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Research Article

Lessons Learned as a Contact Tracer at a State University in Central Pennsylvania: Mitigating the Spread of COVID-19 Virus on a University Campus

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Abstract

Objective: This study shares lessons learned in investigating 113 positive COVID-19 cases and tracing over 1,000 close contacts at a small state university in Central Pennsylvania.

Methods and Materials: Nasopharyngeal swabs were taken from asymptomatic COVID-19 students, faculty, and staff entering and exiting fall 2020 semester for PCR analysis. Bi-weekly, randomized, asymptomatic testing was conducted throughout the semester. Positive cases were immediately assigned to tracers and isolated within 15 minutes of receiving test results. Cases were asked to quarantine immediately. Additional descriptive factors were collected such as number of contacts and symptoms per case.

Results: The most significant super spreader consisted of two cases that produced 53 positive cases. Only 59% of the 113 positive cases reported symptoms during the fall semester of 2020. Positivity rate of asymptomatic testing was 1.1% and symptomatic testing was 32.9%. Face-to-Face (F2F) classes were 15% of the fall 2020 instruction modality.

The positivity rate for fall 2020 instruction and limited collegiate sporting activities was 4.9%.

Conclusion: Universal, random and targeted COVID-19 testing, immediate case investigation and contact tracing, diligent adherence to CDC safety guidelines was effective in interrupting and mitigating COVID-19 transmission on a university campus.

Policy Implications: Rapid response contact tracing is essential for the mitigation of COVID-19.

Keywords: Asymptomatic testing; Athletic programs; Contact tracing; COVID-19; Mitigation; SARS-CoV-2

Introduction

The COVID-19 pandemic caused by SARS-CoV-2 has proven to be challenging for universities across the United States. Universities are struggling to keep their doors open while maintaining proper social distancing protocols, as well as providing adequate educational services while functioning remotely. A state university in Central Pennsylvania (University) has confronted the obstacles of COVID-19 in a collegiate population while implementing a 15% face-to-face (F2F) instruction during the fall 2020 semester with limited sporting events. The student body includes 3,425 students (2,807 undergraduates, 358 graduate).

In response to COVID-19 in fall 2020 the University has utilized tools such as: on campus mandatory entry testing, bi-weekly randomized testing of faculty, staff and, students, and exit voluntary testing of asymptomatic faculty, staff and, students. Additionally, the University engaged in rapid response to positive cases via case investigation, contact tracing, and enforcement of appropriate isolation and quarantine arrangements. Alternative housing opportunities were provided for those in need of isolation and quarantine [1]. The objective of this research is to review the results of 113 positive COVID-19 case investigations and tracing of over 1,000 close contacts and to contribute to general understanding of how to break the chain of infection of COVID-19 on a university campus, as well as enhance the safety, health and academic experience, and overall health of the surrounding community. It is hoped that through the process of rapid case investigation and contact tracing, the University will identify a number of themes and correlated trends. Our study provides insight into adjusting and strengthening the approach to prompt identification and isolation of those who contract COVID-19 and quarantining close contacts of the COVID-19 case. It has been demonstrated that appropriate and immediate responses to positive COVID-19 cases has been key in mitigating the virus. As this virus is unpredictable, contact tracers must be ready to engage in an instantaneous manner in order to prevent and slow the spread of COVID-19 [2].

Methods and Materials

The University conducted a robust multifaceted strategy that included behavior-based prevention, low density student housing, COVID-19 polymerase chain reaction nasopharyngeal asymptomatic testing, rapid detection, isolation and containment of new severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections as part of the defense against a rapid virus spread and forced 100% online delivery of curriculum. These uncertain times underscore the critical need for developing a comprehensive, evidence-based approach to manage COVID-19 in the university environment. A major component of the University's plan was to conduct entry, bi-weekly 10% random sample, and exit PCR nasopharyngeal asymptomatic COVID-19 testing of students, faculty and staff. The most critical component included a rapid response case investigation and contact tracing to interrupt the transmission at the University. The University advertised for tracers from selected upper-class and graduate students in the health science field because they would be well-informed and familiar with the population. These students were highly effective in investigating COVID-19 cases and accumulating critical information. Contact tracers were able to obtain information through detailed interviews of cases and contacts which guided in the development of a comprehensive investigation including the complete and accurate information of each case. To assure consistency in case investigation and contact tracing, a manual was developed to provide a universal protocol.

