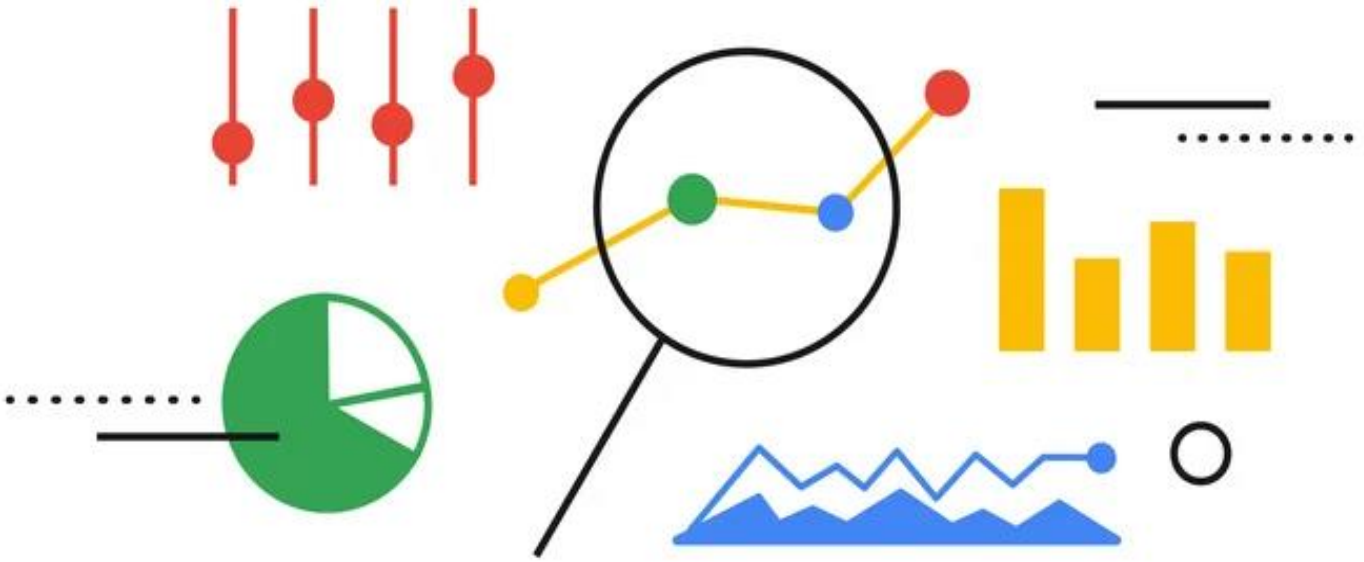

Indian Institute of Technology, Madras

BSMS2001P: BDM Capstone Project

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Final Submission

Analysing Patient Demographics and Characteristics

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1. Executive Summary:

Joga Gani Raju Hospital is a medium-sized private hospital, started by Mr. Joga Veera Balaji (M.D. General Medicine) in early 2020, the key founder of these hospital. The main goal of the proposed capstone is centered around the objective to understand the different characteristics of the patients, optimize the functionalities and enhancing the marketing strategies that increase the growth of the respective hospital.

The primary goal of our capstone project will be to increase patient walk-ins, optimize functionalities and to determine the effective walk-in time of the patient to manage the flow. To achieve this, the project will entail as in-depth analysis of the patient demographics and characteristics over the course of three months. Observing the gaps and improvement of areas in the current strategy will be a critical aspect of this project. The report will also include analysis of the admission details to identify patterns and trends in the patient walk-ins. This analysis will allow us to identify the average length of stay of different categories of the patient, enabling us to understand the accommodation availability and to improve the infrastructure facilities in the hospital leading to increase in patient walk-ins.

To effectively analyze the patient admission details data and to make informed business decisions, I will be using various Excel tools such as pivot tables, graphs etc. that can provide valuable graphical representations. Excel tools enable a visual representation of the patient demographics, making it easier to identify trends, patterns, and key insights. By analysing the different characteristics of patients using the Excel tools, recommendations, marketing strategy and data-driven decisions to optimize functionalities can be formulated.

2. Detailed Explanation of Analysis Process/Method:

2.1 : Data Analysis on Age Distribution

MS Excel is the main tool which will be used for the analysis as mentioned. The age attribute is stored along with other variables from Joga Gani Raju Hospital over a period of 3 months. This raw data is then entered into excel sheet and performed some basic data pre-processing tasks such as imputing, typing errors, sorting etc... are done.

- The pre-processed age column has a total of 3148 rows where each row represent unique patient age like (24,67,45 etc…) on the given day.
- Using "Age" column for the 3 months, divide it into different age groups like 1 to 10, 11 to 20, 21 to 30 etc... and calculated the frequency for each age group bin. For the generation of these age group table, I used Histogram analysis tool in Data Analysis.

Age	*Frequency*
1 to 10	33
11 to 20	270
21 to 30	606
31 to 40	735
41 to 50	655
51 to 60	470
61 to 70	287
71 to 80	88
81 to 90	4

Fig 2.1.1 Table of Age Groups

2.2 : Data Analysis on Patient Walk-ins

- Using patient "Appointment_date" column, which represents the unique patient walk-in to the hospital in a given day. In data pre-processing step convert appointment dates into a standardized format for consistency.
- With excel functions, extracted additional features such as day of the week, month etc., from the appointment date for deeper analysis.
- Using TEXT function in excel, extracted the day of the week column into patient data.

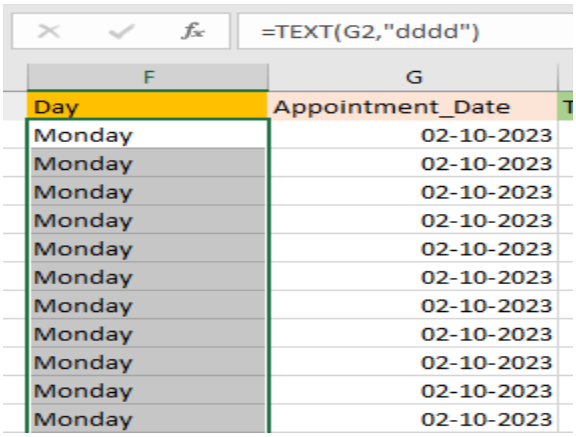

Fig 2.2.1 Table of Day Column

- Again, with same function extracted month and year columns into patient data in abbreviated form.

