

# SUMMER TRAINING REPORT

PART 1- STUDY REPORT

PART 2 – ONLINE COURSE REPORT

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## TABLE OF CONTENTS

| S.No | Content                  | Page Number |
|------|--------------------------|-------------|
|      | <b>PART 1</b>            |             |
| 1.   | Introduction             | 7           |
| 2.   | Materials & Methods      | 7           |
| 3.   | Results                  | 8           |
| 4.   | Discussion               | 15          |
| 5.   | Conclusion               | 16          |
| 6.   | References               | 16          |
| 7.   | Annexure                 | 16          |
|      | <b>PART 2</b>            |             |
| 1    | Why this course          | 17          |
| 2    | Course Description       | 17          |
| 3    | Key Highlights           | 18          |
| 4    | Key Course Objective     | 18          |
| 5    | Course Module            | 19          |
| 6    | Learning Methodology     | 22          |
| 7    | Learning & Final Outcome | 22          |

## LIST OF TABLES

| S.no | Content                                            | Page Number |
|------|----------------------------------------------------|-------------|
| 1    | Characteristics Of respondents                     | 9           |
| 2    | Clinic opening In lockdown V/s Years of practice   | 10          |
| 3    | Revenue generation V/s Place of practice           | 11          |
| 4    | Revenue generation V/s frequency of opening clinic | 12          |
| 5    | Revenue generation V/s Years of practice           | 13          |
| 6    | Problems faced by dentist                          | 13          |
| 7    | Coping with COVID 19                               | 13          |
| 8    | Strategies used my dentists                        | 14          |

## LIST OF FIGURES

| S.no | Content                            | Page Number |
|------|------------------------------------|-------------|
| 1    | Frequency of opening clinic        | 9           |
| 2    | Revenue generation in the lockdown | 10          |

### **LIST OF ABBREVIATIONS**

|       |                                   |
|-------|-----------------------------------|
| COVID | Corona Virus Disease              |
| SARS  | Severe Acute Respiratory Syndrome |
| ANOVA | Analysis Of Variance              |
| CTQ   | Critical to quality               |

## **SUMMER TRAINING REPORT**

### **PART -1**

#### **STUDY REPORT – SITUATION ANALYSIS OF DENTISTS AMIDST COVID 19 LOCKDOWN**

##### **1. INTRODUCTION**

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Viruses have varying abilities to infect people. For COVID-19, each person with the virus can go on to infect around 2.5 people.

This is the major reason why countries have imposed on lockdown emphasising on quarantining at home. The rationale is to ensure people have minimal contact with each other, with people only being allowed to leave to get food or medicine, and to practise social distancing whenever they are in a public place.

In developing and tourist-friendly countries, there is a boom of dental tourism due to the availability of quality treatment at affordable prices, which attracts patients from all over the world.<sup>12</sup> In the event of an outbreak, the dentist can be the first person to come in contact with an infected person; they can either unknowingly become a carrier and infect others or by following proper guidelines can prevent the possible spread of the disease and save the entire community from its disastrous consequences.

Dentists who specialize in the field of public health dentistry are at an increased risk of contacting such an infection due to the nature of their work, which involves promoting oral health among their communities with limited resources.

And this total lockdown has had a significant impact on the dental surgeons. Dental surgeons are facing many problems as COVID-19 continues to affect the economy and risks endangering their lives daily. Health authorities recommended that dental clinic should immediately stop seeing patients, except for emergency treatment. This had led to an unprecedented revenue decline across the sector. The four costs which generally account for the vast majority of dental practice expenses are wages (25%-30%), rent (6%-9%), supplies (6%10%) and lab (3% to 8%) Many dentists who are running their clinic are facing problems like – Rent of the property, Loan EMI (Equated monthly instalment) ,Very low patient flow –very few people visit dental clinics for treatment and now because of COVID-19 lockdown the number decreases even more, Reduced treatment cost , shortage of PPE (personal protective equipment) kit, mask and other equipment's and their procurement being very expensive.

The aim of the study is to have a descriptive analysis of the situation of dental surgeons amidst the lockdown.

