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BRIEF REPORT

Clusters of SARS-CoV-2 Infection Across Six Schools for Students with Intellectual and Developmental Disabilities

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ABSTRACT

Introduction: Individuals with intellectual and developmental disabilities are at increased risk for adverse outcomes from coronavirus disease 2019. Clusters of COVID-19 infections can be used to track SARS-CoV-2 transmission. This is particularly important in environments frequently used for individuals with intellectual and developmental disabilities, such as schools. The objective of this study was to compare the number of clusters of student and staff cases identified during three distinct periods (pre-Delta, Delta, and Omicron) of the COVID-19 pandemic.

Methods: Weekly COVID-19 testing occurred from November 23, 2020 to May 27, 2022 during three phases of the COVID-19 pandemic: pre-Delta, Delta, and Omicron. Structured interviews were conducted with positive cases to determine if they contracted COVID-19 in the school environment, and interviews with school administrators responsible for contact tracing determined school-based clusters.

Results: 160 cases of COVID-19 were identified and 55 cluster positives were recorded during the study period. 0 (0%) cluster positives were recorded during the pre-Delta variant wave, 3 (5%) cluster positives were recorded during the Delta variant wave, and 52 (95%) cluster positives were recorded during the Omicron variant wave. Additionally, 23 (85%) of all positives during pre-Delta, 12 (50%) of all positives during Delta, 66 (61%) of all positives during Omicron, and 36 (69%) of cluster positives during Omicron did not receive CDC-recommended dosages of the COVID-19 vaccine.

Conclusion: The Omicron variant led to an increase in cluster-based transmission, and staying up to date with vaccination guidelines was crucial in limiting transmission.

Clinical Trial Registration: Prior to enrollment, this study was registered at ClinicalTrials.gov on September 25, 2020 (identifier NCT04565509; titled "Supporting the Health

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Keywords: Cluster transmission; Intellectual and developmental disabilities; Omicron variant; SARS-CoV-2; Vaccinations

Key Summary Points

Clusters of COVID-19 increase risk of transmission and can place vulnerable individuals at risk of contracting COVID-19.

More clusters were present during the Omicron wave of the pandemic.

Staying up to date with vaccination guidelines is critical to prevent COVID-19 transmission.

Monitoring for clusters is important to understand COVID-19 transmission in schools ad for mitigation strategy recommendations.

INTRODUCTION

One mechanism for tracking severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) transmission is through the evaluation of clusters, epidemiological links between two or more lab-confirmed cases of coronavirus disease 2019 (COVID-19) [1]. Clusters of COVID-19 lead to more rapid transmission than non-clustered cases [2]. Clusters are particularly pertinent to the pandemic's impact on populations vulnerable to severe COVID-19 complications, including individuals with intellectual and developmental disabilities (IDD).

Children with IDD are vulnerable to COVID-19, with fatality rates reported to be as high as 1.6% [3]. At the beginning of the COVID-19 pandemic, significant concerns were present for students with IDD and school staff returning to school due to the potential inability of students and staff to follow all the proven school-based mitigation strategies, including masking, social distancing, and good hand hygiene. We demonstrated that during the 2020–2021 school year, COVID-19 cases were less common in schools dedicated to students with IDD than community-based transmission with standard mitigation strategies and weekly COVID-19 screening testing [4].

In the summer and fall of 2021, the Delta variant became predominant in the US, leading to a surge in cases at the start of the 2021–2022 school year. In the winter of the same school year, the Omicron variant became predominant, leading to an unprecedented surge in COVID-19 cases throughout the United States. The objective of this study was to compare the number of clusters of student and staff cases identified during three distinct periods (pre-Delta, Delta, and Omicron) of the COVID-19 pandemic.

