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**Component 1: Digital Transformation in the Health and
Care Professions.**

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Introduction

Digital transformation has become a planned priority within the UK National Health Service (NHS), with artificial intelligence (AI) identified as an important technology to improve diagnostic accuracy, workforce performance, and patient outcomes (Department of Health and Social Care, 2022). Artificial intelligence, including machine learning, is transforming healthcare by enabling large-scale examination of clinical data and supporting evidence-based decision-making. Within Health 4.0, AI is integrated with digital infrastructure to improve efficiency, patient outcomes and service delivery (Cwiklicki, Duplaga and Klich, 2022; Sidey-Gibbons and Sidey-Gibbons, 2019), reflecting on a longer direction in which health systems have moved from paper-based records towards increasingly connected, data-driven models of care (Baker et al., 2024). Although AI offers significant opportunities to enhance healthcare, its implementation also raises important challenges relating to transparency, accountability, workforce readiness, and ethical governance (Lim et al., 2026).

One of the most significant recent developments in AI-enabled ophthalmology is RETFound, a retinal foundation model developed by researchers at the University of Oxford and Moorfields Eye Hospital. Unlike conventional Summarize or break down massive amounts used in the Zhou et al. (2023) Nature paper. The model can accurately detect retinal diseases such as diabetic retinopathy, glaucoma, and age-related macular degeneration, while retinal imaging may also provide information for wider systemic conditions, including cardiovascular disease and Parkinson's disease (Zhou et al., 2023). Despite its potential, RETFound is not a standalone solution: its effectiveness depends on successful integration into clinical practice, supported by strong governance, workforce training and compliance with legal and ethical standards, alongside careful attention to AI bias, patient confidentiality, and fair access.

This report critically evaluates the impact of RETFound on the healthcare workforce, service delivery, patients, and the wider community within the UK, considering both positive and negative outcomes of its implementation. It examines the opportunities and challenges associated with implementing AI in healthcare and considers how

RETFound can contribute to improving patient outcomes while supporting safe, fair, and person-centred care.



Figure 1: Image by Optain Health 2024.

Impact on Workforce

The implementation of RETFound has the potential to transform the healthcare workforce by changing professional roles, increasing demand for digital competencies, and reshaping clinical decision-making. As artificial intelligence becomes increasingly integrated into healthcare, the focus is shifting from whether AI will replace professionals to how clinicians can work effectively alongside smart technologies. The Department of Health and Social Care (2022) identifies digital transformation as a priority for the NHS and argues that success depends on developing a workforce capable of using AI safely, ethically, and effectively.

In terms of job roles, RETFound may automate aspects of retinal image learning, allowing ophthalmologists to focus on complex diagnoses, treatment planning, and patient management rather than routine screening tasks (Zhou et al., 2023). Optometrists may use AI-supported analysis to improve referral decisions, while

nurses and imaging technicians may take on greater responsibility for image quality, interpreting AI outputs and supporting patients through AI-enabled pathways — reflecting role expansion rather than simple replacement, in line with Health 4.0 principles (Cwiklicki, Duplaga and Klich, 2022).

Role competency is central to this transition. Existing frameworks predate AI-enabled tools, so professional bodies need to define what safe RETFound use looks like for each role, including the level of understanding needed to interpret AI outputs critically rather than accept them at face value.

The introduction of RETFound requires healthcare professionals to develop competencies in AI literacy, data interpretation, ethics, and digital governance. Consequently, undergraduate education and continuing professional development should incorporate AI training to ensure clinicians understand both the capabilities and limitations of AI (Department of Health and Social Care, 2022). AI should therefore be considered a decision-support tool that complements professional judgement rather than replacing clinical ability. Human oversight remains essential because AI systems may produce false results or perform differently across patient populations.

The importance of workforce readiness is supported by Stogiannos et al. (2024), whose UK study found that healthcare professionals recognised AI's potential to improve diagnostic accuracy and efficiency but raised concerns about accountability, governance, and insufficient training. This suggests that barriers to RETFound implementation are organisational rather than purely technological. Without proper preparation, even accurate AI systems may not improve healthcare outcomes.

Ethical and legal responsibilities must also be considered. Although RETFound can support clinical decisions, accountability for patient care remains with healthcare professionals, and organisations must ensure robust governance and transparency, particularly as trust, accountability and explainability remain a barrier to clinical AI adoption across specialties (Kumar, Chauhan, and Awasthi, 2023). Comparable workforce concerns have been reported in other areas, such as mental healthcare, where staff similarly report uncertainty about integrating AI safely into practice (Alhuwaydi, 2024).

