# A Study to Identify the Geographic Source of Inpatients Using Geotagging and Visual Maps at Manipal Hospitals, Jaipur


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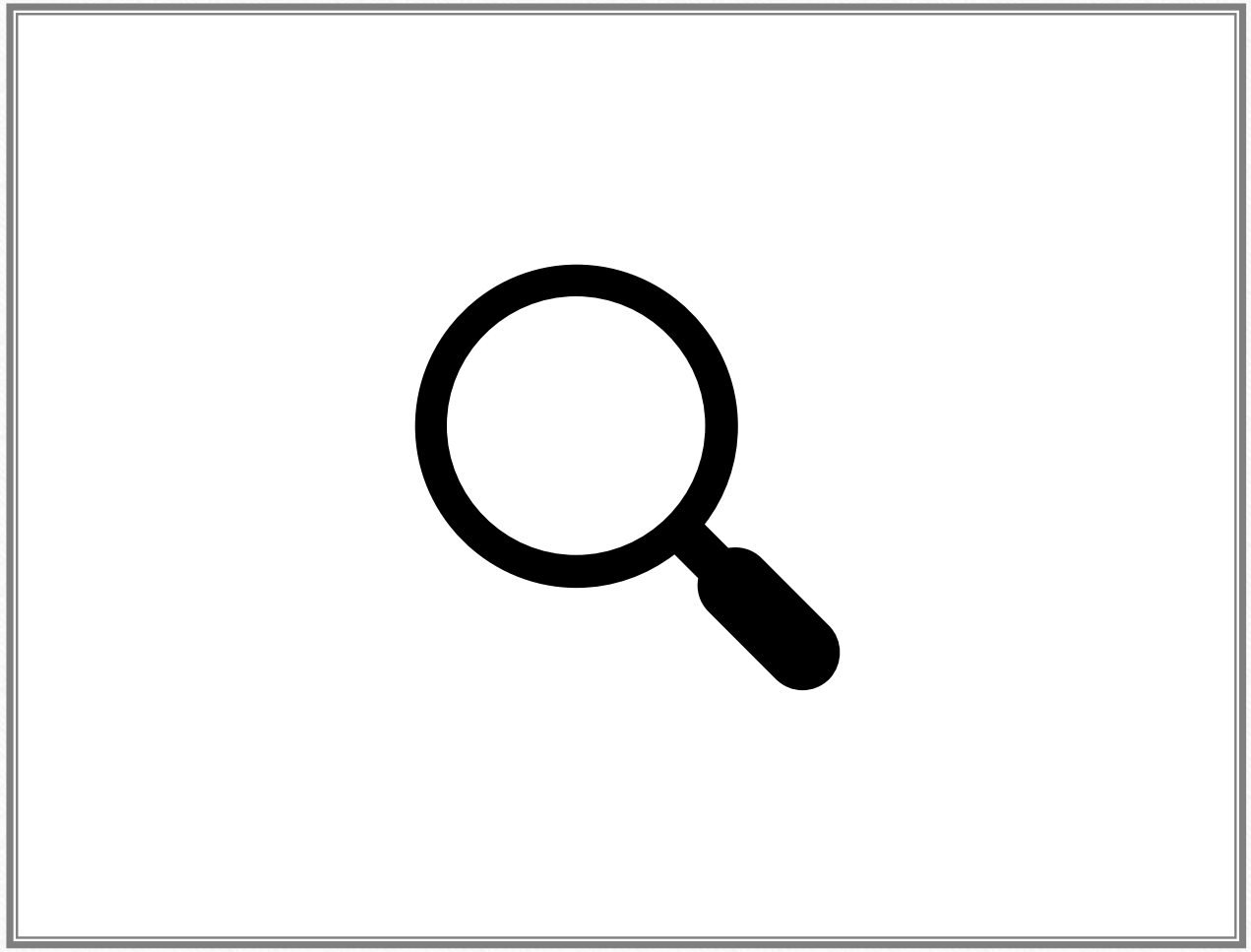
# Introduction

- Geographic, spatial and visual methods have been widely used to study and understand healthcare utilization patterns and health service availability.
- Identification of geographical patterns provides interesting and meaningful insights into the service population and could be of major use in other fields of the health industry.
- With their ability to represent disparities in the demographic and health characteristics of a population, a great opportunity lies in their everyday use in various health facilities.

- A functional and maintained Geographic information system (GIS) that uses Geotagging and Visual Mapping can be utilized as a tool to detect geographic segments or clusters within a market area from which varying proportion of businesses are obtained as well as planning for service deployment.
- Such a GIS would effectively give information regarding a health-care institution's actual catchment area, which would aid in performing further important analyses.

## Rationale

- The inpatient care services provided by a hospital brings in a huge chunk of the hospital revenue. Hospital Managers are required to continuously look for opportunities for growth and expansion.
- Urban tertiary care hospitals are rightfully expected to serve their immediate neighborhoods/vicinity and to address the various disparities in access to specialty care and services.
- Keeping that in mind, the geographic dispersion of inpatients was examined to get a better idea with regards to the service area of Manipal Hospital, a tertiary care hospital situated in an urban center.



## Research Question

- What is the geographic source of patients undergoing inpatient care at Manipal Hospitals, Jaipur?

## Aim

- The aim of the study is to determine the extent and nature of the hospital service area for inpatient care at Manipal Hospitals, Jaipur.

## Research Objectives

- To determine zone-wise geographic distribution of inpatients at Manipal Hospitals, Jaipur.
- To determine the distribution of inpatient specialties served in each zone at Manipal Hospitals, Jaipur.
- To analyze overall trend of inpatient footfall at Manipal Hospitals, Jaipur.
- To illustrate the use and significance of Geotagging and Visual Maps for identifying highly served and underserved regions for inpatient care at Manipal Hospitals, Jaipur.
- To provide recommendations for increasing inpatient footfall in the future on the basis of geographical data at Manipal Hospitals, Jaipur.

