

The Effects of the COVID-19 Pandemic on Individual's Physical Activity Levels and Mental Health: A Descriptive, Cross-Sectional Study in Mumbai

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Abstract

Background: COVID-19 has impacted the well-being of individuals living in India. Lockdowns have helped prevent the spread of COVID-19. Alternatively, this has led to negative impacts on maintaining healthy lifestyles. This study describes the physical activity and mental health status of Mumbai residents living with and without pre-existing illnesses.

Objective: This descriptive, cross-sectional study reviews survey responses from participants from Mumbai, India.

Methods and Material: An online survey was disseminated via social media platforms. Respondents answered questions regarding their demographics, health history, mental status, and physical activity levels pre-pandemic and after the COVID-19 pandemic declaration.

Descriptive statistical analysis was completed. A paired sample t-test was used to calculate differences between pre-pandemic and post-pandemic effects. Significance was set at $p < 0.05$.

Results: A total of 146 responses were returned. Approximately 42% of participants reported having one or more pre-existing medical condition. Total participants reported increased sedentary lifestyle after the declared pandemic ($p = 0.0001$ per weekday and $p = 0.006$ per weekend). Although not significant, physical activity levels were reduced by 35% in participants with pre-existing medical conditions. Respondents reported having increased feelings of nervousness, anxious, or being on edge post-COVID ($p = 0.01$). Significant decrease in general feelings of sadness ($p = 0.006$), anxiety ($p = 0.03$) and stress ($p = 0.002$) post-COVID were also reported.

Conclusions: Quarantine measures trigger psychological problems in certain areas. Physical activity has benefits to reduce COVID-19 infection while also promoting psychological health, thus promoting physical activity should be a public health priority.

Keywords: COVID-19, Pandemic, Quarantine, Physical Activity, Psychological Distress, Lockdown, Anxiety, Stress

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 or COVID-19) has been the largest global outbreak in recent years causing a serious global public health crisis. The World Health Organization (WHO) declared COVID-19 a world-wide pandemic on March 11, 2020. Despite prevention efforts, infections could not be contained, infecting over 163 million people globally as of May 2021. In Mumbai, Maharashtra, India, alone, there have been over 600,000 confirmed cases as of this writing. Individuals with pre-existing medical conditions have shown to be more susceptible to infection and severe health outcomes.

COVID-19 infection and government mandated quarantine and social distancing, together, have impacted the well-being of individuals living in India. The implementation of quarantining protocols have helped prevent the spread of COVID-19 infections, alternatively, may also have led to negative outcomes that have challenged maintaining physical and mental health. The purpose of this investigation was to study the effects of pandemic protocols by comparing people with and without pre-existing conditions and explore their mental and physical activity levels.

Aim & Objective(s)

Describe the influence pandemic protocols have on physical activity and mental health status of Mumbai residents living with and without pre-existing illnesses.

Discuss the trends and significant findings gathered from both subgroups (healthy individuals and pre-existing conditions).

Materials and Methods

Ethics

This study was reviewed by the University of Texas Health Science Center at San Antonio’s Institutional Review Board. This study was determined to be exempt based on the nature of the survey-based research study.

Study Design

A cross-sectional study was conducted in Mumbai in July 2020 (Figure 1). Respondents were recruited using a convenient snowball recruitment

strategy. Word of mouth and survey link distribution via social media platforms were the primary method for recruiting participants. Respondents were 18 years of age or older with access to the internet. The data was collected using Research Electronic Data Capture (REDCap).

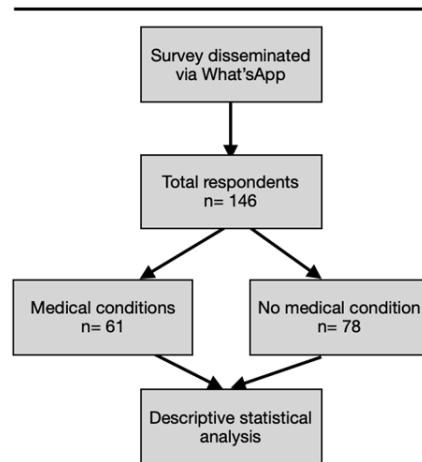


Figure 1 Consort Diagram of the Survey Responses and Study Design

Survey Instrument

A truncated version of a previously published survey was disseminated via WhatsApp. Respondents answered questions regarding their demographics, medical history, physical and mental health. The survey questions were designed to ask respondents to recall on what their lifestyle and health were “before” and “after” the pandemic declaration to help determine the effects the pandemic declaration has had on individuals. The participants demographic information (Table 1) and medical history (Table 2) were collected. Participants answered questions relating to their daily physical activity before and after the COVID-19 outbreak.

