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At the request of Babson College (Babson), Environmental Health & Engineering, Inc. (EH&E) analyzed potential risks of SARS-CoV-2 transmission on the Babson campus under current conditions with near universal mask use indoors, compared to the risks with an optional mask policy in certain indoor spaces, such as common areas. While the use and benefits of masking have evolved over the pandemic, the rapid development and deployment of highly effective vaccines have changed the risk profile for college campuses, especially those with vaccination mandates, such as Babson. The Babson community has a >95% vaccination rate. High community immunity has been shown to reduce the risk of infection to others in the community.[1]

Our analysis included an assessment of SARS-CoV-2 community transmission indicators at Babson compared with Centers for Disease Control and Prevention (CDC) and Massachusetts public health recommendations for use of masks. We also used peer-reviewed models of SARS-CoV-2 transmission to assess potential exposure risks related to mask use in college scenarios.

COMPARISON TO PUBLIC HEALTH RECOMMENDATIONS

Babson's indicators of community transmission are below thresholds for which the CDC recommends indoor mask wearing for the general public. Babson has identified approximately 90 confirmed cases of SARS-CoV-2 amongst its community since August 15, 2021. Converting these cases to the CDC metric for community spread yields an incidence of 24 cases per 100,000 people per week (equivalent to 3.4 cases per 100,000 people per day). The weekly rate corresponds to the CDC moderate transmission risk category (10 to 50 cases per 100,000 people per week).[2] Babson's most recent weekly test positivity of 0.13% and the semester test positivity of 0.23% fall within the CDC low transmission risk category for this metric, which is more than ten times below the 2.6% average statewide for this time period. Currently, CDC does not recommend that vaccinated members of the general public wear a mask indoors in areas of low or moderate transmission.[3,4]

The Massachusetts Department of Public Health (MassDPH) does not recommend that fully vaccinated members of the general public in the Commonwealth wear a mask indoors, except for certain individuals that may be at elevated risk of severe COVID-19, which aligns with the CDC recommendations for conditions that indicate use of masks.[5]

[1] https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html
[2] https://www.cdc.gov/coronavirus/2019-ncov/more/aboutcovidcountycheck/index.html
[3] https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated.html
[4] https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/considerations.html
[5] https://www.mass.gov/info-details/covid-19-mask-requirements

Another notable consideration is that Babson, like many other local colleges and universities, has a higher rate of SARS-CoV-2 testing than the general population in Massachusetts. During the week of October 27 to November 3, 2021, higher education testing has accounted for approximately 70% of statewide tests in Massachusetts,[6] and Babson tests its entire community approximately every 7 days. A higher rate of testing likely results in a higher rate of case detection because cases without symptoms or those with mild symptoms on campus will be identified, whereas members of the general public with unknown or low-level infection are expected to be less likely to be tested.

Despite the comparatively high rate of testing at Babson compared to the state overall, the incidence of new cases at Babson is 3.4 per 100,000 people per day, whereas the current rate of new cases for the state overall is approximately 20 per 100,000 people per day.[7] The current incidence of new cases at Babson is also lower than the majority of rates for Massachusetts as only 12% of the statewide 7-day daily average case rates in the state were below 4 cases per 100,000 between August 15, 2020 and November 2, 2021.

MODELING ANALYSIS

To quantitatively evaluate the potential impact of masking in a highly vaccinated community, we used three peer-reviewed inhalation risk models to assess potential exposure risks related to mask use in typical college scenarios.[8] We evaluated those risks taking into account vaccination and community case rates.

First consider an unvaccinated community. In a common space with a large air volume that is well ventilated, such as the student center at Babson,[9,10] with 100 unvaccinated people in the space and one infected individual, the risk of a secondary infection is estimated to be 1% with universal masking and 3% without masking. The highest risk of transmission is for people located within 6 feet of the infected individual. Thus, masking is estimated to reduce the absolute risk of transmission by 2 percentage points for an unvaccinated population.

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[6] https://www.mass.gov/info-details/covid-19-response-reporting#covid-19-interactive-data-dashboard-

[7] https://globalepidemics.org/key-metrics-for-covid-suppression/

[8] Indoor exposure scenarios were evaluated using models developed by researchers from the University of Colorado-Boulder (Jimenez, et al. 2021), Harvard TH Chan School of Public Health (Azimi, et al. 2021), and the Massachusetts Institute of Technology (Bazant and Bush 2020; Khan, et al., 2021).

[9] 5,000 square feet, 10 foot ceiling, 4 air changes per hour, 15% outdoor air delivery, minimum efficiency reporting value (MERV) 13 filtration, 1.5 hour exposure duration, low intensity physical activity, using https://covid-19.forhealth.org/covid-19-transmission-calculator/.

[10] Babson's ventilation system operations have been modified and meet CDC recommendations for ventilation during the COVID-19 pandemic.

Next consider a fully vaccinated community. Assuming 90% effectiveness of vaccines against infection,[11] the range of transmission risk for the same student center space as above shifts approximately 10-fold lower to 0.1% with universal masking and 0.3% without masking. While, as above, the addition of masking is estimated to reduce inhalation exposure risk by approximately three-fold, the absolute probability of transmission with masking compared to no masking changes by 0.2 percentage points from 0.1% to 0.3%.

These model results indicate that wearing masks has a smaller effect on exposure risks in a highly vaccinated community than in an unvaccinated community. Comparing results of the unvaccinated and vaccinated scenarios shows that vaccination reduces the absolute risk of transmission estimated to result from masking by 10-fold (0.2% compared to 2%). The results also indicate that the effect of vaccination on risk of transmission (10-fold) is greater than the effect of masking (3-fold).

Another notable consideration is that modeling studies are estimates of exposures and to have the possibility of COVID-19 transmission in a space, an infected person must be present in the room. Babson has multiple mitigation layers in place to minimize the presence of infected people in spaces, such as required vaccination, symptom monitoring, ventilation, and surveillance testing for SARS-CoV-2. The case and test positivity rates at Babson demonstrate the effectiveness of these controls.

CONCLUSIONS

The rate of new SARS-CoV-2 cases and test positivity at Babson are below levels for which the CDC and MassDPH recommend indoor mask wearing. In addition, SARS-CoV-2 rates for the Babson community are lower than corresponding rates for the Commonwealth of Massachusetts. The comparatively low impacts of SARS-CoV-2 for members of the Babson community reflect the multiple layers of protection put in place by the College and adherence to the corresponding guidelines and practices by students, staff, faculty, and visitors.

The modeling analysis presented here indicates that vaccination status of a community also likely reduces the absolute risk of SARS-CoV-2 transmission associated with masking versus not masking. The marginal benefit of masking on risk of transmission is estimated to be 2% for an unvaccinated community compared to 0.2 % for a vaccinated community.

The vaccine mandate implemented by Babson is likely the key control put in place for the campus, as vaccination has been shown in studies to reduce the risk of transmission and most importantly, the likelihood of a severe health outcome.[12] While no single control or combination

[11] https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html
[12] https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html

of controls has been identified that will fully eliminate transmission of this virus,[13] vaccination is the path to ending the pandemic. Vaccination complements and can in fact substitute for non-pharmaceutical interventions as indicated by guidance for masking and physical distancing from CDC and other authorities.

CLOSING

EH&E appreciates the opportunity to conduct the analysis described in this communication. We look forward to continuing to work with Babson to monitor and evaluate COVID-19 rates and controls on campus and support data-driven adjustment to protocols as warranted.

MODELING REFERENCES

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[13] https://www.mass.gov/doc/weekly-report-covid-19-cases-in-vaccinated-individuals-november-2-2021/download