

Assessment of behavioural adaptability of population towards the second wave of COVID -19 in selective districts of Maharashtra, India.

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Abstract

The consecutive lockdowns and restrictions in COVID -19 pandemic severely affected life-style behaviour of the population. Impact of the measures taken to inhibit the pandemic is undefined in India. The determination of adaptability of individuals towards the second wave of COVID-19 is the main objective of the present study. The study is cross-sectional virtual-based survey of the responses collected from three most affected districts in Maharashtra state. A comparative analysis was performed using regression and bivariate Chi-square test to determine intensity and impact of the pandemic on health and behaviour of the population. An improvement in healthy habits and definite sleeping patterns during lockdown was observed. Quarantine induced stress levels were increased by 18.7%. About 44.6% of the population has accepted the changes and 8.6% of individuals agreed that their mental health is highly affected by the pandemic. There is a remarkable increase in online screen-time hours of teenagers and working groups. A detailed indulgent can help to develop mediations to ease the negative impact on behavioural patterns can be inculcated during COVID -19.

Keywords: COVID-19 pandemic, regression analysis, chi-Square Test, stress levels.

Introduction

World Health Organization (WHO) declared the SARSr-CoV-2 (Severe Acute Respiratory Syndrome-Coronavirus-2) as a pandemic in March 2020 (Chopra et.al. 2020). Coronavirus, has created a pattern of outbreaks, and records of CoV variants in India were made in many parts of the country. In India, infection due to COVID-19 (COronaVirus Disease of 2019) was first recorded on 2 March 2020 from the Pune district of Maharashtra state (Singhal, T. 2020).

On 24 March 2020, the Government of Maharashtra imposed a strict lockdown to reduce the outbreak of the virus. The effect of the first outbreak lasted for six months (March to August 2020). During this time entire socio-economic activities were put on a hold. After August 2020 the positive cases of infection showed a decreasing trend. The lockdown was partially removed. Meantime, the public settings and social activities were hampered, forcing the poor to move out of the home to fulfill an economic need. The new normal routine was imposed on the population but it created a counter-attack and second outbreak of COVID-19 took place from March 2021. 18-44 age group was permitted to get vaccinated on 1st May 2021 by the government.

The present study aims to determine the impact of second outbreak of Covid-19 during March 2021 and further. The peak period of Covid-19 i.e. a month of May is mainly assessed. The study also aims to study the socio-demographic impact on the areas of responses. There is a lack of evidence of the effects of COVID-19 on the behavioural pattern of the population in Maharashtra. To overcome this dearth of information and knowledge, the study comprehends the impact of COVID-19 on the daily routine of individuals. The total fatalities in Maharashtra was 69,615 and the total number of recovered individuals is 39, 30,302 in the first week of May 2021. The number of vaccinated individuals is 71, 98,207, at the beginning of May 2021(Government Report, 2021). In recent research, the Covid-19 lockdown has affected about 97% of people's lifestyles in India. Various routine habits and their impact on people were tried to assess in the present study.

Study Area

The 443 responses of individuals were collected by the systematic random sampling method of data collection. From the total number of responses observed, 234 responses were from Pune

district, 61 responses were from Nashik district, and 47 responses from Ahmednagar district. 26 responses were from Satara district, Raigad (8), Kolhapur (6), Mumbai (5), Thane and Solapur district recorded 4 responses each. Jalgaon, Nandurbar, Dhule districts had 3 responses each. Hingoli, Latur, Nanded, Sangli, Akola, Aurangabad, and Chandrapur districts had 2 responses each, Palghar, Jalna, Ratnagiri, Buldhana, Osmanabad, Yavatmal, Beed, and Nagpur districts recorded 1 response each district. As the maximum responses were recorded from Nashik, Pune, and Ahmednagar districts, the study mainly focused on these districts. The biased, incomplete, duplicate, and invalid responses were eliminated from the survey considering them as an outliers.

The highest fatalities were recorded in Nashik, Pune, and Ahmednagar districts of Maharashtra state, a western state in India (Figure 1). Hence, the present study focused on these districts. The details of the relative and absolute locations are mentioned in Table 1.

