



**INFECTION
CONTROL EDUCATION
FOR MAJOR SPORTS**

COVID-19 and Sports

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Disclosures

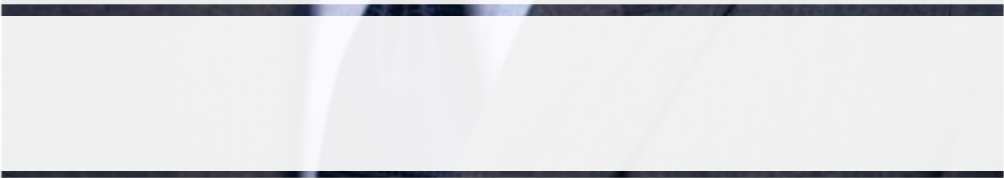
- Co-Owner of ICS

Agenda

- **Background**
- **Discuss effects of COVID-19 on athletics from 2020-2022**
- **Lessons learned from sports leagues**
 - **NFL**
 - **NCAA Football**
 - **NBA**
 - **MLB**
- **Utilization of sequencing**
- **Take home points**

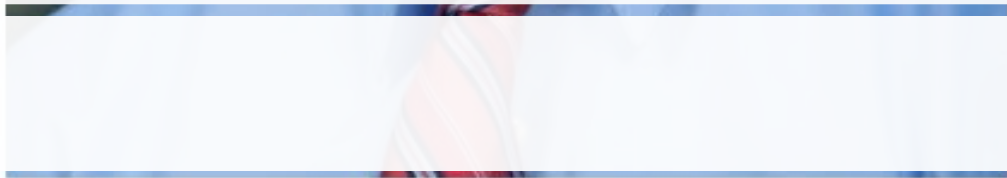
My background

- **BS Nuclear Engineering and Life Sciences – USMA**
- **MPH Public Health Leadership – UNC**
- **MD – Duke**
- **IM Residency, ID Fellowship, CMR at Duke/Durham VA**
- **Current non-ICS roles:**
 - **VA – Chief, Office of Public Health and Epidemiology, DVAHCS**
 - **Duke SOM – Assistant Professor and Physician Epidemiologist for DICON**



Deverick Anderson, MD, MPH

Who is ICS?



Christopher Hostler, MD, MPH

Some of our Partners



Effect of COVID-19 on games 2020-2022

NFL

554 games scheduled

5 postponed

0 cancelled

MLB

3,420 games scheduled

40 postponed

4 cancelled

NBA

1,726 games scheduled

33 postponed

0 cancelled

NHL

1608 games scheduled

~120 postponed

0 cancelled

MLS

784 games scheduled

16 postponed

7 cancelled

How leagues approached 2020

- **Bubble v. no bubble**
- **Tenets of return to play:**
 - **Proactive monitoring for symptoms**
 - Symptom reporting, temperature checks (not useful in athletics either)
 - **Early identification through testing**
 - Cadence ranged from q12h to q48h through professional leagues
 - **Risk mitigation throughout facilities**
 - Masking indoors (and sometimes outdoors), ventilation improvements, ICO
 - **Aggressive contact tracing**
 - Kinexon proximity monitoring, central v. club level traces
 - **Tiered outbreak response**
 - “Intensive protocols” during outbreaks

How leagues approached 2021

- **Wide variation in testing – every other day testing to symptomatic-only testing**
- **Heavily incentivized vaccination – all leagues >90% vaccinated**
- **Facilities largely without COVID restrictions for FV until Omicron (even through Delta)**
- **Normal season length**



Changing the paradigm of how we assess risk

Summary

What is already known about this topic?

COVID-19 contact tracing is important to prevent transmission, but risk characterization is difficult.

What is added by this report?

The National Football League observed SARS-CoV-2 transmission after <15 minutes of cumulative interaction, leading to a revised definition of a high-risk contact that evaluated mask use and ventilation in addition to duration and proximity of interaction. Intensive mitigation protocols effectively reduced close interactions.

What are the implications for public health practice?

Assessment of the context of each interaction, including mask use, indoor versus outdoor setting, and ventilation, in addition to duration and proximity, can improve identification of high-risk contacts during contact tracing. Postexposure quarantine based on redefined high-risk criteria, combined with testing and environment-specific intensive protocols, can protect communities before and after case identification.

