



Scottish Collaborative Optometry-Ophthalmology Network e-research

SCONE
PHASE 2
2022 - 2025
EXECUTIVE SUMMARY

FEBRUARY 2026

Introduction

Since it was established in 2020, the Scottish Collaborative Optometry-Ophthalmology Network e-research (SCONe) retinal image repository has successfully grown from an initial proof of concept to a world-leading project. Nearly 1.5 million retinal images (also known as fundus photographs) have been safely delivered from optometry practices around Scotland to Public Health Scotland's National Safe Haven, a secure data environment for clinical research.

One of the key aims of the SCONe repository is to safeguard retinal images captured in community optometry practices as a highly valuable clinical research resource, which can be used to improve public health across the population. In Scotland, community optometrists collect millions of retinal images every year during eye examinations. Many have been doing so for more than a decade. In conjunction with the latest advances in Artificial Intelligence for medical image analysis, these data are extremely valuable for developing new diagnostic tools, as well as refining important time points in clinical care pathways where there is a need for monitoring, referral and intervention.

This Summary describes the achievements of the second phase of the project, from November 2022 to November 2025.



Image 1: Professor Baljean Dhillon
Photo by Andrew Perry

Governance

The SCONE team visited participating practices, carefully finding and extracting relevant data. This included a patient list from the Practice Management Software (PMS) and, from imaging systems, fundus photographs for patients aged 18+ years old. As these data collection systems are not linked, SCONE researchers developed a semi-automated procedure for matching images to patient data within optometry practices with high rates of accuracy, subsequently preparing the data for linkage to national identifiers held by Public Health Scotland (PHS).

The prepared data were securely transferred to the PHS National Safe Haven, a trusted platform for health research in the public benefit. PHS then linked them to hospital inpatient and day case records (SMR01) and General Ophthalmic Service records (GOS) to provide details of diagnoses and procedures. They removed personal identifiers and replaced them with anonymous study IDs. This linkage of retinal images from the community to routine NHS healthcare datasets creates the opportunity to discover new information about retinal manifestations of ocular and systemic diseases.

This process means that the SCONE repository consists of anonymous images linked to pseudonymised healthcare data within the National Safe Haven. No personally-identifiable data is visible to researchers. In order to access the transferred images and analyse them, SCONE team members must go through the Safe Haven's formal application process to become approved users, with all the technical protections and governance requirements which that entails. We are working towards a mechanism for external researchers to apply to use the SCONE dataset for additional research, with the same protections in place, but this is not yet open for applications.

Governance Protocols:

- NHS Scotland Public Benefit and Privacy Panel for Health and Social Care (HSC-PBPP) authorisation for the use of unconsented healthcare data for research, October 2021; updated 2023.
- Data Privacy Impact Assessment (DPIA) approved by the University of Edinburgh Data Protection Officer, September 2021
- Co-sponsorship from University of Edinburgh and NHS Lothian, following a review by ACCORD (www.accord.scot)
- Data Sharing Agreements signed by each practice Data Controller and both sponsors before any images are extracted
- eDRIS National Safe Haven ethical approval

Data collection

We visited and successfully completed secure extraction of data from a total of 43 practices. This is around 6.5% of the total number of optometry practices in Scotland, or 10.6% of a group of around 400 “independent” practices which we identified at the start of the project to be the main focus of our engagement activity.

We have securely delivered a total of 1,499,677 images for 131,678 individuals to the National Safe Haven. Nearly 800,000 of these images have been linked to NHS health records, making them available for research, while linkage of the remainder is currently in progress.