The confirmed cases of COVID-19 in May 2021 were 2.95 lakhs and recoveries in the same week were 2.57 lakhs in the Pune district. In Nashik district, May 2021 recorded 3.07 lakhs and 2.89 lakhs recoveries in the same week. The confirmed cases of COVID-19 in Ahmednagar district in May 2021 were 2.30 lakhs and the recovered cases were 2.09 lakhs (Government Report, 2021).

Data acquisition and analysis

A questionnaire was developed using daily life-related questions to help assess daily life routine-related behaviour in citizens during this pandemic and its lockdown. It was pre-tested to assure the flow of questions and maintain original significance. The individuals were requested to give responses to the questions. All responses were anonymous. About 35 questions were framed on health and behaviour public awareness and preparedness for the outbreak.

The pattern of the questions was set in three formatted, one with yes/no type, secondly the rating types, and third was the personalized type of questions. Based on this pattern, the questions were categorized and analyzed differently. Personal health questions like vaccination, daily exercise, daily meals, household help, and 23 seconds hand wash, use of mask, weight loss/gain, health facility, and regular sleep. The second category questions were based on ratings like public health facilities, a span of exercise, full meal habits, change in daily sleeping hours, time spent with the family, stress levels, anxiety due to pandemic, and mental health. While the third category of analytical questions includes the knowledge update from social media or newspaper, quality time with family and children, awareness campaigns, preparedness to fight the virus, role of local government, need for severe lockdown, and cope up with the virtual online world.

Methodology

To study the impact of the COVID-19 situation and lockdown, a virtual-based survey was carried out by developing a web-based questionnaire. The procedure and means of data collection was virtual due to the COVID-19 situation.

Bivariate statistical analysis

The Chi-Square test was used to investigate whether COVID-19 has any impact on the behavioural pattern of the population. The hypotheses were designed to test a significant relationship between nominal and ordinal variables organized in a bivariate table. The Chi-Square distribution is a series of distributions that vary according to their degrees of freedom. The methodology derived by Chopra et al. (2020) is used in Chi-square statistics. It summarized the difference between the frequencies observed in a bivariate table and the frequencies to be expected if there were no relationship between the two variables. The comparison of various parameters (Table 2) among Nashik, Ahmednagar, and Pune districts was performed. The formula used for calculating a Chi-Square distribution is as following (equation 1).

Where, O is the observed and E is the expected value. Expected values obtained differ for each district.

Results

For each category, variables were assigned and were presented as frequencies. A Chi-Square test used for qualitative analysis was applied to determine the relationship between each parameter. Bivariate analysis was assessed and the outcomes were interpreted as P-value. For all analyses, a P-value \leq of 0.05 was considered statistically significant. Exponential regression analysis was used to model the situations in which the growth initiates slowly and then accelerates briskly without any barriers and again slows down to get closer and closer to zero. The exponential regression can be applied to the present situation of COVID-19.

Demographic characteristics of the samples

Out of 443 responses, the responses with the age below 18 years were eliminated. 351 responses (54.7% male, 45.3% female) of the above 18 age group were taken into consideration to perform a Chi-Square test. The parameters like the number of vaccinated population, rate of vaccination, daily exercise, change in body weight, online education, online work from home, mental health during COVID-19, online shopping of essentials, the status of local health facilities, and public healthcare are taken into consideration.

The responses collected from the web-based survey included 61 responses from the Nashik district, 47 responses from Ahmednagar, and 243 (69.23%) from the Pune district. There were 61.54% of male responses with 38.46% females. 86.04% of 18-44 age group with 9.12% above 45 age. Maximum responses were from students (71.51%) while the rest is the working group of private (19.37%) and public sector (9.12%). Most of the families are large with >4 persons (38.46%), 4 persons (43.59%). All the demographic characteristics outline the general scenario of responses as shown in Table 1.

The age group included 89% of college students and working group while 7.2% is above 45 age. The comparison of the college group and a working group showed a significant difference in knowledge about the outbreak and preparedness through the above 45 age group showed significant difference (P-value \leq 0.001). Until the 2nd of June 2021 only 14.2% got vaccinated, 55.2% registered as per government norms while 30.6% not registered at all.

