Mental Disability and COVID-19: Instances of Aggression Before and During the Pandemic

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Is there a relationship between the Covid-19 pandemic and aggressive behaviors? We examine the effect of the onset of the pandemic, its prevalence on a regional level in terms of cases and deaths, and its duration on aggressive behaviors. We use data from reports of mental health crises made to the Short Term, Assessment, Response, Treatment (START) clinic to evaluate instances of aggression. We find that there was no relationship between reports of aggression after the beginning of lockdowns on March 13, 2020. We find no relationship between the cases and deaths per 1,000, the duration of lockdown, and reports of aggressive behavior.

COVID-19 | Mental Disability | Aggression

1. Introduction

When the novel SARS-CoV-2 coronavirus first arrived in the United States in early 2020, nobody could have predicted the impact it would have. The pandemic had far-reaching effects. Nearly 80 million Americans were infected by the virus, with nearly one million of those succumbing to it. The entire country shut down in March 2020 in an attempt to limit the spread of the virus, forcing a population of 330 million peoples to remain at home. People who had previously been able to leave uncomfortable, difficult, or even dangerous family situations by escaping their homes were now stuck with no escape. In the United States and around the world, there was a rise in instances of domestic violence, violent crime, and an increase in mental health emergency situations.

A vast literature has emerged since the start of the pandemic that documents this rise. Lakhan et al. 2020 found an increase in depression, anxiety, stress, and other mental health detractors since the beginning of the lockdowns (1). Across the country, people reported feeling isolated and many dealt with the loss of loved ones. Piquiero et al. 2021 found a notable increase in the prevalence of domestic violence since the beginning of the pandemic (2). Outside of the home, the rate of violent crimes has spiked since the onset of Covid-19 (3).

Although aggression is a well-studied psychological behavior, the impact of Covid-19 pandemic on aggressive behaviors remains understudied. Existing literature analyzes the role stressful situations play in increasing aggressive behavior (4). Other literature on aggression examines the link between aggression and homicide (5), sexual violence, and domestic violence (6). In the sociological literature, it is well-documented that black individuals, particularly black males, are more likely to be perceived as aggressive than white individuals (7).

Given the links between stress, violent crimes, and aggression, we ask: how did the Covid-19 pandemic affect aggressive behaviors? In this study, we examine whether mental health emergencies related to instances of aggression changed due to the pandemic. In addition to analyzing the the onset of the Covid-19 pandemic, we examine the impact of regional level Covid-19 cases and deaths and duration of lockdowns. We supplement our analysis by looking at other variables not related to Covid-19 that could affect aggression or perceptions of aggressive behavior such as race and gender.

Our analysis will supplement existing literature of the pandemic and mental health issues by focusing specifically on aggressive behaviors. We hope to contribute to existing findings in three ways. First, we hope that our findings will add to discussions of how the Covid-19 pandemic affected and continues to affect Americans' mental health. Second, we aim to shed light on the causes of the increase in domestic violence and other violent crimes. If we find Covid-19 significantly increased aggressive behaviors, it may explain the increase in those reports. Finally, we hope to continue an analysis of the impacts race and gender play on perceptions of aggression and seeing how the pandemic influenced those trends.

2. Data

Short Term, Assessment, Response, Treatment (START). We pull our data on emergency situations related to mental health from START, which "provide[s] community-based crisis intervention for individuals with IDD [Intellectual and Developmental Disabilities] and mental health needs" (8). From the START data, we pulled two sheets: Demographics and Emergency Crisis Services (Table 1). The Demographics sheet provides information about the race, gender, location, and age of the START patients. The Emergency Crisis sheet tracks calls made to the START Emergency Services, which provide assistance to patients in the event of a mental health emergency. This data includes information on the date of contact, source of contact, reason for contact, and response. In our study, we focused on "reason for contact" as a measure of aggression. If the aggression was

listed as the reason for contact, or one of multiple reasons for contact, we concluded that the patient was exhibiting aggressive behaviors.

Table 1. START Mental Health Data

Sheet Name	Number of Observations	Date Range	Unit of Analysis
Demographics	4,986	September, 2009 to December, 2021 (enrollment dates)	Individual START Participant
Emergency Crisis Services	18,168	April, 2013 to December, 2021	Emergency Event

When merging these sheets, we only kept participants who were included in the Emergency Crisis Services data. While the START data as a whole is more extensive and records a longer time frame, the Emergency Crisis Services data only is recorded from April 2013 through December 2021. The result of combining these sheets is a data set that includes an identifying patient ID, demographics (including race, gender, location including state and county, and age), and emergency instances, including the date of occurrence, reason for contact, and details about the response. In the Emergency Crisis Services data, the same patients can be repeated multiple times if they are call into the services more than once. That is why the emergency crisis data has 18,168 observations whereas the Demographics data has only 4,986 observations.