Table 1 Participants Demographics

	n (%)
Race	
American Indian or Alaska Native	3 (2.1%)
Asian	136 (93.8%)
Black or African American	0 (0%)
Native Hawaiian or Pacific Islander	0 (0%)
White	0 (0%)
Not Reported	3 (2.1%)
Unknown	3 (2.1%)
Ethnicity	
Hispanic or Latino	2 (1.5%)
Not Hispanic or Latino	42 (32.3%)
Not Reported	29 (22.3%)
Unknown	57 (43.8%)
Gender	
Female	86 (58.9%)
Male	60 (41.1%)
Not Reported	0 (0%)
Age	
18-25	68 (46.6%)
26-35	38 (26%)
36-45	10 (6.8%)
46-55	5 (3.4%)
56-65	10 (6.8%)
66-75	10 (6.8%)
76 or above	5 (3.4%)

Self-Reported Physical Activity

Participants described the time spent physically active per day during the week and weekends. Participants indicated time spent between 0 to 30

minutes (min.); 30 to 60 min.; 60 to 90 min.; 90 to 120 min.; or more than 120 min. on specific activities such as walking for exercise or work; jogging; running; bicycling; swimming aerobic exercise; household activities; weight training; playing sports; workout/exercise videos; and exergaming. They were also asked how many hours per day over the weekdays and weekends they spent participating in leisure activities such as watching TV, reading, and playing video games (Table 3).

Table 2 Medical and Pre-Existing Conditions

Medical Conditions	N	(%)
Cardiac	8	5%
Respiratory	11	8%
Gastrointestinal	10	1%
Genitourinary/ Kidney	3	2%
Blood Disorder	5	3%
Infectious Disease	0	0%
Dermatological	3	2%
Vision	3	2%
Endocrine	9	6%
Diabetes	4	3%
Musculoskeletal	5	3%
Abnormal Blood Pressure	16	11%
Cancer	5	3%
Neurological/ Psychiatric	1	1%
Pre-Existing Medical Condition		(%)
1 Condition	37	26.6%
2 Condition	9	6.5%
3 Condition	4	2.9%
4+ Condition	4	2.9%

Percentage of medical conditions are relative to the total sample size of 146 participants.

Table 3 Participants Mental Health Changes as a Result of COVID-19 Pandemic

Mental State Survey Questions	Total Sample		Pre-Existing Medical Conditions		Healthy Individuals	
	Pre-COVID	Post-COVID	Pre-COVID	Post-COVID	Pre-COVID	Post-COVID
If you have experienced any of the previous conditions, how difficult did these make it for you to do your work, take care of things, or get along with other people?	1.5 ± 0.9	1.4 ± 0.9	1.4 ± 1.0	1.4 ± 1.1	1.6 ± 0.8	1.5 ± 0.8
Feeling afraid as if something awful might happen	1.7 ± 0.8	1.7 ± 0.8	1.6 ± 0.9	1.5 ± 0.8	1.7 ± 0.8	1.8 ± 0.9
Becoming easily annoyed or irritable	1.8 ± 0.8	1.9 ± 0.9	1.9 ± 0.8	2.0 ± 1.0*	1.7 ± 0.8	1.8 ± 1.0
Being so restless that it's hard to sit still	1.5 ± 0.8	1.4 ± 0.8	1.4 ± 0.8	1.4 ± 0.8	1.5 ± 0.8	1.3 ± 0.8
Trouble relaxing	1.5 ± 0.8	1.6 ± 0.8	1.6 ± 0.8	1.5 ± 0.6	1.5 ± 0.8	1.7 ± 1.0
Worrying too much about different things	1.8 ± 0.8	1.9 ± 0.9	1.8 ± 0.9	1.9 ± 0.8	1.7 ± 0.7	1.9 ± 1.0*
Not being able to stop or control your worry	1.5 ± 0.7	1.7 ± 0.9**	1.7 ± 0.8	1.7 ± 0.8	1.3 ± 0.5	1.8 ± 1.0**
Feeling nervous, anxious, or on edge	1.5 ± 0.8	1.8 ± 0.8*	1.6 ± 0.8	1.8 ± 0.9	1.4 ± 0.7	1.7 ± 0.8*
In general, I feel that I am more sad.	3.5 ± 1.2	3.2 ± 1.3**	3.4 ± 1.2	3.0 ± 1.3*	3.7 ± 1.1	3.4 ± 1.1
In general, I feel that I have more anxiety.	3.3 ± 1.2	3.0 ± 1.3*	3.3 ± 1.2	2.8 ± 1.3**	3.3 ± 1.1	3.2 ± 1.2
In general, I feel more stressed.	3.2 ± 1.2	2.9 ± 1.2**	3.1 ± 1.3	2.8 ± 1.3*	3.4 ± 1.2	3.1 ± 1.1*