Mack CD, Wasserman EB, Perrine CG, et al. Implementation and Evolution of Mitigation Measures, Testing, and Contact Tracing in the National Football League, August 9–November 21, 2020. *MMWR Morb Mortal Wkly Rep* 2021;70:130–135.

DOI: <http://dx.doi.org/10.15585/mmwr.mm7004e2>

How to utilize Ct values

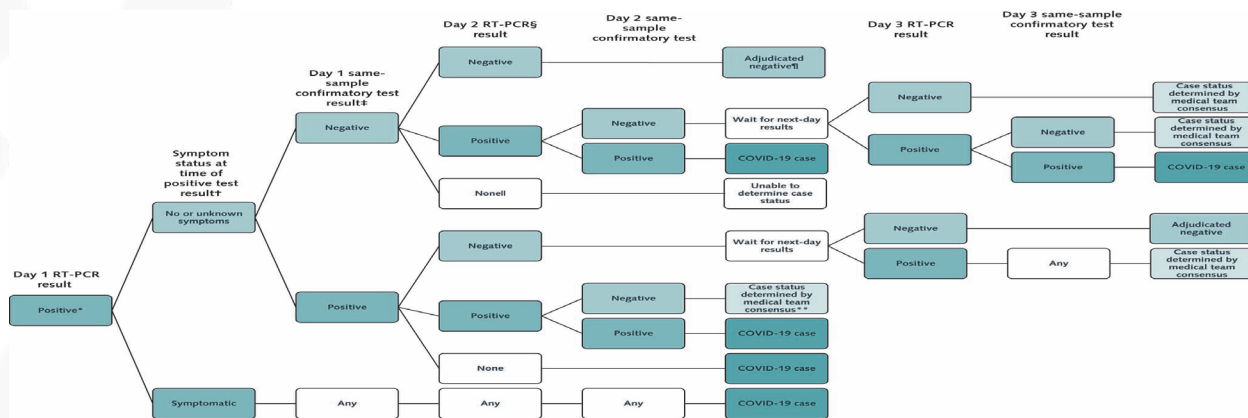
Annals of Internal Medicine

ORIGINAL RESEARCH

Optimizing SARS-CoV-2 Surveillance in the United States: Insights From the National Football League Occupational Health Program

Christina DeFilippo Mack, PhD, MSPH; Michael Osterholm, PhD; Erin B. Wasserman, PhD; Natalia Petruski-Ivleva, PhD; Deverick J. Anderson, MD; Emily Myers; Navdeep Singh, MD; Patti Walton, MHA, MT(ASCP); Gary Solomon, PhD; Christopher Hostler, MD; Jimmie Mancell, MD; and Allen Sills, MD

- >630K tests analyzed
- Ct values can provide useful information and trajectories of viral shedding
- Antigen testing is unreliable as a surveillance tool



Reassuring safety of competition

Duration of actual
close contact during
football games
between opponents is
very low

Helped reassure
athletes and minimize
infection control
theater

> [Phys Sportsmed](#). 2022 Jan 27;1-6. doi: 10.1080/00913847.2022.2028536. Online ahead of print.

Anatomy of an American football game: Player-to-player contact before, during and after an NFL game in context of the 2020 COVID-19 pandemic

Christina D Mack¹, Erin B Wasserman¹, Deverick J Anderson², Gabriel Farkas¹, Molly Delaney³, Daniel Eichner⁴, Kyle Johnston⁵, Madeline K Lassiter¹, Emily Myers³, Thom Mayer⁶, Gary Solomon³, Allen Sills³

Affiliations + expand

PMID: 35040386 DOI: [10.1080/00913847.2022.2028536](#)

Changing isolation period

What is added by this report?

Among 173 vaccinated adults with COVID-19 undergoing serial reverse transcription–polymerase chain reaction (RT-PCR) testing during Omicron predominance, 46% received a negative or high cycle threshold RT-PCR test result on or before day 6 postdiagnosis.

What are the implications for public health practice?

Although a positive RT-PCR test result does not necessarily indicate infectiousness, these data indicate that persons with COVID-19 should continue to take precautions, including correct and consistent mask use, for a full 10 days after symptom onset or after initial positive test result if they are asymptomatic.


