An Academic–Health Department Community Partnership to Expand Disease Investigation and Contact Tracing Capacity and Efficiency During the COVID-19 Pandemic

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ABSTRACT

Disease investigation and contact tracing are long-standing public health strategies used to control the spread of infectious disease. Throughout the COVID-19 pandemic, health departments across the country have lacked the internal workforce capacity and technology needed to efficiently isolate positive cases and quarantine close contacts to slow the spread of SARS-CoV-2. This article describes an innovative disease investigation and contact tracing program developed through a formalized community partnership between a local county health department and local university. This innovative new program added 108 contact tracers to the county’s public health workforce, as well as enabled these contact tracers to work remotely using a call center app and secure cloud-based platform to manage the county’s caseload of cases and contacts. An overview of the requirements needed to develop this program (eg, hiring, health data security protocols, data source management), as well as lessons learned is discussed.

KEY WORDS: community partnerships, contact tracing, COVID-19, health departments

Disease investigation and contact tracing are long-standing public health strategies used to control the spread of infectious disease in communities.1 Specific to the COVID-19 pandemic, disease investigation refers to notifying individuals diagnosed with SARS-CoV-2 of their disease status, isolating them for 10 days, and obtaining a list of contacts they were around for 15 minutes at a distance closer than 6 ft during their infectious period. Next, contact tracing is initiated, where identified close contacts are interviewed for symptoms and asked to quarantine for up to 14 days. In the past, infectious diseases such as tuberculosis were typically investigated and traced by disease intervention specialists employed by health departments; however, at the rate SARS-CoV-2 spreads from person to person, already underfunded health departments are unlikely to have the staffing capacity to keep up with disease investigation/contact tracing needs.1 Recent estimates suggest that up to 30 professionals conducting disease investigation and contact tracing full time per 100,000 population are needed to sufficiently address the influx of SARS-CoV-2 cases in communities across the nation.2
Successful disease investigation and contact tracing result in isolating cases and quarantining close contacts to slow the spread of disease; however, several barriers exist along the way such as the inability to reach cases, an incomplete list of close contacts, or participation refusals. Concerns about privacy or governmental overreach, as well as fear of scams associated with unknown phone numbers, may contribute to a lack of public participation in these control measures. Even if unable to reach all cases and all contacts, statistical modeling suggests that even reaching 50% of those experiencing symptoms of COVID-19 could substantially reduce the need for community distancing policies. Increasing disease investigation and contact tracing efforts were listed as a federal guideline for reopening the country in spring 2020. The purpose of this article is to highlight the partnership between local public health and academia to develop an innovative disease investigation and contact tracing program to slow the spread of SARS-CoV-2 in a community.

**Academic–Health Department Partnership**

The literature suggests that partnerships between academia and the community increase evidence-based practices and decision making. The academic–health department partnership described in this article began prior to the pandemic, when the Butler County, Ohio, local health commissioner became a member of Miami University’s public health program advisory board in 2018 and a memorandum of understanding between the local health department and the university was established in 2019. Having this formalized community partnership in place prior to the COVID-19 pandemic was essential for local public health practice efforts during the pandemic. In March 2020, the local health department was able to call upon the university for external workforce capacity to support the county’s efforts to secure housing for members of vulnerable populations who may lack a safe place to isolate or quarantine. In early May 2020, as the number of cases began to rise, the health department started a volunteer program for contact tracing and the university provided student volunteers for this program. In the summer of 2020, Butler County General Health District obtained funding from the state department of health for contact tracing and contracted with Miami University to provide contact tracing services on the county’s behalf.

