Streamlining Clinical Operations and Financial Management at RD Dental Care

Mid Term report for the BDM Capstone Project

Submitted by

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Declaration Statement

I am working on a Project titled “Streamlining Clinical Operations and Financial Management at RD Dental Care”. I extend my appreciation to **RD Dental Care, Chennai**, for providing the necessary resources that enabled me to conduct my project.

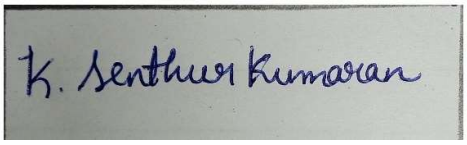
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered from primary sources and carefully analyzed to assure its reliability.

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 principles 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 understand that all recommendations made in this project report are within the context of the academic project taken up towards course fulfillment in the BS Degree Program offered by IIT Madras. The institution does not endorse any of the claims or comments.

Signature of Candidate: (**Digital Signature**) 

Name: K Senthur Kumaran

Date: 09-July-2024

Streamlining Clinical Operations and Financial Management at RD Dental Care

1 Executive Summary (200 Words)

RD Dental Care is one of the best dental clinics located in Rangarajapuram, Chennai which offers differentiated dental care. However, the clinic experiences some deficiencies in the management of clinical processes and financial documentation affecting the performance. Some of these challenges include poor notes writing, slow payments, no supplies order and control, and alteration of dates on the bills with insurance companies.

Due to these challenges, a method of data analysis was adopted fully to ensure that they were solved adequately. This entailed gathering and analyzing data from the Healcon site that includes patients' appointment, transactions, and types of treatments. The collected data was pre-processed and was analyzed using descriptive statistics and different forms of graphs which later led into the understanding of patient involvement, treatment provision and even the company's financial position.

The goals for the mid-term include

- Implementing an inventory management system to streamline pharmaceutical inventory management system to enhance operational productivity.
- To categorize the appointment status distribution to improve patient engagement.
- Analyzing the types of treatments provided to understand patient needs and to understand the returning of the same patients back to the doctor.
- Examining the age distribution of patients for targeted service offerings.

It is through this analysis that RD Dental Care will be able to optimize its operations by ensuring improved financial management and high patient satisfaction. The inventory management website supports objectives such as this with its real-time tracking, streamlined billing procedures, and comprehensive order history.

2 Proof of Originality of the Data

2.1 Letter from organization in letterhead with stamp and sign.

The letter from the organization is in the below Google link drive:
https://drive.google.com/drive/folders/1u8gO3tpADEnjGtlCtfdWlWzt_SCym6cq?usp=sharing

2.2 Images related to organization

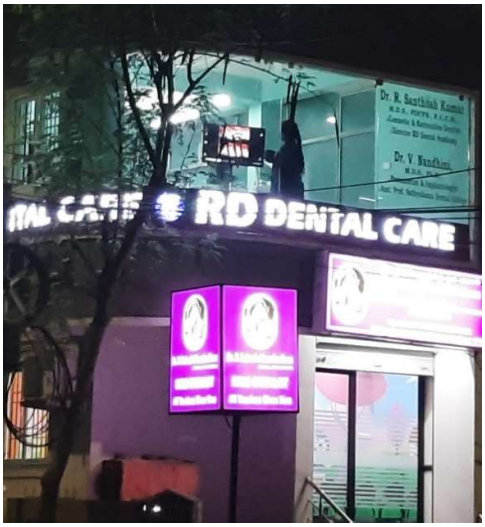


Figure 1: RD Dental Care, Clinic

Figure 2: RD Dental Care Inside with the doctors

2.3 Video with the founder of the organization.

The discussion with the head doctors of RD Dental Clinic is stored in Google Drive link
https://drive.google.com/drive/folders/1W9RL390SEL1c0rsc-zQkfOn_mmVJf1CL?usp=sharing

3 Meta Data

The Appointment Report and Patient Report datasets are very important in addressing the situation where there is a lack of clinical notes and records. Details to do with patient appointments existing in the Appointment Report dataset assist in pointing out missing clinical notes for the clients to ensure comprehensive patient records. This dataset includes fields such as Appointment_ID, Patient_ID, Doctor_ID, Date, Time, Treatment_Type, and Status. Each field is crucial for monitoring patient interactions, the appointment flow, and any gaps in documentation. The report for a patient supplements this with demographic details and patient IDs necessary in the linking of appointment details to individual patients.

