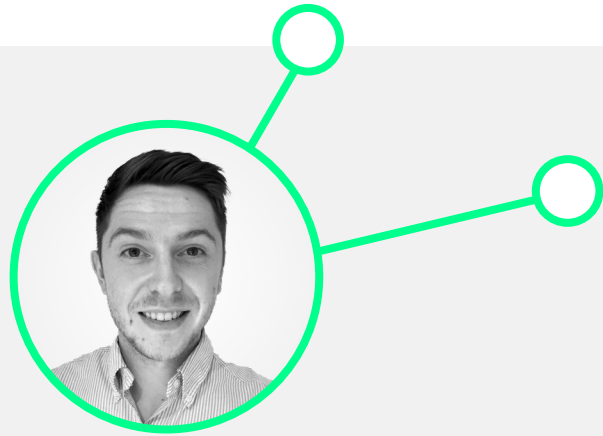
Developing a core outcome set for studies of patients sustaining periprosthetic femoral fractures.

To note – case study 577 has been delayed following the tragic death of the original recipient Conor Jones, Core Surgical Trainee & Honorary Research Fellow, Royal Devon University Healthcare NHS Foundation Trust.

The award has been repurposed in honour of Conor and the research project will be undertaken by Rebecca Fox, Therapy Research and Innovation Lead at Royal Devon University Healthcare NHS Foundation Trust.
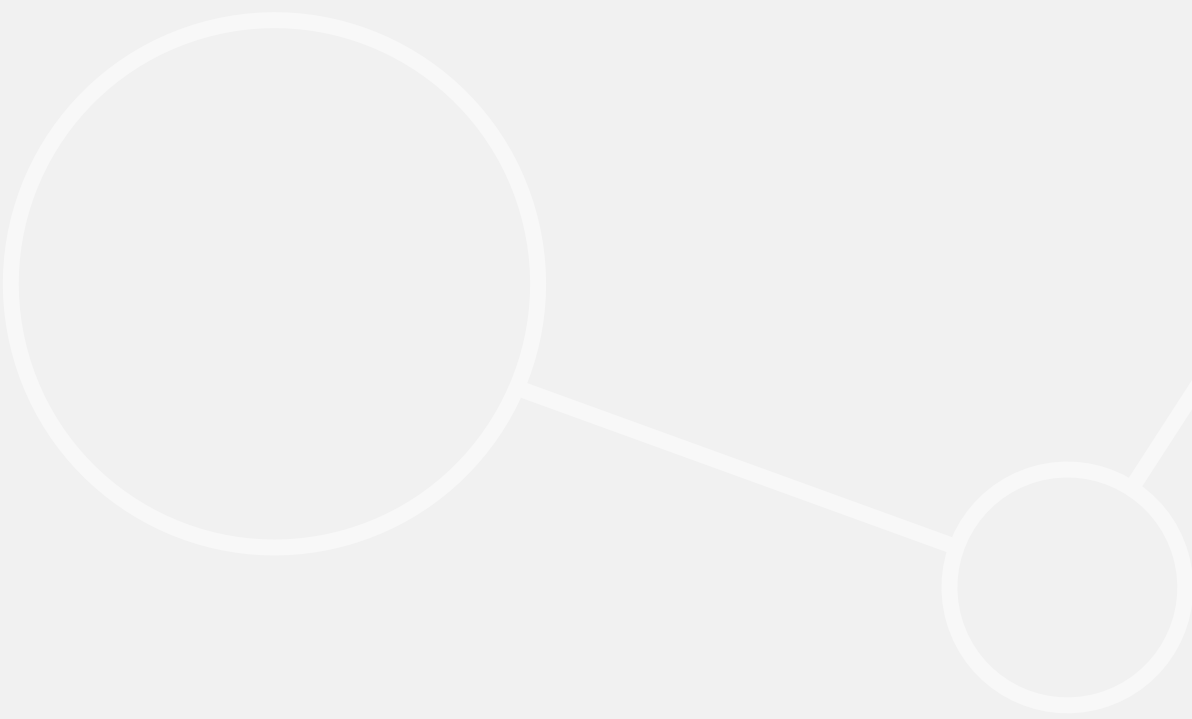
Queen Mary, University of London

Establishing the feasibility of real world surveillance of orthopaedic devices using routinely collected data.