METHODS

The study took place at six schools dedicated to children with IDD within the Special School District of St. Louis County (SSD) between November 23, 2020, and May 27, 2022. These schools educate 716 children with IDD who are aged 5–21 years and employ approximately 605 teachers, staff, and administrators. Staff testing started November 23, 2020 and student testing began December 11, 2020. Although mitigation strategies were difficult to adhere to in this population, school-based mitigation strategies, including mandatory masking until March 14, 2022, social distancing when able, frequent hand hygiene, and staying home when ill, were demonstrated to be effective [4]. Students and staff were constantly in close proximity due to the nature of the care and teaching provided to these students, and vaccines were not required for staff and students. Positive cases from individuals enrolled in a study evaluating weekly COVID-19 testing were identified during three phases of the COVID-19 pandemic. The three phases included pre-Delta from November 23, 2020 to July 17, 2021, Delta from July 17, 2021 to December 18, 2021, and Omicron from

Table 1 Participant demographics

	Pre-Delta (11/23/2020–7/16/2021)		Delta (7/17/2021–12/18/2021)		Omicron (1/3/2022–4/1/2022)	
	All positives	Cluster positives	All positives	Cluster positives	All positives	Cluster positives
Number of positives, no.	27	0	24	3	109	52
Age, median (IQR)	42 (35–50)	–	35 (16–49)	–	42 (33–53)	38 (27–51)
Race, no. (%)						
White	30 (91)	–	15 (63)	–	78 (71)	36 (69)
African American/black	1 (3)	–	6 (25)	–	26 (24)	15 (29)
Other	2 (6)	–	3 (12)	–	5 (5)	1 (2)
Ethnicity, no. (%)						
Non-Hispanic/Latino	23 (85)	–	22 (92)	–	96 (88)	48 (92)
Hispanic/Latino	2 (7)	–	1 (4)	–	4 (4)	4 (8)
Other	2 (7)	–	1 (4)	–	9 (8)	0 (0)
Sex, no. (%)						
Female	21 (78)	–	13 (54)	–	79 (72)	35 (67)
Male	6 (22)	–	11 (46)	–	26 (24)	17 (33)
Vaccination status						
Received CDC-recommended dosages	4 (15)	–	12 (50)	–	43 (39)	16 (31)
Did not receive CDC-recommended dosages	23 (85)	–	12 (50)	–	66 (61)	36 (69)

January 3, 2022 to May 27, 2022. In brief, students and staff consented to weekly saliva-based PCR SARS-CoV-2 testing. They submitted a test at their respective school weekly and were notified of their result by email if negative and by phone call from the study investigators (JGN, SAF) if positive. Furthermore, throughout their participation in the study their vaccination status was assessed [4]. Positive cases completed a structured interview to help determine if the participant contracted COVID-19 in the school environment. A positive case was considered fully vaccinated if they were up to date with CDC recommendations [5] at the time of infection. Additional interviews with school administrators that performed the contact tracing were conducted to help further determine potential school-based clusters of COVID-19 cases. This study was approved by the Washington University in St. Louis Institutional Review Board (IRB), and individuals provided consent prior to participation. This study was performed in accordance with the Helsinki Declaration of 1964 and its later amendments.

RESULTS

A total of 557 teachers, staff, and administrators and 113 students enrolled in the study, a 91% and 16% enrollment rate, respectively. Among 19,521 tests performed during the study, 215

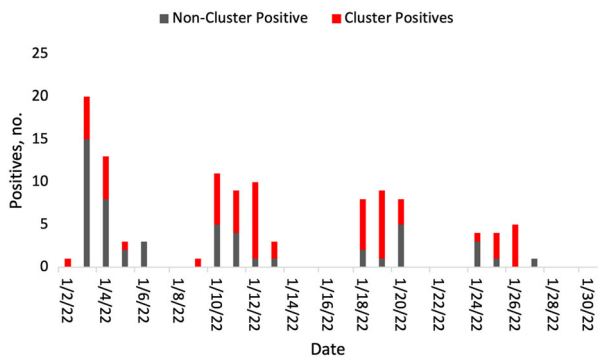

Fig. 1 Numbers of non-cluster and cluster positives during the omicron wave

positive COVID-19 cases and 55 cluster positives were identified (Table 1). Notably, most staff and students who tested positive in a cluster after the availability of the vaccine were not up to date with CDC vaccination guidelines (n = 36, 65%) for COVID-19.