**Disease Investigation and Contact Tracing Efforts**

**Preinnovation**

During the early months of the pandemic, the health department followed its standard process for controlling infectious diseases and utilized its own staff for disease investigation and contact tracing. In late spring 2020, when case numbers started to increase, the health department added volunteers to its disease investigation and contact tracing workforce and a single staff person managed all volunteers. Because of volunteer availability, the contact tracing schedule varied from day-to-day. Volunteers would call cases using personal or Google Voice phone numbers, obtain close contacts, complete 4 different fillable data collection forms, and develop quarantine/isolation letters that would be sent back to the health department daily via secure email. While this standard approach to disease investigation and contact tracing was manageable with a limited number of cases, as the county’s case numbers rose, it became more challenging to manage the growing caseload to successfully isolate/quarantine residents. Additional workforce capacity was needed. The Table provides an overview of the disease investigation/contact tracing processes preinnovation and as part of the innovative academic–health department partnership.

**Innovation: Disease investigation and contact tracing program**

As cases began to rise and with state funding to expand contact tracing efforts, the local health department and the university quickly worked together over the summer of 2020 to establish a new process for disease investigation and contact tracing efforts in the county. The disease investigation and contact tracing program is an ongoing collaboration between the university and health department; however, only data from August 24 (the official program launch date) to December 31, 2020, will be provided in this article. During this time period, a total of 54,208 calls were handled (n = 47,485 outgoing calls; n = 6,723 incoming calls) and 13,553 cases/contacts were processed by the contact tracing team. In December 2020, the contact tracing team began tracking the call status of each assigned case, and 69.2% were reached, 25.2% of cases could not be reached after 3 call attempts, 3.9% of residents refused to participate, and 1.8% were transferred to another jurisdiction.

The university’s team comprised undergraduate contact tracers, graduate student supervisors, a consultant, and project investigators; the health department’s contact tracing team was the accreditation coordinator (serving in the role of contact tracing liaison), the epidemiologist, and the health commissioner (as needed). Each day the health department’s contact tracing liaison would provide the university with a list of case names to call; these cases and their close contacts were then called by contact tracers that same day. Graduate students worked as shift supervisors.
| Process                | Preinnovation                                                                 | Innovation                                                                 | Outcome                                                                 |
|------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Hiring/training        | A single health department staff member was responsible for hiring all       | A full hiring process was completed for each applicant (e.g., cover letter, | The university become responsible for hiring/training all contact      |
|                        | volunteers and ensuring that training was completed.                         | resume, interview, reference checks). University’s human resources         | tracers. Funding allowed for contact tracers to move from volunteers to  |
|                        |                                                                              | department processed all applications.                                      | paid employees.                                                        |
|                        |                                                                              | Training was completed via the university’s online learning platform.       |                                                                         |
| Daily operations       | Volunteers conducted disease investigation/contact tracing interviews when   | Standardized schedule: M-F: 9 AM to 8 PM; Saturday: 10 AM to 5 PM; Sunday: | The standardized schedule allowed for disease investigation/contact     |
|                        | available (not on Sundays); no consistent schedule.                          | 12 PM to 5 PM.                                                              | tracing to be conducted on weekends, which reduced delays in time to     |
|                        | Contact tracer questions were answered by 1 health department staff person,   | Contact tracer questions were addressed by a graduate student supervisor   | isolation/quarantine.                                                  |
|                        | which resulted in delays. Individual volunteers were assigned 3 to 5 cases    | via secure chat.                                                           | Contact tracer questions were addressed in real time; any questions that |