# Research Methodology

## Study Design

- This was a retrospective, descriptive type of study conducted with an aim of determining the nature and strength of the hospital service area for inpatient care at Manipal Hospitals, Jaipur.

## Study Period

- The study was conducted during 10th February 2020 – 9h May 2020, during which secondary data was recorded.

## Type of Research

- Qualitative type of study for geographic source identification as each patients' geographic area was determined.

## Sources of Data

- Secondary Data included the hospital information system (HIS) and data collected by the internet's various data source sites like research gate, google scholar, PubMed, etc. for the review of literature.

# Rationale

- Total sample size for the study was 3482. Total number of patients that were admitted in the hospital between September 2019 - February 2020 were considered in the study. These were as follows :

| MONTH | NO. OF PATIENTS ADMITTED (n) |
|---|---|
| SEPTEMBER | 654 |
| OCTOBER | 579 |
| NOVEMBER | 693 |
| DECEMBER | 548 |
| JANUARY | 520 |
| FEBRUARY | 488 |

| Zone | Distance from Hospital |
|---|---|
| Zone A | Within 5 Kms. |
| Zone B | 5-15 Kms. |
| Zone C | 15-25 Kms |
| Outside | Beyond 25 Kms |

## Data Collection

- For clustering of inpatients which would represent a unique geographical area, zoning was performed on the basis of distance of patient residence (in km.) from the hospital. Patient details such as Patient MRN No., Age, Gender, Area, Department, etc. were recorded from the HIS.

## Sampling

- Complete enumeration, as all the discharges which fulfilled the inclusion criteria were taken into consideration.

## Inclusion Criteria and Exclusion Criteria

- With respect to the Inclusion Criteria, Only Non-scheme patients admitted to the hospital in various wards and patient rooms were included . In exclusion criteria, Scheme inpatients were not included. Also, patients whose local residence information was not available on HMIS were excluded from the study.

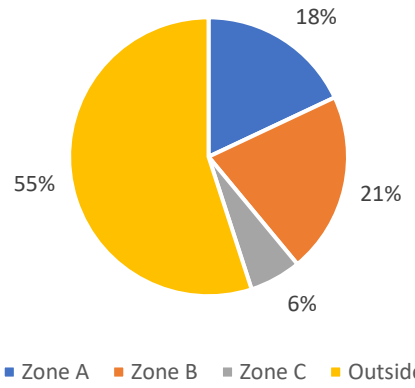
# Results

## Overall Analysis

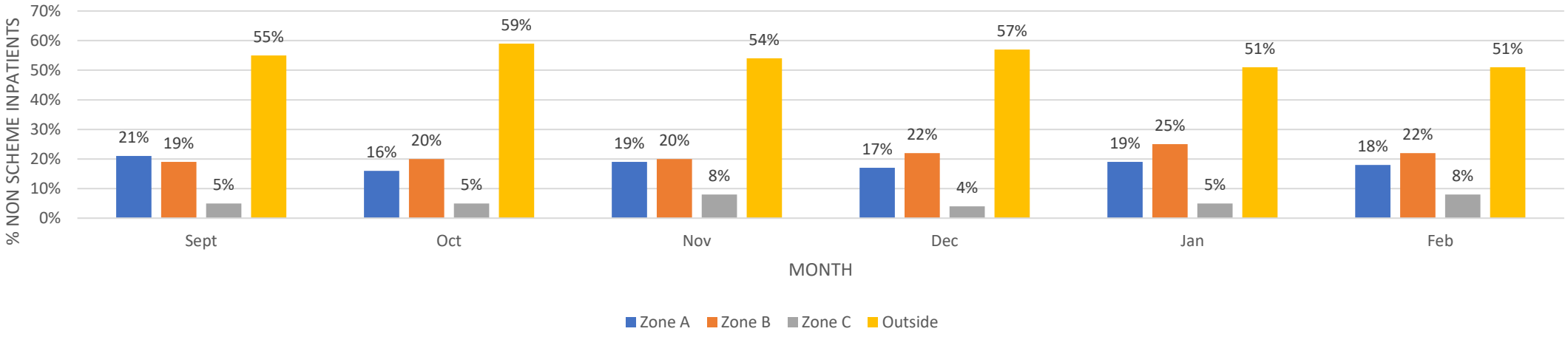
The number of patients availing inpatient care services had remained fairly consistent. However, there was a slight decrease in the number of Non scheme patients for the same.

| Month | Total Inpatients | Total Non-scheme Inpatients | % Non- scheme Inpatients | Total Non- Scheme Plot | Total Non- Scheme Inpatients Jaipur (Zone A+B +C) | % Non- Scheme Inpatients Jaipur (Zone A+B+C) |
|---|---|---|---|---|---|---|
| Sept | 1575 | 659 | 42% | 654 | 293 | 45% |
| Oct | 1527 | 580 | 38% | 579 | 238 | 42% |
| Nov | 1580 | 696 | 44% | 693 | 322 | 46% |
| Dec | 1417 | 550 | 39% | 548 | 233 | 43% |
| Jan | 1438 | 520 | 36% | 520 | 253 | 49% |
| Feb | 1421 | 492 | 35% | 488 | 236 | 48% |

