

# COVID-19 and Domestic Violence in Atlanta, GA

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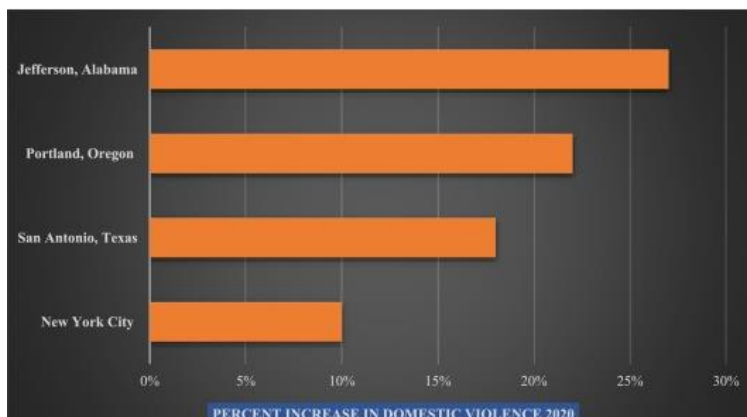
## Introduction

The COVID-19 pandemic impacted life in the United States in many unprecedented ways. In 2020, time spent at home increased 28%, and time spent with people who live outside the household fell by 35% [1]. Unfortunately, this increase in isolation intensified the conditions that fuel domestic violence. Even before the pandemic domestic violence had a devastating toll on America. The CDC reports that 1 in 5 women and 1 in 7 men will report having experienced severe physical violence from an intimate partner in their lifetime. They also estimate the lifetime economic toll of domestic violence to be \$23,400 for men and \$103,700 for women, this amounts to a lifetime loss of \$3.6 trillion for all Americans [2]. America needs to understand the impact the COVID-19 pandemic has on domestic violence cases so we can properly prepare first responders and physicians, fund prevention programs, and develop new strategies to prevent domestic violence.

In this report I focus on how the rate of reported domestic violence cases was influenced by the pandemic, and the potential impact the vaccine had on reported cases. The scope of my research is limited to Atlanta, Georgia and the domestic violence data is manually collected from the Atlanta Police Department's weekly crime report.

## Background/Related Work

Late April 2020, The American Journal of Emergency Medicine published a paper titled "Alarming trends in US domestic violence during the COVID-19 pandemic" [3]. This paper reported that there has been an increase in domestic violence both globally and nationwide in 2020. The report was published early in the pandemic, but it shows a clear increase in domestic violence cases.



This paper serves as motivation to conduct a similar analysis now that more data is available. The research also provided a good baseline understanding of what results other cities and countries have seen to inform me of what I might see in Atlanta, GA. The primary question I ask is "how is domestic violence influenced by the pandemic?". I hypothesize that the number of weekly reported domestic

violence cases during the pandemic is greater than the number of weekly reported domestic violence cases before the pandemic. I also identify what month the cases of domestic violence peaked and explore the impacts the vaccine has had on lowering domestic violence cases.

## Methodology

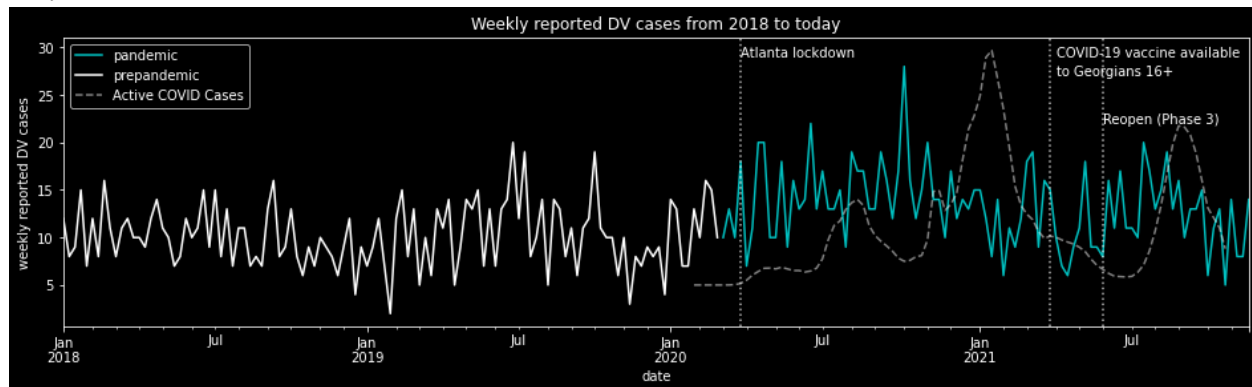
My primary goal with the analysis is to make the results easily interpretable to a non-technical audience. Domestic violence impacts the lives of people in all walks of life; therefore, my report should be understandable by people of all walks of life.