One possible limitation of our data is that it only reflects the behavior of START patients, which may or may not be representative of the whole country. Another limitation is that the "reason for contact" variable in the data is vague. It lists the reason for contact (ie Aggression, Suicidal ideation, Self-injurious), but does not list the specific behaviors the patient was exhibiting. As such, there may be wide variations in what could spark a report of "Aggression" to START. Another limitation is that, in the Demographics data, some of the variables such as race are missing.

COVID-19 Data. We pull our data about the COVID-19 situation from *USA Facts*. *USA Facts* provides daily county-level data on COVID cases and deaths, in addition to county population data. We used the population data to calculate daily cases and death per 1,000 people. Our data covers the time window from January 2020 through December 2021. When combining this data with the START data, we set cases and deaths for events prior to January 2020 to zero. We felt that this was appropriate because we control for whether or not the event occurred during the pandemic, and zero local cases in February 2020 should be equivalent to zero local cases in February 2019 (pre-Covid).

3. Methods

A. Data Cleaning & Merging. The data cleaning and merging in our research methodology took place largely in the 00_data_merging.ipynb file. In all instances of merging, we used exact merges as the data that we were working with was able to be easily merged along indicators of County, Date, ID, or otherwise. The data cleaning process began with selecting columns of interest from the two aforementioned excel spreadsheets from the START initiative, including columns with demographic information, and importantly, the "Reason for Contact" column from the Emergency Response sheet. Additionally, we used regular expressions to extract the state name from the "Region" column in the Emergency Response Data, which was later used to merge with the COVID data. From there, we merged these two data sets together using a right merge with the Emergency Data as the right DataFrame and the demographic data as the left DataFrame, as to preserve the emergency cases, as they are the cases of interest. The number of observations of 18168 was maintained through this merge. We then standardized the column names to all lowercase characters and utilizing underscores in the place of spaces, through a regex pattern, standardized county names to include the string "County", as in "Grafton County", and created a new pd.DateTime column to store the date of contact data free of the timestamp, as it is largely irrelevant to our analyses. Then, we began to clean the data from the USA Facts COVID-19 database by standardizing column names in the same aforementioned way, and then merging the population data onto both the cases data and the deaths data individually, so that we could construct important case and death indicators. We created a user-defined function called *clean_pop_dfs()* that takes in a population-merged DataFrame, and drops any merge duplications, removes observations where the county FIPS code = 0 because this represents un-allocated state data that is unnecessary to our analysis, melts the data to long format, subsets to dates before 12-08-2021 as these are the newest observations in the START data set, and finally creates indicator columns for cases / deaths per 1,000 people on a county level and returns the cleaned DataFrame. We then merged the case and death by population DataFrames directly onto each other using a left join on all columns in the DataFrames and exported this to covid_data_clean.pkl for later use. Finally, we merged this new DataFrame onto the START data using a left merge with the START data on the left as to preserve all cases, and the variables that were merged on were county name, state, and date as the COVID data was collected on a daily basis by county, and we wished to add this information to the START data. State was necessary because there are counties with the same name in different states. This final cleaned DataFrame was exported to merged_dataset.pkl for further use. The number of observations of this final data set was maintained at the value of 18168.

B. Statistical Analyses.

B.1. Difference of Proportions Test. Our statistical analyses were carried out in 01_statistical_analysis.ipynb. In our statistical analyses, we examine whether the onset of the Covid-19 pandemic had a casual effect on reports of aggression to START. We began by constructing columns with boolean values to represent if the call occured before or during covid and if the call was or was not about a case of Aggression. For the *pre_covid* boolean column, we compared the *date_of_contact* column with the

date 03-13-2020 coding to 1 (true) if before and 0 (false) if after, and for the *is_aggression* boolean we used the str.contains method while iterating through the *reason_for_contact* column row-wise to see if the string contained "Aggression," coding to 1 (true) if yes and 0 (false) if no. Then, we ran a simple difference of proportions model from the statsmodels.stats.proportions package (proportions_ztest) to explore if there was a statistically significant difference in the proportions of the two categories created by the *is_aggression* boolean across the *pre_covid* boolean.