Proof-of-concept for POC NAATs

- POC RT-PCR equivalent to lab-based PCR
- Expanded indications for use of platforms such as Mesa Accula and Cue



ORIGINAL ARTICLE | [Free Access](#)

Effectiveness and use of reverse transcriptase polymerase chain reaction point of care testing in a large-scale COVID-19 surveillance system

Christina D. Mack , Erin B. Wasserman, Christopher J. Hostler, Gary Solomon, Deverick J. Anderson, Patti Walton, Kalyani Hawaldar, Emily Myers, Michele Best, Daniel Eichner, Thom Mayer, Allen Sills

First published: 28 February 2022 | <https://doi.org/10.1002/pds.5424>

Funding information: National Football League

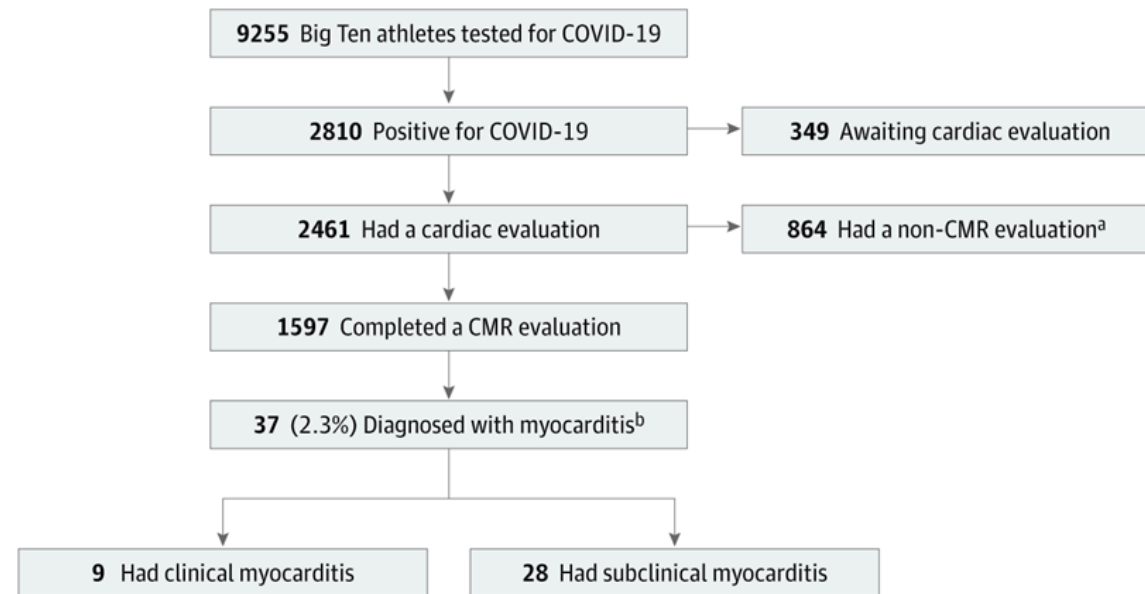


A close-up photograph of a brown leather football resting on a green grass field. The football is positioned on the right side of the frame, with its laces visible at the top. The field is marked with white yard lines, which are slightly out of focus in the background. The text "Lessons from College Football" is overlaid in white, sans-serif font across the middle of the image.

Lessons from College Football

Investigating incidence of myocarditis

- Study of Big Ten athletes
- 0.3% prevalence of clinical myocarditis in college athletes post-COVID



^aAthletes were excluded from analysis for not completing cardiac magnetic resonance (CMR) imaging as part of cardiac evaluation and described in more detail in eAppendix 2 in [Supplement 1](#).

^bAthletes diagnosed with myocarditis were categorized as clinical or subclinical based on presence or absence of cardiac symptoms.



