

# To Test or Not to Test: COVID-19 Prevention Strategies to Keep Large Gatherings Safe

**K**ey nonpharmaceutical interventions (NPIs) implemented to minimize the spread of SARS-CoV-2 among the public were protective yet led to social isolation and other downstream effects. Although the COVID-19 pandemic lingers, many municipalities and regions are liberalizing NPI measures and restrictions to diminish the societal impact. Attempts to “open up” society include increasing public access to previously prohibited crowded indoor social gatherings. However, COVID-19 vaccines are still not universally available, wanted, or implemented. Health officials are therefore searching for strategies to effectively prevent SARS-CoV-2 transmission while allowing certain activities (such as concerts) to proceed, providing both desired psychosocial relief and economic benefits.

Indoor concerts are considered high-risk events and are linked to SARS-CoV-2 transmission (1). So, how can they safely proceed? Libre and colleagues (2) present a solution, and their unique experience prevented SARS-CoV-2 transmission at a large concert when only 6.3% of the community was vaccinated against COVID-19. This experience provides important insights into keeping participants safe by bundling public health mitigation measures.

In Libre and colleagues' study, the ventilation at the venue was maximized. In addition, in order to attend the event, 5000 potential concertgoers were tested using a point-of-care, same-day SARS-CoV-2 antigen test; had negative test results; and wore masks. Participants were carefully followed for 2 weeks to determine whether they developed signs or symptoms of COVID-19. Six unvaccinated attendees developed symptomatic SARS-CoV-2 infection, confirmed by polymerase chain reaction testing. Three of these persons were exposed outside of the concert to a person with known COVID-19, and 1 person was incubating SARS-CoV-2 at the concert. The COVID-19 incidence after the concert was 130.9 cases per 100 000 persons, whereas the citywide prevalence was 295.5 cases per 100 000 persons. Because few transmission events were observed in this closely followed population, such efforts at multimethod prevention strategies could be adapted to prevent SARS-CoV-2 transmission in other high-risk and crowded events.

The preventive approach directed at source control (testing and masking) and enhanced environmental controls (ventilation) is supported by experience and may be especially relevant to implement in settings with low or partial rates of COVID-19 vaccination. Several professional sports teams have successfully used SARS-CoV-2 testing strategies to prevent transmission among players during the pandemic (3). The success of such approaches depends on the performance characteristics of the SARS-CoV-2 test. Daily antigen testing alone has not prevented transmission or case clusters, which suggests that a testing strategy alone is insufficient to prevent transmission (4, 5). Of note, use of masks has not been implemented in elite sports.

Revollo and associates (6) evaluated a multimethod approach to preventing SARS-CoV-2 transmission experimentally at a high-risk indoor concert. The authors randomly assigned 1000 persons to either attend a 5-hour indoor concert with maximized ventilation, have same-day antigen testing, and wear a mask or participate in their routine activities without attending the concert. They did not identify SARS-CoV-2 transmission or infections in those who attended the concert.

Although such findings are encouraging and provide a potential safe path for large indoor events, some important considerations remain. How does one choose the ideal test and evaluate test characteristics to effectively implement a safety protocol for large events? The sensitivity of SARS-CoV-2 antigen tests—especially in asymptomatic persons—is 41.2% to 93.3% depending on the platform used. Furthermore, the reliability decreases as the SARS-CoV-2 prevalence decreases, which affects the success of the testing strategy (2, 7). Antigen tests with lower sensitivities may miss infectious individuals, such as the person presumed to be incubating the virus in Libre and colleagues' study. The transmission risk is not trivial: Fifty nine percent of SARS-CoV-2 transmissions are estimated to have an asymptomatic source (8). However, antigen testing is an ideal method, because results are available rapidly and the tests can be deployed onsite. Polymerase chain reaction testing, on the other hand, is costly; requires more time to perform; and frequently identifies nonreplicating genetic material in persons who are no longer infectious. The excessive sensitivity of polymerase chain reaction testing would needlessly exclude some participants.

That Libre and colleagues reported few transmissions is promising, especially in locations where COVID-19 vaccinations are not widely available. Still, is this complex and layered strategy necessary to protect the public? Using a testing strategy for a large event is logistically challenging and costly. Furthermore, as the prevalence of an infection decreases, the pretest probability of identifying a true case will decrease, making such approaches less cost-effective. The authors note that 1 limitation of their study is the inability to directly compare the incidence of SARS-CoV-2 infections in the general population with that among the event attendees. Hence, the true value of the “study” protocol in preventing COVID-19 transmissions beyond NPIs is unknown.