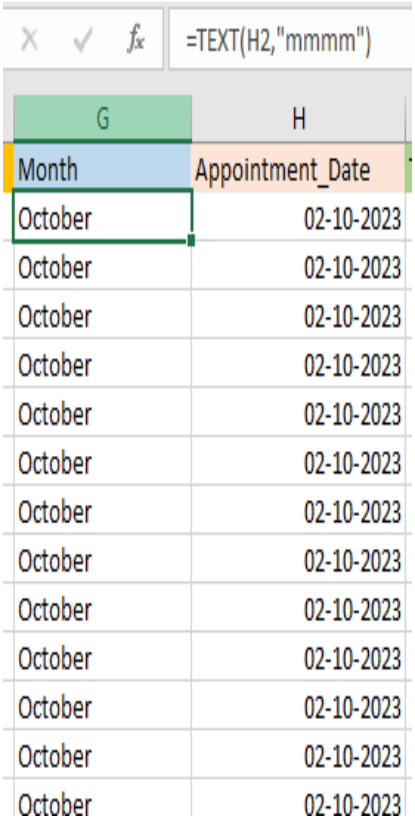

Fig 2.2.2 Table on Month

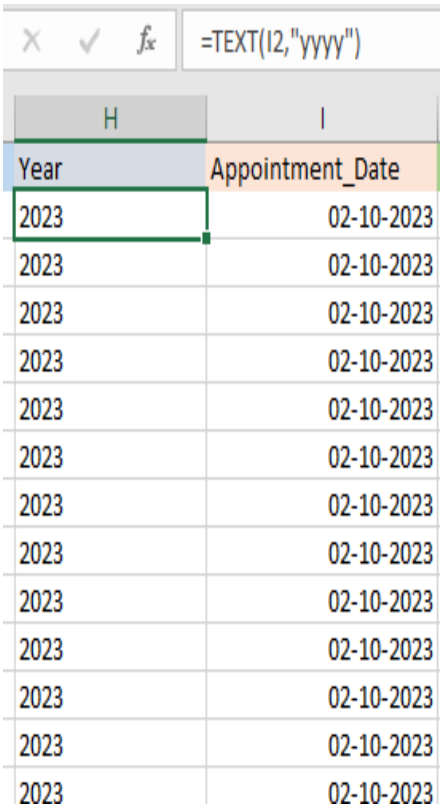

Fig 2.2.3 Table o Year

2.3: Analysis on Patient Gender Category

- The “Gender” attribute column in patient data represents the gender (Male or Female) for each walk-in patient into the hospital. Performed the basic pre-processing steps like missing values, typing errors etc…
- Using the COUNTIF function in excel, calculated the frequency for each gender category and arranged it in a table format

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Patient_ID	Gender
143244	Female
134151	Female
138038	Female
135914	Male
142401	Female
143269	Female
141995	Female
143271	Female
143187	Male
127477	Female

Fig 2.3.1 Table on Gender

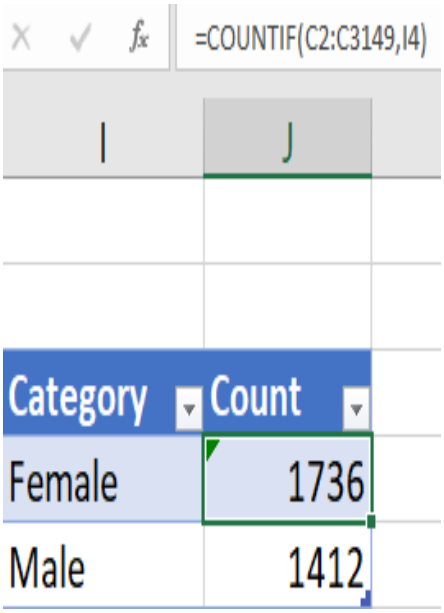


Fig 2.3.2 Table on Gender Count

2.4 : Patient Peak Flow Analysis

- The “Time” attribute column in patient data represents the timestamp of patient walk-in into the hospital on the given day. Performed some data pre-processing steps like missing values, typing errors etc…
- Using the COUNTIF function in excel, calculated the frequency for each time range and arranged it in a tabular format

Patient_ID	Time
143244	09:15:00
134151	09:18:00
138038	09:23:00
135914	09:28:00
142401	09:30:00
143269	09:35:00
141995	09:38:00
143271	09:42:00
143187	09:45:00
127477	09:50:00

Fig 2.4.1 Table on Time Column

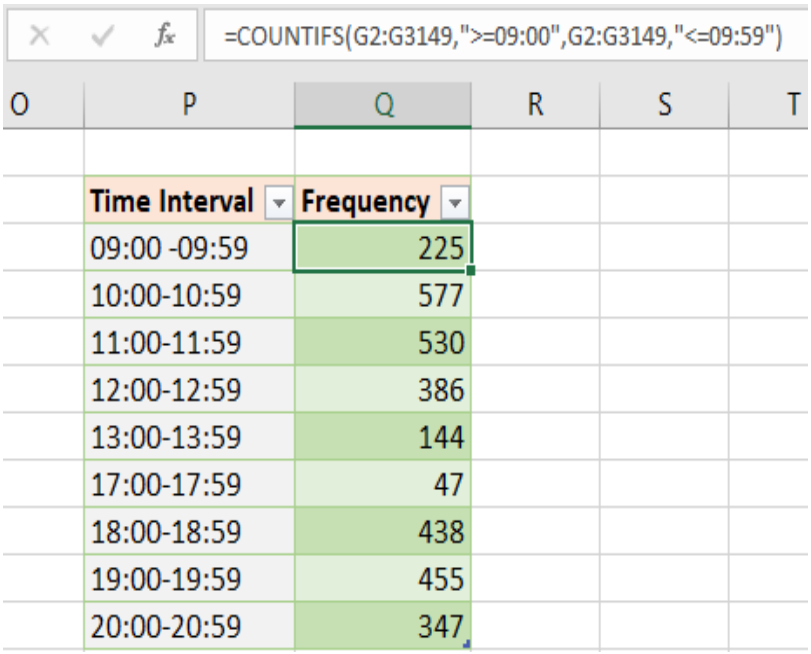


Fig 2.4.1 Table on Different Time Range with Count

2.5 : Analysis on Patient Length_of_Stay

- Using both "Admission_Date" and "Discharge_Date" attributes from Patient Admissions data, the additional attribute "Length_of_Stay" is extracted. This attribute represents the number of days a patient stayed in the hospital to get recovery from the problem.
- The average length_of_stay can be calculated using the length_of_stay attribute.

