

**From:** Dr. Emily Carter – Chief Operations Officer, **Midwest Health Alliance**  
**To:** ABC Company – Data Engineering Solutions Partner  
**Subject:** Development of a Real-Time Data Platform for Patient Flow & Bed Occupancy Analytics.

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## 1. Business Background

Midwest Health Alliance (MHA) is a network of **7 hospitals** across the Midwest region. We face daily challenges in **patient flow management**, especially during high-demand periods such as seasonal flu outbreaks.

We lack a centralized, real-time data system to monitor **bed occupancy, patient admission/discharge patterns**, and **department load**.

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## 2. Business Objectives

- **Monitoring patient admissions** to minimize waiting times.
  - **Identify department-level bottlenecks** (e.g., Emergency, Surgery, ICU).
  - **Enable gender-based and age-based KPIs** for demographic insights.
  - **Automate Alerts in case of failures**.
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## 3. Functional Requirements

### 1. Data Sources

- a. Real-time patient admission/discharge data from hospital registration systems.
- b. Daily batch extracts from Electronic Health Records (EHR) systems.
- c. Department metadata (capacity, staff numbers).

### 2. Data Processing & Storage

- a. Store data in a **Medallion architecture** (Bronze → Silver → Gold).
- b. Handle **schema evolution** when new patient attributes are introduced.
- c. Implement **Slowly Changing Dimension Type 2 (SCD2)** for patient and department history.
- d. Implement **Star schema** for storing the tables.

### 3. Analytics

- a. Use **Azure Synapse** for analytics queries.
- b. Build **dashboards in Power BI** with KPIs such as:
  - i. Current occupancy % by department
  - ii. Gender-based occupancy distribution
  - iii. Average length of stay per patient

### 4. Orchestration & Automation

- a. Use **Azure Data Factory** to automate:
  - i. Daily batch ingestion from EHR
  - ii. Real-time processing triggers
  - iii. Gold-layer refresh for dashboards

### 5. Data Quality

- a. Simulate realistic dirty data issues (e.g., missing admission times, duplicate patient IDs, wrong timestamps) and handle them in Silver layer processing.

### 6. Security & Compliance

- a. Role-based access control for different hospital departments.
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### 4. Deliverables

- Fully functional Azure-based data pipeline.
  - Power BI dashboard connected to live Synapse queries.
  - Data quality & validation reports.
  - Full project documentation (architecture, data models, Git repo).
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### 5. Success Criteria

- Dashboards refresh often for real-time views.
- All pipelines fully automated via ADF.
- Schema changes do not cause downtime.