# A Survey to Infer on the Effects of COVID-19

## Exploring the Ripple Effects of the Pandemic on Daily Habits, Social Interactions, and Well-being

### Statistics Project Report

M.Tech CrS 1$^{st}$ Semester Students

STATISTICAL INDIAN INSTITUTE

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Exploring the Ripple Effects of the Pandemic on Daily Habits, Social Interactions, and Well-being

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We, the M.Tech CrS $1^{st}$ Semester Students, hereby affirm that all the ideas presented herein have been conveyed in our own words, and any external sources used have been appropriately referenced and cited. Furthermore, We attest to having adhered to the highest standards of academic honesty and integrity throughout the creation of this submission. At no point have we misrepresented or falsified any data, fact, or source in this document. We also attest that this document is original and has not been submitted elsewhere.

( M.Tech CrS $1^{st}$ Semester Students)

# Abstract

The new coronavirus $SARS-CoV-2$ that triggered the COVID-19 pandemic arose as an unprecedented worldwide health disaster that drastically altered life as we know it. This contagious disease has spread quickly across continents since it was first discovered in late 2019, posing a threat to global healthcare systems, economy, and social norms.

In addition to posing serious risks to public health, this epidemic has caused significant socioeconomic upheavals that have changed the course of our every-day lives. It is now critical to understand the complexities of this viral outbreak, the ways in which it spreads, the effects it has on different populations, and how to establish effective mitigation techniques.

In this project, we delve into a comprehensive analysis of the multifaceted dimensions of the COVID-19 pandemic. We explore the emergence of vaccines and treatments, worldwide response initiatives, clinical manifestations, epidemiology, transmission dynamics, and societal implications. Understanding these aspects is crucial not only for navigating the crisis but also for preparing and fortifying ourselves against potential future pandemics.

This study attempts to provide light on the intricate interactions between the virus and society by carefully examining scientific studies, statistical data, and socio-economic analysis. Through acquiring a profound understanding of the effects of COVID-19, we hope to add to the current conversation, promoting well-informed choices and supporting initiatives to address this worldwide threat.

Our analysis is based on the data collected from 230 individuals.

# Contents

# 1. The Survey

## 1.1 DATA DESCRIPTION

In order to ensure the success of our work, we formulate a set of questions and obtain the necessary data using a Google Form. To access the form, please visit: `https://forms.gle/VDTpe4S4yUoHkkbG6`

### Personal Information

1. *Name:*

2. *Age:*

3. *Gender:*

4. *Current Employment Status:*

5. *Profession:*

### Family and Vaccination Status

6. Number of Heads in Family (Including yourself):

7. Have you been vaccinated completely against COVID-19?

### Occupational and Activity Engagement

8. Were you engaged in any occupation / project / institutional activities during specific times?

9. Were you engaged in those activities mostly from home during specific times?

## Outdoor Activities and Testing

10. How often did you go outside at the time of Corona?

11. Had you tested yourself for COVID-19?

12. Were the results positive?

## Health and Chronic Conditions

13. Rate the severity of COVID-19 infection on your health ?

14. Did you have any chronic disease / co-morbidity before COVID-19?

15. Please rate the change in severity of the chronic disease before and after the pandemic on a scale of 0 to 5 (With 0 being Did Not Change / Not Applicable and 5 being Reached a Critical Level.)

## Mental Health and Physical Well-being

16. Have you faced any unusual mental health issues during COVID-19?

17. Please mention an approximate value for the following quantity (in Kg): Your weight after the pandemic - Your weight before the pandemic (Subtract, negative values may arise.)

## Financial and Medical Impact

18. Were any of your family members tested positive for COVID-19?

19. Were there any deaths due to COVID-19 in your family?

20. Please mention an approximate value for the following quantity (in *INR*): Monthly medical expenses of your family after the pandemic - That before the pandemic (Subtract, negative values may arise.)

## Hygiene Practices and Adherence

21. Have you used the following items? (*Before/During/After* COVID-19)

    - *Sanitizer.*
    - *Face mask.*
    - *Head mask.*
    - *Hand gloves.*
    - *Face shield.*

22. Have you followed the mentioned rules/practices?

   - *Safe distancing.*
   - *No touch product acceptance.*
   - *Washing marketed products thoroughly.*
   - *Washing hands with soap for a minimum of 20 sec.*
   - *Physically exercising.*

## Lifestyle Changes

23. How much have you depended on the cooked-food delivery system? (Choose the closest answers.)

24. How have your average screen times (on phone, TV, etc.) been? (Choose the closest answers.)

25. Considering its severity, if there is another epidemic like COVID-19 within the next 20 years, do you have any hygiene plans to combat it?

## Perception and Future Preparedness

26. What has been COVID-19's effect on the growth of education in your family?

27. Do you have economic backup plans for any upcoming epidemic within the next 20 years?

28. How have the following aspects changed in your life after COVID-19?

   - *Social interaction.*
   - *Annual family income.*
   - *Monthly family expenses.*
   - *Screen-time.*
   - *Dependence on the ready-made delivery system.*

29. Considering the general reluctance to adapt to the new lifestyle during the COVID-19 pandemic, how likely are you to start following the safety rules imposed (by the nationally accepted medical societies), if there is a pandemic in the next 20 years?

30. Is there any other experience/changes in your life due to the pandemic that you would wish to share with us? If '*Yes*', please write.

# 2. Demographic Details

## 2.1 Male-Female Ratio

The survey aimed to capture a diverse range of experiences related to the effects of COVID-19 on lifestyle changes. One significant aspect of this diversity is the representation of different genders among the respondents.



**Participants of the Survey**
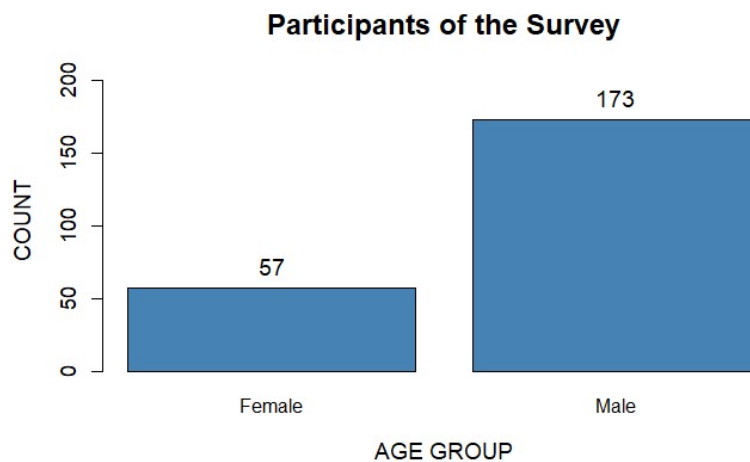
*Figure 2.1:* *Male-Female Ratio*

Figure 2.1 presents the results of a survey with **230** participants corresponding to their genders. The figure is a Bar plot clearly representing **57** female and **173** male participants who took part in the survey.

## 2.2 Employment Status

Figure 2.2 presents the results of the above-mentioned survey categorized by the employment status of the participants. The employment status of the participants shows that **63** are employed, **1** is retired, **126** are students and **40** are unemployed.

*Figure 2.2: Employment Status*

The survey indicates that the majority of participants are students, with a significant number of employed and unemployed individuals and a very small representation of retired persons. The data highlights the distribution of employment status among the survey participants and provides insights into the demographic composition of the sample.
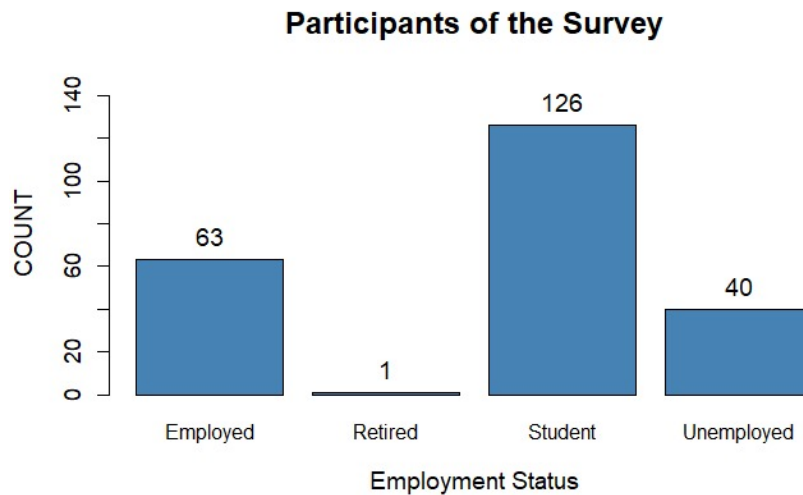
## 2.3  Heads in Family
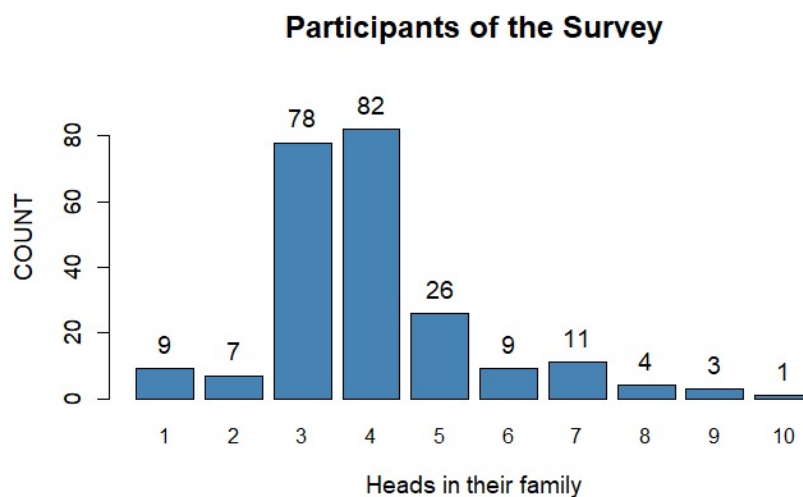


*Figure 2.3: Heads in Family*

In Figure 2.3 the document provides an overview of our survey with respect to the number of heads in the families of the participants.

The data indicates that the majority of participants had 3 to 5 members in their families, with a few outliers having 1, 2, 6, 7, 8, 9, or 10. Overall, the survey aimed to gather information about family size within the specified sample observations.

## 2.4  Age Group
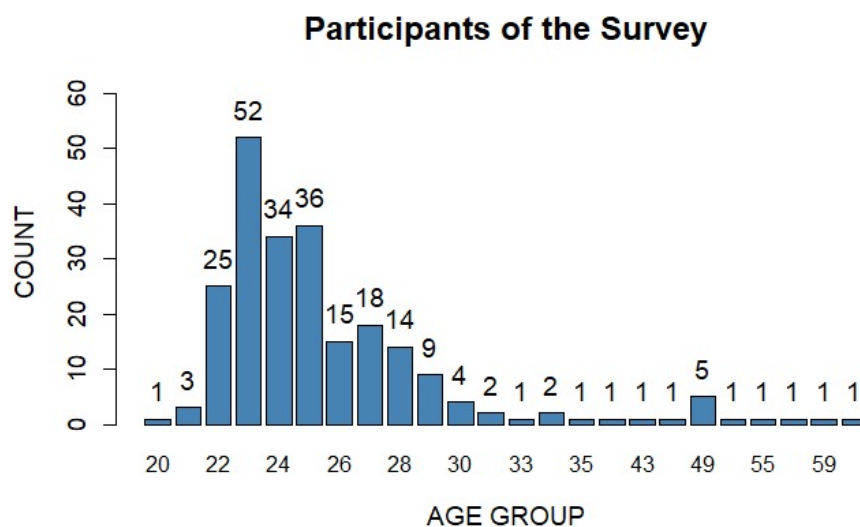


**Figure 2.4:** *Age Group*

The data represented in Figure 2.4 indicates the number of participants corresponding to their ages.

The data, shows that the majority of the participants, who took part in the survey, are aged between 20 and 30 with 52, 34 and 36 persons of age 23, 24 and 25 respectively. Ages of more than 34 have been rare, although we had 5 occurrences of age 49 as an exception. This plot signifies that our sample data greatly consists observations of people having age between 20 and 30.

# 3. Data Analysis

## 3.1 Families getting effected
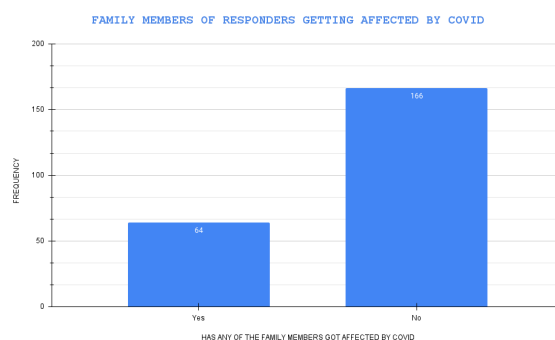


**Figure 3.1:** *Effected by COVID in Family*

Figure 3.1 represents that **64** participants have reported having family members have been affected by COVID-19, while the remaining **166** participants indicated that none of their family members had been impacted by the virus.

### 3.1.1 Deaths
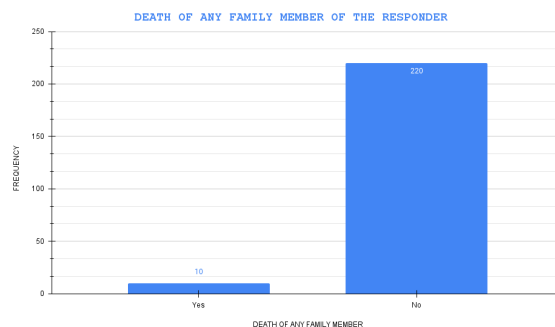


**Figure 3.2:** *Deaths due to COVID in Family*

In Figure 3.2, it is observed that among the **230** participants, **10** individuals have encountered the loss of a family member due to COVID.