To visualize how the COVID-19 pandemic impacted the number of reported domestic violence cases I plotted a connected scatter plot of reported domestic violence cases from January 2018 through November 2021. To increase readability, I color coded the line, included a legend, and highlight key dates, such as the city lockdown. I overlaid a normalized COVID-19 infection rate plot so people could easily see when the pandemic started and how COVID-19 cases were progressing relative to reported domestic violence cases. The final product is an easily consumable visualization. Next, I answered the question with statistical rigor by performing a welch t-test to determine if the increase in domestic violence cases since the pandemic was statistically significant, I support this welch t-test with changepoint detection. I picked a welch t-test because t-tests are widely understood and the welch t-test accounts for the nonuniform variance in the two sets of data. Since there are limitations on using t-tests on timeseries data, I decided to confirm my findings with another analysis type. I selected change point detection to verify that there were detectable changes in the data at key dates. The start of COVID-19 pandemic was such a massive change point in people's lives, I was optimistic that the results of the data would confirm this.

I show the impact of the COVID-19 vaccine on domestic violence rates by creating a connected scatter plot of reported domestic violence cases from the start of the pandemic to the end of November 2021. I color coded the line, included a legend, and highlighted key dates just like I did in the previous graph. The similarities between the two graphs allow the reader to quickly interpret the information. I also include mean lines and standard deviation bands for both pre and post vaccine data so the reader can quickly understand the difference in reported domestic violence cases before and after the vaccine. Just like the first question, I use the t-test and change point detection to determine if the weekly reported number of domestic violence cases during the pandemic but before vaccine are greater than the weekly reported number of domestic violence cases after the vaccine.