Participants selected either (1) not at all, (2) several days, (3) over half the days, or (4) nearly every day. Each response was converted to a numerical score for analysis. For the question on difficulty, participants selected either (0) I did not experience any of the previous condition; (1) not difficult at all; (2) somewhat difficult; (3) very difficult; (4) extremely difficult. *p<0.05; **p<0.01; ***p<0.001

Psychological and Mental Health

Three generalized questions relating to stress, anxiety and sadness were asked using a five-point Likert scale (Table 4). Participants were also asked questions related to (1) feeling nervous, anxious, or on edge; (2) not being able to stop or control your worry; (3) worrying too much about different things; (4) trouble relaxing; (5) being so restless that it's hard to sit still; (6) becoming easily annoyed or irritable; (7) feeling afraid as if something awful might happen. Response options were “not at all,” “several days,” “over half the days,” or “nearly every day.”

The final survey item used to assess anxiety experienced due to the previous conditions mentioned, determined whether these symptoms made it difficult to work, take care of things, or get along with other people. Response options were “I did

not experience any of the previous conditions,” “not difficult at all,” “somewhat difficult,” “very difficult,” or “extremely difficult.”

Statistical Analysis

Descriptive statistical analysis was used to summarize the data. A paired sample t-test was performed to calculate differences in means of responses pre- and post- the pandemic. All data was processed using Graph Pad Prism 9 for macOS Version 9.0.1. All data are presented as frequency (percentage) and mean (standard deviation). Significance was set at $p < 0.05$. Figure 1 is a CONSORT diagram of the survey responses and study design that outlines the number of respondents and further divides the sample size of those with and without medical conditions.

Table 4 Participants Sedentary Behaviors Before and After the Declaration of the COVID-19 Pandemic

Table 4. Participants sedentary behaviors before and after the declaration of the COVID-19 pandemic		
Sedentary Daily Living Survey Questions	Pre-COVID	Post-COVID
How many hours per day on weekdays did you watch television, use the computer for non-work, utilize your phone for entertainment, play video games?	2.3 ± 1.0	2.6 ± 1.0**
How many hours per day on the weekend did you watch television, use the computer for non-work, utilize your phone for entertainment, play video games?	2.5 ± 1.0	2.8 ± 1.0*

Participants selected either (1) 0-1 hour; (2) 1-2 hours; (3) 2-4 hours; or (4) more than 5 hours of time spent participating in sedentary leisure behavior. Each response was converted to a numerical score for analysis. * $p < 0.05$; ** $p < 0.01$

Results

Demographics

A total of 146 responses were returned. Most of the participants reported being Asian (94%), female (59%), and less than thirty-five years old (73%; Table 1). More than 50% reported being single, 43% reported full-time employment status and 51% reported having three to four family members living in the household. Forty-two percent reported being married, 21% had part-time jobs, 36% were unemployed and 40% reported having more than four family members living in the household.

Approximately 53% of the total participants reported having no medical conditions and 42% of participants reported having one or more medical condition (Table 2). Medical conditions with the highest frequency reported were abnormal

blood pressure (n=16), respiratory (n=11) and gastrointestinal (n=10) issues.

