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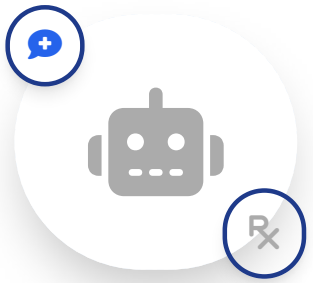
COURSE PROJECT BUILDING AI-POWERED APPLICATIONS

Medsplain

AI-Powered Medication Explainer

Understand your medications with **trustworthy**, **on-demand** answers.



TEAM
Fusion Core

DATE
October 14, 2025

Sourced from OpenFDA & RxNorm
Disclaimer: Educational information only. Not medical advice.

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Problem Statement: Medication Info Isn't Working

- **Comprehension Gap:** Medication leaflets are dense, jargon-filled, and 2-4 pages long—written at a college level but needed by all.
- **Patient Behavior:** Overwhelmed patients skip reading entirely or rely on Google searches filled with horror stories and unreliable advice.
- **Critical Outcome:** Without understanding *why* and *how* to take meds, patients lose confidence and stop treatment prematurely.

The Need

A reliable, on-demand way to translate medical facts into plain answers adapted to personal literacy levels.

30–50%

MEDICATION NON-ADHERENCE RATE

Costing healthcare systems hundreds of billions annually.

>125,000

PREVENTABLE DEATHS / YEAR

Directly linked to medication mismanagement.

The Opportunity

Understanding "how it works" can boost efficacy by **15-20%** via the placebo effect—a benefit currently lost in jargon.

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Our Solution: Medsplain Overview

Translating complex FDA data into personalized, plain-language explanations with interactive support.

- **Plain-Language Explanations:** Automatically converts technical inserts into 8th-grade reading level summaries grounded strictly in FDA labels.

KEY DIFFERENTIATORS

Trusted Sources

Unlike generic chatbots, we use **OpenFDA** and **RxNorm** as the immutable system-of-record.

✓ OpenFDA ✓ RxNorm

Mobile-First Accessibility

- **Interactive Q&A:** A conversational interface handles follow-up questions like "Will this hurt my stomach?" with safety guardrails.
- **Safety-First Design:** Built-in interaction checker for 2-5 medications and automatic escalation for serious warning signs.

SOLUTION Medsplain Project Concept

Web-based interface optimized for older adults—large text, high contrast, no app store download needed.

Pharmacist-Validated

Prompts and safety protocols are reviewed by pharmacists to ensure medical accuracy.

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Scope and Focus

In Scope (MVP)

- **Top 100 Medications:** Plain-language generator validated for high-volume prescriptions.
- **Interactive Q&A:** Handles follow-up questions on side effects & usage patterns.
- **Multi-Medication Checker:** Analyzes interactions for 2-5 concurrent drugs.
- **Safety Guardrails:** Automatic escalation for "Call Doctor" scenarios.
- **Web-Based Interface:** Optimized for mobile & accessible to older adults.

Out of Scope (Deferred)

- Integration with pharmacy systems or EHRs.
- Full medication database (focused only on top 100).
- Symptom checking or diagnosis capabilities.
- Medication shopping or insurance pricing features.
- Native mobile apps (iOS/Android) or multi-language support.

STRATEGIC RATIONALE

Focusing on the **Top 100 medications** enables deep manual validation of accuracy while serving a massive user base. A **web-first** approach allows for rapid iteration without app store delays, keeping the project within achievable safety parameters for

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Target Users: Primary Persona

Demographics & Context

Adult patients (ages 40-75) managing chronic conditions with newly prescribed medications.

PROFILE SNAPSHOT

- **Age Range:** 40-75 years old (often using reading glasses).
- **Education:** High school or below; unfamiliar with medical jargon.
- **Tech Level:** Comfortable with smartphones (banking/FB), but not "tech-savvy."
- **Context:** Mobile-first at pharmacy counter or home; often anxious.
- **Market:** 4.5 billion prescriptions/year in US alone.