## OVERALL ZONE WISE INPATIENTS



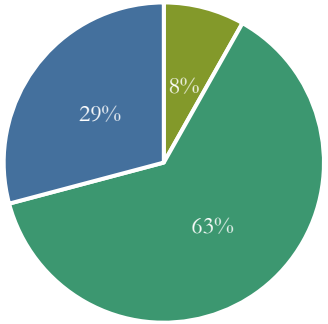

## MONTHLY INPATIENT TREND FOR NON SCHEME PATIENTS



# Zone Wise Analysis

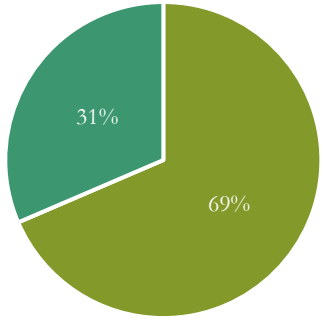
## Zone A

### AGE WISE



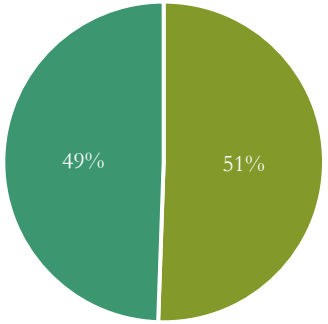

■ <18 ■ 18-64 ■ 65+

### ADMISSION WISE



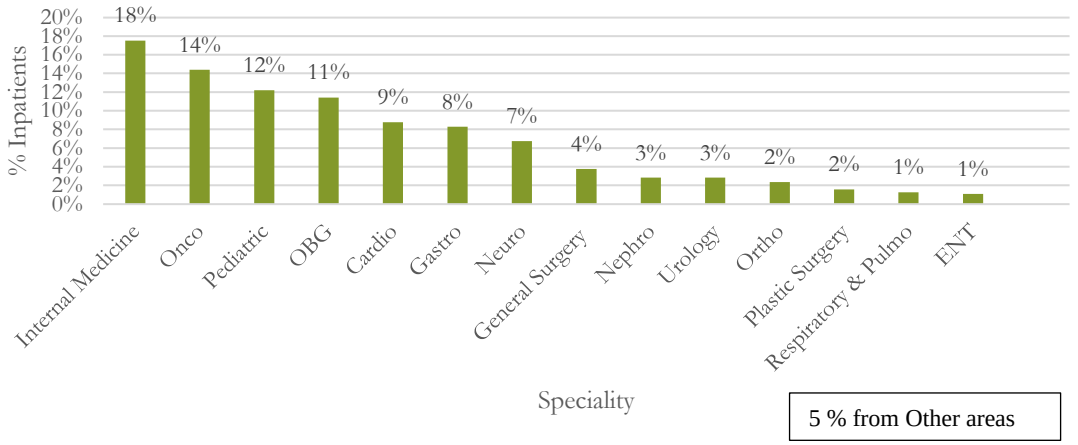

