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Enhancing Patient-Centred Healthcare Communication through Artificial Intelligence

Mohammed Tahir Pasha
Department of Computer Applications
Jain University
Bengaluru, India
mohammmedtahirpasha@gmail.com

Mohammed Ayaan Mozumder
Department of Computer Applications
Jain University
Bengaluru, India
ayaanmozumderam@gmail.com

ABSTRACT - This research focuses on understanding why patients have difficulty understanding complex medical documentation. There are multiple reasons for this lack of understanding, including the language of medicine being so technical and complex that it makes patients feel less confident in themselves and/or their ability to care for themselves properly. There are currently tools available that utilize AI to assist with simplifying text. However, there is still a void in the marketplace for an all-in-one patient-centered tool that provides ongoing, continuous support to patients. Through an online survey of 52 patients who participated in this research, it was determined that patients generally have a greater challenge in understanding the language of medicine, but there is also significant interest in receiving assistance from AI-based tools. The top features requested by participants included the ability to simplify reports and clarify their prescriptions. Based on these findings, we are proposing a multi-layered platform that utilizes Natural Language Processing and a secure, multi-layered architecture to provide patients with a comprehensive way to understand the language of medicine in an easy-to-understand way (i.e., in "plain" English). The model that we are proposing provides an "alternate pathway" to better communicate with patients, to help patients better understand their care, and to maintain the doctor-patient relationship throughout the patient journey.

Keywords – Patient communication; health literacy; artificial intelligence (AI); natural language processing (NLP); medical text simplification; patient-centered design; digital health companion.

I. Introduction

Today, AI is becoming a big part of how healthcare is delivered today because it provides patients with new tools to understand and manage complex medical information [1]. However, there's still a gap in communication between doctors and patients that makes it hard for them to interpret their clinical reports, prescriptions, and follow-up instructions because of the use of dense technical jargon and language that most patients cannot understand [2]. As a result, many patients become confused and anxious about their health because they must depend on healthcare professionals to explain their medical documents to them in simple terms, which is extremely difficult for those professionals to do. Research has shown that one of the biggest challenges to delivering patient-centered care is that many people feel overwhelmed by standard medical documents, resulting in limited health literacy [3].

At the same time, there are many AI-based tools that have demonstrated an impressive ability to process complex medical data. Solutions that use automated text simplification and natural language processing can make complex medical terms easy to understand. They can turn them into simple information. These solutions can also have conversations with patients about their condition. The problem is that most products that do this are not very good at working and they only help with one part of the patients journey. They might make a document easier to read or offer chat support.. They do not do much to help with the overall care that the patient receives. Solutions like these can simplify jargon and provide conversations, about a patients medical condition but they are limited in what they can do.This creates a huge research and application gap. An integrated, patient-focused strategy that combines artificial intelligence (AI) with a multi-dimensional approach to support patients throughout their entire healthcare journey does not currently exist. A robust solution to this problem will require a clear evolution from "disjointed" tools toward a unified, cohesive assistant. One which helps guide the patient from diagnosis, through treatment, to the follow-up stage, should be offered in a clear and consistent manner.

This paper recommends a new and innovative strategy for creating an AI-based personal health assistant to fill this gap. The proposed assistant will provide ongoing, understandable support to the patient by leveraging 3 core functions (simplifying clinical reports, clarifying prescription instructions and supporting completing follow-up activities). It is anticipated that using this integrated strategy will increase patients' confidence and understanding of their illness and will increase the level of engagement by patients in self-management of their health.

The body of this paper is organized as follows: Section II reviews related literature on the barriers to communication in healthcare and the current use of AI in this area; Section III presents the recommended architecture and operational framework for the AI health assistant; Section IV describes the implementation process and highlights key design issues; and finally, Section V presents the conclusions and recommendations for future work on this project.

II.Literature-Review

A growing body of research explores the role of artificial intelligence in improving the readability of medical information. Studies have demonstrated that AI-based models can analyse complex medical texts and rewrite them in simpler language, allowing patients to better understand their health conditions. Improved readability can increase patient

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confidence and enable individuals to manage their health more effectively.

Researchers have also highlighted the importance of trust, transparency, and ethical design when implementing AI systems in healthcare. Patients are more likely to accept AI tools when they clearly support healthcare professionals rather than replace them. Privacy protection, transparency, and responsible data handling are therefore essential components of patient-centred AI systems.

