

Empower AI: Harnessing AI to Educate and Empower Patients After Hospital Discharge

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Problem Statement

- The days after hospital discharge is a vulnerable period for patients and families, particularly those who are underserved. They feel unsupported and overwhelmed as they transition from hospital to home. Patients often struggle to understand medical instructions, medications, and follow-up care, leading to errors, complications, and poor patient experience.
- Patient recollection of their care instructions after leaving hospital is poor with only 58.5% of patients correctly recalling their diagnoses and 50.9% correctly recalling post-discharge treatment plans. Lower health literacy is associated with higher risk for hospital readmission while patient empowerment is a key factor in reducing hospital readmissions.

Proposed Solution

- Promote health by delivering AI powered patient centric education that will provide personalized content based on the patient's diagnosis, treatment plan, discharge instructions, and health history and deliver content in various formats (text, video, audio) to ensure it caters to different learning preferences, languages, literacy levels, and cultures.
- The objective is to connect with patients and deliver personalized, patient centred education to empower patients and care givers after hospital discharge. An AI-powered solution offers significant potential to improve patient outcomes, reduce healthcare costs, enhance the patient experience while reducing the burden on existing constrained health human resources.

Beneficiaries

- The wide diversity in patient sociodemographic factors, literacy levels, language, and cultural backgrounds creates unique challenges in providing personalized education and instruction to patients. The project will support any patient recently discharged home from hospital after an acute hospitalization independent of age, ethnicity, socioeconomic class, gender or physical limitation.

Our Team

- Unity Health Toronto's DSAA team uses data to improve patient care and hospital operations. Since 2017, DSAA has developed and deployed over 50 AI solutions into clinical practice—the most of any North American hospital. Our co-creation model pairs clinicians with data scientists to ensure solutions like CHARTwatch (early warning system) and volume forecasting are clinically relevant, improving outcomes and reducing costs. Supported by a production-level MLOps environment, DSAA drives scalable, impactful AI adoption. Our leadership is recognized through multiple awards, including 2024 AI Champion for Dr. Muhammad Mamdani and the 2024 Solventum Health Care Innovation Team Award.
- We have ~15 years of historical and current hospital data representing the most culturally diverse patient population in the world and including general internal medicine and emergency department data. Encounters are individual visits by patients. This spans many types of data including labs, vitals, demographics, clinical notes, and imaging/imaging orders. This data captures 10s of millions of encounters, for millions of individual patients, with billions of data elements (e.g., a lab test column in a data base, emergency department triage notes). The data we have access to is refreshed anywhere between real time (seconds) and daily. Our machine learning operations (MLOps) environment is capable of data ingestion, data cleaning and standardization, feeding data into machine learning algorithms, and delivering interpretable findings to patients and clinicians in real-time (seconds) or as needed. We are among a handful of hospitals globally with these AI capabilities. The data are private.

Why AI

- Patients are increasingly embracing technology and are interested in using mobile devices for education and reminders. Generative AI is crucial because it brings scalability, personalization and adaptability to post-discharge patient education. Generative AI can create personalized content in various formats (videos, texts, images) designed to reflect a patient's level of health literacy, education, native language and accessibility barriers.
- Traditional educational resources (printed material, videos) are ineffective as they may not address the unique needs of individual patients, are one-size fits all solutions and require manual updates. Phone calls or in-person interactions are expensive, inflexible, and time-consuming.

Performance Evaluation

- We plan to continuously measure the following metrics:
 - (i) Patient Engagement and Satisfaction [patient interaction rates, session duration, frequency of use, validated patient satisfaction tools]
 - (ii) Accuracy and reliability of medical information [medical expert reviews via our team of medical experts]
 - (iii) Patient Health Outcomes [re-admission rates, emergency room visits, healthcare costs] Our team includes data scientists and epidemiologists
 - (iv) Costs - Operational costs per patient, number of patients served per month
- Success and failure will be predominately driven by patient engagement and satisfaction. Our primary goal is to engage patients and empower them.