B.2. OLS Regressions. Then, we continued on to begin creating important variables for the OLS Regression Models that we wanted to run. Through various methods, we extrapolated many of the demographic data columns to simplified variables of gender, race, source of contact, and months from 03-13-2020 (our "COVID-19" pivot date). Given that there were some missing values in the race column, we only retained observations where the race of the individual was listed, so as to not interfere with including race in our regression. We also filled all NA values in COVID-19 case and death columns to 0 as these NAs are a result of the earlier merges having case calls prior to the onset of the pandemic, and thus these missing values can be accurately re-coded as 0 cases or deaths. Finally, we utilized the *pd.get_dummies* function to retrieve dummy variables for all of these simplified variables, so that we could run the OLS Regression models with boolean 1 / 0 variables as opposed to True / False. We then began to create our first regression model, which analyzed *is_aggression_True* as the dependent variable, and *pre_covid_True* as the focal independent variable, including *gender_simplified_not_female, race_simplified_Hispanic, race_simplified_Black, race_simplified_Other, source_of_contact_simplified_Family_Member, source_of_contact_simplified_Self* as control variables sought to explore the effects that the pandemic had on the average number instances of (calls about) aggression. Our second regression model also analyzed *is_aggression_True* as the dependent variable. Yet, in this model, we analyzed the independent variables of cases and deaths per 1,000 people in the region (county) of the caller, with the same control variables as in the first regression model, as well as *months_from_covid*, an indicator of how far into the pandemic the emergency takes place. This indicator was created by using the *diff_month* function to find the number of months away the emergency was from March 13, 2020. For this second regression, we filtered our data to only include observations on or after March 13, 2020, because the *months_from_covid* variable does not carry any meaning prior to the pandemic.

C. Visualizations. Moving on to visualizations, we decided to craft both line plot and geoplot visualizations to accompany our regression models. These visualizations were carried out in 02_visualizations.ipynb. We created the lineplot visualizations to accompany the first regression model in so far as that the line plot visualizes the changes in the number of cases of aggression as well as the percentage of cases total that were about aggression over a four year period surrounding the beginning of the COVID-19 pandemic's US lock downs in March 2020. For these visualizations, we made sure to subset the data to this analytic time period, and we grouped the cases by month, as to smooth the curve in an interpretable way. For the geoplots, we began by fethching shapefile data for US states, and then largely relied on the *produce_geoplot* function which took the parameters "kind" (either "aggression" or "covid") and months_delta specifying how many months post covid the visualization should include. This function grouped the data by county, selected the subset of specified month ranges, merged shape file polygon data on for all given counties, and then subsetted the visualization to New Hampshire as an analytic grouping, with a substantial amount of observations, from the larger data. We further made a barplot to demonstrate the findings of the difference of proportions test. All plots were produced using the *plotnine* wrapper for *ggplot*, and once produced were saved to the output folder for further use.

4. Results

We ran several tests to determine whether there was a difference in instances of aggression before and during the pandemic. First, we ran a difference of proportions test to determine whether there was a significant difference between the proportion of emergency calls before and during the pandemic. Second, we ran a series of regressions to see if we could predict whether an emergency call would be related to aggression based on several factors, both related to COVID-19 and the pandemic and not.

Difference of Proportions Test. Our first test was a difference of proportions test to determine whether the proportion of emergency calls due to instances of aggression by START participants during the pandemic was significantly different from the proportion prior to the pandemic. Using the dummy variables we created (see Section 3) which indicate whether an emergency event was before or during the pandemic (before or after March 13, 2020) and whether it involves aggression, we created a contingency table that groups the data by the two variables (Table 2). We then ran a two-tailed difference of proportions test using the *statsmodels* package in Python.

Table 2. Aggression before and after March 13, 2020

Time-Frame	Aggression	Aggression Proportion	Non-Aggression	Non-Aggression Proportion
Pre-pandemic	7526	0.587	5301	0.413
Pandemic	3206	0.600	2135	0.400

The null hypothesis for the test was that there was no difference in the proportion of calls related to aggression in the two samples (pre- and during the pandemic), and the alternative hypothesis was that the two proportions were different. Our calculated test statistic was 1.689 with a p-value of 0.0911, which is statistically significant at the 90% confidence level. We

can thus reject the null hypothesis of no difference. This suggests that the proportion of instances of aggression during the pandemic was significantly different from what it was prior to the pandemic. Figure 1 demonstrates this difference visually. In the next section, we attempt to determine what factors may have influenced this difference in proportions.

