Where should machine learning-enabled treatment monitoring be placed within the nAMD care pathway and what will influence its implementation?

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Introduction

Neovascular age-related macular degeneration (nAMD) is an increasingly prevalent condition, where insufficient clinical capacity to meet treatment needs in the UK causes avoidable sight loss.[1] Treatment decisions are highly protocolised, imaging dependent and could therefore be amenable to machine learning(ML)-enabled monitoring.[2] Only indirect evidence exists to inform the design of such an intervention or its implementation.[3] This qualitative study aims to inform the refinement of an ML-enabled intervention for nAMD monitoring and strategies for its implementation into practice.

Methods

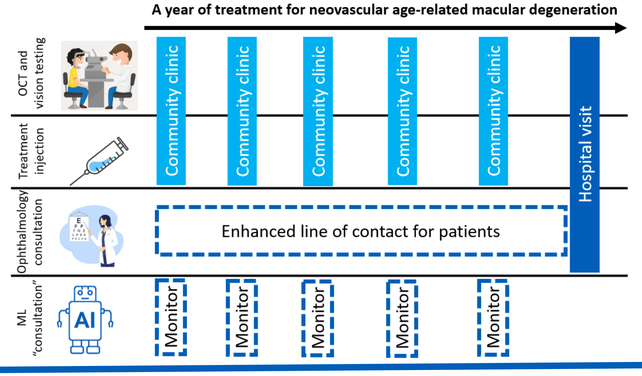
1. Systematic review[3] of stakeholder perspectives on clinical ML to inform participant sampling and questioning
2. Thirty-six semi-structured interviews with clinicians(12), patients(6), managers(5), industry professionals(4), carers(2), commissioners(2), charity professionals(2), regulatory professionals(1) and policy makers(1)
3. Interview transcripts mapped to the Nonadoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) framework[4] (adapted for clinical ML through the systematic review[3]) to identify determinants of implementation success or failure
4. Implementation determinants analysed with the Fit between Individuals, Task and Technology (FITT) framework[5] to understand how the ML-enabled intervention and its implementation should be optimised for the target context

Conclusions

- There is cross-stakeholder agreement that partial automation of treatment interval decisions for patients with known nAMD would hold various forms of value.
- Adoption by host organisations will be enabled by interoperable digital infrastructure including cloud computing, imaging repositories, electronic health records, and secure ML platforms.
- Scalable adoption will require local ophthalmologist endorsement, which is currently limited by ML exposure and training to make independent place-based clinical evaluations. An immediate solution to this is adoption of commercially available tools as a non-medical device for research or audit purposes and targeted education.

Individuals

"I think it should be the people that do the photographs now. Maybes a bit more training if they need it… But them are usually quite good on… what to do. Okay, because I think if the consultants were doing it, why… it wouldn't be sort of saving their time much." **(nAMD patient)**



Task

"…the two decisions that you need to make are, do they need an injection, and when do they need the next one. The first one is already done for you, so the only thing you need to do, is how long until the next one… It's as simple as that. So you don't need a person." **(Ophthalmology registrar)**

Technology

"One of the challenges that we have had though is… which care pathway is most mature from a tech perspective …we could integrate that model on top of an existing mature tech stack which has got open AIs and that sort of thing. So thinking about it more from a platform approach." **(NHS policy maker)**

References

1. Hogg J et al. The prevalence and impact of treatment delays on exudative age-related macular degeneration. IOVS, 2021, 62;2941
2. Hogg HDJ et al. Safety and efficacy of an artificial intelligence-enabled decision support tool for treatment decisions in nAMD and an exploration of clinical pathway integration and implementation: protocol for a multi-methods validation study. BMJ Open, 2023;13:e069443
3. Hogg HDJ et al. Stakeholder perspctives of clinical artificial intelligence implementation: systematic review of qualitative evidence. JMIR 2023;25:e39742
4. Ammenwerth E et al. IT-adoption and the interaction of task, technology and indivduals: a fit framework and a case study. BMC Med Inform Decis Mak 6, 3 (2006)
5. Greenhalgh T et al. Beyond adoption: a new framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability f health and care technologies. JMIR 2017;19(11):e367

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Acknowledgements

Design, analysis and governance of the presented research benefits from patient and public contributions from Rashmi Kumar, Janet Lunn, Trevor Lunn, Rosemary Nicholls, Angela Quilley and Christine Sinnett through separate study advisory and reference groups.
The research has been fully funded by the National Institute for Health and Care Research (NIHR) through a doctoral fellowship award to HDJH (NIHR 301467). The research would not have been possible without generous voluntary contributions of time and perspectives from the 36 interview participants.