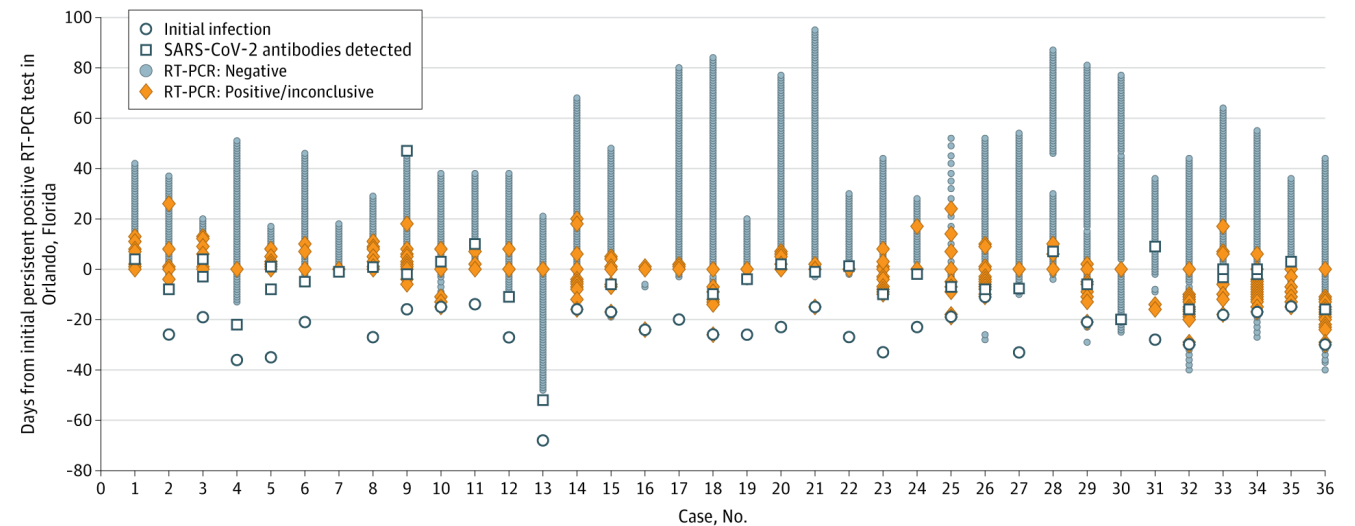
Demonstrating that persistent shedding is not reflective of contagiousness

- A small percentage of people can persistently and intermittently shed for months
- Ct values were typically but not always above the limit of reproducibility
- These individuals are not contagious

JAMA Internal Medicine | Original Investigation

SARS-CoV-2 Transmission Risk Among National Basketball Association Players, Staff, and Vendors Exposed to Individuals With Positive Test Results After COVID-19 Recovery During the 2020 Regular and Postseason

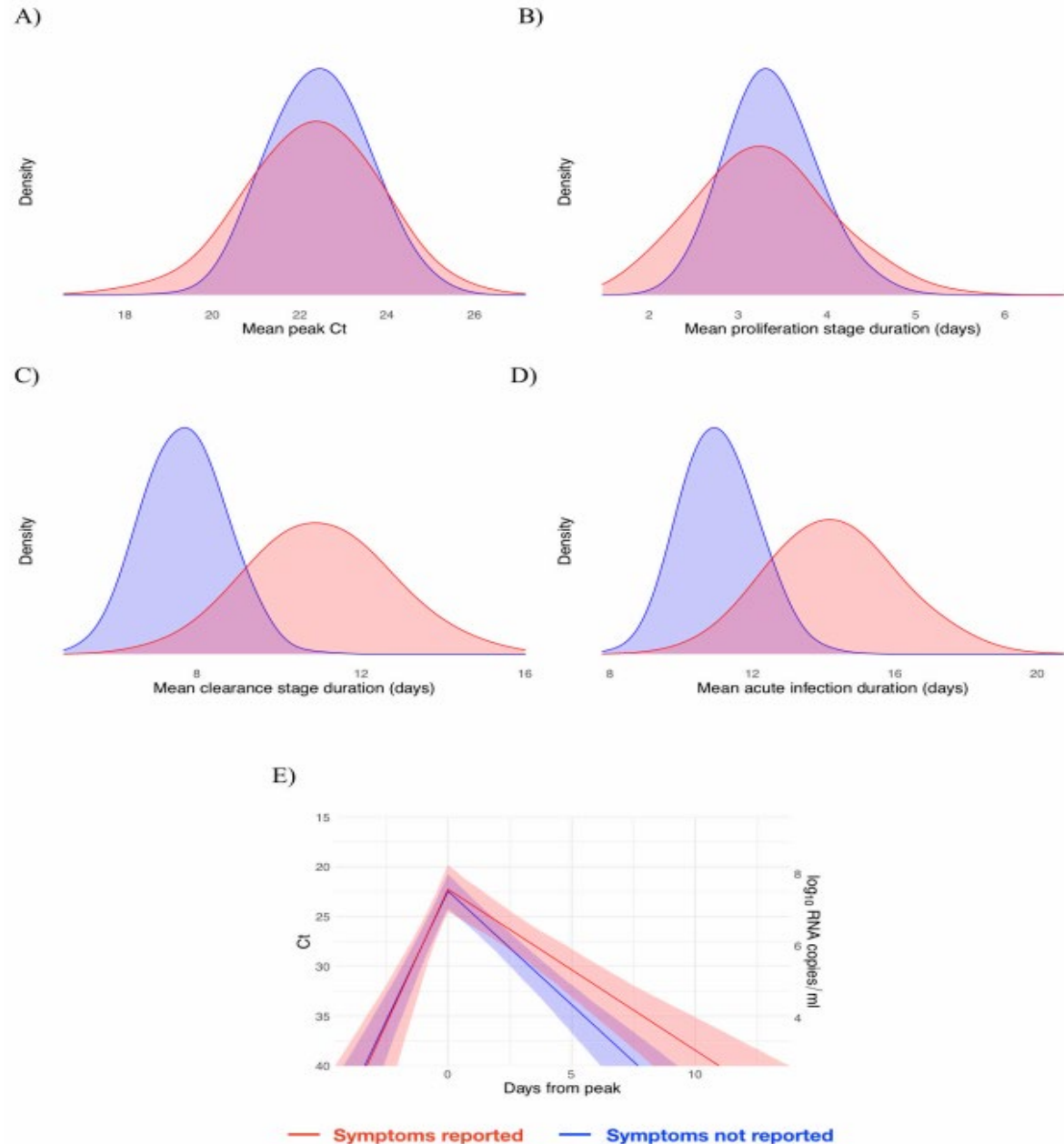
Christina D. Mack, PhD, MSPH; John DiFiori, MD; Caroline G. Tai, PhD; Kristin Y. Shiue, MPH; Yonatan H. Grad, MD; Deverick J. Anderson, MD; David D. Ho, MD; Leroy Sims, MD; Christopher LeMay, DO; Jimmie Mancell, MD; Lisa L. Maragakis, MD, MPH