=ROUNDUP(AVERAGE(D3:D367),0)

B	C	D	E	F	G	H	I
Patient Admissions							
Admission_Date	Discharge_Date	Length_of_Stay					
02-10-2023	03-10-2023	1					
02-10-2023	03-10-2023	1					
02-10-2023	07-10-2023	5					
02-10-2023	03-10-2023	1					
02-10-2023	03-10-2023	1					
02-10-2023	05-10-2023	3					
02-10-2023	06-10-2023	4					
02-10-2023	06-10-2023	4					
02-10-2023	03-10-2023	1		*Average Length_of_Stay =*			4
02-10-2023	05-10-2023	3					
02-10-2023	04-10-2023	2					
03-10-2023	07-10-2023	4					

Fig 2.5.1 Table of Total Average Length of Stay

3. Results and Findings:

3.1 : Volume Analysis (Walk-ins)

The below graph is generated for the number of patients visited the hospital by day of a week for the 3 months.

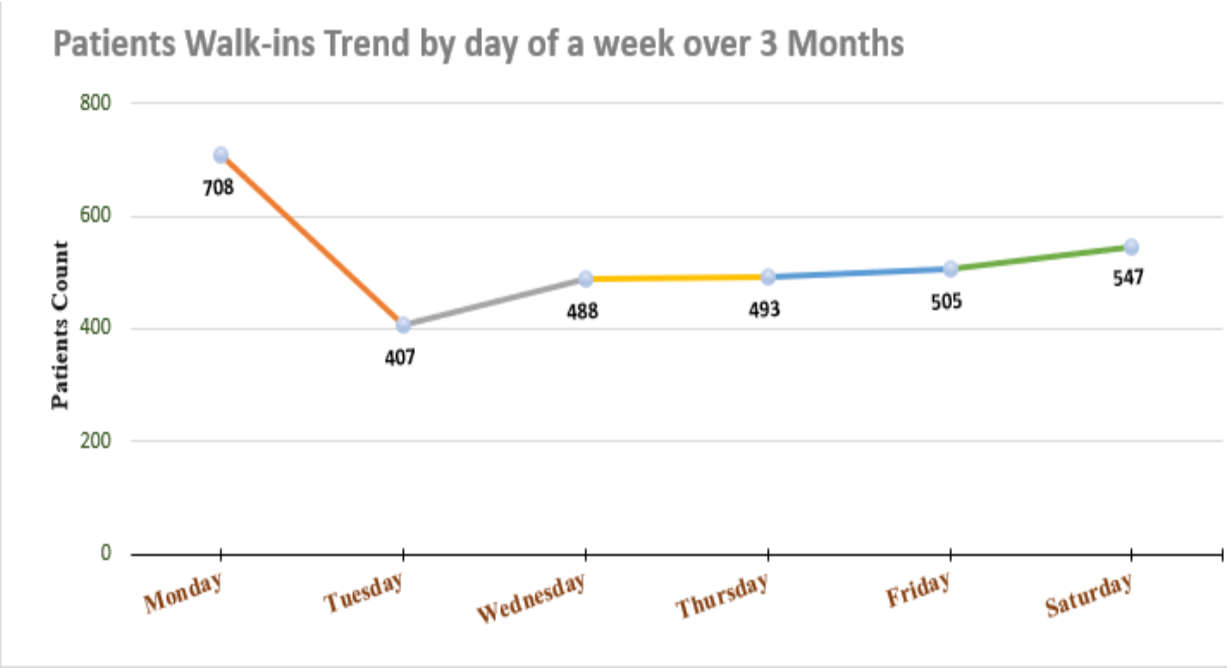


Fig. 3.1.1 Patient Walk-ins by day of a week

- The above analysis shows that Monday and Saturday of a week for the 3 months are highest number of patient walk-ins generating days.

- The maximum number of patient walk-ins on Monday are about 708, Whereas on Saturday is about 547.
- While it can also be observed that in middle of days the number of patient walk-ins are similar.
- The analysis shows that, the minimum number of patient walk-ins on Tuesday is about 407, which is least compared to other working day of the hospital.
- The potential reasons for this trend might include seeking medical attention during their first available opportunity, accumulated health issues over the weekend, or clinic operation hours.

To analyze the total number of patients visited the hospital over each month, the below bar graph is helpful to visualize.

