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

The Final Report for the BDM Capstone Project

Submitted by

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1. Executive Summary

The **Yatharth Super Specialty Hospital**, is a 200 bedded multi-specialty hospital which was established and officially began operation in May 2024. On a daily basis, the hospital registers patients with varying demographic profiles, including different age groups, gender, and localities. However, there is a limited understanding of patient distribution across the sub-regions of Faridabad and age-gender groups. This gap limits the hospital's ability to implement targeted outreach strategies, identify the underserved communities and allocate resources effectively.

This project aims to provide support to the hospital in enhancing patient outreach and maximize revenue potential through data-driven analysis of two key problems: 1. Identifying high and low performing geographic regions to optimize spatial outreach, and 2. Understanding demographic gaps to develop targeted outreach programs. The Data collected spans over a time period of 11 months (July 2024 – May 2025) containing a total of 17,539 patient records. Data Confidentiality has been maintained and its access is strictly controlled and limited to authorized personnel only.

The Analysis Process involved multiple stages: Data collection, cleaning and preprocessing, segmentation and visualization. Data segmentation was done using Rule-Based Text Matching with Keyword Filtering for spatial segmentation (Problem 1) and Age-Based Categorical Classification for demographic segmentation (Problem 2) using Python.

The insights revealed that Greater Faridabad contributes the highest patient inflow, while regions like Ballabgarh, Palwal and Old Faridabad remain underserved. Adults and Elders age-group dominate the registrations at 50.55%, while the pediatric groups represent only 16%, indicating underutilization of pediatric services. Temporal analysis shows a significant October 2024 dip during Diwali, with recovery driven by seasonal illnesses in March 2025.

The key recommendations for addressing Problem 1 include region specific outreach program in low-performing areas and implementing seasonal campaign planning. For Problem 2, enhancement of pediatric services and gender-sensitive programs are recommended to maximize utilization of existing resources and infrastructure. These data-driven strategies are expected to increase patient footfall, optimize resource allocation, and increase revenue growth while emphasizing the importance of integrating analytics into healthcare planning.

2. Detailed Explanation of Analysis Process/Method

The Data Analysis Process plays a critical role in transforming the raw hospital registration data into meaningful and actionable insights. By cleaning, processing, and visualizing the data, the analysis provides evidence-based insights that can help the hospital optimize outreach programs, strengthen patient engagement, improve resource allocation and ultimately drive revenue growth. The complete analysis, visualization procedure and code implementation can be accessed through the Google Colab link provided below:
https://colab.research.google.com/drive/1po9ECYvxywYR8Ilu_k4CnccUk9hBcYlj?usp=sharing

2.1. Data Collection

- The Patient Registration Data used for the project was sourced directly from the hospitals information system.
- Access to the data was restricted to authorized personnel, ensuring strict compliance with **confidentiality and data protection norms.**
- The dataset spans **11 months from July 2024 to May 2025**, encompassing the hospital's operation period.
- The dataset included attributes such as Registration number, Registration Date, Gender, Date of Birth, Age, Local Address, and Permanent Address.
- The original dataset contained **17539 patient registration records**, covering multiple months of operations. From this bulk dataset, only the relevant records were filtered and prepared for analysis to focus on meaningful trends.

SAMPLE DATASET:

registration no	registration date	sex	date of birth	age	local address1	local address2	local address3	localpin	local city	local state	permanent address1	permanent address2	permanent address3	permanentpin	permanent city	permanent state
[redacted]	2024-07-01	M	1976-06-20	48.0	C-405 EMERALD HEIGHTS SEC-88	NaN	NaN	NaN	FARIDABAD	HARYANA	NaN	NaN	NaN	NaN	FARIDABAD	HARYANA
[redacted]	2024-07-01	F	2010-04-28	14.0	E-89, 1ST FLOOR,TO THE RETREAT	SEC-89, FBD	NaN	NaN	FARIDABAD	HARYANA	NaN	NaN	NaN	NaN	FARIDABAD	HARYANA
[redacted]	2024-07-01	F	1974-05-05	50.0	9/208	DDA FLAT	MADANGIR	110062.0	NaN	DELHI	NaN	NaN	NaN	NaN	NaN	DELHI
[redacted]	2024-07-01	F	1982-01-01	43.0	SHRAMIK VIHAR	SEC 30	NaN	121003.0	FARIDABAD	HARYANA	NaN	NaN	NaN	NaN	FARIDABAD	HARYANA
[redacted]	2024-07-01	F	1994-09-05	29.0	PLOT NO 46	OLD BHUPANI	NaN	121002.0	FARIDABAD	HARYANA	NaN	NaN	NaN	NaN	FARIDABAD	HARYANA

Figure 1: Sample Dataset (Registration number not shown due to confidentiality concerns)

2.2. Data Cleaning

- The raw file was imported and structured into a Data Frame using the Pandas library in Python, enabling efficient manipulation and processing.
- The dataset was checked for any duplicate records. However, **no duplicate records were found.**
- Inconsistent records which included incomplete or empty fields that were to be used in the analysis process - namely Age, Gender, Registration date, Local Address and Local City - were removed.
- This step was crucial in **ensuring that no biased or misleading insights were derived** due to incomplete or erroneous information.

