



Multivariate Analysis for Patient Waiting Time Reduction at a Local Hospital

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Abstract The study of patient's waiting time reduction have been receiving attention since the implementation of recent changes in the healthcare quality indicators. However, there is still many areas of improvement the healthcare industry could implement to improve waiting time and positively affect patient satisfaction. This is especially crucial for private healthcare organizations since it has a direct effect on their bottom-line. The quality branch of North West General Hospital and Naseer teaching hospital has been approached to decrease the patient holding up time. To this end, the quality office conceptualizes and recognizes the Service Type and Location type factors that they accept may affect the patient waiting time. By recovering the information list from the Electronic HR framework utilized at the emergency clinic, we can distinguish the time distinction between the different stages by which a patient go through. The information then, at that point, is assessed and investigated to ascertain the average waiting time at facility. The interaction stream of patients is additionally assessed to recognize potential bottlenecks simultaneously and prescribe differences to mitigate such issues. Then, at that point, the information data of the service will be examine again after the change has been implemented to assess the effect of the change on the interaction. In this research, two factors have been identified (location and service type). In addition, considering these two factors (Location, service type) six sigma DMAIC tool have been applied on the data collected from the mentioned two locations. The aim of this research is to reduce patient waiting time before treatment.

Keywords Multivariate analysis, Patient waiting time, Hospital

Introduction

The WHO considers the length of time patients must wait for medical attention to indicate how well a health system responds to their needs. Patients have long complained about long wait times, which is a continuous and essential cause of their discontent. Many studies have found a strong correlation between patient satisfaction and waiting time. By [1], the service quality obtained can be evaluated objectively against the individual's expectations via waiting time. Patient wait time was calculated as the sum of all department wait times in this study. Patients are kept in hospitals for long periods as doctors and other health care providers attend to their needs. Health outcomes are expected to be severely impacted by delays in management and therapy, as well as unexpected costs to patients and the public health system [2]. [3]. At this time, there is a focus on improving the quality of outpatient services, particularly in public health facilities. We need to understand outpatient departments in hospitals in detail and understand how they work [4].



Materials and Methods

We identify the following two factors that might have an effect on the patient waiting time:

1. Location (Naseer Teaching Hospital and Northwest General Hospital Peshawar)
2. Service type (three areas: gynae, pediatrics, and dermatology.)

In this research, we inspect the wait time for all the stages by which patient go through at medical clinics. Our methodology for this review is to gather information from the hospital data files and examine the Patient's wait time during the outpatient process stream at the clinic. Then, at that point, the information will be investigated to search where the aggravation regions are and comprehend reasons for the issue. This was trailed by suggesting of process change to reduce the patient's wait time [5].

A total of 60 patients were enrolled in this study. Three different departments from each location have been selected. Data of ten patients from each department of each location is collected from hospital registration system.

The qualitative variables (e.g., NWGH, pediatrics, etc.) shown in Table 1. This table depicts that we have two locations and three service areas (gynae, pediatrics, and dermatology).

Table 1: Data matrix of two factors (location and service type)

| Locations | Dermatology | Pediatrics | Gynae |
|-----------|--|---------------------------------------|---------------------------------------|
| NWGH | 30, 35, 32, 24, 33, 36, 20, 30, 38, 40 | 21, 20, 45, 24, 12, 40, 33, 35, 30,25 | 25, 32, 34, 45,40, 25, 28, 18, 15, 40 |
| NTH | 44, 38, 45, 34, 36, 35, 45, 44, 35, 33 | 19, 18, 17, 23, 10, 9, 20, 25, 30, 35 | 10, 4, 11, 5, 9, 20, 15, 13, 25, 22 |

Table 2: Coded data matrix of two factors (location and service type)

| → | C1 | C2 | C3 | C4 |
|----|----------|--------------|--------------|----|
| | Location | Service Type | Waiting Time | |
| 1 | 1 | 1 | 30 | |
| 2 | 1 | 1 | 35 | |
| 3 | 1 | 1 | 32 | |
| 4 | 1 | 1 | 24 | |
| 5 | 1 | 1 | 33 | |
| 6 | 1 | 1 | 36 | |
| 7 | 1 | 1 | 20 | |
| 8 | 1 | 1 | 30 | |
| 9 | 1 | 1 | 38 | |
| 10 | 1 | 1 | 40 | |
| 11 | 1 | 2 | 21 | |
| 12 | 1 | 2 | 20 | |
| 13 | 1 | 2 | 45 | |
| 14 | 1 | 2 | 24 | |
| 15 | 1 | 2 | 12 | |
| 16 | 1 | 2 | 40 | |
| 17 | 1 | 2 | 33 | |
| 18 | 1 | 2 | 35 | |
| 19 | 1 | 2 | 30 | |

The qualitative variables (e.g., NWGH, pediatrics, etc.) are then coded as shown in Table 2 so that it is easier to enter the data in Minitab®.

