Transforming Patient Care: Leveraging Data Analytics to Reduce Readmission Rates

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Patient Data Types and Refresh Frequency

Data Types to Store

1

Personal Info

1. Name, Age, Gender
2. Contact Info
3. Insurance Details

2

Medical History

1. Chronic Conditions
2. Past Hospitalizations and Surgeries
3. Medication History

Allergies

3

Healthcare Interaction

1. Dates and Reasons for Recent Visits
2. Discharge Summaries
3. Prescriptions Issued

4

Lab Results & Vital Signs

1. Blood Tests
2. X-rays, MRIs etc.
3. Heart Rate
4. Blood Pressure
5. Temperature

5

Lifestyle Factors

1. Smoking
2. Alcohol
3. Exercise
4. Dietary Habits

6

Social Determinants

1. Employment Status
2. Living Situation
3. Social Network

Refresh Rate

- **Real-time**: Vital signs during hospital stays
- **Daily to Weekly**: Updates from outpatient visits, lab results
- **Monthly to Quarterly**: Reviews of chronic condition management, lifestyle factors
- **Ad Hoc**: Changes in personal information, insurance details, major health events

- **JSON & XML (Structured Data)**
  - **Electronic Health Records (EHRs)**: Comprehensive patient records including medical history, medications, lab results.
  - **Hospital Information Systems (HIS)**: Details of hospital stays, surgeries, and discharge summaries.
  - **Insurance Claim Databases**: Information on patient claims, coverage details, and insurance transactions.

- **CSV & Excel (Semi-Structured Data)**
  - **Laboratory Information Systems (LIS)**: Lab test results such as blood tests, biopsies, and imaging reports.
  - **Pharmacy Management Systems**: Prescription records, medication dispensation data.
  - **Patient Surveys and Questionnaires**: Lifestyle factors, social determinants of health, patient feedback.

- **PNG, JPEG (Unstructured Data)**
  - **Imaging Centers**: Radiology images such as X-rays, MRIs, CT scans.
  - **Patient-Submitted Photographs**: Images of physical conditions or progress reports, where applicable.

- **PDF & DOCX (Unstructured/Textual Data)**
  - **Clinical Notes**: Doctor's notes, nursing notes, specialist referrals.
  - **Research and Study Reports**: Relevant patient-participation studies or clinical trial reports.
  - **Discharge Summaries**: Detailed summaries of patient hospital stays, treatment plans post-discharge.

- **APIs (Real-Time Data Streams)**
  - **Wearable Devices**: Real-time monitoring of vitals like heart rate, blood pressure.
  - **Mobile Health Apps**: Daily inputs from patients on medication adherence, symptom tracking.

Analytics for Patient Data

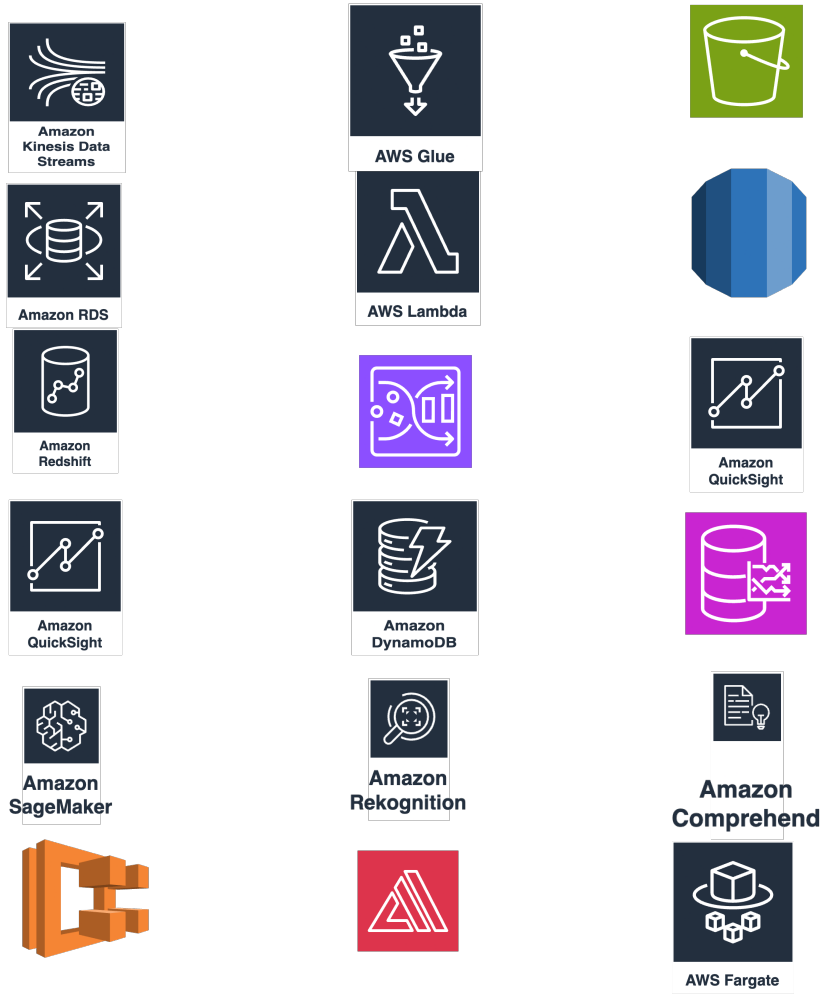
Leveraging Data Science for Health Outcomes