2.3. Data Preprocessing and Filtering

- A new attribute **'RDate'** was created by converting the attribute 'registration date' into a Timestamp format, enabling **time-based filtering** and temporal trend analysis.
- The three local address line attributes were combined into a single attribute named **'LocalAdd' to simplify spatial segmentation** of patient data.
- These preprocessing steps r**educed complexity, improved data readability, and ensured compatibility** with subsequent filtering and visualization tasks.
- **TIME FILTERING**: Only records from July 2024 to May 2025 were included. This ensured that the analysis reflected the most recent and relevant patient behavior patterns.
- The resulting time_filter data frame consisted of **15762 patient records**, out of which only **10319 patient records are from Faridabad**, which is the main focus of the project.
- The time-filtered data was then further divided into Spatial and Demographic Groups.

- **SPATIAL SEGEMTATION (Problem 1):** The Time-filtered data was grouped into sub-regions of Faridabad using **Rule-Based Text Matching with Keyword Filtering**.
- **Rule-Based Text Matching** is a natural language processing (NLP) technique that identifies specific patterns, entities, or information within text using predefined linguistic rules and patterns.
- Sectors were identified using patterns like 'SEC-88A', 'SECTOR 88 A', 'SECTOR 88/A' or 'SEC- 88/A'. For searching the local address for locality keywords like 'OLD FARIDABAD', 'OLD FB', and 'OFD' were used for Old Faridabad.
- Local pin codes could not be used due to missing or incomplete entries, making text-based filtering the more reliable option.
- **Inconsistent Address Formats:** One of the major challenges encountered during text-based filtering was the presence of multiple formats for the same location, particularly in the case of "Sectors." For example, the same sector could appear as "Sec-88A," "Sector 88 A", "88/A" or "Sec: 88 A". Such inconsistencies made it difficult to standardize the program used, so the remaining records were analyzed for formats and code was written to separate the specific formats.
- **Challenges Encountered:** One of the major challenges during the text-based filtering was the presence of multiple formats for the same location particularly in the case of 'Sectors'. Inconsistent address formats made standardization difficult, requiring careful analysis of remaining records to identify formats and write code to handle specific variations. Many addresses contained only partial details, such as just the locality name or society name, without specifying the sector or region. To address this, the segmentation was refined by carefully reviewing unclassified addresses, identifying the recurring keywords, and mapping them to appropriate regions.

- **DEMOGRAPHIC SEGMENTATION (Problem 2):** Patients were classified into well-defined age groups using **Age-based Categorical Classification**, allowing for detailed demographic profiling.
    1. Toddler (age: 1-4 years)
    2. Child (age: 5-12 years)
    3. Teenager (age: 13-19 years)
    4. Young Adult (age: 20-39 years)
    5. Adult (age: 40-64 years)
    6. Elder (age: 65 years & above)
- The number of patient records used for the demographic analysis is **10123**, which is less than the total number of patients records for the spatial analysis due to **existence of Null/nan values** in the 'Age' Attribute.
- This structured segmentation made it possible to **examine which groups dominate hospital inflows**, and where outreach efforts could be strengthened.

2.4. Data Visualization

- Visualization techniques were employed to reveal patterns and trends in the data. Interactive charts and graphs were created using Python libraries to enable clear interpretation of spatial, temporal, and demographic distributions.
- The analysis focused on identifying high-performing regions, understanding seasonal fluctuations, and recognizing demographic gaps in service utilization.

3. Results and Findings

3.1. Spatial Analysis of Patient Distribution: Problem 1

3.1.1. Contribution of Different Regions

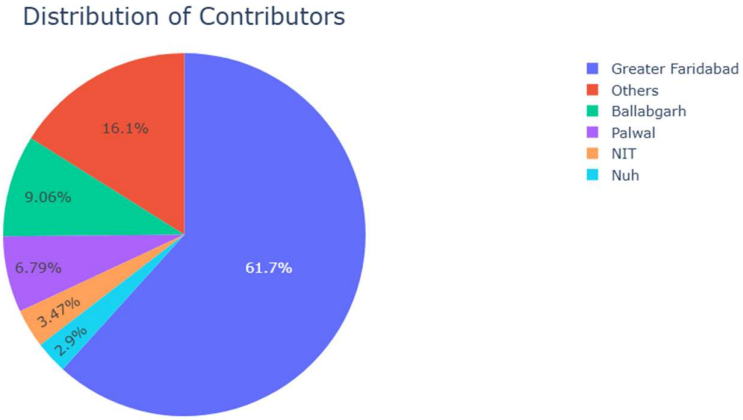

Figure 2: Distribution of Contributors across Faridabad

- The spatial analysis reveals distinct pattern in the patient distribution across Faridabad.
- The 'Others' category (Figure 2), comprising of 16.1% of the total population includes localities and sector such as with the contribution of less than 300 patients (less than 2.9% of the patient population from Faridabad). This scattered distribution suggests the opportunities for consolidation through regional campaigns.
- **Major Contributing Region: Greater Faridabad**