Set against these opportunities are genuine risks for the workforce. Over-reliance on RETFound's outputs could contribute to loss of skills if manual interpretation skills are practised less frequently. Staff in roles most closely tied to routine image grading may also experience uncertainty about job security or scope of practice, and unclear liability arrangements when AI and human judgement disagree could create additional stress rather than solve it.

Overall, RETFound offers opportunities to improve workforce efficiency and enhance clinical practice, but its success depends on workforce preparedness, effective training, and genuine cultural and organisational change, not simply the introduction of innovative technology.

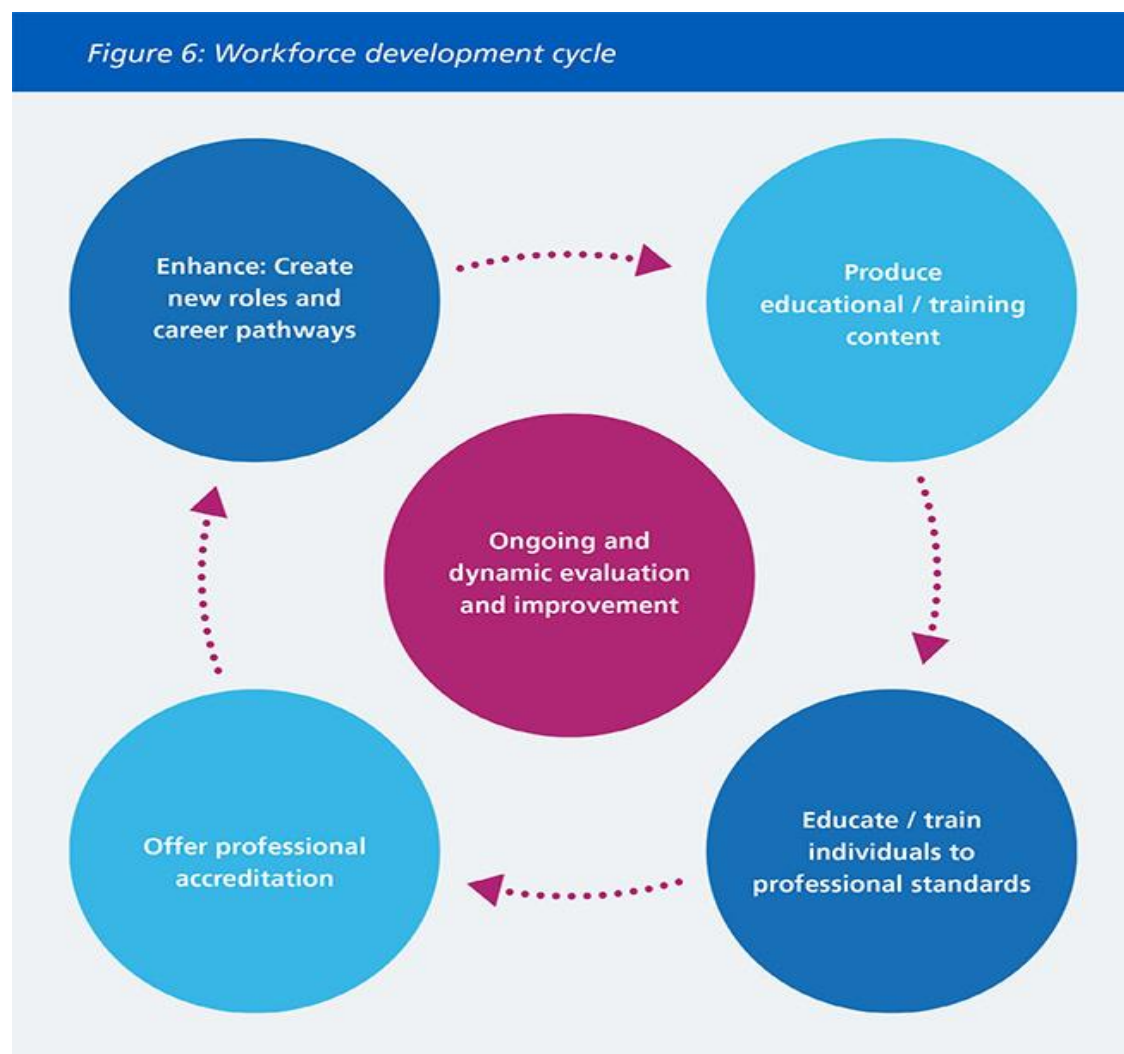


Figure 2: Workforce development cycle (NHS England, 2024)

