**CAPSTONE PROJECT -GROUP 06**

**Optimizing Appointment Scheduling Through Data Analytics**

**PROBLEM FORMULATION**

# INTRODUCTION

Many new facilities have been made available to individuals as a result of modernization in a variety of industries, including healthcare, finance, education, supply chain, etc. Among these, Healthcare sector can be considered as fastest growing rate backed up by the data analytics methods. Healthcare systems' primary responsibility is to ensure that all patients have timely and appropriate access to healthcare services. The quality and patient satisfaction of hospital management depends upon efficient appointment scheduling approach. Fairness is a factor of allocating resources to healthcare so that all patients receive, on average, an equal share of resources over time when a patient is admitted. A system that comes from effective and successful healthcare services is appointment scheduling. It manages access to healthcare facilities. The scheduling of visits results in patient satisfaction in this way. Appointment scheduling is utilised for initial visits, individual visits, therapy sessions and optional operations in a variety of parts. Access to theses services provided by Hospitals and medical clinics is solely dependent on the availability of the doctors and accommodations to the admitted patients. These two are crucial facts to consider prior to admission of patients. scheduling processes for hospital resources are very important to raising the level of patient benefit and service quality. An improved scheduling system is necessary for increased accessibility to the healthcare system as well as cost and revenue reduction. The objective of this project, is to determine the most optimal path for scheduling appointments and minimize the manual effort needed to book the appointments for different medical services (therapy sessions) offered by the Hôtel-Dieu Grace Healthcare medical clinic.

# ABOUT THE COMPANY

At **Hôtel-Dieu Grace Healthcare** (HDGH), are committed to improving the health and wellbeing of the Windsor-Essex community through the delivery of patient-centred, value-based care. Hôtel-Dieu Grace Healthcare is a unique community hospital offering services in Mental Health & Addictions; Rehabilitative Care; Complex Medical and Palliative Care; and Children and Youth Mental Health. They offer a unique blend of services including but not limited to community and home-based services. In collaboration with our healthcare and inter-sectorial partners, Hôtel-Dieu Grace Healthcare is providing care in new ways and in new locations throughout the region to address barriers, improve access and patient outcomes and improve the overall patient experience.

# PROBLEM STATEMENT

HDGH is in need of fully comprehend the issues and possibilities for improvement with the provision of optimal scheduling for **Allied Health** (AH) therapy Minutes in Complex Medical Care Program where it is necessary to conduct a thorough analysis to achieve this. Poor coordination of scheduling therapy session leads to obstacles for both the clinic and the patient. HDGH currently provide multiple AH therapy services for Physiotherapy (PT), Occupational Therapy (OT), Speech & Language Therapy (SLP) and PT and OT assistance (CRA’s) where CRA’s perform both PT and OT assigned therapy. They only can accommodate a maximum capacity of 20 patients since the maximum no of beds available for each of these medical units is limited to 20 beds. This is a important fact as the no of patients that occupy a bed at midnight can not surpass the no of beds available at the medical unit. The resources to accommodate not more than 20 patients for a day is not limited to no of beds but also to the full-time employees that are needed to provide an excellent service. It is very important for HDGH to ensure that the patient gets a minimum of 30-minute session for a day. In addition to the already admitted patients, an average of 2 patients are admitted to the medical clinic daily for different complex care medical units. New patient needs a 45-to-60-minute therapy session. Currently they do not have a limitation on the no of employees but are willing to adjust based on the most optimal scheduling results. Manual processes indeed lead to errors and complications specially in healthcare. In present HDGH follows a manual process for scheduling which has also become a concerning matter for them. They intent to explore the possibility to reduce the manual effort need to schedule a session. It is crucial for them to address these problems availing now in order to provide effective and efficient service to the need of the patient.

# KNOWLEDGE AND TECHNIQUES

The initial approach to this analysis is to clean and prepare data for analysis which includes identifying and handle outliers and missing data and transforming of the data (as needed). There’re fine data cleaning tools like Excel, Power Query and Python are available for the data preprocessing. We will also need the knowledge for creating powerful data visualizations and interactive dashboards and story telling in order to improve the user friendliness. Knowledge on Machine leaning techniques in analyzing data is very important to find insights and build a solution for the end goal of this project. It is essential to remember that these tools and procedures employed will rely on the type and scope of the project.