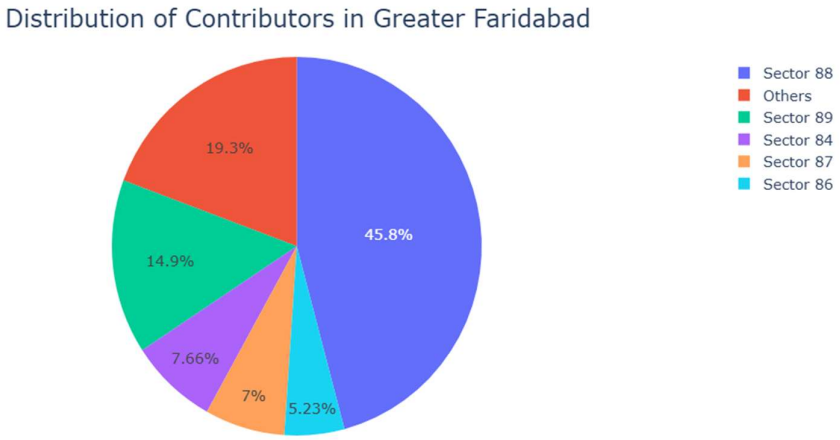

Figure 3: Distribution of Contributors across Greater Faridabad

- In Figure 3, **Sector 88** emerges as the largest contributor from Greater Faridabad, which is expected as the hospital is located there, representing the primary revenue base.
- The **Sector 84-89** located near the hospital show steady patient numbers, indicating that the hospital constantly attracts people from its surrounding areas within the **4-5 km radius primary catchment zone**.
- The 'Others' segment comprising of 19.3% of the patient population from Greater Faridabad includes sectors of Greater Faridabad with less than 300 patients (less than 4.71%).
- **Moderate Contributing Regions: Ballabgarh** (15 km), **Palwal** (40 km), **NIT** (9 km) and **Nuh** (70 km) were selected for focused analysis due to their large contribution to the patient footfall after Greater Faridabad ranging from 300-950 patients.
- **Low Contributing Regions: Old Faridabad, Sector 16, Sector 29 and Sector 37** contribute minimally despite being within the Faridabad District. Each of these areas account for less than 1-2% of registrations, indicating significant untapped market potential or challenges in accessibility and awareness.

3.1.2. Temporal Trend of Patient Footfall

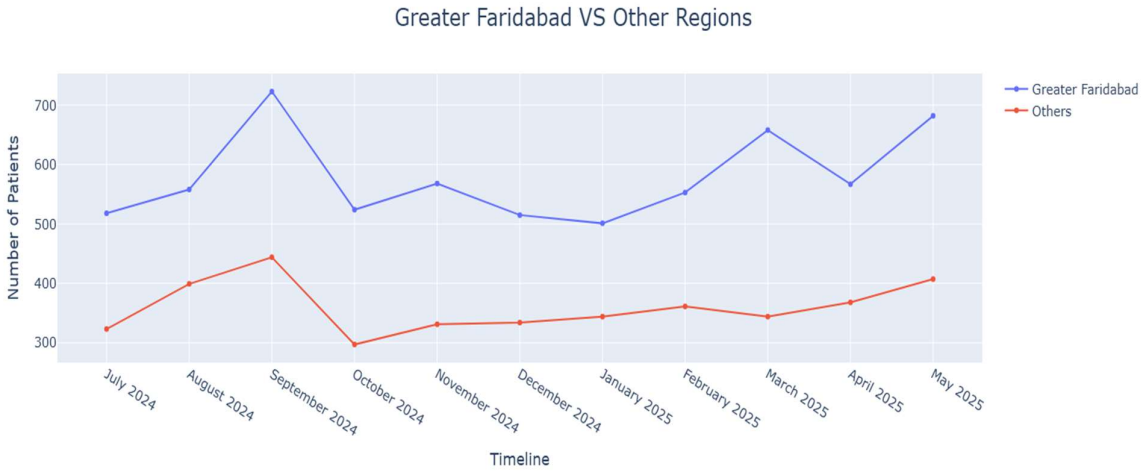

Figure 4: Temporal Trend for Greater Faridabad and Other Regions

- The time-series analysis (Figure 4) highlights that **Greater Faridabad** consistently contributes that **highest patient inflow** as compared to other regions throughout the 11-month period.
- A **noticeable dip in October 2024** is observed across all regions, coinciding

with the **Dusshera and Diwali festive period**. During this time, non-emergency healthcare visits typically decline as families prioritize celebrations, travels, and social gatherings.

- The inflow gradually recovers in the following months, indicating that the October dip is **temporary rather than a long-term decline**.
- **Understanding Seasonal Variations:** The October dip coincides with the Diwali and Dusshera festive period. However, **March 2025 shows a sharp increase** in Greater Faridabad despite Holi festivities, unlike the slight dip for other regions.
- This contradiction can be explained by several factors: Unlike Diwali, which involves extended multi-day celebrations and outstation travel, Holi is a shorter, localized festival whose impact lasts only 2-3 days, causing minimal disruption to routine healthcare visits. Additionally, February-March are **generally favorable business months** for the healthcare industry due to **increased patient footfall driven by seasonal factors**. **Post-winter seasonal illnesses such as respiratory infections, allergies, and viral fevers reach their peak during this period**, driving heightened healthcare-seeking behavior that substantially offsets any temporary festive decline.
- The sharp rise in Greater Faridabad specifically may also reflect successful local outreach campaigns conducted in February-March 2025.