Researcher: Miss Jennifer Lane

Supervisor(s): Prof Xavier Griffin

University or Trust:
Queen Mary University of London

Award stream:
Early Career Research Fellowship

Award duration: 1 year

Amount rewarded: £50,000

Other funders: N/A

Collaborations/ partners:
- Mrs Kristin Kostka and Prof Dani Prieto-Alhambra.
- Established collaborators in Oxford, Spain and the USA.
- Administrative claims data from private and national insurance providers: IBM MarketScan and Pharmetrics.
- Observational Health Data Sciences and Informatics (OHDSI) data science community

Research activity area: Treatment Evaluation and Disease Management

MSK focus area: Joints and bones

Research topic:
- AI / Big data / Digital technology / Computational modelling
- Biomaterials, biomechanics, prosthetic and surgical devices
- Trauma and orthopaedic surgery

The MSK health issue the research project is trying to address

Implants used in bone and joint surgery make up 65% of all devices used in the NHS. Information is collected for some implants, like hip and knee replacements, but not the majority used in other operations. Doctors are putting thousands of medical implants into people every year, but unfortunately most of these implants are difficult to monitor for their safety. This has led to some people being harmed. A government led enquiry in the UK was asked to focus on medications and a medical device that have been found to have harmful side effects. Many patients contributed to the enquiry, but unfortunately because routinely collected big data is currently not fully utilised, no one actually knows how many patients were harmed.

This project will test if it is possible to collect information about bone and joint implants, so that future surgeries are safer for patients and better value for money for the NHS. The project will also focus on how best to inform patients, if an issue is found with a device they have had implanted, and how they would like their data to be used to help them get the best care.

The main aims and objectives of the research study

This study uses routine data from one large NHS Trust mapped to a common data model (CDM) used in an international data science community called OHDSI (Observational Health Data Sciences and Informatics). The research is establishing the feasibility of orthopaedic implant safety surveillance, using longitudinal data linked between the feasibility of orthopaedic implant safety surveillance. This uses longitudinal data linked between primary and secondary care, alongside mortality data to identify complications associated with device use. This fellowship will establish the feasibility of data-driven decision identification of devices at risk of causing harm. It will also develop infrastructure for a UK centre which is leading international collaborative research in big data and devices.

The objectives of this fellowship are to:

1. Establish the feasibility of surveillance of orthopaedic devices using routine NHS data.

2. Identify if orthopaedic device surveillance is possible within an international common data model, enabling multi-centre replication.

3. Undertake surgical and device research in underrepresented patient groups.

4. Build an infrastructure upon which to lead future work in national and international post-market surveillance of orthopaedic devices, externally validating results internationally to address biases.

5. Establish the patient perspective upon how best to involve them in care pathways should a device appear to have higher levels of complications.

6. If sufficient time, or international replication does not appear feasible, to determine if this data -driven approach can be used to identify comparable cost effectiveness of orthopaedic devices.

How this research is going to help address MSK health

This project is a direct response to the national enquiry into drug and implant safety, designing a method for quickly identifying patients who have been treated with implants that may be causing harm. It aims to offer solutions to better monitor patients who are at risk, and to streamline the work needed in the NHS to monitor devices. Alongside this, the research will include patients and members of the public from the beginning to ask them how they would best want to see their data used, and how best they would like to have information about implant safety given to them.

The main research methods, or datasets being used

This project is establishing the feasibility of undertaking epidemiological studies, investigating adverse events associated with orthopaedic device use, and the temporal and geographic trends in patient demographics and treatment undertaken. Studies will be developed in UK data, undertaken in anonymised routinely collected data mapped to the OMOP (Observational Medical Outcomes Partnership) CDM.

The research is using 1 NHS dataset of routine healthcare records covering primary, secondary care, intensive care and mortality data. 2.4 million patients are currently included in the host mapped dataset over a ten-year life course; data are refreshed monthly. Mapping of the host institution to the CDM is already complete for routine fields due to a successful grant awarded by the EU. This fellowship works with collaborative partners to map surgical procedure and device data collected at the time of surgery, including unique device identifier, into the CDM. The researcher will undertake mapping of this data into the CDM within an iterative process with data scientists, with the aim of also developing methods converting reproducible analytical pipelines for drug utilisation already used in the OHDSI community for device utilisation analyses.

All analysis plans will be set a priori in a published protocol. In descriptive epidemiology studies, the number of patients in each subgroup will be reported, along with chosen covariates of interest. Standardised mean differences will be reported and plotted to compare subgroups. In comparative cohort studies, multivariable regression modelling and large-scale data driven propensity score analysis will be undertaken to identify associations with outcome using R software.

Research results generated

Currently beginning feasibility work within NHS dataset, considering which device identifiers are best to use and most available in the data

Impact of this Orthopaedic Research UK fellowship on your research and career

"As part of undertaking this work, I was able to lead our group to apply for a UKRI fellowship alongside UK OHDSI node partners- this was successful in seed funding (£60k) and we are currently applying for stage 2."

Engagement with research users, special interest groups and the general public to inform them about the research.

Currently leading UK research into surgical devices within the UK OHDSI node of partners with data converted to the CDM.

University of Cambridge

A precision health approach to osteoarthritis: early diagnosis, stratification and risk prediction using state-of-the-art machine learning models.