Impact on Service Delivery

The implementation of RETFound has the potential to transform healthcare service delivery by improving diagnostic efficiency, supporting earlier intervention, and strengthening ophthalmology pathways. Within the NHS, increasing demand for eye care services due to an ageing population and rising rates of chronic disease has created pressure on existing resources. The Department of Health and Social Care (2022) identifies artificial intelligence and digital technologies as important tools for modernising healthcare services and improving productivity.

RETFound supports this concept by using AI to examine retinal images rapidly, helping clinicians identify patients who require urgent assessment while reducing delays in diagnosis. This aligns with the concept of smart hospitals, where AI, digital infrastructure and data-driven systems are used to improve clinical decision-making and healthcare quality (Kaldoudi, 2024). By supporting automated retinal image analysis, RETFound may improve service delivery through faster triage, reduced waiting times, and more effective use of specialist resources.

On a day-to-day level, images could be flagged automatically as they are captured rather than queued for individual review, freeing appointment slots for urgent or complex cases and allowing high-risk findings to be escalated the same day.

One of the key benefits of RETFound is its potential contribution to screening programmes, particularly diabetic eye screening, where AI-assisted analysis may allow larger numbers of retinal images to be assessed consistently, helping professionals detect conditions such as diabetic retinopathy, glaucoma and age-related macular degeneration earlier (Zhou et al., 2023). However, AI should support rather than replace clinical judgement, as false-positive or false-negative results could affect patient safety.

Integration into NHS services also presents practical challenges. Zhang et al. (2023) highlight that transparent planning of national data flows is essential to guide infrastructural transformation and protect privacy; technological capability alone is insufficient, as AI tools must connect with existing electronic health records, imaging systems and referral pathways to create meaningful improvements in care.

The scale of the basic screening needs to demonstrate why this integration matters. Around four million people in England are registered with the NHS Diabetic Eye Screening Programme, with 3.3 million screened annually; NHS England (2024) estimates that expanding AI-compatible screening closer to home could save up to 120,000 hospital appointments a year, with RETFound-type tools helping direct lack of specialist capacity to the patients who need it most.

Cost-effectiveness is another consideration. RETFound requires investment in digital infrastructure, staff training, and ongoing evaluation, but potential benefits include reduced demand on specialist services and earlier prevention of avoidable complications, though evidence on long-term budgetary impact is still developing.

Negative outcomes are also possible. If RETFound flags a high percentage of borderline cases for human review, this could create a new congestion rather than relieving pressure on specialist clinics, particularly during the transition period while staff build confidence in the system. System downtime, software updates, or IT failures could also disrupt screening clinics that have become dependent on AI-assisted triage, and the upfront cost of infrastructure and training may temporarily divert resources from other service priorities.

Overall, RETFound has the potential to enhance service delivery, but successful implementation depends on organisational readiness, effective governance, and integration into existing NHS systems rather than technological innovation alone.

Impact on Patients

The implementation of RETFound has the potential to improve patient care by enabling earlier diagnosis and more personalised healthcare. Many retinal diseases, including diabetic retinopathy, glaucoma and age-related macular degeneration, develop gradually and may remain unnoticed until significant vision loss occurs; earlier diagnosis may reduce disease progression, preserve vision, and shorten waiting times for specialist assessment (Zhou et al., 2023).

RETFound may also improve patient experience by increasing the efficiency of ophthalmology pathways. AI-assisted retinal image analysis can support clinicians in identifying high-risk patients more quickly, allowing urgent cases to be prioritised. However, improved efficiency does not automatically guarantee patient acceptance.

AI should be viewed as a support tool that enhances, rather than replaces, professional judgement.

Patient trust is essential for successful AI adoption. Jeyakumar et al. (2023) found that patients were more supportive of AI when it complemented healthcare professionals and when they received clear explanations of how it contributed to clinical decisions, showing that confidence depends on transparency and communication as much as technological accuracy.

Data privacy is another important consideration. RETFound requires access to large datasets of retinal images, meaning organisations must ensure patient information is handled securely and ethically. Compliance with the Data Protection Act 2018 is essential, while Zhang et al. (2023) highlight that transparent, well-governed data flows are necessary to support public trust in digital healthcare. There is also a risk that AI could increase health inequalities if systems perform less accurately for groups underrepresented in training datasets. Continuous evaluation using diverse populations is therefore necessary to reduce bias and ensure fair access.