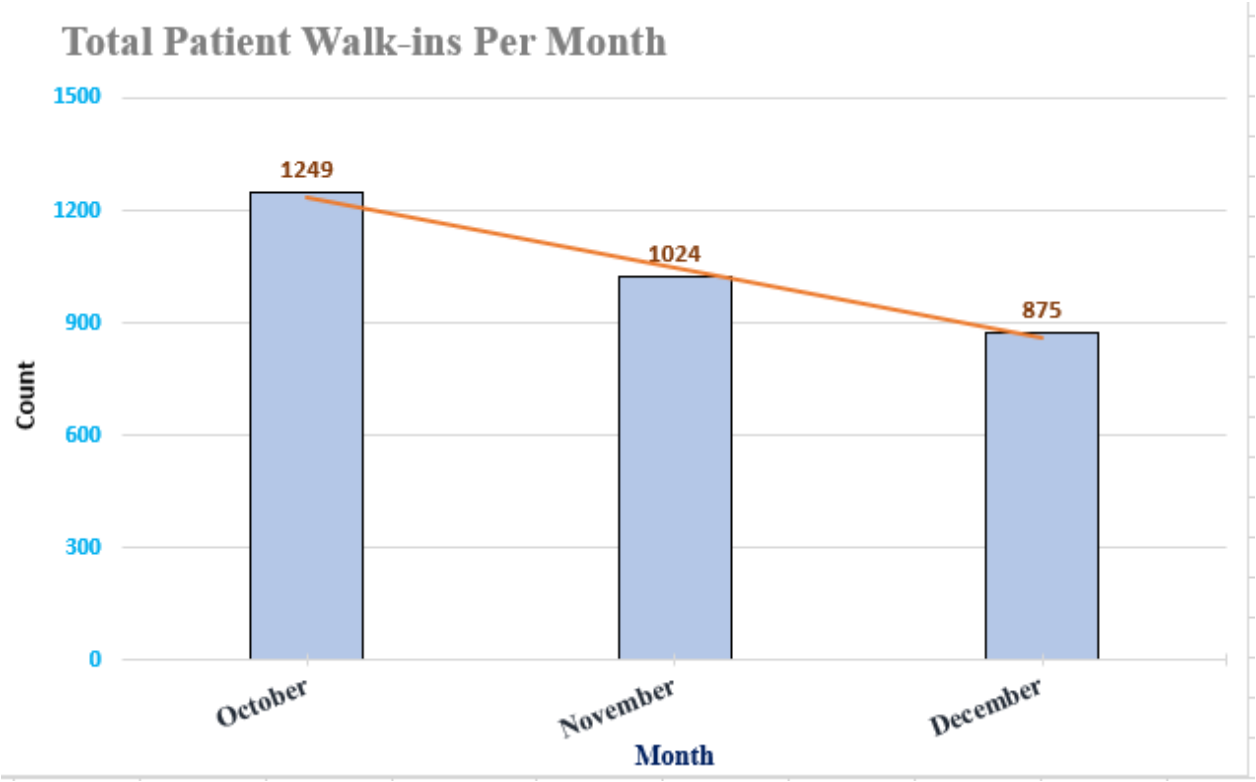


Fig. 3.1.2 Total Patient Walk-ins over a month

- The above analysis depicts that, October and November months are generating highest number of patient walk-ins.
- The maximum number of patient walk-ins on October is about 1249, whereas on November is about 1024.

- We can also observe that, the minimum number of patient walk-ins on December is about 875, which is least compared to other two months.
- The reason could be for higher number walk-in patients is due to seasonal changes from rainy season to monsoon season is happen in October, this leads to various infections, viral fevers etc. can be caused.
- During December more number of patients seeking medical attention for flu, respiratory illness like influenza and the common cold.

The below bar graph is generated to analyze gender characteristic of the total number of patients visited to the hospital from Female and Male categories for the 3 months.

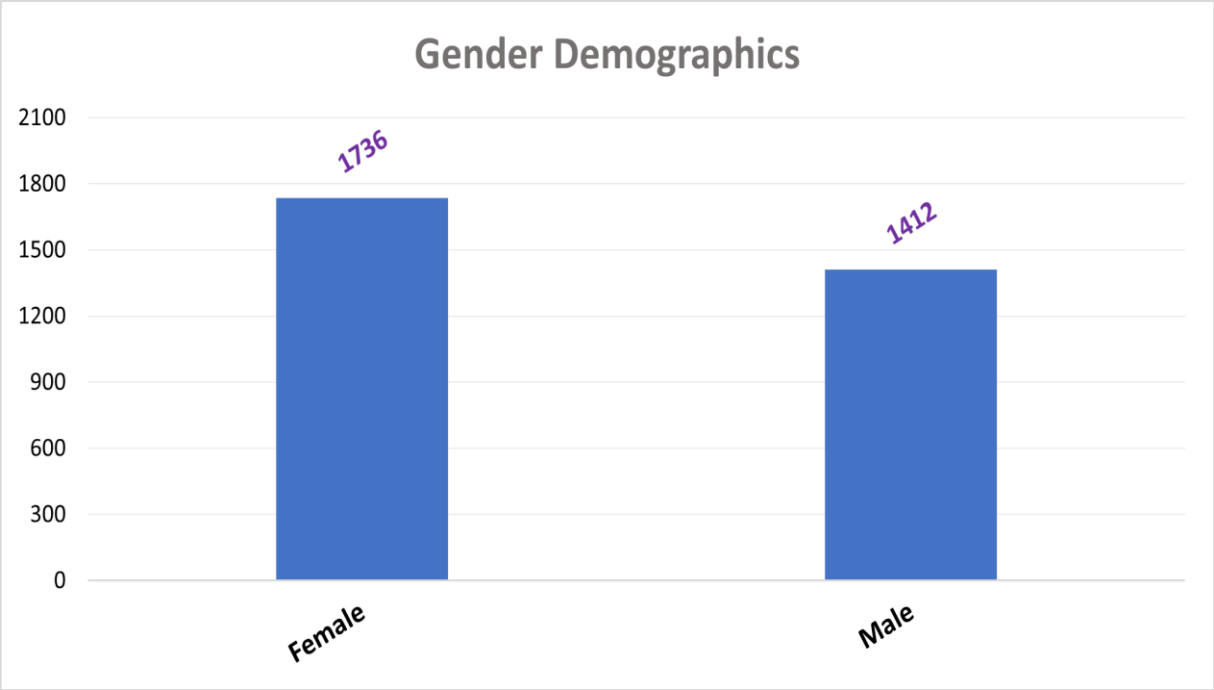


Fig. 3.1.3 Gender Distribution of Patients

- As we can see from the graph, there are two main categories: male and female patients. The bar graph visually represents the count of patients in each gender category.
- The gender distribution of patients in their hospital reveals interesting insights. We observe that there are 1736 female patients and 350 male patients. This indicates that females overlay a larger proportion of their patient walk-ins compared to males.
- It concludes that, the females are more affected to the health issues compared to males in neighboured regions of pithapuram.

To analyze the total number of patients visited to the hospital from different age groups, the below column chart is generated to visualize.