Favorable COVID-19 case and vaccination rates (such as when SARS-CoV-2 infection rates are less than 5% or more than 70% of the population is vaccinated) make the elaborate testing, masking, and improved ventilation mitigation strategy less cost-effective. However, consider the emerging delta SARS-CoV-2 variant, which is 60% more transmissible than the alpha variant—which itself is at least 40% more transmissible than wild-type SARS-CoV-2 (9). The emergence of these variants places unvaccinated persons attending mass gatherings at risk for acquiring and transmitting SARS-CoV-2 widely, as occurred in 103

concertgoers in Japan (1). Countries with highly vaccinated populations where the delta variant has surged have recently found that 50% of new SARS-CoV-2 infections are taking place after vaccination. This has required the public health authorities to reimplement NPIs, suggesting that the risk extends beyond just unvaccinated persons (10). These events may require us to rethink how to safely support large social events.

To test or not to test, especially for a large event, remains an unanswered question. Vaccines against COVID-19 are remarkably effective. However, they are not available to all, and keeping the public safe as countries and their economies reopen remains a challenge. We will need to be nimble and thoughtful and insist on safety first as we balance the emergence of SARS-CoV-2 variants, rising infections with SARS-CoV-2, and the desire for normalcy. In areas with low vaccination rates or high penetration of variants with spread, a strategy using point-of-care antigen tests with masking may help further mitigate the risk for SARS-CoV-2 transmission and support attending large indoor gatherings, such as concerts or the approaching Olympics.

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## References

1. Koizumi N, Siddique AB, Andalibi A. Assessment of SARS-CoV-2 transmission among attendees of live concert events in Japan using contact-tracing data [Letter]. *J Travel Med.* 2020;27. [PMID: 32520993] doi:10.1093/jtm/taaa096
2. Llibre JM, Videla S, Clotet B, et al. Screening for SARS-CoV-2 antigen before a live indoor music concert: an observational study. *Ann Intern Med.* 2021. 20 July 2021. [Epub ahead of print]. doi:10.7326/M21-2278
3. Pedersen L, Lindberg J, Lind RR, et al. Reopening elite sport during the COVID-19 pandemic: experiences from a controlled return to elite football in Denmark. *Scand J Med Sci Sports.* 2021;31:936-9. [PMID: 33480037] doi:10.1111/sms.13915
4. Pray IW, Ford L, Cole D, et al; CDC COVID-19 Surge Laboratory Group. Performance of an antigen-based test for asymptomatic and symptomatic SARS-CoV-2 testing at two university campuses—Wisconsin, September-October 2020. *MMWR Morb Mortal Wkly Rep.* 2021;69:1642-7. [PMID: 33382679] doi:10.15585/mmwr.mm695152a3
5. Moreno GK, Braun KM, Pray IW, et al. SARS-CoV-2 transmission in intercollegiate athletics not fully mitigated with daily antigen testing. *Clin Infect Dis.* 2021. [PMID: 33977295] doi:10.1093/cid/ciab343
6. Revollo B, Blanco I, Soler P, et al. Same-day SARS-CoV-2 antigen test screening in an indoor mass-gathering live music event: a randomised controlled trial. *Lancet Infect Dis.* 2021. [PMID: 34051886] doi:10.1016/S1473-3099(21)00268-1
7. Pilarowski G, Lebel P, Sunshine S, et al. Performance characteristics of a rapid severe acute respiratory syndrome coronavirus 2 antigen detection assay at a public plaza testing site in San Francisco. *J Infect Dis.* 2021;223:1139-44. [PMID: 33394052] doi:10.1093/infdis/jiaa802
8. Johansson MA, Quandelacy TM, Kada S, et al. SARS-CoV-2 transmission from people without COVID-19 symptoms. *JAMA Netw Open.* 2021;4:e2035057. [PMID: 33410879] doi:10.1001/jamanetworkopen.2020.35057
9. Bolze A, Cirulli ET, Luo S, et al. Rapid displacement of SARS-CoV-2 variant B.1.1.7 by B.1.617.2 and P.1 in the United States. medRxiv. Preprint posted online 30 June 2021. doi:10.1101/2021.06.20.21259195
10. Hart R. Israel prepares to reinstate mask mandate as delta variant drives new Covid surge. *Forbes.* 24 June 2021. Accessed at [www.forbes.com/sites/roberthart/2021/06/24/israel-prepares-to-reinstate-mask-mandate-as-delta-variant-drives-new-covid-surge/?sh=b5eff6a6d091](http://www.forbes.com/sites/roberthart/2021/06/24/israel-prepares-to-reinstate-mask-mandate-as-delta-variant-drives-new-covid-surge/?sh=b5eff6a6d091) on 29 June 2021.

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