## 3.2 Family Income and Expenses

### 3.2.1 Annual family Income
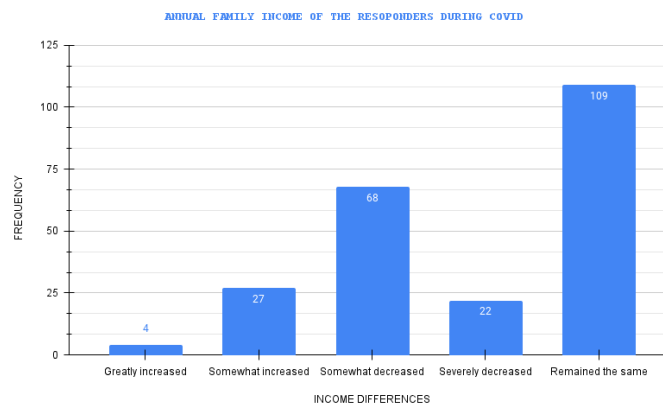


*Figure 3.3: Income and Expenses*

Figure 3.3 indicates the fluctuations in annual family income among respon-dents during the COVID-19 pandemic. The majority, of **109** participants have reported no significant change in their family income. However, **68** participants experienced a bit decrease, while **22** participants faced a substantial decrease. On a positive note, **27** participants saw a moderate increase, and **4** participants reported a significant boost in their annual family income.

### 3.2.2 Annual family Expenses
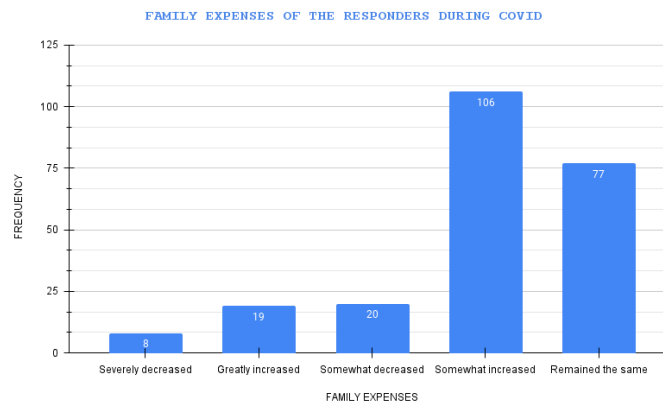


*Figure 3.4: Income and Expenses*

However, for the majority of participants, monthly family expenses have either remained constant or experienced a slight increase. Figure 3.4 shows that for **106** participants, the monthly expenses have somewhat increased, while for **77** participants, family expenditures have stayed the same.

### 3.2.3 Comparative Analysis of Family Expenditure Across Different Employment Categories
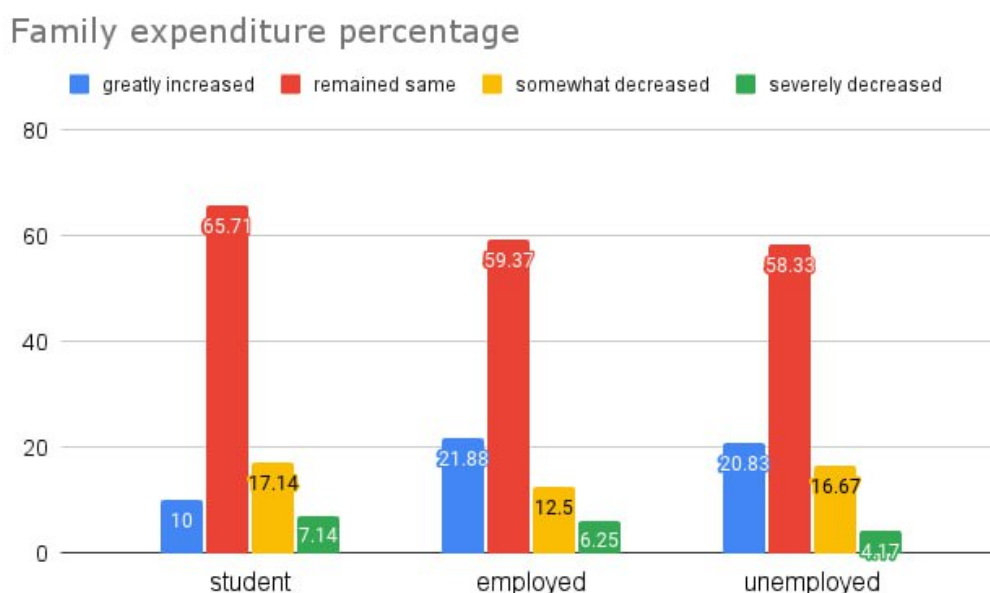


*Figure 3.5: Percentage of Family Expenditure*

*Student(126) | Employed(63) | Unemployed(40)*

The bar chart depicts the distribution of family expenditure levels across three distinct categories of individuals: *students, employed individuals, and the unemployed*. Expenditure levels are classified into four groups: "**Greatly Increased**," "**Remained Same**," "**Somewhat Decreased**," and "**Severely Decreased.**"

Let's analyze the Family Expenditure, So for students, **10%** experienced a substantial increase in family expenditure, while a majority (**65.71%**) maintained a consistent level. Approximately **17.14%** observed a moderate decrease, and a smaller portion (**7.14%**) faced a significant reduction.

Among employed individuals, **21.88%** noted a substantial rise in family expenditure, while the largest portion (**59.37%**) sustained a steady spending pattern. About **12.5%** experienced a moderate decline, and a smaller proportion (**6.25%**) encountered a considerable drop.

Unemployed individuals experienced noteworthy changes as well, with **20.83%** noting a significant increase, **58.33%** maintaining consistency, **16.67%** observing a moderate reduction, and a minority (**4.17%**) facing a substantial decrease in family spending.

**Key Insights :**

Consistency Among Employees: The largest percentage of both employed individuals and students maintained similar family expenditure levels, with around **59.37%** and **65.71%**, respectively, staying consistent.

Impact of Unemployment: Unemployed individuals showcased a slightly higher percentage in experiencing increased family expenditure (**20.83%**) compared to employed individuals (**21.88%**).

Variance in Decreased Expenditure: There is a notable difference in the per‐ centage of individuals who experienced a severe decrease in family spending among the employed (**6.25%**) compared to students (**7.14%**) and the unemployed (**4.17%**).

This breakdown of family expenditure across employment categories offers valuable insights into how different groups manage their expenses amidst varying employment statuses.

### 3.2.4 Comparative Analysis of Income Change Across Different Employment Categories
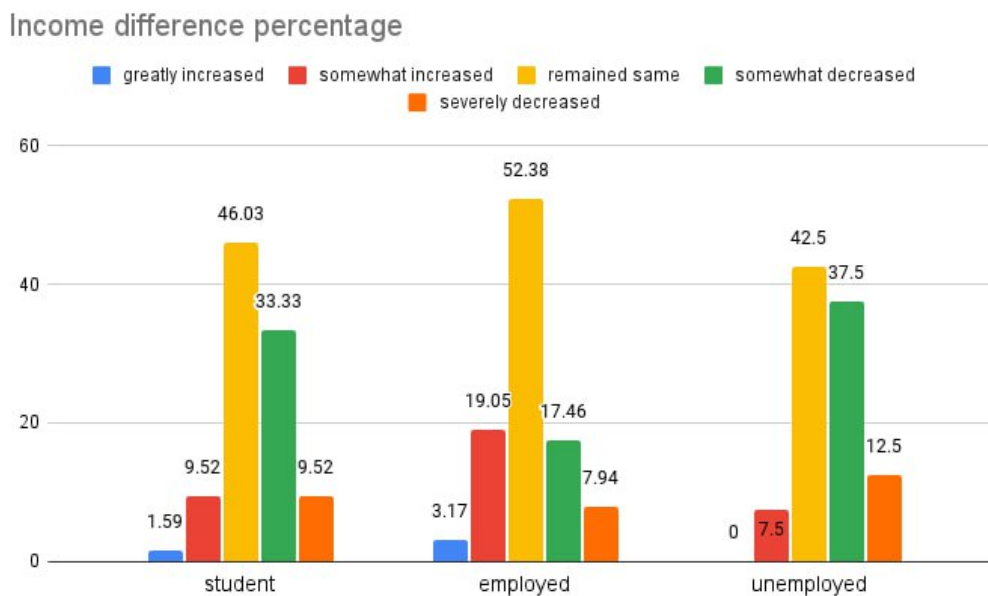


*Figure 3.6: Percentage of Differences in Incomes*

*Student(126) | Employed(63) | Unemployed(40)*

The bar chart provides an overview of income change percentages across three distinct categories of individuals: *students, employed individuals, and the unemployed*. The income change percentages are divided into five groups: "**Greatly Increased**", "**Somewhat Increased**", "**Remained Same**", "**Somewhat Decreased**", and "**Severely Decreased**".

In the case of students, **1.59%** experienced a significant increase in income, while **9.52%** observed a moderate rise. A substantial majority of students (**46.03%**) maintained a consistent income level, with approximately **33.33%** facing a moderate decrease and **9.52%** encountering a substantial reduction.

Among employed individuals, **3.17%** saw a notable increase in income, and **19.05%** experienced a moderate rise. The largest portion of employed individuals (**52.38%**) sustained a steady income level, while around **17.46%** observed a moderate decline, and **7.94%** faced a substantial reduction.

For unemployed individuals, none experienced a significant increase, and **7.5%** observed a moderate rise. A significant majority (**42.5%**) maintained a consistent income level, while around **37.5%** experienced a moderate decrease, and **12.5%** encountered a substantial reduction.

Analyzing these figures reveals that the largest percentage of employed individuals (**52.38%**) maintained a steady income level, surpassing both students (**46.03%**) and unemployed individuals (**42.5%**). Moreover, a notable portion of students (**33.33%**) faced a moderate decrease in income, exceeding the corresponding percentages for employed and unemployed individuals.

It is noteworthy that the percentage of unemployed individuals experiencing any level of increased income (**7.5%**) is notably lower compared to students (**11.11%**) and employed individuals (**22.22%**). This breakdown of income change percentages across employment categories provides insights into the varying income dynamics experienced by different groups based on their employment status.

### 3.2.5 Income Difference between Pre‑Pandemic and Post‑Pandemic Situation



| Count of INCOME_DIFF | | | | |
|---|---|---|---|---|
| | Employed | Retired | Student | Unemployed |
| Greatly increased | 3.17% | 0.00% | 1.59% | 0.00% |
| Remained the same | 52.38% | 100.00% | 46.03% | 42.50% |
| Severely decreased | 7.94% | 0.00% | 9.52% | 12.50% |
| Somewhat decreased | 17.46% | 0.00% | 33.33% | 37.50% |
| Somewhat increased | 19.05% | 0.00% | 9.52% | 7.50% |
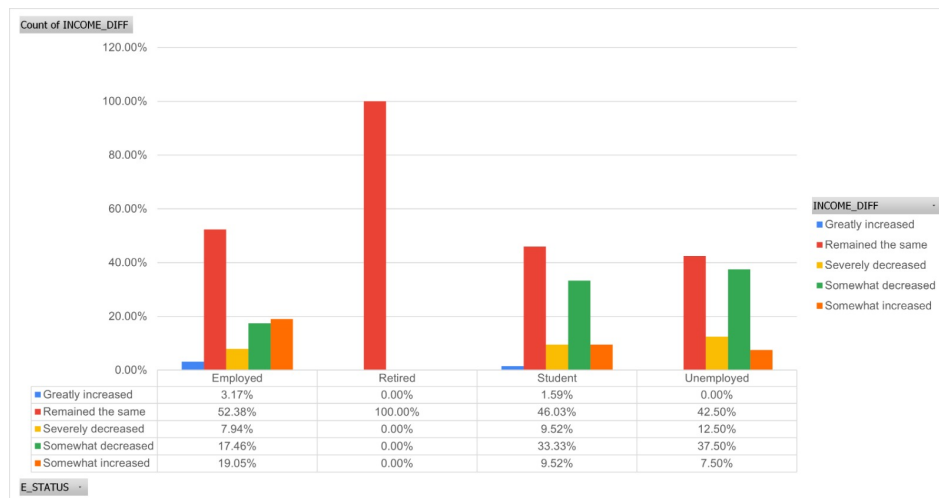
*Figure 3.7*: *Difference in Incomes*

*Employed(63) | Retired(1) | Student(126) | Unemployed(40)*

The bar graph in Figure 3.7 illustrates the difference in incomes between the pre‑pandemic and post‑pandemic period for participants with different em‑ployment status. It is measured in percentage. Overall it can be observed that the income remained almost same or somewhat decreased in each employment category.

Almost half of the participants with the employed, student and unemployed status had their salary unaffected and also the retired one. In the group of student and unemployed ones, $1/3^{rd}$ portion and among employed ones 17.46% had slight decrement in their income. Only a very small part in employed and student category claimed great increase in their income. About 10% participant's salary got critically decreased.