- **Descriptive Analytics:** Monthly/Quarterly review to identify patterns in readmissions and treatment effectiveness.
- **Diagnostic Analytics:** Detailed analysis of readmission cases to pinpoint contributing factors on an as-needed basis.
- **Predictive Analytics:** Daily/Weekly predictions to identify high-risk patients using historical data, aiding in early interventions.
- **Prescriptive Analytics:** From real-time to monthly recommendations for care plans to prevent patient readmissions.
- **Data Science Solutions:** Risk models, NLP for clinical notes, time series for vital sign analysis, social determinant assessments, and intervention outcome analysis.

Optimizing Healthcare with AWS Cloud Services

Strategic Cloud Solutions for Enhanced Data Management

- **Data Ingestion:** AWS Glue for ETL; Amazon Kinesis for real-time streaming; Amazon S3 for diverse data storage.
- **Data Storage & Processing:** AWS Lambda for serverless computing; Amazon Glue DataBrew for processing, RDS, DynamoDB and Timestream for structured, unstructured and time series data respectively
- **Data Warehousing & BI:** Amazon Redshift for warehousing; Amazon QuickSight for BI.
- **Data Science - ML/AI:** Amazon SageMaker for end-to-end ML solutions, AWS Rekognition, AWS Comprehend
- **Applications – Webapps, Mobile:** Amazon ECS for compute capacity; Cognito for user authentication, AWS Amplify for app development; Amazon RDS for managed databases.



Detailed Data Size Estimation

Quantifying AWS Storage for Healthcare

- **Amazon S3**
  - **Medical Images:** Estimation: 500,000 patients x 10 images/patient x 10 MB/image = 50 TB total.
  - **Documents & Lab Results:** Estimation: 500,000 patients x 100 documents/patient/year x 1 MB/document = 50 TB annually.
- **Amazon RDS - Structured Data:** Estimation: 500,000 patients x 10 KB/patient record = 5 GB annually.
- **Amazon DynamoDB - Wearable Data:** Estimation: 500,000 patients x 100 records/patient/day x 1 KB/record x 365 days = ~18.25 TB annually.