# REQUIREMENTS FOR THE SOLUTION

## Data and Information accessibility

Accessing the data for the scheduling optimizer is very important to the project as the solution is built upon the data available. To understand the provided data respective information should also be obtained. For this project the data has been given by HDGH. This data package consists of **medical unit** data and **patient admission** data.

## Project Plan

A well-defined project plan needs to be created to complete the project within the given time and available resources. The project plan must be outlined with all the tasks that needs to be carried out to build the solution.

## Research Approach

A thorough Research needs to be carried out for this project to systematically approach to the solution. This process will help to determine the strengths and weaknesses in the solution and address them accordingly. It will also allow to explore different techniques and decide the most effective one to build the solution.

## Solution Design

A well outlined and architected solution is required to achieve the end goal of this project. It is important to note that the solution design is solely based on an unbiased data analysis approach followed by data analysis methods. The solution must address all the problems the customer is currently having, and must be efficient, and insightful.

## Data analysis

The examination of the data should be done with thoroughness and transparency, and the proper statistical methods should be applied. The team must have the knowledge on carrying out data analytics activities from beginning to end to find the patterns and provides insights to the final product. Both technical and functional skills is needed for analyzing the data such as python and different visualization tools (Mentioned in Knowledge and Techniques).

## Ethics

Ethical practices should be followed in this project as Healthcare requires a robust ethical code to provide direction in decision-making because it deals with ethical problems involving life and death. This data analysis is done on patient therapy information and admissions. Therefore, moral principles are a must to be followed. This includes protecting the HDGH confidentiality, and ensuring that the rights and welfare of participants are protected.

# EXISTING SOLUTIONS

There’s a considerable no of similar solutions has been built in address problems in different sectors including the healthcare sector. These solutions mainly focus on appointment scheduling through calls and emails rather than focusing on the optimization in scheduling. Following are some of the existing solutions similar to our project goal. IT must be noted that the requirements and parameters defined to built these are very much different than this project. The main drawback in these is the excessive cost.

**Capterra** - These applications automate a broad range of business process functions for medical offices. Doctors and administrators use Medical Scheduling software to manage their appointment calendars, staff scheduling, patient records, and billing and invoicing.

**Calendly** - Calendly is a scheduling automation platform for eliminating the back-and-forth emails for finding the perfect time and much more to book appointments.

**Doodle** - Doodle is the fastest and easiest way to schedule anything from meetings to the next great collaboration.

# EVALUATION

This project will be evaluated by how the solutions aligns with the requirement of the customer and to overcome the current problems they are having as follows.

* Determining the no of full-time employees that are needed to accommodate maximum of 20 patients for a day.
* Allocating a minimum of 30 minutes therapy session for an admitted patient in different complex care medical units which is dependent on the patient needs.
* For the new admissions allocate assessment of 45-to-60-minute therapy session for AH provide service.
* Reduce the manual effort needed to schedule the therapy session.

The evaluation will also include the research of the problem statement and the most effective proposed solution followed by a requirement analysis, SWOT (strengths, weakness, opportunity, threats) analysis , existing solution analysis. The analysis will consider the areas such as, availability of the resources and the potential of the medical unit to provide services optimal scheduling service.

The effectiveness of the research would be assessed by how accurately the findings were communicated to our stakeholders, enabling them to make wise decisions about how to enhance their business operations.

# GOALS

The goal of the project is to identify and understand the current process followed by the HDGH to schedule appointment per day and develop a solution to do the optimize the scheduling of the therapy sessions by reduce the manual effort needed. Stakeholders will be able to make strategic decisions about where to focus their efforts for the best results by reviewing to discover areas for improvement and areas with potential for growth.

# CHALLENGES AND ETHICAL CONCERNS

Data collection and understanding the data can be challenging to understand the requirements to develop a solution. The reason for this is that data is confidential to the customer (Healthcare provide in our project) and providing them would needs to be undergo a privacy and confidentially ethical morals.

The solution design can be challenging in determining the correct approach to address the requirements even though existing solutions are developed for various optimizations. This includes how the machine learning concepts and visualization techniques be applied to achieve the final goal. Since the solution needs to be user friendly to the end users, we also need to research on developing web page or an application deploy the developed solution. It may be challenging to carry out research that are comparable across various environments as a result.

In the domains of Big Data healthcare and market viability privacy rights, data quality, and algorithm fairness. Also, data is stored in accordance with established guidelines for the security and privacy of each patient's data.

To perform the research, it's critical to have a well-defined plan, a committed team, and the flexibility and adaptability to handle any unforeseen obstacles that may appear.

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