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Artificial intelligence (AI) based Telemedicine for cost-effective cataract surgery follow-up at NHS: An economic evaluation

Aim

The aim of this real-world early-stage economic analysis study is to compare the direct staff cost savings from the use of Artificial intelligence (AI) based telemedicine (autonomous call) for post-operative cataract follow-up versus the standard face-to-face-led follow-up for the patients at Imperial College Healthcare NHS Foundation Trust (ICH).

Objectives

Financial

- To provide an overview of the potential cost savings for using AI based telemedicine in the cataract post-operative care pathway at ICH
- To evaluate the cost-effectiveness of implementing AI autonomous calls in comparison with routine face to face (F2F) follow up calls in the standards care

Non-financial

- To explore the potential benefit and acceptability of AI based telemedicine call for cataract post-operative follow-up to be used in routine clinical practice
- To establish efficacy for AI based telemedicine for detection of patients requiring further assessment and reducing unplanned visits to hospital for patients without any complications

Follow up pathway with AI automated call for real world deployment

Methods

Patients undergoing cataract surgery were recruited over five months at the ICH. 528 cataract surgery cases were carried out at the hospital and were all screened for recruitment. 268 cases were suitable, and 250 cases were unsuitable for the study. The autonomous call follow up route and model of care was followed by 97 post operative cataract patients.

All patients are seen Face to Face in clinic within 3-4 weeks post-operation. All AI autonomous calls are scheduled within 7 days prior to face-to-face clinic review.
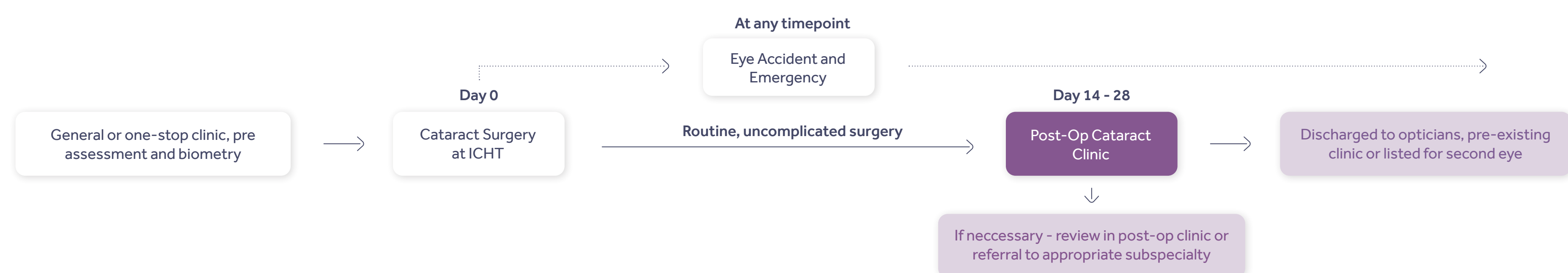
For this analysis, the real-world data for the standard care pathway of all the 97 patients who would have had F2F follow up with clinicians were provided by Ufonia and ICH. For the autonomous call trial study, a total population of 97 cataract surgery post-operative follow-up calls were enrolled. Out of the 97 patients, 92 patients were called by autonomous call, with 82 completed calls. 10 patients did not complete the calls and 5 patients who did not pick up were considered withdrawn from the study. 82 patients were called by autonomous call and 45 patients were failed by AI telemedicine (as significant symptoms were identified). In a real-world AI telemedicine pathway, the 10 patients who did not complete the calls would be booked for nurse call-back (these patients are costed for nurse call back in the analysis).

The software automatically recorded the autonomous call and the supervising clinicians' decisions for data collection. Clinical follow-up data was collected by the supervising clinicians through review of each hospital's electronic health record.

The model considered the annual cost of a Band 7 nurse for the nurse lead post-operative follow-up and the cost of all the various clinicians attending the patient F2F listed in table 1 and table 2.

From the real-world data provided by Ufonia, an early stage analysis was performed for ICH for the direct face to face follow-up cost associated with standard pathway when compared with the alternative pathway when follow up by autonomous call.

ICH Trust routine follow up pathway

Patients are routinely seen F2F in a post-op dedicated clinic. Clinic is led by a consultant nurse, and is staffed by ophthalmologists and specialist nurses.

Results

The early economic analysis concluded there was an average staff cost saving of £35.18 per patient with the autonomous call in the post operative pathway when compared to the F2F follow up pathway in the standard care(costs of AI telemedicine for call delivery was not accounted)

The value of the autonomous call implementation was avoiding the F2F clinicians' appointment time for non-complicated cases. In real-world operation, these patients would not be seen for an in-person follow-up assessment or for further clinical review, significantly reducing clinical follow-up workload and costs of service delivery.

