# **Comprehensive Monitoring Team Initial Report:** Oct. 22, 2020

## The Work to Date

The Ohio State University Comprehensive Monitoring Team (CMT) began its work on Aug. 10, 2020. The CMT is a subset of the Safe Campus and Scientific Advisory subgroup, which conducted its work to help structure a safe campus environment during the pandemic from March through the summer. CMT membership is based on specific but broad expertise (Table 1). It is composed of recognized leaders in infectious diseases, infectious disease epidemiology, data analytics, mathematics, public health, systems engineering, public policy, law and ethics, library sciences, and communications. Members of the group regularly consult with other leaders in their field as needed, and work in collaboration with university leadership, including Ohio State's legal team. Two members also sit on the Ohio Department of Health (ODH) CMT. Other members of the OSU CMT also collaborate closely with local public health authorities, particularly leveraging expertise from Columbus Public Health.

**Table 1:** CMT Membership

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| Amy Lauren Fairchild, PhD, MPH – Dean, College of Public Health |
| Jose Bazan, DO – Associate Professor, Division of Infectious Diseases and Medical Director, Sexual Health Clinic, Columbus Public Health |
| Tanya Berger-Wolf, PhD – Faculty Director, Translational Data Analytics Institute, Professor, Computer Science and Engineering, Electrical and Computer Engineering, College of Engineering, and Professor, Evolution, Ecology, and Organismal Biology, College of Arts and Sciences |
| Misti Crane, MPH – Director, Strategic Communications and Marketing, College of Public Health |
| Susan L. Koletar, MD, FACP, FIDSA – Professor, Internal Medicine, Director, Division of Infectious Diseases |
| Ryan Lovell, Interim Dean of Students, Interim Assistant Vice President, Senior Director of Parent and Family Relations, Office of Student Life |
| Samuel Malloy, Research Scientist, Battelle Center for Science, Engineering, and Public Policy, John Glenn College of Public Affairs |
| William Miller, MD, PhD, MPH – Senior Associate Dean for Research and Professor, Epidemiology, College of Public Health |
| Michael Oglesbee, DVM, PhD – Director, Infectious Diseases Institute and Professor of Virology, College of Veterinary Medicine |
| Efthimios Parasidis, JD, MBE – Professor, College of Law and Professor, College of Public Health |
| Mikkel Quam, PhD, MScIH, Assistant Professor – Practice, Epidemiology, College of Public Health, Case Investigation and Contact Tracing Team |
| Michael Rayo, PhD – Assistant Professor, Integrated Systems Engineering, College of Engineering |
| Stacey Renker, Director, Risk and Emergency Management, Office of Student Life |
| Stephanie Schulte, MLIS – Associate Professor and Assistant Director, Research and Education, Health Sciences Library |
| Joseph Tien, PhD – Associate Professor, Mathematics, College of Arts and Sciences and Associate Professor, Epidemiology, College of Public Health |
| Lisa Van Dyke, MBA – Business Intelligence Analyst, College of Public Health |

Since Aug. 10, the CMT has met daily Monday through Friday, and weekends as needed. The CMT is supported by data analytics, epidemiology, and literature search teams. Data to support the monitoring effort are drawn from several campus sources. The CMT directs analyses that help us assess patterns, trends, and emerging concerns on and around the Columbus campus, as well as each regional campus. CMT reviews and assesses policies and procedures of the Case Investigation and Contact Tracing Team (CICTT), which conducts case investigations, contact tracing, isolation and quarantine.

The CMT also directs and reviews predictive modeling, as discussed below. The CMT is also represented in multiple groups responsible for addressing concerns, linking their data-driven analyses with university-wide and community responses and contributing to the decision-making around responses that decrease individual risk and reduce infection spread throughout our campuses and surrounding communities.

Members of the Ohio State CMT also support the ODH CMT, providing opportunities for information sharing and for the rapid contextualization of data seen by either team. This relationship is particularly important for Ohio State's regional campuses, which exist in communities experiencing disease environments that are dynamic and distinct from the Columbus campus. This relationship has also allowed ODH to better understand the COVID-19 situation in counties where Ohio State's presence and testing program could alter the perception of what is happening among county residents not affiliated with the university.

**Patterns and Trends**

The university is currently conducting four kinds of COVID-19 testing. All are based on polymerase chain reactions (PCR) that detect genetic material from SARS-CoV-2, the virus that causes COVID-19.