3.1.3. Spatial - Temporal Patterns

1. The Major Contributing Regions in Greater Faridabad

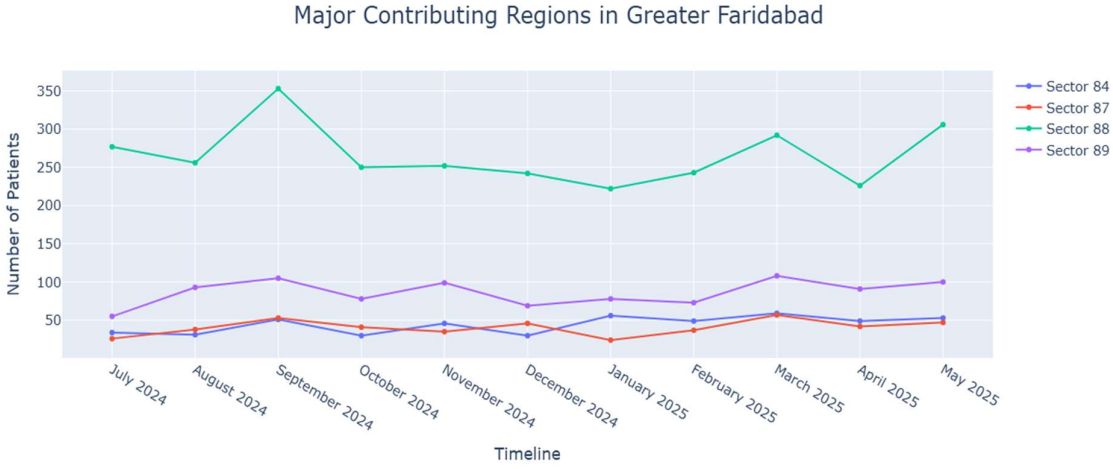

Figure 5: Temporal Trends for the Major Contributing Regions in Greater Faridabad

- Within Greater Faridabad, temporal trends (Figure 5) reveal that **Sector 88** experiences noticeable peaks, while patient inflow from other sectors remain relatively constant.
- The consistency in neighboring sectors suggests stable community trust, while peaks in Sector 88 may be the result of successful campaigning and awareness programs, or immediate walk-in patients and emergency cases due to proximity.

2. The Moderate Contributing Regions in Faridabad

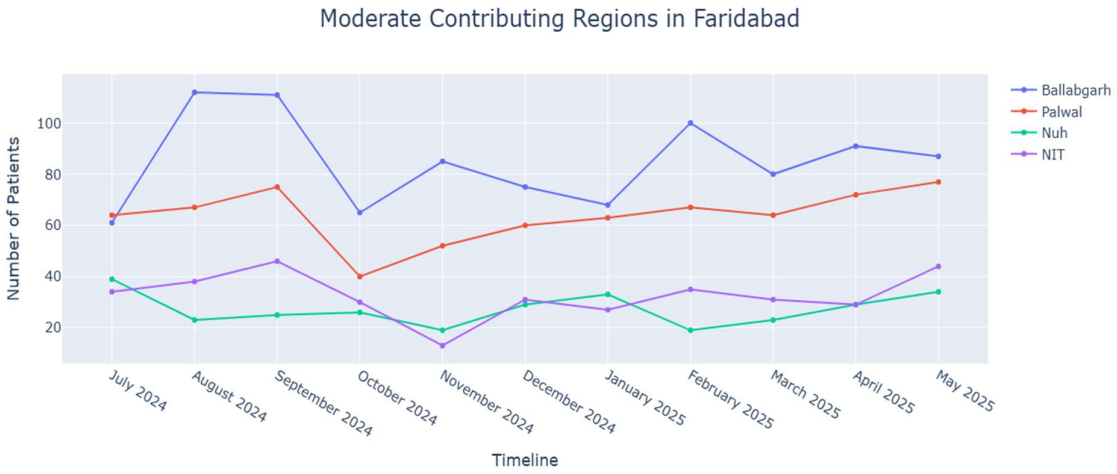

Figure 6: Moderate Contributing Regions in Faridabad

- In Figure 6, regions such as **Ballabgarh, Palwal, Nuh, and NIT** show the October 2024 dip pattern. However, the post-festive recovery varies significantly.
- The declining inflow from Ballabgarh suggests competition from alternative healthcare facilities or weakening referral networks.
- After the dip, the patient footfall from **Palwal** has nearly restored with time and shows **a continuous increase in the number of incoming patients** while Nuh and NIT experiences some fluctuations with time, suggesting inconsistent engagement with the patients.
- This finding suggests the **need for targeted engagement strategies** to revive and stabilize patient inflow from these regions.