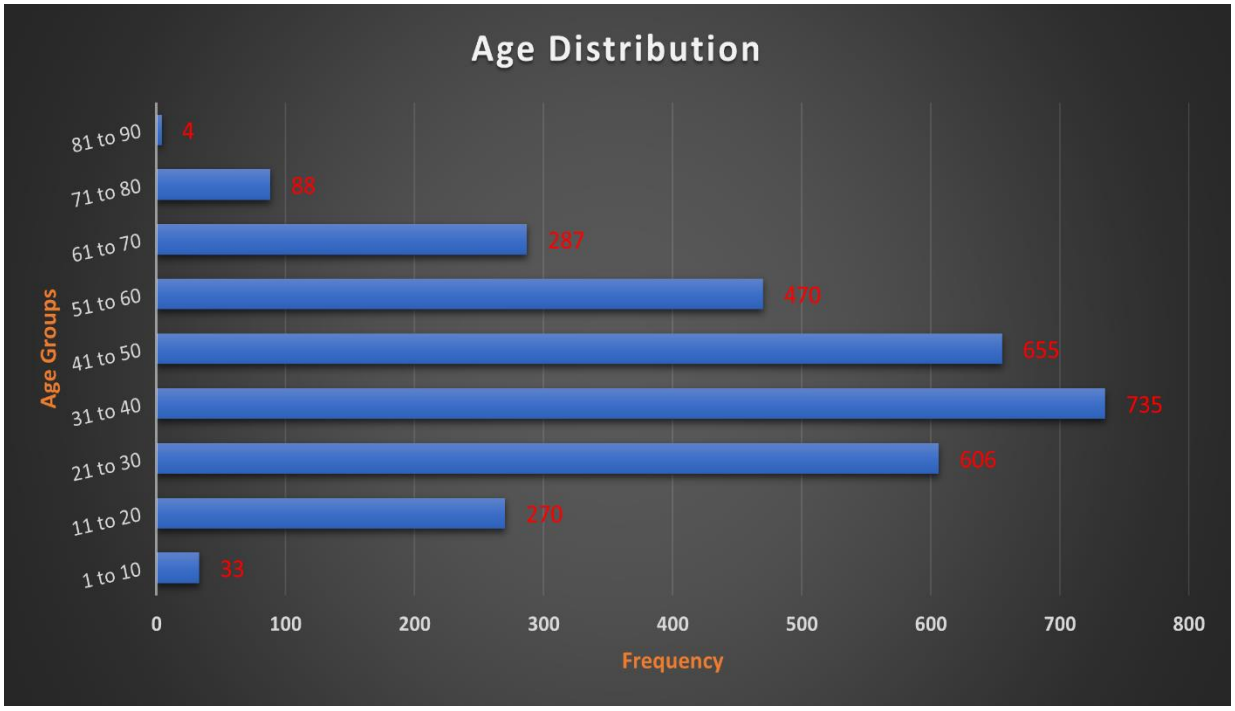


Fig. 3.1.4 Different Age groups vs. Frequency

- As depicted in the column chart, the x-axis represents the different age groups, while the y-axis represents the number of individuals in each age group. Each column represents the count of patients within a specific age group.
- The age distribution chart provides some valuable insights into the demographic makeup of patients. We see that certain age groups are more prominent or larger in size compared to other groups.
- The age group of 31 to 40 age is more prominent with 735 patients and the age group of 81 to 90 is less size with only 4 patients.

To analyze each admission type contribution, the pie chart is generated to show the proportion of each admission type contribution to total patients visited to the hospital for the 3 months.

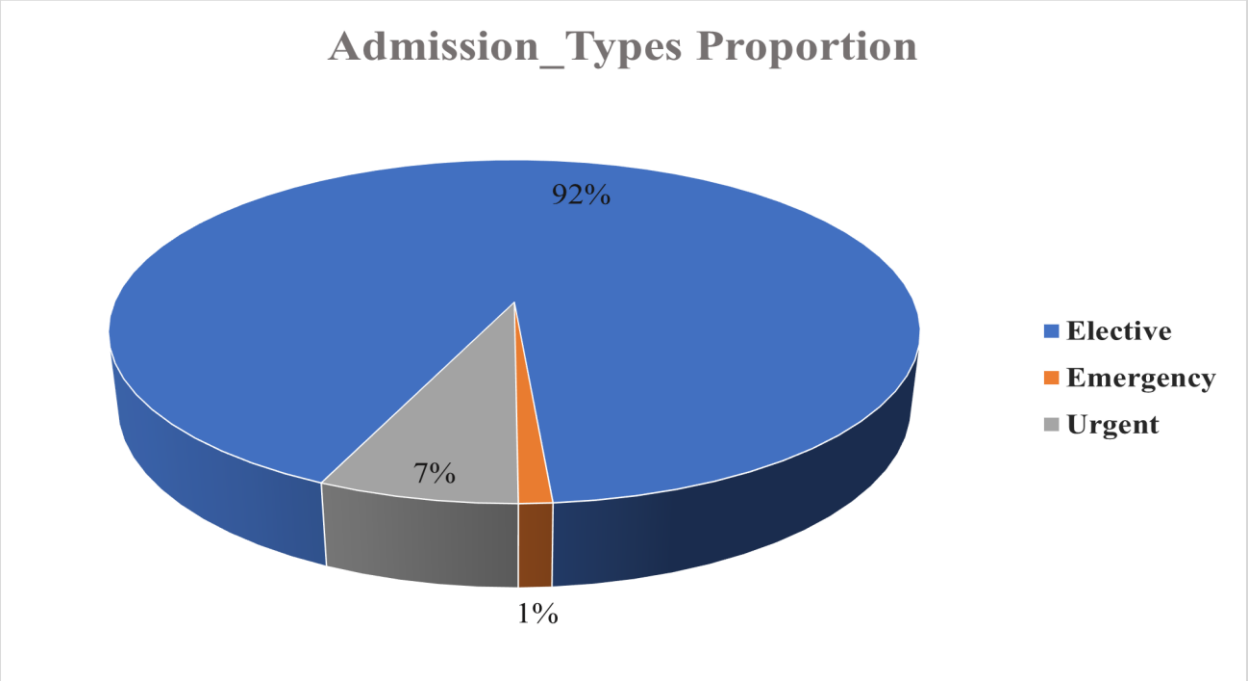


Fig. 3.1.5 Admission_type Proportion to Total Patient Walk-ins

- As depicted in the pie chart, each slice represents a different admission type at the time appointment, such as Elective, Urgent and Emergency. The size of each segment corresponds to the proportion of hospital appointments attributed to that admission type.
- We observe that Elective appointments constitute the larger proportion and Urgent, Emergency constitute very less proportion to the total appointments.
- The Elective appointments took 92% of the overall proportion and the combination of both Urgent and Emergency constitute only 8% of the overall proportion.
- The Elective appointmens are more, represents the signify planned procedures. Whereas very less number of patients are taking Urgent appointments to their busy work or depending on the factors.