- Weekly routine screening of *all* (mostly undergraduate) students living on our Columbus, Mansfield, Newark, and Wooster campuses (referred to as on-campus student screening). These data, looking at prevalence among asymptomatic people, give us the best insight into whether transmission on campus is increasing, plateauing, or slowing. This testing approach also helps to ensure that we identify and isolate nearly all cases and quarantine close contacts in a timely manner. It serves as both a monitoring tool and a powerful part of our core mitigation strategy. Routine screening began on Aug. 17. These tests are currently performed by a commercial entity (Vault Health®) using saliva samples.
- Clinical diagnostic testing at the Wilce Student Health Center (referred to as student health clinical diagnostic testing) for students who are symptomatic or close contacts of known cases. This population includes students living on and off campus. These tests are performed on campus using nasopharyngeal swab samples. We expect infection rates in this category to be higher than with routine screening if the monitoring team is accurately identifying clusters and the Case Investigation and Contact Tracing Team is accurately identifying close contacts.
- Weekly random testing (accompanied at times with focused testing of certain populations) of asymptomatic undergraduate students living off campus in Columbus (referred to as off-campus undergraduate screening) began the week of Sept. 7. Tests are performed by Vault Health® using saliva samples. Although students who test positive are isolated and

their close contacts are quarantined, this testing is not primarily about mitigation. Rather, because the population is large, it gives reliable insight into patterns and trends off campus that can then inform other mitigation strategies.

- A random sample of 1,500 graduate and professional students was added to the weekly Columbus campus screening testing on the week of Sept. 21.
- Voluntary pilot testing of asymptomatic staff, graduate students, and faculty using nasopharyngeal swab samples was made available the week of Sept. 14.

After testing began, we anticipated an initial rise in the number of students with positive tests, but the strategy of frequent testing, isolation, quarantine, masking, distancing, and limits on class and gathering size in an overall de-densified context has been successful in reducing infection rates for undergraduate students living on and off campus. Among graduate and professional students in the program, rates have been low but testing has been limited. Most cases have remained asymptomatic. **Our analyses underscore the value and power of having a complete dataset. It is possible to drive infection down with an infusion of determined university leadership, resources, and effort through close monitoring and focused intervention.**

Infection rates for all students, including those who have received a diagnostic test result through the Student Health Center or the Wexner Medical Center, are presented on the Safe and Healthy Buckeyes dashboard. Results shown in Figures 1 and 2 separate on-campus student screening from student health clinical diagnostic testing. Both figures show data for on- and off-campus student populations.

**Figure 1:** Seven-day rolling average of asymptomatic testing of students living on campus (red) and off campus (blue). On-campus students are tested weekly. Off-campus students are included in a weekly random sample. Specific off-campus groups may be included in directed testing in response to observed patterns of infection.

