My title*

My subtitle if needed

First author   Another author

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First sentence. Second sentence. Third sentence. Fourth sentence.

1 Introduction

You can and should cross-reference sections and sub-sections.

The remainder of this paper is structured as follows. Section 2….

2 Data

```
file_path <- "../../outputs/data/bully_clean_data.csv"
bully_clean_data <- read.csv(file_path)
bully_clean_data$date <- as.Date(bully_clean_data$date)
pop_2019_clean<- read.csv("../../outputs/data/pop_2019_clean.csv")
pop_2020_clean<- read.csv("../../outputs/data/pop_2020_clean.csv")
state_ratios<- read.csv("../../outputs/data/state_ratios.csv")
sample_data <- head(bully_clean_data, 6)
```

Talk way more about it.

3 Results

?@fig-Composite-Search-Intensity shows the number of searches for bullying (by category) starting in 2012 and ending in 2021. The graph visually shows how bullying searches relate to

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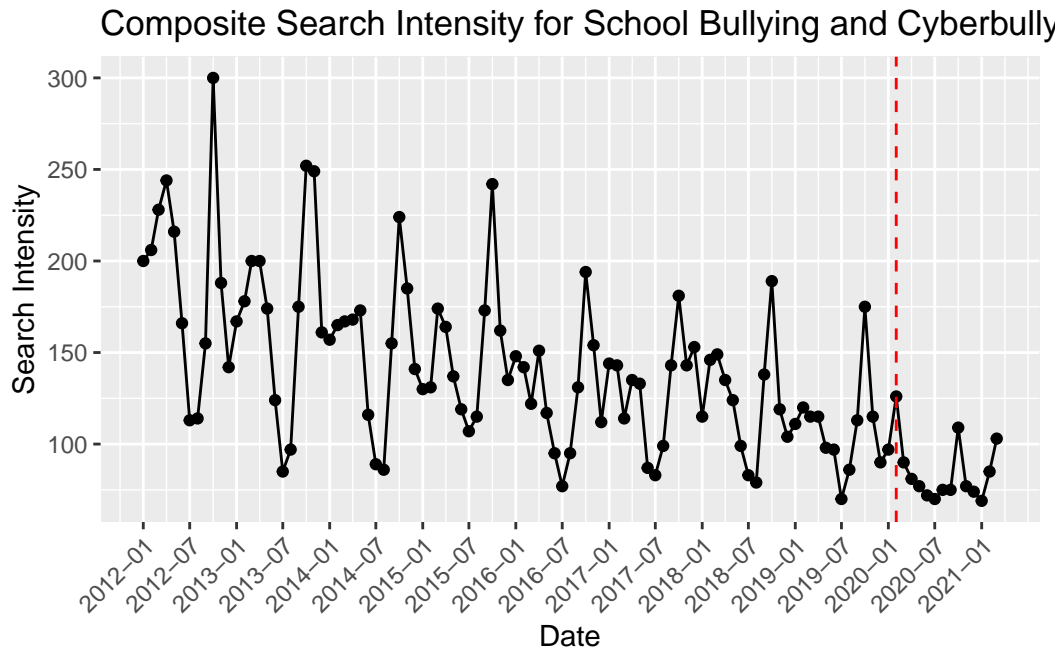*Code and data are available at: LINK.
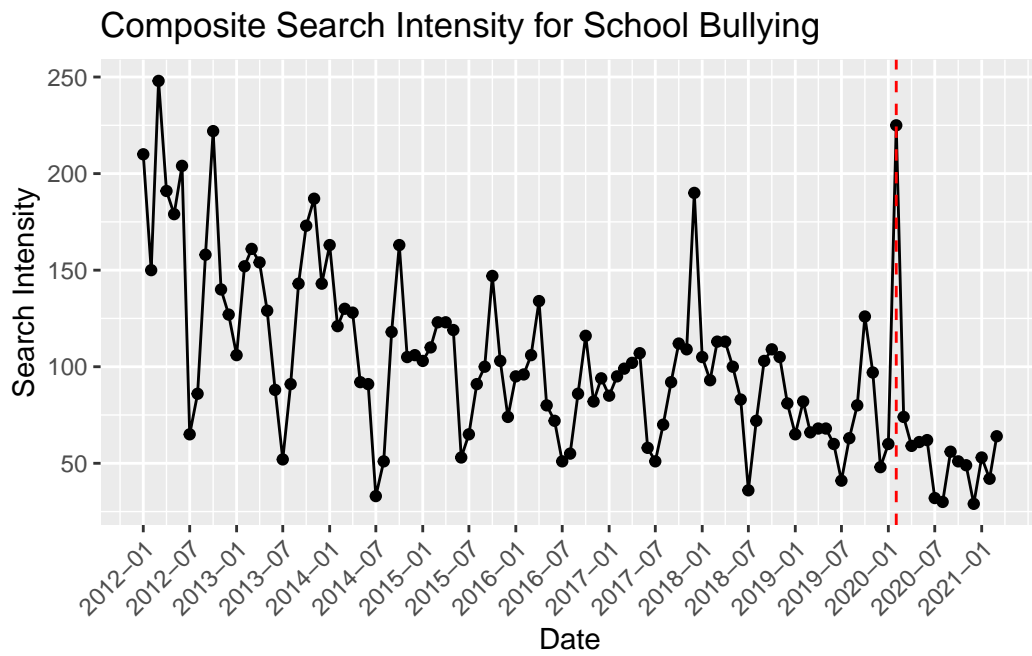
Figure 1: Composite-Search-Intensity by type