The Chi-squared test

The null (H_0) and alternative (H_a) hypotheses were stated. H_0 hypothesis for all the three study areas state that there is no relation between the change in habits and behaviour of people and COVID -19 lockdown, while H_a stated strong relation between the change in habits and behaviour of people and COVID -19 lockdown.

The hypotheses were tested at a 5% level of significance. The positive and negative responses demonstrated significant differences in various parameters. The population demonstrated significant differences in the level of behavioural changes amidst COVID-19. The survey shows that the Pune district being the highly affected, shows low P-values ($P \leq 0.02$) indicating that people are more aware of the post-Covid consequences. The hygiene protocols were followed in the Pune district but registration for vaccination is still a painstaking job. Ahmednagar shows a lower rate of vaccination. Daily exercise is done significantly is done in the entire study area ($P \leq 0.02$) indicating an increase in awareness of fitness among the 18-44 age group.

COVID-19 lockdowns have restricted the free movement of a working group and attending

the offices. The office hours are replaced by online work from home (WFH) mode ($P \leq 0.025$) causing an increase in screen time hours by 2–3 hours. Normally the online working hours range from 3–4 hours, but in lockdown, it increased up to 4–6 hours (38.5%), 8–9 hours (19.8%), and even more than 10 hours a day (6.1%) in private-sector jobs ($P \leq 0.013$). The increase in screen time has increased in metropolitan cities, Pune district has more use of the internet (70%) than Nashik (21%) and Ahmednagar (19%). However, there is a significant inter-relationship between the increase in screen time and lockdown due to the Covid-19 outbreak even in the second wave. Meanwhile, there is no significant relationship between online shopping and lockdown, instead even today people move out from the home to buy essentials and groceries (75.3%).

Local health facilities are under tremendous pressure. 53.82% of the people opined that local health facilities are working satisfactorily but the infrastructure can be improved ($P \leq 0.02$). While 20.1% are unhappy with local health care centers at the $P \leq 0.01$ level. 75% of individuals are satisfied with the urgent help provided by the government in all aspects.

Half of the population (43.23%) have maintained good emotional health even in lockdown and there is no significant relationship between degradation in the mental health of people and lockdown ($P \leq 0.09$). About 65.1% of the population agrees with the need for a severe lockdown. All age groups and genders insisted on severe lockdown (65.71%) at the $P \leq 0.019$ significance level. The maximum P-value is ranging between 0.08 and 0.0001 significant levels (Figure 3). Overall, the null hypothesis is rejected and it can be concluded that there is a strong relationship between behaviour and COVID-19. $P < 0.05$ values off all the districts indicate that there is a definite correlation between changes in the behaviour of people after lockdown. The null hypothesis is rejected in all the cases and the alternative hypothesis with $P < 0.05$ is accepted.

Exponential Regression

The regression analysis was performed to the model situation of dynamics of COVID-19 positive cases. The exponential function $y = abx$ was used in the present study to evaluate the differences in the rate of change in positive cases. The x function indicates the parameters used in the survey while y is the function of collected responses, a and b are the exponential constants. As seen in Figure 2, the positive cases of second-wave Coronavirus increased slowly in March and then accelerated rapidly in April and slowing back during May-end 2021 when the present survey was carried out. The rate of recoveries is highest in the first week of June (91.43%) as compare to mid-May (81%).

It was determined that the population from Pune is more likely aware of COVID-19 symptoms and has maintained all norms of lockdown. The three residual sums of square (RSS), a total sum of square (TSS), and error sum of square (ESS) where A_i is an averaged value and p is the predicted value of the observed value of each district.

Dividing Equations 2 and 3 gives the difference in the residual values of observed values and the total sum of a square. After the exponential regression, the R value of the observed value obtained is 0.415 or 41.5% which indicates the number of COVID positive cases in the state will reduce after June 2021.

Change in the behavioural aspects of Population

COVID-19 has made a huge impact on lives giving a sudden change to the daily routine. Social distancing or isolation for a longer period leads to stress, boredom, anxiety, which affects the ability of thinking and responding, This has led to a greater tendency to low mental health, overeating, and also disturbing sleeping habits of the individuals (over sleepiness 18.2%). Prolonged confinement within home/houses has to lead to an increase in the screen time reducing exercise times, thus leading to disturbance in meal habits, anxiety(18.7%), and sleeping hours (Table 3).