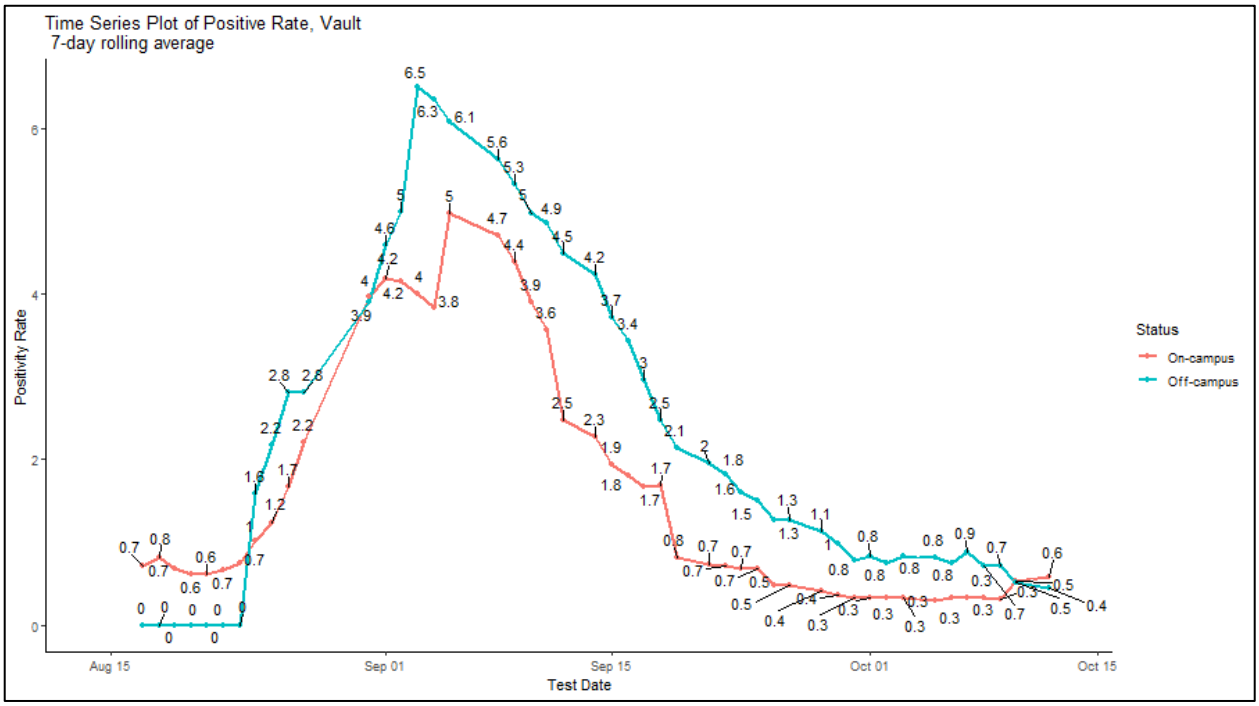
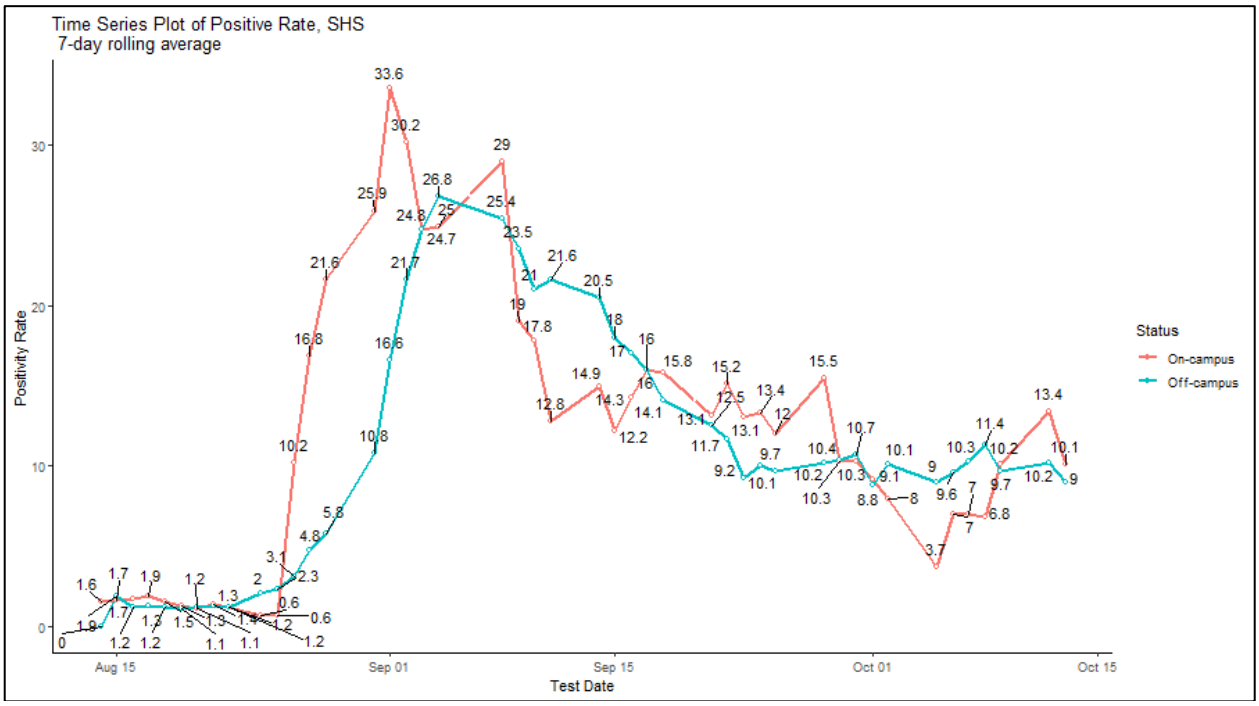


**Figure 2:** Seven-day rolling average of positivity rate for testing of students on campus (red) and off campus (blue) performed at student health services. These tests include students who seek tests because of symptoms and students who are referred because of close contact with a known case. The positivity rate is expected to be much higher than the positivity rate in Figure 1.




