

# Statistical Analysis of Shattuck-St. Mary's (SSM) COVID-19 Test Results August 2020 - April 2022

My L. Vo

Shattuck-St. Mary's, 1000 Shumway Ave, Faribault, Minnesota, 55021, USA; marenwliberty@gmail.com

**ABSTRACT:** Shattuck St. Mary's School (SSM) is a cohabitating residential community of multiple dormitories with approximately 350 full-time boarding students in Faribault, Minnesota. This article examines factors that may have impacted SSM's COVID-19 positive testing data. Further, it compares the school's figures with the surrounding areas of Rice County, Minnesota, and the United States' COVID-19 testing trends from August 2020 to April 2022.

**KEYWORDS:** Biomedical and Health Sciences; Epidemiology; COVID-19; residential community; boarding school.

## ■ Introduction

Coronavirus Disease 19 (COVID-19) is an infectious respiratory disease caused by Severe Acute Respiratory Syndrome (SARS-COV-2).<sup>1</sup> COVID-19 is contagious through droplets released by the host during breathing, talking, sneezing, and coughing.<sup>1</sup> This virus can also spread by touching a surface previously touched by the host and then touching one's face, nose, and mouth.<sup>2</sup> COVID-19 has been reported to introduce a wide range of symptoms among different people. According to the CDC guidance, 2 to 14 days after exposure to the virus, patients may experience typical symptoms such as fever, chills, shortness of breath, sore throat, fatigue, and congestion.<sup>3</sup> In most severe cases of COVID-19, people with chronic diseases and a positive diagnosis of SARS will be admitted to the hospital, isolated, and provided treatments such as ventilation with oxygen, antibiotics, antiviral medications, and high doses of steroids to prevent swollen lungs if needed.<sup>4</sup> Until now, there has been no proven cure for SARS-COV-2 yet; there are only supportive treatments.<sup>5</sup> Thus, the CDC suggests individuals should get vaccinated, wear appropriately fitted masks in public, follow the guidance of quarantine, testing, isolation, or travel requirements, and socially distance themselves if any symptoms are introduced. Further preventions such as washing hands frequently with alcohol-based hand soap, cleaning hands often, and avoiding poorly ventilated spaces are also encouraged.<sup>1</sup>

Much research has been done to understand the transmissibility of COVID-19 in different environments. High-risk environments are places with a higher risk of COVID-19 transmission and where prevention guidance may be difficult to execute.<sup>6</sup> More specifically, congregate settings such as hospitals, schools, prisons, worker dormitories, residential aged and disability care facilities, and correctional or detention facilities are considered high-risk.<sup>7</sup> Because these environments share similar features of large cohabitating places, residents may be at higher risk due to more prolonged close exposure, lack of social

distancing and adequate hygiene, limited health care resources, and predominantly indoor life.<sup>8</sup> Thus, in high-risk settings, elderly, disabled people, residents coming from racial and ethnic minority groups, or those experiencing chronic diseases also face higher risks of getting infected.

Likewise, Shattuck St. Mary's School (SSM) is an example of a cohabitating, residential community consisting of multiple dormitories with approximately 350 full-time boarding students. To mitigate the severity and transmissibility of COVID-19 within the campus, several approaches have been initiated since 2020. Throughout the two academic years, the school adopted many anti-COVID-19 protocols. These protocols include cleaning surfaces with approved disinfectants, ventilating hallways with heavy fans, and COVID-19 testing upon suspicion, request, and arrival for students, faculty, staff, family members, and visitors. In addition, the school followed CDC-recommended 10-day isolation and 14-day quarantine precautions, including mask mandates, frequent temperature checks, and limited large gatherings. SSM also implemented special social distancing-cohort restriction—which only allowed students to attend activities with others in the same cohort, and inter-cohort interactions were strictly prohibited. As a result, social activities were minimal. As the pandemic continued, SSM fostered testing and isolation changes (also known as the “test-to-stay” program) in accordance with the CDC's 5-day isolation recommendations.