3.2: Time Series Analysis on Patient Walk-ins

The below line graph in time series is generated to analyze the patient walk-ins into the hospital in different time intervals in each month.

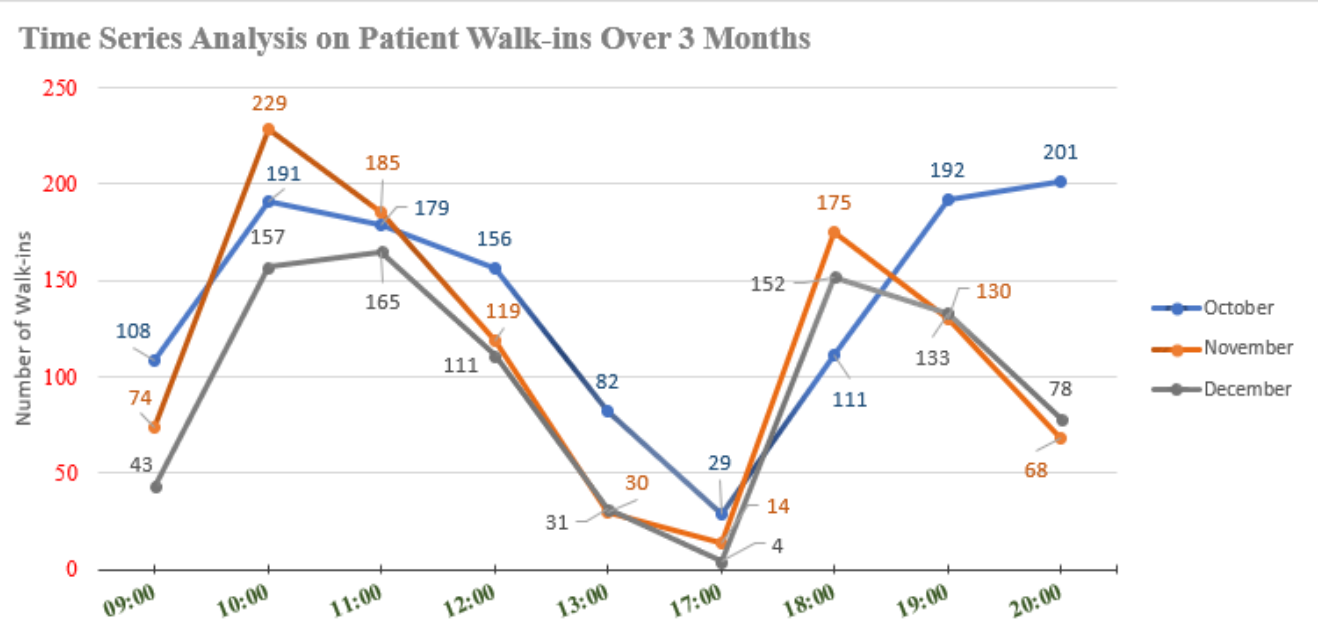


Fig. 3.2.1 Time Series on Patient Walk-ins over 3 months

- The above analysis depicts that, a steady rise in walk-in patients over the past three months, potentially indicating a growing demand for urgent medical care services.
- From the graph we can observe that, the peak time around (10:00 AM to 11:00 AM) higher number of patients visited the hospital in October, November, December months.
- Around early evening (5:00 PM) lesser number of patients visited to the hospital across all the three months.
- The reason for the increase in number of walk-in patients around (6:00 PM) and sudden decrease in walk-in patients around (7:00 PM to 8:00 PM) is due to seasonal changes.
- The winter season comes by the end of November, which leads to early sunset in evenings. So, patients are more likely to go in early hours than the late night hours around (7:00 PM to 8:00PM).

To analyze the number of patients visited the hospital in a day of a week over different time intervals of a day. The below stacked column chart is helpful to visualize the patient walk-ins in working hours of the hospital.