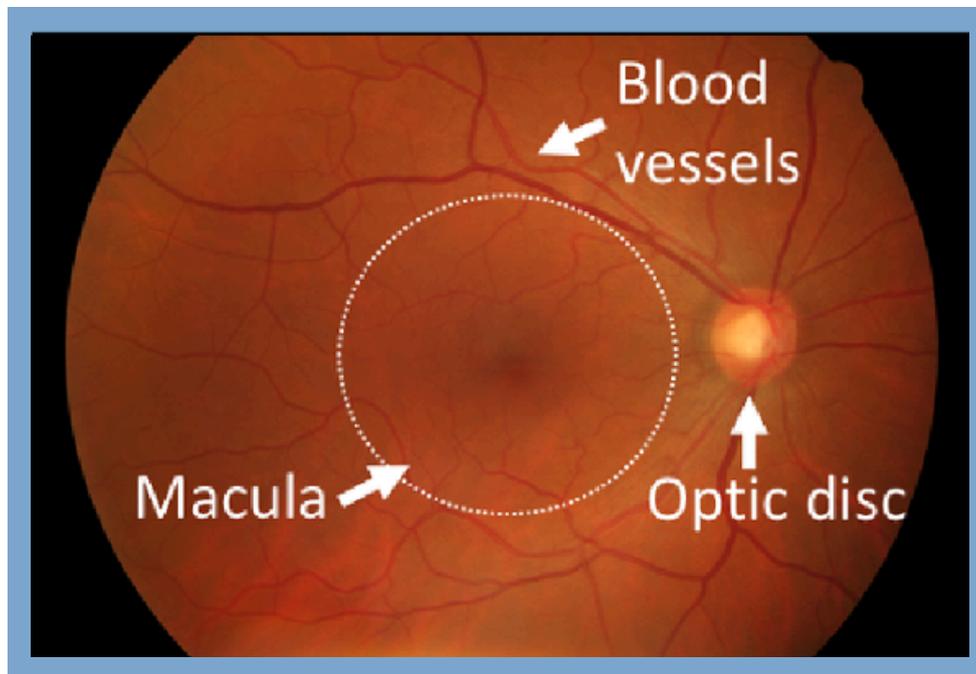


Image 2: A retinal fundus photograph

Data curation

In a collaborative effort with the Belfast Ophthalmic Reading Centre, we have completed grading of approximately 9,500 retinal images using a novel grading protocol. Graders indicated whether signs of age-related macular degeneration (AMD) were visible, in addition to other key information about the quality of the image and the presence of other pathology. This tidy, labelled dataset of graded images is now being fed into the modelling.

Involving the public

Our Patient and Public Involvement (PPI) Group is made up of contributors with lived experience of AMD. The group has been actively involved in the co-design of specific research questions and engagement activities, in particular:

1. To develop recommendations that can be used by SCONE as the foundation for materials that will enhance public awareness of the value of retinal images in healthcare research;
2. To support people in understanding why regular eye tests matter, not just for vision, but for overall health, and to encourage habits that help protect eyesight as we age.

As part of this second objective, the group, together with our researchers and artist Alice Haskell, co-designed a video entitled “The Eye as a Window to Your Health” to help promote eye health as an important part of general health. The video can be found here: <https://youtu.be/raAIN3q3Xrk>



Image 3, left to right: A meeting of our PPI Group and the video promoting eye health

We have participated in public engagement events, such as Edinburgh Open Doors Day in September 2024 and Edinburgh Science Festival in April 2025 at the National Museum of Scotland. Members of the SCONE team have also spoken at various Macular Society patient group events.

Image Analysis

Our Artificial Intelligence (AI)-based work on prediction of age-related macular degeneration (AMD) has delivered strong results.

We have developed and validated two complementary AI algorithms for AMD diagnosis and prognosis:

1. an AMD detection model that identifies the presence of clinical AMD in fundus images, and
2. an AMD progression-prediction model that estimates the likelihood that a non-AMD or early-AMD eye will progress to clinically significant AMD within a defined future window of time.

These findings are currently being prepared for publication, following peer review.

We have also designed a follow-on study to evaluate how effectively our system performs in real-world settings. The purpose of this research is to ensure that our tool can accurately identify individuals who would benefit from treatment or healthcare interventions, making it practical and beneficial for use in everyday clinical and community settings, such as optometry practices. We are seeking additional funding for this workstream.

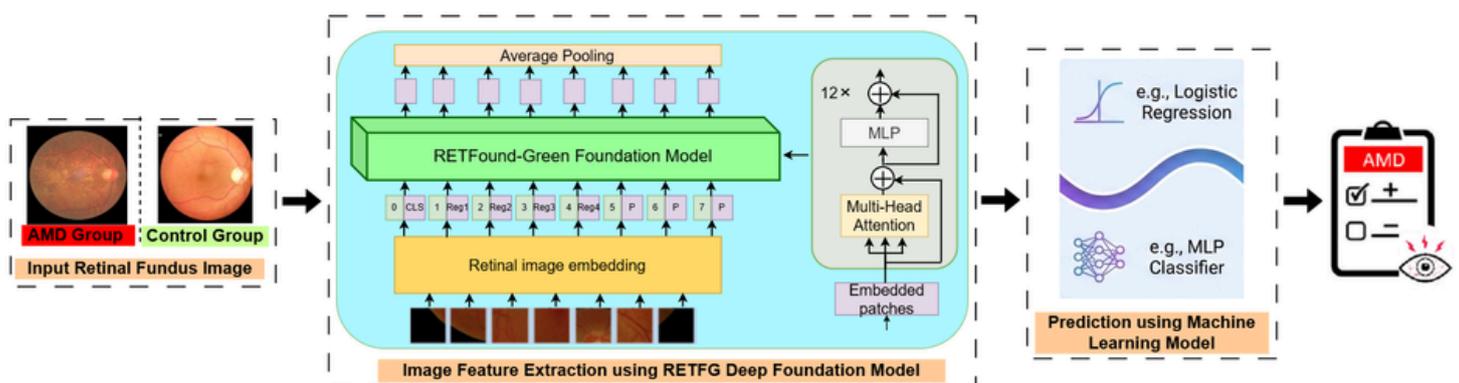


Image 4: We process retinal fundus images using the RETFound-Green model to find important details (deep feature embeddings). We then use these details to detect whether someone has AMD and predict progression of disease, through either a statistical tool (logistic regression) or a more complex neural network (multilayer perceptron: MLP) that can learn from the data.