Off-campus rates remain higher than on-campus rates. The university testing program for students living off campus is currently a random sample of 8,000 tests per week. This limits the potential of testing as part of a broader mitigation strategy. The university also has less control over isolation and quarantine conditions and monitoring off campus.

### Effective Reproduction Number over Time or $R_t$

The reproduction number (R) is an epidemiological measure of the potential for ongoing transmission. R is the average number of people to whom a single person passes the infection. For example, if R is 2, then each person with an infection would infect two other people, *on average*. When R is greater than or equal to 2, the epidemic would expand quickly. When R is 1, the epidemic would be at a plateau. And when R is less than 1, the epidemic would be slowing.

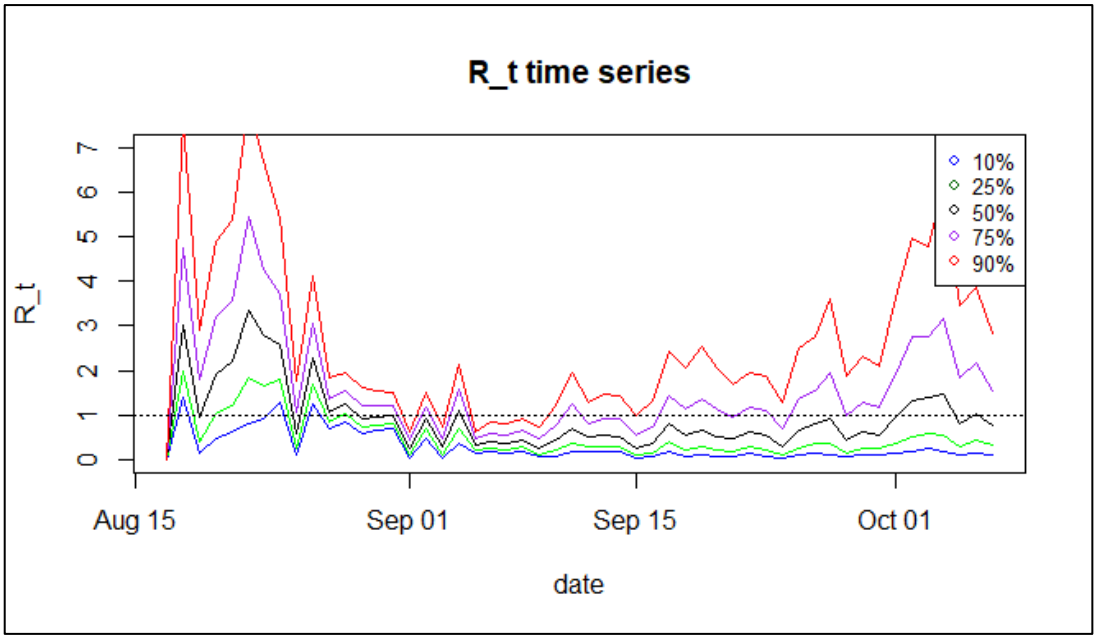
The value of R depends on how infectious the virus is, how long infections last, how much contact people have and how susceptible the population is to infection. The version we present is referred to as $R_t$, the reproduction number over time, which takes into account the number of people who remain susceptible to infection with time. $R_0$, or "R-naught," is used in other settings and is the reproduction number in an entirely susceptible population.

The trend in $R_t$ mirrors what we have found in both the numbers of cases over time and in positivity. $R_t$ has remained stable, typically falling below 1, starting Sept. 12, which means that

transmission on campus continues to slow (Figure 3). Note that when positivity is very low, random fluctuations in the data may result in inaccurate $R_t$ estimates.

There are other limitations to the model, in particular the fact that it does not account for mixing between the off-campus and on-campus populations. Steady, low-level infections brought in from outside campus could make $R_t$ appear to be around 1, despite there being little transmission within the residential undergraduate community. For these reasons we recommend caution when interpreting $R_t$ estimates when prevalence is low.

**Figure 3:** Time series plot of the reproduction number over time estimated from the on-campus undergraduate testing program time-series data. The median is indicated by the black line. The colored lines indicate the percentiles.