Additionally, Shattuck St. Mary's School has diverse students, faculty, staff, and their families from inside and outside of the United States. These students and school employees traveled home for summer, fall, winter, and spring breaks. Therefore, we examined the COVID-19 test result trends before and after these breaks to determine the effect of traveling for breaks on COVID-19 positive trends within the community. As new variants of SARS-COV-2 were introduced nationally and globally, people may have been exposed and faced different intensities of risks of infection based on their local situations. It

is reasonable to assume that COVID-19 positive testing trends may have influenced the number of COVID-19 positive tests in surrounding areas. Therefore, we compared the number of COVID-19 positive tests at SSM to the number of positive COVID-19 tests in Rice County, Minnesota, and the United States from January 2020 to April 2022.

## ■ Methods

Currently enrolled students (grades 6-12), alumni, faculty, staff, and their family members residing on campus could access testing resources at Shattuck-St. Mary's School (SSM) in Faribault, Minnesota, upon request or as an approach to contact tracing protocol. Students, visitors, faculty, staff, and their families who resided on campus were required to submit negative results before their arrival on campus and after returning from summer, fall, winter, and spring breaks. There were 3962 COVID-19 test results gathered by Shattuck-St. Mary's School's Health Service personnel which were added to one database from January 6, 2020, to April 3, 2022. These tests were collected using different tests, which were rapid, PCR, and saliva tests. Since the testing data had been previously obtained, the analysis of this database required no additional interaction with the subjects. Each COVID test-taker in the database was assigned a 5-digit, non-sequential, unique identifier by Shattuck-St. Mary's School's Student Data Coordinator.

This study was reviewed and approved by the Shattuck-St. Mary's School's Ethics Review Board. No informed consent form was needed because the data was previously collected. To keep data confidential, all data was kept on a secure Shattuck-St. Mary's School server is accessible only by the Director of BioScience or the student researcher's password-protected computer. In addition, only the Shattuck-St. Mary's School's Student Data Coordinator and the Director of Health Services had access to the original database.

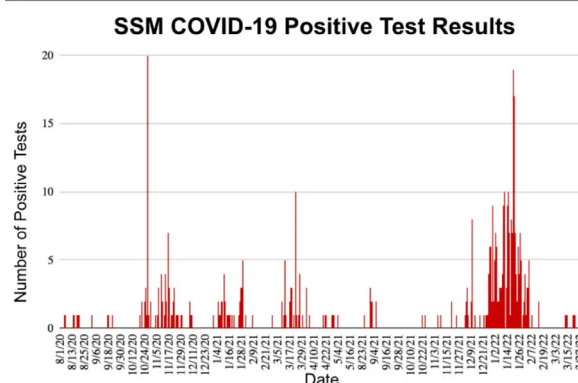
First, the data collected from Shattuck-St. Mary's School comprised seven graphs, one depicting SSM's overall positive testing trend. The other six graphs centered two weeks before and after the following breaks: winter and spring breaks of the 2020-2021 school year and summer, fall, winter, and spring breaks of the 2021-2022 school year. These graphs will examine the effect of traveling for holidays.

Second, the data collected from Shattuck-St. Mary's School was then compared to the general public's positive COVID-19 testing rate at county, state, and national levels. This public-accessible database of positive COVID-19 cases per county in the United States was taken from USA Facts. It contained entries from every county of 50 U.S. states and Washington, D.C., from January 22, 2020, to December 7, 2022. This database was used as a comparison source to SSM's overall positive rate reported between January 6, 2020, and April 3, 2022, and the overall rate in Rice County, Minnesota, and the United States for that same time.

## ■ Observations:

From August 2020 to March 2022, we witnessed a fluctuation of positive COVID-19 test trends, and such data clustered the most during October 2020 and January 2022 (Figure 1).

These spikes could be due to traveling from breaks and intercohort interaction that transmitted disease more vigorously.

