Case Report: Designing an AI Agent to Enhance Patient Education and Administrative Support within an NHS Hospital Healthcare setting

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Abstract. Artificial Intelligence (AI) has the potential to revolutionise healthcare by improving patient engagement, streamlining administrative workflows, and alleviating both the patient experience and reducing the burden on healthcare staff. However, designing an AI system that addresses both patient education and administrative support while navigating real-world constraints faced by the National Health Service (NHS) requires a careful balance of innovation, practicality, and human-centred design. This case study examines the design and deployment of OcciAI, a conversational AI agent (Chatbot) at Chelsea and Westminster Hospital NHS Foundation Trust in London (England) that integrates personalised patient education with administrative assistance through patient questionnaires into a single, user-friendly system. The study illustrates opportunities for stronger collaboration between academia and the Healthcare industry, emphasising the benefits of bridging research and practice in Interaction Design to enhance UX (User Experience) and accessibility.

Keywords: Interaction design, Artificial intelligence, Chatbot, UX

1   Introduction

The first outpatient appointment is an important milestone that facilitates the journey to secondary care and managing complicated health conditions, acting as a gateway into diagnostics, treatment pathways, and care management [14]. National data has shown that the average Did Not Attend (DNA) rate for first outpatient appointments has been 8.7%, which costs the NHS (National Health Service) England approximately £1 billion. This creates a significant financial burden for a healthcare system already under strain [6]. Reducing the number of patients who do not attend new outpatient appointments is critical to improving health outcomes. This will allow patients to receive an earlier diagnosis and access specialist expertise and treatments [12, 14].

In recent years, as technology advances, Artificial Intelligence (AI) has become increasingly prevalent [15]. Conversational agents (AI Chatbots) allow users to communicate with computers using natural language processing (NLP) [7]. AI chatbots can mimic human conversations, allowing them to automate services and reduce effort. This makes them increasingly popular in a variety of fields, including healthcare [13].

OcciAI is an AI-driven patient information portal designed by two consultant ophthalmologists to simplify the outpatient appointment process and provide patients with greater understanding before their appointment. Patients access the portal to receive personalised, AI-generated videos explaining their condition and treatment options, available in multiple languages. An integrated AI chatbot addresses further questions, and additional information is summarised and uploaded to the patient's electronic health record. OcciAI aims to reduce inefficiencies in outpatient care, improve surgery conversion rates, and address healthcare inequalities by offering multilingual support, ultimately leading to better patient outcomes and efficient usage of clinician time.

It should be noted, however, that interaction design is a complex discipline, and challenges arise regarding implementation in the real world. The fundamental challenge to overcome is the disparity of perspectives among academics, healthcare professionals, User Experience (UX) designers, and patients [3]. Despite the various design approaches that have been proposed over the years, researchers and practitioners are often viewed as separate islands, and better Industry-Academia collaboration is needed [9].

This case study examines the design and deployment of OcciAI at Chelsea and Westminster Hospital NHS Foundation Trust (London, United Kingdom). It explores how it could be applied in the NHS context, addressing its specific challenges, such as resource constraints, diverse patient populations, and complex organisational structures. It emphasises the benefits of bridging research and practice in Interaction Design to enhance UX (User Experience) and accessibility.

2   Background: Addressing Dual Pain Points

In healthcare systems worldwide, including the NHS (National Health Service), patients encounter two primary challenges:

2.1. Educational Gaps

Alignment between patients' and clinicians' perspectives on health status is not always possible [8]. Due to limited consultation time and inaccessible information, patients often struggle to understand medical terminology, treatment options, and pre-/post-operative instructions. Consequently, clinicians and researchers cannot assess the outcomes of patients affected by these barriers comprehensively or reliably, which may adversely affect their health [8]. This can lead to confusion, poor adherence to treatment plans, and increased non-attendance, resulting in the demand for follow-up care.

2.2   Administrative Overload

Informatics has been identified as an essential component of Medicine, contributing to transforming healthcare systems. However, that causes a high workload for medical staff [2]. Routine administrative processes, including collecting routine patient information, strain healthcare staff and patients. Long waiting times, unclear processes, limited capacity, and limited staff availability exacerbate these issues, particularly in under-resourced healthcare settings [1].

OcciAI was designed to tackle these dual pain points by offering a unified solution that empowers patients to understand their healthcare journey while streamlining the collection of routine patient information.

3   Design Approach

The literature recognises the challenges in designing healthcare solutions that should be addressed to make new technology usable and acceptable. In the context of user-centred design in the NHS (National Health Service), the challenges come up at different stages, including the approval process of ethics, user recruitment and stakeholder involvement, eliciting needs from users associated with sensitive and personal issues, and bringing together different disciplines [11]. In order to ensure effective participation of users and stakeholders, the time, logistics, and financial implications must be carefully planned at the beginning of a project [11].

The development of OcciAI followed an iterative, user-centered methodology that emphasized accessibility, empathy, and scalability.