|                        | per day; incomplete case/contact assignments were given back to the          | List of urgent concerns created for health department to address issues/   | required health department intervention were added to an urgent concerns  |
|                        | health department to be addressed the next day.                              | concerns in real time.                                                     | document that health department staff could access in real time via the |
|                        |                                                                              | A daily log, updated in real time, was used to create a running list of    | secure cloud.                                                          |
|                        |                                                                              | all close contacts, as well as track all call attempts and the interview   | The need to transfer cases to a new contact tracer was eliminated with   |
|                        |                                                                              | status of all cases/contacts. All cases were uploaded to the daily log     | the creation of a daily log that updates in real time and allows for     |
|                        |                                                                              | each morning.                                                              | collaboration among contact tracers working remotely.                   |
| Phone calls            | Individual phone numbers (e.g., Google Voice, cell phones) were used by      | A remote call center was created with a single phone number used for all   | Community members became familiar with the phone number used for disease |
|                        | volunteers to place outgoing calls.                                          | outgoing/incoming calls.                                                   | investigation/contact tracing in the county. Call backs could be        |
|                        |                                                                              |                                                                              | answered by the next available contact tracer. Contact tracers did not  |
|                        |                                                                              |                                                                              | receive calls after their shifts were over.                            |
| Interviewing and data  | Four separate fillable Word/PDF/Excel forms were used to collect information. | A single, electronic survey containing all required questions and an       | Data obtained through interviews now stored in a single data source      |
| collection              | Separate forms were sent back to the health department via secure email by    | interview script was implemented and used by contact tracers for each     | (health department was no longer required to merge multiple forms from   |
|                        | each volunteer daily and data were merged into a single data source.         | interview. Health department had access to all collected data in real     | individual contact tracers into a single data source).                 |
|                        |                                                                              | time.                                                                     | A standardized interview script reduced call times so that more         |
|                        |                                                                              |                                                                              | interviews could be conducted per contact tracer per shift. Reduction   |
|                        |                                                                              |                                                                              | in missing data because the electronic survey form was programmed to    |
|                        |                                                                              |                                                                              | force responses to interview questions.                                 |
| Health information     | Health department’s secure email server was used to transfer sensitive health | Secure cloud-based platform used to share and store sensitive health       | Reduction in number of emails sent. Real-time collaboration becomes       |
| data security          | information (e.g., case assignments, answering contact tracer questions).    | information. Courtesy accounts established for health department staff to  | possible due to the secure cloud. Secure cloud eliminated the need for   |
|                        | Personal computers were used by volunteers and information was deleted       | reduce number of emails sent per day and to transfer files. Contact       | contact tracers to download files to personal computers.                |
|                        | nightly.                                                                     | tracers followed step-by-step guidelines to secure personal computers.    |                                                                         |
TABLE