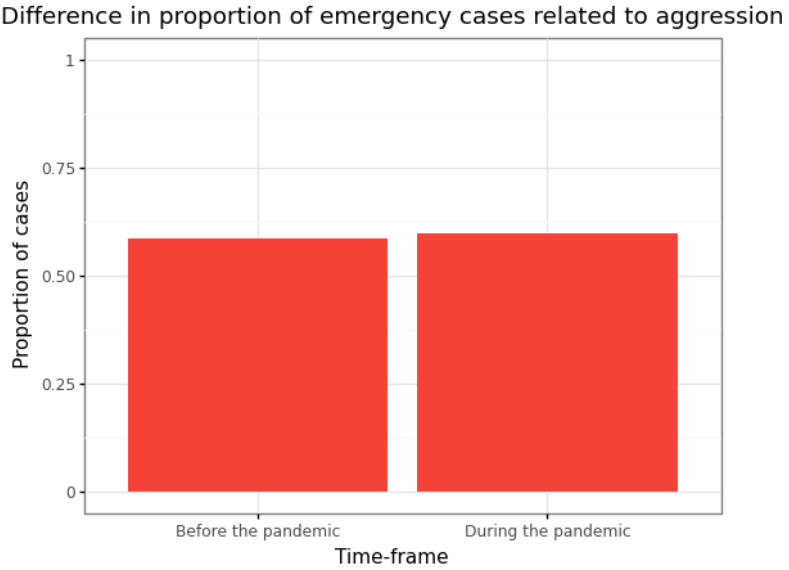

Fig. 1. Difference in the proportion of emergency calls related to aggression prior to and during the pandemic.

Regression Tests. Next, we ran two regressions with the dummy variable indicating whether a call was due to an instance of aggression as the outcome variable. We tested several explanatory variables, ranging from demographic indicators of race, age, and gender to pandemic-related factors, including case counts.

We used an Ordinary Least Squares (OLS) regression model to make our predictions. We initially considered using a logistic model in order to bound the value of the outcome variable between 0 and 1. However, when we ran the logit models and estimated marginal effects for each of the predictor variables, they were nearly identical to the marginal effects found using OLS regression. Thus, we decided that the OLS regression could be used to predict the outcome variable. The OLS model fits the equation:

$$\hat{y} = \alpha + \beta_1 x_1 \quad [1]$$

Here, $\hat{y}$ is the predicted value of the outcome variable, α is the intercept coefficient, β_1 is the estimated slope coefficient, and x_1 is the value of the explanatory variable. We can add additional explanatory variables as well; with n explanatory variables, the equation would be as follows:

$$\hat{y} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + ... + \beta_n x_n \quad [2]$$

Regression 1: Regressing on Pre/During Pandemic. Our first regression estimates the effect that the dummy variable indicating whether or not an emergency call took place during the pandemic has on its likelihood of being a case of aggression, controlling for the race and gender of the start participant. Race and gender are coded with dummy variables, using female and white, respectively, as the baseline. We also include the source of contact (noted as SOC in the regression equation). We coded for three types of sources of contact: self, family member, and other (typically a medical professional). In this model, we use other as our baseline. The pre/during the pandemic dummy variable is coded as a "0" if the event occurred after March 13, 2020, and takes the value of "1" if the event occurred before or on that date. Thus, our regression equation is as follows:

$$\begin{aligned} AGG = \alpha + \beta_1 PRE\_COV + \beta_2 GEN\_NOT\_FEM + \beta_3 RACE\_HISP + \\ \beta_4 RACE\_BLACK + \beta_5 RACE\_OTHER + \beta_6 SOC\_FAM + \beta_7 SOC\_SELF \end{aligned} \quad [3]$$

Our results are summarized in the following table:

Table 3. Regression Results for Pre and Post Covid

Dep. Variable:	is_aggression_True	**R-squared:**	0.159
Model:	OLS	**Adj. R-squared:**	0.159
Method:	Least Squares	**F-statistic:**	392.5
Date:	Sat, 12 Mar 2022	**Prob (F-statistic):**	0.00
Time:	17:28:08	**Log-Likelihood:**	-9003.8
No. Observations:	14493	**AIC:**	1.802e+04
Df Residuals:	14485	**BIC:**	1.808e+04
Df Model:	7		

	coef	std err	t	P> |t|	[0.025	0.975]
const	0.5633	0.010	59.237	0.000	0.545	0.582
pre_covid_True	-0.0039	0.008	-0.485	0.627	-0.020	0.012
gender_simplified_not_female	0.1076	0.008	13.661	0.000	0.092	0.123
race_simplified_Hispanic	0.0655	0.018	3.586	0.000	0.030	0.101
race_simplified_Black	0.0903	0.009	9.975	0.000	0.073	0.108
race_simplified_Other	0.0456	0.014	3.307	0.001	0.019	0.073
source_of_contact_simplified_Family_Member	0.0392	0.008	4.617	0.000	0.023	0.056
source_of_contact_simplified_Self	-0.4525	0.011	-42.078	0.000	-0.474	-0.431