■ Medical ■ Surgical

### SEX WISE



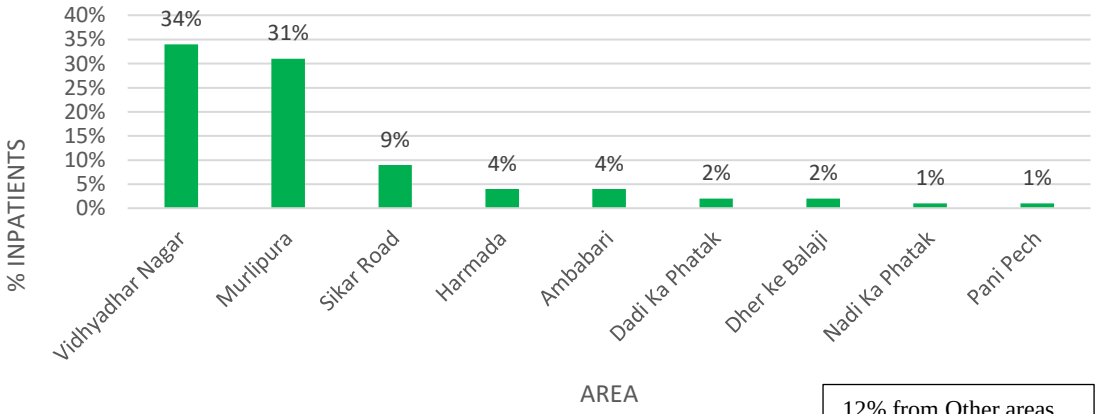

■ Male ■ Female

### SPECIALITY WISE



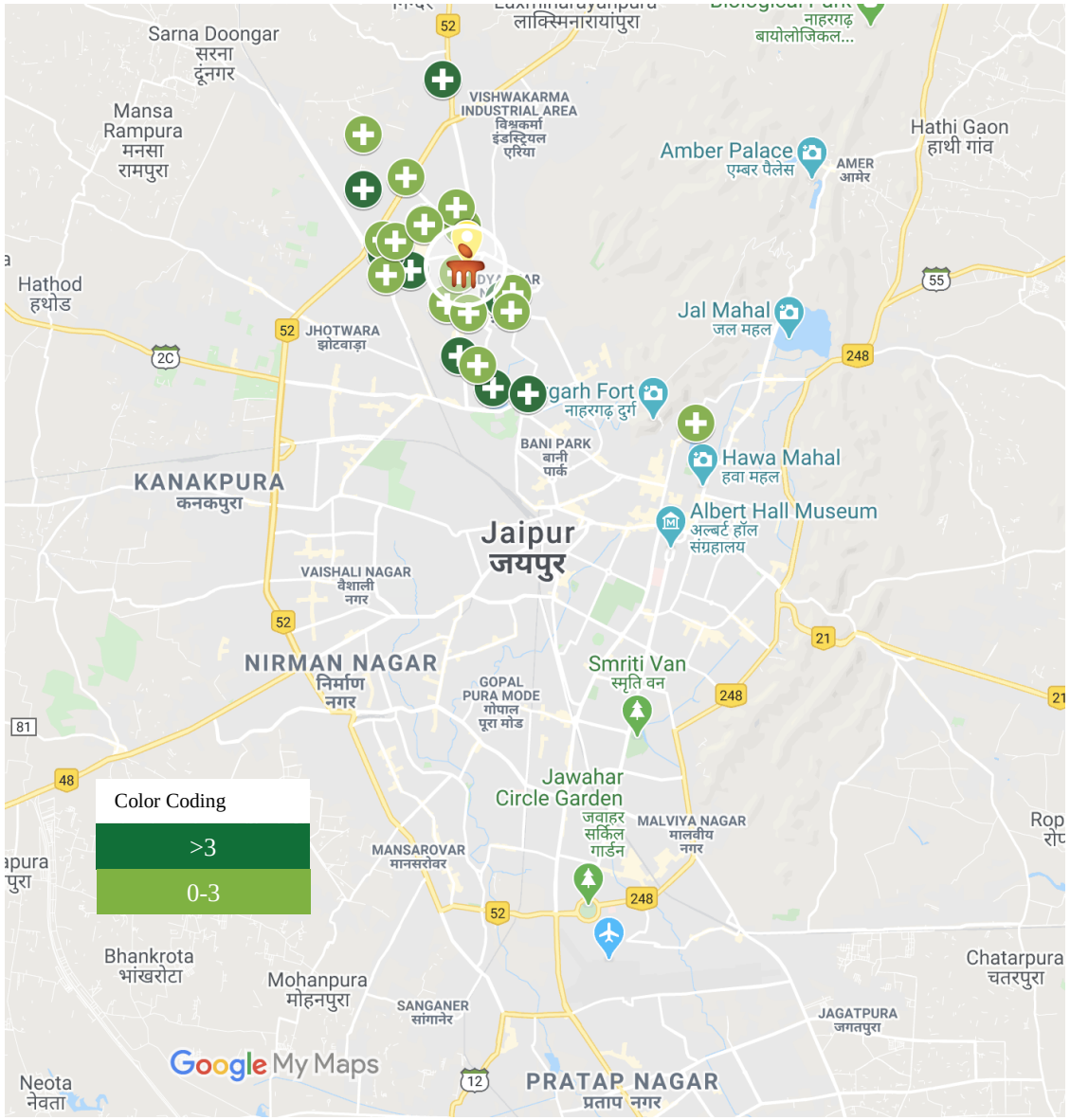

5 % from Other areas

### GEOGRAPHICAL AREA DISTRIBUTION (ZONE A)



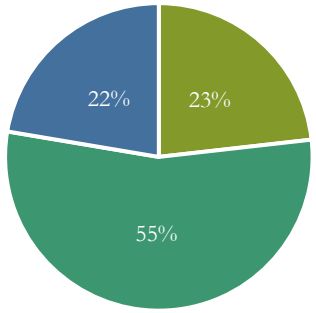

12% from Other areas

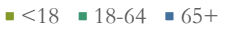
# Geotagging (Zone A)