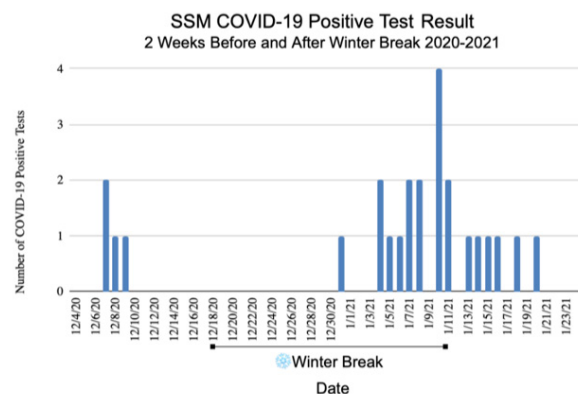


**Figure 1:** Shattuck-St. Mary's COVID-19 positive test results from August 2020 to March 2022. Generally, there were more COVID-19-positive test clusters within two weeks after fall, winter, and spring breaks.

## ■ Returns From Breaks:

Traveling back from breaks may have been an important factor that could have influenced the development of COVID-19-positive testing clusters and spikes. In the 2020-2021 school year, SSM encouraged students to participate in online classes even though hybrid learning was also offered at school. In fact, many students chose to stay at home and continue distance learning; thus, there was insufficient testing data upon returning from the summer break of 2020. In addition, in the same school year, the school canceled fall break and extended winter break to mid-January.

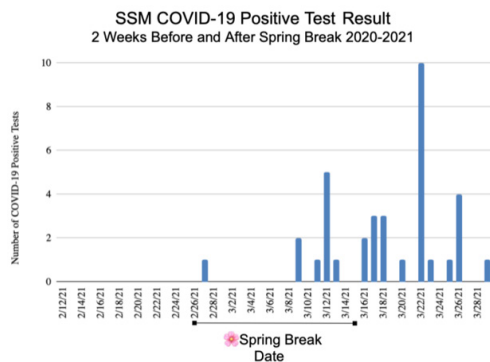
Figure 2 suggests an increasingly positive trend within two weeks after winter break SSM compared to two weeks before. There were 22 positive tests reported at the end of winter break 2020-2021 and within two weeks of returning from break. This indicates a contrast to the lack of positive tests reported by the end of the fall term before everyone left for a break; however, further statistical investigation is highly recommended to draw more robust observations.



**Figure 2:** Shattuck-St. Mary's COVID-19 positive test results two weeks before and after winter break 2020-2021. We observed greater positive COVID-19 test results during and after the winter break of 2020-2021, which could be attributed to traveling for breaks.

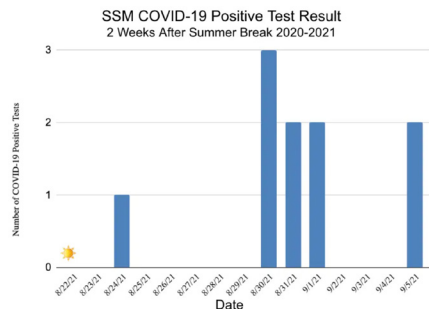
Likewise, 34 positive tests were reported at the end and within two weeks of returning from break, compared to the

lack of positive testing results reported before the break. Overall, this graph suggests an increasingly positive trend within two weeks after spring break (Figure 3).



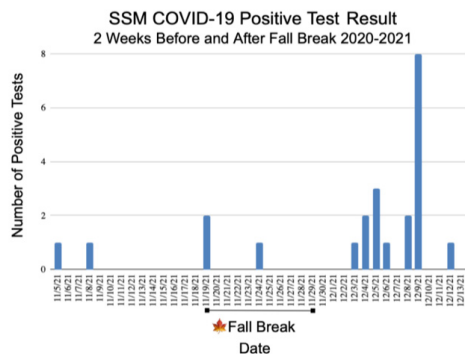
**Figure 3:** Shattuck-St. Mary's COVID-19 positive test results two weeks before and after spring break 2020-2021. An increase in positive test reports was seen during and after spring break 2021.

In the next school year of 2021-2022, the school mainly operated in-person classes and received several new students. Generally, although some positive tests were reported after the summer break (Figure 4), there was no significant increasing pattern compared to spring break 2020-2021. Therefore, these figures needed to be significantly larger to be specified as spikes.