Omnibus:	9813.222	**Durbin-Watson:**	1.765
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	1410.558
Skew:	-0.496	**Prob(JB):**	5.03e-307
Kurtosis:	1.837	**Cond. No.**	7.30

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Onset of Covid

Our coefficient for our pre-Covid variable is -0.0039. The p-value is 0.627, indicating that our results are not statistically significant. We cannot conclude that the onset of the pandemic had any effect on aggressive behaviors.

Gender

The not-female dummy variable includes all males, as well as transgender, non-binary, questioning, and other genders in the data set. We found a coefficient of 0.1067, indicating that being not-female increases an individual's chances of being reported for aggressive behavior. The p-value for this variable was 0.000, so this finding is statistically significant.

Race

We found a coefficient of 0.0655 for our Hispanic dummy variable and a coefficient of 0.903 for our Black dummy variable. The p-value for both of these variables was 0.000. Hispanic and Black individuals were 6-9% more likely to be reported for aggressive behavior than White individuals. Our Other dummy variable for race included all individuals in the data set who were not White, Hispanic, or Black. This variable had a coefficient of 0.0456 and p-value of 0.001, indicating that while being a race other than White, Hispanic, or Black increased an individual's chances of being reported for aggressive behavior, Hispanic and Black individuals were still more likely to be reported for aggression.

Source of Contact

Family Members as a source of contact were more likely to report an individual for aggressive behavior than other sources of contact. Family members had a coefficient of 0.0392 and a p-value of 0.000. When the source of contact was the individual themselves, there was a coefficient of -0.4525 and a p-value of 0.000. Our "Source of Contact-Self" variable was had the most significant effect on determining aggressive behavior in this regression. Individuals were unlikely to report themselves as exhibiting aggressive behavior.

Regression 2: Regressing on Daily COVID-19 Data. Our second regression was designed to measure two variables: the prevalence of Covid-19 in the region of the individual contacted for Covid-19, measured in terms of cases per 1,000 and deaths per 1,000 by county, and the duration of the pandemic, measured in months since March 2020. We also controlled for gender, race, and source of contact as dummy variables in this regression. In order to measure to effect of the regional prevalence of Covid-19 and the duration of the pandemic, we subsetted our data to only calls made to START after March 13, 2020. Thus, while our first regression had 14,493 observations, this regression has 4,779. We used an OLS regression to produce this equation:

$$AGG = \alpha + \beta_1 CASES + \beta_2 DEATHS + \beta_3 MONTHS\_FROM\_START + \beta_4 GEN\_NOT\_FEM + \beta_5 RACE\_1 + \beta_6 RACE\_2 + \beta_7 RACE\_3 + \beta_8 SOC\_FAM + \beta_9 SOC\_SELF \quad [4]$$

Our results are summarized in the following table:

Table 4. Regression Results for Prevalance and Duration of Covid

Dep. Variable:	is_aggression_True	**R-squared:**	0.164
Model:	OLS	**Adj. R-squared:**	0.162
Method:	Least Squares	**F-statistic:**	133.4
Date:	Sun, 13 Mar 2022	**Prob (F-statistic):**	5.82e-180
Time:	12:45:50	**Log-Likelihood:**	-2946.9
No. Observations:	4779	**AIC:**	5910.
Df Residuals:	4771	**BIC:**	5962.
Df Model:	7		

	coef	**std err**	**t**	**P> |t|**	**[0.025**	**0.975]**
const	0.5487	0.017	32.080	0.000	0.515	0.582
cases_per_1k	-1.565e-16	8.04e-18	-19.464	0.000	-1.72e-16	-1.41e-16
deaths_per_1k	-4.277e-17	3.57e-18	-11.982	0.000	-4.98e-17	-3.58e-17
months_from_covid	-0.0007	0.001	-0.585	0.558	-0.003	0.002
gender_simplified_not_female	0.0976	0.014	6.968	0.000	0.070	0.125
race_simplified_Hispanic	-0.0121	0.025	-0.475	0.634	-0.062	0.038
race_simplified_Black	0.1477	0.017	8.689	0.000	0.114	0.181
race_simplified_Other	0.0716	0.025	2.893	0.004	0.023	0.120
source_of_contact_simplified_Family_Member	0.0782	0.015	5.302	0.000	0.049	0.107
source_of_contact_simplified_Self	-0.4296	0.019	-22.620	0.000	-0.467	-0.392