## 3.3 Dependence on Cooked Food Delivery System



*Figure 3.8: Dependence on Cooked Food Delivery System*



*Figure 3.9: Dependence on Cooked Food Delivery System*

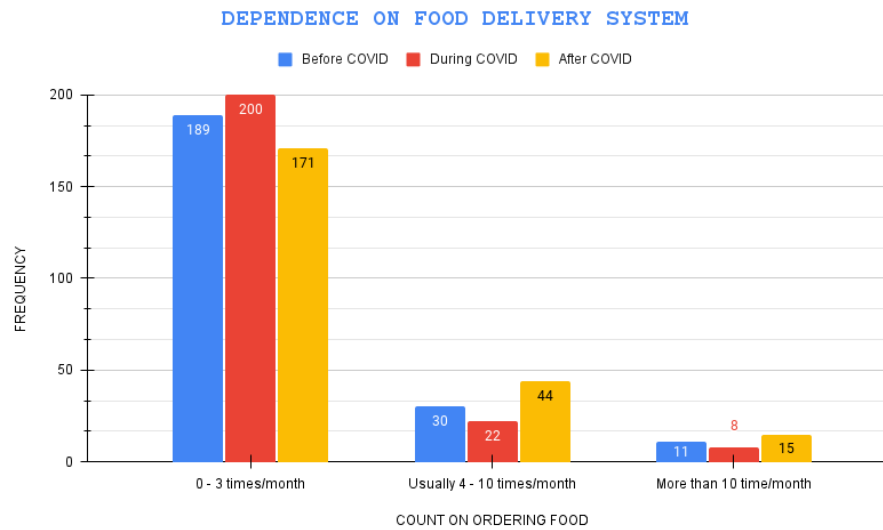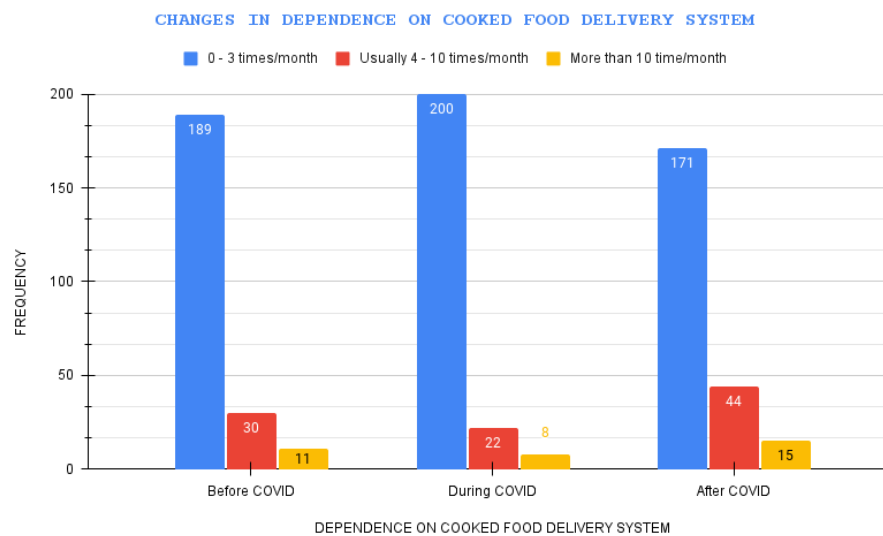Figure 3.8 and Figure 3.9 illustrate a comparison between the number of times the participants ordered food online in a month before, during and after COVID-19. The majority of participants, regardless of the pandemic, exhibit a trend of ordering food online 0-3 times per month.

### 3.3.1 Changes in Online Food ordering frequency
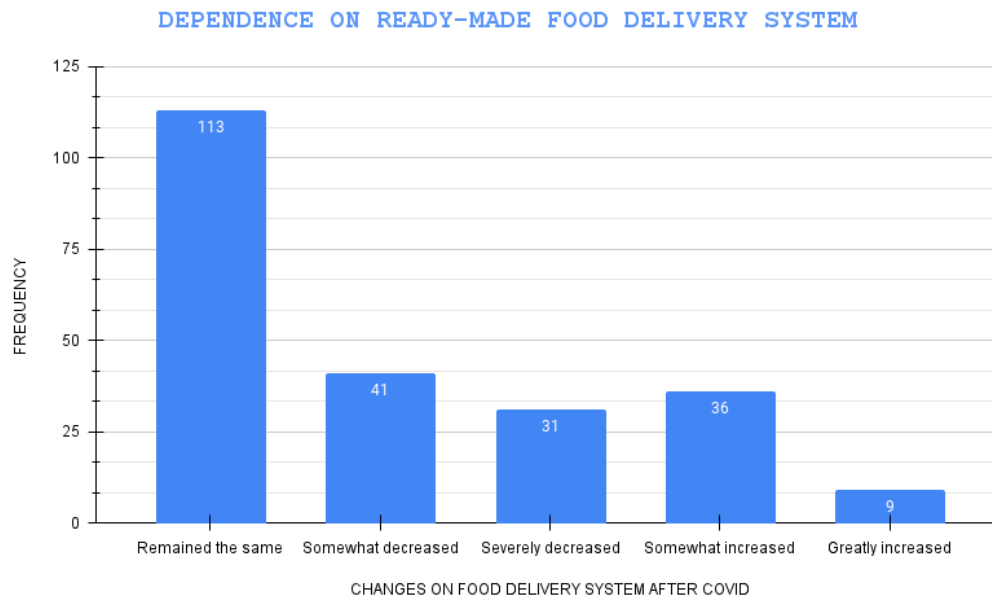


*Figure 3.10*: *Dependence on Cooked Food Delivery System*

The data provided in Figure 4.3 illustrates the frequency dependence on ready‑made food delivery systems. The majority of the respondents reported that their dependence on ready‑made food delivery remained the same, while a smaller percentage indicated a somewhat decreased dependence and an even smaller percentage reported a severe decrease in dependence. Conversely, some respondents mentioned a somewhat increased dependence on ready‑made food delivery, but the number of responses with greatly increased dependence has been very low.

This data mostly indicates two aspects of thought processes adapted by people during the COVID‑19 Lockdown period. A significant number of families believed that the Virus could be carried through right into the house with the ready‑made food despite all the precaution and contactless delivery etc. Hence, the chances of contamination may increase. Therefore, they somewhat decreased ordering ready‑made food. On the other hand, a significant amount of people felt the need of ordering ready‑made food more often than before. This may be due to lack of availability of raw cooking materials during the Lockdown period, or it might be safe to say that a few got addicted to an easier lifestyle that the pandemic offered.

### 3.3.2 Changes in Online Food ordering frequency across different employment Categories
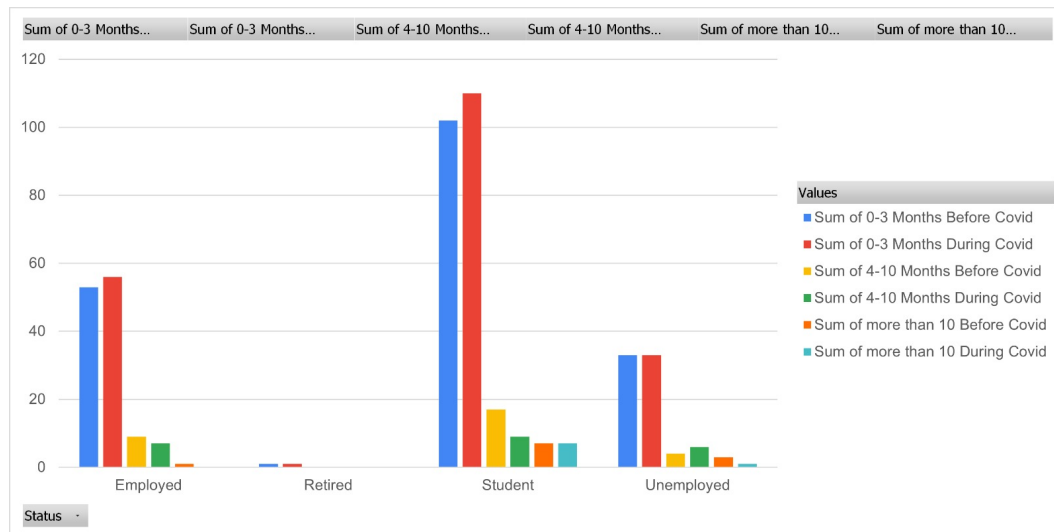


*Figure 3.11:* *Dependence on Cooked Food Delivery System*

*Employed(63) │ Retired(1) │ Student(126) │ Unemployed(40)*

Figure 3.11 represents the change in 'Dependence on cooked-food delivery system' due to pandemic for participants corresponding to several employment status. It is measured in corresponding frequency.

From the mere observation, it can be seen that there has been some upward trend in the **"0-3 times per month"** segment among the student and employed participants. Whereas the no. of unemployed and retired ones in this segment remained same as before COVID.

The no. of students and employed persons in the "**4-10 times per month**" segment gets slightly decreased while the no. Of unemployed ones in this segment got slightly increased.

In the "**More than 10 times per month**" the students did not show any change of habit, while employed and unemployed ones reduced their order frequency. It should also be noted that there has been lest no. Of participants in this segment during COVID as well as before COVID.

## 3.4 Vaccination Status
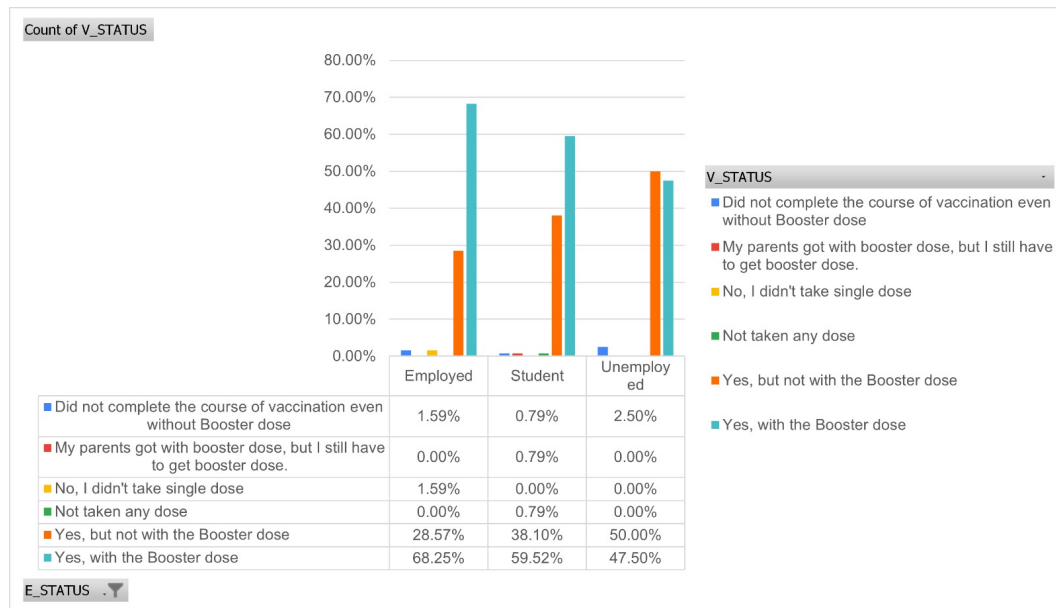


*Figure 3.12: Vaccination Status*

*Employed(63) | Retired(1) | Student(126) | Unemployed(40)*

The bar graph in Figure 3.12 illustrates the vaccination status for participants with different employment condition. It has been measured in percentage.

There is **1.59%** employed participants who did not take any dose and a same portion with incomplete course of vaccination. The majority of employed participants (**68.25%**) finished the vaccination with booster dose and **28.57%** without booster dose.

It can be observed that a very small portion of students either did not take the booster dose or any dose. About **59.52%** of students got properly vaccinated and the remaining **38.10%** are to be vaccinated with the booster dose.

Among the unemployed participants only **2.50%** did not complete the vaccination process. While half of them got vaccinated without booster dose, **47.5%** completed the vaccination with booster dose.

It can be seen that almost all the participants are either fully vaccinated with booster dose or without booster dose.

## 3.5  Medical Expenses



*Figure 3.13:* Count of Medical Expenses

*Employed(63) | Retired(1) | Student(126) | Unemployed(40)*

Figure 3.13 shows that none of the employed candidates' medical expenses for their family members decreased by more than $10,000$ after the pandemic. Meanwhile, **0%** of employed candidates experienced a decrease betw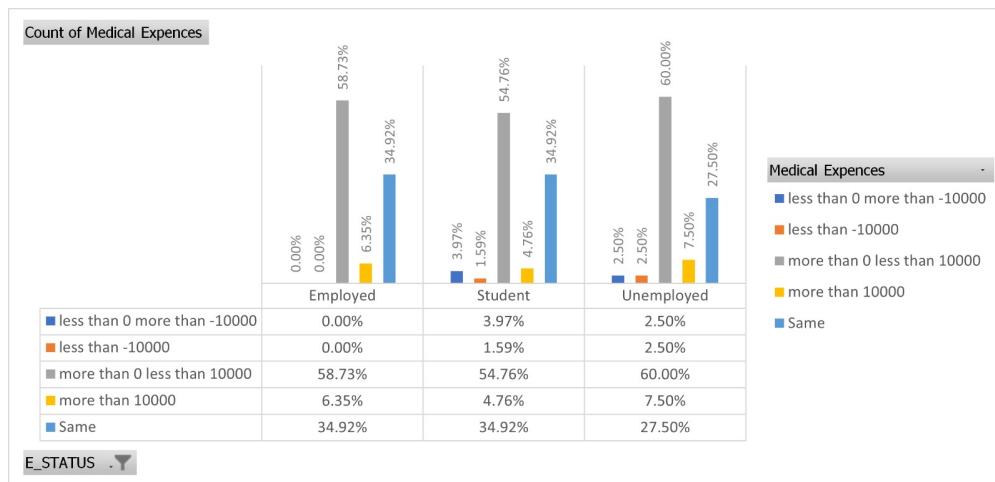een zero and $10,000$. About **6.35%** of employed candidates reported an increase of more than $10,000$ in medical expenses for their family, while **58.73%** reported an increase between zero and $10,000$. Additionally, **34.92%** of employed candidates stated that medical expenses for their family remained unchanged after the pandemic.