## 2. MATERIALS AND METHODS

Prior to the implementation of this study, the questionnaire structure, validation, and strategies to enrol dentists for maximum participation across the globe was discussed. A research proposal was drafted, and the study protocol was followed as mentioned in the proposal. The mode of data collection was through the link: <https://docs.google.com/forms/d/1sW4tPD2oI4xEzYObBt-vyCD3JWO5EH9vM-kSgYOEwh4/edit>. Upon clicking the form, the first page described the objective of the research which was to study the situation of dentist across the globe amidst COVID 19 lockdown. The consent page of the questionnaire promised on keeping the confidentiality of the participants and that their participation in the study was voluntary. The inclusion criteria for the participants was to have access to internet connection to obtain the questionnaire. Dentist who have completed their studies and practicing as a clinician or an academician. The exclusion criteria included participants who did not give complete responses to the questionnaire. The duration of the study was from 1<sup>st</sup> June- 30<sup>th</sup> June, 2020. The questionnaire was purposefully forwarded to dentists who practiced across the globe. The questionnaire was also broadcasted to their colleagues. It was also shared on social media platforms like LinkedIn and Facebook, to meet the required sample size and of 72 which was estimated by  $(Z^2pq/d^2)$ .

The questionnaire focused on characteristics of the dental clinicians which included their place of practice, years of practice. Questions were asked to see how the dental clinicians perceived their revenue generation at clinic during lockdown. Part of questionnaire also focussed on their mental health, reasons why they feel difficulty in running their clinic normally amidst lockdown and the strategies on how the clinicians are planning to cope with their lost businesses.

The data analysis included descriptive statistics of the data collected through Ms- Excel and Minitab Statistical Software.

## 3. RESULTS

A total of 80 dentists responded to the questionnaire. Complete responses were given by only 54 dentists that were taken for the analysis with a response rate of 67.5%.

### 3.1 Characteristics of respondents

As observed in Table 1 , 94.4 % of the respondents were from India and 5.56% were Abroad. Of all the respondents, 68.52% of the respondents were practicing as clinicians and 31.48% were practicing as both academician and clinician. 55.56% of the respondents were having an experience of less than 2 years, 27.78% with an experience of 3-5 years, 11.11 % were having an experience of 6-9 years and only 5.56 % had an experience of more than 10 years.

75.93 % of the dental practitioners accepted the government's regulation of closing dental clinic during COVID 19 Lockdown and 24.07% did not. 83.33% of the dental practitioners have been working during lockdown.

Table 1: Characteristics of respondents

### Tally

| Place of practice |         |       | practicing as |         |       | years of practice |         |       |
|-------------------|---------|-------|---------------|---------|-------|-------------------|---------|-------|
| Count             | Percent |       | Count         | Percent |       | Count             | Percent |       |
| Abroad            | 3       | 5.56  | Both          | 17      | 31.48 | >10 years         | 3       | 5.56  |
| India             | 51      | 94.44 | Clinician     | 37      | 68.52 | 0-2 years         | 30      | 55.56 |
| N=                | 54      |       | N=            | 54      |       | 3-5 years         | 15      | 27.78 |
|                   |         |       |               |         |       | 6-9 years         | 6       | 11.11 |
|                   |         |       |               |         |       | N=                | 54      |       |

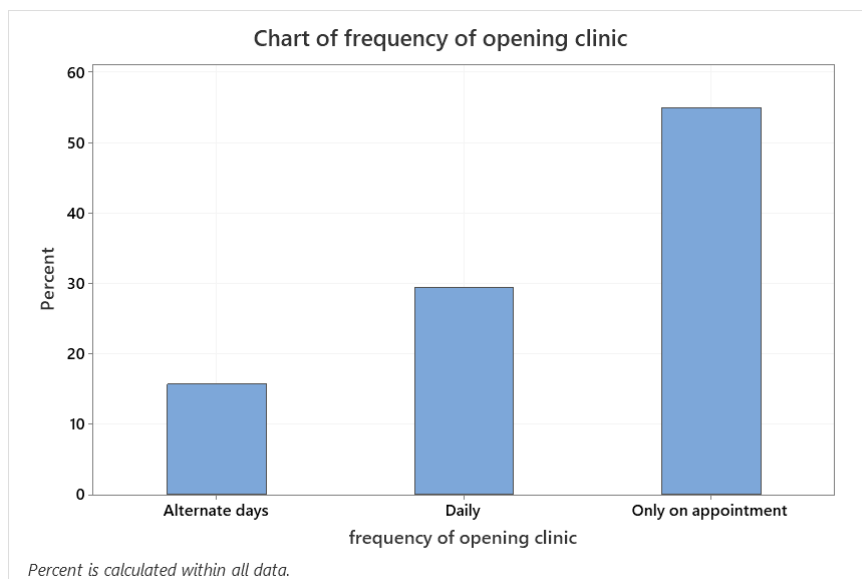
  

| accept govn relations |         |       | working during lockdown |         |       |
|-----------------------|---------|-------|-------------------------|---------|-------|
| Count                 | Percent |       | Count                   | Percent |       |
| No                    | 13      | 24.07 | No                      | 9       | 16.67 |
| Yes                   | 41      | 75.93 | Yes                     | 45      | 83.33 |
| N=                    | 54      |       | N=                      | 54      |       |

75.93 % of the dental practitioners accepted the government's regulation of closing dental clinic during COVID 19 Lockdown and 24.07% did not. 83.33% of the dental practitioners have been working during lockdown.

