**CSO Innovation Academic Fellowship – 2023 Guidance**

Potential applicants should read these guidance notes carefully before completing the application form. Application forms must comply with the Guidance to be considered.

**Background**

Innovation is the translation of scientific research and breakthrough technology into practice.

Innovation has been identified as a key enabler of health and care recovery and re-design. Scotland aims to be a global leader in innovation, co-creation and adoption, resulting in health, wellbeing and economic benefits. Our triple helix approach brings together substantial expertise from the NHS, academia and industry to facilitate creative solutions to our most pressing challenges.

Innovation will play a critical role in supporting the Scottish Government's efforts to radically transform health and social care delivery to ensure sustainability and high-quality, timely, accessible services. Embedded within this approach is enhancing the workforce's productivity during the recovery and transformation of services.

Through the Scottish Health and Industry Partnership (SHIP), part of the Chief Scientist Office, the Scottish Government support and invest in innovative opportunities developed through a triple helix approach to collaborations between NHS and Social Care, industry and academia.

Clinical Innovation is receiving attention as the key to devising new health and care delivery models. Clinical Innovation supports fresh thinking that creates value - developing new ways of working, new models of care, and solutions that can impact patient care. It is also recognised that skills gaps in the workforce are a key barrier to supporting Innovation. For Scotland to achieve its aim, we need a workforce with the knowledge and skills they need to lead successful Innovation in health and care.

**Purpose**

This fellowship programme is designed so that successful applicants develop the capacity and capability to engage with and lead research, development and Innovation (RD&I) in NHS Scotland and prepare them to be leaders in this area in the future. Applicants will demonstrate the ability to engage with partners to develop products, services or devices, creating the evidence to support decision-making for adoption within NHS Scotland. This is with the clear intention of radically transforming the design and delivery of health and social care services in ways that ensure sustainability and high-quality, timely, accessible services. Embedded within this approach is enabling and developing the skills and capabilities of the workforce while enhancing productivity during the recovery and transformation of services.

**Candidates**

The CSO Innovation Academic Fellowship is targeted at early-stage innovators working within NHS Scotland. It provides the opportunity for clinical professionals (non-consultant grade doctors, dentists, NMAHPs and Healthcare scientists) early in their career to undertake a higher degree.

There will be up to 3 places available across Scotland, subject to the suitability of the candidates.

Candidates will demonstrate motivation and ability to develop a project to respond to defined challenge areas. They should demonstrate how they envisage their innovations could scale and be adopted, with key learning and a framework that can be applied across clinical contexts.

The scheme is 100% funded, including university fees, although there are limits around salaries payable as the scheme is designed to support people early in their careers. Specific eligibility requirements for each professional group are provided below.

The fellows will continue to be employed by their Health Board while being able to dedicate up to 20% of their time to clinical commitments. The host Board's Research and Innovation governance procedures will provide support for their research and innovation activities.

Candidates will be expected to identify a university of their choice, offering expertise in the topic area.

**Innovation Themes**

Candidates will be invited to apply for a PhD or MD to carry out a project in one of these three themes that align with the Demand Signalling Plan, the NHS Scotland Recovery Plan and approved by the Chief Scientist for Health:

1. Innovation in Cancer Pathways

2. Innovation for Long Term Conditions Optimisation

3. Innovation for Long Term Conditions Diagnostics

Projects should also seek to address the current Chief Medical Officer priority areas of inequality, sustainability and workforce challenges.

Example projects with a network of Innovation Leads will be advertised with the application (see below). NHS Health Boards employ the Innovation Leads and will be available as potential supervisors for each theme.

Applicants will be required to develop their PhD proposal in conjunction with the Innovation Leads and regional Innovation Hubs, utilising existing innovation infrastructure. Innovation Fellows will work with partners to build the project and provide evidence of its value against patient, clinical and economic outcomes.

**Example Projects**

Applicants can find information about example projects and their respective innovation leads in Appendix 1, which they can use to develop their PhD proposal. It is important to note that the example projects are not mandatory.

**Support and Application**

Applicants will collaborate with Project Innovation Leads and Regional Innovation Hubs (further information below) and a university of their choice specialising in their field of interest to develop their application. It is recommended that they seek a senior innovation leader to guide their progress and contribute to the project's design and implementation. Additionally, they should select a supervisor from their chosen university and may consider involving other professionals from the NHS and/or industry.

**The Fellowship**

Throughout the fellowship, participants will acquire the necessary knowledge and skills to create a research and innovation project, collaborating with industry, academia, and other partners. This may include formal training or experience in areas such as care pathway mapping, developing a value proposition, ethics and innovation governance, relevant regulatory processes such as medical device approval, methods of evaluation, patient and public involvement, decision-making in the wider strategic system and methodologies for productively working across and through the Triple Helix.

To obtain the necessary project design, management, and data analysis skills. Candidates must complete a formal qualification, which could be a PhD/MD. The fellowship will cover the fees for this study. Applicants must indicate their desired supervisory team and host institution when they apply. Additionally, the qualification should demonstrate their proficiency in data analysis.