Physical Activity and Sedentary Leisure Behavior

Trends observed for the entire sample size of the time spent physically active revealed a 12% increase in exercise done for *0 to 30 min.*, 18% decrease in exercise done for *30 to 60 min.*, and 6% increase in *more than 60 min.* of time spent physically active per day. The trends observed for the healthier participants reported decreasing their overall physical activity levels by 21%. Although not significant, physical activity levels were decreased by 35% with participants reporting having pre-existing medical conditions. However, there was significant difference in the average time spent walking for exercise or walking to work ($p < 0.0001$), where

participants reported walking less after the declared pandemic (Figure 2).

Participants were asked to report how many hours per day during the week and on weekends they spent doing leisure activities such as watching television, using the computer for non-work, utilizing the phone for entertainment and or playing video games. Sedentary behaviors were significantly increased post COVID-19. Participants reported an increased sedentary lifestyle after the declared pandemic ($p = 0.0001$ per weekday and $p = 0.006$ per weekend) (Table 4).

Psychological Health

Significant differences in psychological emotions were reported for individuals with and without pre-existing medical conditions (Table 3). Collectively there was increased *feelings of not being able to stop or control worry* ($p = 0.006$) and *feelings of nervousness, anxious, or on edge* ($p = 0.01$) post-COVID. Alternatively, there was overall decrease in emotions on general feelings of *sadness* ($p = 0.05$), *anxiety* ($p = 0.03$) and *stress* ($p = 0.002$) post-COVID.

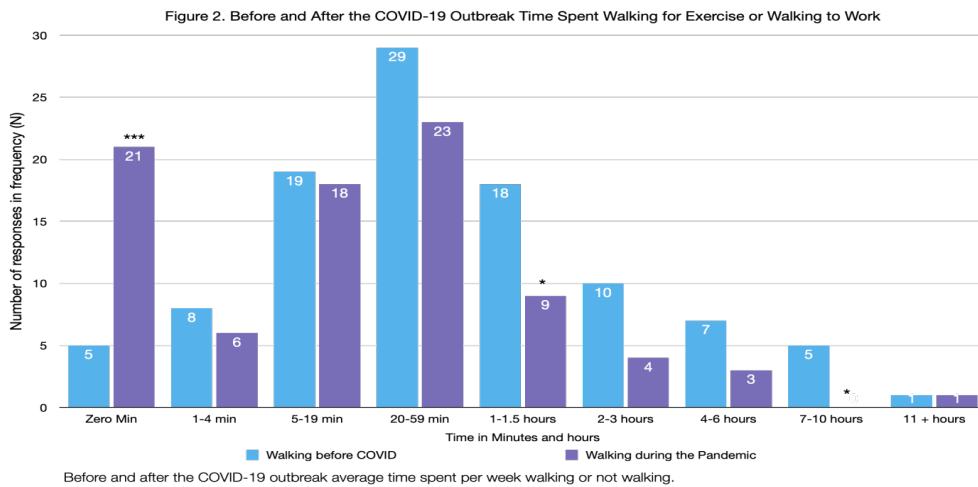


Figure 2 Walking Activity before and after the COVID-19 Pandemic Declaration

For participants with pre-existing medical conditions the analysis revealed significant increase in the category of feeling *more easily annoyed or irritable* ($p = 0.05$) post-COVID. There was a decrease in feelings of *sadness* ($p = 0.02$), anxiety ($p = 0.008$), and stressed ($p = 0.02$) in this population post-COVID, as well. The healthier counter parts had significant increased feelings of *worrying* ($p = 0.05$), *not being able to stop or control worry* ($p = 0.003$), and more feelings of *nervousness, anxious, or on edge* ($p = 0.03$) (Table 3). There was a decrease in the general feelings of *stress* ($p = 0.03$) in this healthy population. Due to potential age associated bias, we stratified mental health based on age, however there was no significant difference.