Among students, **1.59%** reported a decrease of more than $10,000$ in medical expenses for their family after the pandemic, while **3.97%** reported a decrease between zero and $10,000$. About **4.76%** of students experienced an increase of more than $10,000$, and **54.76%** reported an increase between zero and $10,000$. Furthermore, **34.92%** of students mentioned that medical expenses for their family remained unchanged after the pandemic.

For unemployed candidates, **2.50%** reported a decrease of more than $10,000$ in medical expenses for their family, and **2.50%** reported a decrease between zero and $10,000$. About **7.50%** of unemployed candidates experienced an increase of more than $10,000$, while **60%** reported an increase between zero and $10,000$. Additionally, **27.50%** of unemployed candidates stated that medical expenses for their family remained unchanged after the pandemic.

## 3.6  Weight Difference
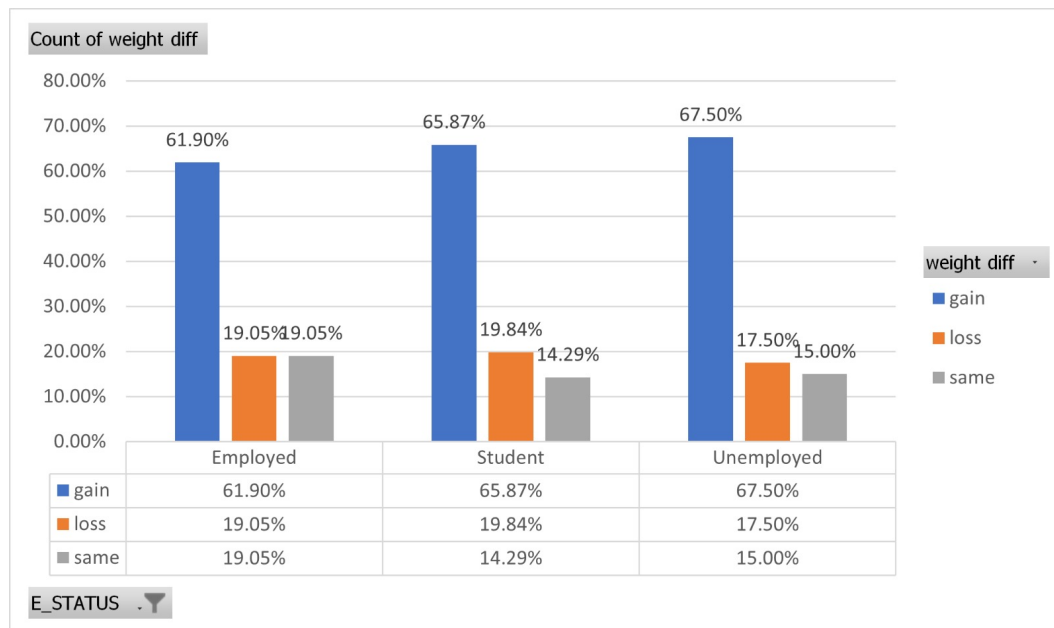


*Figure 3.14: Weight Difference between Pre and Post‑Pandemic Situations*

*Employed(63) │ Retired(1) │ Student(126) │ Unemployed(40)*

Figure 3.14 shows that among employed candidates **61.90%** gained weight during the pandemic (COVID‑19), **19.05%** lost weight, and the weight remained the same for **19.05%**.

Among students, **65.87%** gained weight during the pandemic (COVID‑19), **19.84%** lost weight, and the weight remained the same for **14.29%**.

Among unemployed candidates, **67.50%** gained weight during the pandemic (COVID‑19), **17.50%** lost weight, and the weight remained the same for **15.00%**.

## 3.7  Outdoor Socialization

### 3.7.1  Going Outside
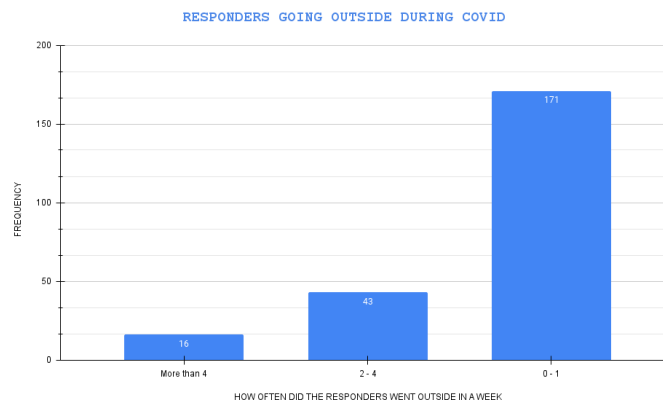


**Figure 3.15:** *Going Outside*

Due to the impact of COVID‑19, the frequency of going out has undergone a substantial change. From figure 3.15 we see that among the **230** participants surveyed, **171** individuals reported going out at most once a week during the pandemic.

### 3.7.2  Social Interaction
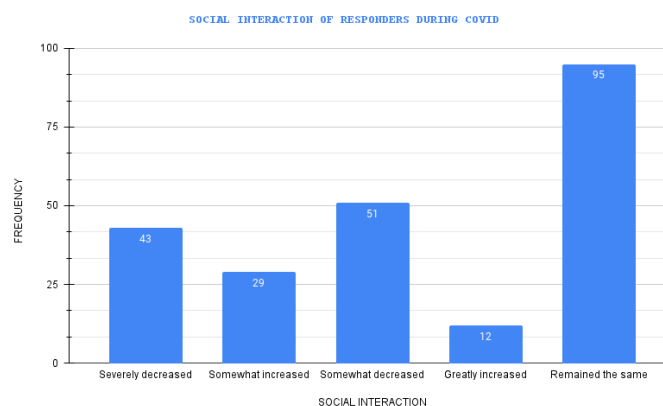


**Figure 3.16:** *Social Interaction*

Clearly it has also affected social interaction. Figure 3.16 illustrates that the social interaction of **43** people has markedly diminished, while **29** people have experienced a modest increase. For **51** individuals, social engagement has somewhat decreased, whereas **12** people have seen a notable rise in their social interactions. Remarkably, the social interactions of **95** people have remained unchanged.

### 3.7.3  Precautionary Measures taken up by Individuals



(a) *Precautions taken*



(b) *Staying at home*



(c) *Moderately going out*



(d) *Frequently going out*
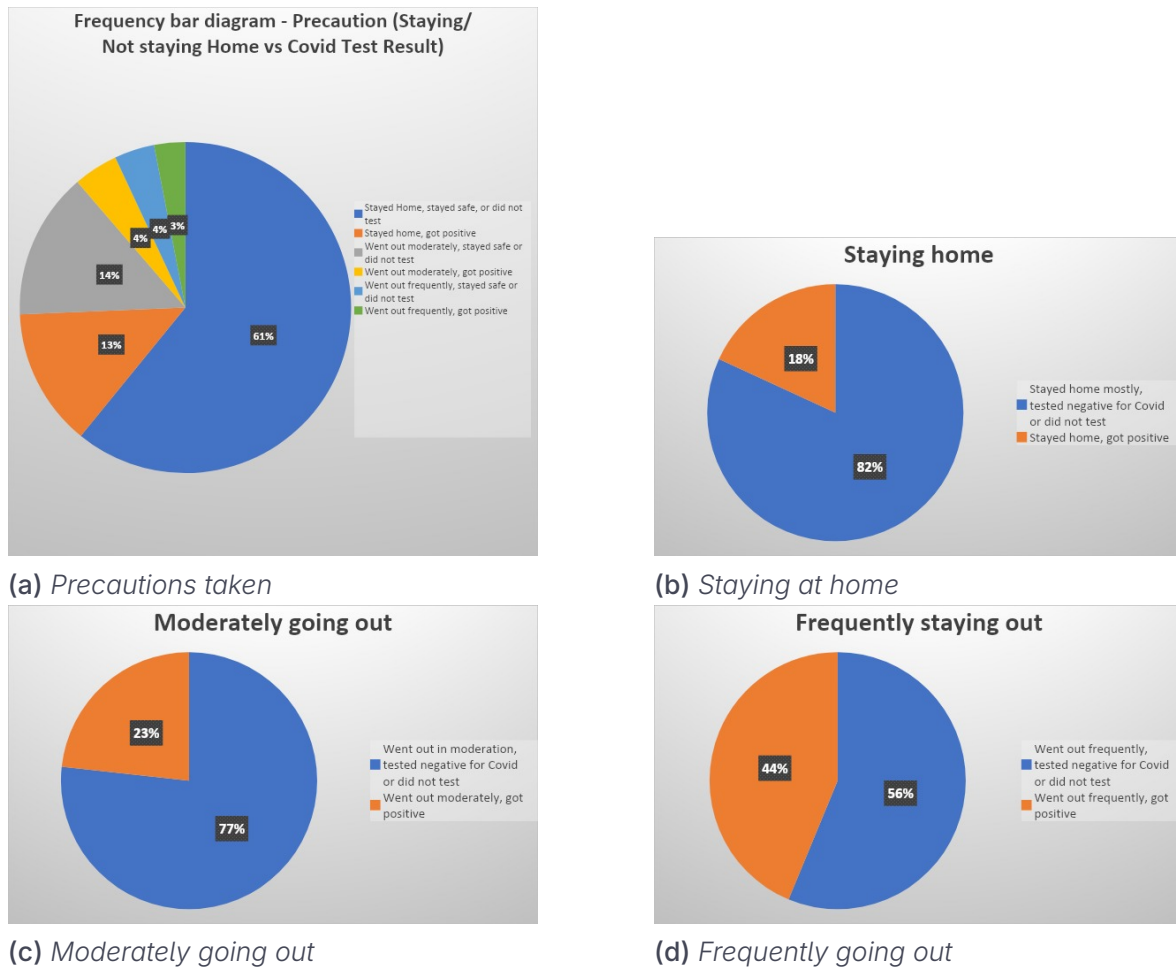
**Figure 3.17:** *Precautions taken in four images*

The pie charts 3.17 above provides an overview of the percentage distribution of the sample population across different categories related to staying at home during the COVID‑19 pandemic. Approximately **61%** of individuals mostly stayed at home and remained untouched by COVID infection. Another **14%** of individuals contracted COVID while staying at home for unknown reason. Additionally, about **14%** of the population ventured out moderately during the COVID pandemic and either stayed negative or did not get tested. A small percentage **4%** of individuals who went out moderately got infected by the COVID virus. The percentage of people who frequently went out was small, and **4%** of them either stayed safe or did not get tested. Only **3%** of the population that went out frequently got infected with COVID.

Analyzing the pie chart, it becomes evident that staying at home played a crucial role in preventing the spread of COVID-19. Only **18%** of the sample population staying at home were infected, while **82%** remained mostly safe. The next pie chart illustrates the infection spread due to moderate outings, showing that **23%** of the sample population got infected due to moderate outings during the COVID pandemic. In the last pie chart, the results of frequently staying out are shown to contribute significantly to the increase in the spread of COVID infection, rising to **44%**. This suggests that going out frequently led to a higher risk of contamination.

The insights derived from the data are noteworthy. Staying at home emerged as a significant factor in preventing the spread of COVID and getting infected, as evidenced by the relatively low infection rate of **18%**. However, as people went out moderately from home, the rate of infection and positive cases increased by **5%**, indicating a relatively lower impact of moderate outings. Overall, the survey depicts that frequently staying out is a major factor contributing to the spread of COVID. Due to this factor, the infection rate rose by **26%** compared to staying at home.

## 3.8   Screen-time

### 3.8.1   Changes in Screen time
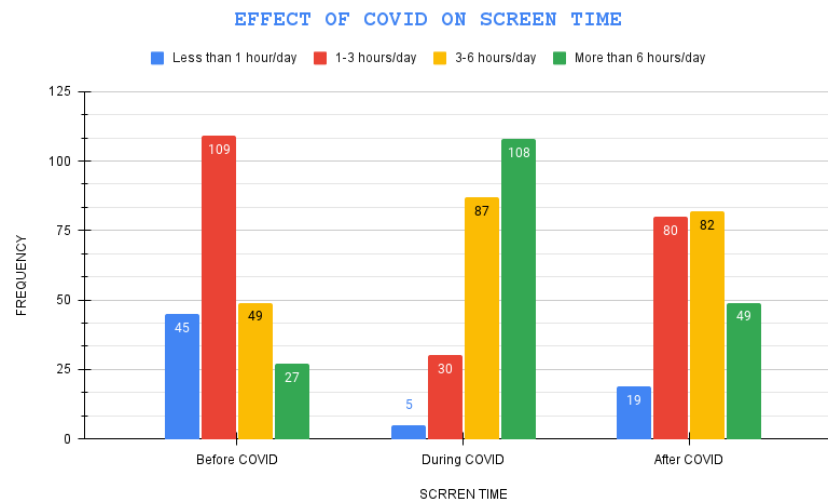


**Figure 3.18:** *Changes in Screen-time*

The information presented in Figure 3.18 illustrates a comparison of daily screen time during distinct time periods—before, during and after the COVID-19 pandemic.