**Output**

Once their training is complete, fellows will be well-placed to be future leaders in the research and innovation field. They will have secured higher degrees up to PhD level and robust training in all aspects of research methodology and statistical analysis. Uniquely, these skills will be grounded in the reality of delivering and evaluating cutting-edge innovation projects within time- and resource-pressured health service environments. This is important because high-quality, strategically relevant evaluations of innovative products are an essential foundation for adoption at scale to bring about substantial national improvements in health and wellbeing outcomes and sustainability.

**Eligibility**

The scheme invites applications from early-career clinical professionals wishing to become clinical academics. This includes Medics, Dentists, Nurses, Midwives, Allied Health Professionals (NMAHPs) and Healthcare Scientists. Specific requirements for each category are detailed below.

Applicants need to demonstrate a set of values and passion for spreading their innovation to benefit more people across the country and a willingness to share their learnings and experiences for others to benefit openly.

If your specific situation is not covered or you wish to query your eligibility, please contact – InnovationFellowship@gov.scot.

Health professionals (e.g. NMAHPS, Healthcare Scientists, Pharmacists, Psychologists)

Applicants must be employed in a Health Board in Scotland in a clinical role (direct care) or a role that supports clinical practice (teaching, facilitation, leadership, management) but can demonstrate a commitment to research and innovation and the development of an innovation career. Salary requests for this category of applicant can be no higher than Band 7.

Medical and Dental Specialists

Applicants are required to hold a Scottish National Training Number (NTN). Successful applicants who are in training will remain on current salary scales and progress as normal for the duration of the award. The maximum salary payable is the top of the training scale - SpR9 (includes Public Health trainees who do not have a medical degree).

The time out of research training (OOPR) will need to be agreed upon by your postgraduate dean before application. Written support from the training programme director is required at the time of application.

The provisions of the Gold Guide (A guide to postgraduate speciality training in the UK) will apply.

Please note that in line with the Gold reference guide for postgraduate speciality training in the UK, time out of programme (OOP) will not normally be agreed upon until a trainee has been in a training programme for at least one year of training and trainees in their final training year will not normally be granted OOPR.

GPs

In recognition of shorter training time GPs are eligible for a period of up to 4 years post-CCT. The maximum salary payable is at the top of the training scale.

Dental Core Trainees

Applicants who are dentists may be considered if they do not hold a National Training Number (NTN), but they should have achieved satisfactory completion of DCT2 before they take up the fellowship. Prospective applicants should seek to discuss their application at an early stage with the Associate Postgraduate Dental Dean (Core and Specialty Training) and the Dean of Postgraduate Dental Education. Applicants should also show how they plan to get an NTN.

General Dental Practitioners (GDPs)

GDP’s can also apply. To be eligible, they must have 2 years of clinical experience after graduation (one in vocational training, one in ‘practice’ ) and a maximum of 6 years experience post-graduation.

**General Requirements**

* The Health Board must be the proposed host.
* The candidate will register for and complete an MD or PhD.
* Where already registered for a PhD (or MPhil with transfer to PhD), the applicant should not have been registered for more than 12 months at 100% WTE by the time the award starts.

**Application Process**

* Applicants must develop their application in conjunction with the Regional Innovation Hubs. Contact details are provided below.
* To submit completed forms, please send them via email to: InnovationFellowship@gov.scot.
* Forms should be submitted electronically to the email address above no later than noon on Thursday, 12th of October 2023.
* Applications that do not have signatures will not be taken into consideration.
* The interviews are scheduled for January 2024.
* By the end of January 2024, applicants will receive notification regarding the outcome of their application.

**Regional Innovation Hub Clinical Leads and Contact Details**

* South East: Professor Tim Walsh (timothy.walsh@ed.ac.uk) - [Health Innovation South East Scotland](https://hises.edinburghbioquarter.com/) (innovations@nhslothian.scot.nhs.uk)
* North: Dr Andrew Keen (andrew.keen@nhs.scot) and Dr Colin Fleming (colin.fleming@nhs.scot) - [North of Scotland Innovation Hub](https://www.nhsgrampian.org/innovation-hub) (gram.nosinnovationtestbed@nhs.scot)
* West: Professor David Lowe (David.Lowe@ggc.scot.nhs.uk) and Dr Neil Patel (Neil.Patel@ggc.scot.nhs.uk) - [West of Scotland Innovation Hub](https://www.woshealthinnovation.scot/) (innovation@ggc.scot.nhs.uk)

**Monitoring**

As an Innovation Fellow, you will need to maintain a milestone progress report to keep track of your progress. Your supervisors will regularly review this report with you. In case you fail to meet the targets, you may be given an action plan to address the situation or risk losing the award.

The funding will be granted based on a Service Level Agreement that will undergo an annual review. The Innovation Hub and University supervisors will evaluate the satisfactory progress for each year before releasing the funding.

**Filling in the form**

Your application should be typed throughout, using a clear monospaced or San-Serif font (such as Courier, Helvetica or Arial). You must use a typeface which is not smaller than 10 point (12 point if you choose a narrow typeface)**.**

You must stay within any specified word or page limits.