3. Low Contributing Regions in Faridabad

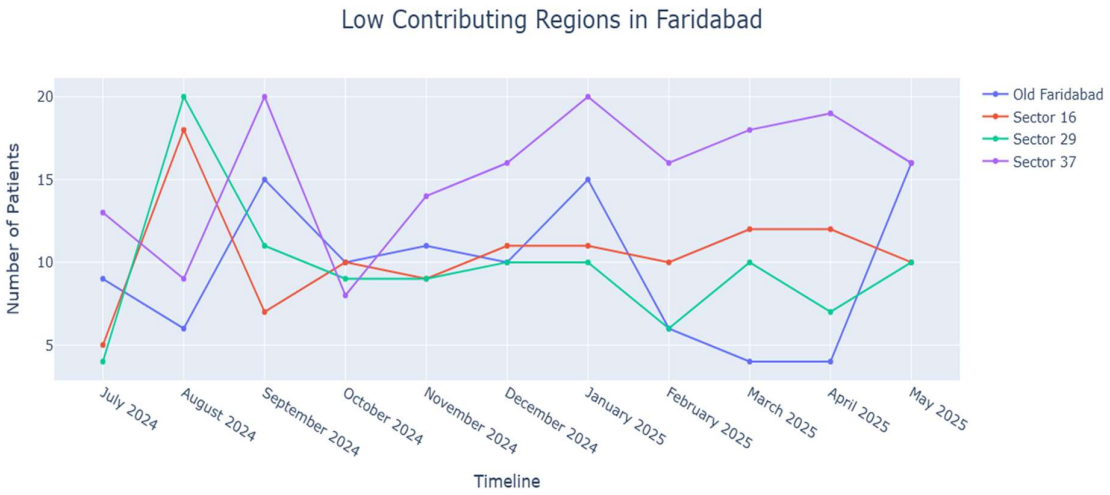

Figure 7: Temporal Trends for the Low Contributing Regions in Faridabad

- Old Faridabad shows **negligible inflow during March–April 2025**, followed by **a sharp increase in May 2025**, suggesting a delayed campaign effect.
- **Sector 37** demonstrates steady growth after October 2024, suggesting a gradual strengthening of hospital reach in that area.
- The patient inflow from Sectors 16 and 29 experiences a lot of fluctuation after the October dip and does not restore with time.

3.2.Demographic Distribution and Trends: Problem 2

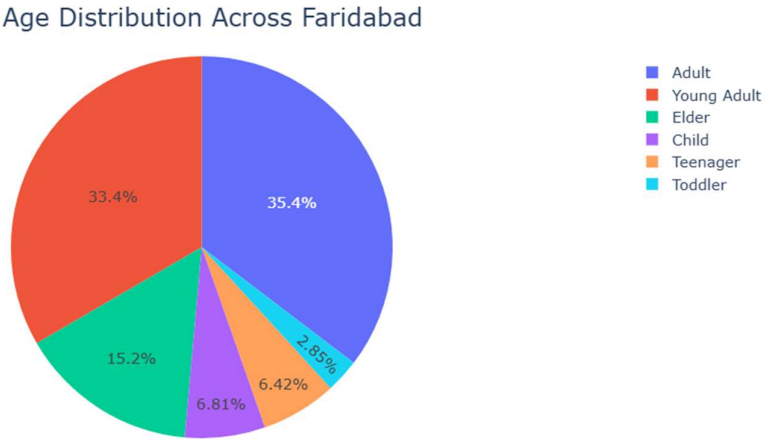

Figure 8: Distribution of the Patient Population Across various age groups

- **Age Group Distribution** (Figure 8)**:** The demographic distribution indicates that the hospital's patient base is **dominated by Adult (40-64 years) and Young Adult (20 – 39 years) age-groups followed by the Elders age group** (65+ years), with limited representation from younger age groups.
- **Age Group Distribution in Greater Faridabad:**

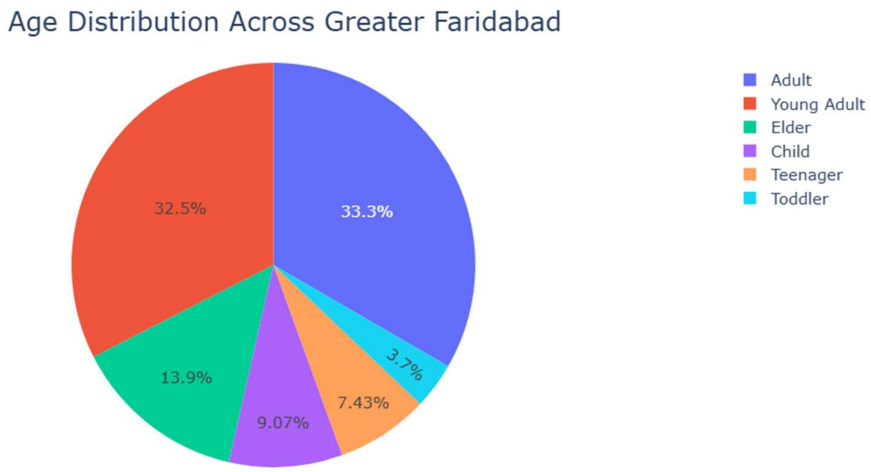

Figure 9: Age Distribution Across Greater Faridabad

- A focused analysis of Greater Faridabad (Figure 9) reveals a similar age group distribution to the overall distribution.
- This indicates that the **underutilization of pediatric services is not distance-related but rather reflects broader awareness and marketing gaps**. Even in the immediate vicinity of the hospital, families are not accessing pediatric and neonatal care at expected levels.
- The insight suggests that while the hospital currently serves as a trusted destination for adults (20-64 years) and elderly patients, **strategic marketing could attract younger populations** and expand overall reach.
- The dominance of Adult and Elder patients indicates **strong performance in general medicine, chronic disease management, and geriatric care.** However, the minimal pediatric presence represents a significant growth opportunity.