| Process                  | Preinnovation                                                                 | Innovation                                                                                                                    | Outcome                                                                                   |
|--------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Quarantine/isolation letter | Volunteers would create individual letters for each case/contact and securely email to the health department. | Autocrat (Google add-on to mail merge) automatically created PDF isolation/quarantine letters that the health department could access via the secure cloud. | Contact tracers could spend more time placing calls to cases/contacts instead of making individualized quarantine/isolation letters. |

and would assign contact tracers to cases/contacts to call, would answer contact tracer questions, and bring any complex issues to the attention of the university’s project investigators, who would then directly communicate with the epidemiologist/liaison. Health department staff also worked with the university’s project consultant to ensure that community residents had resources, such as food and thermometers, to successfully isolate/quarantine. The university and health department brought different strengths to the partnership; the university had the workforce capacity and advanced IT infrastructure (described later), while the health department brought advanced knowledge of infectious diseases and changing public health guidelines. In general, the university handled the majority of the cases/contacts; however, if a situation was considered complex (eg, outbreaks, prior Covid-19 cases, legal issues), the university informed the health department of the situation and the health department either provided guidance on how the university could move forward or took over the case investigation depending on complexity. Regular communication between the health department staff and the project investigators was key to the program’s success.

Disease investigation and contact tracing were conducted every day of the week: Monday to Friday 9 AM to 8 PM, Saturdays 10 AM to 5 PM, and Sundays 12 PM to 5 PM. A total of 108 university students (n = 102 undergraduates; n = 6 graduates), referred to as contact tracers, each worked approximately 9 to 12 hours per week; by the end of December 2020, there were an average of 40 student contact tracers working per day. The average age of contact tracers was 20.5 ± 1.5 years, while the majority of contact tracers (n = 88, 81.5%) were female, White (n = 69, 63.9%), and university seniors (n = 58, 53.7%). A third (n = 36) of all contact tracers were public health majors and 16.7% (n = 17) were fluent in languages other than English. For detailed demographics of contact tracers, see Supplemental Digital Content Table 1, available at http://links.lww.com/JPHMP/A806. Compared with the community, the program’s contact tracers were slightly more diverse (eg, 9% Black in community vs 13% of contact tracers). It makes sense that the university population would not exactly mirror the community population because the university population comprised students across the state, country, and world. Details of the contact tracing innovation are described in the following sections.

Call center

As part of this innovation, the university’s IT Services department implemented a remote call center that allowed contact tracers to place outbound calls and receive incoming calls using the Cisco Jabber App from their personal computers. If one contact tracer was on the phone with a case or close contact, an incoming call from a community member would simply be routed to the next available contact tracer. Using a call center with a single phone number improved upon the previous process; community residents had a centralized number to call with their questions about quarantine/isolation and community residents were also made aware that the phone number was associated with the health department and not spam.

Real-time collaboration

Prior to the innovation, volunteer contact tracers received approximately 3 to 5 cases to call per day and were responsible for interviewing their assigned cases and the cases’ associated contacts. Challenges emerged from this process because often contact tracers could not complete all case/contact interviews during a single shift and there was no easy way for the next contact tracer to pick up where the last one left off. Also, when questions about unique situations emerged during an interview, there was often a delay in getting a response from the health department due to limited staff capacity.

To improve upon this system, a secure cloud-use program with a basic spreadsheet, referred to as the “daily log,” was used to keep track of progress in real time. The health department provided a daily spreadsheet of cases and then contact tracers were assigned to cases. Contact tracers would place close contacts obtained during disease investigation interviews on a separate tab in the daily log and any contact tracer could immediately follow up with a case’s close contacts. Each case and contact received
up to 3 phone calls to complete their interview, and all call attempts, completions, and refusals were recorded in the daily log. This real-time, cloud-based approach increased efficiency by allowing contact tracers to pick up where others had left off across work shifts, and it allowed for the creation of a running list of close contacts. Any cases or contacts left over from the day would be carried over to the next day’s daily log and called until 3 call attempts had been made. After 3 call attempts, cases were processed in the system as “could not reach” and removed from future daily logs. Delays in laboratory reporting to the health department occurred; however, call attempts were made to cases/contacts within 24 hours of receiving the name of a case/contact. Contact tracers also had access to a secure chat function to ask questions to graduate supervisors in real time, and this function allowed contact tracers to get their questions answered quickly and reduced the need to call back cases/contacts.

**Interviewing and data collection**

Contact tracers used a Google Forms survey, programmed with an interview script and all of the health department’s required questions (eg, symptom start date, last date of contact), to conduct all disease investigation and contact tracing interviews with community residents. To begin an interview, contact tracers simply needed to click on the Google Forms link, follow the script, and enter the community residents’ responses. Data collected from disease investigation and contact tracing interviews were stored in a single data source that the health department was able to securely access. This aspect of the innovation streamlined the previous process because all 4 of the health department’s fillable PDF/Word/Excel forms were integrated into a single survey with a single script and all contact tracers had to do was follow the script and enter the residents’ responses. Adding a script and integrating all fillable forms into a single Google Forms survey reduced interview time by approximately 5 to 7 minutes per phone call, which enabled contact tracers to increase the number of calls and interviews made per shift.

**Essential Requirements for Launching the Disease Investigation and Contact Tracing Program**

**Hiring process: Human resources and training**

While the technical components of the innovative program greatly enhanced the efficiency of daily operations, the disease investigation and contact tracing program would not be possible without man power. Because of the pressing need to hire a team of contact tracers in the midst of the pandemic, the university’s Human Resources department had to quickly process more than 100 applications to get contact tracers trained and working within a week’s time. All hired contact tracers completed 11 hours of online training including interviewing techniques and practice sessions, Health Insurance Portability and Accountability Act (HIPAA) certification, and training on using required technology (eg, call center, cloud-based system), in addition to completing the Johns Hopkins Contact Tracing for COVID-19 certification program.