Negative experiences are also plausible. Patients who are not given a clear explanation of how an AI-generated result was reached may feel anxious about a diagnosis they do not fully understand, particularly where a false-positive result leads to unnecessary worry before further assessment. Some patients may also perceive AI-assisted appointments as more impersonal than a fully human-led consultation, which could reduce satisfaction even where diagnostic accuracy improves.

Overall, RETFound has the potential to enhance patient outcomes, but successful implementation depends on balancing innovation with privacy, fairness, and human-

cantered care.



FIGURE 3: UCLH NEWS (2023)

Impact on Community

RETFound may create wider benefits for communities by improving access to healthcare, supporting public health initiatives, and reducing inequalities. This reflects the principles of Health 4.0, where digital technologies and AI are integrated into healthcare systems to improve efficiency, prevention, and personalised care (Kaushik et al., 2023). Other AI-enabled innovations show a similar pattern of shifting care from hospitals into community and home settings, for example wearable-based detection of atrial fibrillation, which allows monitoring to take place outside traditional clinical environments (Lown et al., 2020).

In terms of service location, one potential benefit is improved access for rural and underserved populations. AI-supported retinal image analysis could allow screening to take place in community settings such as high street optometrists or mobile units, reducing travel to specialist hospitals and supporting earlier identification of disease,

though this depends on reliable digital infrastructure and investment across different communities.

For family members and carers, earlier and more efficient diagnosis may reduce the practical burden of arranging time off work, transport, and support for hospital appointments. Preventing avoidable sight loss also benefits families and carers directly by supporting patient independence and reducing demand for informal and formal care over the longer term.

From a public health perspective, RETFound may strengthen population-level screening programmes such as diabetic eye screening. More efficient image analysis could increase service capacity and support early intervention, reducing preventable sight loss across the population rather than only for individual patients.

Successful implementation also requires community involvement. The Social Care Institute for Excellence (SCIE, n.d.) highlights the importance of co-production in digital health, ensuring that patients, carers, and communities contribute to service design and evaluation. Applying this principle to RETFound may improve public trust and reduce concerns about AI adoption.

Nevertheless, digital inclusion remains a challenge. Communities with limited digital access or lower digital literacy may be less able to benefit from AI-enabled healthcare. Therefore, RETFound must be implemented alongside education, accessible services, and investment in digital infrastructure to prevent widening existing inequalities. Without this investment, there is a genuine risk that RETFound could widen rather than narrow inequalities, concentrating benefits in areas that already have stronger digital infrastructure and health literacy while underserved communities see minor change.

Overall, RETFound has the potential to support more accessible and preventative healthcare, but its success depends on fair implementation and addressing barriers to digital inclusion.



Figure 4: OCT retinal scanning equipment in use at an NHS eye clinic, 2025.

Conclusion

RETFound is a significant advancement in the use of artificial intelligence within ophthalmology and demonstrates strong potential to improve diagnostic accuracy, clinical efficiency, and patient outcomes, while also carrying genuine risks that must be actively managed rather than dismissed. Its ability to support earlier detection of retinal disease may contribute to improved clinical decision-making, reduced disease progression, and better long-term visual outcomes for patients.

For the workforce, RETFound offers opportunities to reduce repetitive diagnostic tasks and allow clinicians to focus on more complex, patient-centred care, but this requires new digital competencies and clear understanding of AI limitations and governance responsibilities. For service delivery, it has the potential to streamline pathways and improve triage, while patients may benefit from faster diagnosis and more personalised care, provided this is underpinned by effective communication, trust, and shared decision-making.

Across all areas, ethical governance remains essential. Compliance with data protection requirements, transparency in AI decision-making and ongoing monitoring

for bias are critical to ensuring safe and fair use of the technology. Importantly, RETFound should be viewed as a clinical decision-support tool rather than a replacement for healthcare professionals, with human oversight remaining central to safe practice. At the same time, the risks identified across this report — including deskilling, workflow bottlenecks, patient worry and the potential to widen digital inequalities — are not incidental and must be actively managed rather than treated as acceptable side effects of innovation.

Overall, the success of RETFound depends on balancing technological innovation with ethical practice, workforce preparedness, and patient-centred care.

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