Compute Sizing and Service Estimates

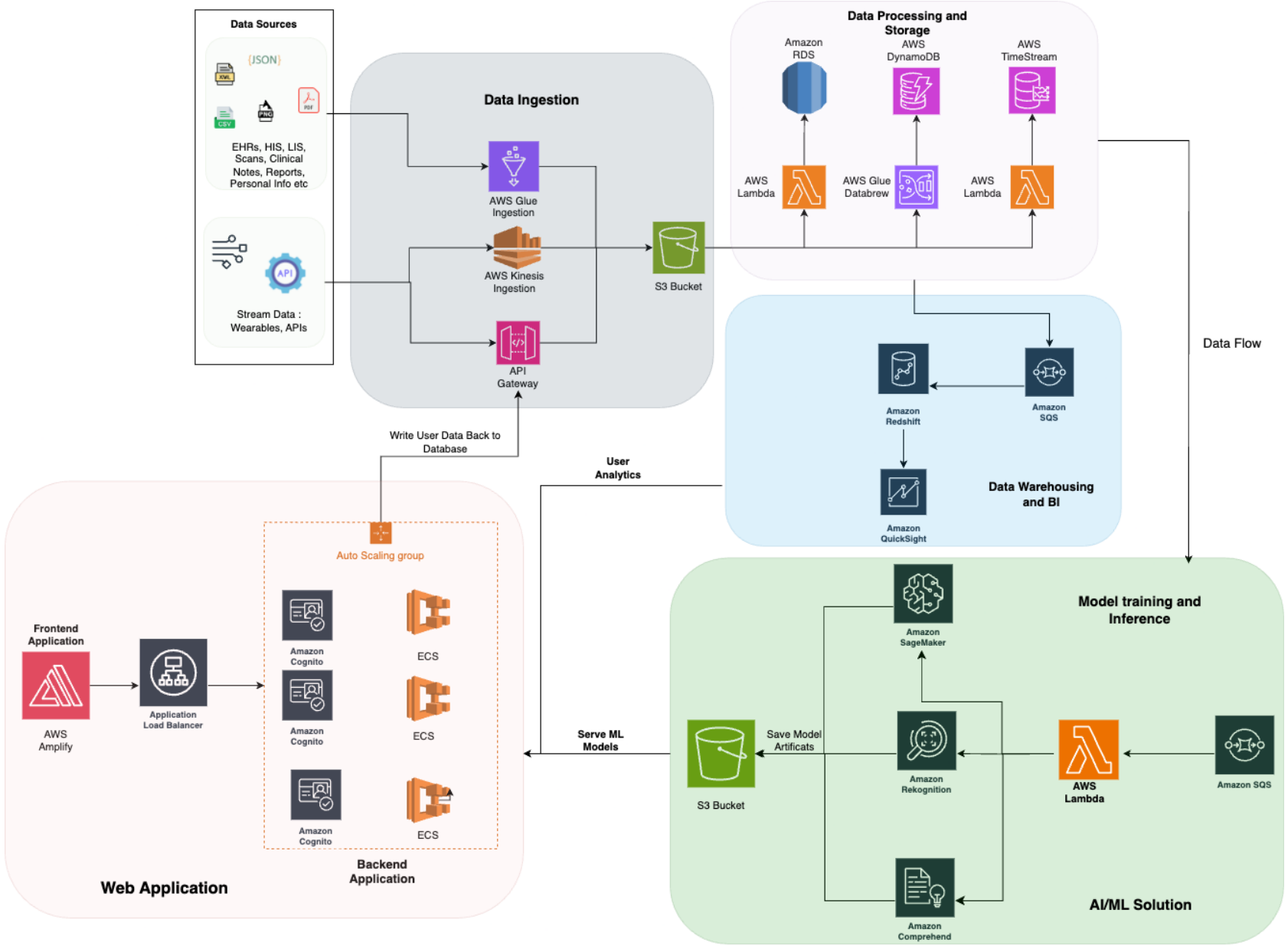
Services	Monthly Cost (USD)
AWS Sagemaker	1,200.28
Amazon Rekognition	25.00
Amazon Comprehend Medical	285.00
AWS Glue	8.80
Amazon Kinesis Data Streams	525.60
Amazon Simple Storage Service (S3)	188.42
Amazon RDS for PostgreSQL	2,041.90
AWS Fargate	340.25
AWS Lambda	72.37
Amazon Cognito	771.75
Amazon Timestream	735.00

- **Monthly Cost** = 6,194.37 USD
- **Annual Cost** = 74,332.44 USD

AWS Calculator Link

https://calculator.aws/#/estimate?id=9fddd7b3f2db869f7fa498944f738582eb012a02

Architecture Diagram



Thank You