**Ensuring health information data security**

Because of health and safety concerns associated with the pandemic, it was essential that contact tracers had the ability to work remotely. Because of limited funding, the project was unable to purchase laptops for each (100+) individual contact tracer, which meant that personal laptops needed to be used to allow for remote work. To address potential health data security concerns from using personal laptops for disease investigation and contact tracing, project investigators worked closely with the University’s chief information security officer to establish guidelines (eg, using strong and unique passwords, setting up full disk encryption, adding antivirus/antimalware, updating operating system) for securing personal devices. Contact tracers were provided training and followed step-by-step guidelines for securing their personal devices and signed an agreement indicating that they would adhere to these guidelines.

Securing personal devices was the first step but not the only requirement needed for protecting the sensitive health information collected through the contact tracing program. The university also needed a secure method for collecting, processing, and storing data, as well as collaborating in real time. The health department directed that all parties shall comply with requirements established by the HIPAA Standards for Privacy of Individually Identifiable Health Information (Privacy Rule 45 CFR Part 160 and Subparts A and E of Part 164) regarding safeguarding and protecting individually identifiable health information referred to as protected health information. Thus, the University entered into a business associate agreement with Google LLC, which enabled the contact tracing team to utilize Google services (eg, sheets, forms, docs, chat) to share, disclose, create, or use protected health information securely.

The university also needed a secure way to share data collected from case and contact interviews with the health department. To do this, the university created courtesy accounts for health department staff, which enabled health department staff to log into the
university’s Google platform and access data in real time. Granting health department staff access to the university’s Google platform significantly reduced the number of emails containing sensitive data sent by the health department daily.

While ensuring that basic security practices were in place, the university also established a process for logging and investigating any potential data breaches associated with the contact tracing program. Protecting the security of protected health information is important not only in safeguarding the privacy and confidentiality of patient medical information but also guarded by HIPAA rules and compliance oversight. The HIPAA violations (eg, failure to enter into a HIPAA-compliant business associate agreement, failure to use encryption on portable devices, leaving portable devices unattended) may result in fines of up to $50,000 per violation.8

Data collection and data source management

To increase the efficiency of disease investigation and contact tracing efforts in the county, a shift from multiple fillable PDF/Word/Excel forms to a single electronic data entry form with a centralized data source was essential. Project investigators recognized this need early on and developed a single interview script and combined the multiple forms used by the health department into a single Qualtrics survey. However, due to the university’s licensing agreement with Qualtrics, it was determined that Qualtrics could not be used to provide services on behalf of another institution. Therefore, with less than 2 weeks before project launch, the university’s IT Services department pivoted to a new data collection platform, completed the business associate agreement with Google LLC, and integrated the multiple forms and interview script into a single Google Forms survey.

Integrating the forms into a single scripted survey allowed for quicker case and contact interviews and it eliminated the need for the contact tracer to switch back and forth between multiple forms; however, it did not solve the issue of the health department’s requirement that data be presented in specific formats. The university’s IT Services department transformed and loaded the data collected from case and contact interviews to automatically appear in the format of the original fillable forms. Without this initial load on the back end, an efficient contact tracing program would not be possible because of the health department’s need for data to be presented in a particular way in order to be used in epidemiology reports or shared with the state. In addition to formatting the data, the university’s IT Services department also enabled the use of AutoCrat (a Google add-on for mail merge) to automate the generation of quarantine and isolation letters for community residents. The support of the university’s IT Services department was essential for maintaining the contact tracing program and ensuring that any technical glitches or enhancements (eg, too much data in a particular spreadsheet slowing the system down, issues with Google services, format changes) experienced along the way were resolved so that the health department could receive information in a timely manner.