Results and Analysis

Multivariate charts have been plotted in Minitab with variables ‘waiting time’, ‘location’ & ‘service type’ to verify whether waiting time indeed depends on location and service type, and also whether there is any interaction between location and service type.

The following interpretations can be made from Figure 1.

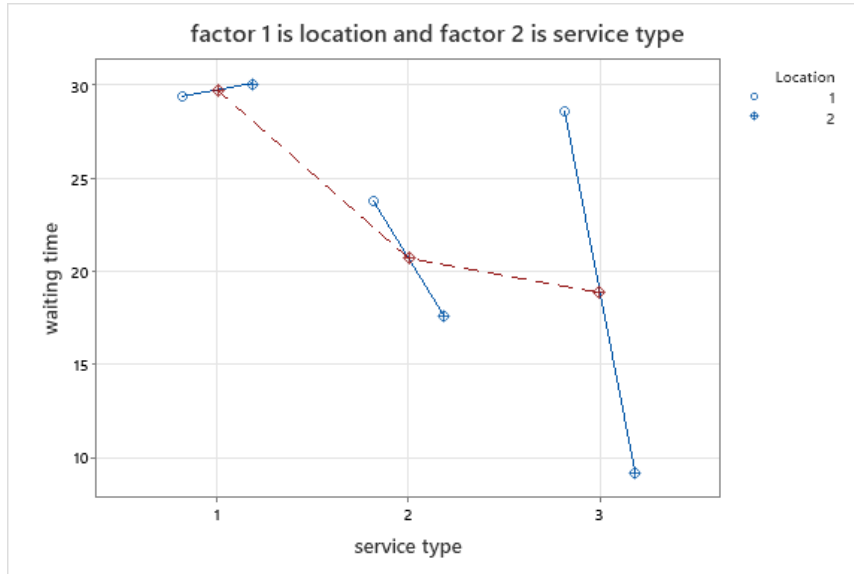


Figure 1: Multivariate chart to show waiting time in three different service types

At Location 2 (NTH), the average Waiting Times for Service Types 2 and 3 (Pediatrics and Dermatology) are shorter than that at Location 1 (NWGH).

At Location 1 (NWGH), the average Waiting Time for Service Type 1 (Gynae) is shorter than that at Location 2 (NTH).

The average Waiting Time is the longest for Service Type 1 (Gynae) among all Service Types.

The shortest average Waiting Time is for Service Type 3 (Dermatology) among all Service Types.

For Service Type 3 (Dermatology), the average Waiting Time at Location 1 (NTH) is much longer than that at Location 2 (NWGH).

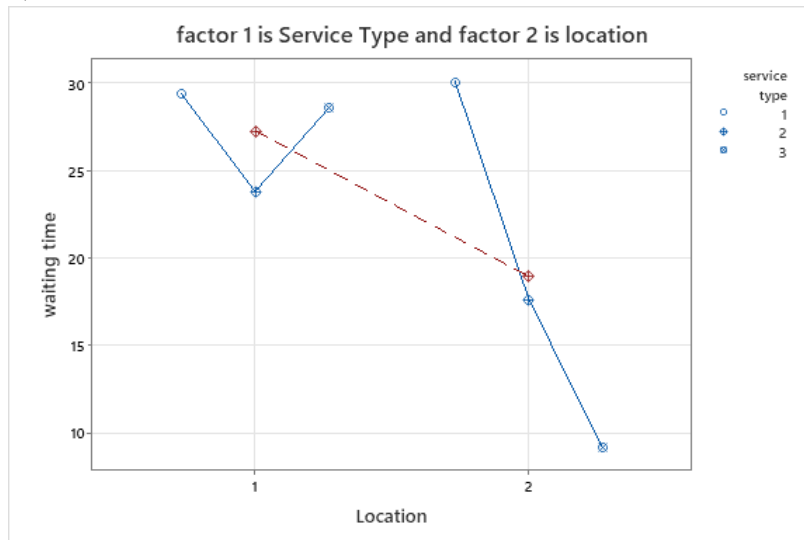


Figure 2: Multivariate chart to show waiting time at two locations



- The average waiting time at Location 1 (NWGH) is longer than that at Location 2 (NTH)
- At Location 1 (NWGH), the average waiting time for Service Type 2 (Pediatrics) is the shortest among all service types.
- At Location 2 (NTH), the average waiting time for Service Type 3 (Dermatology) is the shortest among all service types.

