A University-Led Contact Tracing Program Response to a COVID-19 Outbreak Among Students in Georgia, February–March 2021

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Abstract

Few reports have described how university programs have controlled COVID-19 outbreaks. Emory University established a case investigation and contact tracing program in June 2020 to identify and mitigate transmission of SARS-CoV-2 in the Emory community. In February 2021, this program identified a surge in COVID-19 cases. In this case study, we present details of outbreak investigation, construction of transmission networks to assess clustering and identify groups for targeted testing, and program quality metrics demonstrating the efficiency of case investigation and contact tracing, which helped bring the surge under control. During February 10–March 5, 2021, Emory University identified 265 COVID-19 cases confirmed by nucleic acid testing in saliva or nasopharyngeal samples. Most students with COVID-19 were undergraduates (95%) and were affiliated with Greek life organizations (70%); 41% lived on campus. Network analysis identified 1 epidemiologically linked cluster of 198 people. Nearly all students diagnosed with COVID-19 (96%) were interviewed the same day as their positive test result. Of 340 close contacts, 90% were traced and 89% were tested. The median time from contact interview to first test was 2 days (interquartile range, 0-6 days); 43% received a positive test result during their quarantine. The surge was considered under control within 17 days, after which new cases were no longer epidemiologically linked. Early detection through systematic testing protocols and rapid and near-complete contact tracing, paired with isolation and quarantine measures, helped to contain the surge. Our approach emphasizes the importance of early preparation of adequate outbreak response infrastructure and staff to implement interventions appropriately and consistently during a pandemic.

Keywords

COVID-19, case investigations, contact tracing, institutions of higher education, communicable disease control

Colleges and universities have experienced COVID-19 outbreaks.1,2 Partnerships between institutions of higher education and public health authorities are valuable in reducing SARS-CoV-2 transmission when widespread community outbreaks overwhelm local health department resources.3 In some jurisdictions, university student volunteers have collaborated with health departments in case investigations and have also incorporated new analytic methods into the health department workflow.4-6

Universities can further augment public health capacity by mobilizing internal resources and infrastructure—such as student health services, faculty in medicine and public health, information technology staff, and student volunteers—to establish outbreak response programs. To date, few studies have described the effectiveness of university programs to respond rapidly to and curb outbreaks.7-9 This case study details a university-led response to an on-campus surge in
COVID-19 cases. The methods described in this case study may help other universities with contact tracing and outbreak response.

**Methods**

Emory University is a private university in metropolitan Atlanta, Georgia, with a student body of approximately 15,000 students, of whom 8000 are undergraduates. In June 2020, Emory University established a case investigation and contact tracing program in preparation for faculty, staff, and students returning to campus for the 2020-2021 academic year. Housed within both Student Health Services and Employee Health Services (Figure 1), the program originally included 5 full-time and 10 part-time staff members. Initially, staff were redeployed from other departments (eg, athletic trainers) and trained to conduct case investigation and contact tracing. Public health faculty and staff provided guidance on targeted testing, restrictions on in-person courses, revisions to testing or screening protocols, and related policies. Student Health Services received student COVID-19 testing results from screening and diagnostic tests performed at university sites free of charge and testing sites in the surrounding community. Mandatory COVID-19 testing was implemented as one of numerous measures to protect the university community. During the 2020-2021 academic year, students residing on campus were required to test once per week. Students living off campus were required to test at least once before the semester.

Case investigators at Emory University called all students with positive SARS-CoV-2 test results to interview them, gather information on close contacts, and initiate isolation. Students who received a positive COVID-19 test result who resided on campus were provided isolation accommodations at a nearby hotel. Those living off campus self-isolated and received support from the isolation and quarantine team, including education on how to isolate themselves most effectively based on their living arrangement.

Contact tracers notified Emory University–affiliated close contacts via text message or telephone of their possible COVID-19 exposure and the need to initiate evaluation, testing, and quarantine. Quarantine accommodations were provided for students residing on campus; off-campus students self-quarantined in their respective off-campus homes. Master of public health student volunteers from outbreak and emergency response student organizations assisted during this surge.