Tracer investigation is guided by standard protocols to obtain any symptom history and other relevant health information, provide instructions for self-isolation for cases and self- quarantine for contacts, and make appropriate referrals to testing, clinical services, and other essential support services. Tracers complied with policies and procedures provided by the University and the Pennsylvania Department of Health (PA DOH), and the Health Insurance Portability and Accountability Act (HIPAA) regarding confidentiality and data security for the handling of sensitive client information and protected health information. University tracers completed the Johns Hopkins Case Investigation & Contact Tracing Training Program and Training through the Centers for Disease Control and Prevention (CDC). As positive COVID-19

cases were discovered, tracers were assigned cases. The average time period for contact was 22.5 minutes from the identification of a positive case until contact to that positive case. Close contacts of the positive cases were reached within 15 minutes to one hour. Random samples of 10% students/faculty/staff population were selected to receive testing on a bi-weekly basis. Asymptomatic widespread tests were conducted on Wednesdays and results returned within 48 hours. Each positive case was given the option to utilize the university's alternative housing option for isolation. This option was also provided to students who were identified as close contacts of positive cases. In addition, tracers provided health education, including proper CDC guidelines in areas of isolation and quarantine, identification and monitoring of signs and symptoms of COVID-19 measures, and alternative housing opportunities to interrupt ongoing disease transmission.

Guidance from CDC, PA DOH, and Johns Hopkins Tracing Education Protocol was utilized. Unique identifiers were given to each positive case and were labeled as FA20-## whereFA20 refers to the fall 2020 semester and the corresponding numbers refer to positive COVID-19 cases as they were discovered. A data base was built to collect multiple factors from each case including name; unique identifier; birthdate; tracer; test date; clinically cleared date; number of contacts; number of symptoms; and list of symptoms. The University's Institutional Research Board approved the research on October 1, 2020 (IRB Proposal FA-09).

Results

The University provided universal testing to students, faculty, and staff that were engaged in face-to-face instruction which totaled over 2,310 tests conducted. Of the 2,310 tests conducted, 113 students and staff tested positive for a Final Fall 2020 positivity rate of 4.9%. A database was created for the intake interview of positive cases and contained factors such as housing situations, locations visited on campus 3 days prior to testing positive, signs and symptoms experienced, and a list of university faculty, staff and student contacts during their infectious period. PCR asymptomatic COVID-19 testing, positive COVID-19 case investigation, and contact tracing during the Fall 2020 semester provided the university with a great deal of information. PCR nasopharyngeal asymptomatic testing was conducted as students arrived on campus and totaled over 830 students, faculty, and staff on August 20 and 21, 2020. Table 1 indicates the results of these tests.

Population	Tests Completed	Positive Tests	Positivity Rate (%)
Students	789	5	0.63
Faculty/Staff	41	0	0
Overall	830	5	0.6

Table 1: PCR Testing Results LHU students, faculty and staff on August 20 and 21, 2020.

Through the database, tracers were able to identify clusters, defined as an occurrence of five or more epidemiologically linked cases. Emergent clusters included athletes, fraternities, study groups and roommates. Athletic teams made up 75% of total clusters and were thus both the largest and the most frequent clusters. The most significant cluster recorded was composed of 53 positive cases and was responsible for a two-week pause of face-to-face instruction at the University. These 53 cases were traced back to two COVID-19 positive cases who attended three house parties.

All positive cases were isolated within 15 minutes to 30 minutes of receiving the test results, and a total of 9 contacts from cases one (FA20-01), two (FA20-02) and three (FA20-03) were quarantined within two hours. Positive test results and contact tracing for case four (FA20 04) and five (FA20-05) identified a major COVID-19 cluster. These two cases proved to be "*ground zero*" for a super spreader event (Table 2). Cases four and five moved into off campus housing one week prior to the start of the fall 2020 semester and hosted an "*ice-breaker*" and attended three large house parties over a two-day period. Contact tracing identified over 150 contacts. Upon investigation, it was discovered that 100% of all contacts reported not wearing masks or following social distancing guidelines and sharing food and drink while attending such events. Due to the lack of students following CDC COVID-19 Guidelines, all contacts were invited, but not required, to be tested with results reported in (Table 2).

Population	Tests Completed	Positive Tests	Positivity Rate (%)
Students	131	29	22.1

Table 2: Super Spreader PCR Testing Results.

These results combined with pre-semester testing results produced a 4.5% overall positivity rate at the University. The University administration instituted a 14-day F2F instruction pause due to the escalation of overall positivity rate toward the CDC's 5% standard for "HIGH" positivity rate of infection. Additional testing of these contacts produced another 5 positive COVID-19 cases, adding to the cumulative positivity rate at 4.9%. Contact tracing produced an additional 10 cases. The University reached a 5.6% positivity rate that was created by cases FA20-04 and FA20-05, illustrated in Figure 1.