Outputs

During the SCONE project, we have published academic papers describing our work, including a paper in BMC Medical Research Methodology on our novel linkage approach (<https://doi.org/10.1186/s12874-024-02143-3>), an introductory paper in BMJ Health & Care Informatics describing the SCONE dataset (<https://doi.org/10.1136/bmjhci-2024-101236>), and a paper in BMC Research Involvement and Engagement describing our public involvement and engagement strategy (<https://doi.org/10.1186/s40900-025-00752-w>).

A further nine papers are currently in development and will be submitted for publication in 2026.

A full list of papers, posters, and talks where we have presented SCONE to academics, the public, and the optometry and ophthalmology community can be found on our website, with links to some posters and recorded talks where available.

SCONE research has also been featured in media outlets such as BBC News, the Times, the Telegraph, and the Scotsman, as well as health sector publications such as Optician, Optometry Today, and Eye News.



Image 5, left to right: Ana-Paula Rubio at Health Data Research UK Conference, October 2025; Dr Alice McTrusty at Scottish Vision Strategy conference September 2025; Heather Anderson at Scottish Optical Conference, November 2024

The Next Phase

Securing new funding is a constant challenge in health research. To ensure the long-term sustainability of our project, we're currently exploring additional funding opportunities to support our team members. In the short term, we are prioritising delivering high-impact research outcomes while temporarily pausing our data collection activities with optometry practices. This pause will enable us to concentrate our resources on producing more research outputs, fulfilling our commitments to existing funders, and demonstrating the value of the SCONE repository.

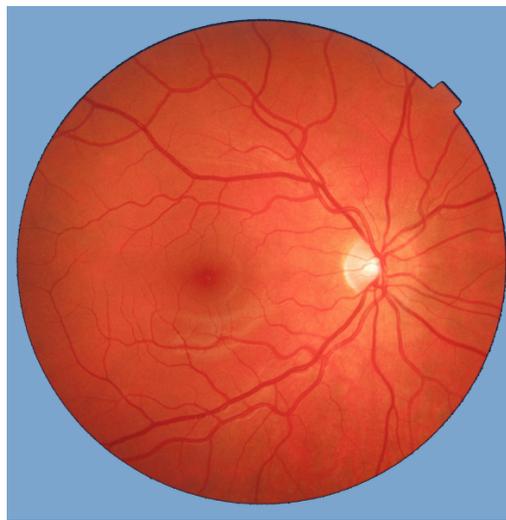


Image 6: A retinal fundus photograph

With the support of Public Health Scotland, we are now in discussion with the Scottish Government-funded Research Data Scotland (RDS) to include SCONE in their portfolio of research datasets. If successful, this will open a mechanism to allow other trusted researchers to use it securely, bringing in financial support for the costs of maintaining and improving the repository and ensuring that its potential benefit to the public is maximised via a self-sustaining model.

Additionally, Scottish Government has signalled high-level support for SCONE and is currently exploring the feasibility of modifying the GOS contract for continued curation of retinal images from primary care optometry. If this can be achieved both legislatively and technically, this would vastly expand the size and power of the SCONE repository for research in the public good.

Acknowledgements

The creation of the SCONE retinal image repository was made possible by the generosity and commitment of our funding partners. We would like to express our sincere appreciation to the four SCONE Phase 2 funders – The RS Macdonald Charitable Trust, Sight Scotland, Fight For Sight and RCSEd – as well as to NHS Lothian Charity and the Chief Scientist Office, who contributed directly to Phase 1 of the project and have continued to fund our work through grants for Public and Patient Involvement and Engagement and glaucoma-focused research respectively.

We would also like to extend our gratitude to all our collaborators who have played a crucial role in the project's success. This includes Public Health Scotland (eDRIS) and EPCC for providing access to the infrastructure of the National Safe Haven and for data ingestion, linkage and access within it; Scottish Government for their support for the SCONE concept and encouragement of the optometry community to participate; contacts at Topcon, Birmingham Optical and other companies for generously giving their time and advice to help us to develop our data extraction processes and overcome technical barriers; the SCONE Steering Group members and Patient and Public Involvement Group participants for their enthusiasm and input; and especially the Scottish optometrists and optometry practices who came forward to participate, without whom this project would have not been possible.

Finally, we would like to thank all the SCONE team members, past and present, for their tireless efforts and dedication to the vision and objectives of SCONE. Their hard work, expertise, and commitment have been vital to the achievements detailed in this summary.



Further information about the project can be found on the SCONE website:
www.ed.ac.uk/clinical-sciences/ophthalmology/scone