The cluster frequency increased significantly at week 59 in the study (1/3/2022–1/7/2022) following a return to school from the winter break during the Omicron variant surge. The total number of cluster positives that occurred during the Omicron surge was 52 and the total positive case count was 109 (Fig. 1). During the Omicron surge, all the clusters were identified during the period from 1/6/2022 to 1/28/2022, when masks were still required.

DISCUSSION

In this study, we demonstrated an increase in COVID-19 school-based clusters over the course of the COVID-19 pandemic. Furthermore, we observed that those individuals in a cluster were often not up to date with their COVID-19 vaccines.

The increase in transmissibility of the Delta and Omicron variants helps explain the increase in clusters observed during the study. Data suggest that R_0 is 5 and 9 for Delta and Omicron, respectively [6]. Additionally, during the 2021–2022 school year, more students attended, and no hybrid options were utilized, increasing the density of students and staff. While masking was still mandated during these times, the increase in transmissibility of the Omicron variant made the mitigation strategies—especially masking and staying home when sick—even more important. Furthermore, none of the staff in the clusters reported using eye protection, but all wore masks, though the types of masks were not determined. In working closely with IDD students who often did not wear masks, eye protection likely could have provided additional protection, as this personal protective equipment has been essential in the prevention of COVID-19 transmission [7].

We observed that those individuals in a cluster were often not up to date with their COVID-19 vaccines. Data from the Omicron surge demonstrated that adults not vaccinated with their primary series and those with a primary series but no booster experienced respective hospitalization rates 10.5 and 2.5 times higher when compared to individuals with a primary series and booster [8]. Promoting and ensuring staff and students are up-to-date with their COVID-19 vaccination will better protect these high-risk students and their teachers from infection and hospitalization.

As mitigation strategies such as masking and distancing are made optional, tracking cluster transmission in schools is an important strategy to consider, especially in schools with children at high risk for severe disease. By monitoring schools for clusters of cases, administrators and public health officials will be better able to predict the common COVID-19 symptoms [9]. Furthermore, monitoring clusters will help schools control the spread of COVID-19 by implementing the mitigation strategies that have been demonstrated to be so effective [10].

Limitations

The design of our study may have limited the reporting of COVID-19 cases. Not all students and staff were enrolled in the study, which could have impacted the accuracy of our positive case and cluster counts. Students and staff may not have reported their illnesses, causing an underestimate of cases and clusters, especially early in the study.

CONCLUSIONS

The higher transmission rate of the Omicron variant and possibly the lack of use of eye-protection increased the frequency of clusters. Staying up to date on vaccinations will play an important role in limiting the frequency of cluster-based transmission. As schools, including those for children with IDD, decrease the number of mitigation strategies, monitoring clusters in these schools may be a helpful strategy to help determine the need for the addition of more mitigation strategies to limit COVID-19 transmission.

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Author Contributions Study conception and design were completed by Michael Gemmell, Tyler Walsh, Jason G. Newland, and Christina Gurnett. Material development and data collection and analysis were performed by all authors (Michael Gemmell, Tyler Walsh, Michael Sherby, Adwoa Imbeah, Kelly Bono, Megan Baldenweck, Christina Gurnett, and Jason G. Newland). The first draft of the manuscript was written by Michael Gemmell, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data Availability Deidentified individual participant data (including data dictionaries) will be made available, in addition to study protocols, the statistical analysis plan, and the informed consent form. The data will be made available upon publication to researchers who provide a methodologically sound proposal for use in achieving the goals of the approved proposal. Proposals should be submitted to jgnewland@wustl.edu.

Ethical Approval This study was approved by the Washington University in St. Louis Institutional Review Board (IRB), and individuals provided consent prior to participation. This study was performed in accordance with the Helsinki Declaration of 1964 and its later amendments.

Conflict of Interest Michael Gemmell, Tyler Walsh, Michael Sherby, Adwoa Imbeah, Kelly Bono, Megan Baldenweck, Christina Gurnett, and Jason Newland have no conflicts of interest to disclose.

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