Please check your application very carefully before submitting it to us to make sure that all sections are filled in.

**Application Summary**

Host Board – Must be the NHS Scotland Health Board that the candidate has a contract of employment.

Supervisor – Provide details of your Innovation Hub and University supervisors.

Project Title - Insert the title of your project from the list of projects provided.

Start Date - Successful fellowships can start between 1 April and 1 October 2023 following interviews in January 2023. Please state your intended start date.

Amount of funding requested – Insert the total amount of funding requested, as detailed in section 3.

**Section One – Applicant Information**

Application category - Medic /Dentist/ NMAHP/ Healthcare scientist

Specialism – for Medics and Dentists please input your training speciality e.g. general surgery. - for NMAHPS and Healthcare scientists please input your Clinical

Profession e.g. –Nurse, Physiotherapist, Biochemical engineer.

If you are a medic or dentist still in training please state your current state of training and give your NTN number.

If you are a GP, GDP, NMAHP or Healthcare scientist please give the date you completed the training to enable you to be eligible for the role. Please state the number of years FTE of work since completion of training till the application deadline. Work in your clinical profession and work in research both count. Time spent on extended leave does not count.

Research and Innovation Experience to Date - provide details of your research and innovation experience, training, skills and up to 5 publications (600 word limit).

Impact of Fellowship – provide the reasons for why you are applying for this award and your current long-term innovation and clinical career plans (600 word limit).

**Section Two – Proposed Research and Innovation Project Plan**

The project must have clear potential for directly benefiting patients/service users, carers or the public and respond to inequality, sustainability and/or workforce challenges.

**Plain English (Lay) Summary** – this should be a clear explanation of your research and innovation project understandable to someone without a scientific/clinical background. If your application is successful this summary will be placed on the Chief Scientist Office (CSO) website. You may find it helpful to involve patients or members of the public in developing this summary to ensure it is appropriately written.

**Detailed Research and Innovation Project** - this is the main part of the application detailing your research and innovation project. Please ensure the information is accurate, succinct and clearly laid out. Please use all the headings with a total word limit of 5000. Please ensure this section includes your plans to involve patients and the public.

**Background Problem Statement** – provide a clear explanation of the problem to be addressed and the impact on patients and how this project will fill an evidence gap.

**Why the Research and Innovation Project is Important** – clearly identify the health need and outline the value this study will provide. Does the existing literature support this proposal.

**Proposed Research and Innovation Aims and Objectives** – please summarise the research and innovation aims and objectives.

**Alignment to NHS Scotland Priorities and Recovery Plan** – outline how your project is aligned to NHS Scotland Priorities and Recovery Plan.

**Project Plan** - Provide an expert description of the project plan for the research and innovation project, including a Gantt chart, which can be submitted as a separate document. Include any additional points required to support statements made in the previous sections, and include any key references required to justify the points made (e.g. in the use of particular outcome measures or methods of analysis). You should include where applicable; study design, justification of sample size, selection and exclusion criteria, methods of data collection and analysis, and justification for your choice of methodology.

**Success Criteria, Outputs, Risks and Anticipated Impact** – Please set out measures of success you intend to use to evaluate the project. Describe what the outputs of the research and innovation project might be, how these will be disseminated and what impact there might be. Please detail the key risks to delivering this research and innovation project and what contingencies you will put in place to deal with them.

Please consider the following questions when completing this section:

* What do you intend to produce from your research and innovation project?
* How will you inform and engage the public?
* How will your outputs enter our health and care system or society?
* What will be the impact of your research and innovation project and how will this be measured?

**Patient and Public Involvement (PPI)**

Public involvement means innovation being carried out with or by members of the public rather than it being something that is done to, about or for them. Examples of public involvement include: involvement in identifying research and innovation priorities; assisting in the design and management of a research and innovation project; being a co-applicant on a grant or a joint grant holder; carrying out specific research and innovation activities; being members of a project advisory or steering group; disseminating findings. Patient and public involvement should also be part of the detailed project plan.

Use this section provides more detail. You should describe who has or will be involved and why this is appropriate, what role(s) they have/will play and what influence or change has/may happen as result of their involvement. You can signpost to the detailed project plan to help.

If you have not had PPI training, please include this in the training and development programme for the fellowship

If it is not considered appropriate and meaningful to actively involve patients/service users, carers and the public in your proposed project a space is provided for you to justify this decision.

For help and resources with PPI –

[Patient and Public Involvement (PPI) Guidance and Training | NHS Research Scotland | NHS Research Scotland](https://www.nhsresearchscotland.org.uk/public/help-shape-research/patient-and-public-involvement-guidance-and-training)

**Training and Development Programme**

Please use this section to detail the training and development you will need to undertake and the resources required for this as part of the Fellowship. This should cover both training you may need to undertake your proposed research and innovation project and any also training to support your development as a future innovation leader.

**Clinical Commitments**

Please indicate what clinical commitments you will have during the fellowship and how/if these relate to your proposed research and innovation project. You may allocate up to 20% of your time to clinical commitments.

**Section Three – Finance**

Please fill in all relevant boxes in this section and ensure it is signed by the Host Board Finance Officer.