- **Gender Distribution:**

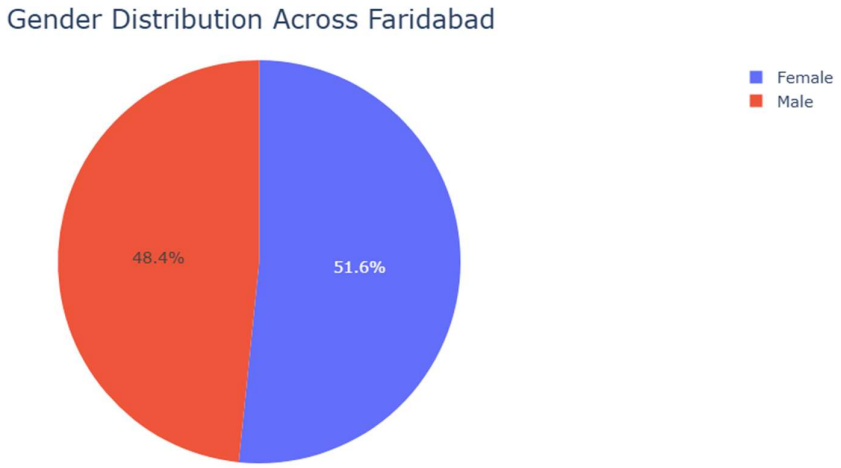

Figure 10: Gender Distribution Across Faridabad

- The **gender distribution** (Figure 10) **reveals a relatively balanced patient inflow** across Faridabad. This near-equal distribution demonstrate that the hospital successfully serves both genders without significant access barriers or gender-based disparities in healthcare utilization.
- The slightly higher female representation may **reflect greater healthcare-seeking behavior among women for preventive care, family health concerns, and routine checkups.**
- **Age-Gender Distribution:**

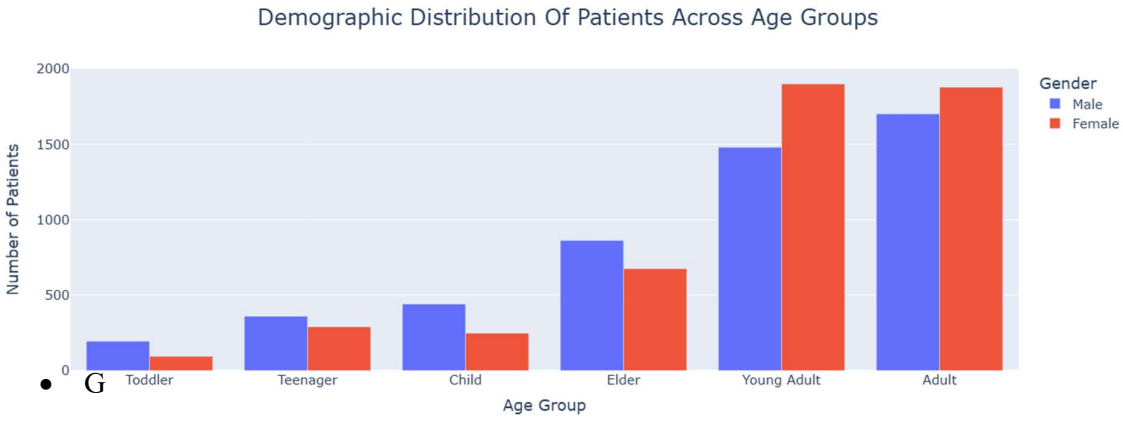

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Figure 11: Age-Gender Distribution across Faridabad

- When examined across age group (Figure 11), the gender distribution shows interesting patterns. In the **Adult and Young Adult** categories, **female patients slightly outnumber males.**
- However, in the **Elders category**, male patients show marginally higher representation, indicating potential underutilization of services by elderly women. This gap may reflect **cultural barriers, mobility constraints, or lack of geriatric services tailored to elderly women's specific needs** such as osteoporosis care, post-menopausal health management, and age-related gynecological concerns.
- Similarly, among **Pediatric groups** (Toddler, Child, Teenager), male children consistently outnumber females. This disparity suggests gender-based healthcare access gaps for female children, potentially **reflecting traditional preferences for male child healthcare or socio-cultural factors affecting female child health-seeking behavior in the region.**
- While overall gender balance appears satisfactory, these age-specific disparities suggest the need of **targeted interventions to improve elderly women's access to geriatric care and ensure equal healthcare access for female children**.
- The hospital's ability to attract equal proportions of male and female patients across most age groups **suggests effective positioning as a family-oriented healthcare destination**, but focused efforts on these underserved sub-groups would strengthen its reputation as a truly **gender-sensitive provider**.

