CAREPULSE HDHI

A COMPREHENSIVE DATA ANALYTICS SYSTEM FOR PATIENT OUTCOMES AND ENVIRONMENTAL RISK AT HERO DMC HEART INSTITUTE

PROJECT OVERVIEW

Insight:
Leveraging clinical, demographic, and environmental data can transform patient care and hospital efficiency

- Built an end-to-end analytics system using real HDHI hospital data
- Focused on patient outcomes, predictive modeling, and environmental impact
- Tools used: Python, Power BI, DAX, XGBoost
- Datasets: Patient records, lab results, mortality, pollution overlays
- Outputs: 3-page dashboard, predictive risk engine, clinical insights

PATIENT DEMOGRAPHICS & TRENDS

Insight:
Elderly males accounted for the majority of admissions with seasonal inflow peaks

- 61–80 years age group made up over 40% of total admissions
- More male admissions than female across all age buckets
- Clear monthly seasonality observed in admission volume
- Average length of stay (LOS): ~5.3 days
- LOS spikes during winter, linked to respiratory conditions

OUTCOME OVERVIEW

Insight:
Mortality rate stands at ~6.3%, concentrated in specific admission types and comorbid groups

- Most outcomes recorded as “Recovered”, followed by “Expired” and “LAMA”
- Emergency admissions had higher average LOS and mortality
- Heart failure and renal failure strongly associated with higher mortality
- Rural patients had slightly longer stays than urban patients

PREDICTIVE RISK INSIGHTS

Insight:
29% of patients were predicted as "Likely Long Stay" using machine learning models

- XGBoost model trained on admission/lab features
- Flags: "Likely Long Stay" and Predicted LOS in days
- Long stay predictions aligned with older age, lab anomalies, and comorbidities
- Model validation showed high alignment with actual outcomes

LOS RISK VS OUTCOME PATTERNS

Insight:
Patients predicted for long stay had disproportionately higher real-world mortality and complications

- "Likely Long Stay" group had 2x mortality compared to normal stay group
- Higher concentration of heart failure, severe anemia, and low hemoglobin
- Flagged group required longer ICU care and complex interventions
- Extended LOS often correlated with environmental triggers (e.g., pollution spikes)

Environmental Impact on Health

Insight:
Pollution exposure, especially PM2.5, had a measurable effect on mortality and LOS

- PM2.5 and NO2 levels strongly correlated with mortality patterns
- High pollution days linked to respiratory admissions and LOS spikes
- Rural patients had higher predicted LOS under same pollution levels
- Environmental indicators can serve as early warning triggers for staff planning

CLINICAL LAB MARKER INSIGHTS

Insight:
Lab markers such as glucose, platelets, and hemoglobin significantly influenced outcomes

- High glucose linked with long stays and readmission risk
- Low hemoglobin consistently seen in patients with heart failure and mortality
- Platelet abnormalities indicated infection risk and ICU escalation
- These markers can be prioritized during triage and patient stratification

STRATEGIC RECOMMENDATIONS

Insight:
A three-pronged strategy is required across clinical, operational, and policy domains

- *Clinical Focus:* Prioritize lab-based triage, risk flag monitoring, elderly protocols
- *Operational Focus:* Pre-allocate ICU beds for high-risk periods, use dashboard for weekly review
- *Policy Focus:* Use pollution-health data for research and region-level health alerts

THANK YOU

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