Funding will normally cover:

**Reimbursement of the basic personal salary** (not out-of-hours bands) of the award holder (including superannuation and national insurance), with increments, based on an appropriate point for the individual on a relevant clinical pay scale. Request for salaries should be based on actual costs at the time of application, increases for inflation should not be included. In making requests for salaries please note this is a research training fellowship and maximum salaries apply.

All Medical Applicants – Current grade on the specialty registrar scale, the maximum salary payable is SpR9 even if you would progress above this during the fellowship or are GP with a higher salary.

Other applicants – current grade as long as that is in Band 7 or below.

**Fees for registration for a MD/PhD** (at appropriate home student rates at the relevant institution)

**Training costs** up to £3000 where appropriate. Please provide details of additional research innovation training courses including justification for why this training is required. CSO require all Fellows to have received PPI training – please include PPI courses here or detail what training you have already received. Note that clinical training is not eligible. If no training is proposed please justify why none is required. Costs for attending conferences should not be included.

**Project costs** – provide a breakdown of the Research and Innovation Project Costs requested. This should not exceed £5,000 per annum (£15,000 in total or £10,000 if award duration is 2 years). This budget is intended to cover any fieldwork expenses, minor equipment costs (e.g. computer software), printing, postage, travel and stationery. These costs must be fully itemised and justified. Note that the provision of computer hardware will not be made therefore you should negotiate access to computer equipment and support before submitting your application.

**Please note that the financial year runs from 1 April to 31 March and required costs must be split by financial year and detailed in the summary table.**

**Section Four – Support**

**Innovation Hub Supervisor –** Applicants must identify a suitable senior innovation leader from the host Innovation Hub to supervise their development and provide input into the design and delivery of the project. All named supervisors must fill in the form and sign to show they have agreed to take on this role. It should be clearly shown that supervisor support addresses all areas of the proposed work.

**University Supervisor –** Applicants must identify a suitable supervisor from their chosen university to supervise their project and progression towards the higher degree. All named supervisors must fill in the form and sign to show they have agreed to take on this role. It should be clearly shown that supervisor support addresses all areas of the proposed work.

**Head of Innovation** – of the prospective Host Board must fill in the form and sign to indicate their formal approval of the application, their willingness to offer an appointment to the individual (if successful) for the tenure of the award subject to their normal employment practices, their approval of the salaries sought, and the acceptance of the terms and conditions associated with an Innovation Fellowship.

**Clinical Supervisor (current or most recent)** – must fill in the form and sign to indicate their support of the suitability of the candidate and their project for this award.

**Postgraduate Deans Statement – if appropriate** – This must be completed for all medical and dental candidates who are still training.

**Letters of Support –** Other letters of support are not required. If you wish to submit other letters of support they must be included in the one application document or they will not be included in the review.

**Section Five– Declarations**

By signing the form, applicants are confirming that CSO may hold and process, by computer or otherwise, all personal information supplied with the application.

**Assessment of Applications**

All applications will be assessed by a National Assessment Panel. Candidates who are short-listed will be invited to an interview held by the Panel in January 2023.

**Outcome of the Assessment**

Applicants will be informed as soon as a final decision has been taken on their application. Candidates who are interviewed will be notified of the decision as soon as possible after funding arrangements have been confirmed. The decision of the Panel is final and no appeals will be considered.

*The National Assessment Panel will use the following assessment criteria when reviewing your application:*

**The Applicant**

The Panel will look at the experience and relevant expertise of the individual. They will look for evidence of commitment to a clinical innovation career and that the applicant has the potential to become an innovation leader.

**The Research and Innovation Project**

The Panel will wish to fund high quality applications both in terms of the individual and the project. The Panel will judge the merit of the research and innovation project and the factors they will be considering include:

* Has the candidate been involved in the writing and design of the project?
* Is the methodology appropriate?
* Is the work is achievable, feasible and deliverable within the timeframe?
* Has PPI been used in the development of the project and is it a continued thread throughout the project?
* Will the research and innovation project benefit patients?
* Alignment to NHS Scotland priorities and Recovery Plan

**Supervision**

The panel will look for confirmation that the supervision for the candidate and the project is of high quality and is able to cover all aspects of the training and supervisory requirements of the individual.

**Appendix 1. Example Projects**

1. Digital Transformation and Artificial Intelligence in the Lung Cancer Diagnostic Pathway
2. Development, deployment and testing of artificial intelligence-driven dashboard to manage COPD in patients with multimorbidity
3. Evaluating innovative approaches to proactive care for older people living with frailty
4. Digital Transformation in Colonoscopy: Enhancing Assessment, Ergonomics, and Efficiency.
5. Implementing and evaluating wearable and AI-based assistive technologies: Improving outcomes in cardiorespiratory long term condition management
6. Diagnostic technologies for evaluation of Acute Ischaemic Stroke due to Large Vessel Occlusion
7. Implementing and evaluating Closer-to-Home Ophthalmic Diagnostics: Improving outcomes and reducing carbon in ophthalmology for long-term condition monitoring and management