4. Interpretation of Results and Recommendation

4.1. Interpretation of Results

The analysis of the patient registration data from Yatharth Super Specialty Hospital. Faridabad highlights important patterns across spatial, demographic and temporal dimensions.

SPATIAL TRENDS (Problem 1):

1. **High-Contributing Areas** (Figure 3)– Regions such as Sector 88 and Sector 89 emerged as the primary sources of patients. This is expected, as the hospital is itself located in Sector 88. The strong performance in immediately surrounding sectors **validates the hospital's establishment location and indicates effective penetration** within the 2-3 km primary catchment area.
2. **Moderate-Contributing Areas** (Figure 2)– Areas like Ballabgarh, NIT, Palwal, Nuh, and Old Faridabad recorded significantly fewer patients despite being in reasonable proximity. These gaps may reflect **limited awareness of hospital services, lower accessibility, or weaker outreach in these regions.**
3. **Low-Contributing Areas:** The particularly low contribution from Old Faridabad (Figure 3) **suggests strong competition from existing healthcare providers or insufficient differentiation of the hospital's service offerings**. The distance factor alone does not explain low contributions, as Palwal (40 km away) shows better engagement than Old Faridabad (12 km away), indicating that **accessibility, awareness, and referral networks play more critical roles than mere distance.**

TEMPORAL TRENDS (Problem 1):

1. **Festive Season Impact:** The October 2024 registration decline reflects **predictable festive season behavior patterns** figure 4). Diwali's extended celebration period and associated travel significantly reduce non-emergency healthcare utilization. However, the hospital must recognize that this is **not merely a passive decline but an opportunity for proactive planning.**
2. **Seasonal Disease Cycles:** The March 2025 recovery demonstrates the combination of seasonal disease prevalence and festival impact. Post-winter

seasonal illnesses (respiratory infections, allergies, viral fevers) create **healthcare demand that outweighs the shorter festive disruption of Holi**. Rather than applying uniform festive-season strategies, the hospital should develop **month-specific campaigns that account for disease seasonality.**

3. **Recovery Patterns:** The varying recovery of patient inflow across regions (Figure 5,6 & 7) post-October 2024 indicate that **regional factors (competition, loyalty, referral strength) significantly influence patient retention.** Palwal's strong recovery versus Ballabgarh's continued decline highlights that **proximity alone does not guarantee sustained engagement.**

DEMOGRAPHIC TRENDS (Problem 2):

1. **Adult and Elderly Dominance:** The majority of patients fall within the Young Adult, Adult, and Elders age groups (Figure 8), suggesting strong demand for general and **specialty healthcare services catering to middle-aged and senior populations.** This pattern indicates successful positioning for chronic disease management, lifestyle-related conditions, and geriatric care.
2. **Pediatric Service Gap:** In contrast, very few registrations were observed for Toddlers, Children, and Teenagers. This points toward an **underutilization of Pediatrics and Neonatology** services, signaling a potential area for growth. The low pediatric numbers persist even in Greater Faridabad's immediate vicinity (Figure 9), ruling out distance as a barrier. Instead, this suggests **insufficient awareness of pediatric capabilities, lack of targeted family-oriented marketing, or absence of pediatrician referral networks.**
3. **Gender Balance:** The almost equal number of male and female patients (Figure 10) shows that healthcare access is balanced across genders. This suggests the hospital's **services are inclusive and equally accessible**, helping it build an image as a gender-sensitive provider.

4.2. Recommendations

Based on the insights generated through demographic, spatial and temporal analysis, following recommendations are proposed to Yatharth Super Specialty Hospital, Faridabad for improving outreach services, and increasing revenue:

1. Strengthen Regional Outreach (Problem 1)

- **Target underserved regions** such as Ballabgarh, NIT, Palwal, and Nuh, where patient registrations are comparatively low, by designing region-specific engagement strategies. A one-size-fits-all campaign may not work here, so tailoring outreach efforts to local needs is essential.
- Organize **regular health camps, free screening drives, and mobile OPDs** to build trust and bring healthcare closer to communities with limited access. This will not only increase awareness but also create an early connection between the hospital and potential patients.
- Use **door-to-door health awareness campaigns, community health talks, and local partnerships with NGOs** to strengthen presence at the grassroots level. Leverage local influencers, community leaders, and patient testimonials to build credibility. Over time, these efforts can shift the hospital's image from being primarily sector-based to being a regional healthcare leader.
- Deploy **geographically targeted digital marketing campaigns using social media platforms and Google Ads**. Create location-specific content highlighting success stories, specialist availability, and accessibility features.