Peak viral concentration and proliferation time are similar among symptomatic / asymptomatic

Clearance time and acute infection duration are shorter for asymptomatic

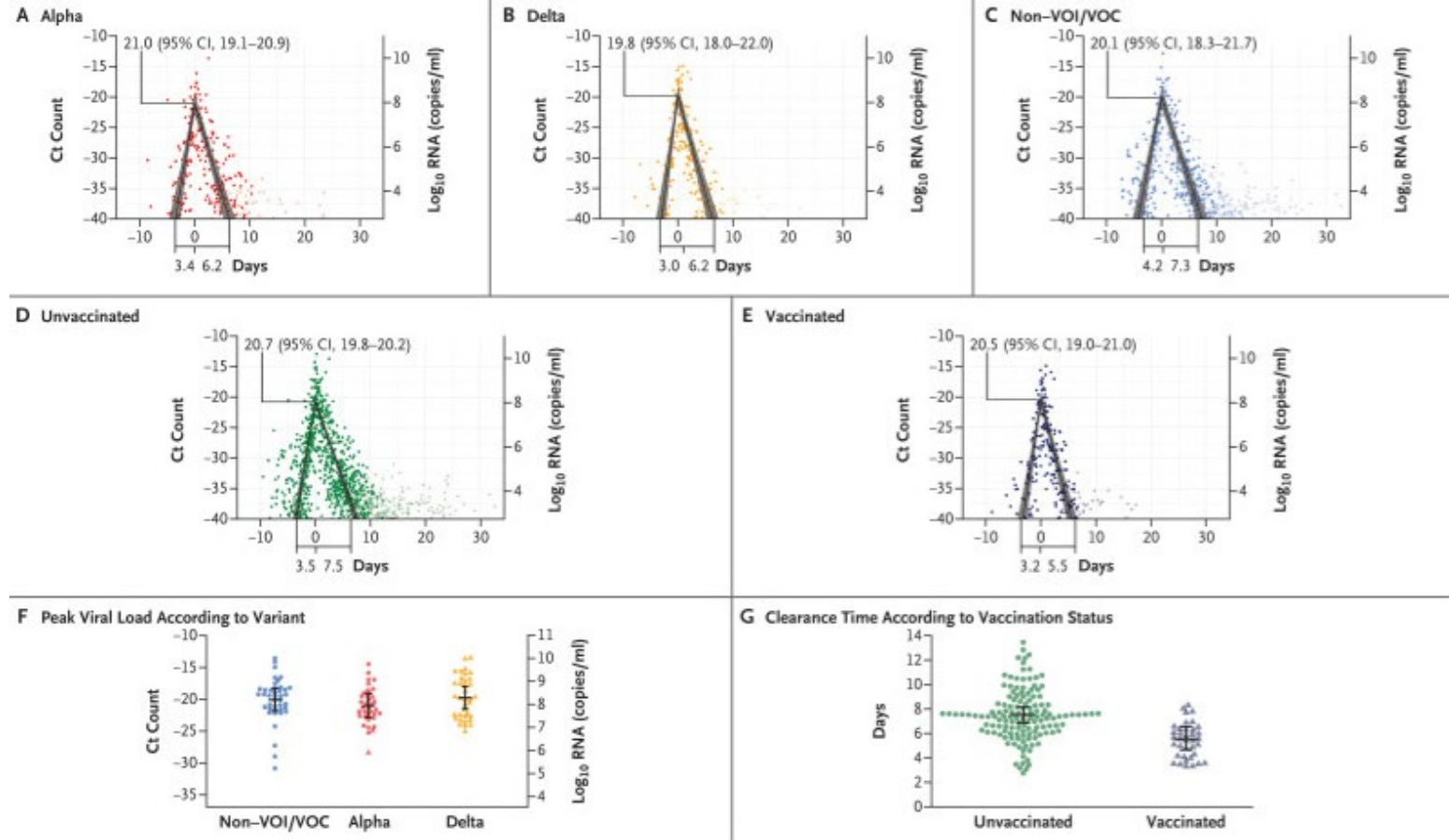
Duration of shedding is shorter for asymptomatic