**Title:** **Digital Transformation and Artificial Intelligence in the Lung Cancer Diagnostic Pathway**

**Proposed Innovation Hub:** Heath Innovation South East Scotland (HISES); Edinburgh Cancer Centre

**Innovation Hub Lead contact:** Prof Tim Walsh: timothy.walsh@ed.ac.uk

**Innovation Lead contacts:**

1) Dr Stephen Harrow***,*** Consultant Clinical Oncologist, NRS Career Fellow, Clinical Lead Cancer Transformation & Innovation stephen.harrow2@nhslothian.scot.nhs.uk

2) Dr Rishi Ramaesh***,*** Consultant Radiologist & NHS Scotland Innovation Fellow Rishi.Ramaesh@nhslothian.scot.nhs.uk

**Demand signalling priority area:** Innovation in Cancer Pathways; Early Cancer Diagnostics; Integrated Planned Care

**Summary:** In Scotland, lung cancer is the second most diagnosed cancer in both men and women, and the most common cause of death from all cancers. Only 11.1% of men and 16.3% of women survive 5 years following diagnosis. South East Scotland Cancer Network data in 2020 showed that by the point of case discussion at the Multidisciplinary team (MDT) 50% had incurable metastatic disease. Of all patients discussed at MDT less than half went on to receive cancer treatment and those that did often had options limited by the advanced stage of their disease and/or general health state. In order to identify fitter patients, that would most benefit from treatment, the pathway must be as efficient as possible to ensure that these patients receive prompt treatment. However, the current lung cancer diagnostic pathway requires multiple sequential, multimodality imaging and procedural tests prior to a treatment decision. There are potential delays at each step of the patient pathway from reporting and dissemination of the findings - patients can wait up to 3 weeks for a report of an abnormal chest x-ray when referred from primary care, with further delays waiting for cross sectional imaging and respiratory specialist review. Patients that go onto have a CT guided biopsy or bronchoscopy require a multitude of face-to-face consultations to convey information and organise the next steps. This results in the pathway taking several weeks to complete. We believe that nascent artificial intelligence (AI) and digital health technologies (DHTs) can be leveraged and deployed to address these issues and streamline the pathway, thereby significantly reducing the time taken to definitive treatment and ultimately improving patient outcomes and experiences.

**Problem Statement:** Lung cancer remains the second most common cancer in the Scottish population and the deadliest. By the time patients are diagnosed their cancer is often too advanced and the patients’ health has deteriorated such that curative intent treatment is not possible. A strategy to increase the number of patients suitable for curative treatment is to improve early diagnosis and streamline treatment planning and initiation. Within the current diagnostic pathway there are processes that could be improved with AI and DHTs to realise this objective.

**Proposed Area of Work:** The PhD project will take a multifaceted approach to evaluation of DHTs and how they can address current barriers and challenges in the lung cancer pathway. Research will closely align with established industry partners, academic collaborators and healthcare professionals. Themes include:

* Evaluation of novel AI solutions for triages of abnormal chest x-rays, and deployment into the lung cancer pathway. Research into the efficacy, model safety and accuracy of the solution, via retrospective and prospective methodologies.
* A novel patient information and e-consent digital solutions to improve the patient experience and reduce the need for multiple face to face appointments with healthcare professionals. Investigating the feasibility, utility and acceptability of DHTs amongst patients, including in automated patient recall for appointments and assessing the value of digital media content in conveying patient information and the consent process compared to current resource and time intensive pathway

Training will potentially include: data science within healthcare; artificial intelligence tools for improving patient flow; care pathway design; patient and public engagement; working with industry; evaluation of digital healthcare, including the health economic and operational impact of these digital healthcare tools within NHS diagnostic pathways.

This PhD would be suitable for a Radiologist, Respiratory Physician or Oncologist interested in devising and implementing innovation strategies within cancer care to improve outcomes for patients. The work done as part of this project would contribute to the wider digital transformation of cancer pathways and play a key role in improving the patient experience and ultimately outcomes.

**Title: Development, deployment and testing of artificial intelligence-driven dashboard to manage COPD in patients with multimorbidity**

**Proposed Innovation Hub:** Health Innovation South East Scotland (HISES)

**Innovation Hub Lead contact**: Prof Tim Walsh: timothy.walsh@ed.ac.uk

**Data/methodology lead contacts:** [**Dr Syed Ahmar Shah**](https://www.research.ed.ac.uk/en/persons/syed-ahmar-shah)**,**Centre for Medical Informatics, Usher Institute (University of Edinburgh)

[**Dr Nazir Lone**](https://www.research.ed.ac.uk/en/persons/nazir-lone)**,**Centre for Population Health Sciences, Usher Institute (University of Edinburgh)

**Clinical Lead contact:** Dr Gourab Choudhury, Regional COPD Lead, NRS Clinician, Honorary Senior Lecturer: Gourab.Choudhury@nhslothian.scot.nhs.uk

**Demand signalling priority area:** Chronic Respiratory Disease/ COPD; Management of Long Term Conditions; Integrated Planned Care

**Background:** Chronic obstructive pulmonary disease (COPD), a chronic respiratory illness that require long-term, effective management strategy, is a global healthcare challenge. COPD is complex and heterogeneous that encompasses several lung diseases and managing it is challenging due to its heterogeneity suggesting differing pathophysiology, aetiology, and risk factors. This is further exacerbated by the presence of co-morbidities which are more likely to occur if suffering from COPD. Despite the prevalence of co-morbidities in COPD, majority of previous studies investigating different management strategies either exclude co-morbidities or suffer from significant study design limitations (such as being cross-sectional).