When it comes to addressing payment delays through instalments, the use of data like the Financial Report and Payment Report is active. The Financial Report includes revenue and expenditure; it gives an overview of the clinic's financial condition and is useful in identifying the effects of late payment. Transaction details include Transaction_ID, Date, Description, Earning or Expense, Amount and Payment_Method. It facilitates the study of the flow of cash and financial imbalance. The Payment Report offers more detailed data concerning the dates and methods of payments as well as the amounts which can be essential for the identification of payments' delays and their impact. There are such fields in this dataset as Payment_ID, Patient_ID, Date, Amount, and Payment_Method, which makes it possible to reveal behavioural patterns that lead to financial unsteadiness. It enables the analysis of cash flow and financial discrepancies. The Payment Report provides specific information on payment dates, amounts, and methods, crucial for

analyzing payment delays and their effects. Regarding the absence of an inventory management system, it returns to the Financial Report for cost analysis related to inventory.

For the specific case of adjustment of billing dates for patient's insurance claims, both the Financial Report and Payment Report are necessary. The Financial Report contains such fields as Transaction Date, and Transaction Type, which can help to reveal the cases of Billing Date manipulation. This helps in determining the financial effect as well as the balancing of accounts of the industrial relations committee. Using the Payment Report, it is possible to find out the payment dates and the amounts that were paid, which will be useful to analyze the correlation between the payment date and the billing date so that financial stability can be provided and administrative staff's workload can be minimized.

The data collected is in the following drive:

https://drive.google.com/drive/folders/1DI7entMSA-juZDPftSWLQYqU7r6KhhRE?usp=sharing

Detailed Metadata Overview

3.1 Appointment Report:

- The purpose of this data is to identify why there is a gap in clinical notes and ensure comprehensive patient records. This data has been taken because the Healcon app contains an input where the doctors or clinical staff can enter the clinical notes, but many cases, they have not done it.
- Fields:
    - Appointment_ID: For each appointment, there is a unique id.
    - Patient_ID: For each patient, there is a unique patient id.
    - Doctor_ID: For each doctor, there is a unique doctor id.
    - Date: Date of the appointment.
    - Time: Time of the appointment.
    - Treatment_Type: Type of treatment provided.
    - Status: Status of the appointment such as Completed or Cancelled or To be continued in next sitting etc.

3.2 Patient Report:

- The purpose is to provide demographic information and link appointment details to specific patients. This can also be used in future to identify the upcoming problems which the patient will face depending upon the treatment done.
- Fields:
    - Patient_ID: For each patient, there is a unique patient id.
    - Name: Full name of the patient.
    - Age: Age of the patient.
    - Gender: Gender of the patient.
    - Contact: Contact details such as phone number or email.
    - Address: Residential address of the patient.

3.3 Financial Report:

- The purpose is to track financial health and analyze payment delays, inventory costs, and confusion occurring in billing date manipulation.
- Fields:
    - Transaction_ID: Unique transaction id.
    - Date: Date of the transaction.
    - Description: Description of the transaction.
    - Type: The type of transaction is either Earning or Expense.
    - Amount: Monetary value of the transaction.
    - Payment_Method: Method of payment used such as Cash, GPAY or UPI, or Credit Card.

3.4 Payment Report:

- The Purpose is to analyze the payment delays and to track discrepancies in billing dates.
- Fields:
    - Payment_ID: Unique payment id.
    - Patient_ID: For each patient, there is a unique patient id.
    - Date: Date of the payment.
    - Amount: Amount paid by the patient.
    - Payment_Method: Method of payment used such as Cash, GPAY or UPI, or Credit Card.