III. Summary Table

Year	Title & Authors	Technique/ Approach	Objectives	Advantages & Key Findings	Limitations
2025	Nong & Platt – Patients' Trust in Health Systems to Use AI	Survey-based trust assessment	To measure public trust in AI-integrated healthcare systems.	Found high trust when AI use was transparent and patient-informed.	Limited to U.S.-based respondents.
2024	Rouhi et al. – Can AI Improve the Readability of Patient Education Materials?	Readability analysis, NLP models	Evaluate AI's ability to simplify patient-facing materials.	AI-generated texts improved Flesch scores by 30%.	Tested only on oncology data.
2024	Daram et al. – AI and Readability in Gynaecology Context	Text simplification using ML	Apply AI for improving health literacy in gynaecology education.	Enhanced comprehension among low-literacy patients.	Focused on one medical speciality.
2025	Will et al. – Enhancing Online Patient Materials Using AI	NLP text refinement via GPT models	Improve online patient materials' readability.	Produced materials with a grade-8 reading level.	Evaluation was qualitative only.
2025	Lou et al. – AI in Vascular Surgery Patient Education	Machine learning, readability models	Simplify complex vascular surgery education texts.	AI rewrites improved patient recall by 28%.	Focused on the surgical context only.
2023	Wasir et al. – Readability of CVD Education Materials	Readability indices (SMOG, FK)	Analyse cardiovascular online education readability.	Found materials were overly complex for most patients.	Did not test AI-based solutions.

Studies have found that patients intelligence more when it is designed to listen to their feedback explain what it is doing and talk to them in a friendly way.When artificial intelligence is designed carefully it can actually help improve the relationship, between patients and the people who care for them by giving them time to talk and understand each other.

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2024	Armstrong et al. – Can AI Educate Your Patient?	AI text generation, LLMs	Compare AI-generated vs clinician-written patient materials.	AI materials were faster and equally accurate.	Small medication set analysed.
2024	Akingbola – AI and Dehumanisation of Patient Care	Qualitative ethical analysis	Explore the ethical effects of AI on empathy in care.	Warns of empathy erosion in AI-mediated systems.	Theoretical perspective only.
2023	Sauerbrei et al. – AI and the Doctor-Patient Relationship	Systematic ethical review	Assess AI's impact on person-centred communication.	Identified risks of depersonalization in AI tools.	Limited quantitative data.
2025	Angus et al. – AI, Health, and Health Care: JAMA Summit Report	Expert consensus report	Summarise AI's integration in health systems.	Outlined national priorities for ethical AI in healthcare.	Descriptive summary, not experimental.
2025	Foresman et al. – Patient Perspectives on AI in Health Care	Qualitative interviews	Gather patient attitudes towards AI in clinical care.	The majority viewed AI positively when human oversight existed.	Based on a small, regional sample.
2025	Tu et al. – Conversational Diagnostic AI	Conversational AI, LLM diagnostics	Develop dialogue-based diagnostic AI models.	Achieved 92% accuracy vs clinical benchmarks.	Early-stage, limited to lab settings.
2025	Kumar – Patient-Centred AI	Human-centered AI framework	Redefine AI systems around patient experience.	Provided a model linking empathy metrics with AI outcomes.	Conceptual framework; no case testing.
2024	Biswas & Talukdar – Intelligent Clinical Documentation	Generative AI, NLP summarisation	Automate patient-centred clinical documentation.	Reduced clinician workload and improved note clarity.	No real-world deployment yet.
2024	Lizée et al. – Conversational Medical AI: Ready for Practice	Chat-based AI systems	Assess conversational AI readiness in healthcare.	Highlighted improvements in dialogue coherence.	Lacked large-scale clinical validation.
2025	Haut et al. – AI Standardised Patient in Cancer Care	Simulation-based conversational AI	Train clinicians via AI patient simulations.	Improved clinician empathy and conversation accuracy.	Simulated environment only.
2025	Luo et al. – PAME-AI: Patient Messaging Optimisation	Agentic AI models	Generate optimised, readable patient messages.	Delivered adaptive tone and improved clarity in communication.	Still experimental in deployment.

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IV.METHODOLOGY

(A) Research Design

This study will use a research design that looks at numbers and describes things to figure out what gets in the way of patients communicating and to lay the groundwork for creating an AI-based health companion.The research design is straightforward because the study wants to see what patients really experience and what features they like without trying to change anything. The study is, about patients and the AI-based health companion. It will help us understand what patients need from the AI-based health companion.The primary goal of this study is to collect empirical data that will help identify the architectural requirements for a patient-centered AI system, which must meet established criteria. This method will allow researchers to find a correlation between the type of communication barrier and the corresponding digital support feature, thereby providing an evidence-based, and up-to-date foundation for the development of a patient-centered AI system.