Peak viral concentration and proliferation time are similar among vax / unvax

Clearance time and acute infection duration are shorter for vax

Duration of shedding is shorter for vax



https://www.nejm.org/doi/10.1056/NEJMc2102507?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%20pubmed

Recent boosters reduced risk during Omicron surge

Table 2. Association Between Booster Vaccination and SARS-CoV-2 Infection, December 1, 2021-January 15, 2022

Table 2. Association Between Booster Vaccination and SARS-CoV-2 Infection, December 1, 2021-January 15, 2022

Outcome	Adjusted HR (95% CI) ^a	P value
Any confirmed SARS-CoV-2 infection	0.43 (0.35-0.53)	<.001
Symptomatic SARS-CoV-2 infection	0.39 (0.30-0.50)	<.001

Abbreviation: HR, hazard ratio.

^a The analyses were adjusted for age and prior SARS-CoV-2 infection. Comparison of individuals who were fully boosted vs those who were fully vaccinated, not boosted, and booster eligible (referent).

Tai CG, Maragakis LL, Connolly S, DiFiori J, Anderson DJ, Grad YH, Mack CD. Association Between COVID-19 Booster Vaccination and Omicron Infection in a Highly Vaccinated Cohort of Players and Staff in the National Basketball Association. JAMA. 2022 Jul 12;328(2):209-211. doi: 10.1001/jama.2022.9479. PMID: 35653123; PMCID: PMC9164115.