4 Descriptive Statistics

I have gathered an extensive 2-year dataset of the RD Dental Care clinic's main branch in Rangarajapuram, Chennai alone. The data and details are stored in Healcon website which is a fully fledged clinic management portal, used by the clinic management. It contains a data from June 2022 to June 2024. Considering this period, my data collection approach involved extracting the data from the Healcon website, allowing me to compile a comprehensive set of cumulative data encompassing the entire time span.

The descriptive statistics for RD Dental Care provide the following.

Total Number of Patients Visited are 1824 in the span of June 2022 to June 2024

4.1 Number of Records in Other CSV Data Files

- Financial Transactions: 2,652 transactions recorded
- Appointment Statuses: 3 unique statuses which are Confirmed, Cancelled and No show
- Payment Methods: 7 unique methods are GPay, other UPIs, Debit or Credit Card, Cash, Net Banking, Cheque
- Delayed Payments: 2,090 transactions

4.2 Identification of Gaps in Data

There are many missing values and entries found in the data. The data entry has been skipped in many aspects such as patient's demographics or payment date and type or the treatment type etc. This is occurred due to inconsistent entries by the clinic attenders.

4.3 Basic Analysis of the data

4.3.1 Appointment Status Distribution

Knowing how completed, cancelled, and no-show visits are distributed by appointment status may be very helpful in understanding the level of patient engagement and clinic efficiency.

- Total number of Confirmed Appointments including walk-ins through phone calls: 912
- Total number of Cancelled Appointments: 113
- Total number of No Shows: 300

The greatest number of appointments are those that are confirmed; then come the cancelled and 'did not show' ones. This indicates good use of appointment management; however, there is still some room for improvement by reducing cancellations and appointments not confirmed.

4.3.2 Types of Treatments Provided

Treatment type analysis gives insight into what services the clinic provides an requires.

- Follow-up: 1,265 appointments
- Pharmacy: 335 appointments
- Consultation: 296 appointments

Based on the data, we can conclude that patients frequently return to the doctors for follow-up appointments. It is an indication of satisfaction on the part of patients with the quality of care received, hence being confident from the doctors at the clinic, creating a reason for repeated visits, and continued trust in its services.

4.3.3 Patient Report Analysis

The age distribution of patients helps in understanding the demographic profile of the clinic's clientele. Noting these will help doctors to identify the patients who will get a problem in the future depending on the severity of the problem, and they can provide treatment accordingly to prevent this.

Age Groups:

- Above 12 and below 19: 100 patients (8.3%)
- Above 20 and below 35: 500 patients (41.7%)
- Above 35 and below 50: 400 patients (33.3%)
- Above 50 and below 80: 150 patients (12.5%)
- Above 80: 50 patients (4.2%)

Gender Distribution:

- Male Patients: 666 (57.1%)
- Female Patients: 501 (42.9%)

4.3.4 Financial Report Analysis

Total earnings audited at the end of the year: ₹ 54,209,772

Total Amount of Delayed Payments: ₹ 7,127,058

I have provided the snapshot of data which has been audited at the end of a year. The doctors don't want the complete official financial data and calculation details they do regarding it to be disclosed outside their management. Through regular conversations with the doctors, they say that the payments are correctly being done by the patient's even though they are in parts. The amount paid and the due amount when paid through installments are physically noted down in prescription backside or through notebooks. The total income and the expenditure are done through physical calculation by using GPay or Net Banking history. They get to know the total profit made only when they audit using a professional audit.

Figure 3: Earnings noted down in the Healcon app, comparison in June 2022-June 2023 and June 2023 to June 2024; provided by the doctor

