**Analysis of Telemedicine Use Before and During the COVID-19 Pandemic**

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**Introduction**: COVID-19 is a virus that is caused by the SARS-CoV-2 strain of the family of coronaviruses. This virus was first reported on December 1, 2019, and researchers think may have started in an animal and mutated to infect humans. The coronavirus spreads by particles or droplets when an individual talks, laughs, sneezes, coughs, etc. Researchers have found that the best way to protect oneself from infection is through social distancing, wearing a mask, and getting vaccinated. (1) Due to the high rise of infection, providers needed to find a way to meet with patients without increasing the risk of spreading the virus. Through this came the rise of the use of telemedicine during the COVID-19 pandemic.

The primary goal of this project was to analyze the use of telemedicine before and during the COVID-19 pandemic. The data that was used to make this analysis was gathered from a data set by the CDC titled, “Access and Use of Telemedicine During COVID-19”.(2) The primary use of this dataset is to show the percentage of people in the United States who have a usual place of care, provider that offers telemedicine in the past 2 months, who used telemedicine in the past 2 months, or those who have a usual place of care and a provider that offered telemedicine prior to the pandemic. Data were collected during June 2020, July 2020, August 2020, and May 2021. (2) The question I answered using this dataset is, “Did the COVID-19 pandemic increase the use of telemedicine?” I hypothesized that there was a growth of telemedicine during the COVID-19 Pandemic. I came to this hypothesis on the information that many individuals were not allowed to leave their homes due to being quarantined and to minimize the spread of the virus.

**Methods:** The dataset that was downloaded from the CDC to assess telemedicine was not originally in a tidy format. To analyze the question proposed I used tidy methods in Excel and R to make the data R readable and easier to analyze the information. First off, an R script was created and the original data set was imported into R. In order to analyze the data more efficiently I chose to convert the values which were in percent into the actual sample size. To start off the tidy methods the following packages were needed; readr (3) , openxlsx (4), tidyverse (5), tibble (6), tidyr (7), dplyr (8). I took the values from the response column (categorical) and turned them into 5 columns with the associated values. This resulted in one row for each indicator, group, and subgroup. I then read in the information directly from excel starting with row 2. (9) Using group\_by a data frame of unique sample.size values were created. (9) Left join was then used on the original data frame and the grouped one, which kept all the rows and columns but added a new sample size column where the new values would go. (9) An equation was then used to turn the percent into the actual values and placed in the new column.

Using write.xlsx the data set created in R was imported into Excel. (10) In excel all unnecessary columns were removed and a new excel file titled, “Telemedicine\_Analysis\_final”, was created. Using the =SUM function on each of the response sections the actual sample size response values were calculated and tables were made. One large bar graph was created using offers telemedicine currently, schedules one or more telemedicine appointments, and offered telemedicine prior to the pandemic. Two other excel files were created titled “Telemedicine\_Analysis\_Table2”, and “Telemedicine\_Analysis\_Table3”. The second table contained responses that said yes to offering telemedicine currently and before the pandemic, and the third graph contained responses that said no to offering telemedicine currently and before the pandemic.

*Figure 1: Shows access to telemedicine during the pandemic and provides yes, no, idk, responses for providers who currently offer telemedicine, scheduled one or more telemedicine appointments during the pandemic, and offered telemedicine prior to the pandemic.* *Figure 2: Shows providers who currently offer telemedicine(blue) and those who offered telemedicine prior to the pandemic(orange).*

*Figure 3: Shows providers who do not currently offer telemedicine(left) and those who did not offer telemedicine prior to the pandemic(right).*

**Results:** The purpose of figure 1 is to see all the information together and also make it easier to create figure 2 and 3. Figure 2 shows the providers that offer telemedicine currently and those who offered it prior to the pandemic. This figure shows that there are about **27,155** more practitioners who are currently offering telemedicine compared to those who offered it prior to the pandemic. Then figure 3 shows there is a difference between about **8,446** practitioners who did not offer telemedicine prior to the pandemic to those who currently do not offer telemedicine. These analyses show that there was a growth in telemedicine use before and after the pandemic of about 95%. Another analysis that was made from this data is that there was only a slight change in providers that did not offer telemedicine prior to the pandemic and who currently do not offer telemedicine during the pandemic in comparison to the information in figure 2.

**Discussion/Conclusion:** All in all, my hypothesis was supported by the analyses that were made using the CDC dataset. The COVID-19 pandemic increased the awareness and use of telemedicine throughout the United States. Telemedicine is a fairly new concept that became more popular due to people not being able to leave their homes from being quarantined to reduce the transmission of COVID-19. I can see telemedicine growing as providing healthcare in areas where doctors cannot be present in person and helping those who are in need but cannot make it to a physical area. Further research that can be conducted to expand the knowledge of this question is to collect data from new practitioners who do not offer telemedicine now and see if the response changes in the future as well as monitor practitioners from current data to see if the response changes from either eliminating telemedicine or adding it.

Another question this project raised was why telemedicine didn’t grow at a larger degree than I had expected in terms of those who did not offer it prior to the pandemic still do not offer it now. Research from “Telemedicine during and post-COVID 19: The insights of neurosurgery patients and physicians”, think that the major drawback of telemedicine that has some providers hesitant in using this service are technological barriers, privacy concerns, patient data security concerns, and compromised physician-patient relationship. (11) I think these disadvantages can be resolved by upgrading certain programs and services to provide the care and safety that people and providers need to have trust in telemedicine. Overall, the number of practitioners who answered yes to offering telemedicine prior to the pandemic compared to those who answered yes to currently offering it had a percent difference of 95%, concluding that telemedicine grew throughout the pandemic.

Data: Link to GitHub Repository:

<https://github.com/nathaliecalixtro/Access_Telemedicine_Covid19.git>

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