Bridging the Healthcare Knowledge Gap

A Post-Visit Informational Tool

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THE CHALLENGE

Patients frequently leave doctor's visits **confused** about their diagnosis, medications, or **what** they're **supposed to do** next. This is especially true for:
- Older adults
- Non-native English speakers
- Patients with limited health or digital literacy

Short visits, complex medical language, and lack of translated or simplified explanations create a communication gap; one that puts patients at risk of poor outcomes and mismanaged care.

WHY IT MATTERS

According to a 2022 Milken Institute report: **88% of U.S. adults lack proficient health literacy.**
This contributes to:
1. Low medication adherence and care plan confusion
2. Preventable ER visits and hospital readmissions
3. Up to $238 billion in avoidable healthcare costs each year

Patients from underserved communities are especially vulnerable, making this both a health and equity issue.

Our Solution: A Post-Visit Support App
To address this gap, we developed a two-part digital tool designed to improve understanding and support self-management between visits.

OUR SOLUTION

Part 1: Visit Summary Tool
A natural language system powered by large language models (LLMs) that helps patients make sense of their care.
- **Step 1:** Patients input their **diagnoses**, **medications**, and any relevant details from their visit
- **Step 2:** The tool generates a **simplified, structured summary** of:
  - What the condition means
  - How and when to take each medication (including drop colors)
  - What to expect next
- **Step 3:** Technical terms are matched to a built-in glossary for quick, plain-language definitions
- **Step 4:** Prompt engineering ensures summaries are accurate, balanced, and easy to understand
- **Step 5:** Language models like BiomedBERT are used behind the scenes to help fill in and format medical language more naturally

Part 2: Health Log & Tracker
An interactive space where patients can stay engaged in their care after the visit.
- **Medication Scheduler:** Visual timing guides with clear drop/medication instructions
- **Visit Tracker:** Countdown to next appointment or follow-up
- **Symptom Journal:** Daily rating tool to monitor trends in symptom severity
- **Concern Log:** Patients can record which symptoms are bothering them most, or questions to ask at the next visit

Together, these features help patients stay informed, organized, and in control; without relying on technical medical portals or complex EMR access.

ANALYTICS PROBLEM FRAMING

Problem:
How can we quantify and improve comprehension of post-visit medical information to reduce errors, improve adherence, and optimize clinic operations?

Assumptions:
- Publicly available health literacy data (e.g., Milken Institute) reflects real gaps across populations
- Better comprehension → better adherence → fewer negative outcomes (e.g., missed meds, readmissions)
- Tailoring content by role (patient, technician, provider) improves clarity and efficiency

Success Metrics:
1. Reduction in misunderstanding
2. Less technician training time
3. Fewer repeat physician explanations
4. Improved operational efficiency

Health Literacy Risk Composition by Demographic Factor

Projected Impact of Improved Medical Comprehension
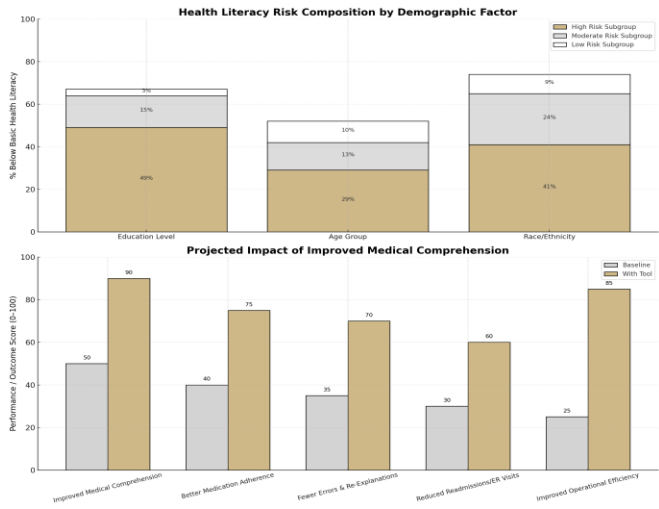
DATA

Disease Data (AAO):

We scrape the American Academy of Ophthalmology's "Eye Health A–Z" webpage to obtain a list of eye conditions. This extraction pulls condition titles and associated URLs that lead to detailed pages describing symptoms, treatments, and risk factors. This curated disease data forms the basis for matching user inputs with standardized medical information.

Drug Data (EyeWiki):

Drug information is scraped from multiple EyeWiki tables in the "Comprehensive Drop Guide." These cover various medication types (antibiotics, steroids, combinations, antimicrobials, and pressure regulators). For each drug, we capture key details like generic name, brand name, cap color (as a visual aid), and usage notes. This multidimensional dataset ensures our application matches both generic and brand names accurately.

Glossary of Ophthalmic Terms:

A custom CSV file serves as a glossary of common ophthalmic and anatomical terms with plain-language definitions. It generates bullet points that translate medical jargon into everyday language, making the summary more accessible to non-experts.