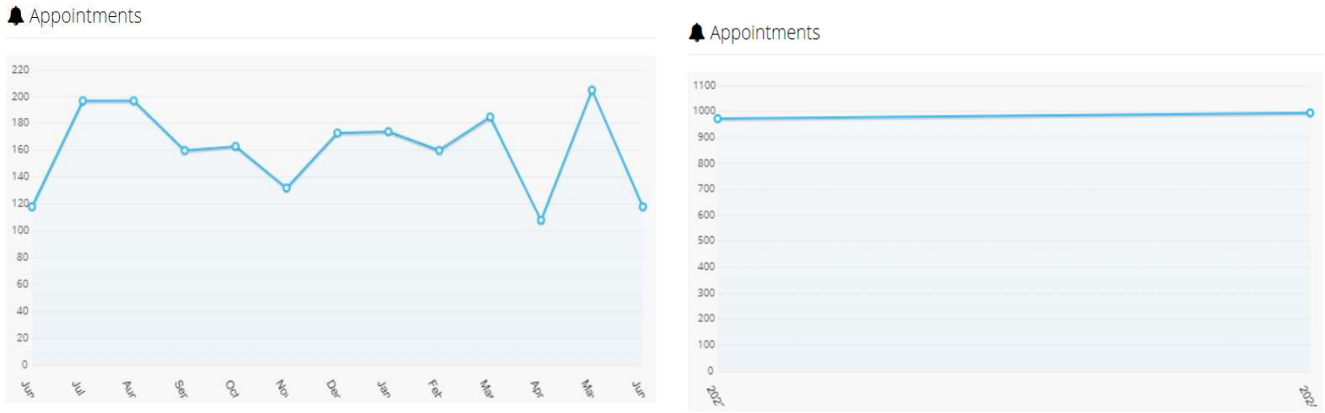


Figure 4 Total Number of Appointment noted down in Healcon app comparison in June 2022-June 2023 and June 2023 to June 2024; provided by the doctor