Mitigation needs to be applied at work and home to be effective



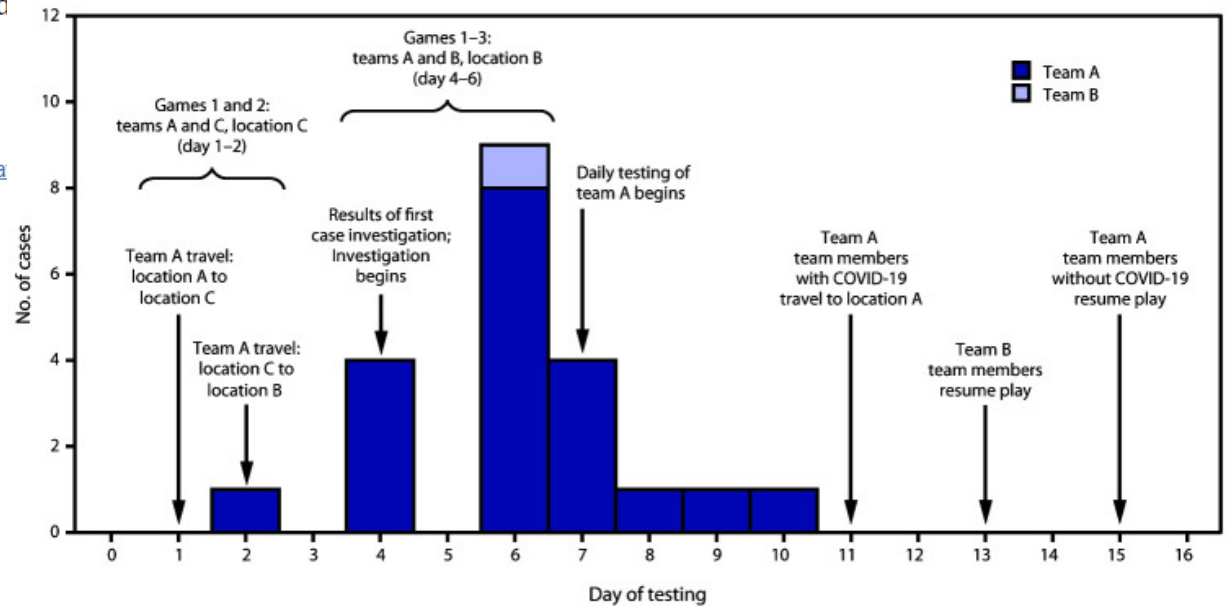
[MMWR Morb Mortal Wkly Rep.](#) 2020 Oct 23; 69(42): 1542–1546.
 Published online 2020 Oct 23. doi: [10.15585/mmwr.mm6942a4](https://doi.org/10.15585/mmwr.mm6942a4)

PMID: [PMC7583504](https://pubmed.ncbi.nlm.nih.gov/33090983/)
 PMID: [33090983](https://pubmed.ncbi.nlm.nih.gov/33090983/)

Mitigating a COVID-19 Outbreak Among Major League Baseball Players — United States, 2020

[Meghan T. Murray, PhD,^{1, 5}](#) [Margaret A. Riggs, PhD,²](#) [David M. Engelthaler, PhD,³](#) [Caroline Johnson, MD,⁴](#)
[Sharon Watkins, PhD,⁵](#) [Allison Longenberger, PhD,⁵](#) [David M. Brett-Major, MD,⁶](#) [John Lowe, PhD,⁶](#)
[M. Jana Broadhurst, MD,⁶](#) [Chandresh N. Ladva, PhD,²](#) [Julie M. Villanueva, PhD,²](#) [Adam MacNeil, PhD,²](#) [Shouka PhD,²](#) [Hannah L. Kirking, MD,²](#) [Michael Cherry, MD,²](#) and [Ali S. Khan, MD,⁶](#)

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Soon to be published

- Antibody correlation with incidence of infection

Sequencing

- All isolates sequenced until Omicron (and then, only a portion) for multiple leagues
- In conjunction with the in-depth contact tracing already performed, allowed us to determine where transmission was happening
- Gave a good picture of regional variants over time

Athletics in 2022?

- Same issues, but now with “returning to normal work”
- Vaccination and boosters add a layer of safety (and complexity)
 - Athletic leagues have far higher vaccination rates than society (or even many healthcare organizations)
 - Difficult rolling back “incentives” for vaccination
- Most leagues are completely rewriting (or eliminating) protocols

My takeaways

- The shared experience of athletic organizations has advanced public health knowledge and informed public health guidance
- Risk mitigation is far more effective than testing or symptom reporting at minimizing the risk of transmission
- Previous barriers to data-sharing among athletic organizations have largely been removed
- Transitioning to the endemic phase of illness was tough (structurally and cognitively), especially for those who didn't play through the initial Omicron surge.

How to apply lessons from leagues to healthcare settings

- Taking a nuanced approach to isolation removal (serial testing, Ct values) may allow you to safely remove precautions earlier than solely relying on time-based strategies – huge for bed capacity!
- Utilizing sequencing in outbreak investigations can help identify where there are (and aren't) issues
- Focus on prevention (vaccination and risk mitigation) rather than surveillance
- Expand use of POC high-sensitivity testing to increase access

Thanks

- **Dev Anderson – partner**
- **Dan Sexton – former co-creator of the DICON program**
- **Chris Woods – sounding board**
- **Carol Hostler – wife/contracts**
- **Allen Sills – CMO NFL**
- **Christina Mack – IQVIA Epidemiologist**

Questions?