An early economic analysis was conducted to assess the possible cost saving of implementing the AI automated call solution when compared to the routine F2F follow-up for post operative calls booked at ICH.

Assumptions of the analysis included the annual costs for various healthcare professionals and the length of F2F follow-up appointments (estimated at 30 minutes).

The base case results with the provided real world data modelled suggested that based on the parameters in table 1, table 2, there is a cost saving in the cataract patient post operative follow up pathway with AI based telemedicine at the ICH.

Table 1: Cost for standard care follow up calls

Costs for standard care follow up calls at ICH	Number of Patients	Cost
Nurse Consultant (Bands 8a-c Nurse consultant- Average)	35	£1,452.50
Associate Consultant	32	£1,920.00
Fellow	12	£312.00
Consultant Ophthalmologist	11	£671.00
Registrar	3	£75.66
Optometrists (All)	4	£124.00
Total cost of Current Pathway (A)		£4,555.16
Average staff cost per patient		£46.96

Table 2: Cost for AI based telemedicine follow up calls

Costs for AI based telemedicine follow up calls at ICH	Number of Patients	Cost
Nurse Consultant (Bands 8a-c Nurse consultant- Average)	5	£218.33
Associate Consultant	3	£200.87
Fellow	1	£24.87
Consultant Ophthalmologist	1	£58.35
Registrar	1	£12.43
Optometrists (All)	0	£0.00
A-Total cost of face-to-face follow-up		£514.85
Cost of Telephone follow-up	Time spent on calls	Cost
Nurse - Band 7	10 minutes	£62
B-Total Cost of Telephone follow-up		£569
Total staff cost for autonomous call pathway (A+B)		£1084.21
Average staff cost per patient at ICH		£11.78

Conclusions

This study concludes that there is cost saving when AI based telemedicine is implemented for the post operative cataract surgery follow up pathway when compared to the F2F follow up pathway at ICH in the standard care. These findings have implications for AI based telemedicine adoption within cataract surgery and more broadly for future applications of AI-enabled telemedicine in healthcare.

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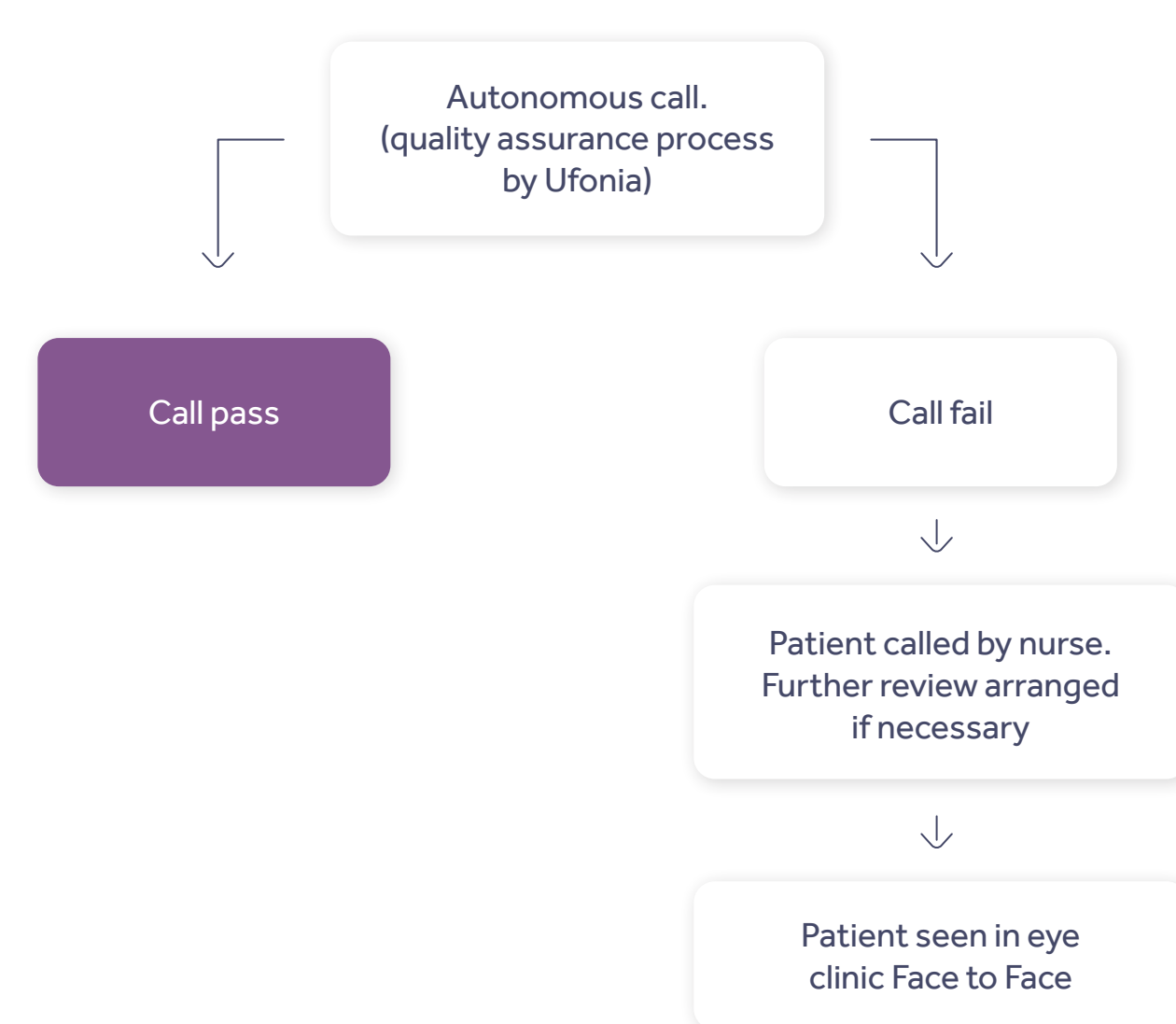Email: mamta.bajre@healthinnovationoxford.org
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References