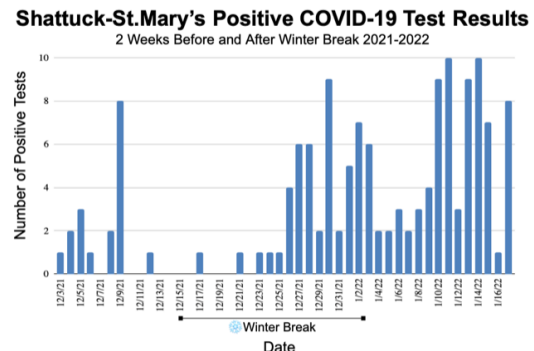
**Figure 4:** Shattuck-St. Mary's COVID-19 positive test results two weeks after summer break 2021-2022. A slight increase in COVID-19 tests was reported to SSM after summer break. Since these reports were few, observations are inconclusive.

In this school year, fall break came back into effect, and upon arrival, the reported number of students' COVID-19 positive test results (Figure 5) once seemed to support that there was an increase within two weeks of returning from break.



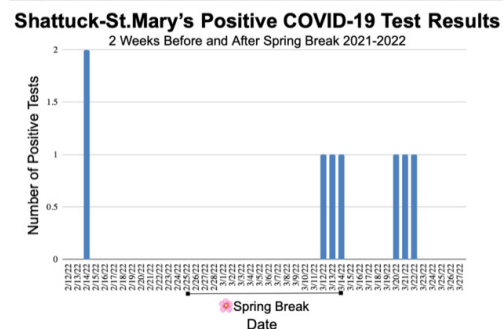
**Figure 5:** Shattuck-St. Mary's COVID-19 positive test results were obtained two weeks before and after the fall break in 2021-2022. Within two weeks of returning from fall break, there was an increase in COVID-19 positive tests.

Unfortunately, SSM witnessed one of the biggest clusters of the two years after fall break to mid-January. This could be due to people's optimism regarding the gradual recovery of COVID-19 at the beginning of the school year; thus, people came back to socialize, which may have led to a significant outbreak. In addition, winter break 2021-2022 happened during this period and reported a significant surge that started before, during, and after the break (Figure 6).



**Figure 6:** Shattuck-St. Mary's COVID-19 positive test results two weeks before and after winter break 2021-2022. We observed the largest increase in two years during and after winter break, possibly due to human behaviors.

Once again, during the two weeks after returning from spring break, before the school ended its testing policy, more data was needed to conclude that there was a significant increasing pattern, and these figures were not significantly large enough to be specified as spikes. However, some positive tests were reported, as shown in Figure 7.



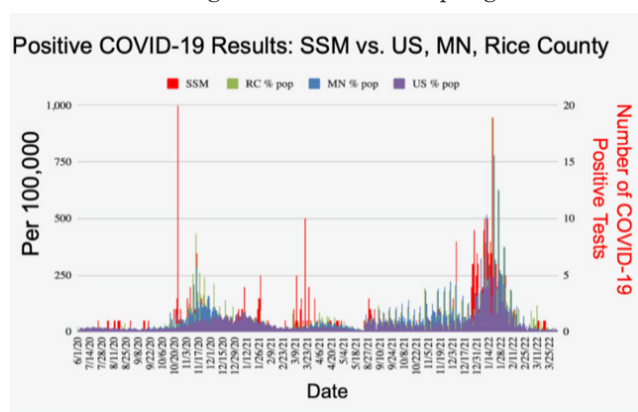
**Figure 7:** Shattuck-St. Mary's COVID-19 positive test results two weeks before and after spring break 2021-2022. While COVID-19-positive tests were reported, there were too few to draw conclusions regarding the data.