### 3.2 Frequency of opening clinic in the lockdown

Figure 1: Frequency of opening clinic in the lockdown



Of all the dentists who had been working during lockdown, it was found that 54.90% dentists opened their clinic only on appointment, 29.41% have been opening it daily and the rest opened it only on alternate days.

### 3.3 Description of opening clinic in the lockdown V/s years of practice

Table 2: Description of opening clinic in the lockdown V/s years of practice

Rows: years of practice Columns: frequency of opening clinic

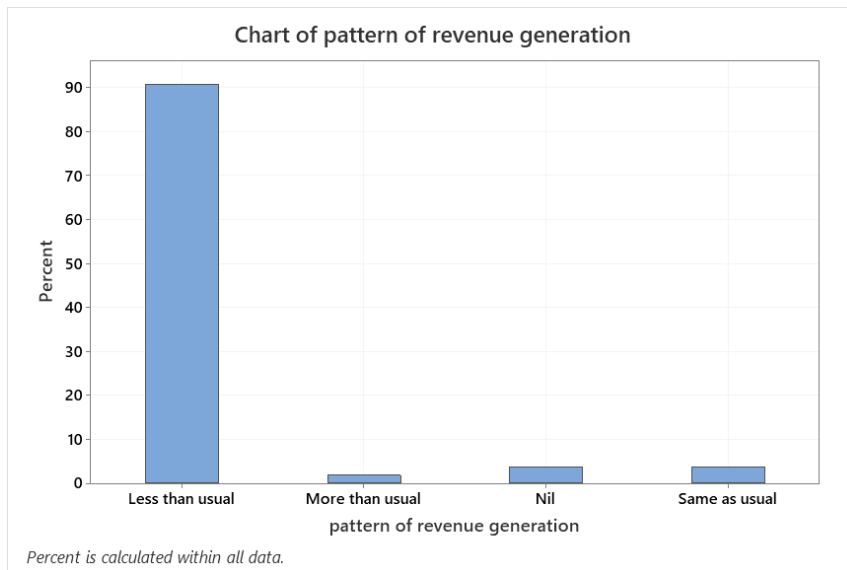
|           | Alternate<br>days | Daily appointment | Only on | All    |
|-----------|-------------------|-------------------|---------|--------|
| >10 years | 0                 | 0                 | 3       | 3      |
|           | 0.00              | 0.00              | 100.00  | 100.00 |
|           | 0.00              | 0.00              | 10.71   | 5.88   |
| 0-2 years | 4                 | 10                | 14      | 28     |
|           | 14.29             | 35.71             | 50.00   | 100.00 |
|           | 50.00             | 66.67             | 50.00   | 54.90  |
| 3-5 years | 4                 | 4                 | 6       | 14     |
|           | 28.57             | 28.57             | 42.86   | 100.00 |
|           | 50.00             | 26.67             | 21.43   | 27.45  |
| 6-9 years | 0                 | 1                 | 5       | 6      |
|           | 0.00              | 16.67             | 83.33   | 100.00 |
|           | 0.00              | 6.67              | 17.86   | 11.76  |
| All       | 8                 | 15                | 28      | 51     |
|           | 15.69             | 29.41             | 54.90   | 100.00 |
|           | 100.00            | 100.00            | 100.00  | 100.00 |

Cell Contents  
Count  
% of Row  
% of Column

It was found that all dentists with more than 10 years of experience and 83.69% of the dentists with an experience of 6-9 years opened their clinic only on appointment during lockdown. 35.71% Dentists with less than 2 years of experience opened their clinic daily, 50% opened it on appointment whereas only 14.29% opened it on alternate days.