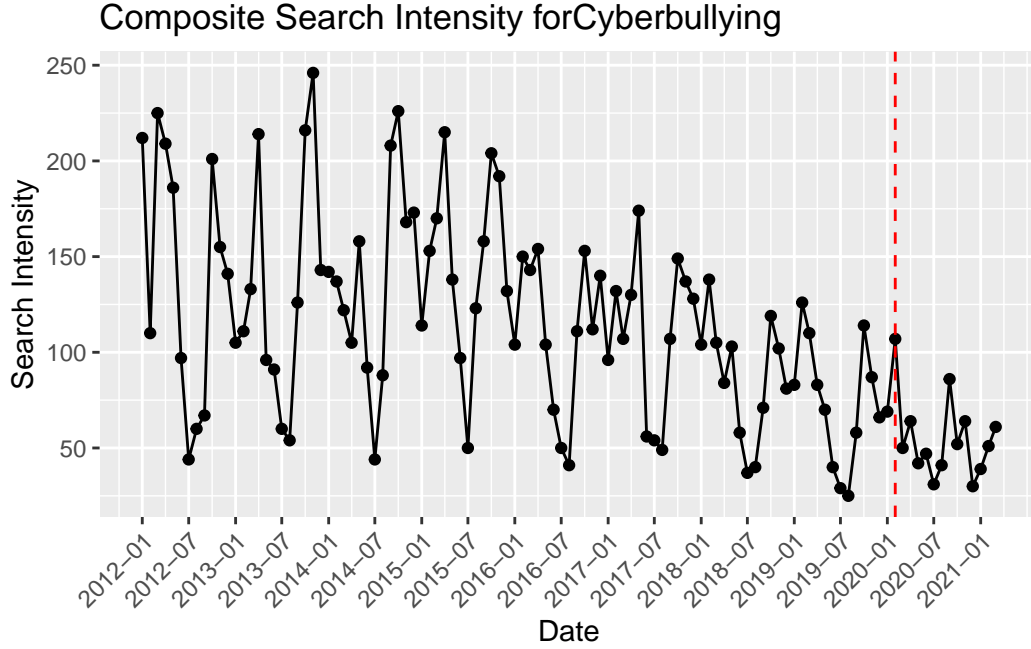Figure 2: Composite-Search-Intensity by type

Figure 3: Composite-Search-Intensity by type

time. From this we can see every year during the first month of school, the number of searches for bullying rises to a peak, and then quickly dwindles to a trough in the summer. Depending on where the red dotted line is, that's when the pandemic started. Affected by online learning, the search volume for bullying broke the pattern of previous years and remained at a low level. Only searches for cyberbullying rebounded, but not by much.