### Clusters and Modes of Transmission among Students

As a result of both routine screening and off-campus sampling, the team identified clusters associated with certain types of congregate housing (both on and off campus) that have had an impact on case numbers and campus transmission. Mitigation included focused testing combined with isolation and quarantine strategies. CMT worked with Columbus Public Health to develop best-practice isolation, quarantine, and testing guidelines for outbreaks in congregate housing situations.

CMT is leveraging a variety of resources to monitor cases and transmission. For example, the modeling group is completing an analysis of transmission risks among students within residence hall rooms, in residence hall suites, on residence hall floors, and in face-to-face classrooms. We plan to share these results in our next report.

## The Work Moving Forward

Although the CMT remains cautiously optimistic considering reductions in case numbers, reductions in the positivity rate for the routine screening program, and a trend that includes R(t)

< 1, containing transmission requires continual adherence to the many layers of protection required of all students, faculty, and staff. We monitor emerging trends including the potential impact of a return to fall sports and other events with the potential to erode adherence to masking, distancing, hygiene, and density measures known to prevent transmission. We also know that shorter, colder days will push people inside and that subsequent indoor gatherings large and small could drive increased transmission. Also concerning are increasing anecdotal reports of growing complacency about safety measures including masking and physical distancing.

**Vulnerable populations**

CMT, in collaboration with the Ohio Department of Health and Columbus Public Health, is investigating the potential impact on vulnerable populations in areas surrounding the Columbus campus. The state has automated capacity to flag instances of unexpected increases in positivity in low opportunity census tracts (as defined by the Ohio Opportunity Index). Thirteen census tracts that meet the criteria of "lowest opportunity quintile" and "highest population adjusted case rate quintile" are in Franklin County. Several have shifted into flagged status in the last few weeks. We are particularly concerned with a potential clustering in the Northland area of Columbus. We need to continue to monitor the potential impact of Ohio State in the surrounding communities.

**Expansion of monitoring of regional campuses**

Although most of the CMT's work in August and September focused on the Columbus campus, an increasing amount of the team's efforts will be focused on regional campuses. Regular monitoring of each campus's home and neighboring counties has begun. Direct connections are being made to regional leadership to more quickly disseminate information related to elevated concerns. For example, because there is evidence of community transmission associated with an outbreak in a correctional facility, the university immediately expanded testing on the Mansfield campus. CMT continues to monitor ODH data in Richland on a daily basis. We are doing the same for Marion County, where we are also seeing evidence of community transmission associated with a correctional facility outbreak.

**Wastewater Surveillance**

Ohio State's wastewater sampling strategy captures the major student residences on campus. Samples are collected weekly from six sites. We have begun to overlay results of wastewater and individual testing for students in these residence halls (Figure 4). Wastewater testing offers the advantage of detecting the dynamics of infection in a population. While screening tests are an active approach, wastewater testing represents a parallel passive approach that offers a floodwall in the event of major testing issues. It also offers a way of continuously performing a quality control of the active screening effort and provides a path to transition to a program with less testing or a different testing protocol when this is desirable. Consider the following:

- The sensitivity of wastewater testing is such that spikes in evidence of infection spread have been shown to precede outbreaks of clinically diagnosed infections by up to a week.
- Wastewater testing provides a stopgap for unknowns in the current testing regimen, including the possibility that several students in the same residence hall receive false-negative test results. The approach could be expanded to survey off-campus student residential areas, and the technology could be offered as a service where surveillance of asymptomatic individuals is not possible.

**Figure 4:** Cumulative case counts (red line) in the residence halls in the south campus wastewater catchment area are plotted against levels of virus contained in wastewater (aqua dots). Note that numbers of infections are cumulative and plotted on a linear scale, whereas the five wastewater signals are plotted on a log scale.