Changes in daily routine

To assess the daily life routine meal patterns, exercise habits, and variations in weights of individuals due to lockdown were included. It was seen that the pandemic and its lockdown effect has highly affected the exercise routine (19.4%) due to the closure of fitness centers and the restricted physical activity (Table 3). Due to changes in the exercise routines, there was an influence on the meal habits with a substantial percentage of individuals having less than three meals a day and a very small amount consuming more than 4 meals a day. There is less variance observed in the weight of individuals.

Anxiety or Stress levels during COVID-19 pandemic

COVID-19 related restrictions have not only affect physical health but also have an impact on mental health to a great extent, leading to a large number of individuals getting more stressed and anxious due to lockdown (Table 4). 44.6% of the population has accepted the changes make them stressful 'sometimes'. This proportion is comparatively large. Significantly, about 8.6% of individuals agreed that their mental health is highly affected by the pandemic.

Effect of a virtual world and social media

Most of the people are far apart in their preferred mode of getting health and other updates related to the current situation. A maximum number of people relying on social media (30.4%). Getting updates from a news broadcast on television is equally significant (30.2%). Newspaper, print media, and information given by health care NGOs are also preferred by 12.6%, and 12.4% respectively. About 10.4% of the individuals do not use any of the online/ offline platforms but rely on family and friends to get the updates.

Awareness and Preparedness in COVID-19

COVID-19 pandemic and lockdown have brought a sudden jerk in lifestyle-related behaviour of individual terms such as “immunity”, “Social distancing” and “self-isolation/quarantine” have become a drastic need. A reasonable amount of the population relates the health facility in their particular areas to be average. At the same time, authorities can be more desirable in restricting the spread of the deadly virus. Trying to clear rumors and myths surrounding COVID-19, a sizable amount of the population (78.6%) is seen indulging in creating awareness in society.

About 73.9% of the individuals are aware of the situation and adopted healthy habit to keep away the disease in the form of cleaning the hands thoroughly (23 seconds ideal time), use of washable/reusable mask, creating awareness in the society, using masks, maintaining food hygiene and sanitizer and all other precautions. Meanwhile, people also want the local government (35%) to become more responsible and increase the rate of vaccination.

Conclusion

The present study highlights the perspective of people towards a 'new normal' routine that is adaptive. The population is completely aware of the fact that lockdown is only the solution. Though the stress levels are increased, altering the online mode for some period is adapted. The results of the survey indicate that the public and government together can do better to curb the situation by adopting healthy habits. It is no surprise that people may lose control of all psychological encumbrance during the lockdown.

The major findings of the study are that about 18.7% find themselves in stress and 44.6% consider it 'sometimes'. The survey exhibited no significant differences regarding preparedness to fight against COVID-19 level between areas, age, gender, and educational and occupational groups. However, $P \leq 0.05$ determines the significant change in lifestyle and daily routine of individuals. 53% of the population expect direct participation of local government to restraint COVID-19 outbreaks in the future.