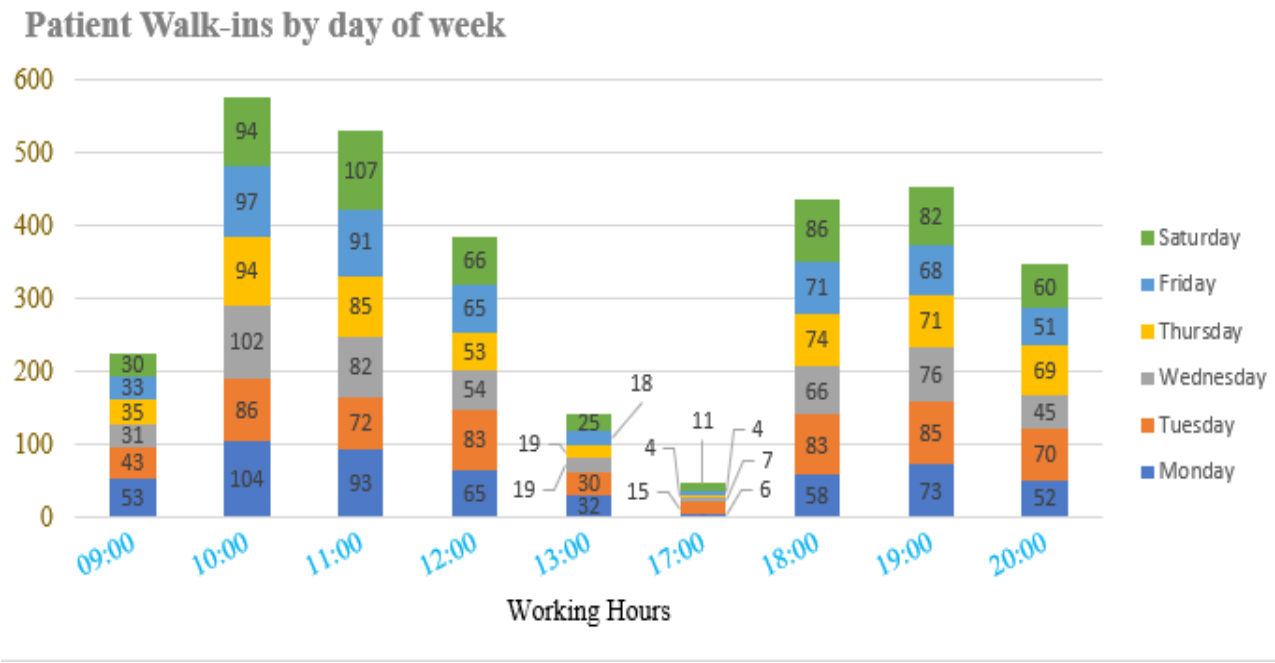


Fig. 3.2.2 Time Series Analysis on Patient Walk-ins by day of week

- From the graph we can understand that, the highest number of walk-ins patients occurs on weekdays especially on Monday and Saturday, with a peak time around mid-morning (10:00 AM to 12:00 PM).
- Additionally, there is a secondary peak in the evening around (6:00 PM to 8:00 PM).
- The Joga Gani Raju hospital experiencing higher influx of patients, that aligns with typical working hours and suggest that many patients might seek medical attention during working hours or breaks.
- The reason could be for higher cases on morning hours is that, it is very easy to travel with availability of public transportation, auto rickshaw etc…
- The reason could be for higher cases on evening time is that the farmers, daily labours etc. are come to home from work at this time and took family members to hospital.

3.3: Analysis of Hospital Inpatient Stay Durations

To analyze the average length of stay for female and male in the hospital, the below graph is helpful to visualize the average length of stay.

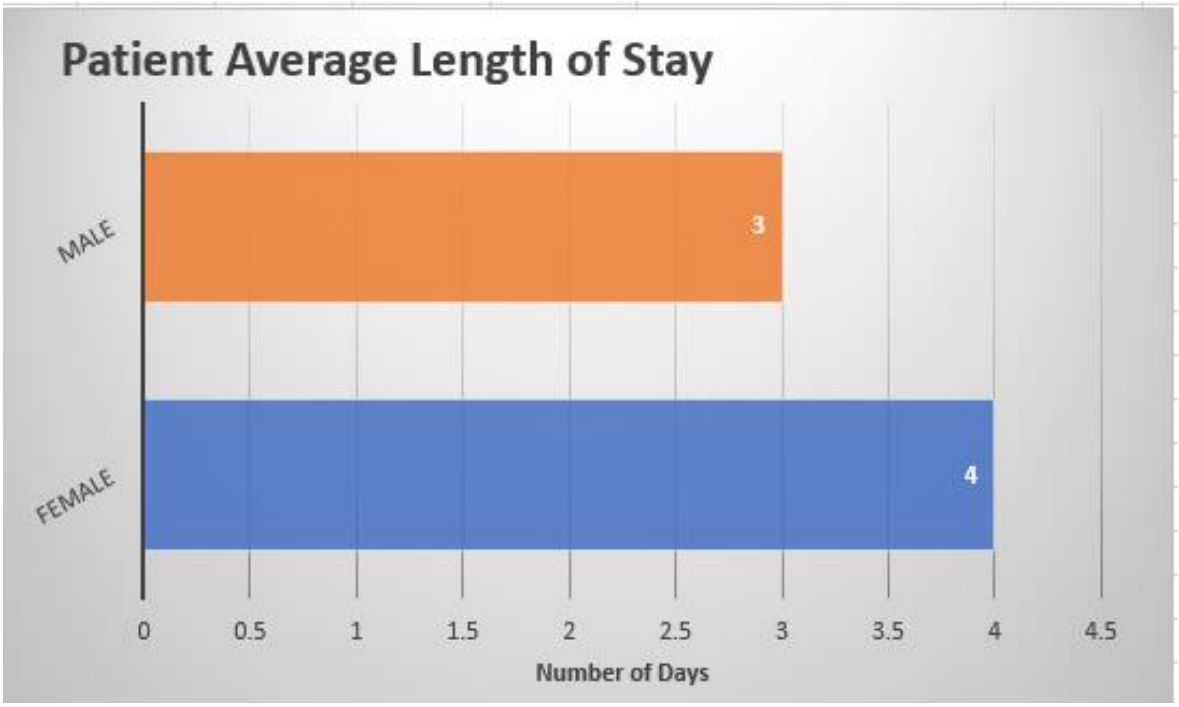
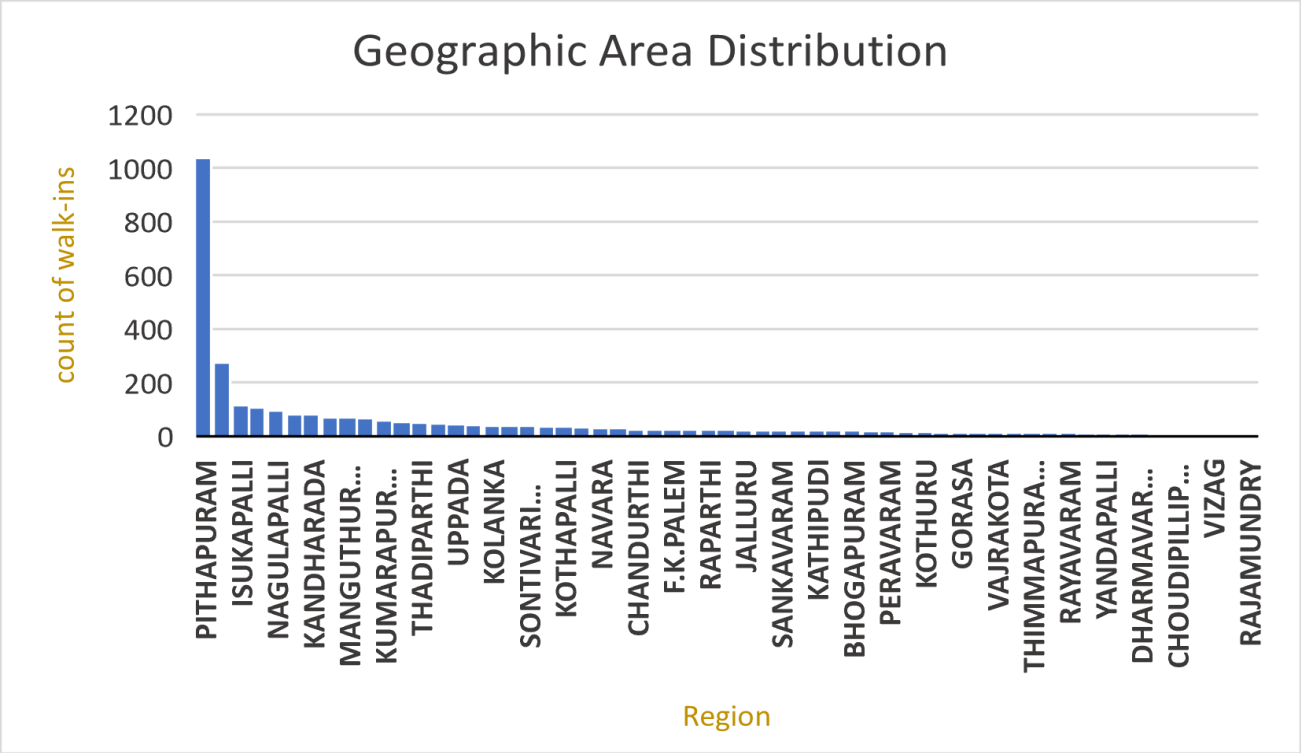