Mirroring local health authorities, case investigators collected information on demographic characteristics, symptom onset, symptoms and comorbidities, place of residence, in-person class attendance and campus facility use, all on- and off-campus locations visited, and close contacts (within 6 feet for ≥15 minutes) 2 days preceding and since illness onset. Illness onset was defined as symptom start date for...
symptomatic cases or date of positive specimen collection for asymptomatic cases. Initial case interviews were often followed up with subsequent interviews for further information to establish epidemiological links. Contacts were called again 3, 7, 10, and 14 days after initiating quarantine to assess symptoms, provide updates on testing, and address any questions or concerns during the quarantine period.

For this case study, our quality metrics included the proportion of cases and contacts interviewed and time to completion of each step from case diagnosis to testing of contacts. We performed transmission network analyses to examine epidemiological links and assess clustering to target groups for testing. We included all index cases associated with Emory University and all close contacts regardless of affiliation. We established epidemiological links via case investigation and contact tracing interviews.

We entered data into a standardized REDCap version 10.6.3 database (Vanderbilt University). We performed network analyses using the igraph and statnet packages in R version 4.0.4 (R Core Team). This study was approved by the Emory University Institutional Review Board.

### Outcomes

University staff detected a surge in cases approximately 2 weeks after the start of the spring 2021 semester (Figure 2). During February 13-17, 2021, Emory University identified 139 COVID-19 cases confirmed by nucleic acid testing via reverse transcription–polymerase chain reaction on saliva or nasopharyngeal samples (mean, 28 cases/day). In total, 265 students were diagnosed with COVID-19 during February 10–March 5, 2021; 251 (95%) were undergraduate students, and 109 (41%) lived on campus. During the spring 2021 semester, 667 students were diagnosed with COVID-19.

More than two-thirds of all people with COVID-19 (n = 185; 70%) were affiliated with a Greek life organization, 17% (n = 44) were on an athletic team, and 13% (n = 35) were affiliated with both. Positivity rates among Greek life
organizations varied, but new members (ie, those who had recently accepted an invitation to join a Greek life organization) had consistently higher rates than established members. Throughout the outbreak, the overall positivity rate for new members was 19% (47 cases among 244 new members) among sororities and 32% (41 cases among 129 new members) among fraternities. In contrast, the overall positivity rate for established members was 6% (39 cases among 678 established members) among sororities and 12% (52 cases among 427 established members) among fraternities. The positivity rate among male athletes was 25% (40 cases among 163 athletes) and among female athletes was 2% (4 cases among 172 athletes).

Network analysis identified 1 large cluster of 198 people that consisted of 106 diagnosed cases and 92 close contacts (Figure 3). Within the network, 99 (50%) students diagnosed with COVID-19 were affiliated with a Greek life organization, 28 (14%) of whom were also affiliated with an athletic team. The network also included 70 smaller clusters and pairs, 31 students with no reported contacts, and 3 students who could not be reached. The median (interquartile range [IQR]) network degree (number of direct connections to any other individual) was 2 (0-2), and the maximum degree for any individual was 18. The median (IQR) path length (ie, smallest number of people connecting any 2 individuals) was 8 (5-11). Several off-campus gatherings, including a single large gathering, were identified as potential transmission events.

Upon identification of this surge, a multidisciplinary team from across Emory University collaborated to develop mitigation strategies, starting with rapid case investigation, contact tracing, and follow-up. During February 10–March 4, 86% of all laboratory-confirmed cases among students were reported to the university contact tracing program within 2 days (median [IQR], 1 [1-2] day). Among the 265 student cases, 96% were interviewed on the day their test result was reported; 99% were interviewed within 48 hours of receiving a test result, and 100% were interviewed overall. Among 340 close contacts elicited (median [IQR], 2 [1-3] per case), 90% (n = 306) were successfully traced, 271 (89%) of whom were tested. The average time between case interview and contact notification was <1 day (median [IQR], 0 [0-0] days). The median (IQR) time from contact interview to test was 2 (1-6) days.

Among the 340 close contacts elicited in the 265 case interviews, 145 (43%) had a subsequent positive test result. In response to the surge, student testing and quarantine/isolation accommodations were expanded, and testing frequency doubled to twice weekly for students living on campus, with strong incentives for compliance. Compliance strategies included knock-and-talk visits to dormitory rooms by student life staff members if students could not be reached or were nonadherent to testing protocols; they also could include Wi-Fi access restrictions, educational and behavioral interventions, and loss of access to campus buildings. The

Figure 3. Network diagrams of index cases (n = 265) and reported close contacts (n = 340), stratified by Greek life and/or athletic team affiliation (A), and network degree distribution of transmission network (B), Atlanta, Georgia, February–March 2021. The large cluster of 198 people, consisting of 106 diagnosed cases and 92 close contacts, is in the bottom left-hand corner of the network diagram.
frequency of mandatory testing for all off-campus students who accessed the campus increased from once, only at the beginning of the semester, to weekly.