1. Oliver D, Foot C, Humphries R. Making our health and care systems fit for an ageing population. In: The King's Fund: Ideas that change health care. London: The King's Fund; 2014. 2. Illman J. Exclusive: NHS prepares to cancel elective ops in readiness for covid-19 surge Internet. Health Service Journal 3. Donachie PHJ & Sparrow JM. National Ophthalmology Database Audit. Year 3 Annual Report – The Second Prospective Report of the National Ophthalmology Database Audit. Healthcare Quality Improvement Partnership 2018. 4. Birmingham CCG [https://www.birminghamandsolihullccg.nhs.uk/your-health/treatment-policies/cataracts] Accessed 15 Oct 2020.] 5. Cataract and surgery for cataract. Allen, D., et al 2006. British Medical Journal. 333(7559): 128–132. https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC1502210/ 6. Author A. Managing an outbreak of postoperative endophthalmitis. United Kingdom: The Royal College of Opthalmologists]. https://www.researchprotocols.org/2021/7/e27227 7. Machado, T. M. D., Santana, R. F., Vaqueiro, R. D., Santos, C. T. B., & Alfradique de Souza, P. (2019). Telephone follow-up of the elderly after cataract surgery. British Journal of Visual Impairment, 38(2), 184–195. https://doi.org/10.1177/0264619619874825] 8. Jones, D. T., Yoon, M. J., & Licameli, G. (2007). Effectiveness of Postoperative Follow-up Telephone Interviews for Patients Who Underwent Adenotonsillectomy. Archives of Otolaryngology–Head & Neck Surgery, 133(11), 1091. 9. Milne-Ives M, de Cock C, Lim E, Shehadeh MH, de Pennington N, Mole G, Normando E, Meinert E. The Effectiveness of Artificial Intelligence Conversational Agents in Health Care: Systematic Review.J Med Internet Res 2020;22(10): e20346] 10. Ebony Lewis, Sarah Samperi, Christopher Boyd-Skinner, Telephone follow-up calls for older patients after hospital discharge, Age and Ageing, Volume 46, Issue 4, July 2017, Pages S44–S46, https://doi.org/10.1093/ageing/afw251 11. Bian Y, Xiang Y, Tong B, Feng B, Weng X. Artificial Intelligence–Assisted System in Postoperative Follow-up of Orthopedic Patients: Exploratory Quantitative and Qualitative Study. Journal of medical Internet research 2020;22:e16896. 12. Jones, K. & Burns, A. (2021) Unit Costs of Health and Social Care 2021, Personal Social Services Research Unit, University of Kent, Canterbury. DOI: 13. Khavandi S, Lim E, Mole G. 110 Patient acceptability of telephone follow up after cataract surgery BMJ Leader 2020;4: A41-A42. 14. Milne-Ives M, de Cock C, Lim E, Shehadeh MH, de Pennington N, Mole G, Normando E, Meinert E. The Effectiveness of Artificial Intelligence Conversational Agents in Health Care: Systematic Review.J Med Internet Res 2020;22(10): e20346