### ***COVID-19 Positive Trend in Rice County, Minnesota, and the U.S.:***

Figure 8 compares the number of positive COVID-19 tests in SSM with the number of positive COVID-19 tests per 100,000 people in Rice County, Minnesota, and the U.S. population. Overall, the positive testing pattern of SSM suggests some imitation of public trends. Upon closer inspection, many of the spikes at SSM were reported during particular times in the year, such as after-school breaks. Specifically, within two weeks before and after winter break of December 2020-January 2021 and December 2021-January 2022 school years, a similar increase with different intensities can also be spotted in Rice County, Minnesota, and the United States, where SSM

displayed the closest similarity to Rice County's. This suggests that the COVID-19 prevalence in the surrounding area indeed influenced SSM's trend. Notably, the winter break of 2020-2021 marked the introduction of Delta, first discovered in late March 2020 and rapidly became the dominant variant strain in the U.S. until Omicron's appearance in mid-December 2021. Delta was about 80-90% more contagious than Alpha and Beta variants;<sup>9</sup> thus, the mutation of Delta may have been a possible factor influencing the development of SSM outbreaks after 2020. During winter break 2021-2022, SSM's testing data also closely resembles the public positive testing trend. This outbreak's timing was characterized by the emergence of a new COVID-19 variant, Omicron, first identified by early December 2021. The development of Omicron came with its unique characteristics of greater transmissibility and marginally less severe symptoms,<sup>9</sup> and its impact on COVID-19 prevalence at SSM and the public may have been deepened as people gained more confidence in the past seemingly positive situation.

On the other hand, two apparent clusters showed no similarity with the surrounding trend, which happened during October 2020 and the spring break of March 2021. The October cluster could have been due to intercohort interaction, as it was during the school year, and the latter cluster could have been due to traveling back to SSM after spring break.



**Figure 8:** Positive COVID-19 results: SSM vs. the U.S., MN, Rice County from August 2020 to March 2022. Generally, the positive COVID-19 trends at SSM resembled the trends in the surrounding area, which could be due to social interactions and new variant introductions.

### Summary:

Although statistical testing was not possible with this data, the combination of concurrent COVID prevalence in Rice County, MN, and the U.S. may have contributed to the positive testing trend at SSM.

Within two weeks after returning from breaks, most of the data suggested an increase in positive tests compared to two weeks before school breaks started. Moreover, some of SSM's COVID-19 positive testing rates somewhat imitated the COVID-19 prevalence in the surrounding area, whether due to the timing of returning from breaks, the emergent variants, or other distinctive factors that could be explored in the future.

Human behaviors may also have been a critical factor contributing to many spikes and clusters at SSM. For example, many students may have concealed their symptoms before

tournaments or breaks to leave school on time. Generally, many students chose not to report their infection to avoid being stigmatized or quarantining the whole team (cohort). They stayed in dormitories when online learning was a primary means of education. Since the 10-minute dorm inspection only took place at night, students had a lower chance of being spotted for their infection. Likewise, during the weekends, school nurses were only accessible through texts and calls; thus, there was a lower tendency to test unless nurses highly suspected students were infected. Otherwise, they would assume students were experiencing influenza and wait until weekdays to test. There was also a possibility of false positive and false negative rapid test results since the school acquired different COVID-19 tests throughout the years.

### Implications:

The school should lengthen its anti-COVID-19 protocols for future preparation for another outbreak, especially after traveling from breaks. Since the prevalence of COVID-19 in the surrounding area could contribute to increased cases within smaller communities, boarding schools should also consider adjusting students' interaction with the public outside the school during regional/national outbreak periods. Schools could limit student travel for breaks or school events, for example, by reducing the number of breaks or by combining two breaks into one.

Future studies could examine the relationship between positive COVID-19 testing trends and the vaccination status of community members. Including school-sponsored traveling information could also give a broad overview of the COVID-19 transmission pathway between the SSM community and local and regional areas. The COVID-19 transmission rate between cohorts could be further analyzed to assess the effectiveness of this approach, which would offer a potential protocol for boarding schools during future pandemics.

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## ■ Author

My Vo is a rising sophomore in Fall 2024 at Villanova University in Villanova, Pennsylvania, where she majors in Chemical Engineering and minors in Mathematics.