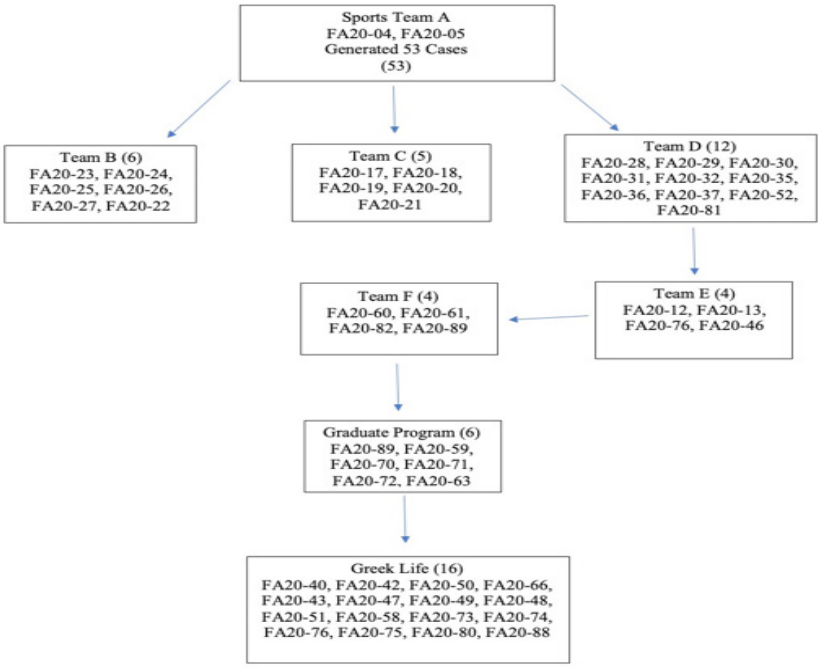

Figure 1: Illustration of Super Spreader Event during the fall 2020 Semester.

A, B, C, D, E. and F as a way to protect privacy. FA20-## represents the fall 2020 semester and the following numbers are the positive case's assigned unique identifier. In the beginning of the fall 2020 semester, sports team a generated two positive cases by hosting an in person gathering at an off-campus apartment. Through case investigation and rigorous contact tracing, it was discovered that sports team a spread the virus to sports teams B, C, D, E, and F through a string of house parties. Positive cases who attended these house parties amongst the sports teams listed further spread the virus to a small graduate program that meets regularly for clinical. Positive cases in the graduate program had contact with individuals in Greek life and created another cluster in the sororities and fraternities on campus. Case investigation and contact tracing made it possible to track the movement of the virus amongst the listed populations illustrated in Figure 1. It was found that cases FA20-04 and FA20-05 were primarily responsible for the super spreader event that generated a total of 53 positive COVID-19 cases.

The University's reopening plan included PCR nasopharyngeal testing of students, faculty, and staff and a comprehensive CDC-guided plan for COVID 19 mitigation. PCR nasopharyngeal test results after the F2F instructional mode pause are reported in (Table 3).

Population	Tests Completed	Positive Tests	Positivity Rate (%)
Students	721	17	2.3
Faculty/Staff	10	0	0
Overall	731	17	2.3

Table 3: PCR Testing Results of LHU students, faculty and staff on September 16 and 17, 2020.

Similar to earlier semester COVID-19 cases, strict protocol and opportunity for isolation of cases and quarantine of contacts was implemented. Students in isolation and quarantine were provided immediate options for housing including meals. Bi-weekly random asymptomatic testing was implemented and produced an average 1.1% positivity rate. From October 17-October 27, the University enjoyed a zero active positivity rate. On October 27th two new COVID-19 cases were reported by the University health center which conducts symptomatic testing. For the remainder of the fall 2020 semester, the active positivity rate varied between 0.16% and 1.2% [3].

Fifty-nine percent of the University's positive COVID-19 cases reported symptoms. The most common symptom reported was muscle pain (48%). The next most frequently reported symptoms were dry cough (42%), loss of taste and smell (40%), and fever (13%). Another symptom frequently identified was headache. These signs and symptoms are consistent with those listed by the Centers for Disease Control and Prevention. The gender breakdown for positive cases was 56% female and 44% male [4]. Asymptomatic test positivity rate was 1.36% while symptomatic test positivity rate was 32.9%.

The University's 15% F2F instruction ended on November 24th and remote instruction was implemented for the remaining two weeks of the semester. Students moved into virtual learning the week prior to finals and the week of finals to mitigate the possibility of family-related COVID-19 spread over the Thanksgiving holiday. The fall 2020 semester ended on December 13th. During the two weeks where the majority of students were absent from campus, nine positive COVID-19 cases emerged. Eight of the nine positive cases identified during this time period were University staff. These additional nine positive cases are not included in the results. The University ended with a total of 124 positive COVID-19 cases [5].