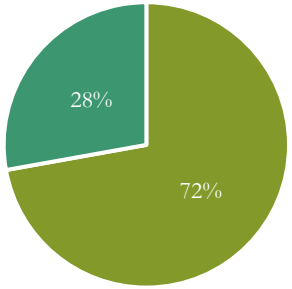
# Zone B

## AGE WISE



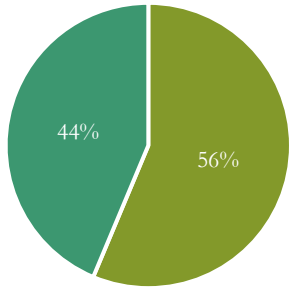




## ADMISSION WISE



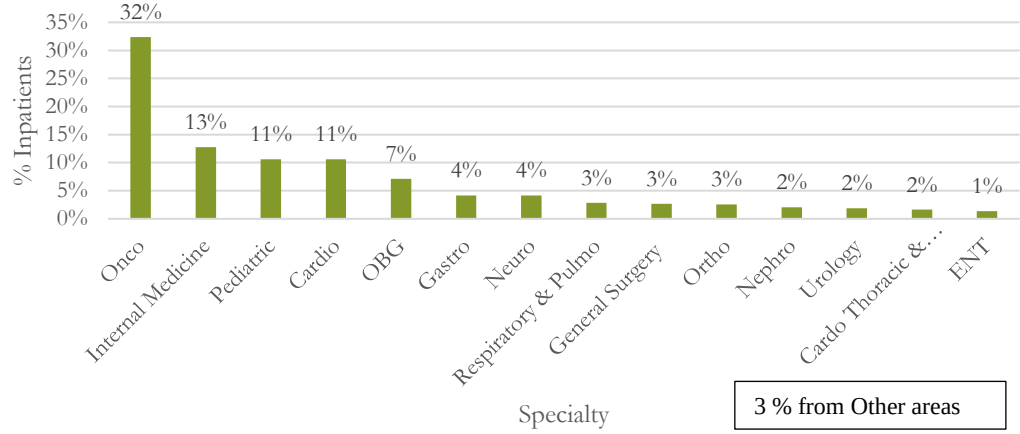


## SEX WISE



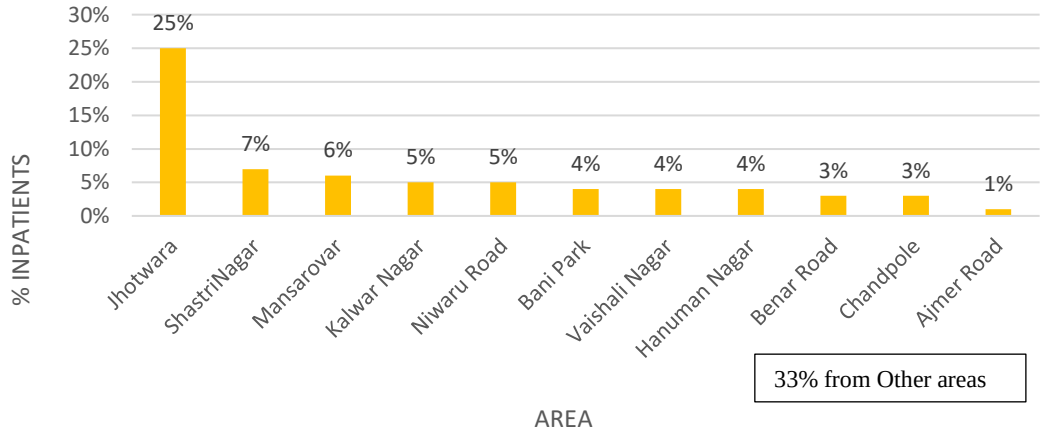


## SPECIALTY WISE



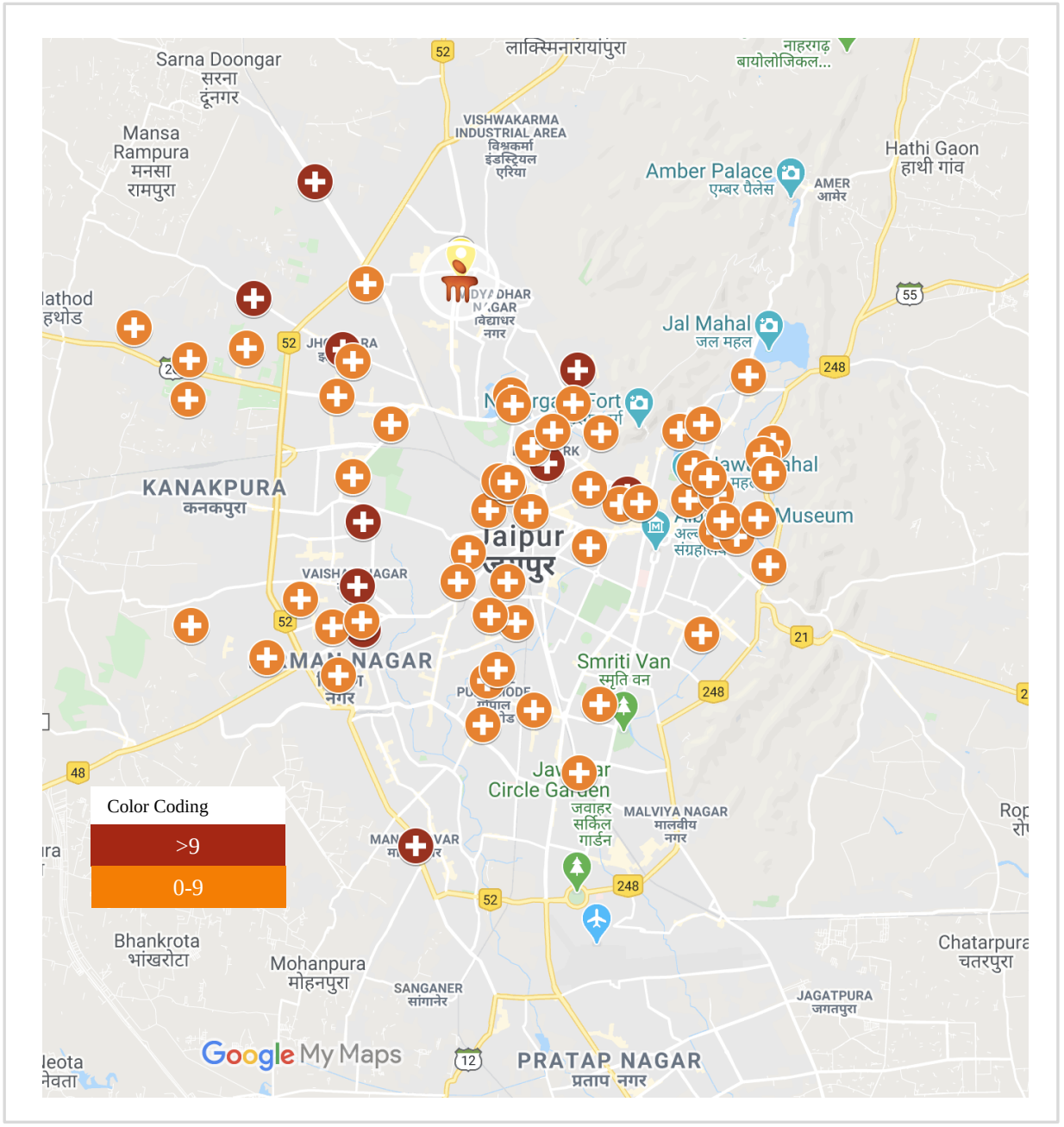

3 % from Other areas

## GEOGRAPHIC AREA DISTRIBUTION (ZONE B)



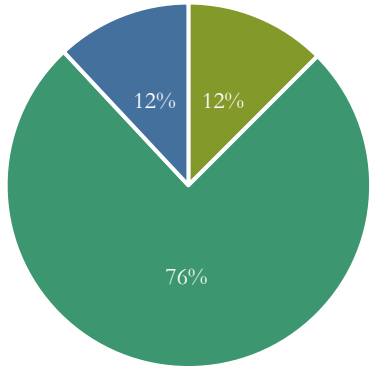

33% from Other areas