Lessons Learned

Through this project, 4 key lessons about contact tracing program implementation and academic–health department partnerships were learned.

1. Increased efficiency may lead to increased public health workforce needs. The first lesson is that increased disease investigation/contact tracing workforce capacity and efficiency may lead to increased workloads for already understaffed and underfunded health departments. Prior to the innovation, approximately 25 to 30 cases and associated contacts were processed daily and postinnovation up to 400 cases/contacts could be processed daily leading to increased workloads (eg, data entry into larger reporting systems, follow-up from advanced disease investigation specialists for complex situations) for health department staff on the back end. It is important for policy makers to consider that increased funding for one public health need (eg, contact tracing) results in a higher throughput of cases/contacts, which in turn leads to an increased need for additional staffing resources in order to keep up with workloads.

2. University students are an untapped source of man power than can increase public health workforce capacity. Through this program, a total of 108 university students gained paid, real-world work experience and transferable skills that will help them become more well-rounded when they enter the workforce or attend graduate or professional school. Contact tracers obtained interviewing and data collection skills and gained experience working with community residents from diverse racial, cultural, socioeconomic, and political backgrounds. Specifically, this program provided students with the opportunity to obtain public health workforce and educational competencies (eg, communication, cultural competence, leadership, and systems thinking) outlined by the Council on Linkages Between Academic and Public Health Practice
and by the Council on Education for Public Health.

3. **Planning is essential to successful operations but may lead to delays.** Thoughtful planning and collaboration between the health department and the University’s project investigators and IT Services department were essential to the contact tracing program’s success. While this comprehensive planning was needed to ensure data security and data delivery, it delayed the official launch date of the contact tracing program. Under normal circumstances, the time taken to carefully plan operations would be expected; however, any delayed start during the pandemic was a challenge for the health department, which quickly needed additional workforce capacity to isolate and quarantine the growing number of cases and contacts in the community.

4. **Adaptability during a pandemic is essential for a successful academic–health department partnership.** Perhaps the most important lesson learned was that adaptability is essential to moving public health forward in the midst of a pandemic. On the public health side, when the Centers for Disease Control and Prevention changed guidelines (eg, close contact definition, recommended quarantine dates) or when the health department switched from contact tracing all contacts to only high-risk contacts due to rising case numbers, the academic side of the partnership was also impacted. University project investigators had to learn these new guidelines, reprogram the data collection forms, rewrite the interview script, and then retrain 100+ contact tracers on any new process. Contact tracers also needed time to adapt to new processes and successfully implement changes into practice.

**Conclusion**

The contact tracing innovation described in this article highlights how formalized academic–health department partnerships can increase efficiency and public health workforce capacity. As a result of this partnership, contact tracing capacity for the community more than doubled, a greater number of community residents were able to be successfully quarantined and isolated to slow the spread of SARS-CoV-2, and more than 100 university students obtained public health workforce competencies. We know that contact tracing alone cannot stop the spread of the disease; however, it is an essential component of communicable disease control alongside other methods such as social distancing, masking, and increased vaccine uptake. While this academic–health department partnership increased workforce capacity during the pandemic, reinforcing mutually beneficial partnerships between local public health and universities should continue for other public health issues in the future.

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**Implications for Policy & Practice**

- Digital technology increases the efficiency and security of disease investigation and contact tracing efforts; local health departments need additional funding to update existing technologies appropriately.

- University students can increase public health workforce capacity, while learning applied public health skills and competencies to help them become more effective public health practitioners.

- When contracting with academic institutions to deliver services on behalf of public health, it is essential that academic institutions adopt and implement proper protocols well in advance of program execution to ensure the security of sensitive health information and that deliverables meet the health department’s needs.

- It is important for policy makers to consider that increased funding for one public health need (eg, contact tracing) may result in additional staffing needs for public health due to increased workloads for local health departments.