Spatial and Demographic Analysis of Hospital Registration Data for Optimizing Healthcare Outreach

A Proposal report for the BDM capstone Project

Submitted by

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Declaration Statement

I am working on a Project Title “Spatial and Demographic Analysis of Hospital Registration to Optimize Healthcare Outreach”. I extend my appreciation to Yatharth Hospital, Faridabad, for providing the necessary resources that enabled me to conduct my project.

I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. In the event that plagiarism is detected in the report at any stage of the project's completion, I am fully aware and prepared to accept disciplinary measures imposed by the relevant authority.

I agree that all the recommendations are business-specific and limited to this project exclusively, and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.

Signature of Candidate: 

Name: Yashika Sharma

Date: 11th June 2025

1 Executive Summary

The Capstone project aims to provide support to Yatharth Super Specialty Hospital, Faridabad in enhancing patient outreach and footfall through data-driven demographic and spatial analysis. Despite consistent patient inflow, there is limited understanding of the sub-regional distribution and demographic characteristics of its patients. This limits its ability to optimize the outreach strategies, allocate resources effectively and target underserved communities.

The project utilizes the Patient Registration Data collected from the hospital to identify the patterns in patient footfall across Faridabad. Throughout this project, Patient Data Confidentiality has been maintained and its access is strictly controlled and limited to authorized personnel only. The insights drawn by mapping these patterns and segmenting the patients by age and gender would reveal critical gaps in patient engagement and highlight potential areas for growth.

The approach to resolve the problem includes Data Collection and Cleaning, Geographical Mapping and Demographic Segmentation and Trend Analysis. Tools like Google Colab and python libraries will be used to effectively manipulate and visualize the data.

To conclude, this project will enable Yatharth Super Specialty Hospital, Faridabad to better understand the patient base, strategize outreach efforts and enhance its service reach within Faridabad, ultimately contributing in improved healthcare access and business growth.

2 Organization Background

BUSINESS NAME: Yatharth Super Specialty Hospital, Faridabad

Yatharth Hospitals & Trauma Care Services Limited, incorporated in 2008, is a group of multi-specialty hospitals. It was founded by Dr. Ajay Kumar Tyagi and Dr. Kapil Kumar. It operates 7 hospitals with total bed capacity of 2300.

VISION: “To evolve as the most preferred destination for quality healthcare that provides a comprehensive range of services and is trusted for personalized care with compassion.”
MISSION: “Committed to deliver quality & personalized care to improve the well-being of patients and communities we serve.”

The Yatharth Super Specialty Hospital, Faridabad was established following the acquisition of 175-bed Asian Fidelis Hospital in February 2024. After extensive renovation and expansion to increase the bed capacity to 200, the facility was officially inaugurated and began operations in May 2024.
Currently, the hospital offers more than 30 clinical specialties including Neuro Sciences, Cardiac Sciences, Orthopedics & Robotic Joint Replacement, Nephrology, Urology, Minimal Access Surgery and Robotic Surgery, Gastroenterology, Pulmonology, Cosmetic & Reconstructive Surgery, and Endocrinology.

3 Problem Statements

1. The hospital lacks the comprehensive insights into the sub-regional distribution of patients across Faridabad, limiting their ability to conduct geographically-targeted outreach and service planning.

2. The absence of analysis of age-gender demographics which hinders their ability to identify the and engage the underrepresented groups in the patient population.

4 Background of the Problem

Yatharth Super Specialty Hospital, Faridabad serves a wide and diverse population across multiple states including Delhi, Haryana, Uttar Pradesh and Rajasthan. Each day the hospital registers patients varying demographic profiles, including different ae groups, genders, and localities. Although the data is routinely collected during the patient registration, it is not being fully utilized to extract meaningful insights about the footfall trends of the patients.

Currently, there is a lack of in-depth analysis concerning how patients are distributed across the sub-regions of Faridabad and how the footfall varies by age and gender. Without this understanding the hospital may miss key trends in healthcare-seeking behavior. This limits the ability of the hospital to recognize underserved demographic groups, affecting its capacity to design targeted outreach initiatives and tailor services to the needs of the particular population.

To summarize, the absence of demographic insights hinders the hospital effective outreach and service delivery. A data-driven analysis of the Patient Registration Data can provide valuable insights of the demographic trends in patient footfall. These insights can help in effective resource allocation, identifying gaps in service delivery, and improve planning of targeted awareness campaigns.

5 Problem Solving Approach

DETAILS ABOUT METHODS USED WITH JUSTIFICATION:

- Analyzing the distribution of patients across Faridabad and visualizing the data using pie charts and bar charts to pinpoint the underserved regions in the patient data.
- Grouping the patient data into various age groups such as toddler, child, teenage, young adult, adult and elderly, and analyzing the gender representation in the patient footfall using bar charts, line charts, pie charts and histograms.
- Evaluating the Time-based trends to analyze the correlation between seasonal change, age and gender using line graphs and scatter plots to identify health-seeking patterns.