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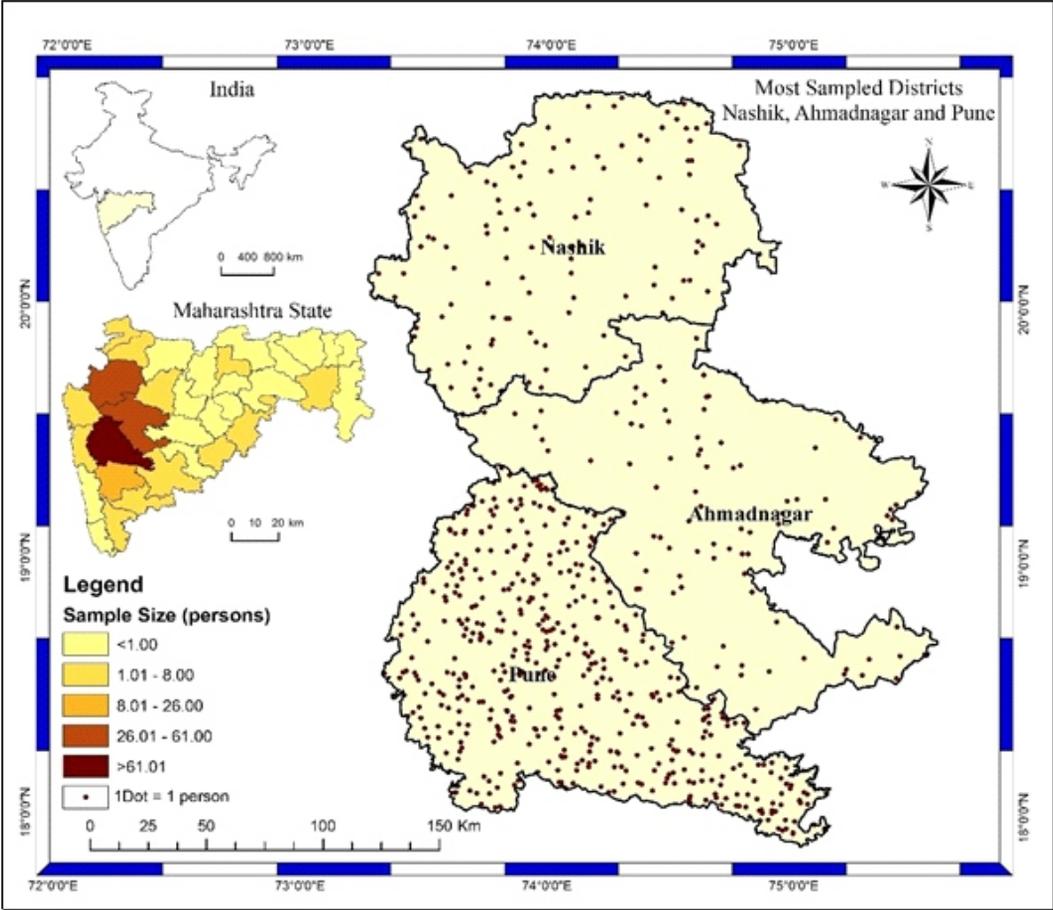


Figure 1. Location of the study areas. The choropleth map of Maharashtra state indicates sample size collection (middle panel) from different districts. The dark brown color shows a maximum number of responses. Web-based virtual responses were collected from the three districts – Nashik, Ahmadnagar and Pune (Right panel).

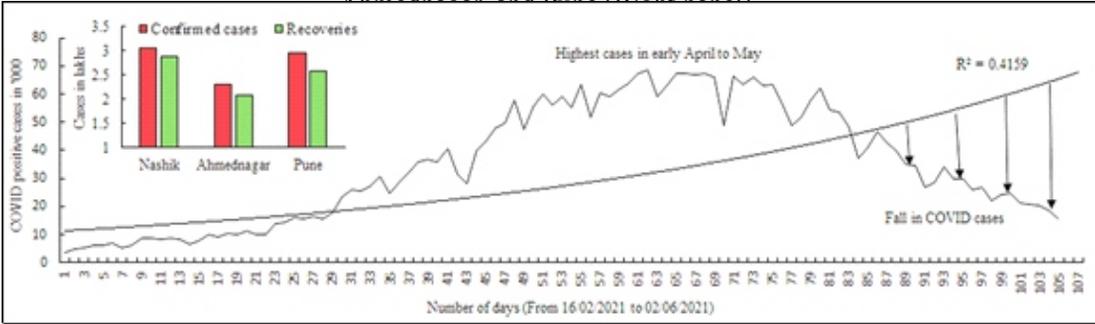


Figure 2. Number of COVID-19 positive cases in Maharashtra state during a period of 16/02/2021 to 02/06/2021. The exponential regression line predicts an increasing trend in the infections but the