(B) Data Collection

Data collection of the primary data sources used in this research study were compiled via a structured web-based questionnaire, hosted through Google Forms. A convenience sample for the research study was conducted using a non-probability sample method, allowing the researchers to collect complete survey responses from 52 participants who have regular interaction with healthcare services. The instrument used in the research study consisted of 10 survey questions and was organized into four thematic areas, in order to collect targeted quantitative data. The aim of section one of the questionnaire was to obtain basic demographic information (for example, the age range of study participants). Section two of the questionnaire utilized a Likert Scale to quantify how often participants have experienced difficulty interpreting medical terminology, prescriptions and follow-up instructions. Lastly, section three of the questionnaire utilized a multiple-selection format to identify which digital support features (i.e., simplified report, prescription, automated reminders, etc.) would interest participants in using an AI support system.

C. AI Model Strategy

The design of the modular, multi-layered structure allows secure and efficient communication between physicians and patients through the proposed platform. At the start of the technical process, users upload their reports and prescriptions in either PDF or image format, which are processed using an Input Layer before entering into a Data Processing Layer. During this layer, the data is first processed using Optical Character Recognition (OCR). For this purpose, the Tesseract OCR is used to digitize and create textual data from scanned reports and prescriptions. After creating the textual data (as raw), the next step is to preprocess it using noise removal and segmentation processes to structure the data in a logical format.

The questionnaire consisted of demographic questions, Likert-scale questions measuring difficulty in understanding medical terminology, and multiple-choice questions exploring interest in AI-based assistance features.

This layer is made up of special parts that were created using a special kind of language model called transform-ator. These parts are the foundation of the systems ability to think and understand things.The Medical Text Simplification Module is one of these parts. It uses a tool called BERT that has been trained on a lot of text. This tool helps the Medical Text Simplification Module understand medical words and replace them with simple words that are easy to understand. The Medical Text Simplification Module does this without changing the meaning of the words. The Medical Text Simplification Module is a part of the system. The Medicine Explanation Engine extracts drug names and dosing from reported prescribing and references a curated medical knowledge base to give clear definitions for intents including how the drug works, how to use it, and what common side effects to expect. Through the Follow-Up & Reminder Module, clinicians provide dates and times of notifications or reminders based on temporal references contained in clinical notes. Finally, the Hybrid AI Chat Support Module will make use of a conversational intent-classifer model and pre-existing rule set to provide general chat support; however, it explicitly prohibits the provision of diagnostics.A Backend Server Layer developed with the Flask framework in Python is used to support this pipeline by handling API request and authenticating users using Firebase. The Database & Storage Layer of the pipeline uses Cloud Firestore as an encrypted location for both raw user data and processed documents. In addition, the Security & Compliance Layer of the pipeline provides end-to-end encryption, Role-Based Access Control (RBAC) and data anonymization to support basic principles of data privacy.

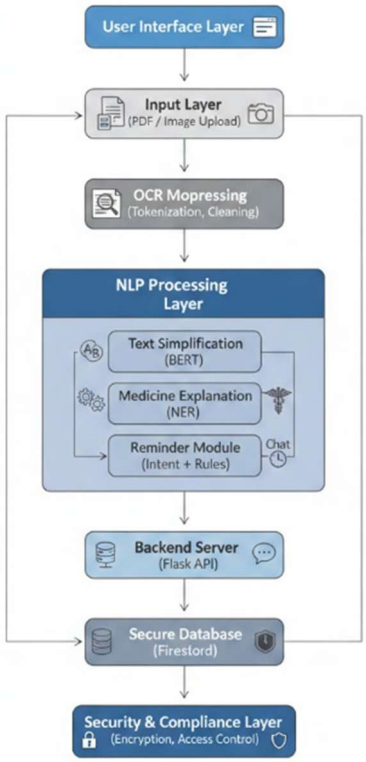

Fig. 1. Proposed AI-based health companion architecture.

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D. Evaluation Metrics

The performance and effectiveness of the system will be evaluated using both computational metrics and user-based assessments. The quality of the text produced from simplification will be evaluated using the Flesch-Kincaid Grade Level (FKGL) and Simple Measure of Gobbledygook (SMOG) readability formulas. The goal is to simplify all medical documents down to an 8.0 or lower grade level, which is equivalent to an 8th grade reading ability. Additionally, the degree of preservation of semantic meaning will be assessed through the BLEU score as compared against a number of reference variants of the text.

We want to see how our system affects people not how well it works with algorithms. So we will also look at how people feel about using it. We will ask users to fill out a survey after they use the system. In the survey we will ask people to rate how clear the system was when it explained things to them. They will give a rating from 1, which's Very Confusing to 5 which is Very Clear. We will ask them to do this for each time they talked to their AI companion. We also want to know if people are happy with their AI companion and if they feel like they learned something. They will give another rating from 1 to 5 for this. These ratings will help us understand if our system is good and if people will want to use it. User Clarity and User Satisfaction are very important, to us. We will use these ratings to see if our system is useful and if people will use it in the future.