### 3.4 Revenue Generation from clinic in the lockdown

Figure 2: Revenue Generation from clinic in the lockdown



It was found that 66.67% of the dentists had the revenue coming from the clinic as their only source of income. 90.74% of the dentists perceived their revenue generation at clinic to be less than usual. 1.85 % dentists perceived it to be more than usual. Where 3.70% of dentists perceived it to be same as usual there were another 3.70% who did not have any revenue generation from clinic in the lockdown.

### 3.5 Revenue generation in the clinic V/s Place of practice

Table 3: Revenue generation in the clinic V/s Place of practice

**Rows: Place of practice Columns: pattern of revenue generation**

|        | Less than usual | More than usual | Same as usual | All    |
|--------|-----------------|-----------------|---------------|--------|
| Abroad | 3               | 0               | 0             | 3      |
|        | 100.00          | 0.00            | 0.00          | 100.00 |
|        | 6.25            | 0.00            | 0.00          | 5.88   |
| India  | 45              | 1               | 2             | 48     |
|        | 93.75           | 2.08            | 4.17          | 100.00 |
|        | 93.75           | 100.00          | 100.00        | 94.12  |
| All    | 48              | 1               | 2             | 51     |
|        | 94.12           | 1.96            | 3.92          | 100.00 |
|        | 100.00          | 100.00          | 100.00        | 100.00 |

Cell Contents

Count

% of Row

% of Column

On analysing the revenue generation with respect to the place of practice, it was found that 94.12 % dentists globally perceived their revenue generation to be less than usual. 93.75 % of the Indian dentists felt their revenue generation to be less than usual, whereas all the

respondents abroad perceived their revenue to be less than usual. Of all the dentists who responded, 1.96 % felt their revenue generation was more than usual. 2.08% of the dentists practicing in India perceived it to be more than usual. And 4.17 % of the dentists practicing in India found the revenue generation to be same as usual.

### 3.6 Revenue generation V/s Frequency of opening clinic

Table 4: Revenue generation V/s Frequency of opening clinic

Rows: frequency of opening clinic Columns: pattern of revenue generation

|                     | Less than usual       | More than usual      | Same as usual       | All                    |
|---------------------|-----------------------|----------------------|---------------------|------------------------|
| Alternate days      | 6<br>75.00<br>12.50   | 1<br>12.50<br>100.00 | 1<br>12.50<br>50.00 | 8<br>100.00<br>15.69   |
| Daily               | 15<br>100.00<br>31.25 | 0<br>0.00<br>0.00    | 0<br>0.00<br>0.00   | 15<br>100.00<br>29.41  |
| Only on appointment | 27<br>96.43<br>56.25  | 0<br>0.00<br>0.00    | 1<br>3.57<br>50.00  | 28<br>100.00<br>54.90  |
| All                 | 48<br>94.12<br>100.00 | 1<br>1.96<br>100.00  | 2<br>3.92<br>100.00 | 51<br>100.00<br>100.00 |

Cell Contents  
Count  
% of Row  
% of Column

It was found that 75% of the clinicians who opened their clinic on alternate days had a lesser than usual revenue at clinic, 12.50% of the clinicians had a revenue generation more than usual whereas 12.50% had it same as usual. All clinicians who opened their clinic daily, however had revenue generation less than usual. 96.12% of the dentists who opened their clinic daily perceived their revenue to be less than usual, 1.96% perceived it to be more than usual and 3.92% felt it to be same as usual.

### 3.7 Revenue generation V/s Years of practice

Table 5: Revenue generation V/s Years of practice

Rows: years of practice Columns: pattern of revenue generation

|           | Less than usual       | More than usual     | Same as usual       | All                    |
|-----------|-----------------------|---------------------|---------------------|------------------------|
| >10 years | 3<br>100.00<br>6.25   | 0<br>0.00<br>0.00   | 0<br>0.00<br>0.00   | 3<br>100.00<br>5.88    |
| 0-2 years | 26<br>92.86<br>54.17  | 0<br>0.00<br>0.00   | 2<br>7.14<br>100.00 | 28<br>100.00<br>54.90  |
| 3-5 years | 13<br>92.86<br>27.08  | 1<br>7.14<br>100.00 | 0<br>0.00<br>0.00   | 14<br>100.00<br>27.45  |
| 6-9 years | 6<br>100.00<br>12.50  | 0<br>0.00<br>0.00   | 0<br>0.00<br>0.00   | 6<br>100.00<br>11.76   |
| All       | 48<br>94.12<br>100.00 | 1<br>1.96<br>100.00 | 2<br>3.92<br>100.00 | 51<br>100.00<br>100.00 |