Omnibus:	2498.180	**Durbin-Watson:**	1.806
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	450.675
Skew:	-0.498	**Prob(JB):**	1.37e-98
Kurtosis:	1.872	**Cond. No.**	2.78e+17

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Regional Prevalence of Covid-19

Our coefficient for the cases and deaths per 1,000 in the region of the individual are -1.56e-16 and 4.277-17, respectively. The p-value for both was 0.000. While they are statistically significant, we can be relatively certain that the deaths and cases in and individual's county had no substantive effect on their likelihood to be reported to START for aggressive behavior.

Duration of The Pandemic

The coefficient for months from March 2020 was -0.0007 and the p-value was 0.558, so it was neither a substantively nor statistically significant variable. The duration of lockdown did not affect reports of aggressive behavior.

Other Variables

Although the coefficients for our variables controlling for gender, race, and source of contact varied slightly from the first regression, the only noteworthy change is that our "Race-Hispanic" variable had a negative coefficient of -0.0121. This variable also has a p-value of 0.634, however, so we cannot draw any conclusions about how being Hispanic changed an individual's likelihood of being reported for aggressive behavior in this regression. The change from the first regression is likely due to the smaller number of observations in this regression.

Findings. Our statistical analyses demonstrate that there was not a statistically significant increase in the reported instances of aggression to the START clinic. The following graph Fig. 2 demonstrates that there was a not an increase in reports of aggression made before and after the pandemic. The red line represents the number of calls made for aggressive behavior and the grey line represents the total number of calls.

Fig. 2 demonstrates that while the total number of calls made for mental health had a sharp increase after the start of lockdowns, calls made for aggressive behaviors remained relatively stable. In fact, it appears that there has been a recent decline in calls made to the START clinic, however we cannot conclude that that change is meaningful due to the lack of statistical significance in our "Months from Covid-19" variable. Nevertheless, our difference of proportions test suggests that the onset of the pandemic increased the likelihood that any given call made to START would be for aggressive behavior.

The smoothed line in Fig. 3 representing the proportion of calls made to the START clinic that were related to aggression has a negative slope across the four-year sample, which suggests that the negative coefficient of the pre-Covid variable in our first regression, although not statistically significant, may have been picking up the effects of a continuous negative trend in proportion of cases related to aggression. Additionally, the slope seems to flatten out following the start of lockdowns. This figure appears to contradict the difference of proportions test, which found that the proportion of cases related to aggression during the pandemic was higher than the proportion prior to the pandemic. However, this contradiction can be explained by the fact that Fig. 3 is subsetted to data from 2018 through 2021, while the Difference of Proportions test includes data