The regional Data Driven Innovation (DDI) programme in Edinburgh recently launched the DataLoch Respiratory Registry, bringing multiple regional COPD-relevant data into a single resource (see: <https://dataloch.org/insights/news/introducing-dataloch-respiratory-registry>). This resource now provides a unique window of opportunity to investigate how different comorbidities impact COPD and develop and validate algorithms that could be used to improve COPD management. In addition, we have partnered with industry (Lenus; https://lenushealth.com/) to help co-design, implement, and evaluate a data-driven digital dashboard that could then be used in a care setting as a decision support tool.

**Proposed Area of Work:** The overarching aim of this project is to improve the management of COPD patients who suffer from substantial comorbidities. More specifically:

(i): interrogate DataLoch and describe the burden of COPD and co-morbidities (while also investigating the variation in management across region when stratified by socioeconomic status)

(ii): Cluster COPD patients into different phenotypes while taking account of the various co-morbidities identified

(iii): For each cluster, develop risk prediction models (to predict adverse outcomes) to aid risk stratification

(iv): Design ‘intelligent’ dashboard that can show outputs from (ii)-(iii) (e.g., showing each patient phenotype and risk level)

(v): Support the development, deployment, and testing of dashboard in collaboration with various stakeholders including industry

Proposed Methods: (i) Descriptive Statistics; (ii-iii) Data Science Methods (Clustering for (ii), two-class classification and cox regression for (iii); (iv) Co-Design Workshops, and Digital Design (v) Stakeholder Engagement

Public and Patient Involvement (PPI): PPI will be embedded throughout the project. Access to a patient advisory group (with 3-5 COPD patients) will be facilitated. Six focus group meetings (interspersed evenly throughout the project duration) will be arranged to ensure meaningful PPI throughout the PhD project (ideation, development, interpretation of results, and dissemination)

Training Outcomes: Develop expertise in data science applied in healthcare; first-hand experience of developing and building a minimum viable product in NHS that can then be tested; develop expertise in co-design workshops to develop digital health interventions; exposure and engagement with clinicians in NHS involved in COPD and related care; develop familiarity of regulatory barriers within NHS and experience of dealing with them when implementing a digital health product.

**Title:** **Evaluating innovative approaches to proactive care for older people living with frailty**

**Proposed Innovation Hub:** Health Innovation South East Scotland (HISES)

**Innovation Hub Lead contact**: Prof Tim Walsh:  timothy.walsh@ed.ac.uk

**Innovation Lead contact:** Dr Atul Anand: atul.anand@ed.ac.uk

**Demand signalling priority area:** Managing long term conditions / frailty; integrated planned care

**Summary**

Our ageing population has placed unprecedented demand on health and social care services. In partnership with NHS Lothian and Health Innovation South East Scotland (HISES), the Data Driven Innovation DataLoch programme has been integrating primary and secondary health records with social care data to better understand older people in our region at highest risk of decline. A registry of over 5,000 older people currently living with frailty has been created, with live dashboards providing enhanced views of this population for clinicians to support proactive, rather than reactive, care. Using existing support from the Scottish Health and Industry Partnership (SHIP), we are developing this register further, to include additional automated frailty tools from routine data, process measures of optimum care, and outcomes data such as hospitalisations to track progress of interventions. A PhD candidate would join the ‘Frailty Innovation Community’ in SE Scotland.

**Problem statement**

As our population ages, the demands on health and care services are increasing. People living with frailty are particularly susceptible to increased care needs and emergency hospitalisation. While most older people are not frail, data from one area of Edinburgh suggests that fewer than 3% of the moderately or severely frail older population account for over one third of all occupied hospital bed days. Well established comprehensive geriatric care already offers evidence-based interventions to prevent some of these expected harms. However, as frailty lacks the diagnostic criteria of a single health condition, routine health and care data has struggled to identify and track this population in real-time, or to proactively deliver appropriate interventions prior to a health or care crisis.

**Proposed area of work**

A successful PhD candidate would be embedded within the Frailty Innovation Community, benefitting from the collaborative environment between HISES, the University of Edinburgh (Data Driven Innovation DataLoch programme) and clinicians (GPs and secondary care geriatric medicine physicians). The PhD candidate would develop and evaluate risk prediction and visualisation tools using routine health and social care data, and support the appraisal of test interventions of practice change. This includes a planned Innovation Challenge focussed on creating an integrated health and social care data dashboard to support complex case management of people living with frailty. Our ambition is to break down existing silos between multiple data systems and provide a combined view of actionable data to help both health and social care practitioners support these people.