Researcher: Dr Simone Castagno

Supervisor(s): Prof Andrew McCaskie (Professor of Trauma and Orthopaedic Surgery and Head of the Department of Surgery), Prof Mihaela van der Schaar (founder of the Cambridge Centre for AI in Medicine) and Dr Mark Birch (Cambridge Stem Cell Institute).

University or Trust:
University of Cambridge

Award stream: ORUK/Versus Arthritis AI in MSK Research Fellowship

Award duration: 2 years

Amount rewarded: £100,000

Other funders: Versus Arthritis

Collaborations/ partners: Dr Kirsten Rennie (MRC Epidemiology Unit) and Prof Stephen McDonnell (Associate Professor at the University of Cambridge and Consultant Orthopaedic Surgeon at Addenbrooke's Hospital in Cambridge).

Research activity area:
- Detection and Diagnosis
- Treatment Development

MSK focus area: Joints

Research topic:
- AI / Big data / Digital technology / Computational modelling
- Osteoarthritis

The MSK health issue the research project is trying to address

The research targets osteoarthritis (OA), a disabling MSK condition affecting over 500 million people globally, with more than 10 million cases reported in the UK alone. With an ageing population, these numbers are likely to rise, posing great challenges to healthcare systems worldwide. As there is presently no approved treatment to prevent or reverse disease progression, the primary focus of current medical practices is on symptom management and, eventually, joint replacement.

The main aims and objectives of the research study

The overall aim of the research is to develop novel precision health tools for the early diagnosis, progression prediction, stratification and, eventually, management of OA. The project plans to harness the power of cutting-edge machine learning methodologies to achieve this. These tools will pave the way for the design of streamlined clinical trials, the identification of novel treatment targets, and ultimately, the creation of efficacious therapies that can halt or even reverse OA progression.

How this research is going to help address MSK health

The research focuses on enhancing the management of OA, aiming for early diagnosis and tailored treatment strategies to significantly improve patient quality of life. The precision health tools will be designed to assist clinicians in optimising patient care, leading to better outcomes and potential healthcare cost reductions through more efficient OA management. The long-term advantages extend to improved patient care through personalised treatments, increased clinical trial efficiency, discovery of new therapeutic targets, and overall cost savings from early interventions.

The main research methods, or datasets being used

The main research methods in the project involve collecting data from publicly available datasets such as the Osteoarthritis Initiative (OAI) or the UK Biobank, which offer a wealth of clinical, radiological, biological, and accelerometry data. Subsequently, the project aims to harness the advanced machine learning tools developed by the 'van der Schaar lab' to construct predictive models based on these comprehensive datasets. A key focus of the research is ensuring the fairness and transparency of these models. Ultimately, the project intends to conduct local prospective studies with real patients to validate the models in a clinical setting. These studies are crucial in evaluating the potential clinical utility of the tools, ensuring their effectiveness and applicability across diverse patient groups.

Research results generated

The preliminary models demonstrated high reliability in predicting OA progression using clinical, X-ray, MRI and biochemical marker data. Patient-reported outcomes and MRI features emerged as primary predictors of progression. To enhance clinical utility, we developed web applications to provide intuitive visualisation of personalised predictions.

Next steps of this research project

The researchers plan to externally validate and refine their models by integrating additional data, such as movement data from wearable accelerometers and -omics data.

They also plan to adapt their methodology to diagnose and predict progression of other MSK conditions as well as other complex chronic non-MSK diseases.

Publications and presentations related to this fellowship

Conferences:

- EORS (European Orthopaedic Research Society) 2023: (Castagno et al., 2024).

- OARSI (Osteoarthritis Research Society International) 2024.

Castagno, S., Birch, M., Schaar, M. van der, McCaskie, A., 2024. A precision health approach for osteoarthritis: prediction of rapid knee osteoarthritis progression using automated machine learning. Orthopaedic Proceedings 106–B, 19–19. https://doi.org/10.1302/1358-992X.2024.2.019

Awards or recognition received related to this project

EORS2023 New Investigator Best Clinical Presentation Award.

Engagement with research users, special interest groups and the general public to inform them about the research.

The researchers have forged a relationship with the PPI team at Addenbrooke's Hospital, Cambridge. Recently, they convened a focus group comprising both OA and non-OA patients to discuss their research. This dialogue underscored the urgent need for innovative tools to enhance OA management through early diagnosis and patient stratification. It also emphasised the critical role of public involvement in the early stages of the research, particularly when developing tools, such as our web-based app, that could be directly utilised by the public. The conversation brought to light potential concerns about Machine Learning, including the risk of bias in the data used to train our models and the opacity of "black-box' models that are not easily understood or interpreted. We are committed to maintaining an ongoing dialogue with this group throughout our research process. We plan to hold regular focus group meetings to discuss our research, solicit feedback, and ensure our work remains patient-centric.