Needs & Pain Points

USER NEEDS

- **Plain Language:** Need to understand "mechanism of action" without a medical dictionary.
- **Risk Clarity:** Distinguish "call 911" side effects from harmless ones.
- **Safety Check:** Verify safety with current daily meds (e.g., Lisinopril).

PAIN POINTS

> *"I can't understand what 'contraindicated in hepatic impairment' means - is that me?"*

> *"The insert lists 50 side effects. Which ones should I actually worry about?"*

> *"The pharmacist only had 2 minutes and I forgot my questions."*

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Secondary Users & Use Cases

Caregivers (Adult Children)

- **Proxy Management:** Need a consolidated view to manage medications for elderly parents across multiple doctors.
- **Safety Monitoring:** Highly motivated to check interactions and prevent adverse events before they happen.
- **Digital Proficiency:** Often more tech-savvy than the patient; acts as the "bridge" to the tool.

Healthcare Students

- **Communication Practice:** Use the tool to learn how to explain complex jargon in plain language.
- **Quick Reference:** Study common side effects and safety interactions on the go.

Shared Goals

Speed to Insight
Both groups need quick clarity without wading through pages of text.

Actionable Safety
Knowing exactly when to escalate a symptom to a doctor vs. when to wait.

Trusted Authority
Reliance on FDA-backed data rather than forums or anecdotes.

USERS Medsplain Project Concept

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Product Success Metrics

Comprehension
70%+
Correctly answer 3/5 post-session questions

User Confidence
3.8 / 5
"I feel confident taking this medication" rating

Session Efficiency
3-7 min
Time from medication input to session exit

Information Quality
80%+
Users rating explanation as "helpful"

Adoption & Engagement
20 Users
Unique users with 30+ total sessions

METRICS KPIs & Success

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Technical Success Criteria

Response Latency
< 5s / < 3s
Initial explanation <5s; Follow-ups <3s (p95)

System Availability
≥ 90%
Uptime during 4-week user testing period

Factual Accuracy
90%+
Correctness of medical info vs FDA labels

Error Rate
< 8%
Requests that fail or produce nonsensical output

Cost Efficiency
< $0.25
Per complete session (explanation + 3-5 Qs)

Safety Incidents
ZERO
No contradictions of doctor's orders in testing

CRITERIA MVP Technical Performance Targets

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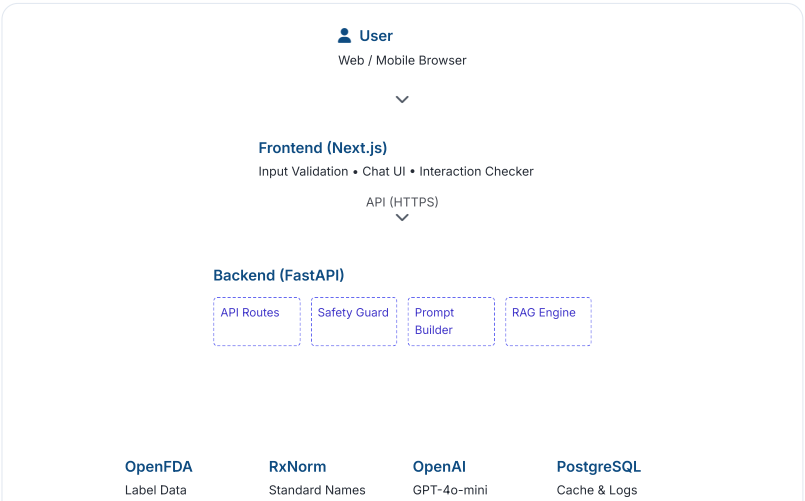
Architecture Overview

Frontend
- Next.js (React Framework)
- Tailwind CSS + Shadcn UI
- Vercel Hosting
- Mobile-First Responsive

Backend
- FastAPI (Python 3.11)
- LangChain Orchestration
- Pydantic Validation
- Server-Sent Events (SSE)