DETAILS ABOUT INTENDED DATA COLLECTION WITH JUSTIFICATION:

To carry out the demographic and spatial analysis of patient footfall at Yatharth Super Specialty Hospital, Faridabad, the project will utilize Patient Registration Data already collected by the hospital. The dataset is a time-series data collected for the time period of 9 months (July 2024 – April 2025). The dataset includes demographic attributes such as date of registration, age, gender, and local/permanent address. This information is essential to identify the distribution of incoming patients across the sub-regions of Faridabad and across different age-gender groups.

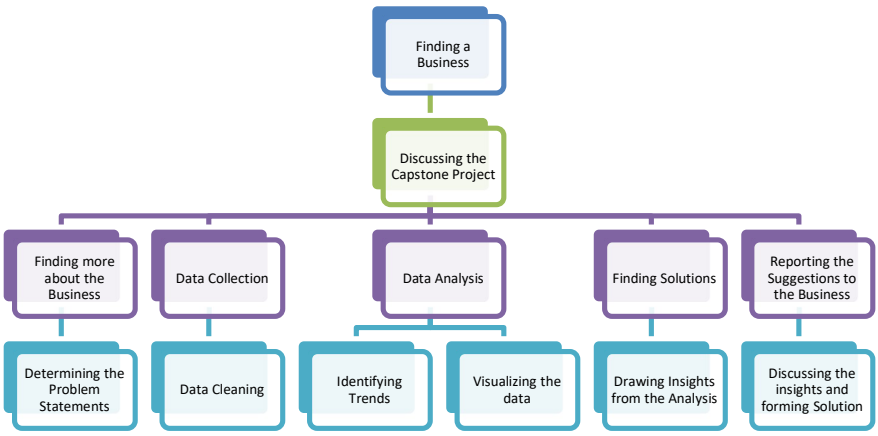
DETAILS ABOUT ANALYSIS TOOLS USED WITH JUSTIFICATION:

The analysis of the data will be done using the following tools:

- Google Colab: Efficient for data cleaning and processing using python
- Python Libraries: Libraries like Pandas, NumPy, Matplotlib and plotly are used for data manipulation and creating graphs and plots.

6 Expected Timeline

WORK BREAKDOWN STRUCTURE:



- Data Collection: The primary data for the project is collected for the from the Hospital Registration Database for the span of 9 months.
- Data Cleaning: Processing the data to handle inconsistencies in the data
- Data Analysis: Mapping the sub-regional distribution and analyzing age-gender distribution of patient footfall
- Visualization and Interpretation: Creating maps, charts and drawing insights
- Finding Solution: Drawing conclusions and reporting the recommendations

GANTT CHART:

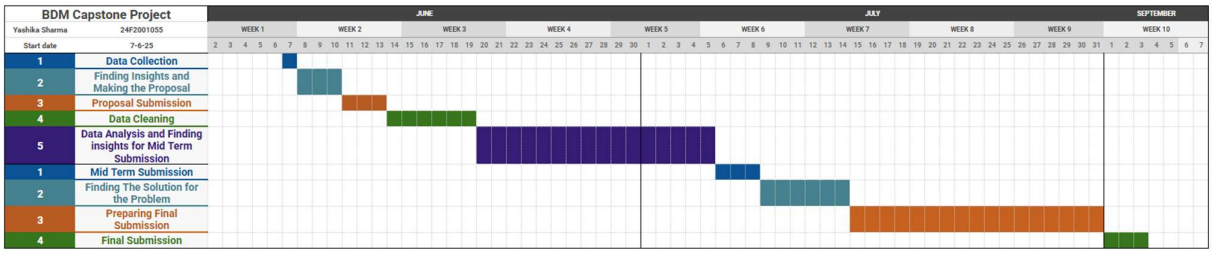


Figure 1: Timeline for the Capstone Project

7 Expected Outcome

The insights drawn from the project would provide aid in optimizing resource allocation, marketing efforts, and service offerings based on the actual patient data.

1. Identification of Sub-Regional Patient Distribution:

   Mapping the patient footfall across the sub-regions of Faridabad to identify the high and low engagement areas. The insight would be used to organize targeted outreach to the necessary areas

2. Demographic Insights:

   Understanding of trend in footfall in terms of age and gender to understand the composition and identify the underserved population segments.

3. Temporal Insights:

   Trends in the footfall over time to identify the variation of age-gender group registration with seasonal changes. This insight would help in identifying peak periods and effectively allocating resources.

4. Detecting Outreach Gaps:

   Recognizing the population gaps where patient engagement is low to form efficient targeted outreach strategies.