Discussion

This study aimed to evaluate physical activity and mental health of individuals in Mumbai

before and during the pandemic lockdown in India. This study also compared how these results differed in individuals with medical conditions versus their healthier counterpart. Risk factors for severe COVID-19 infections include age, race/ethnicity, gender, certain medical conditions, use of certain medications, poverty and crowding, certain occupations, and pregnancy. In addition, hypertension may lead to increased mortality in patients contracting severe COVID-19 infection. Of note, our study sample reported abnormal blood pressure being amongst the highest frequency in reported medical conditions in this study. Therefore, given the propensity of individuals with abnormal blood pressure that reside in Mumbai, its imperative precautions are undertaken, both individually and by the local health departments, to protect individuals' infection.

At the time of the survey, social distancing and lock-down protocols were being implemented in Maharashtra that aimed to protect the community from the spread of COVID-19. While the primary benefits may outweigh the secondary effects of these protocols, it is important to learn more about what these secondary risks are to such drastic measures.

Physical activity is associated with the prevention and management of chronic diseases, such as abnormal blood pressure. Our study found discrepancies between physical activity levels both before and after the pandemic declaration in individuals with and without pre-existing conditions. Our analysis suggests that physical activity levels decreased by 35% in participants with medical conditions and 21% in healthy individuals. Significant findings in the average time spent in certain recreational activities such as walking was also decreased. In addition, leisure sedentary behavior significantly increased after the declaration of the pandemic for both weekday and weekend activity. This may have been as a result of people working from home or implementing the stay-at-home orders. Our results support other international studies. According to a study by Castañeda et al. that evaluated university students in Spain, an overall negative effect on physical activity intensity was reported during the pandemic with increased in sedentary behavior and an increase in consuming unhealthy food. In addition, this reduction of physical activity revealed increased levels on anxiety among 18- to 34-year-old individuals. Our group similarly found a reduction in physical activity in a cohort of residents in the United States. Given that sedentary lifestyles influence comorbidities associated with COVID-19, future considerations by health agencies should consider the use of public service announcements, fliers or handouts to educate the general community on ways to combat sedentary lifestyles that increase during a pandemic lockdown.

The mental health outcomes reported by survey respondents provided varying view points. For instance, general feelings such as sadness, anxiety and stress were significantly decreased post-COVID for the total sample. For individuals with medical illnesses there was increased feelings of being annoyed or irritable and decreased feelings of

sadness, anxiety, and stress. The healthier individuals reported feeling more nervous, worried, and not being able to control it. For both subgroups there was a decrease in stress. These results contradict original reports from our first group study and Flanagan et al. (2021) that reported mental health decline and many changes in health behaviors as a result of individuals becoming confined to their homes during the pandemic. Alternatively, according to a similar study done in China during the pandemic, psychological disorders such as anxiety, depression and overall poor mental well-being was significantly increased. One potential explanation for the varying feelings of sadness, anxiety and stress could be due to a large percentage of our respondents living with multiple people within the household. Another post hoc hypothesis could be the younger demographic surveyed in this study; however, no significant differences were observed when we stratified for age.

According to Thapa et al. a study conducted to evaluate psychosocial disorders and post-traumatic stress disorder after a year of a catastrophic natural disaster concluded prevalence in these symptoms to be high even after a year of the exposed event. Catastrophic natural disasters such as this ongoing pandemic has the potential to lead to post-traumatic stress disorder (PTSD) long after the end of this pandemic. Grover et al. reported that The Indian Psychiatric Society provided free mental health aid to people seeking mental health care. Therefore, promoting mental and physical health during a pandemic and incorporating coping strategies to manage potential PTSD is of major public health importance.

There is a potential bias in our sample as most of our participants were young adults between 18 to 35 years old and female. The sampling method used (convenience sampling using a snowball strategy via WhatsApp) may have been a potential limitation that led to this potential bias response. This bias response may be due to participants referring other participants that are socially interconnected which may justify similarities in the population such as in age, race, and gender. In addition, younger generations are more likely to use social media while older generations may not be as sophisticated using

technology. In addition, those 47% of participant that reported being ages 18 to 35 years old with medical conditions, reported having only one diagnosed condition. Younger adults tend to be more resilient and free of clinical health concerns than the older population.

This study was done four months after the WHO declared COVID-19 a pandemic and had not yet reached its peak in India according to national statistics. There may have been an under reporting of COVID-19 infections due to decreased testing reported at the time. At the time of this study, only 13% of the participants had reported being tested for coronavirus. Therefore, the lack of COVID-19 testing and limited research at the time may have impacted how participants reported their medical condition, physical and mental health.