Fifteen additional people with COVID-19 were discovered via targeted testing interventions beyond the named contacts: 2 in athletic teams and 13 in Greek life organizations. By March 5, 2021, athletic organizations had tested 255 of 287 (89%) athletes and found a positivity rate of <1%. In each Greek life organization with ≥1 case (n = 10), 77% to 100% of members were tested, with an overall positivity rate of 2%.

The surge was considered under control within 17 days, after which new COVID-19 cases were no longer epidemiologically linked.

**Lessons Learned**

This case study highlights how a comprehensive university testing, tracing, and follow-up protocol contained a COVID-19 outbreak on a university campus. During February 10–March 4, 2021, COVID-19 cases surged at Emory University. Transmission was most likely propagated via several off-campus student gatherings, with most infected students affiliated with Greek life organizations. Among Greek life students, new members had higher positivity rates than established members did, a finding that could reflect differing levels of participation in social activities. Higher contact rates among male athletes may have contributed to their higher positivity rates compared with female athletes. More than one-third of all cases were epidemiologically linked to 1 large cluster.

Challenges included maintaining appropriate staffing for surge case volume, communicating effectively with public health authorities, and rapidly scaling up testing capacity. Staff reallocation was helpful for improving contact tracing capacity, and the use of other staff including athletic trainers and nutritionists was integral to bridging gaps in case volume over time. Informing local health authorities of non–Emory-affiliated cases was a challenge because of the technical inability to communicate between data collection and management systems, which led to delayed reporting. Improving technical communication between academic and local government organizations would improve reporting capabilities and decrease the time burden on staff. It was also important to rapidly scale up testing capacity to reach targeted groups and expand routine testing. Extensive logistical challenges require engagement by groups across campus, and centralized leadership is imperative to mobilizing this response. Because of reallocation of resources to mitigate the surge in cases, observed metrics were better than almost all metrics of Emory’s program during the preceding 6 months. Substantial resources are required to maintain a program at this capacity. Building in flexibility for staffing and using information technology resources to automate and formalize reporting processes will be essential. Informed and involved leadership is critical for a successful program.

Although COVID-19 outbreaks among people involved in Greek life organizations and athletics on university campuses have been described, the surge at Emory University described in this study was smaller or shorter than those surges. Furthermore, most outbreaks were at least partially managed by local health departments and, thus, individual-level epidemiological links and program quality metrics could not be reported. Visualization of networks provided useful information to prioritize testing and identify clusters that might otherwise have been difficult to recognize. While such analyses have been performed previously on university campuses, none have used person-to-person exposure links. Paired up-to-date epidemiological and transmission network analyses not only assisted in identifying transmission links and behaviors that put students at risk but also provided reassurance that in-person classes were not associated with SARS-CoV-2 transmission during the surge. This specificity allowed for targeted interventions rather than campus-wide shutdowns that would have been more disruptive to the university community.

The findings in this case study were subject to at least 4 limitations. First, incomplete case investigations might have resulted in people missing from the transmission networks and, therefore, excluded from our analysis. Second, data were missing on students who did not regularly access campus, were outside targeted groups, or did not test at university-related sites. Potentially excluded or missing data from this analysis could have introduced bias and may have limited the interpretation of these results by underestimating cases or undersampling certain types of cases. Third, recall and social desirability biases likely influenced information collected from students about their off-campus activities. Fourth, we could not establish a causal relationship between the contact tracing program at Emory University and the observed decline in cases but solely provide an association between the two. Finally, interviewed students might have underreported contacts because of apprehension about providing information that could result in peers having to quarantine.

Despite these limitations, Emory University’s case investigation and contact tracing program responded quickly and effectively to a large COVID-19 outbreak among students. This case study highlights the importance of maintaining adequate outbreak response infrastructure and staffing in settings at high risk of COVID-19 transmission, such as university campuses. In the context of a pandemic, it is crucial to acknowledge persistent challenges and implement interventions appropriately.

**Authors’ Note**

Kristin Harrington and Meron Siira are co–first authors.

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