### 3.8.2   Screen time Frequency
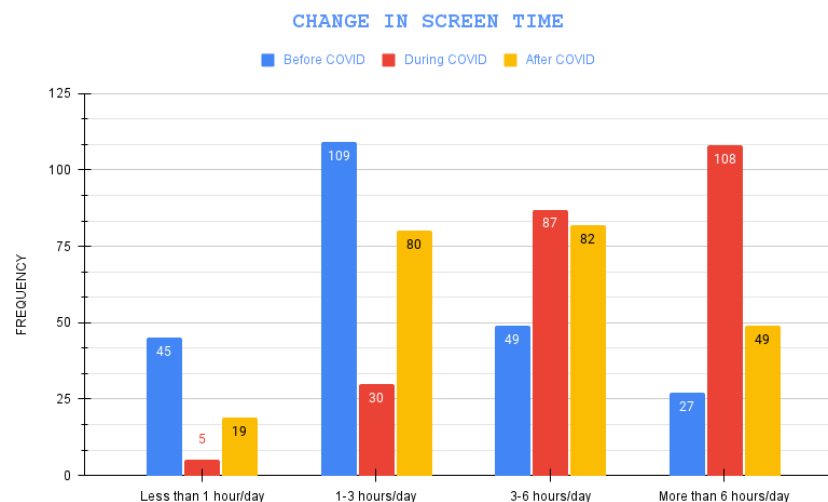


**Figure 3.19:** *Screen-time Frequency*

Figure 3.19 presents a visual representation comparing the number of people having a particular limit of screen time before, during and after the COVID-19.

### 3.8.3 Screen time Percentage
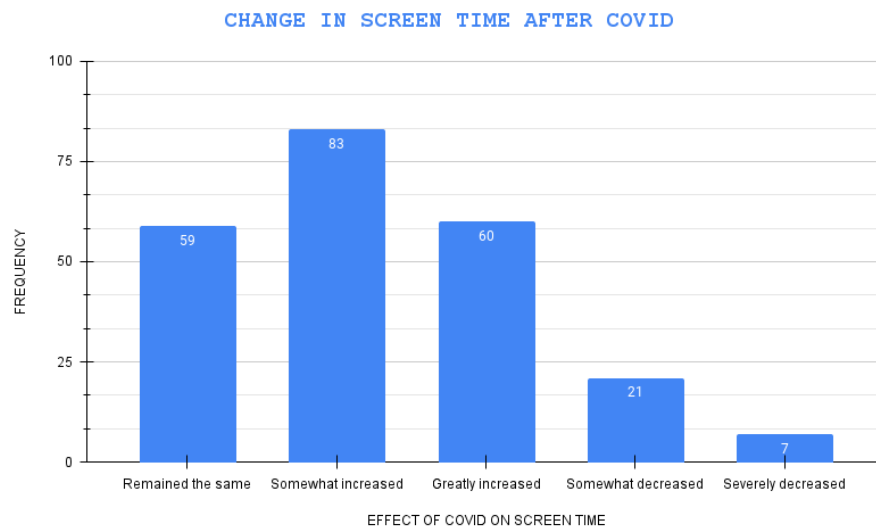


*Figure 3.20: Screen-time Percentage*

Figure 3.20 shows that for majority of the participants the screen time has somewhat increased during COVID 19. Before COVID-19, the majority of partici-pants reported engaging in screen time for **1-3 hours** per day. However, with the advent of the pandemic, there has been a notable and significant increase in the number of individuals spending more than **6 hours per day** on screens. Also, the proportion of people with **less than 1 hour** of screen time per day during this period has diminished considerably. Post-COVID-19, a substantial portion of participants now falls within the range of **1-6 hours** of daily screen time.
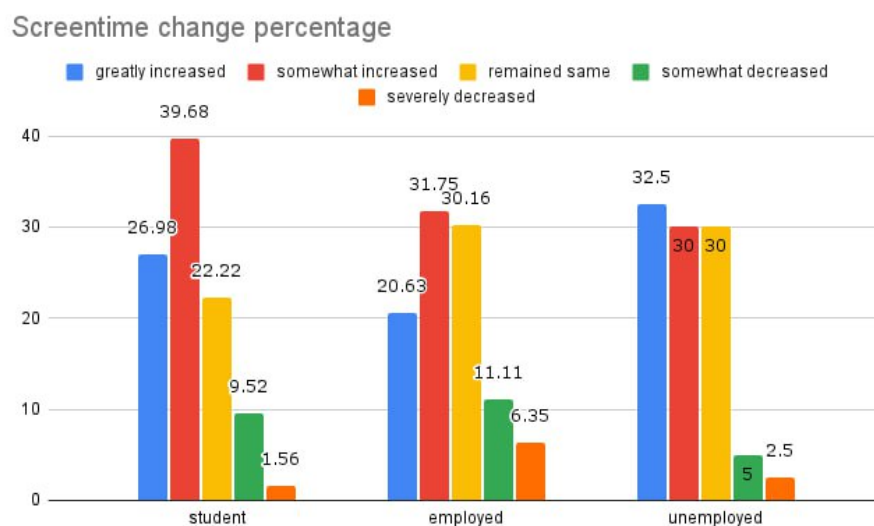


*Figure 3.21: Screen-time Percentage of different Employment Categories*

Figure 3.21 represents the screen time changes for different categories of people during COVID‑19. It indicates that across all categories, screen time has somewhat increased to a large extent.

For students, employees and unemployed, the percentages are **39.68%**, **31.75%** and **30%**, respectively. Additionally, a significant percentage increase is observed for people from different categories, with percentages of **26.98%**, **20.63%** and **32.5%** for *students, employees and unemployed* respectively.

The data also reveals that screen time has remained the same for a substantial number of people. An interesting observation is that among those experiencing a significant increase in screen time, the proportion is highest for unemployed individuals, followed by students and employed individuals in decreasing order.

## 3.9  Mental Health

### 3.9.1  Mental Health conditions
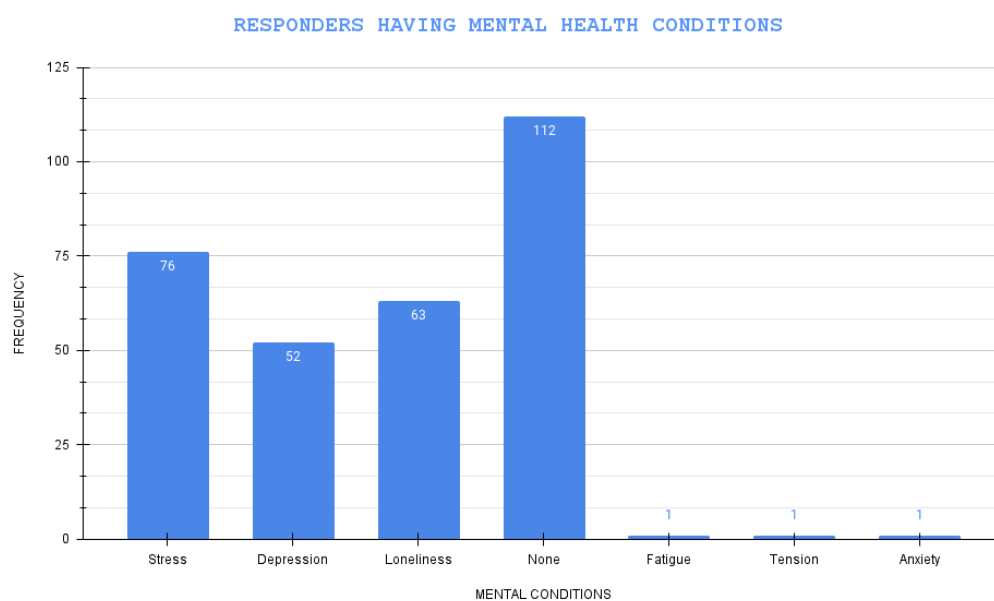


*Figure 3.22: Mental Health Conditions*

Figure 3.22 shows the number of responders having mental health conditions during COVID‑19 pandemic. The predominant conditions reported were stress, loneliness and depression, affecting **76**, **63** and **52** individuals, respectively. Note‑worthy outliers included cases of fatigue, tension and anxiety. It is important to highlight that a substantial proportion of participants did not experience any mental health issues during this challenging time.

### 3.9.2 Mental Health across different Employment categories
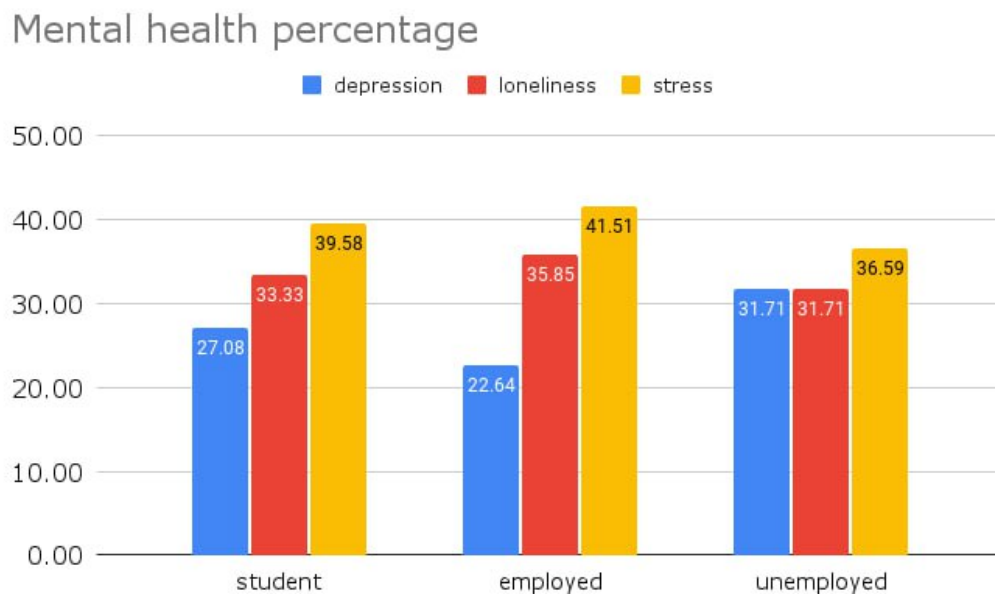


**Figure 3.23:** *Mental conditions across different Employment Categories*

*Employed(63) | Retired(1) | Student(126) | Unemployed(40)*

Figure 3.23 represents the mental health status of different categories during COVID-19.

It shows that 39.5% of students, 41.51% of employed individuals, and 36.59% of unemployed persons were experiencing stress. A significant number of people were also dealing with loneliness, with rates of 33.33% for students, 35.85% for employed individuals, and 31.71% for the unemployed. Additionally, 27.08% of students, 22.64% of employed individuals, and 31.71% of unemployed persons have faced depression.

The above observations depict that almost everyone in all categories has gone through a mental health crisis. A sense of uncertainty and helplessness are the main reasons behind it. Loss of families, friends, jobs, and many more have pushed us towards another significant crisis—mental health.

## 3.10    Effects on Education System



**EFFECTS OF COVID ON EDUCATION OF DIFFERENT AGE GROUPS**

■ Under 10     ■ Between 10 - 20     ■ More than 20
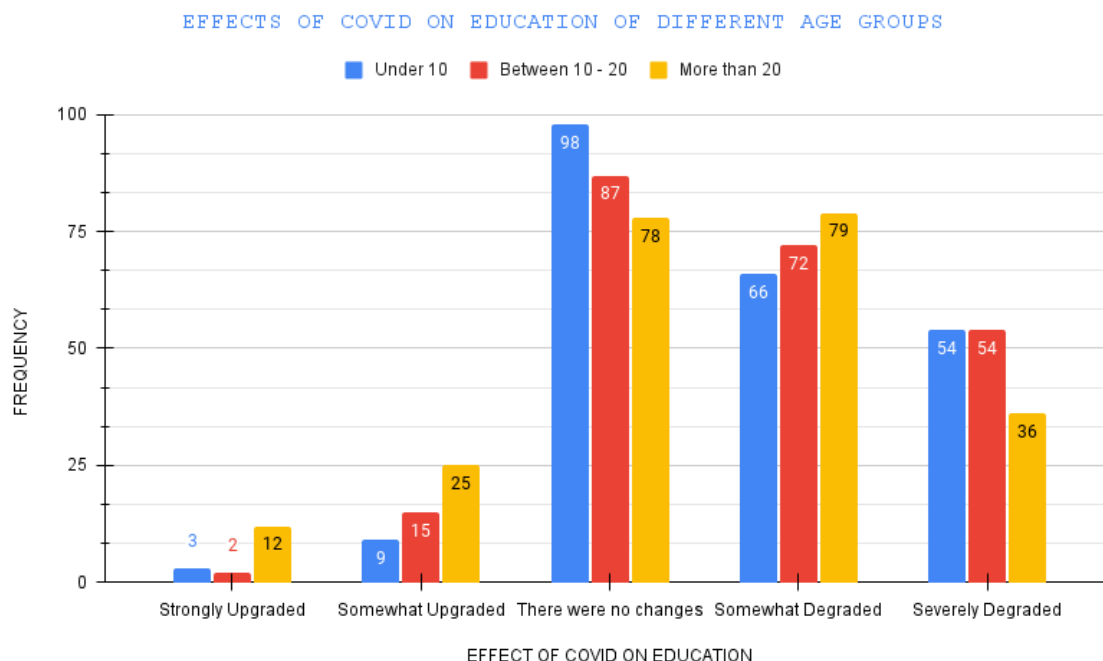
*Figure 3.24: Effects on Education*

Figure 3.24 provides insights into the impact of COVID-19 on the education of various age groups.

In conclusion, the data indicate that education among children under the age of 10 has either stayed consistent or has decreased in comparison to the pre-pandemic period. The quality of education has remained the same or has declined for children aged 10 to 20 and adult education has stayed stable or has deteriorated a bit.

### 3.10.1    Association with any Institutional Activities

Figure 3.25 displays the impact of the COVID-19 epidemic on responder's participation in institutional activities. Before the pandemic, the frequency of engagement stood at 84, but during the pandemic, it soared to 146. Subsequently, post-pandemic, the frequency dropped to 98. This dynamic pattern demonstrates a significant increase in overall responders engagement during the pandemic. On the other hand, 54 respondents, remained uninvolved in any institutional activity for the entire period.