Cell Contents  
Count  
% of Row  
% of Column

It was found that all the dentists with more than 10 years of practice perceived their revenue generation to be less than usual. However, 7.14% of the dentists with 3-5 years' experience found their revenue generation to be more than usual

### 3.8 Problems faced by dentists in the lockdown

Table 6: Problems faced by dentists in the lockdown

#### Tally

| clinic rent | Percent | salaries | Percent | emi | Percent | stock | Percent |
|-------------|---------|----------|---------|-----|---------|-------|---------|
| No          | 42.59   | No       | 35.19   | No  | 51.85   | No    | 62.96   |
| Yes         | 57.41   | Yes      | 64.81   | Yes | 48.15   | Yes   | 37.04   |

It was found that 57.41% of the dental clinicians found it difficult to pay their clinic rent or monthly electricity charges of their clinic, 64.81% found difficulty in paying the salaries to their employees, 48.15% found difficulty in paying their monthly EMI whereas 37.04% of the dental clinicians perceived a wastage of stock inventory in the lockdown.

### 3.9 Coping up practice in COVID 19

Table 7: Coping up practice in COVID 19

## Tally

| mental stress |         | charge additional fee |         | time taken to function |         | treating covid patients |         |
|---------------|---------|-----------------------|---------|------------------------|---------|-------------------------|---------|
|               | Percent |                       | Percent |                        | Percent |                         | Percent |
| No            | 46.30   | Maybe                 | 27.78   | >12 months             | 11.11   | Maybe                   | 14.81   |
| Yes           | 53.70   | No                    | 46.30   | 1 month                | 1.85    | No                      | 64.81   |
|               |         | Yes                   | 25.93   | 2-5 moths              | 42.59   | Yes                     | 20.37   |
|               |         |                       |         | 6-12 months            | 44.44   |                         |         |

It was found that 53.70% of the dental clinicians have been going through mental stress during lockdown . 25.93% dentists plan to charge additional fee for practice to their patients to compensate to their lesser revenue post lockdown, 27.78% of the dentists are sceptical about the decision whereas 46.30% of dentists do not plan on charging additional fee to their patients.

Around 44.44 % of the dental clinicians feels it would take 6-12 months for them to function normally post lockdown, whereas 42.59% dentists feel it would take them 2-5 months to resume normally.

It was found that 20.37% dentists would be hesitant in treating patients with COVID 19, where 14.81% dentists are sceptical and 64.81% do not hesitate in treating COVID patients.

### 3.10 Startegies taken up for practice in COVID 19

It was found that 83.33% dental clinicians have implemented the preventive measures in their clinic on COVID 19 based on WHO guidelines whereas , 16.67% of the dentists do not have knowledge on the guidelines.

Table 8 : Counselling strategy adapted by dentists

## Tally

|                                                                                  | counceling strategy | Percent |
|----------------------------------------------------------------------------------|---------------------|---------|
| I have/planning to print IEC material for patient education and put it up in the |                     | 22.22   |
| I prefer counselling through a word of mouth                                     |                     | 75.93   |

75.93% dental clinicians prefer a word of mouth counselling to their patients coming to the clinic, 22.22% have printed IEC materials for patient education at their clinic and the rest don't find the necessity on patient education.

#### 4. DISCUSSION

The transmission of COVID-19 poses a risk for people who come in close contact with an infected individual, and the risk is greater among those who are in close proximity to or work near the patient, i.e., relatives and healthcare workers. The distance between the working field and the dentist is approx. 35–40 cm, and certain procedures can be very time-consuming, which puts the dentist at a higher risk of contacting COVID-19.

The Covid-19 pandemic and the subsequently implemented policies worldwide are unprecedented in modern times. Mitigation and suppression, necessary to contain the spread, are likely to impact on the economy, with catastrophic results for many small- and middle-sized businesses. These mitigations put dental practices under a financial stress. In the base analysis it was found that majority of the dental practices have been producing very little profit in the lockdown. This could be attributed to the reduced clinic opening hours during lockdown which has influenced the revenue generation.