4 Discussion

4.1 COVID-19 Effects on Bullying

The overall bullying (**?@fig-Composite-Search-Intensity**) displays a decreasing trend over time, with a significant decline when COVID-19 pandemic emerged. The impact of COVID-19 on bullying cases results in a reduction to the lowest levels observed. The search intensities of bullying during and after remote learning sometimes almost reached zero.

It is clear that the incidence of school bullying has generally been decreasing over time. The original paper [cite] states that COVID-19 pandemic and remote learning has caused a decrease in school bullying cases. Our data has a slight different conclusion compared to the original paper (**?@fig-Composite-Search-Intensity**). It is observed that with the sudden COVID-19 outbreak in the United States around January 2020, instances of school bullying experienced
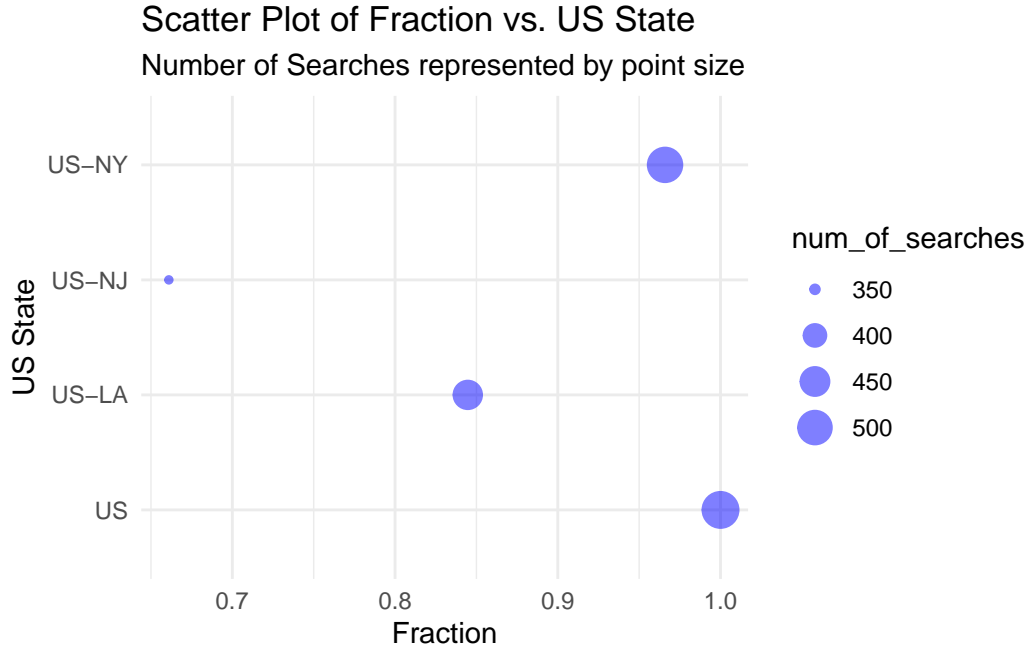
Figure 4: Composite-Search-Intensity by type

a notable surge, almost reaching global maxima in February 2020. The unexpected rise in bullying during the pandemic could be attributed to various factors, for example, individuals seeking to alleviate stress through harmful behavior to other people. Furthermore, a disturbing trend of Chinese-hate emerged during this period, due to the misguided assumptions that China was responsible for spreading the virus (Jianhua Xu 2021). Asian students, especially Chinese ethnicity, might experience discriminatory actions, verbal abuse, or physical assaults due to this misinformation. So it most likely contributed to an increase in school bullying cases. As schools closed down in February 2020, a consequential decline in bullying cases was observed, at times nearly reaching zero. This is understandable since student interactions have declined due to remote learning.