RESPONDERS ENGAGED IN CERTAIN INSTITUTIONAL ACTIVITIES DURING COVID
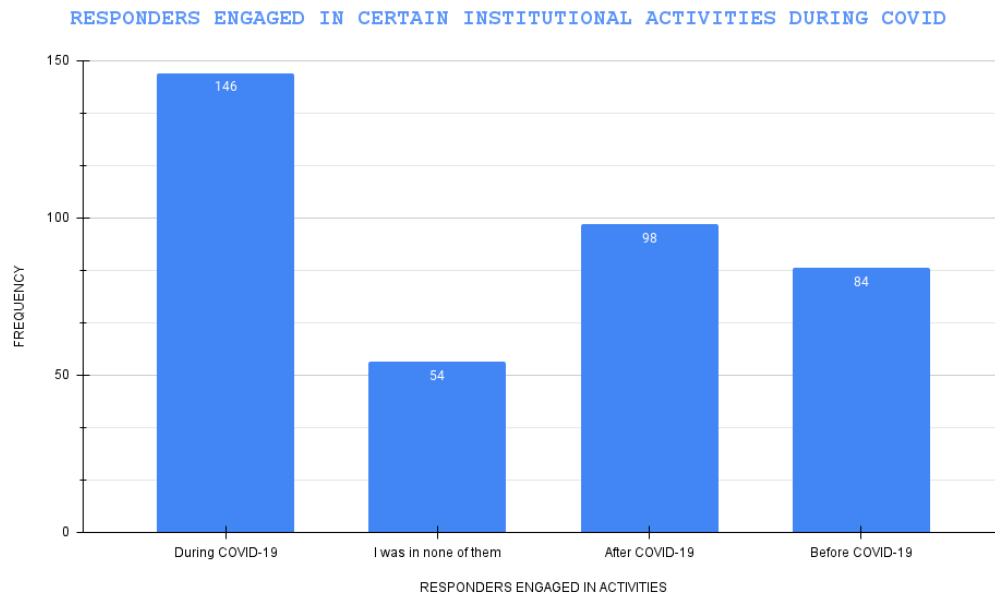


*Figure 3.25: Institutional Activities*

## 3.11   Work from Home

Figure 3.26 Among participant **73** people used to work from home before the COVID‑19 outbreak and after COVID‑19 the number of people who worked from home has been increased to **87**.

RESPONDERS ENGAGED IN WORK FROM HOME ACTIVITIES
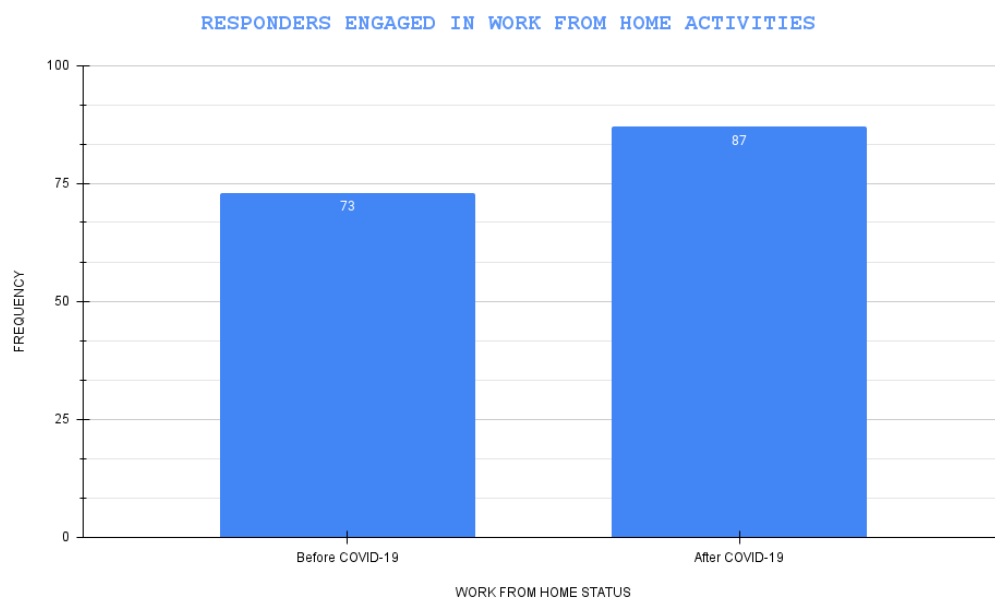


*Figure 3.26: Work from Home*

## 3.12   Healthy Habits taken up by Individuals
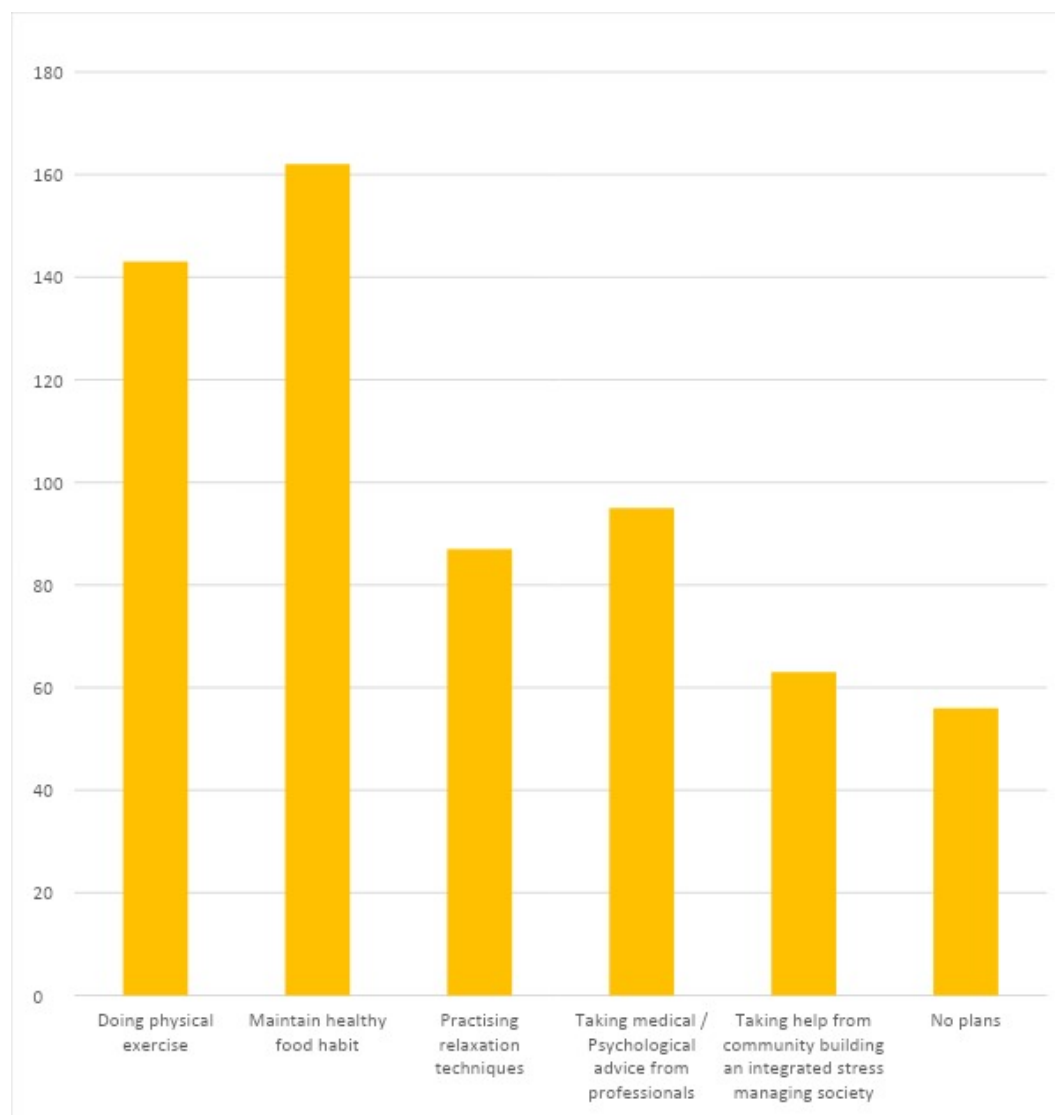


*Figure 3.27: Healthy Habits*

Analyzing the healthy habits taken up by the individuals reveals some inter‑esting trends among the **230** participants. A significant **70.43%** express a desire to maintain a healthy food habit, emphasizing the importance placed on nutrition in their overall well‑being. Additionally, **62.17%** are keen on incorporating regu‑lar physical exercises into their routines, highlighting a conscious effort to stay physically active for optimal health.

Furthermore, the data indicates that **37.82%** of participants are inclined towards practicing relaxation techniques, showcasing a recognition of the importance of mental well‑being. Notably, **41.30%** express a preference for seeking medical or psychological advice from professionals, indicating a proactive approach to managing their health through expert guidance.

In an intriguing dimension, **27.39%** of individuals express a desire to seek support from their community in building an integrated stress management society to address the challenges posed by diseases. This reflects a community-oriented mindset in combating health issues collaboratively.

However, **24.34%** of the participants seem to lack pre-planning in adopting specific healthy habits. This highlights a potential area for intervention and education to raise awareness about the benefits of proactive health measures.

Insights drawn from the data underscore the prominence of individuals aiming to maintain both a healthy food habit and regular physical exercises, with percentages of **70.43%** and **62.17%**, respectively. This dual focus on nutrition and physical activity suggests a holistic approach to health, particularly in the context of combating severe pandemics.

As we navigate the challenges of the current pandemic, it becomes evident that having hygiene plans in place is a proactive measure against potential future epidemics, such as the possibility of another COVID-19-like situation within the next 20 years. The importance of developing personal and community hygiene strategies cannot be overstated, as these measures play a crucial role in mitigating the spread of infectious diseases and fostering a healthier society overall.

## 3.13  Proclivity for Physical Exercise - Before and After COVID-19
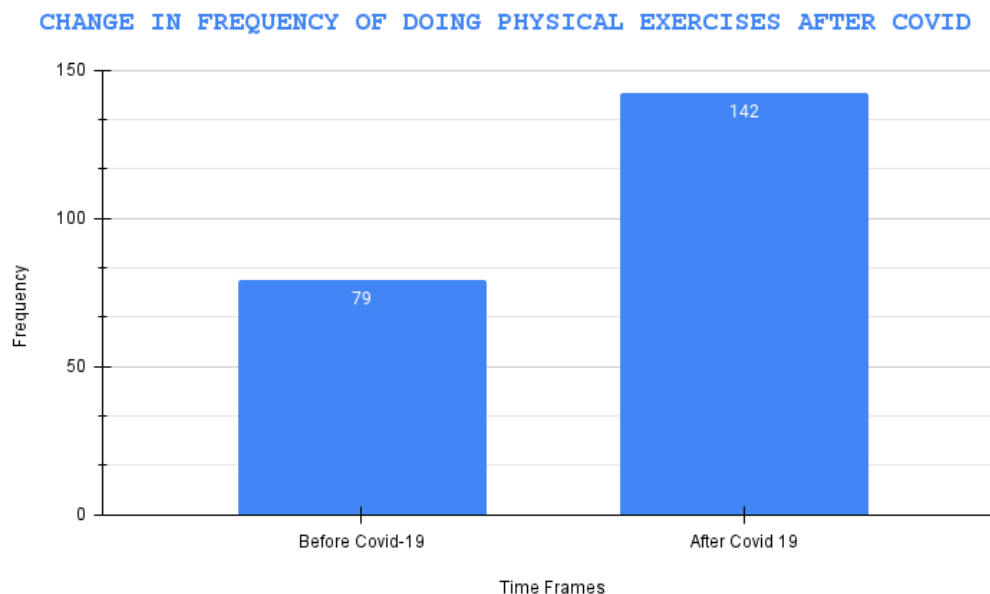


*Figure 3.28: Physical Exercises after COVID-19*

In the Bar diagram 3.28 illustrates findings from the aforementioned survey, showcasing the distinctions in physical exercise patterns before and after the onset of COVID‑19.

Based on the figure 3.28 depicting physical exercise frequency before and after COVID‑19, it is evident that there was an increase in the frequency of physical exercise. Before COVID‑19, the frequency was 79, while after COVID‑19, the frequency rose to 142. This suggests a notable shift in exercise habits, with a higher number of individuals engaging in physical activities post‑COVID‑19 compared to the Pre‑COVID‑19 period.

The increase in frequency may be attributed to various factors, such as height‑ened awareness of health, changes in daily routines, or a greater emphasis on physical well being in response to the pandemic.

## 3.14 Evolving Impact of Widespread Sanitizer Use
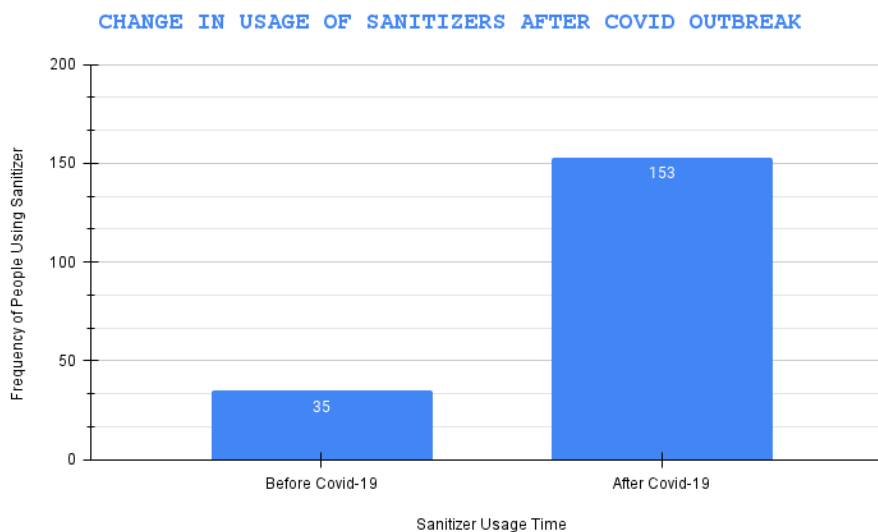


**Figure 3.29:** *Sanitizer Usage*

In the Bar diagram 3.29 represents the results of the above‑mentioned survey, categorized by the Pre‑COVID and Post‑COVID usage of Sanitizers

The diagram illustrates a significant change in the frequency of sanitizer usage time before and after COVID‑19. Before the pandemic, the frequency of people using sanitizer was 35, whereas after COVID‑19, this frequency increased substantially to 153. This considerable uptick in sanitizer usage suggests a heightened awareness and adherence to hygiene practices post‑COVID‑19.