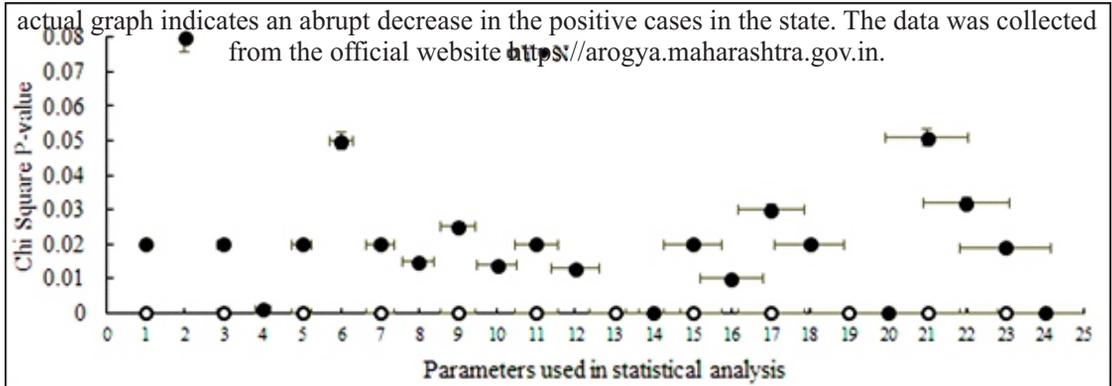


Figure 3. Graph representing P-values distribution of all the parameters with error bars outlined circle represents positive responses and filled circle represents negative responses of the participants. Negative responses are nearby or away from the P

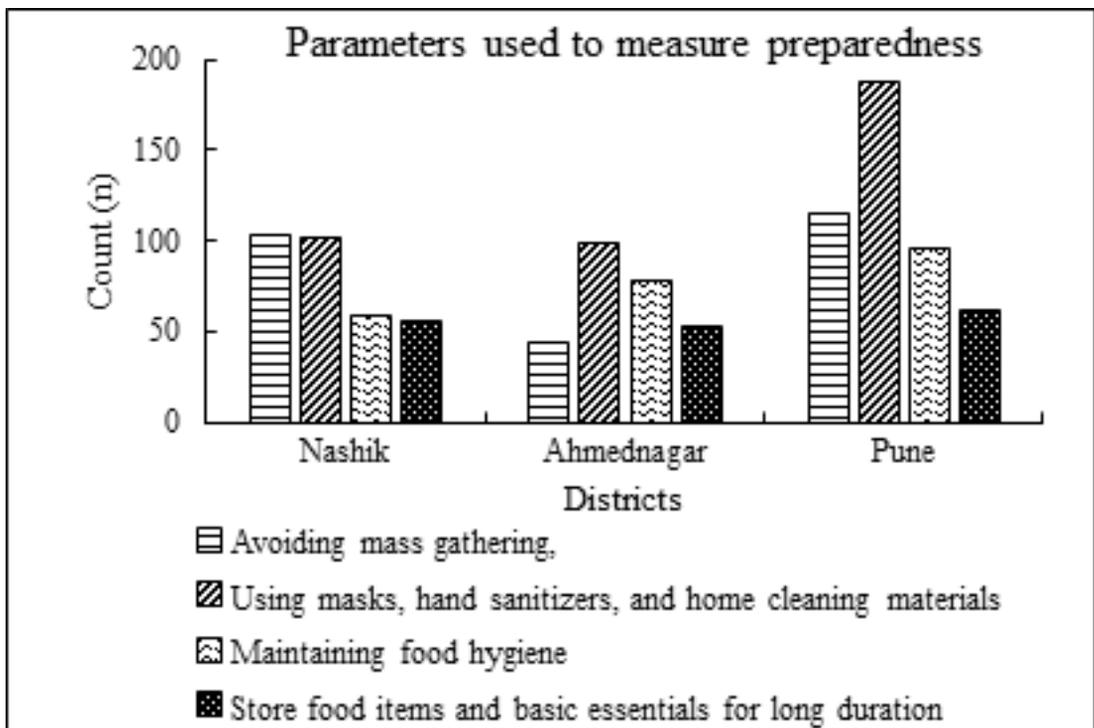


Figure 4. Parameters used to measure the preparedness of the individual during the second wave of COVID-19

Table 1. Relative and absolute location of the study area

| Districts | Pune | Nashik | Ahmednagar |
|---|----------------|----------------|----------------|
| Area(sq km) | 15,643 sq.km | 15,582 sq.km | 17,048 sq.km |
| Latitude | 17°53'42" N to | 20°50'42" N to | 18°19'57" N to |
| | 19°23'04" N. | 19°34'43" N. | 19°59'45" N. |
| Longitude | 75°08'31" E to | 74°56'18" E to | 75°32'12" E to |
| | 73°19'23" E. | 73°14'51" E. | 73°37'13" E. |
| No. of Talukas | 14 | 15 | 14 |
| Population | 10,089,916 | 6,778,978 | 4,861,397 |
| Confirmed cases (in the first week of May 2021) | 2.95lakhs | 3.07lakhs | 2.30lakhs |
| Recoveries (in the first week of May 2021) | 2.57lakhs | 2.89lakhs | 2.09lakhs |