3.1. Research and Ideation

The design process began with extensive research to understand the needs of patients and healthcare providers:

• Discussion with NHS Stakeholders: Met with NHS clinical and administrative staff to understand common frustrations with a patient group meeting arranged in early 2025. Key insights included the need for optimising patient education and collecting routine patient information, with a system capable of supporting non-native speakers.

• Journey Mapping: Mapped the NHS patient journey, from the point of referral (optometrist, general practitioner) through to the pre-operative appointment, identifying critical touchpoints where OcciAI could provide meaningful assistance.

3.2. Interaction Design and Prototyping

OcciAI was designed as an integrated conversational AI system capable of handling both educational and administrative tasks. Key features included:

• Personalized Education: OcciAI provides patients with educational AI driven videos based on their reason for referral. The video content is easily customisable to the hospital and available in multiple languages to promote equality and diversity within the NHS.

• Conversational Interface: OcciAI's natural language processing (NLP) capabilities enabled intuitive, conversational interactions. Patients could ask, "What is a cataract?" or "What will happen during surgery?" in a language of their choice and receive clear, actionable responses in the same language.

• Multi-Modal Interaction: Occiai provides both text and visual interactions to accommodate patients with different communication preferences or accessibility needs. An inclusive usability testing, in which the participants have special access needs, such as voice interaction, is being planned for late 2025 based on feedback from discussions conducted so far. For example, visual aids and multilingual support were particularly useful for non-native speakers and patients with low literacy levels. Following the initial deployment of the pilot, OcciAI will also aim to enhance accessibility for people with disabilities in accordance with the Web Content Accessibility Guidelines.

3.3 Usability Testing and Iteration

OcciAI is in the process of arranging a pilot study within the surgical suite of Chelsea and Westminster Hospital (London, United Kingdom) to begin in early 2025 with the aim of:

• User Testing with NHS Patients: Obtain patient feedback to optimise the software design to ensure it is simple to use and enhance the AI response output.

• Multiple specialties: The surgical suite caters for 8 different specialties and the pilot would aim to be used across 3 specialties: ophthalmology, gynaecology and trauma and orthopaedics. Targeting multiple specialties will establish whether the theoretical benefits of occiAI within an NHS setting are present across multiple patient demographics and across different conditions.

4   Application in the NHS: Challenges and Opportunities

Applying OcciAI in the NHS requires addressing unique constraints and challenges while leveraging opportunities for impact:

4.1. Challenges in the NHS Context

• Resource Constraints: NHS resources are often stretched, with staff shortages and limited funding for new technologies [16]. OcciAI addresses this by reducing staff administrative workload, freeing up time for patient care.

• Integration with Existing Systems: In the digital era of the NHS, digital health records permit the whole record (or relevant information from it) to be shared quickly, securely, and in a standard way between health professionals to support patient care, achieving 'integrated' electronic health records, such as GP (General Practitioner) records or the NHS app [5]. OcciAI was designed to integrate seamlessly with these platforms, ensuring interoperability and minimizing disruption to existing workflows.

• Digital Literacy and Inclusivity: A significant proportion of NHS patients may have limited digital literacy or lack access to technology. Thus, in the design of any service, it is essential to consider digital inclusivity, ensuring no one is left behind [4]. OcciAI's multi-modal design, including planned voice interactions and offline functionality, ensures inclusivity for these populations.

• Trust and Data Security: Patients and NHS staff must trust OcciAI to handle sensitive medical and financial data. Robust encryption, compliance with GDPR (General Data Protection Regulation), and transparent privacy policies were built into OcciAI's design to address these concerns.

• Sustainability and ethical considerations: AI systems can be highly energy and water intensive, particularly during training and continuous use. As part of the NHS's commitment to net-zero emissions, this project prioritizes energy efficiency with lightweight, fine-tuned models hosted on green infrastructure. It is designed to minimize computational waste, with periodic efficiency reviews and lifecycle assessments.

4.2. Challenges in the design process

 Applying recommended interaction design methods and processes in an NHS context presented unique challenges and opportunities.

• The NHS prioritizes patient safety, data privacy (e.g., GDPR compliance), and equitable access, which may limit the flexibility to iterate quickly or adopt experimental design approaches common in commercial tech development. We therefore outsourced this aspect of the work to a company with long-standing experience in governance and compliance within the healthcare setting to ensure we could iterate our product at pace and in accordance with all necessary regulations.

• Additionally, the variability in user demographics—spanning diverse age groups, digital literacy levels, and cultural backgrounds—creates complexities in designing intuitive and universally accessible interactions. We presented at the Hospital's Quality, Equality and Health Inequality Impact meeting in December and were given approval to progress to the next stages of implementing OcciAI within the Trust. We also undertook a patient participation group in January 2025 of 10-15 patients of different ages, sex and ethnic backgrounds. All patients saw the huge potential in the platform to support patient engagement and improve the clinical pathway.