AI & Data
- GPT-4o-mini (Primary)
- Claude Sonnet 3.5 (Fallback)
- OpenFDA API (Drug Labels)
- RxNorm API (Interactions)

Storage



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Data Flow & AI Integration

1. **Input & Validation:** User enters medication (e.g., "Atorvastatin") + current meds. Frontend validates & sends to FastAPI backend.
2. **Retrieval (RAG):** Backend checks cache, then fetches FDA labels (OpenFDA) & interaction data (RxNorm). Relevant sections extracted.
3. **Generation:** Pharmacist-reviewed system prompt + FDA data context + User query sent to LLM (GPT-4o) via streaming API.
4. **Safety & Delivery:** Post-generation regex scan checks for danger signals. Response streamed to UI via SSE for speed.

Latency Budget
Target: **< 3.5 seconds** to first meaningful content.
Optimized via aggressive caching (Redis/Postgres) and token streaming.

Prompt Strategy
- **Strict Grounding:** "Answer strictly based on provided FDA context."
- **Safety Rules:** "Never diagnose. Escalate serious symptoms immediately."
- **Low Temperature:** Set to 0.3 to minimize hallucinations.

Efficiency
Minimal context window reduces API costs and noise. FDA label parsing extracts only relevant sections (e.g., "Warnings") rather than dumping raw text.

Est. Cost: <$0.25 per full session

ARCHITECTURE System Flow & AI Logic

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Risk Assessment & Mitigation

Technical Risks

LLM Hallucinations (Medium Likelihood)
MITIGATION Strict prompt grounding in FDA text only; post-gen safety filters; pharmacist review of prompts.

API Rate Limits / Downtime
MITIGATION 30-day caching for FDA labels; graceful degradation with retries; secondary LLM (Claude) fallback.

Prompt Injection
MITIGATION Strict input sanitization; separate system instructions from user content.

Product Risks

User Trust Barriers
MITIGATION Display "Source: FDA" badges; clear "Educational Only" labeling; link to original labels.

Scope Creep
MITIGATION Strict feature freeze week 8; prioritize Top 100 meds only; MOSCOW prioritization method.

Reading Level Mismatch
MITIGATION User testing with diverse education levels; iterative prompt tuning for 6th-8th grade target.

Team Risks

Workload Imbalance
MITIGATION Weekly standups & task board tracking; peer evaluations at Week 8/15; early intervention.

Member Unavailability
MITIGATION Cross-training on codebase; pair programming; 1-week schedule buffer included.

Safety & Ethical Risks

Harmful Decisions / Misinterpretation
MITIGATION "Never contradict doctor" rule; conservative escalation ("Call Doctor") for all ambiguity.

Data Privacy
MITIGATION No PII collection; anonymous session IDs; ephemeral logs; clear privacy policy.

Bias in Output

Contingency Plans & Learning Goals

Contingency Plans

- **OpenAI Outage:** Switch to Claude Sonnet 3.5 (API key ready). Verify output with 5 sample medications.
- **Low Tester Count:** Pivot to synthetic evaluation with 50 test cases + Pharmacist review if user recruitment <10.
- **Schedule Slip:** Trim features strictly: (1) Multi-med checker, (2) History, (3) Detail toggle. Protect core Q&A.
- **Cost Spike (>$50):** Implement aggressive 30-day caching for all meds; switch dev to cheaper models; rate limit users.

Team Learning Goals

Tekla Chaphidze (AI/Prompting)
Prompt engineering for accuracy/safety; evaluating AI in high-stakes domains.

Saba Samkharadze (Frontend)
Accessible design for older adults; streaming chat UX & state management.

Giorgi Ksovreli (QA/Ops)
Quality evaluation pipelines; building telemetry for production LLM apps.

Mariam Tarkashvili (Data/Cost)
Cost optimization (caching); RAG for structured medical data (FDA/RxNorm).

Akaki Ghachava (Backend/Security)
Secure backend architecture; medical privacy compliance; API integration.