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.

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.

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.

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.

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).

5. Success Criteria

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