These challenges highlight opportunities to bridge the gap between interaction design theory and real-world practice. The NHS's focus on evidence-based practices can be leveraged to validate AI-driven solutions through participatory design and co-creation with clinicians and patients. By involving stakeholders early, designers can better align AI systems with clinical workflows, improving adoption and utility. Furthermore, the AI video avatars can address communication barriers by personalizing interactions, offering multilingual support, and simplifying complex medical information.

4.3. Opportunities for Impact

• Reducing Waiting Times: By providing patients with information prior to their appointment, this ensures that patients understand the important of attending their appointment and also allows patients to decline referral if they do not wish to proceed with treatment. This will help to reduce non-attendance and enhance clinic efficiency.

• Improving Health Literacy: By simplifying complex medical information, OcciAI empowers patients to take a more active role in managing their health, reducing the need for repeat consultations. With OcciAI, complex medical terminology is translated into clear, accessible language that is tailored to the level of literacy of the individual. With the chatbot, patients can make informed decisions about their treatment and recovery by interacting with a conversational, on-demand explanation of diagnoses, medications, procedures, and aftercare instructions. By improving comprehension, patients

are able to gain greater confidence, adhere to care plans, and are less likely to rely on clinicians for repetitive clarifications.

• Supporting Underserved Communities: OcciAI's multilingual support and inclusive design make it particularly beneficial for underserved and diverse populations within the NHS. OcciAI is designed with inclusivity in mind, providing multilingual support and culturally sensitive communication so that the diverse patient populations within the National Health Service may be better served. Using an AI agent, individuals from marginalised or underserved communities - including non-native English speakers, recent migrants, and those without access to traditional health education resources - receive accurate, empathetic health information that is easily understood. Ultimately, this will result in greater equity in care, more confident engagement of patients with healthcare services, and a reduction in disparities in access to healthcare, quality of care, and satisfaction with care. The accessibility and responsiveness of OcciAI support the NHS' commitment to delivering inclusive, patient-centered care.

4.3 Outcomes and Reflections

Key Successes

• Empowered Patients: OcciAI aims to enhance health literacy and administrative confidence.

• Streamlined Operations: By automating routine queries, OcciAI aims to reduce administrative workloads, freeing up NHS staff for more complex tasks.

• Enhanced Accessibility: The system demonstrates strong usability across diverse NHS patient groups, including older adults, non-native speakers, and individuals with disabilities. The OcciAI system is designed for ease of use and accessibility, so that patients of all ages, languages, abilities, and abilities can interact effectively with it. To support older adults less comfortable with digital technologies, the chatbot offers simplified navigation, a clear visual design, and voice interaction. With the system, non-native English speakers can communicate in plain language and avoid miscommunications. In addition, OcciAI aims to adhere to accessibility standards such as WCAG, providing features like alternative text font, and adjustable text sizes. A broad range of accessibility needs is addressed by OcciAI, ensuring that all patients have equal access to health care.

Challenges and Solutions

• Scalability: Rolling out OcciAI across NHS Trusts required balancing customization with scalability and adapting to different systems in place at different Trusts

• Complex Queries: For unresolved issues, OcciAI provides seamless escalation protocols to human staff, maintaining patient satisfaction and trust.

5   Broader Implications for Interaction Design

OcciAI offers valuable insights for Interaction Design in complex, resource-constrained environments like the NHS:

 1. Human-Centered Design in Public Systems: Designing for public healthcare systems requires balancing user needs with operational constraints, such as scalability and resource limitations. Human-centered design principles ensure that OcciAI's technology meets the needs of diverse users with different levels of health literacy, clinical staff under pressure, and administrative teams managing high workloads, while being intuitive, empathic, and responsive. In addition to budget constraints, infrastructure variability, and interoperability requirements, the system is built with operational realities in mind. This solution is designed to be scalable, easy to deploy, and maintainable to ensure widespread adoption across NHS sites. Using user feedback, iterative testing, and co-design with NHS stakeholders, OcciAI aligns digital innovation with public health's values of accessibility, equity, and sustainability.

2. Empathy at Scale: OcciAI's conversational tone and multi-modal design illustrate how AI systems can deliver empathetic, patient-centered experiences at scale.

3. Collaborative Innovation: The success of OcciAI underscores the importance of partnerships between academia and industry in addressing real-world challenges through design.

6   Conclusion

OcciAI demonstrates the transformative potential of AI in healthcare, particularly within complex systems like the NHS. By integrating patient education and administrative support into a single, unified system, OcciAI empowers patients, reduces staff workload, and enhances the overall healthcare experience.

  The collaborative partnership between academia and industry will be instrumental in OcciAI's success, blending user-centered design principles with practical insights to create an innovative and scalable solution. In the NHS context, OcciAI's potential to reduce waiting times, improve health literacy, and support underserved communities offers a roadmap for the future of AI-driven healthcare.

  As the NHS continues to face growing demand and resource constraints, OcciAI represents a critical step forward in delivering equitable, efficient, and patient-centered care.

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