Conclusion

COVID-19 and government mandates, together, have significant impact on emotional distress and physical activity. The result of our cross-sectional study suggests that physical activity was reduced by 21% in healthy participants and 35% in those with medical conditions. Sedentary behaviors were significantly increased for both subgroups. Stress was reduced in both healthy and medical conditions subgroups. However, feelings of worry, nervousness, and anxiety were increased overall.

Recommendation

The clinical importance of this study is to promote mental health aid and promote physical activity throughout a pandemic. Individuals with medical conditions are at increased risk for severe infections and a leading sedentary lifestyle may contribute to worsening of chronic illnesses.

Limitation of the Study

There are several limitations in this study. The first is that the survey was only distributed in English, although, Marathi, Hindi and Gujarati are also primary languages spoken in Mumbai. Further, the results are limited to the self-reporting nature of our survey. Having participants self-report and recall their pre-pandemic mental and physical state are limited to assuming that participants were able to recognize changes in their behavior. The sampling method and recruitment strategy may have led to

potential bias in responses. Age also serves as a limitation as the majority of the participants were younger than 35-years old.

Relevance of the study

Current knowledge reports significant changes in common health behaviors because of mandated lockdown protocols implemented. In addition, sedentary behaviors have also increased. According to a study conducted by Castañeda et al. during COVID-19 confinement there were more inactive people who did not fulfill the 75 min/week of physical activity during lockdown. Further Fitbit, Inc, confirms a decline in step counts by 7% to 38% during March, 2020.

Our study also adds to the profound data on psychological effects that the COVID-19 pandemic has had on people. Data shows that the pandemic has played a toll on the declining mental health. Flanagan et al. (2021) reports a 20% percent increase in anxiety, that's 14% higher compared to anxiety level measured before the pandemic.

References

- Castañeda-Babarro, Arkaitz, et al. "Physical Activity Change during COVID-19 Confinement." *International Journal of Environmental Research and Public Health*, vol. 17, 2020.
- Cook, T.M. "The Importance of Hypertension as a Risk Factor for Severe Illness and Mortality in COVID-19." *Anaesthesia*, vol. 75, no. 7, 2020, pp. 976-77.
- FITBIT Staff. "The Impact of Coronavirus on Global Activity." *Fitbit*, 2020.
- Flanagan, Emily W., et al. "The Impact of COVID-19 stay-At-Home Orders on Health Behaviors in Adults." *Obesity*, vol. 29, 2021, pp. 438-45.
- Grover, Sandeep, et al. "Psychological Impact of COVID-19 Lockdown: An Online Survey from India." *Indian Journal of Psychiatry*, vol. 62, no. 4, 2020, pp. 354-62.
- Harris, Paul A., et al. "The REDCap Consortium: Building an International Community of Software Partners." *Journal of Biomedical Informatics*, vol. 95, 2019.
- India Country Overview*. World Health Organization, <https://www.who.int/countries/ind>

- Kumar, Manoj, and Souhaila Al Khodor. "Pathophysiology and Treatment Strategies for COVID-19." *Journal of Translational Medicine*, vol. 18, 2020.
- Patel, Darpan I., et al. "Decline of Psychological Health Following the Designation of COVID-19 as a Pandemic: Descriptive Study." *Journal of Medical Internet Research*, vol. 23, no. 4, 2021.
- Qiu, Jianyin, et al. "A Nationwide Survey of Psychological Distress among Chinese People in the COVID-19 Epidemic: Implications and Policy Recommendations." *General Psychiatry*, vol. 33, 2020.
- Sallis, James F., et al. "An International Physical Activity and Public Health Research Agenda to Inform Coronavirus Disease-2019 Policies and Practices." *Journal of Sport and Health Science*, vol. 9, no. 4, 2020, pp. 328-34.
- Thapa, Prakash, et al. "Anxiety, Depression and Post-Traumatic Stress Disorder after Earthquake." *Journal of Nepal Health Research Council*, vol. 16, no. 1, 2018, pp. 53-57.
- "Assessing Risk Factors for Severe COVID-19 Illness." *Centers for Disease Control and Prevention*, <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/assessing-risk-factors.html>

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