Discussion

Throughout the duration of the semester a number of trends were identified. Students in a collegiate population have a tendency to purposely or unconsciously omit key information when talking to a contact tracer. There were several instances where the tracers of this University were given misleading information regarding a case's whereabouts or close contacts. Although this was infrequent, the outcomes of not having accurate information to trace close contacts reduced the effectiveness of interrupting the viral spread. It was found that 95% of students who were offered options for quarantine or isolation housing refused to take advantage of the opportunity.

Another theme that was identified was students who are in close-knit groups have formed clusters of the virus. Many of the sports teams, students in the same specialized graduate programs that included clinical experience, or those in Greek life were found spending significant time together, lead to rapid transmission of COVID-19 in these select populations.

As the semester progressed tracers discovered that students were more forthcoming with accurate information. Students began to develop a keen sense of community and provided comprehensive and thoughtful information to tracers concerning contacts and activities that may have led to their COVID-19 infection. Students who tested positive with COVID-19 increasingly took responsibility for isolation to reduce the likelihood of infection among their peers, family and community members. Students often were disappointed and expressed being depressed about remaining isolated or quarantined in their apartment and not seeing friends. President of the National Association of Independent Colleges and Universities, Dr. Barbara Mistick states, "Small school's camaraderie is often stoked by a specific set or moral principles. The shared sense of purpose may make it easier for smaller schools to get students to comply with university policy such as mask wearing and social distancing." This theory was realized at the University during the fall 2020 15% F2F instruction. Many students expressed guilt and felt responsible for others needing to quarantine, which further demonstrates the benefit of a close-knit bond found at smaller campuses. There were no positive COVID-19 cases identified for students in on-campus housing.

It was quickly discovered that immediate contact tracing and the isolation of positive cases is key to mitigating the infection of SARS-CoV-2 on this university campus. Through extensive and immediate case investigation and contact tracing, the University was able to complete the fall 2020 semester with a 0.17% active positivity rate and an overall cumulative positivity rate of 4.9%. Although only 5% of University students took advantage of the opportunity, immediate housing and food opportunities were provided to students who contracted COVID-19 was critical and assisted in controlling the spread of the virus in populations with potential to become super spreaders. Events and factors that continue to challenge the University's ability to control the virus include off campus gatherings, household spread and some student's reluctance to follow safety guidelines set forth by CDC and Pennsylvania Department of Health (DOH). The most critical lesson learned was that the more aggressive the mitigation the lower the pandemic severity. In conclusion, possibly the most telling statement came from a 19-year-old freshman who was disappointed when the University announced the canceling of Spring Break 2021. She commented, "I lost my senior year in high school, I'm losing my freshman year in college. I am so exhausted and depressed by COVID and I just don't see an end in sight!"

COVID-19 will be a defining moment in the lives of Generation Z's most transformative years. As defined by Pew Research Center, this generation was born from 1997 onward

and in 2020 are ages 23 years and under. Generation Z's are known for their openness in addressing emotional and mental health concerns which may be a critical tool as they confront the disruptions and unpredictability of COVID-19 and the challenges of a post-pandemic life [5]. COVID-19 will undoubtedly have grave implications on Generations Z's academic performance, professional development, mental health and overall well-being [3]. Although vaccines and therapeutic cures will ultimately control this virus, a public health strategy that combines disease surveillance, testing, contact tracing, isolation and quarantine will reduce infections and allow for universities to conduct F2F instruction while protecting their students/faculty/staff and our communities. We are in the infancy of learning all the lessons COVID-19 has to offer, but we will take the education we received from this virus in fall 2020 and move forward with actions rooted in evidence [4]. Although often disappointed and discouraged, in the end students at this University demonstrated remarkable self-control, discipline and sacrifice to allow for the completion of 15% F2F instruction in fall 2020 semester in the midst of a global pandemic.

Policy Implications

The results of this study support the critical need to employ contact tracers that are integrated within the population, available to take prompt action, able to prioritize as multiple investigations are conducted simultaneously, and possess attention to detail and data management. Due to the many misconceptions surrounding COVID-19 and upcoming vaccinations, educators and public health professionals should continue to promote behavioral-based prevention, provide accurate education, address misinformation, and have appropriate personnel conduct immediate case investigation and contact tracing. The discoveries in this study are encouraging given the potential rate of transmission of COVID-19 on university campuses.

Declarations

All authors contributed to the study conception, design, and data analysis. McCartney Register is the lead author and primary editor of this manuscript. She completed the results section of the manuscript and constructed the tables. Payton Bell completed the abstract and introduction. Beth McMahon, Ph.D., completed the methods section. Madison Dura and Beth McMahon, Ph.D., completed the discussion section. Madison Dura completed the references section. Sherry Moore was responsible for the management of the University's COVID-19 database.

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