The reduced profit generation of dentists has led to their increased out- of pocket expenditure. The data generated from the study shows that most of the clinics opened only on appointment and this trend was much evident amongst dental practitioners with more than 4 years of practice. Opening clinics only on appointment leads to a reduced patient flow than usual and eventually affects the revenue generation being less than usual. The dental practitioners practicing Abroad felt a legit decrease in trend of revenue generation however the trend in India was different. There were a few percentages of dentists who felt their practice generated revenue more than usual in the lockdown and around 4% didn't feel any difference in their revenue generation. Even if the clinic was opened daily during lockdown, dentists felt their revenue was less than usual. This could be attributed to the restrictions imposed by government on carrying out only emergency treatment. Travel restrictions imposed in the lockdown would have made transporting laboratory work difficult thereby reducing the revenue generated at clinic through prosthodontic procedures.

The study observed that dentists found it difficult to pay their clinic rent and most importantly salary to their employees. This has made them mentally stressed. The need of the hour for dentists is to look out for business strategies to cope with their lost businesses keeping in mind the regulations put forth by the government with dental practices.

#### 5. CONCLUSION

In the present study, dentists were found to have been having a struggle to cope up with their practice in the Lockdown imposed due to COVID 19. To combat the situation, dentists must be well versed with the recent developments, especially those related to public health, and by following apt guidelines (i.e., the WHO guidelines at <https://www.who.int/emergencies/diseases/ novel-coronavirus-2019/technical-guidance>) make efforts to prevent the transmission of such diseases. Dentists should appropriately use the social media to spread awareness among people, and in their clinical practice, they should screen, isolate and refer the potential cases having the symptoms of COVID-19. They are also advised to follow the CDC and WHO guidelines in their clinics and sensitize their staff so that no stone is left unturned in defeating this pandemic.

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## 7. ANNEXURE

Online questionnaire form - <https://docs.google.com/forms/d/1sW4tPD2oI4xEzYObBt-vyCD3JWO5EH9vM-kSgYOEwh4/edit>.

## **SUMMER TRAINING REPORT**

### **PART – 2**

#### **ONLINE COURSE REPORT – DATA ANALYTICS IN LEAN SIX SIGMA**

##### **Why this course?**

My quest to see how to interpret and utilise data lead me to Data Analytics In Lean Six Sigma, an aptitude that is turning out to be increasingly more helpful nowadays, as the measure of accessible information is expanding. Lean Six Sigma is a procedure for process improvement, and it utilises data and data analytics.

Questions that can be examined inside a Lean Six Sigma venture are:

- What is the most significant issue that an association should concentrate on?
- How to evaluate a specific marvel?
- Do the workers impact on what amount time it takes to deal with an occupation?
- Which division shows the best performance?
- Which division is the most reliable, or shows the highest calibre?
- How to diminish the quantity of deformities?
- Is there a genuine distinction in quality in a venture?

These kinds of questions are addressed utilising data analytics in a Lean Six Sigma venture. The utilisation of data analytics apparatuses has, truth be told, a lot more extensive application zone. Data analytics can be valuable in different regions where one experiences information. Hence this course would complement me in building an acumen in crafting a career in Operations & Quality Assurance

##### **Course description**

The course presents Lean Six Sigma which is a technique that depends on a synergistic collaboration to improve performance and shows where data and data analytics have their place inside the DMAIC system. It additionally presents the product bundle Minitab (a statistical programming software for data analytics).

The first week covered the utilization of information in Lean Six Sigma undertakings and how to compose information. A prologue to Minitab, the statistical software which is utilized for data analytics was given. Further talks spread the ideas on comprehension and envisioning information utilizing diagrams like histogram, box plot, bar outlines, pie outlines, pareto outlines with translation of these charts and besides, required to summarise data.

A module on probability distribution was shrouded in the second week with a target to quantify uncertainties and responding to business questions.

The third week module was on testing, instructed to formulate statements that can be done using data analytics.

After this, two modules on statistical testing, in which methods to establish relationships between variables was taught using correlation and regression techniques.

The arrangement of video addresses in the course was about how to utilise data analytics for functional issues at a hierarchical level and had a solid spotlight on the use of data analytics inside the Lean Six Sigma structure.

### **Key highlights**

#### **I. IMPROVING PROCESS THROUGH LEAN SIX SIGMA**

Lean six Sigma is a data driven way to deal with process improvement. Processes are progressions of steps made to make an item or product a service. Processes occur all over the place .An extremely well-known approach to improve process is Lean Six Sigma. This is a stepwise strategy for running a process improvement venture. So, principle highlights of Lean Six Sigma are its proof based.Lean Six Sigma offers a guide known as DMAIC or D-M-A- I- C. These five stages endorse a stage shrewd technique for process improvement dependent on estimations, and proof-based improvement activities. Thus, data and data analysis are significant in any DMAIC venture. The D represents Define, the M represents Measure, A for Analyse, I for Improve, and C for Control. An individual who drives a Six Sigma Project is known as a belt.