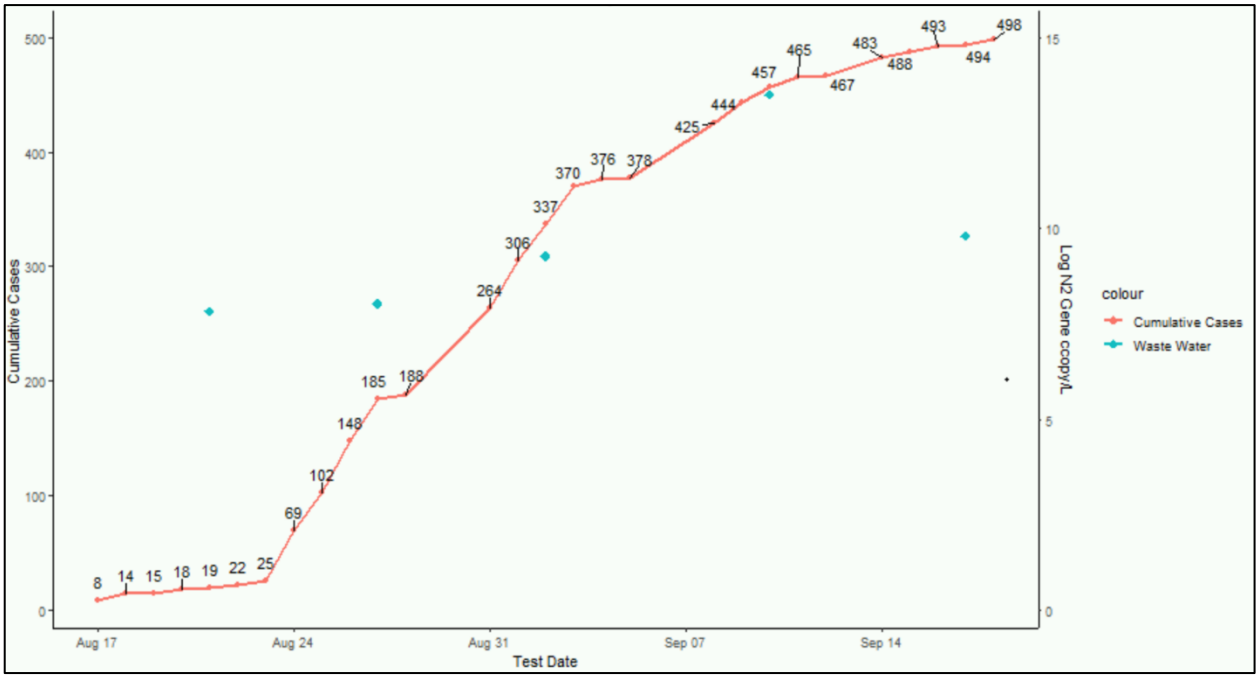
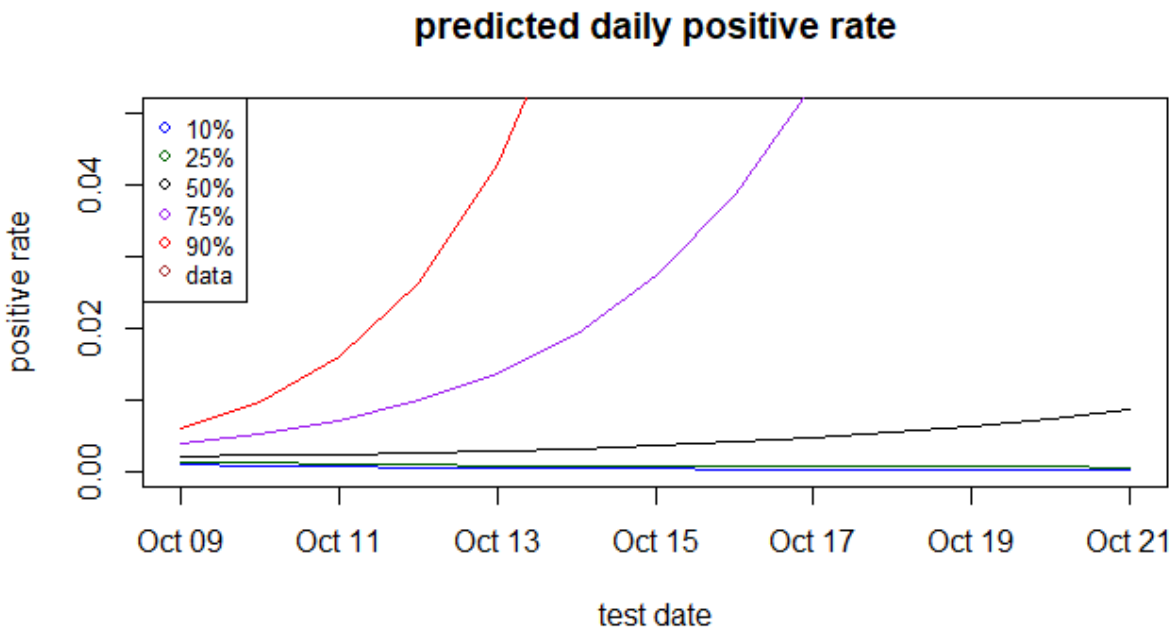