Fig. 3.3.1 Analysis on Patient Average Length of Stay

- From the above analysis it can be clearly understand that, the average number of days a female patient took to recover from the hospital is somewhat higher than the average number of days a male patient took to recover.
- The average number of days a female patient stayed in the hospital is about 4 days, where as the average number of days a male patient stayed in the hospital is about 3 days.
- There could be some reasons for this are female patients have more complex medical conditions that require a longer recovery time.
- Also, childbirth and other female-specific procedures may also contribute to more length of stay in the hospital.
- Biological factors specific to females might influence healing times or require additional monitoring, leading to a longer stay

3.4: Geographic Area Analysis on Patient Walk-ins

To analyze the number of patients visited to the hospital from different neighbouring regions, the below graph is generated to visualize the count of patients from different areas.



2.4 Geographic Area vs. Count of walk-ins

- As illustrated in the graph, each bar represents a different geographic area, such city, village, or town. The height of each bar corresponds to the number of walk-in patients from that particular region. We observe variations in the count of walk-ins from each region, indicating differences of utilization patterns in healthcare and patient access to service.
- We can identify areas of high demand or underserved communities. We observe that, from the pithapuram region a greater number of patients are seeking healthcare service from Joga Gani Raju hospital.
- The total number patients over 3 months to the hospital from the pithapuram region is about 1037, which is greater compared to other regions like choudipillipeta,vizag,rajamundry etc.., with number patients are about 1 to 4.

- The main reason is that, the pithapuram region is the local region where the hospital is situated and while, other regions like rajamundary, vizag, tirupathi etc..., are longer distance to the hospital.

4: Interpretation of Results and Recommendation

4.1 : Recommendation 1: Optimize Patient Walk-ins Flow at Peak Times

Based on the analysis it is evident that, patients visiting hospital on Monday and Saturday have significantly higher walk-ins compared to other days in a week. We can also observe that, during 10 AM and 6 PM higher number of appointments are registered. The hospital management can take advantage of this by implementing necessary steps to optimize the patient walk-ins.

- Extended Hours : Instead of following regular working hours, consider offering convenient extended hours on Monday and Saturday during mornings or evenings to cater to busy schedules.
- Shift adjustments : Schedule additional staff during this time to handle the increased patient flow.
- Inform patients : Communicate the observed peak time and suggest alternative options like scheduling appointments after the peak hours.
- Reduce Long wait times : The long wait times are caused due to late test results, inavailability of staf etc. which leads to peak time. Replacing with advanced machineries in processing tests will reduce the long wait times.

4.2 : Recommendation 2: Increasing bed capacity in hospital

It is observed that the number of beds present in the hospital for patients are about 15, which are lesser compared to standard hospitals. The Female length of stay in hospital is higher compared to Male, which means by implementing necessary facilities like increasing female staff, allocate rooms separately.

- Expanding Bed Capacity : Infrastructure development like physical expansion of the hospital by adding new wings or floors.
- Area Optimization : Analyze underutilized areas within the hospital and search on alternative possibilities for converting them into additional patient rooms.

4.3 : Recommendation 3: Technological Advancements:

It is Observed that, the Joga Gani Hospital is still using old technology equipment for operations like storing patient records, checking blood pressure, blood tests etc; which leads to long wait time for patient in the hospital. To overcome this issue, the hospital management have to invest more on technological advancements like implementing electronic health records systems, advanced technology-based test machines in all operations.

- Collaboration with larger hospitals : Partnering with larger institutions for access to specialized services like advanced imaging, advanced testing tools etc. The growth of the hospital can be increased with its outreach to community.
- Train existing staff : The hospital management should invest in training programs to equip existing staff with the skills needed to operate and utilize new technologies effectively.

4.4 : Recommendation 4: Additional Steps

4.4.1 : Effective Cost Strategies for Hospital

Another aspect to consider in increasing profitability is implementing effective cost strategies. The hospital management can explore the following approaches:

- Optimizing Resource Management : Implement measures to minimize waste of medical supplies, pharmaceuticals. For the consistent and efficient utilization of resources, ensure standard procedures and protocols.
- Cost-Effective Staffing : Using the data on patient volume and peak hours to define optimal staffing process.
- Financial Assistance Programs : Implement clear and accessible government programs to assist patients facing financial hardship.

4.4.2 : Optimize Hospital Location for Enhanced Service Delivery and Future Growth

It is observed that, the hospital is situated in one corner of the city on first floor of a complex. The space for the hospital is too small to treat patients. Following suggestions can take in account to enhance the service mechanism:

- Accessibility : Consider factors like public transportation options, parking availability and closer to major roads.
- Community Events : Collaborate with local authorities to organize health awareness campaigns and preventive care programs.
- Informative Billboards : Highlight the services offered by the hospital that directly benefit patients. Promote awards, recognitions, or accreditations that demonstrate the hospital's quality of care. Place billboards in areas with high visibility, along major roads, or near public transportation hubs.
- Seasonal Campaigns : Introduce temporary campaigns around specific health awareness days, offereing free screenings or promoting seasonal health tips.

5. Conclusion :