# Geotagging (Zone B)

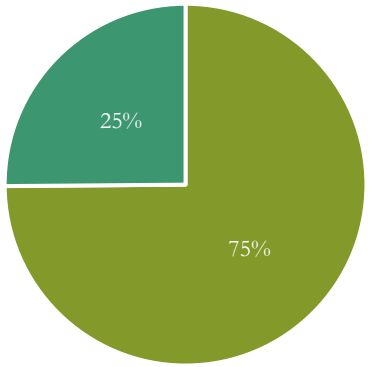


# Zone C

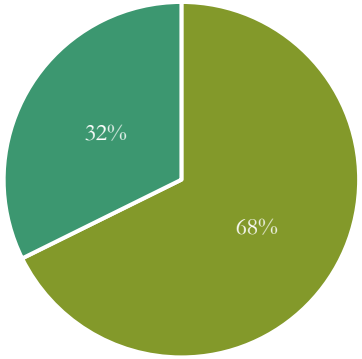
## AGE WISE



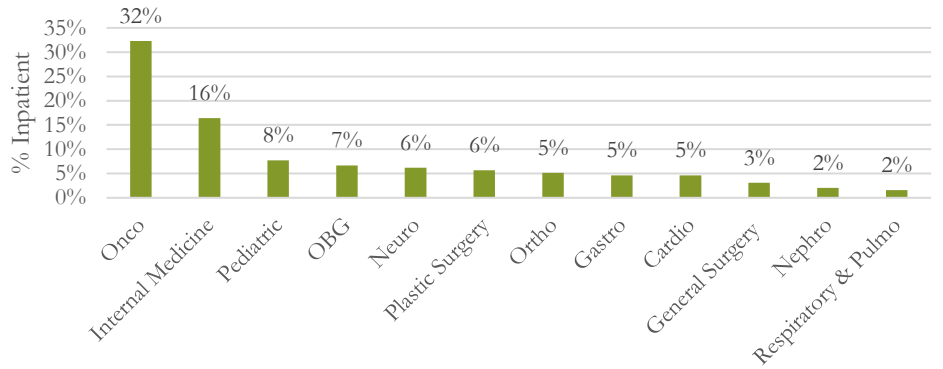

## ADMISSION WISE




## SEX WISE

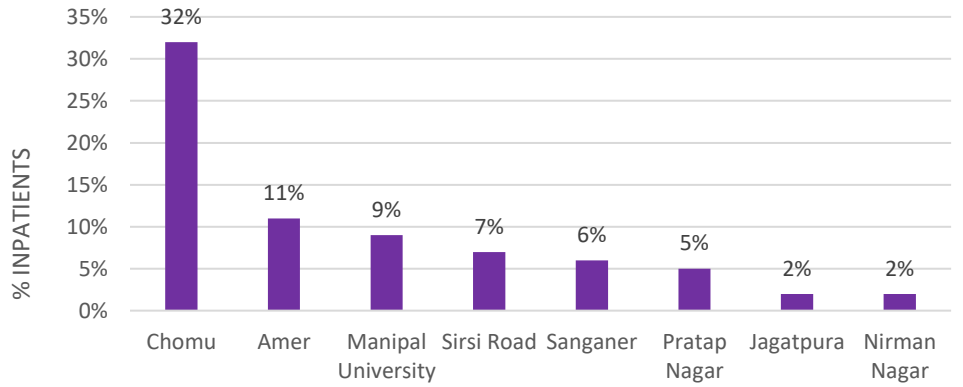



## SPECIALTY WISE




4 % from Other areas

## GEOGRAPHIC AREA DISTRIBUTION (ZONE C)

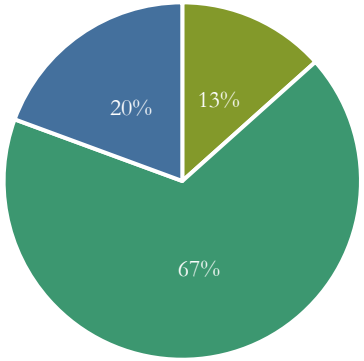



26% from Other areas

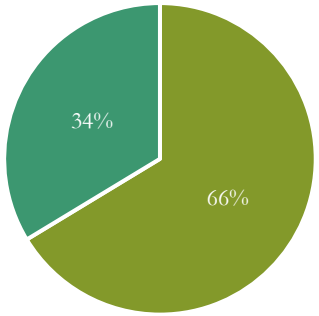
# Geotagging (Zone C)