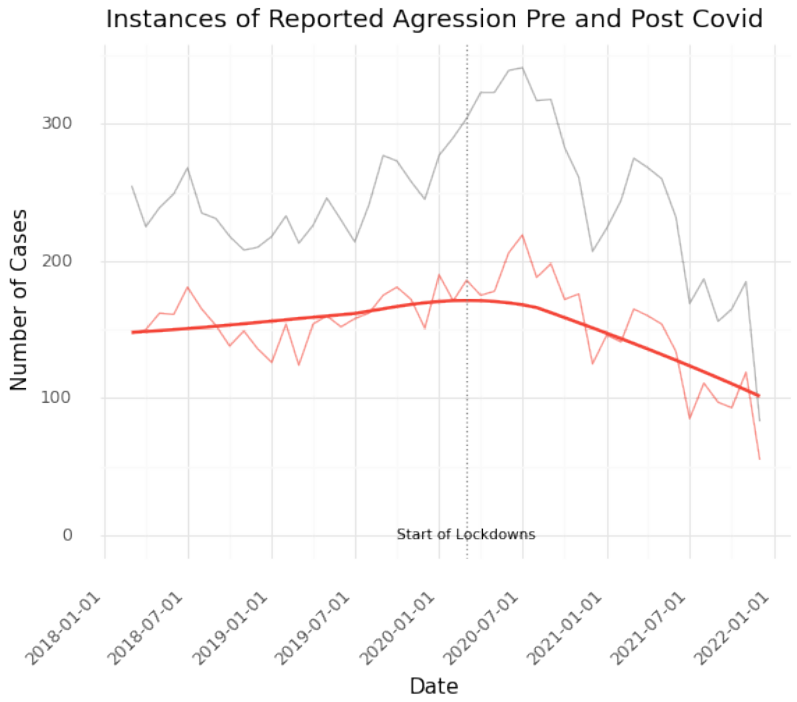

Fig. 2. Instances of reported aggression (red) and total reports (grey) pre and post covid. There is a spike in total emergency reports right around the start of the pandemic in March 2020, which is accompanied by a spike in reports of aggression.

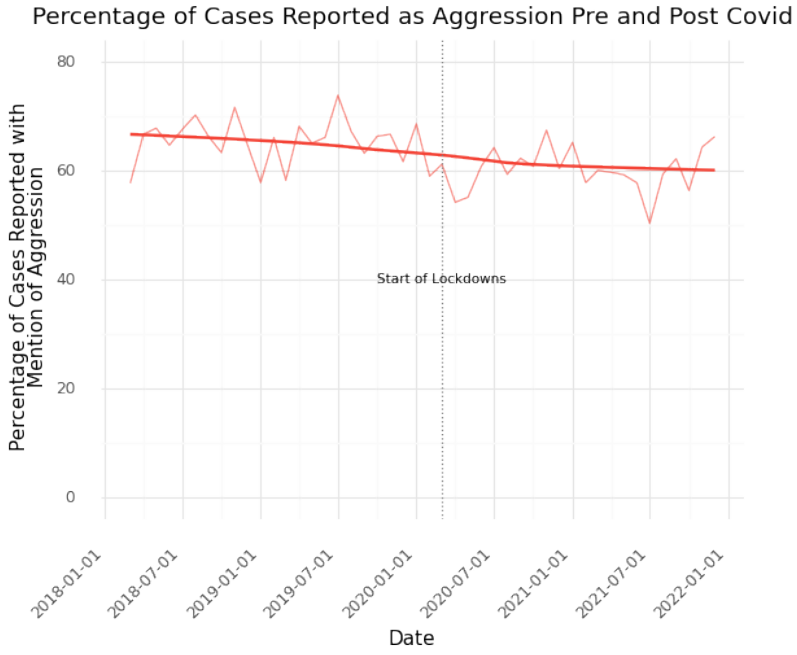

Fig. 3. Proportion of total calls relating to aggression. The smoothed line shows a general downward trend since the beginning of 2018, which flattens out after the start of the pandemic. Overall, the proportion of cases related to aggression remains relatively constant, fluctuating only by a few percentage points.

from 2013 through 2021. This suggests that the proportion of cases related to aggression prior to 2018 was lower, which may indicate that cases of aggression are higher now than they were 5 years ago. This is be a potential source of further inquiry in a future research project.

Our findings indicate the the stress related to the Covid-19 pandemic and national lockdowns only marginally increased aggressive behaviors. (see Section 1). In addition to our findings on the lack of results between the onset of the pandemic and aggressive behaviors, our results indicate that aggressive behavior is unrelated to the prevalence of Covid-19 cases and deaths

in an individual's county and the amount of time and individual has been in lockdown. That finding is exemplified in Fig. 4 and Fig. 5, which show the number of calls made to the START clinic reporting aggressive behavior and the number of cases per 1,000 in New Hampshire on a county-level basis, respectively. We chose New Hampshire for this visualization as it was the only state where every county was represented in the dataset, thus was yielded the best visualization. Fig. 4 and Fig. 5 demonstrate there was very little relationship between counties where reported instances of aggression were higher and counties where Covid-19 cases were higher.

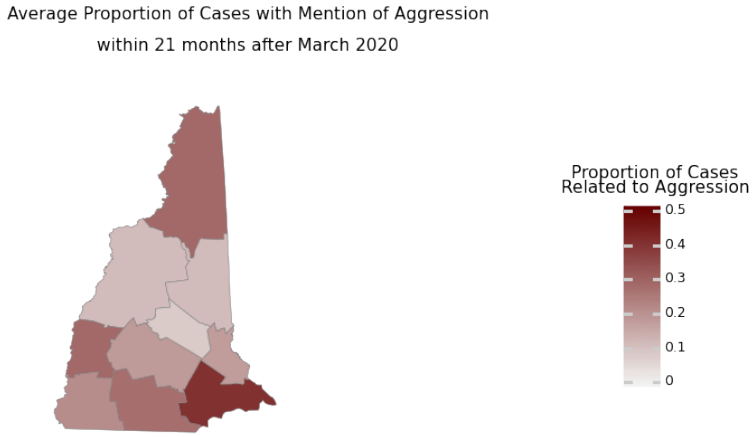

Fig. 4. Instances of reported aggression by county in NH.