2. Enhance Pediatric Engagement (Problem 2)

- The current underrepresentation of Toddler, Child, and Teenager patient groups suggests that **Pediatrics and Neonatology services** are underutilized. To address this, the hospital should invest in awareness and education initiatives that **highlight the availability of advanced pediatric care and child-friendly infrastructure.**

- **Partner with schools, daycare centers, and community centers** to conduct p**ediatric health checkups, vaccination awareness drives, and wellness programs** for parents. Such initiatives would not only increase visibility but also instill confidence in families regarding the hospital's pediatric expertise. Organize **parent education workshops on topics like child nutrition, developmental milestones, common childhood illnesses, and preventive care.**
- Build **strong referral channels with neighborhood pediatric clinics and family doctors** by offering collaborative care models and structured referral benefits. This collaborative approach **ensures continuity of care and builds trust within the medical community.**
- Introduce child-friendly hospital programs, such as **play areas in waiting rooms, storytelling hours, or wellness workshops,** for parents to improve patient experience and foster long-term loyalty among families. Train staff in **child-friendly communication techniques and ensure minimal waiting times** for pediatric appointments.
- Launch **targeted digital campaigns on parenting forums, social media groups, and school WhatsApp groups** emphasizing the hospital's pediatric capabilities, specialist credentials, and success stories.

3. Seasonal Outreach Planning (Problem 1)

- Patient inflow data indicates a clear dip during the festive season. Instead of treating this as a natural decline, the hospital should proactively design campaigns that **align healthcare with festive priorities and anticipate seasonal disease patterns.**
- Introduce **festive-time promotional health checkup packages, family wellness offers, or seasonal disease awareness programs** such as post-monsoon dengue screenings or winter flu prevention drives. These can encourage patients to maintain their healthcare routines despite festivities.
- Adjust **staffing levels, OPD schedules, and promotional activities around festivals to maintain efficiency** and prevent underutilization of resources. For example, extending OPD hours during evenings or weekends in festive months

can cater to patients who are otherwise occupied.

- Beyond festivals, the hospital should also **plan for seasonal illness cycles** (e.g., flu in winters, allergies in spring, or heat-related issues in summer) to **anticipate demand, design timely campaigns, and capture additional patient segments**. Establish **season-specific health packages that bundle relevant tests and consultations**—for example, a "Winter Wellness Package" covering respiratory health, vitamin D testing, and immunity boosting consultation.
- Launch **proactive awareness campaigns 2-3 weeks before peak disease seasons**, educating communities about preventive measures, early warning signs, and available treatments. Consider establishing **"seasonal health clinics"** with extended hours during epidemic peaks (e.g., dengue season) to manage surge capacity efficiently.

4. Referral and Networking Programs (Problem 1 & 2)

- **Strengthen relationships with local doctors, nursing homes, and clinics** by building a structured referral ecosystem. Offering formalized referral programs, professional recognition, and revenue-sharing models can incentivize long-term partnerships.
- Conduct **CME (Continuing Medical Education) workshops and joint conferences with community doctors** to build trust and position Yatharth as a collaborative center of excellence rather than a competitor. Create a **"referring physician portal"** where local doctors can **track their referred patients' progress, access reports, and communicate with specialists.**
- **Establish digital referral platforms or mobile apps** where local practitioners can quickly connect their patients to hospital specialists. This not only streamlines the process but also ensures continuity of care. The platform should enable **seamless sharing of patient history, diagnostic reports, and treatment summaries.**

5. Continuous Monitoring and Analysis (Problem 1 & 2)

- Implement a **robust patient data monitoring system** to track monthly inflows, service-wise utilization, and demographic participation. This real-time analysis will allow the hospital to **identify emerging gaps early and adapt strategies dynamically**.
- Establish a **dashboard-based reporting system** accessible to management, displaying key performance indicators such as patient registration trends, department-wise utilization, regional contribution percentages, demographic mix, and campaign effectiveness metrics.
- Conduct **quarterly strategic reviews involving key departments** (Pediatrics, General Medicine, Specialty Clinics) to evaluate outreach effectiveness and refine initiatives. These reviews should include **identification of emerging patient needs and adjustment of resource allocation based on performance data.**
- Leverage **advanced data analytics tools** to monitor not only patient numbers but also referral success rates, seasonal campaign impact, geographical growth and revenue per patient category. Implement **predictive analytics to forecast demand surges, identify potential service gaps** before they become critical, and **optimize inventory management** for medicines and consumables.

5. Conclusion

The comprehensive analysis of patient registration data from Yatharth Super Specialty Hospital, Faridabad has revealed valuable insights into spatial, demographic and temporal patterns that can guide strategic decision-making.

The hospital demonstrates strong performance in its immediate catchment area (Greater Faridabad) while significant opportunities exist in underserved regions like Ballabgarh, Palwal, and Old Faridabad. The identification of seasonal fluctuations, particularly the October festive dip and March recovery driven by disease cycles, enables proactive resource planning and targeted marketing interventions. The Age-Gender analysis reveals the underutilization of Pediatric and Female child care. Gender-specific gaps in elderly women and female children highlight the need for inclusive, culturally sensitive outreach programs.

By implementing the recommended steps, such as strengthening regional outreach, enhancing pediatric engagement, seasonal campaign planning, building referral networks and establishing continuous monitoring systems, the hospital can significantly expand the patient base, improve service accessibility, and drive sustainable revenue growth.

Ultimately, this project demonstrates that data-driven healthcare planning provides better understanding of the needs of the community, optimize resources allocation and design targeted strategies to improve the outreach to the underserved population.