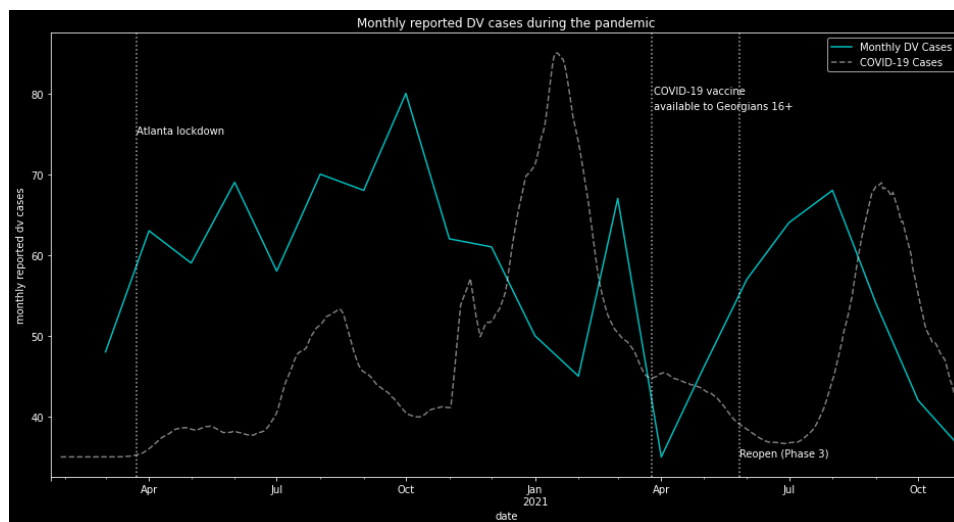
## Findings

### Impact of COVID-19 on Domestic Violence Cases



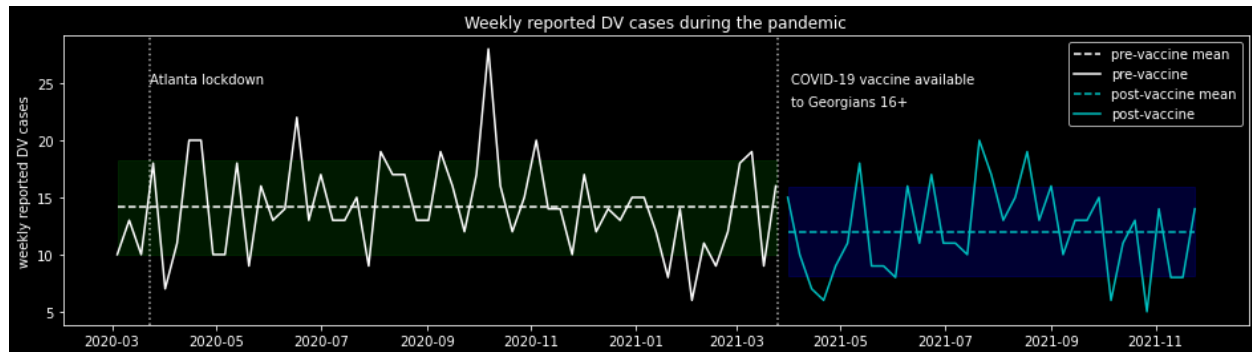
This graph shows Atlanta's weekly count of reported domestic violence cases from January 2018 to November 2021. The color of the line changes on Atlanta's first reported case of COVID-19, March 2<sup>nd</sup>, 2020 [4]. The graph appears to show an upward trend of domestic violence cases since COVID-19. By comparing the means, we see a 29% increase in mean reported domestic violence cases during the pandemic. The claim that domestic violence cases are higher during the pandemic is supported by Welch t-test. I ran a one-sided Welch t-test with the null hypothesis; "Domestic violence cases during the COVID-19 pandemic are equal to or less than domestic violence cases before the COVID-19 pandemic". The mean p-value over 50 trials was .0002. Therefore, I can confidently reject the null hypothesis in support of the alternative; "Domestic violence cases during the COVID-19 pandemic are greater than domestic violence cases before the COVID-19 pandemic". I support this finding by running a change-point analysis. The change-point analysis I conducted detected 3 dates as change points: 2019/02/18, 2020/03/11 and 2021/11/24. The 2020/03/11 change-point falls 9 days after the first reported case of COVID-19 and supports the conclusion that the COVID-19 pandemic did impact the number of reported domestic violence cases.

### Peak Month for Domestic Violence Rates



The peak month of reported domestic violence was October 2020 with 80 reported cases of domestic violence. Casual observance shows spikes in reported DV cases after initial COVID case rise in July, when many people may have started isolating at home. Further analysis is needed to determine if at home isolation practices could explain this peak.

## Impact of the COVID-19 Vaccine on Domestic Violence



This graph shows Atlanta’s weekly count of reported domestic violence cases from March 2<sup>nd</sup>, 2020, the start of the pandemic in Atlanta, to the end of November 2021. The lines change color on the week that COVID-19 vaccine was made available to Georgians 16 and up. The graph also includes mean weekly case lines and  $\pm$  standard deviation bars. The graph shows that the mean rate of reported domestic violence cases has fallen since the vaccine was made available, however t-tests and change point detection do not indicate statistical significance. I ran a one-sided t-test with the null hypothesis; “The weekly number of reported domestic violence cases after the COVID-19 vaccine is equal to or greater than the weekly reported number of domestic violence cases during the pandemic but before vaccine”. The mean p-value over 50 trials was .03, however the number of p-values over .05 was 10. Therefore, I cannot confidently reject the null hypothesis in support of the alternative. At this time, I cannot claim that the weekly reported number of domestic violence cases after the COVID-19 vaccine are less than the weekly reported number of domestic violence cases during the pandemic but before vaccine. Change point detection did not detect any changes around March 25<sup>th</sup>, 2021, the day vaccines became available to Georgians 16 and up.

## Discussion/Implications

My finding that domestic violence cases have increased in Atlanta Georgia during the COVID-19 pandemic are crucially important toward preparing first responders and medical professionals to appropriately respond to the crisis. The mean reported cases difference of 29% is higher than what was found in American cities by Boserup et al. and is more in-line with the 30% increase seen in other countries [3]. I was expecting the availability of the vaccine to correspond to measurably lower rates of domestic violence, sadly I was not able to conclude it does. My findings do rely on t-tests, using a ARMA model would be a more statistically sound method to verify my findings and given more time it would be worthwhile to implement. I will also caveat my finding by saying that the APD’s domestic violence data quality is worth investigating before any results from my analysis are used to influence policy or decision making.