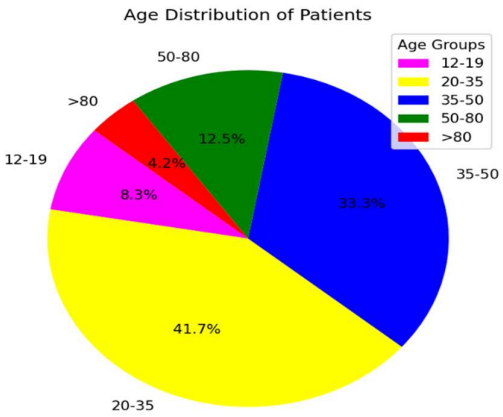


Figure 6 : Age of patients

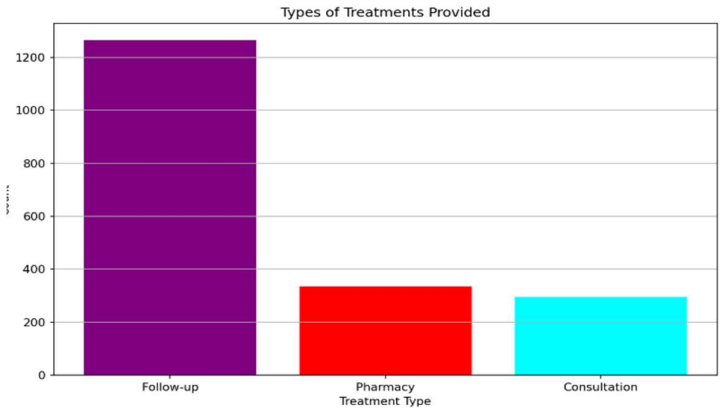


Figure 5 : Types of treatment provided

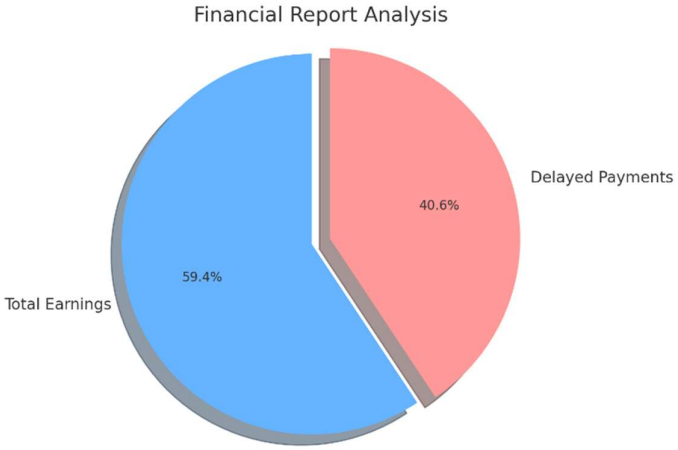


Figure 7 : Delayed Payments

5 Detailed Explanation of Analysis Process / Method

To help the clinic manage its pharmaceutical inventory management, I have made a fully functioning inventory management website using HTML, CSS, JavaScript and Bootstarp[. The website allows real-time tracking of stock levels, ensuring and providing insights on stock levels. This will help them to restore stock levels quickly. The integrated billing and checkout system will help the clinic staff and doctors reducing errors and speeding up transactions. The comprehensive order history shows all the details of transactions and orders, helping to identify trends and areas for improvement. This comprises of Dashboard, a View and Adding stock page, a New Products or Billing page, a checkout page, and an Order History and summary page.

Data was gathered from the Healcon website for two consecutive years, followed by its systematic cleaning, organizing, and analysis. First and foremost, the data that was collected was checked to see if it was correctly structured and formatted for an efficient analysis. The inconsistencies, missing values, or outliers that would impact the results were checked. After that, a number of techniques from descriptive statistics were applied to summarize and explore the data. These included mean, average, and totals for various parameters to arrive at meaningful insights about the working of the clinic.

Graphical representations of the visits by patients, financial transactions, appointment statuses, types of treatments, and methods of payments were represented using bar and pie charts. These charts make it easy and simple to get an overview of performance and distribution of different metrics in the clinic, showing trends, patterns, and points that require improvement for decision-making. These descriptive statistics and visualizations will help us have a clear view of what the data has in store for the clinic. The analysis shall enable all data-driven decisions and clinic strategy optimizations for robust performance and profitability. For the Appointment Status Distribution, a bar chart was created. This chart provides an effective representation of the distribution of confirmed, cancelled, and no-show appointments, helping to understand patient engagement and clinic efficiency. The bar chart displays the individual status values for each appointment, sorted in descending order to highlight the most common statuses.

Another bar chart was used to display the proportions of the various kinds of treatments given. The chart is quite successful in highlighting what relative contribution different kinds of treatments make toward the total number of ratified appointments. Bars correspond to a certain kind of treatment, and their respective height is proportional to the number of appointments for this kind of treatment; this latter feature makes it easy to identify which treatments are more common.

There was a pie chart on the age distribution of the patients. The chart gives one the feeling for different contributions from various age groups in the total population of patients. In the pie chart, populations are divided with respect to age, and each slice represents peoples falling under a particular range of age. Each slice has its proportion in relation to others according to the number of patients falling under a particular age group, thus showing clearly demographic characteristics of the clinic.