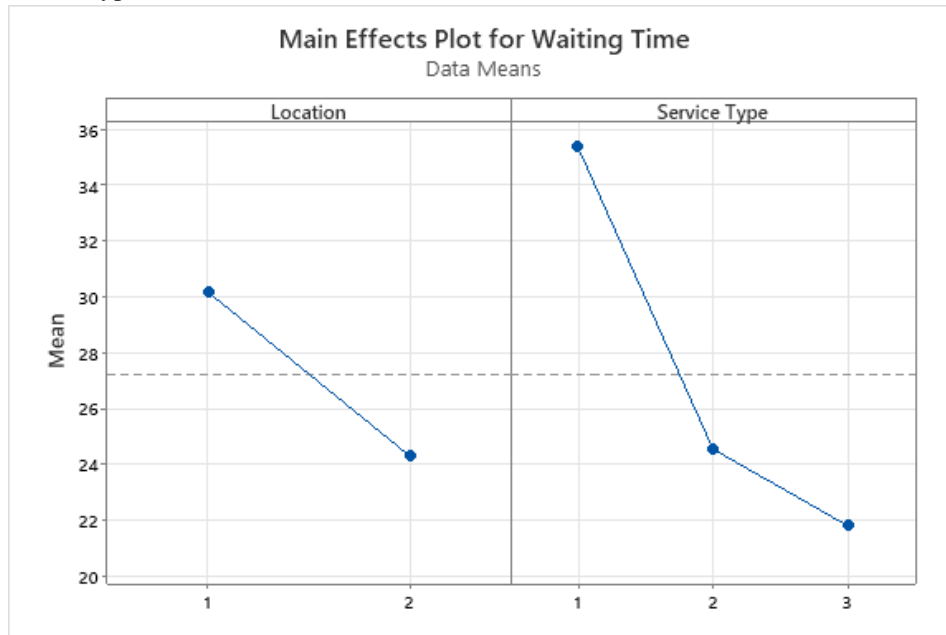


Figure 3: Main Effects plot for waiting time

It is evident that Location 1 (NWGH) has the longer average waiting time, and that Service Type 1 (Gynae) has the longest average waiting time

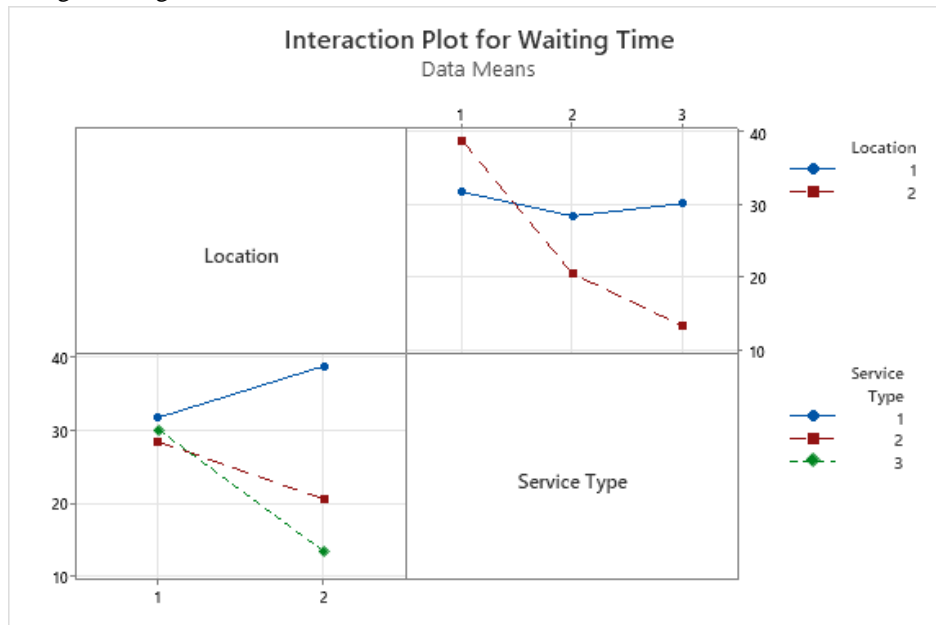


Figure 4: Interaction plot for waiting time

It is evident from both the plots (left side bottom plot and right side top plot) that the longest average waiting time is for Service Type 1 (dermatology) at Location 1 (NWGH).

Recommendations

For more correct result, one can select more locations than two

One can select more data points

Further work can be done by simulation on this data, because simulation is an effective tool for making decisions in complex but plausible contexts.

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