Figure 4 shows the overlay of case and wastewater data for one of the university's six catchment areas. A total of 3,206 students live in these residence halls. When the cumulative number of cases rose above 250, we began to see levels of SARS-CoV-2 in the wastewater. The value begins to decline as cumulative cases start to plateau. In this instance, it appears that because of the robustness of the routine testing program, the wastewater signal followed the testing signal. Data will be normalized for student number in different residence halls as we compare data between sample sites, and this will further be refined by incorporating estimates of toilet- and shower-flow rates. Ohio State is unique in having test data for the entire population contributing to the wastewater sample. This will allow the teams working on developing wastewater data to refine risk assessment tools.

**Modeling the Future**

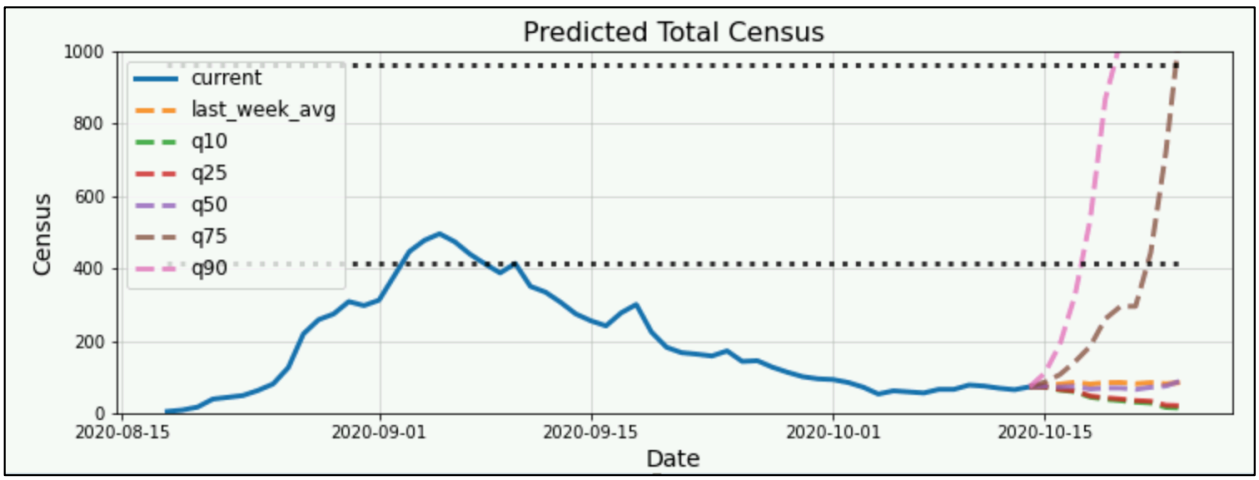
In addition to daily reviews and special analyses, the CMT calls on sophisticated expertise uniquely available at a top research university. The Ohio State CMT has members who are part of the modeling teams assisting both the Governor and the Ohio Department of Health. These teams have adapted their statewide approach to account for the campus situation. We now have enough data to allow them to model.

**Figure 5.** The figure shows the predicted daily positivity rate (PR) over time. Each line represents a percentile of the projections with the uppermost equal to the 90th percentile and the lowest equal to the 10th percentile. The 50th percentile shows a continued projected decline in the positivity rate. The model draws on previous data to project the future. The model assumes conditions remain similar to the current situation.




The analytical and modeling teams have tracked isolation and quarantine bed use over time. They have combined these data with individual case data to help the university predict needed bed capacity going forward (Figure 6).

**Figure 6.** The blue line in this figure shows actual use of isolation and quarantine beds on and off campus. The extended dotted lines show predicted bed needs based on the current week (orange), the previous week (green), and modeled predictions based on projections of expected new cases.



In the coming days, weeks, and months the CMT will continue to assess the on-campus, off-campus, and community situations in Columbus and at our regional campuses. As we do so, we will continue to check our assumptions against the literature, using the best available evidence to guide CMT deliberation about what we have seen on campus since opening and what we predict going forward to form recommendations about mitigation strategies.

We will continue to issue reports as our understanding of campus dynamics relative to the COVID-19 pandemic deepens.