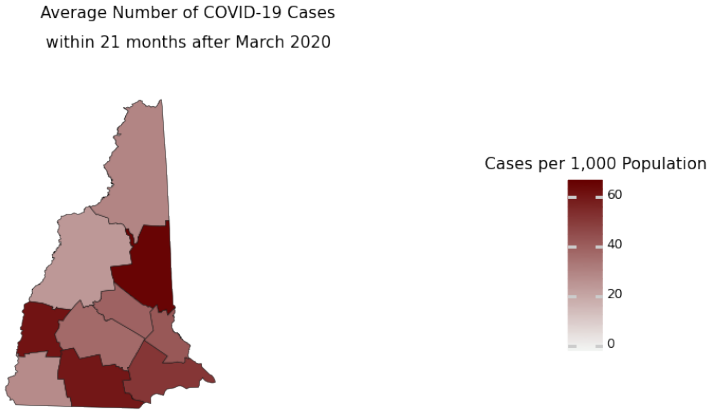

Fig. 5. Covid cases per 1,000 in NH.

5. Discussion

We found no meaningful causal relationship between the onset of the Covid-19 pandemic, the regional prevalence of Covid-19, and the duration of the pandemic and the likelihood of a mental health emergency being related to aggression. While our difference of proportions test showed some increase in aggression after the onset of Covid-19, our regressions show we cannot be certain it was not due to some other variable.

We propose two possible explanations for our findings: First, it is possible the pandemic did not increase aggressive behaviors. The increases in violent crime and domestic violence could have been due to other confounding variables. Perhaps domestic violence victims feel more comfortable reporting their abusers in 2021 than previous years, for example. Even if the pandemic increased aggressive behaviors in some individuals, perhaps isolation decreased instances of aggression in others because they were not around other people as much. These conflicting effects could explain the lack of relationship between the pandemic and aggression.

Second, it is possible that the pandemic did have an effect on aggressive behaviors, but our study had limitations that prevented us from finding that. One limitation of our study was that we only used the START emergency calls database. Perhaps nationwide there was an increase in aggression, but among START patients there was not. START patients are individuals seeking treatment for their mental health, so perhaps were less susceptible to the stress of the pandemic and less likely to exhibit aggression. Another limitation of our study was that we only measured aggressive behavior through calls made to the START emergency services. Even if START patients experienced increases in aggressive tendencies, the pandemic may have decreased people's willingness to call in about aggression. Some people may have worried they would have to leave their house to seek treatment and feared contracting Covid-19. Another limitation of relying only on calls is that it relies on perceptions of aggressive behavior and is not an objective measure of whether someone displayed aggressive tendencies. We found strong statistically significant correlations between race, gender, and the likelihood to be reported as aggressive, even while controlling for the source of contact. It could be possible that being male, Hispanic, or Black determines whether an individual will be reported for aggressive behaviors regardless of whether they actually display them. On the other hand, white females may not have been reported for aggression even if their aggressive behaviors increased after the pandemic.

Future research should continue to study our questions about the Covid-19 pandemic and aggressive behaviors. A future project could, for example, expand the individuals studied to those outside the START clinic and the measurement of aggression to instances beyond reported cases to mental health clinics.

6. Conclusion

Our study found only a minimally significant relationship between the onset of the COVID-19 pandemic and START mental health emergencies related to aggression. A difference of proportions test showed a marginally significant difference between the proportion of emergency situations related to instances of aggression prior to and during the pandemic. The proportions were 0.587 and 0.600, respectively, and there was a statistically significant difference at the 90% confidence level. Our regression tests found that the pre-covid dummy variable (see Section 4) was not statistically significant in predicting the likelihood of an emergency call being related to aggression. Additionally, local COVID-19 cases and deaths were statistically significant, but had no substantive significance (see Section 4). This indicates that local case and death statistics did not have a substantive impact on the likelihood of a mental health emergency being related to aggression. Finally, the variable indicating how far into the pandemic the emergency situation took place was also not statistically significant. Overall, we conclude that the onset of the COVID-19 pandemic did not affect mental health emergencies related to aggression in a substantive way.

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