Understanding Vaccine Adverse Events

Making Sense of Real-World Reports

The Real Problem

Same Symptom, Different Words

"I had a fever"

vs

"Pyrexia"

vs

Who Needs This?

Public Health Officials

> *"Are 1,000 people reporting the same new symptom using different words?"*

Individual Patients

> *"Did anyone else experience what I'm experiencing? Is this a documented issue?"*

The Current Reality

VAERS Reports Use Natural Language

- "My arm was sore and red"
- "Injection site erythema with pain"
- "Redness and soreness at shot location"

FDA Documents Use Medical Terms

- "Injection site reactions"
- "Erythema"
- "Local reactions"

How do we connect these?

Real Examples from Our Data

Injection Site Reactions

VAERS Says	→	FDA Says
"Injection site vasculitis"	→	"cellulitis", "injection site reactions"
"Vaccination site joint pain"	→	"injection site reactions", "arthralgia"

Real Examples: Allergic Reactions

Allergic Symptoms

VAERS Says	→	FDA Says
"Throat tightness"	→	"anaphylaxis", "swelling"
"Pharyngeal swelling"	→	"anaphylaxis", "angioedema"

Real Examples: Systemic Reactions

🤒 Whole-Body Symptoms

VAERS Says	→	FDA Says
"Body temperature increased"	→	"fever", "pyrexia"
"Feeling hot"	→	"fever", "flushing"

What This Enables

📊 For Public Health Monitoring

Before:

- 500 reports of "throat tightness"
- 300 reports of "pharyngeal swelling"
- 200 reports of "difficulty swallowing"

After:

- **1,000 reports of potential anaphylaxis 🚨**

What This Enables

🔍 For Individual Patients

Your Symptom: "My face feels hot and tingly"

Find Similar Reports:

- "Facial flushing" (243 reports)
- "Face hot" (189 reports)
- "Burning sensation face" (97 reports)
- "Facial paraesthesia" (156 reports)

Total: 685 people with similar experiences

Our Solution: Two-Part AI System

🔧 Pre-Processing: Building the Foundation

- **Extract** FDA adverse events from package inserts
- **Create mappings** for common symptoms using Claude AI
- **Build crosswalk** between patient language and medical terms
- **Validate** mappings with real VAERS reports

⚡ Real-Time Processing: Handle Anything New

- **MCP Claude agents** analyze new symptoms on the spot
- **No pre-mapping needed** - works with any input
- **Context-aware** - uses symptom text for better matching
- **Instant results** - no waiting for batch processing

How It Works

Pre-Processed Mappings

```
"Injection site vasculitis" → "cellulitis", "injection site reactions" "Body temperature increased" → "fever", "pyrexia" "Throat tightness" → "anaphylaxis", "swelling"
```

Real-Time Agent Analysis

```
New symptom: "My arm feels like it's on fire" ↓ Claude Agent analyzes in context ↓ Maps to: "injection site burning", "pain", "inflammation"
```

The Technology Stack

Hybrid Approach

1. **Pre-processed mappings** for speed and consistency
2. **MCP/Claude agents** for flexibility and new symptoms
3. **Context analysis** using full symptom descriptions
4. **Subset of VAERS data** for demo purposes
5. **Real FDA documents** for ground truth

User Interface: Find Your People

Search Your Symptoms

[Screenshot: Search interface]

- **Natural language search**: "arm hurts and red"
- **Medical term search**: "injection site erythema"
- **Find both** automatically

See Similar Reports

[Screenshot: Similar reports list]

- **Grouped by similarity** not exact matches
- **Severity indicators** (hospitalized, ER visit, etc.)

Impact: Finding Hidden Patterns

Case Study: Myocarditis

Different ways patients reported heart inflammation:

- **"Chest pain" (2,341 reports)**
- **"Heart inflammation" (892 reports)**
- **"Myocarditis" (423 reports)**
- **"Pericarditis" (198 reports)**
- **"Heart racing" (1,205 reports)**

Total: 5,059 potential cardiac events

(vs 423 if only counting "myocarditis")

Making Data Accessible

Before Our System

- **Medical professionals**: Use medical terms
- **Patients**: Use everyday language
- **Researchers**: Miss connections
- **Public health**: Delayed pattern recognition

After Our System

- **Everyone**: Can find relevant reports
- **Patterns**: Emerge faster
- **Communities**: Form naturally
- **Response**: More timely and accurate

Technical Implementation

Four Core Data Files

1. **FDA adverse events** - What we expect
2. **VAERS reports** - What people experience
3. **Symptom mappings** - How they connect
4. **Report categorization** - Match analysis

Smart Matching Algorithm

- Exact medical term matches
- Synonym recognition
- Context-based matching
- Severity alignment

Live Demo Scenarios

Scenario 1: "I'm Worried About My Symptoms"

1. User searches: "dizzy and nauseous after shot"
2. System finds: Vertigo, dizziness, nausea reports
3. Shows: 1,847 similar experiences
4. Provides: This is a known symptom

Scenario 2: "Public Health Monitoring"

1. Official views: Real-time symptom dashboard
2. System alerts: Unusual cluster of "throat tightness"
3. Investigation: Maps to potential allergic reactions
4. Action: Issue guidance to healthcare providers

Call to Action

For Public Health Officials

- **Better surveillance** with unified terminology
- **Faster pattern detection** across language barriers
- **Community insights** from patient experiences

For Patients

- **Find other people** with similar experiences
- **Understand your symptoms** in context
- **Know whether** your symptoms are already documented clinically

Questions & Discussion

Try It Yourself

- **Demo URL**: [Application URL]
- **GitHub**: Repository URL

Thank you!