The objective is to decide the idea of the current issue. After finding of the current procedure a belt creates and executes improvement activities dependent on fundamental impact factors in the improve stage. At long last in the control stage, the procedure controls are improved, and the undertaking is shut.

#### **II. CTQ –CRITICAL TO QUALITY**

In the DMAIC stages, the piece of CTQ goes under the measure stage, which is tied in with making an issue quantifiable and quantifiable. This is likewise called the operationalization of an issue.

A CTQ is a property of an item or an assistance that is applicable to extend objective. One can discover it by asking, what is the metric one needs to change? In Lean Six Sigma phrasing, this measurement is known as a CTQ. In different fields, be that as it may, this is regularly called Y-variable, dependent variable, or the outcome variable.

#### **III. UNITS AND OPERATIONAL DEFINITION**

. Units are the things one gathers information on. The estimation unit characterises what an estimation implies. The measurement units are the properties of the things one gathers information on. The concession to how to gauge a variable and what the unit is called an operational definition. An operational definition can be minimal self-assertive, it can change dependent on your procedure of intrigue however should be a reasonable one.

#### **IV. ORGANISING DATA**

The fundamental method to compose data is in a structure dependent on units and variables. A unit speaks to an individual case, what is being estimated. The variables are the properties of the units that are being measured. Units are constantly put away in the columns of data set. A unit is known as the experimental or observational unit or at times alluded to as a case. A data set additionally comprises of variables, which is constantly put away in the rows. A variable speaks to the properties of the units estimated. Sorting out information makes investigations of information simpler.

#### **V. NUMERICAL AND CATEGORICAL DATA**

There are two principle classifications of data. The first is numerical, and the subsequent one is continuous

Numerical data is a quantitative data. The data depends on numbers that one can ascertain with, for example, temperature, dimensions, or the quantity of individuals in a room

Categorical data is qualitative information. Thus, one can divide the information into groups. On the off chance that there is a significant request to the groups, it is ordinal information. If the groups comprise of unordered classes, it is nominal information. If one just has two alternatives accessible, we will call it binary information

#### **VI. VISUALIZING NUMERICAL DATA**

There are 2 types of visual numerical data

Histogram

Boxplot

Histogram: The bigger piece of the information that is thought together is known as the bulk and the rest of the parts on the two sides are known as the tails. Tails decline outwards.

boxplot :comprises of a box which is the centre half of information, that is 25% of the information is littler and 25% of the information is bigger. These are shown by the whiskers. If there are perceptions that are far away from the case, these perceptions are called outliers and are shown with a star. A boxplot uncovers where the information is situated on the genuine line. It shows you the base worth and the most extreme worth. The boxplot additionally shows the interquartile range. The interquartile range is equivalent to the length of the box

#### **VII. VISUALISING CATEGORICAL DATA**

For a single categorical value, a pie graph, bar outline or a count table can be utilised. A pie diagram shows how regularly every classification happens. A bar diagram gives a similar data; however, it is simpler to spot which class happens regularly. A count table gives the specific numbers.

**Tally table:** To make a tally table, in Minitab statistical software, go to Stat, and then to the menu Tables and choose the first option, the Tally Individual Variables. A tally table gives the exact numbers and percentage of the required data.

## **VIII. PARETO ANALYSIS**

80% of all issues can be ascribed to 20% of the causes. The horizontal axis contains the kind of issues. The tallness of the bars in the diagram shows how regularly these issues happen.

Pareto graph with the frequencies just shows how regularly every issue happens. Be that as it may, often one is increasingly inspired by which issue occupies the vast majority of time. In such cases one ought to likewise quantify the duration.

## **IX. NORMAL, LOGNORMAL AND WEIBULL DISTRIBUTION**

In a Lean Six Sigma venture, one generally experiences an Normal, Lognormal and Weibull distributions.

The Normal distribution is even or symmetrical and it looks somewhat like a bell shape. The blue bars in the histogram show the circulation of 50 values in estimated sample. The red curve is the populace dispersion that Minitab fitted to the information. The more N builds up, the more it begins to appear as though a bell shape.

A Normal Distribution has two parameters that decide the shape of its distribution.

The principal parameter is the location parameter which decides the midpoint. This is indicated by  $\mu$ , which is the location or mean. The subsequent parameter portrays the state of the distribution and is known as the dispersion parameter, indicated by  $\sigma$ . Also, it decides the spread of the distribution.