The substantial increase in frequency may be indicative of a broader societal shift towards prioritizing preventive measures for health and safety in response to the pandemic.

## 3.15  Financial Coping Skills

FUTURE PLANS FOR FINANCIAL COPING SKILLS OF THE RESPONDERS AFTER THE COVID OUTBREAK
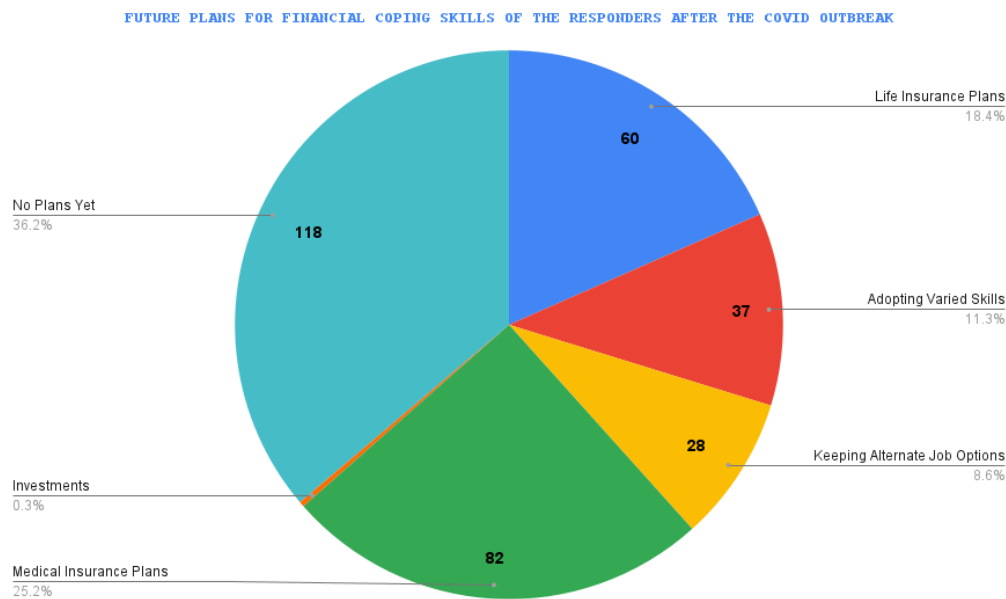
**Figure 3.30:** *Financial Coping Skills*

The Pie chart in 3.30 represents the distribution of Post‑COVID financial cop‑ing strategies, with notable emphasis on medical insurance, varied skill acquisition, and a substantial portion undecided about future plans.

In summary, the analysis of post‑COVID financial coping plans, as depicted in the chart, reveals a diverse landscape. Notably, **25.2%** of respondents prioritize their well‑being with medical insurance, while **18.4%** consider life insurance. A proactive approach is evident, with **11.3%** aiming to acquire diverse skills, and **8.6%** exploring alternate job options. Surprisingly, only **0.3%** express plans for investments. Significantly, **36.2%** of individuals have yet to formalize specific financial strategies, underscoring the prevailing uncertainty.

This numerical breakdown emphasizes the variety of approaches, highlighting the intricate and individualized nature of post‑pandemic financial planning among surveyed individuals.

## 3.16  General awareness in controlling a pandemic in near-future
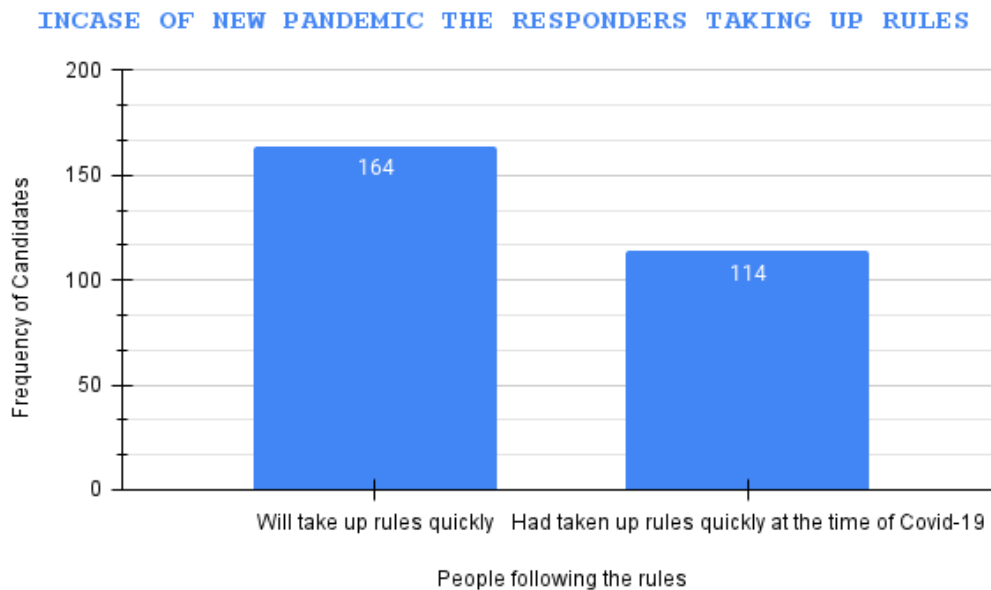


*Figure 3.31: General awareness of public*

As we can see from Figure 3.31 the harsh matter of fact, it is likely for the world to face more pandemics in the near future, followed by COVID-19. However a word of hope is that we have, from our data set, the number of people likely to follow government prescribed guidelines has increased quite a bit compared to that at the time of onset of COVID-19.

Out of **230** individuals, the number **114** of people, taking up guidelines and rules at the time of the Corona Outbreak is quite less than the number **164** of people willing to quickly follow the new guidelines if a similar history of COVID repeats itself in near future.

It is conclusive that a general awareness regarding the pandemic and its control have grown among the responders.

# 4. Estimation

## 4.1 Point Estimation of the Proportion of COVID-19 Positive Cases in the Survey

### 4.1.1 Point Estimation

The following report presents a **point estimation analysis** regarding the proportion of individuals tested positive for COVID-19 within our survey. The aim is to provide a precise estimate of the mean percentage of individuals who tested positive for COVID-19 based on the collected survey data of **230** individuals.

Out of **230** participants, **107** individuals have been identified as having undergone COVID-19 tests. The point estimation we want to compute is based on the proportion of positive results within the surveyed population.

Consider $X_1, \ldots, X_n$ being the random variables representing COVID-19 test results for $n$-individuals.

Now, let $p$ be the probability that a particular person has a positive test result, i.e., $X_i$ being "Yes" or **1** has the probability $p$.

Then,

$$X_i = \begin{cases} 1 & \text{with probability } p \text{ (indicates "\textbf{Yes}" instance)} \\ 0 & \text{with probability } 1 - p \text{ (indicates "\textbf{No}" instance)} \end{cases}$$

$$\forall \; i = 1 \ldots n.$$

and each individual should have their independent test result. Thus :

$$X_1 \ldots X_n \sim \text{IID Ber}(\mathbf{p})$$

Therefore, $E(X_i) = p, \; Var(X_i) = p(1-p) \; \forall i = 1 \ldots \ldots n.$

Here, a natural choice to estimate the population mean $p$ is the sample mean

$$\bar{x} = \frac{x_1 + \ldots + x_n}{n}$$

which is our test-statistic $T$.

$$T(X_1, \dots, X_n) = \bar{X} = \frac{X_1 + \dots + X_n}{n}$$

Now,

$$E[T(X_1, \dots, X_n)] = E[\bar{X}] = \frac{1}{n} \cdot \{E[X_1] + \dots + E[X_n]\}$$

$$= \frac{1}{n} \cdot n \cdot p = p \ (\text{as } E[X_i] = p) \ \forall \ i = 1, 2, \dots, n$$

Hence, $T(X_1, \dots, X_n) = \bar{X}$ is an unbiased estimator of $p$.

In our observed data, $n = 107$

$$\text{Sample mean} = \bar{x} = \frac{x_1 + \dots + x_n}{n} = \frac{48}{107} \approx 0.448598$$

Since, the number of COVID positive results in the data is **48** out of **107** positive tests.

$$\text{Sample Variance, } SD = \sqrt{\frac{48 \times 59}{106 \times 107}} \approx 0.49691$$

Thus, sample mean $\bar{x} = 0.448598$ being an estimate of $p$ while $\bar{X}$ being estimator for population quantity $p$ along with standard error,

$$SE = \frac{SD}{\sqrt{n}} = 0.048307$$

Since, $SE$ here is very small, therefore for large sample sizes (i.e. when $n \to \infty$), the standard error decreases further.

### 4.1.2  Maximum Likelihood Estimate (MLE)

Now, we follow the following steps to compute the MLE of $p$.

$$L(p) = \prod_{i=1}^{n} \Pr\{X_i\} = \prod_{i=1}^{n} p^{x_i} \cdot (1-p)^{1-x_i} = p^{\sum_{i=1}^{n} x_i} \cdot (1-p)^{n - \sum_{i=1}^{n} x_i}$$

where,

$$\Pr\{x_i\} = P[X_i = x_i] = p^{x_i} \cdot (1-p)^{1-x_i}$$

Here, we will maximize the likelihood $l(p) = \log_e L(p)$

$$l(p) = \sum_{i=1}^{n} x_i \cdot \log p + (n - \sum_{i=1}^{n} x_i) \cdot \log(1 - p)$$

$$l'(p) = \frac{\sum_{i=1}^{n} x_i}{p} - \frac{n - \sum_{i=1}^{n} x_i}{1 - p}$$

For $l'(p) = 0 \implies (1 - p) \cdot \sum_{i=1}^{n} x_i = p \cdot (n - \sum_{i=1}^{n} x_i)$

$$\implies p = \frac{\sum_{i=1}^{n} x_i}{n} = \bar{x}$$

We have,

$$l''(p)|_{p=\bar{x}} = \left( -\frac{\sum_{i=1}^{n} x_i}{p^2} - \frac{n - \sum_{i=1}^{n} x_i}{(1 - p)^2} \right)\Bigg|_{p=\bar{x}} = -\frac{n}{\bar{x}} - \frac{n \cdot (1 - \bar{x})}{(1 - \bar{x})^2} = -\frac{n}{\bar{x}} - \frac{n}{1 - \bar{x}}$$

Substituting our observed value of $n$, $\bar{x}$ we get,

$$l''(p)|_{p=\bar{x}} = -\frac{n}{\bar{x}(1 - \bar{x})} = -481.54 < 0 \ \forall \ p$$

Thus, we have $l(p)$ is maximum at $p = \bar{x}$. So finally,

$$\hat{p} = \bar{x} = \frac{x_1 + \ldots + x_n}{n}$$

From our observed data,
$$\hat{p} = 0.448598$$

is the **MLE** of $p$.

Hence, the MLE indicates that approximately **44.8598%** of the surveyed population tested positive for COVID-19. This estimation is an alignment with the earlier point estimate derived using sample proportions.

Thus, $\bar{X}$ being consistent estimator of $p$ as well as unbiased.

While the MLE's are the consistent estimator and provide a robust estimate based on the given sample data, further investigation considering larger sample sizes (i.e. when $n \to \infty$) could refine the accuracy of the estimation.

## 4.2 Interval Estimation of Mean Difference of Monthly Expenditure (Before-After COVID)

Here, we want to estimate the mean difference of monthly medical expenditure. We have collected data from 230 individuals, depending on which we carry out the estimation :

Consider $(X_1, Y_1), \ldots, (X_n, Y_n)$ are paired data on $n$-individuals where

$\{X_1, \ldots X_n\}$ : be the monthly expenditure of $n$-individuals before COVID

$\{Y_1, \ldots Y_n\}$ : be the monthly expenditure of $n$-individuals after COVID

Let's Take,
$$D_i = Y_i - X_i, \ \forall \ i = 1, 2, \ldots, n$$
$$\bar{D} = \frac{1}{n} \cdot \sum_{i=1}^{n} D_i \sim N(\mu_d, \sigma_d^2)$$

where $\mu_d = \mu_y - \mu_x$ and $\mu_x$, $\mu_y$ are the population means of $X$ and $Y$ respectively.

We want to estimate $\mu_d$ by the *Sample mean difference* $\bar{d}$ i.e. $\hat{\mu}_d = \bar{d}$.

As, $E(\bar{d}) = \frac{1}{n} \cdot \sum_{i=1}^{n} E(d_i) = \frac{n \cdot \mu_d}{n} = \mu_d$, so $\bar{d}$ is an unbiased estimator of $\mu_d$.

Also, $\frac{\bar{D} - \mu_d}{\frac{s_d}{\sqrt{n}}} \sim t_{n-1}$, where $s_d$ is the *Sample standard deviation*.