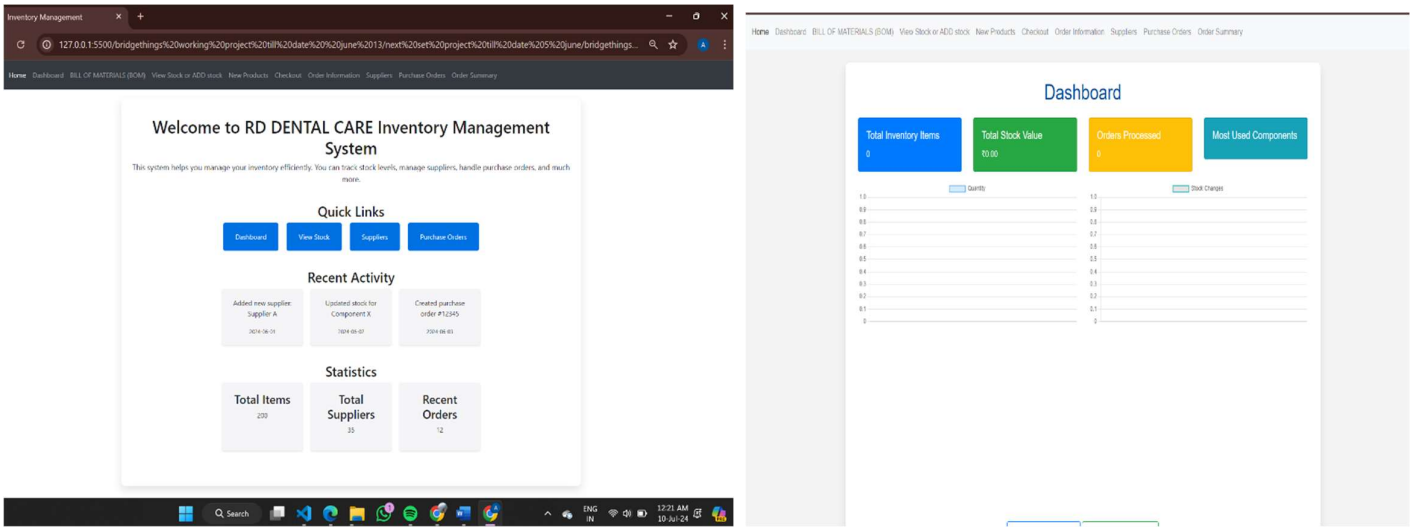


Figure 8: Preview of the inventory management website ; welcome and dashboard page

6. Results and Findings

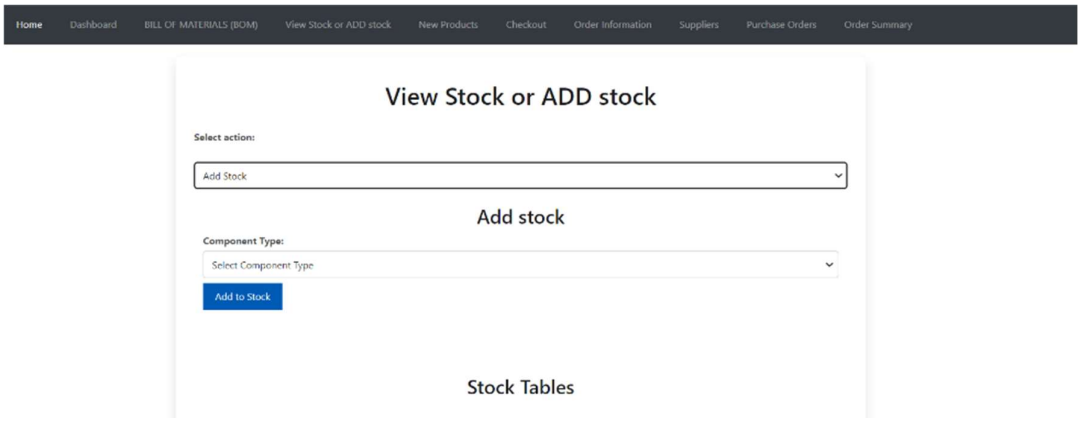


Figure 9: Preview of the inventory management website for adding stock

The project can be found in the below GitHub link:

https://github.com/ksenthurkumaran18052004/RD-DENTAL-CARE-INVENTORY-MANAGEMENT

The biggest component of patient activity is comprised of confirmed appointments; this finding is indicative of good appointment management and a good level of patient activity. However, cancellations and no-shows still create space for better patient follow-up and reminder systems. Follow-up appointments are at the highest rate of booking. It speaks to high patient satisfaction and trust in the clinic's services that they are willing to return for ongoing care. It portrays the importance of keeping up high standards within follow-up care to ensure continued loyalty from patients.

Evidence from patients' age distribution shows that most of them are between 20 and 50 years. This demographic profile tells that the services of the clinic have been more endearing to adults and middle-aged persons. Knowing this can help the clinic tune its services and marketing for this age group.

Financial data analysis shows that a lot is due in arrears. This signals that an improved payment reminder system and follow-up system are highly required, so that payments can be collected during the optimal time for both parties to be financially stable.

It therefore shows that the appointment management system of the clinic is effective, there is high satisfaction among patients regarding follow-up treatments, and it projects demographic trends of the patient population. More importantly, it shows the need to take measures against delayed payments for better financial health.