Table 2. Socio-demographic characteristics of the individuals.

| Parameters | | Count (<i>n</i>) <i>n</i> = 351 | Percentage (%) |
|-----------------------|----------------|--------------------------------------|----------------|
| Region | Nashik | 61 | 17.38 |
| | Ahmednagar | 47 | 13.39 |
| | Pune | 243 | 69.23 |
| Gender | Male | 216 | 61.54 |
| | Female | 135 | 38.46 |
| Age group | < 18 | 17 | 4.84 |
| | 18- 44 | 302 | 86.04 |
| | >45 | 32 | 9.12 |
| Occupation | Student | 251 | 71.51 |
| | Private Sector | 68 | 19.37 |
| | Public Sector | 32 | 9.12 |
| Family Size (persons) | 2 | 16 | 4.56 |
| | 3 | 47 | 13.39 |
| | 4 | 153 | 43.59 |
| | >4 | 135 | 38.46 |

Table 3. Observed responses on various parameters. These Parameters are used to perform the Chi-Square test. N- Nashik, A- Ahmednagar, and P-Pune, WFH-Work from Home

| Parameters | | N | A | P | Count (<i>n</i>) | | P-value |
|---|---|-----|----|-----|--------------------|-------|---------|
| | | | | | O | E | |
| 1. Vaccinated | Y | 4 | 5 | 36 | 45 | 9.73 | 0.02 |
| | N | 57 | 42 | 198 | 297 | 64.20 | 0.08 |
| 2. Covishield* | Y | 9 | 2 | 33 | 44 | 9.51 | 0.02 |
| | N | 52 | 45 | 201 | 298 | 64.41 | 0.001 |
| 3. Daily Exercise | Y | 53 | 42 | 187 | 282 | 60.96 | 0.02 |
| | N | 8 | 5 | 47 | 60 | 12.97 | 0.05 |
| 4. Weight Gain | Y | 11 | 5 | 55 | 71 | 15.35 | 0.02 |
| | N | 50 | 42 | 179 | 271 | 58.58 | 0.015 |
| 5. WFH | Y | 31 | 27 | 133 | 191 | 41.29 | 0.025 |
| | N | 30 | 20 | 101 | 151 | 32.64 | 0.014 |
| 6. Online work | Y | 21 | 18 | 94 | 133 | 28.75 | 0.02 |
| | N | 40 | 29 | 140 | 209 | 45.18 | 0.013 |
| 7. Online Shopping for essentials | Y | 14 | 14 | 60 | 88 | 19.02 | 0.15 |
| | N | 47 | 33 | 174 | 254 | 54.90 | 0.0001 |
| 8. Status of local health facilities | Y | 34 | 43 | 172 | 249 | 53.82 | 0.02 |
| | N | 27 | 4 | 62 | 93 | 20.10 | 0.01 |
| 9. Urgent response of local government in emergency | Y | 82 | 67 | 202 | 351 | 75.87 | 0.03 |
| | N | 21 | 7 | 42 | 70 | 15.13 | 0.02 |
| 10. Effect on mental health | Y | 26 | 19 | 117 | 162 | 35.02 | 0.09 |
| | N | 127 | 45 | 28 | 200 | 43.23 | 0.0001 |
| 11. Awareness about the hygiene | Y | 82 | 57 | 210 | 349 | 75.44 | 0.051 |
| | N | 21 | 17 | 45 | 83 | 17.94 | 0.032 |
| 12. Severe need of Lockdown | Y | 72 | 67 | 165 | 304 | 65.71 | 0.019 |
| | N | 31 | 27 | 82 | 140 | 30.26 | 0.0001 |

* Government of Maharashtra initiated the vaccination program with only available Pune-based Serum Institutes' Covishield vaccine in April and May.

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