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METHODOLOGY

Sequential Entry & Validation:

Users enter conditions and drugs one at a time via an interactive Shiny interface. For each entry:
a) The app checks for an exact match against our scraped datasets.
b) If no exact match is found, fuzzy matching (using the stringdist package) generates a list of likely candidates. A modal dialog then prompts the user to select the correct option.
c) Saved entries are displayed as short feedback in the sidebar, and users can remove the most recent entry if needed.
d) The final output (detailed summaries) remains hidden until the user explicitly clicks "Generate Output."

Health Log & Tracker:

Integrated as a post-visit engagement tool, this feature provides patients with an interactive calendar-based log:
a) **Calendar View:** A large, visual calendar displays the current day and upcoming days.
b) **Medication Scheduler:** By clicking on a specific day, patients see clear instructions on when to take their medications.
c) **Appointment Highlighting:** The next appointment is automatically highlighted to help patients prepare for follow-ups.
d) **Symptom Logging:** Patients can record daily symptom severity using a simple rating tool.
e) **Concern Input:** A notes section allows patients to jot down which symptoms are most troublesome or any questions they have for their next visit.
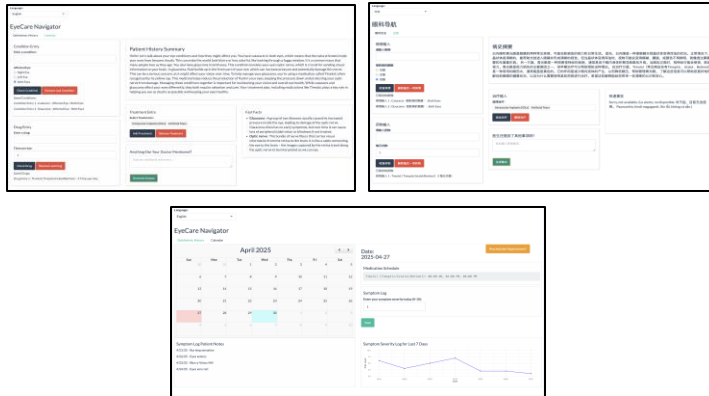
MODEL BUILDING

Prompt Creation
- The app pulls detailed descriptions of user-selected conditions (from AAO) and medications (from EyeWiki) into a structured prompt.
  - This prompt tells the model to generate a clear, patient-friendly summary based only on the provided info.

Symptom Tracking Integration
- The app also collects daily symptom ratings and patient notes through an interactive tracker.
  - This info is added to the prompt so the model can summarize symptom trends and highlight changes over time.

GPT-4o Integration
- Using a community OpenAI wrapper (like skinner927/openai), the app calls the chat endpoint with create_chat_completion().
  - It uses your custom model (like "gpt-4o") with set parameters (max tokens, temperature, etc.) and pulls out a concise, jargon-free summary.

Final Output Display
- The GPT-generated summary shows up in the app's final output section with glossary bullet points.
- Patients get a clean overview of their medical history and symptom trends without extra technical stuff.

DEPLOYMENT & LIFE CYCLE MANAGEMENT

Business Validation:

Currently, our tool requires manual data input, but our vision is to integrate with Electronic Health Record (EHR) systems to automatically aggregate patient information. Such integration would allow for role-specific medical explanations for clinicians, technicians, and patients. By drawing directly from real-time patient data, the system would improve communication, reduce manual errors, and streamline clinical workflows while providing context-aware, accurate insights that enhance decision-making and patient engagement.

Business Impact:

National data shows that nearly 50% of adults with less than a high school education, 29% of seniors, and over 40% of Hispanic adults have below basic health literacy. These populations are at **higher risk for misinterpreting medical guidance,** leading to **reduced adherence and worse outcomes.** Our solution aims to address this by **simplifying content** for patients, **contextualizing** it for technicians, and **preserving full clinical detail** for providers.

Anticipated Benefits:

By adjusting the complexity and format of health information based on user role, the tool is expected to:
- Support technicians in explaining diagnoses and prescriptions confidently
- Help patients with limited literacy better understand and follow medical advice
- Reduce time physicians spend re-explaining information across care touchpoints

Future Scope:

Planned development includes:
- Multilingual and voice-enabled formats to serve diverse patient populations
- Expansion beyond ophthalmology into high-need specialties like cardiology and dermatology
- Integrated feedback loops that assess patient understanding to guide future content refinement

Projected Impact of Tailored Health Literacy Tool (2025-2029)
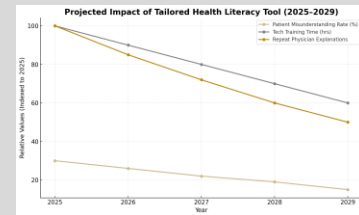
Key Populations with Below Basic Health Literacy
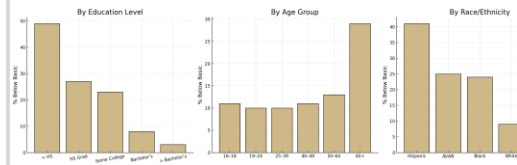
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