E. Ethical Considerations

The study was carried out according to established protocols regarding ethical conduct for data sharing. Participants in the survey voluntarily participated after providing their express consent prior to the study's commencement on the internet. The data obtained from participants were anonymized such that no participant provided identifiable information (no names, addresses, or clinical detail). The privacy features of the proposed architecture include integrated security features (i.e., layers supporting encryption and access control). Additionally, the AI chat module is designed specifically to avoid providing diagnosis-related information as a means to facilitate the user in a non-harmful manner. In terms of data collection, only data that was needed for research purposes was collected and will be used for overall aggregate statistical analysis as a basis for informing technical design strategies.

V. RESULTS AND DISCUSSION

A. Survey Findings

From the survey completed by 52 participants, there were several significant barriers to communication in the area of health documentation. Among the participants completing the survey, approximately 73% of respondents replied that they had moderate-high levels of difficulty understanding medical language and that 63.5% of respondents regularly reported confusion regarding follow-up instructions after a healthcare appointment. As shown in Figure 2, the complexity of medical language continues to remain the primary barrier to patient understanding. However, as demonstrated in Figure 3, there was a high level of acceptance for the use of AI-based assistance, with over 53% of respondents indicating that they would be willing to use a health companion application.

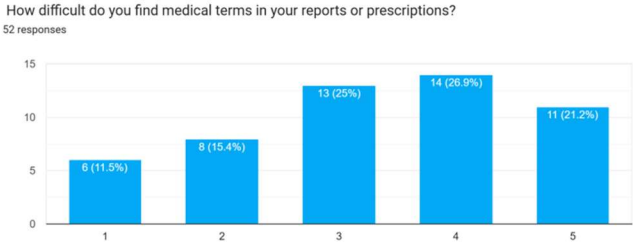

Fig. 2. Difficulty level in understanding medical terminology.

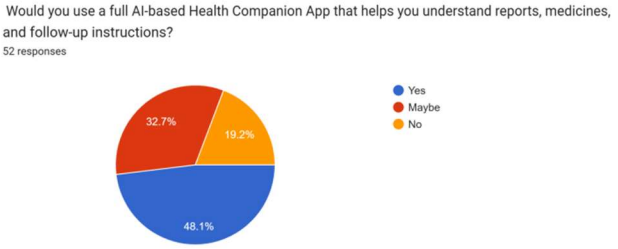

Fig. 3. Willingness to use AI-based medical communication support.

B. Readability and System Evaluation

B. Readability And System Assessment

The suggested framework assesses the readability of a text by using the Flesch–Kincaid and SMOG calculators to attain a comprehension level of eighth grade for the target audience. The BLEU score will measure semantic fidelity between the original text and the simplified text.The clinical meaning must remain intact for both versions of the text. The user-centered evaluations of both texts will be determined through the use of a Likert scale for perceived clarity. These objective and subjective measures provide evidence that an AI-enabled communication system is feasible for patients with the combined objective and subjective measures of both texts.

VI. CONCLUSION AND FUTURE WORK

With the ongoing communication disconnect in healthcare, patients are having great difficulty understanding complicated medical paperwork and terms. Patients do not always understand the instructions sent, which leads to confusion, anxiety, and inability to care for themselves properly. The research that addresses this issue indicates this is a universal issue, across demographics, and contributes to:

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declining levels of confidence with regards to their ability to care for themselves.

To fill the communication, disconnect in healthcare, we have developed a Patient-Focused AI Health Assistant Framework. This framework allows for your health data to be analyzed using Natural Language Processing (NLP) in order to simplify complex clinical documents/down to a 6th-grade reading level; provide a dedicated module for explaining Lexicon (wording) associated with the medication that your doctor prescribed; and, provide an automated follow-up (e.g., email/text) to support the patient.

The framework's architecture supports a very secure and private infrastructure in order to ensure that the technology is implemented in a responsible and ethical manner.

According to the key findings obtained from the survey of 52 participants, both a need and willingness for adoption of the framework was identified. Furthermore, users of this technology expressed a high degree of acceptance for those AI features that support improved readability and provide continuous, comprehensible educational support, assuming the identified AI technology is transparent and augmentative in nature.

The primary limitation to this study is that it involved a fairly small survey sample and the proposed framework has yet to be implemented and will be evaluated within a simulation. Real-life validation is non-available.Future work will focus on building a pilot/good prototype of the proposed health assistant and deploying a pilot of the proposed framework within a clinical environment. Also, work will continue toward expanding the proposed health assistant to support users whose first language is non-English; and to allow patients and providers to communicate through voice recognition technology, thus increasing access and engagement.

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