Outcomes

- We expect to reach 500 patients and/or caregivers within the first 12-18 months. We anticipate a 30% improvement in patient and caregiver satisfaction, a 20% increase in patient engagement rate, a measurable increase in health literacy scores and an increase in patient self reported outcomes.
- We expect to reach 5000 patients within 24-36 months and demonstrate a 25% reduction in emergency room visits, 10% reduction in 30 day hospital re-admissions, 25% reduction in no-shows in follow up appointments, translating to a 20% reduction in healthcare costs.

Technical Risks and Mitigations

- (I) AI Model Accuracy: Given the complexity of medical terminology, the AI may generate incorrect or incomplete information. Mitigation: Develop protocols that require multiple data sets to confirm accuracy, continuously retrain the model using patient feedback, new medical data and have a medical advisory review and approve content.
- (II) Patient Data Privacy & Security. Mitigation: Use strong encryption protocols for data storage and transmission, ensure regulatory compliance, use personal smart devices with robust authentication, conduct periodic security assessments.
- (III) AI Bias: The AI may inadvertently propagate biases (inappropriate educational content to certain ethnicities/demographics). Mitigation: Train on diverse datasets, human oversight.

User interaction

- The proposal is a unidirectional AI solution for educating patients where the flow of communication is only from the AI to the patient. Patients will access the AI solution through a SMS-based system using their own personal smart device. The AI will generate and deliver relevant educational content for the patient, tailored to their discharge diagnosis and condition including information about their condition, care instructions, lifestyle changes (diet, exercise, etc.), warning signs/red flags, and appointment reminders. Content is delivered over a series of days after discharge to prevent overwhelming the patient. The content will be a combination of text, image, video or audio format directed by patient preference. This kind of solution offers value by ensuring patients are well- informed, supported, and reminded about important post-discharge steps while keeping the communication simple, and structured while minimizing risk.
- Future enhancements could enable a bi-directional system.

Potential Scale

- There is a significant care gap after hospital discharge, worsened by the ongoing human resource crisis. Machine learning and LLMs can help close this gap by delivering personalized patient education and tailored communication, supporting multiple languages and accessibility features (e.g., voice commands, text-to-speech, font adjustments). These solutions require no additional health human resources and can be deployed across departments and geographies.
- Scaling the infrastructure will be crucial to support growing user demand and data volumes. Initially, the focus will be on expanding within a single organization by adding new departments (e.g., cardiology, obstetrics). Once proven, scaling to new hospitals will require a standardized implementation process, EHR integration, and strong data security practices.
- Unity Health's DSAA team has a successful pedigree in scaling AI through ventures like Autoscribe by Mutuo Health and Signal 1, demonstrating the ability to bring innovative technologies into real-world clinical practice.

Sector Buy-In

- We have solicited buy-in and support from multiple stakeholders in the healthcare ecosystem; including patients, care-givers, healthcare providers, hospitals and technology partners. We have conducted a comprehensive literature review that demonstrate a growing trend in smart device use among patients, with many preferring these devices for receiving educational content. Data suggest that simple text message reminders help patients adhere to medication schedules, attend follow-up appointments, and engage in self-care practices. We have assembled a world renowned multi-disciplinary clinical advisory team with expertise in post discharge metrics, care-giver advocacy, and AI research scientists. We have surveyed patients who have demonstrated an overwhelming desire and interest in this proposal.

Financial Sustainability

- The DSAA team at Unity Health Toronto is a funded corporate initiative, with ongoing costs supported by the organization's operating budget. If significant demand emerges, the solution could be scaled through corporate partnerships or the creation of a startup, as demonstrated by DSAA's success with Autoscribe and Signal 1.
- The Data Science and Advanced Analytics team at Unity Health Toronto is a corporate initiative with ongoing financial commitment. The team is composed of 30 FTE in technical roles. Should the tool meet or exceed the project's benchmarks, the team will commit its resources to keep the tool in production.