Given the high risk of harms associated with frailty, such as unplanned hospitalisation, even small improvements in case management and proactive care could deliver significant benefits for local health and care services, as well as improving the lives of older people. Integrated routinely collected data now offers the basis of this innovation platform, with strong support from clinicians, NHS boards and local authorities. A PhD candidate would be expected to support the deployment of new technology designed to maximise independence and wellbeing for older people living with frailty.

**Title: Digital Transformation in Colonoscopy: Enhancing Assessment, Ergonomics, and Efficiency.**

**Proposed Innovation Hub:** NHS Tayside Innovation:  tay.innovation@nhs.scot

**Innovation Hub Lead contact:**  Professor Colin Fleming: colin.fleming@nhs.scot

**Innovation Lead contacts:**

1) Dr Richard Hansen***,*** Clinical Reader in Child Health, Honorary Consultant Paediatric Gastroenterologist, RHansen002@dundee.ac.uk .

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**Demand signalling priority area:** AI for Early Cancer Diagnostics, ergonomics for flexible endoscopy, Digital Transformation of Endoscopy,

**Summary:**

The proposed project aims to revolutionise the role of diagnostic flexible endoscopy procedures across a number of bowel diseases, including colorectal cancer and inflammatory bowel diseases (IBD), specifically Crohn's disease and ulcerative colitis (UC). It encompasses three primary objectives aimed at advancing disease assessment, improving ergonomic conditions for the endoscopist, and enhancing overall diagnostic efficiency.

To enhance disease assessment accuracy and minimise discrepancies, artificial intelligence (AI) technology will be implemented to evaluate disease severity, specifically focusing on matching AI disease evaluation against user-scored Crohn's Disease Endoscopic Index of Severity and Mayo index in UC, comparing AI and user detection rates for colon cancer. A comprehensive dataset of endoscopic procedure videos will be collected and annotated through a collaborative effort involving healthcare institutions and industrial partners. This dataset will serve as a valuable resource for training and validating the AI system used in disease assessment. The involvement of industrial partners throughout the project duration will ensure access to their expertise and resources, facilitating the collection, annotation, and analysis of the data. The AI-assisted system will ultimately provide clinicians with objective, standardised, real-time, automated disease assessments, leading to improved accuracy and reliability in disease grading.

Recognising the significance of ergonomic considerations, the project will conduct a thorough analysis of the current endoscopic procedure, accounting for factors such as physical strain, mental workload, and the anatomical differences of relevance to endoscopy between clinicians (e.g., hand size/handedness). Feedback from clinicians will be gathered through surveys, interviews, and observational studies to identify areas for improvement. Based on these findings, a novel technological solution will be developed involving robotic endoscopy and utilising gamepad-type control systems and validated to address ergonomic concerns and enhance procedure efficiency and safety.

Moreover, the project emphasises the importance of considering clinicians' work conditions as a vital aspect of technology assessment. By reducing mental and physical stress on clinicians, the project aims to improve their well-being and job satisfaction, ultimately contributing to a more efficient National Health Service (NHS).

With the high prevalence of bowel diseases and a substantial number of colonoscopy and sigmoidoscopy procedures performed annually, approximately 1.4 million in the UK alone, the project's impact is substantial. By leveraging AI technology, addressing ergonomic concerns, and involving clinicians and industrial partners in the development process, the project aims to enhance the effectiveness and efficiency of endoscopy procedures in the management of bowel diseases, leading to improved patient outcomes and both accurate and timely disease detection in colorectal cancer and automated/objective/reproducible disease severity in IBD.

**Title: Implementing and evaluating wearable and AI-based assistive technologies: Improving outcomes in cardiorespiratory long term condition management**

**Proposed Innovation Hub:** West of Scotland Innovation Hub

**Innovation Hub Lead contacts**: Prof David Lowe: David.Lowe@ggc.scot.nhs.uk and Dr Neil Patel Neil.Patel@ggc.scot.nhs.uk

**Innovation Lead contact:** Dr Chris Carlin: Christopher.Carlin@ggc.scot.nhs.uk

**Demand signalling priority area:** Chronic Respiratory Disease/ COPD; Management of Long Term Conditions; Integrated Planned Care

**Problem statement**

Cardiorespiratory long term conditions affect 3m patients in Scotland. Management of these currently accounts for 50% of GP attendances, 70% of hospital occupied bed days, 70% of annual NHS expenditure. Prevalence is highest and patient outcomes are poorer in areas of greatest deprivation.

**Proposed area of work**

The DYNAMIC program and related projects in the West of Scotland innovation test bed portfolio have established implementation-effectiveness framework for digital transformation of long-term condition management. This is based on user-centric co-design, focused adoption and scale-up of assistive technologies, supported by a range of strategic triple-helix (NHS, academic, industry) partnerships. Successful outputs so far include improved patient outcomes with positive offset of inequality and sustainability metrics, and improved clinical user experience with improved workload metrics.

This fellowship would provide experience and training in the range of innovation activities which are required for end-end service transformation. Specific project(s) would be developed from within the portfolio in discussion with potential applicants.