## **X. DATA BASED TESTING IN LEAN SIX SIGMA**

Information based testing of thoughts and improvements is one of the most significant standards of Lean Six Sigma. It is alluded to as proof based improvement activities. In DMAIC venture, relating the CTQ to the impact factor will be a piece of the improve stage where one creates and actualises successful improvement activities.

## **XI. HYPOTHESIS TESTING**

An estimate is just distinct. Subsequently, one regularly changes from estimation to testing. Testing implies that one claims something. What is more, information is utilised to test this claim. This claim is known as a hypothesis testing. For this one ascertains the p-value. The P-value is a probability, that is the reason it is called p-value. This p-value will permit choosing whether to reject null hypothesis.

On the off chance that the p-value is small enough, this implies one has discovered a huge impact, that  $H_0$  is impossible and that you reject the null hypothesis. If a p-value is sufficiently little, lesser than 0.05 stating that we reject the null hypothesis.

On the off chance that the p-esteem is bigger than this edge of 0.05, we do not reject the null

### **Key Course Objective**

#### **Data based testing through**

**Anova analysis :** ANOVA represents analysis of variance. ANOVA is the suitable measurable method when the Y variable is numerical, and the X variable is categorical. ANOVA can be acted in three stages; the initial step is to sort out information. The X and Y factors ought to have their different column. Each row in data set needs to contain one unit. With information organised, one can go to stage two and really play out the ANOVA. The third step consists of a presumption check on the grounds that after playing out an ANOVA, one needs to confirm the reliability of the outcomes.

**Predictive analysis :** The prediction value can be utilised to decide the degree of impact factor, which guarantees a certain CTQ execution

**Logistic regression :** At the point when you have a categorical Y variable and a numerical X variable, the logistic regression is calculated. Logistic Regression comprises of three stages. In the initial step you arrange your information in the event trail manner. In the second step you make a fitted line plot. What is more, in the third step, you check if the outcomes are huge and can be summed up to the populace

**Chi square analysis :** If you have a Y variable is categorical and a X variable or the influence factor that is numerical, we need to play out a chi-square investigation. How about we make a glance at the strides of the chi-square investigation. The initial step is to make a cross tabulations. You can either do this by duplicating a cross table into worksheet, or by having it done by Minitab. The subsequent advance is to investigate the p-value.

### **Course module**

#### **Week 1**

- Introduction to Lean Six Sigma
- The five phases of DMAIC
- Introduction to CTQ measurement
- Collection of a representative sample
- Organization of data and distinguish between units and variables
- Operational definition corresponding to a CTQ

#### **Week 2**

- Numerical and categorical data
- Descriptive statistics
- Histogram and boxplot interpretation
- Bar graph, pie diagram, count table interpretation
- Pareto graph interpretation
- Creating an appropriate graphical visualisation for two variables and interpreting the results

### **Week 3**

- To comprehend the connection between a sample and population
- To comprehend the concept and use of estimation
- To quantify precision of estimate (using confidence intervals)
- To distinguish various kinds of probability distributions (Normal, Lognormal, Weibull)
- To determine the distribution of numerical variation using probability plot
- To determine the probabilities and percentages using Empirical CDF
- To use "rule of thumb" to compute probabilities for normally distributed variables
- To comprehend parameters of normal distribution

### **Week 4**

- To recognise X variable and Y variable in practice and select the suitable test
- To interpret p-value of hypothesis testing
- To interpret results accurately by distinguishing between causality and relation

### **Week 5**

- To interpret and use correlation
- To judge when regression is the pertinent technique
- To play out a regression and interpret output, particularly p-value and R-squared
- To process and interpret a prediction interval
- To perform and interpret a quadratic regression
- To judge the validity of regression using residual analysis

### **Learning Methodology**

The necessary pledge to the course was 5 weeks (4 hours of study for each week) covering an aggregate of 20 hours of study time. The course was started on April 20, 2020 and completed on May 15, 2020. The course incorporated 65 video addresses, readings, practice works out, conversation discussion and reviewed tests toward the finish of the module.

### **Lesson Drawn & Final Outcome:**

Toward the finish of the course, I briefly know about Lean Six Sigma and how data analytics methods are valuable inside Lean Six Sigma improvement process. I am ready to analyse and interpret information accumulated for any improvement process needed in an organisation and have built up the effectiveness to utilize Minitab to break down the information, with different information expository devices and interpret the result.