# Outside

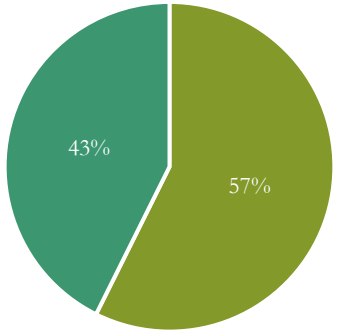
## AGE WISE



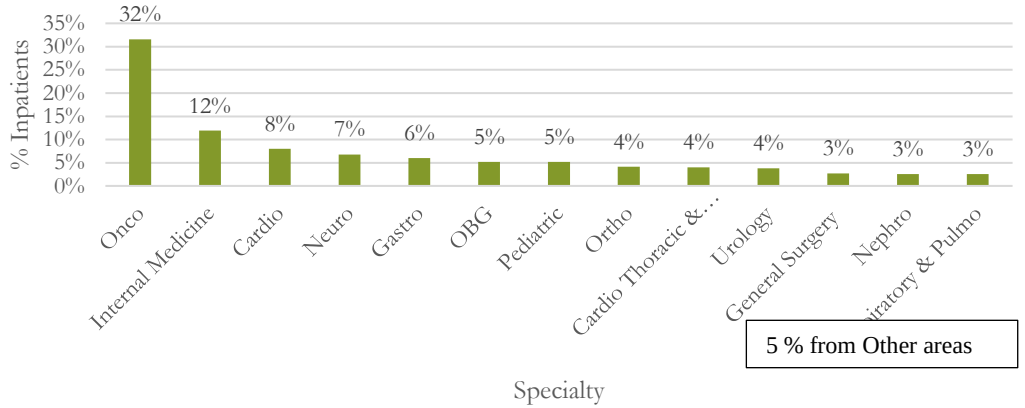

## ADMISSION WISE




## SEX WISE

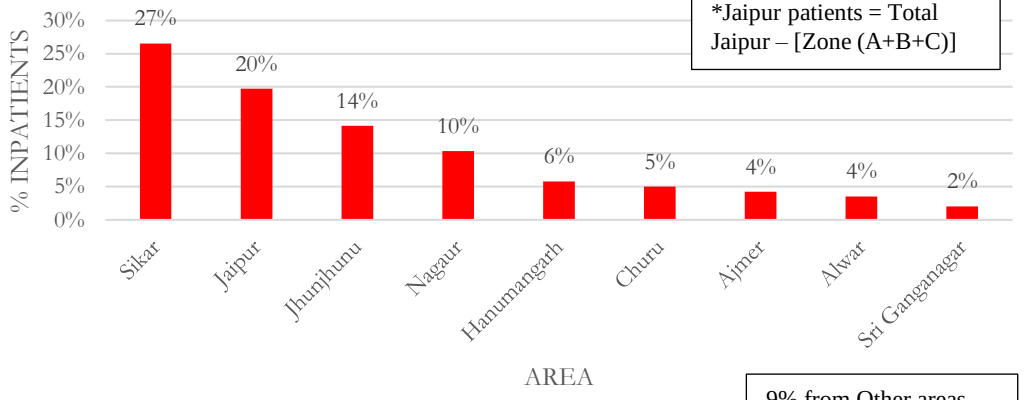



## SPECIALTY




5 % from Other areas

## GEOGRAPHIC AREA DISTRIBUTION (RAJASTHAN)

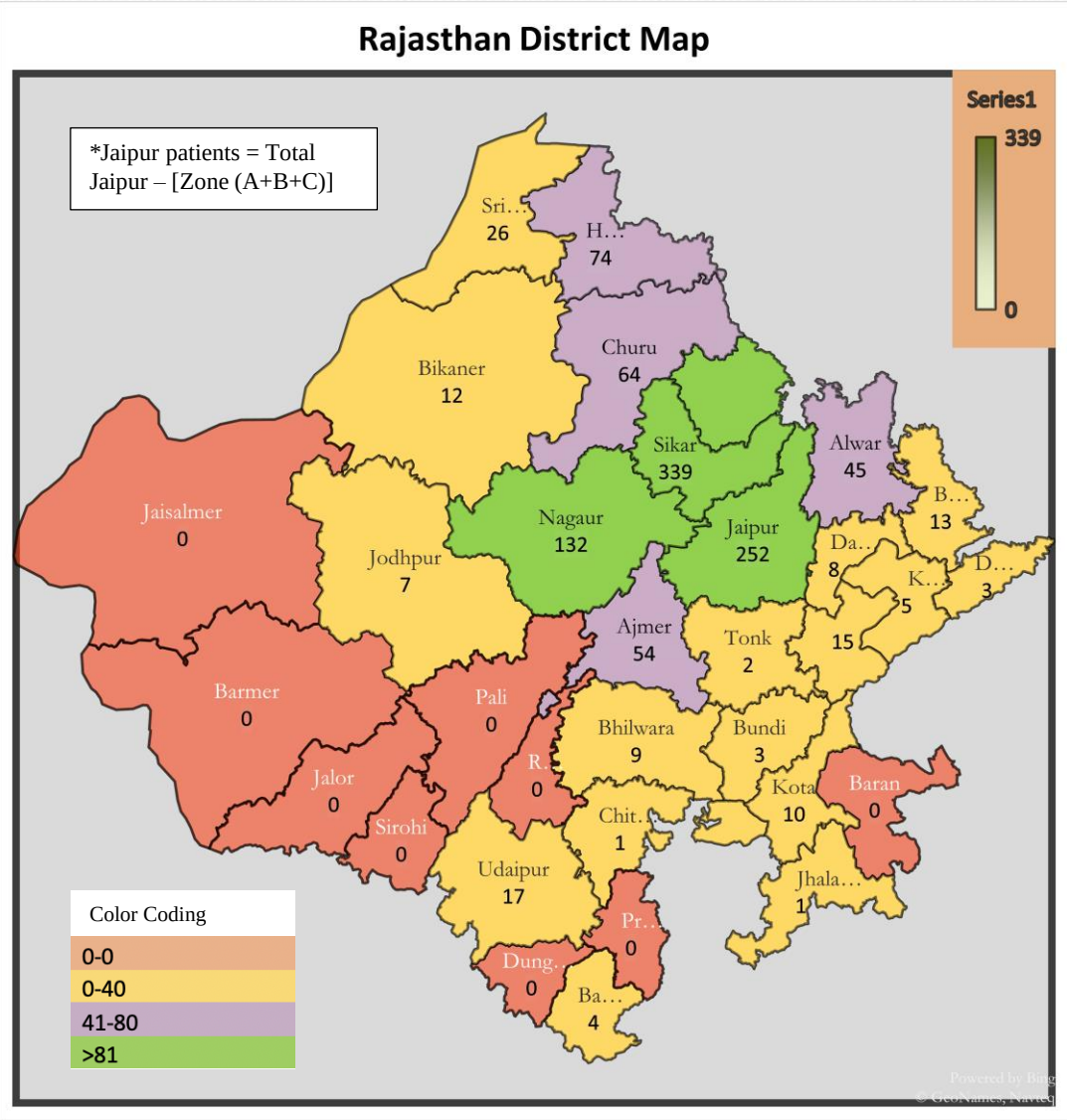


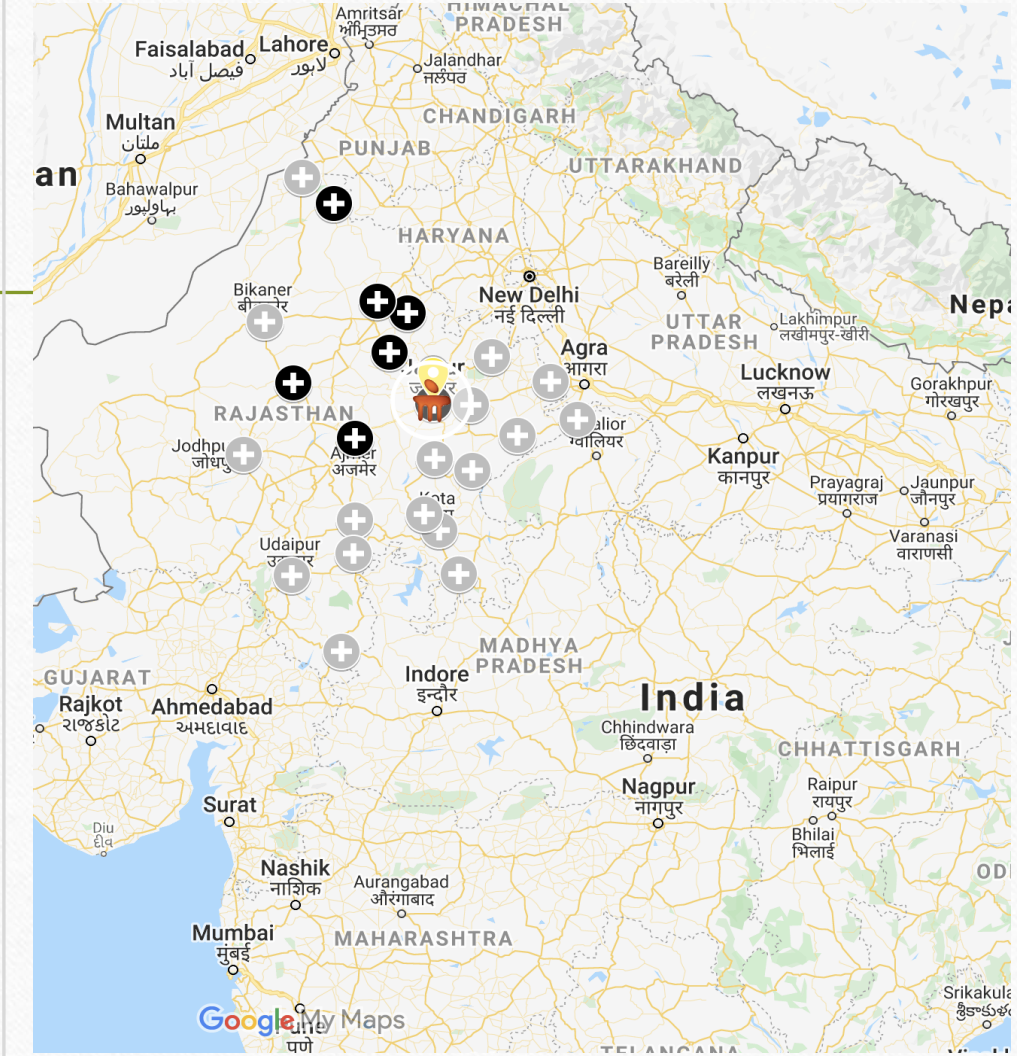

*Jaipur patients = Total Jaipur – [Zone (A+B+C)]

9% from Other areas

# Rajasthan Map

# Geotagging (Outside)



# Findings

- Results confirmed the expected outcome that the major portion of inpatients was drawn from areas surrounding the hospital, although these areas themselves diversified in reach on the basis of the demographics of the population or the specialties that were availed. There was a slight decrease in the overall inpatient footfall trend to the hospital along with decrease in the ratio of Non-scheme patients.

- Clusters or Zones were identified on the basis of distance (in km.) from the hospital. The highest number came from Outside, while Zone B accounted for highest number of inpatients among nearby areas while the monthly trend remained fairly consistent indicating similar clusters.

- Zone Specific Analysis extracted unique details regarding demographics, specialty, and area-wise density
- In Zone A, the inpatients of the age group 18-64 formed the highest consumer group, where rate of admission was surgery was high with an equal representation of both males and females. Internal Medicine department accounted for the highest number of patients served, forming patient clusters which could be identified easily via Geotagging.
- In Zone B and C, yet again the age group 18-64 was the major user, but with increased participation of other groups in Zone B. Planned admissions for Medical treatment were more in number than admissions for surgeries, especially in Zone C. Oncology inpatient services were the most utilized in both zones.

- Outside analysis gave interesting results regarding the reach of hospital inpatient services. Jaipur, being the location area of the facility recruited maximum patients but the Visual Map for geographic distribution of inpatients within Rajasthan showed a healthy inpatient inflow from surrounding areas such as Sikar, Nagaur and Jhunjhunu which indicates further analysis could help in identifying catchment areas outside Rajasthan as well.

