**Healthcare – Patient Readmission Risk Prediction System**

*A Simple, Smart System to Help Doctors Act Early*

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**The Problem -**

Every year, 1 in 5 patients returns to the hospital within 30 days of going home. This is expensive, stressful, and often preventable. Doctors can’t check every patient manually. They don’t know who is at high risk until it’s too late.

**Our Solution –** “Health Warning Light” for doctors. We built an AI system that works like a smart assistant for doctors:

1. It reads patient information (age, blood pressure, medicines, etc.)

2. It predicts: “This patient has a 78% chance of coming back in 30 days.”

3. It alerts the doctor instantly via a simple dashboard or phone message.

**How It Works –**

| **Steps** | **What Happens** | **Simple Explanation** | **Technical Detail** |
| --- | --- | --- | --- |
| **1. Data Collection** | All patient records (age, BP, meds, etc.) are uploaded and stored securely. | One safe digital vault for all patient files. | hospital\_ds.csv → AWS S3 / Azure Blob with encryption at rest and IAM access control. |
| **2. Smart Cleaning & Prep** | The system cleans and organizes data:  • Splits "130/80"  → systolic=130, diastolic=80  • Converts text like "Yes/No"  → numbers | Makes messy data neat and readable. | Pandas pre-processing pipeline:  • str.split('/') for BP  • LabelEncoder for categorical fields  • Handles missing values & outliers |
| **3. AI Model Training** | The system studies 30,000 past patients to learn: *“Which factors cause readmission?”* | Teaches the AI to spot danger signs. | Random Forest trained on 30,000 patients → Deployed via AWS SageMaker Endpoint  Saved: `rf\_model.pkl` + `label\_encoders.pkl` → Model Registry |
| **4. Live Risk Prediction** | When a new patient is discharged, the AI instantly calculates: “78% chance of return in 30 days” | Gives doctors a clear warning score. | Flask API endpoint: /predict  • Input: JSON patient record  • Output: readmission\_risk: 0.78 (probability) |
| **5. Doctor Dashboard** | A real-time web screen shows: 🔴 High Risk (>70%) 🟡 Medium (40–70%) 🟢 Low (<40%) | Doctors see only what matters — fast. | Streamlit / React Dashboard  • Pulls live predictions via API  • Color-coded risk heatmap  • Searchable patient list |
| **6. Auto Alerts** | If risk > 70%, the system sends: SMS, Email | Never miss | Risk > 70% → CloudWatch Event Rule → \*SNS (SMS/Email)  Monitors: model drift, latency > 300ms, error rate > 1% |

**Expected Outcomes:**

| **Metric** | Target |
| --- | --- |
| **AUC-ROC** | 0.82 |
| **Recall @ 90%** | 0.75 |
| **Alert Latency** | < 2 sec |

**Bottom Line:** This AI doesn’t replace doctors — it helps them save more patients.