Surprisingly, the shift to remote learning during the COVID-19 pandemic did not lead to an expected increase in cyberbullying cases. Given that students spent the majority of their time on digital devices (Fayiqa Ahamed Bahkir 2020), it was natural to assume that cyberbullying would increase. Instead, there was a noticeable decrease. This challenges the assumption about the relationship between online activity and cyberbullying. The reduction in personal interactions during remote learning may have played a role in diminishing students' motivations or reasons to engage in cyberbullying. Also, since students stayed at home, there would always be adult supervision, for students under 12 years old (Mónica Ruiz-Casares 2021), which may have regulated their behaviour. This indicates that face-to-face interactions and the environmental factors have a strong impact on the prevalence of online harassment.

4.2 Cyclic Pattern of Bullying During Semesters and Vacations

In all three types of bullying (school bullying, cyber-bullying, and bullying), a cyclic pattern can be observed. It is clear that the data peaks during the months of January and September, which are the commencement of school terms, followed by a gradual reduction in bullying cases as the semester progresses. The local trough occurs during the summer vacation when students are away from school. It can be inferred that there might be a positive correlation between academic stress and bullying and between in-person interactions and bullying (Hui Chen 2022).

As the semester begins, students need to transition from a relaxed vacation state to a rigorous school learning state. As they navigate the challenges of academic demands, they may experience stress and peer pressure from many sources (Adele Pitt 2018). This will urge students to release their emotions and stress by bullying other students. It is important for teachers and schools to see this trend and understand its implications. Effective strategies for mental health support should be carried out to deal with this, in order to reduce bullying.

Furthermore, there is obviously a clear positive correlation between in-person interactions and incidents of bullying. During the semesters, students engage in regular face-to-face interactions, potentially creating opportunities for bullying to occur. During summer vacation and the Christmas holiday, students typically limit their interactions to family members, with occasional exceptions when hanging out with friends. This reduction in direct, in-person interactions tends to reduce social pressures. Some individuals may feel the need to show dominance within the school by performing bullying behaviors in the presence of others (Albert Reijntjes 2016). However, during vacations, the reduced personal interaction may reduce their need for such assertive actions, resulting in a decrease in bullying activities.

4.3 Third discussion point

4.4 Limtations

4.4.1 Limited Comprehensive Representation

One key limitation of the study is the relatively low number of data entries for each bullying type within each state, which are only 111 entries. This sample size may not be able to provide a comprehensive representation of the entire state. The analysis about bullying might be skewed.

4.4.2 Biases in Data Collection

The paper has several biases in its data collection process. Firstly, it seems to lack consideration for various minority groups, such as those based on ethnicity, gender, or belonging to the

LGBQT community. This could potentially cover up the bullying experiences faced by these groups, which limits the study's inclusivity.

Additionally, socio-economic status is a critical factor influencing the bullying situation. Communities facing economic challenges lack sufficient teaching resources, and children might learn negative behaviors due to their challenging circumstances. However, the current dataset does not seem to account for these socio-economic factors, which should be added as a data feature.

Moreover, the data collection method is conducted on Google Trends, which introduces another bias. People without access to a computer or Internet may not have their experiences included in the dataset. Unfortunately, these students, who face economic difficulties, are more likely to be targets of bullying. The data does not have their perspective which compromises the comprehensiveness of the study. Also, public data from Google Trends shows the trends in the search intensity. However, there is no information about the person who performed the search. It is hard to decide whether they are the victim, the bully, or a random person.

4.4.3 Time Inaccuracy

The study analyzes the bullying situation before, during, and after COVID-19, specifically focuses on the impact of remote learning. Therefore, there are some limitations related to the temporal aspect of data collection. The closure of schools during the COVID-19 pandemic occurred on different dates across states. This difference in the timing of school closures introduces potential inaccuracy in the analysis.

4.5 Future Steps

Future research should focus on gathering more inclusive and representative data by increasing the volume of data entries and mitigating bias in data collection. Beyond simply collecting data about bullying, researchers should investigate the mental well-being of students affected by bullying.By investigating their mental well-being, researchers can arrive at conclusions if the mental health support system is effective for students in the school. It is important to ensure that individuals who experience bullying have access to the necessary resources and support. This makes sure that the research not only analyzes the situation, but also contributes to actionable improvements for those affected.

Appendix

A Additional data details

B Model details

B.1 Posterior predictive check

B.2 Diagnostics

References

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