# Conclusion

- In summary, mapping of patients availing inpatient services provides an illustrative mechanism for visualizing inpatient service patterns. Analysis via Geotagging and Visual Maps adds another layer of understanding to the distribution of patients admitted to the hospital.
- Using these tools, the study was able to identify and define various zones centering around the location of the hospital for all inpatients and many subgroups. Also, this analysis may facilitate us to increase our understanding of patient behavior, especially as we reach out to special groups such as minority, female, and young or elderly populations.

# Recommendations

- **Make Patient source of origin based geographic distribution and demographic analysis part of hospital operations analysis.** A monthly geographic distribution and demographic analysis could be performed for overall hospital services as well as for different service lines – OPD, IPD, Home Care, etc. This will enable hospital administrators to identify trends in patient service-seeking behavior, quality and effectiveness of services, etc.
- **Use of Mapping tools and spatial statistics for continuously monitoring the facility's catchment area.** Tools such as Geotagging and Visual Maps to be made use of for identifying hospital's reach locally as well as beyond borders.

- **Analyzing trends in Marketing.** Patient source of origin studies provide a visible avenue for evaluating the orientation and directional dispersion of customers. The methods suggested in the study can be used to convert small patient clusters into well-defined market areas. Further recommended use for marketing includes:

  - Determination market potentials
  - Pinpointing of various promotional efforts
  - Interpretation of variations in sales penetration
  - Determination of sales territories
  - Evaluation of the location for new facilities
  - Analyzing differences in promotional response

- **Craft an awareness stage content strategy for under-serviced areas.** For areas of with low inpatient share (Dausa, Alwar, Tonk, etc.), a content strategy should be developed for promoting IPD services which would include SEO, Social Media, etc.

- **Market Penetration of highly-services areas.** For areas already attracting patients to the hospital for IPD care (Jhotwara, Murlipura, etc.), target customers on the basis Zone wise demographics. For example, in Jhotwara area, Oncology services could be marketed to Males of the age group 18-64 years.

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# THANK YOU