The lower mean seen in cases post vaccine is promising but I do not have enough granular data in Atlanta to confirm that vaccine availability corresponds to lower rates of domestic violence. This

research could be conducted after more time has passed or in another city with more granular data available. I believe a large area of opportunity to expand on this research is to include additional signals for time spent at home and investigate the correlation between time at home and domestic violence cases.

Throughout this research I have strived to develop visuals and conclusions that are interpretable to the audience that is being impacted. My visuals are well labeled, have familiar reference points, and carry common themes throughout the collection. My notebook and repository are literate, and my research should be quite simple to reproduce. I am concerned about the quality of the APD domestic violence data; however, my conclusions are in-line with previous research.

## Limitations

The largest limitation in my analysis is the quality and method of reporting domestic violence cases by the Atlanta Police Department. The APD published a weekly PDF which contains the count of domestic violence cases for the week as well as a year-to-date total and the previous year's year-to-date total. The year-to-date total does not always align with the sum of the weekly count of domestic violence cases for the year, and the previous year's year-to-date (YTD) totals can be very different than the year-to-date totals achieved by opening up the pdf for the week of that year. For example, if I compare week 40 of 2020's pdfs (CS-2020-40.pdf) and week 40 of 2019's pdfs (CS-2019-40.pdf) I will see that the YTD cases reported for 2019 in CS-2020-40.pdf is 324 while the YTD cases reported for 2019 in CS-2019-40.pdf is 329. To remain consistent, I use the reported case counts from the pdfs that were released at the time the cases were first reported, so I'm using CS-2019-40 as the true count of domestic violence cases in week 40 of 2019.

There are two limitations in my analysis I want to highlight. First, I did not account for population growth in my analysis of domestic violence cases. If the population of Atlanta grew suddenly during the pandemic that could also explain the rise in domestic violence cases. Second, I used t-tests to test for significance in my data. T-tests assume independence across observations, due to the way domestic violence is perpetrated and also how it is reported this condition may not be met there may also be some time patterns such as autocorrelations that would need to be adjusted for.

## Conclusion

From my research I am able to conclude that the COVID-19 pandemic coincides with an increase in the rate of domestic violence in Atlanta Georgia. The rate of reported domestic violence cases peaked in October 2020, but still remain elevated when compared to pre-pandemic rates. Cases visually appear to be trending down since their peak, but I am not able to conclude that cases of domestic violence have decreased since the vaccine has become available.

All my research can be reproduced easily from my literate Jupyter Notebook, but caution should be taken when leveraging APD crime data for analysis. Understanding the extent of the increase in domestic violence is crucial for first responders and medical professionals to properly respond to this crisis. Data such as this are critical for understanding public health, however researchers need better transparency in detailing how data is collected so we can understand the validity of our analysis.

## References

1. U.S. Bureau of Labor Statistics American Time Use Survey:  
<https://www.bls.gov/news.release/atus.nr0.htm#>
2. The CDC preventing intimate partner violence information page:  
<https://www.cdc.gov/violenceprevention/intimatepartnerviolence/fastfact.html>
3. The American Journal of Emergency Medicine: "Alarming trends in US domestic violence during the COVID-19 pandemic:  
[https://www.ajemjournal.com/article/S0735-6757\(20\)30307-7/fulltext](https://www.ajemjournal.com/article/S0735-6757(20)30307-7/fulltext)
4. City of Atlanta's COVID-19 Response Page  
<https://www.atlantaga.gov/government/mayor-s-office/city-of-atlanta-covid-19-response>

## Data Sources

1. Kaggle repository of Johns Hopkins University COVID-19 data:  
[https://www.kaggle.com/antgoldbloom/covid19-data-from-john-hopkins-university?select=RAW\\_us\\_confirmed\\_cases.csv](https://www.kaggle.com/antgoldbloom/covid19-data-from-john-hopkins-university?select=RAW_us_confirmed_cases.csv)
2. CDC Masking Mandate by State:  
<https://data.cdc.gov/Policy-Surveillance/U-S-State-and-Territorial-Public-Mask-Mandates-Fro/62d6-pm5i>
3. The New York Times mask compliance survey data:  
<https://github.com/nytimes/covid-19-data/tree/master/mask-use>
4. The Atlantic Police Department crime data:  
<https://www.atlantapd.org/i-want-to/crime-data-downloads>