Then the 95% paired-$t$ confidence interval for $\mu_d$ is given by

$$\mu_d \pm t_{(0.025, \ n-1)} \times \frac{s_d}{\sqrt{n}}$$

So, from the collected data, we have :

$$\bar{d} = 1920.739$$
$$s_d = 9756.072$$
$$n = 230$$
$$\text{Confidence} = 0.95$$
$$t_{0.025,229} = 1.970377$$

So, Confident interval for $\mu_d$ = (653.2025, 3188.275)

**Conclusion:** We have a 95% confidence that the mean difference of monthly medical expenditure falls within the interval (653.2025, 3188.275). This suggests that, on average, monthly expenses have increased by significant margins during the COVID period.

# 5. Hypothesis Testing

## 5.1 Analysis on Weight Difference before and after COVID outbreak

Here our goal is to check whether the COVID-situation had an impact on weight. We collected data from **230** individuals and we have done the following study depending on that data.

Consider $(X_1, Y_1), \ldots, (X_n, Y_n)$ being paired data of $n$-individuals, where :

$X_1, \ldots, X_n \sim$ IID $N(\mu, \sigma^2)$ : weight distribution of $n$-individuals before COVID

$Y_1, \ldots, Y_n \sim$ IID $N(\mu, \sigma^2)$ : weight distribution of $n$-individuals after COVID

Here,
$$E(X_i) = \mu_1, \ V(X_i) = \sigma_1^2, \ \forall \ i = 1, 2, \ldots, n$$
$$E(Y_i) = \mu_2, \ V(Y_i) = \sigma_2^2, \ \forall \ i = 1, 2, \ldots, n$$

where $\sigma_1, \sigma_2$ are unknowns.

Assuming normality, we will assess whether the weights remain the same before and after COVID, testing against the alternative hypothesis that they do not.

**Hypothesis**:
$$H_0 : \mu_1 = \mu_2 \ \text{vs} \ H_1 : \mu_1 \neq \mu_2$$

Here, $(X_i, Y_i) \sim$ BVN $(\mu_1, \ \mu_2, \ \sigma_1^2, \ \sigma_2^2, \ \rho)$, where $\rho$ being the correlation coefficient of $X_i$ and $Y_i$.

So Let's take,
$$D_i = X_i - Y_i, \ \forall \ i = 1, 2, \ldots, n$$
$D_1, \ \ldots, D_n$ are IID $N(\mu_1 - \mu_2, \ \sigma^2)$, where $\sigma^2$ unknown.

where we have,

$$\sigma^2 = V(X) + V(Y) - 2 \cdot \text{Cov}(X, Y)$$

$$= \sigma_1^2 + \sigma_2^2 - 2 \cdot \rho \cdot \sigma_1 \cdot \sigma_2$$

Now, the above test becomes equivalent to one sample test of

$$H_0 : \mu = 0 \text{ vs } H_1 : \mu \neq 0 \text{ with unknown } \sigma^2$$

where, $\mu = \mu_1 - \mu_2$.

In this two-tailed test, consider

$$\bar{D} = \frac{D_1 + \ldots + D_n}{n}$$

$$E\left[\bar{D}\right] = E\left[\frac{D_1 + \ldots + D_n}{n}\right] = \frac{n \cdot \mu}{n} = \mu$$

$$V\left[\bar{D}\right] = V\left[\frac{D_1 + \ldots + D_n}{n}\right] = \frac{1}{n^2}\{V[D_1] + \ldots + V[D_n]\}$$

$$= \frac{1}{n^2} n\sigma^2 = \frac{\sigma^2}{n}, \quad \text{as } D_1, \ldots, D_n \text{ are IID}$$

thus, $\bar{D} \sim N(\mu, \frac{\sigma^2}{n})$.

**Test Statistics**: Consider following test-statistic using paired $t - test$.

$$T = \frac{\bar{D} - \mu}{\frac{s}{\sqrt{n}}}, \quad \text{where } s \text{ being sample standard-deviation}$$

and $T \sim t_{n-1}$, i.e. $t$-distribution with $(n-1)$ degrees of freedom.

Now, based on our data collected form $n = 230$ observations :

Sample Mean $= \bar{d} = 3.058696$

Sample Median $= m_e = 3$

Sample Variance $= 45.643920$

Sample Standard deviation $= 6.756028$

Now, under the null-hypothesis $\mu = 0$ and $s = 0$,

$$T = \frac{\bar{D} \cdot \sqrt{n}}{s}$$

using the above data,

$$t \approx 6.866079, \text{ observed value of } T.$$

**Critical Region** : Since, $n = 230$ and $d.f. = 229$, then

$$T \sim t_{229, \, 0.975}$$

thus critical region at **5%** level of significance is

$$(-\infty, \, 1.9709] \bigcup [1.9709, \, \infty).$$

**Decision Rule**: To make our decision, we will check if test-statistics lies in confidence interval or not. Our test-statistic is $t = 6.866079$.

If $t$ lies within the critical region, we reject null-hypothesis.

**Decision**: Since,

$$t = 6.866079 > t_{229, \, 0.975} = 1.9709$$

i.e. $t$ lies within the critical region $(-\infty, \, 1.9709] \cup [1.9709, \, \infty)$.

Therefore, we **reject null hypothesis** $H_0 : \mu = 0$ against $H_1 : \mu \neq 0$.
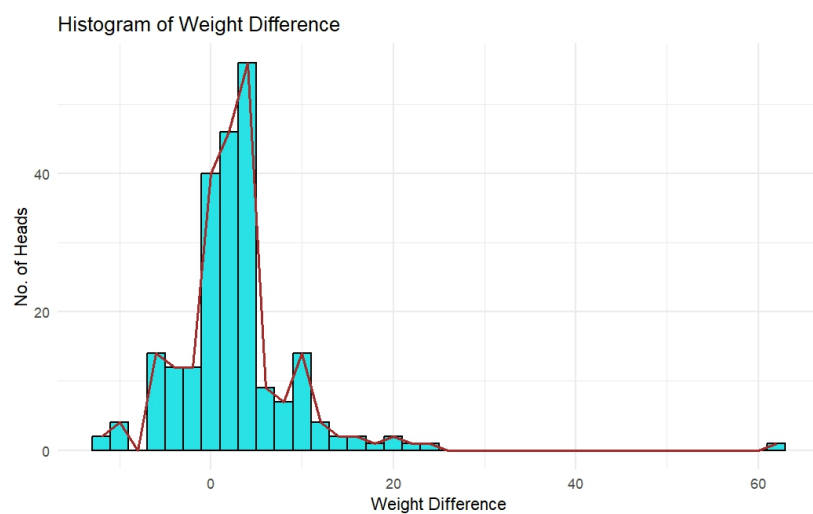


*Figure 5.1: Difference in Weights*

Above, in Figure 5.1 we provide a pictorial representation of our data set of weight difference

**Result Interpretation**: Rejecting null‑hypothesis provides strong evidence that there is a statistically significant difference in weights before and after COVID‑19.

Hence, our study shows COVID‑19 pandemic might had an impact on indi‑vidual's weight.

We have outliers in our data set.  Except these, our data set is clustered between $-20$ to $30$, which indicates persons under study may have encountered significant changes in their weights.

From the graph above shown (figure 5.1), indicates the mean is greater than zero, which means there is a high probability that individual's had his/her weight decreased after COVID‑situation.

| NAMES | Ideation | Question Preparation | Google Form Preparation | Conducting Pilot Survey | Circulation of Google Form | Correction & Maintaining Google Sheets | Plotting Graphs (Fig No.) | Abstract |
|---|---|---|---|---|---|---|---|---|
| CRS2301 : Aniv Mazumder | ✓ | | | | ✓ | | 3.5,3.6,3.21,3.23 | |
| CRS2302 : Arani Raychaudhuri | | | | | ✓ | | | |
| CRS2303 : Argha Sardar | ✓ | ✓ | ✓ | | ✓ | ✓ | 2.1,2.2,2.3,2.4,3.1,3.2,3.3,3.4,3.8,3.9,3.10,3.15,3.16,3.18,3.19,3.20,3.22,3.24,3.25,3.26 | |
| CRS2304 : Bibek Ghosh | ✓ | | | | ✓ | | | |
| CRS2305 : Bibek Giri | ✓ | | | | ✓ | | | |
| CRS2307 : Debabrata Maji | ✓ | | | | ✓ | | | |
| CRS2308 : Debanwita Hajra | ✓ | ✓ | ✓ | | ✓ | ✓ | 3.17(a),(b),(c),(d),3.27,3.28,3.29,3.30,3.31 | |
| CRS2309 : Jhelum Dhar | ✓ | ✓ | ✓ | | ✓ | ✓ | | |
| CRS2310 : Kiran Deep Ghosh | ✓ | | | | ✓ | ✓ | | |
| CRS2311 : Kumar Rahul | ✓ | ✓ | | | | ✓ | | ✓ |
| CRS2312 : Mrinmoy Bera | ✓ | | | ✓ | ✓ | | | ✓ |
| CRS2313 : Prabal Das | ✓ | | | | ✓ | | | ✓ |
| CRS2314 : Prasun Kumar Mandal | ✓ | | | | ✓ | | | |
| CRS2315 : Priti Pramanick | ✓ | ✓ | | | ✓ | | | |
| CRS2316 : Puspamalya Sahoo | ✓ | | | | | | | |
| CRS2317 : Rittwik Hajra | ✓ | | | | | | | |
| CRS2318 : SK Golam Kuddus | ✓ | | | ✓ | | | | ✓ |
| CRS2319 : Soham Biswas | ✓ | ✓ | | | | | 3.7,3.11,3.12,3.13,3.14 | |
| CRS2320 : Subhendu Pramanick | ✓ | | | ✓ | | | | |
| CRS2321 : Subhradip Palchaudhuri | ✓ | ✓ | | | | | | |
| CRS2323 : Suparna Das | ✓ | ✓ | | ✓ | | | | |
| CRS2324 : Tanushri Sen | ✓ | | | | | | 5.1 | |
| CRS2325 : Supriyo Banerjee | ✓ | | | | | | | |

| NAMES | Writeup In Chapter 1 | Writeup In Chapter 2 (Section No.) | Writeup In Chapter 3 (Section No.) | Ideation & Writeup In Chapter 4 | Ideation & Writeup In Chapter 5 | Document Designing | Document Type-Setting in Latex |
|---|---|---|---|---|---|---|---|
| CRS2301 : Aniv Mazumder | | | | | ✓ | | |
| CRS2302 : Arani Raychaudhuri | ✓ | | | ✓ | | ✓ | (ENTIRE) |
| CRS2303 : Argha Sardar | ✓ | | | | | ✓ | Abstract, Chapter : 1, Credit |
| CRS2304 : Bibek Ghosh | | | 3.2.5,3.3.2,3.4 | | | | |
| CRS2305 : Bibek Giri | ✓ | | | | | | |
| CRS2307 : Debabrata Maji | | | 3.5,3.6 | | | | |
| CRS2308 : Debanwita Hajra | | | 3.16 | | | | |
| CRS2309 : Jhelum Dhar | | | 3.1,3.1.1,3.21,3.2.2,3.3,3.3.1,3.7.1,3.7.2,3.8.1,3.8.2,3.8.3,3.9,3.10,3.10.1,3.11 TOGETHER* | | | | |
| CRS2310 : Kiran Deep Ghosh | | | 3.1,3.1.1,3.21,3.2.2,3.3,3.3.1,3.7.1,3.7.2,3.8.1,3.8.2,3.8.3,3.9,3.10,3.10.1,3.11 TOGETHER* | | | | |
| CRS2311 : Kumar Rahul | | | | | | | |
| CRS2312 : Mrinmoy Bera | | | | | | | |
| CRS2313 : Prabal Das | | | | | | ✓ | |
| CRS2314 : Prasun Kumar Mandal | ✓ | | 3.12 | | | | |
| CRS2315 : Priti Pramanick | | | 3.1,3.1.1,3.21,3.2.2,3.3,3.3.1,3.7.1,3.7.2,3.8.1,3.8.2,3.8.3,3.9,3.10,3.10.1,3.11 TOGETHER* | | | | |
| CRS2316 : Puspamalya Sahoo | | | 3.8.3,3.9.2 | | | | |
| CRS2317 : Rittwik Hajra | | | 3.2.3,3.2.4 | ✓ | | | |
| CRS2318 : SK Golam Kuddus | ✓ | | | | | | |
| CRS2319 : Soham Biswas | | | | | | | |
| CRS2320 : Subhendu Pramanick | | | 3.7.3 | | | | |
| CRS2321 : Subhradip Palchaudhuri | | 2.1,2.2,2.3,2.4 | 3.3.1 | | | | |
| CRS2323 : Suparna Das | | | 3.1,3.1.1,3.21,3.2.2,3.3,3.3.1,3.7.1,3.7.2,3.8.1,3.8.2,3.8.3,3.9,3.10,3.10.1,3.11 TOGETHER* | | | | |
| CRS2324 : Tanushri Sen | | | 3.2.3 | ✓ | ✓ | | |
| CRS2325 : Supriyo Banerjee | | | 3.13,3.14,3.15 | | | | |

# Credits

- Aniv Mazumder
- Arani Raychaudhuri
- Argha Sardar
- Bibek Ghosh
- Bibek Giri
- Debabrata Maji
- Debanwita Hajra
- Jhelum Dhar
- Kiran Deep Ghosh
- Kumar Rahul
- Mrinmoy Bera
- Prabal Das

- Prasun Kumar Mandal
- Priti Pramanick
- Puspamalya Sahoo
- Rittwik Hajra
- SK Golam Kuddus
- Soham Biswas
- Subhendu Pramanick
- Subhradip Palchaudhuri
- Suparna Das
- Tanushri Sen
- Supriyo Banerjee

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