**Title: Diagnostic technologies for evaluation of Acute Ischaemic Stroke due to Large Vessel Occlusion**

**Proposed Innovation Hub:** West of Scotland Innovation Hub

**Innovation Hub Lead contacts:** Prof David Lowe: David.Lowe@ggc.scot.nhs.uk and Dr Neil Patel Neil.Patel@ggc.scot.nhs.uk

**Innovation Lead contact:** Professor Keith Muir, SINAPSE Chair of Clinical Imaging & Consultant Neurologist: Keith.Muir@glasgow.ac.uk

**Demand signalling priority area:** Managing long term conditions; integrated planned care

**Summary**

Acute ischaemic stroke is a medical emergency, leading to around 4000 hospital admissions annually in Greater Glasgow & Clyde alone. Stroke is the largest cause of adult neurological disability. Among patients with acute disabling stroke, restoring brain perfusion significantly reduces the extent of brain injury, improving the likelihood of recovery without disability: this is achievable with intravenous thrombolytic drugs, or, in a subgroup of patients with large vessel occlusion (LVO – occlusion of the intracranial internal carotid, basilar or middle cerebral arteries), with endovascular mechanical thrombectomy. Endovascular thrombectomy greatly improves the chance of recovery to independence in a group of patients with otherwise poor outcome despite thromboysis, since thrombolytic drugs alone achieve rapid recanalization in only around 10% of cases. Both treatments are critically time-dependent, with rapidly reducing benefit as the interval from onset to treatment increases.

**Problem Statement**

The clinical diagnosis of stroke is challenging and current routine brain imaging with non-contrast CT has poor sensitivity to acute ischaemia. CT is therefore commonly used to rule out other pathologies such as intracerebral haemorrhage, but cannot positively confirm ischaemic stroke within the first few hours from onset, when reperfusion treatment is most effective. To distinguish stroke due to LVO from other ischaemic stroke is a further diagnostic challenge, with clinical severity alone a poor guide, and various clinical scoring systems having limited sensitivity and specificity.

Basic brain imaging is widely available at acute hospitals, but use of CT angiography to confirm LVO is currently limited and expert diagnostic interpretation of images a potential bottleneck for transfer to specialist thrombectomy services, provided by interventional neuroradiology (in the West of Scotland at the QEUH site). Further, for patients in the conurbation across west and central Scotland, transport to the nearest local hospital may move them further from the neurovascular centre, delaying definitive treatment if an LVO is present.

**Proposed area of work**

In the context of diagnostic technologies for evaluation of acute ischaemic stroke, the project will address three relevant and complementary technologies:

1. Immediate mobile MRI diagnosis. This ongoing collaboration with Hyperfine will evaluate a low-field MRI system with respect to diagnostic sensitivity and specificity for acute stroke diagnosis, including detection of LVO.
2. AI systems for CT angiography (CTA) and CT perfusion (CTP). Routine acquisition of CTA and CTP has complemented non-contrast CT in acute stroke patients at QEUH since 2020 and several competing software systems offer automated detection of LVO on CTA as well as processing of perfusion imaging. Prospective comparison of different software will evaluate performance.
3. A novel microwave-based device for detection of stroke and other acute brain injuries has been developed by a Swedish technology company (Medfield diagnostics), suitable for portable use in ambulance settings. The device was recently CE marked. Validation of diagnostic performance is necessary, and in particular the potential for the device to offer discrimination of LVO from non-LVO stroke. If diagnostic accuracy is sufficient, then further evaluation as a tool for in-field triage of patients suitable for thrombectomy may be warranted. In the first instance, a hospital-based cohort of suspected acute stroke patients undergoing CTA and CTP will be recruited for validation.

**Title:** **Implementing and evaluating Closer-to-Home Ophthalmic Diagnostics: Improving outcomes and reducing carbon in ophthalmology for long-term condition monitoring and management**

**Proposed Innovation Hub:** West of Scotland Innovation Hub

**Innovation Hub Lead contacts**: Prof David Lowe: David.Lowe@ggc.scot.nhs.uk and Dr Neil Patel Neil.Patel@ggc.scot.nhs.uk

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**Demand signalling priority area:** Managing long term conditions; integrated planned care

**Problem Statement**

Glaucoma affects half a million individuals in the UK, a figure that is projected to rise by 44% over the next 15 years. Ophthalmology accounts for more outpatient visits than any other speciality in NHS hospital care and glaucoma is the most prevalent condition among those attending. Patients with glaucoma consume considerable resources due to the large number of follow up visits and lifelong monitoring required.

Several SBRI Competitions at various stages have refined technologies towards remote monitoring of visual function, resulting in market ready technologies active within NHS testbeds. Goals of digital disruption in this space include reduced carbon, decreased burden to secondary care, increased patient convenience and re-centration of monitoring Closer to Home, in turn preventing blindness through earlier detection of deterioration.

**Proposed area of work**

This fellowship would provide experience and training in the range of innovation activities

required for end-end service transformation, building on established relationships with community optometry, third sector, industry, and academia. Specific project(s) would be developed from within the portfolio in discussion with potential applicants.