This is team The Data Collective. My name is [speaker 1] and am joined by [speaker 2]. For this presentation, we will share with you the impact COVID has had on sports' team performance due to the lack of fans and when teams can fully reopen their stadiums in a safe and responsible manner.

Agenda

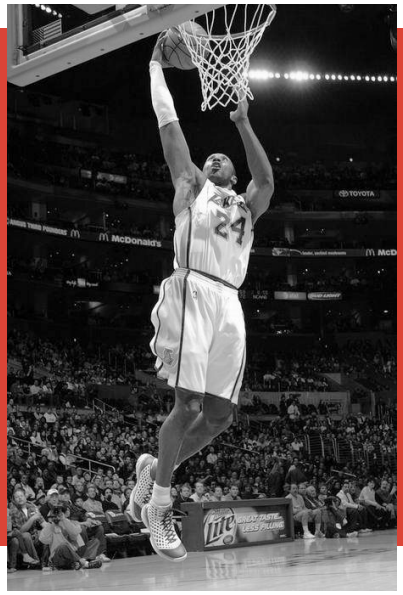
01 Executive Summary

02 Sports: Home Game Advantage

03 Vaccination Forecast

04 Recommendations

Here is the agenda for our presentation. We will go ahead and start with Executive Summary and then move onto the effect the lack of fans has had on sports teams. After, we will discuss the timetable around vaccinations and herd immunity pertaining to the sports teams and conclude with our recommendations.



Executive Summary

01. COVID-19 has impacted the sports industry by reducing the number of attendees

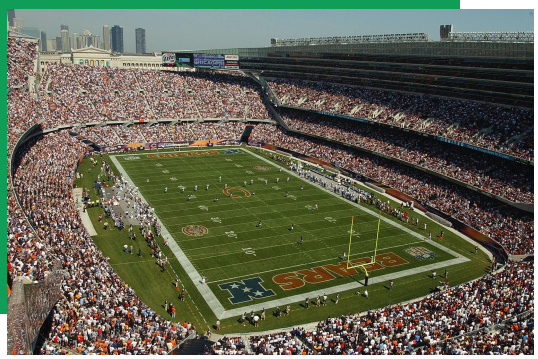
02. We analyzed sport team's performance with little to no attendees to find the importance of fans at games, ultimately focusing on NBA basketball

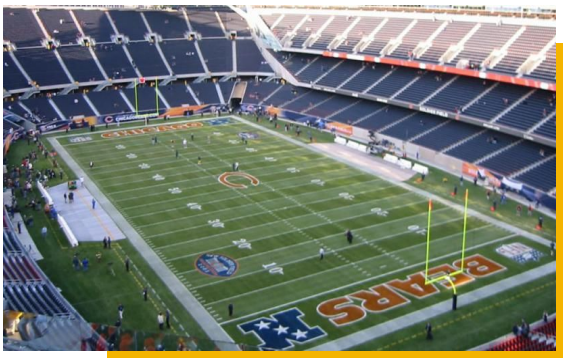
03. We predicted when NBA basketball teams should fully reopen their stadiums by evaluating vaccination rates across states

04. During COVID, home teams have lost 4% more of their games proving the importance of fans returning to stadiums, but only when it is safe to do so

COVID-19 has impacted the sports industry by reducing the number of attendees. We analyzed sport team's performance with little to no attendees to find the importance fans have on their teams' performance, ultimately focusing on NBA basketball. We predicted when NBA basketball teams should fully reopen their stadiums by evaluating vaccination rates across states. During COVID, home teams have lost 4% more of their games proving the importance of fans returning to stadiums, but only when it is safe to do so.

A Once-in-a-Lifetime Natural Experiment



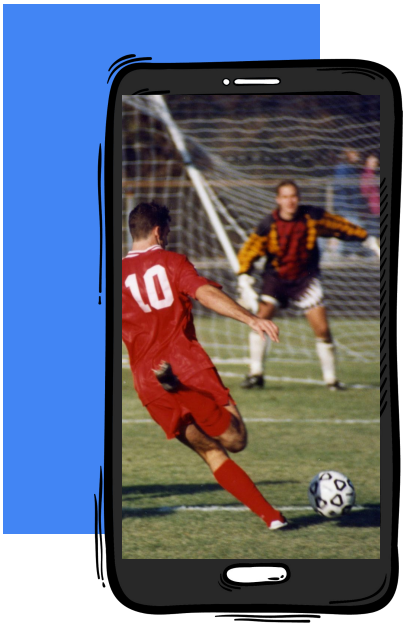


"All of us in the N.F.L. want to see **every one of our fans back**"
- *New Study Finds Covid Spikes After N.F.L. Games With Fans*, Roger Goodell

4

COVID has changed the way people act and behave in a way not seen in modern civilization. This has led to a potentially once-in-a-lifetime opportunity to observe how certain aspects of society change with changing human behavior, including in the realm of sports. Since the start of the COVID pandemic a year ago, sports teams have drastically reduced their allowable attendance, and in many cases, not allowed fans at all. With enough games during the COVID era with limited attendances, we have the opportunity to discover what impact fans have when they *do* attend games. This is important for sports teams to know as they try to reopen their venues for fans in the coming months to not only increase revenue but also to give their teams a bigger edge. However this is a balancing act with the nation trying to mitigate risk when it comes to COVID.

https://www.investopedia.com/articles/personal-finance/062515/how-nfl-makes-money.asp
https://chicago.cbslocal.com/2014/08/14/bears-remind-fans-of-soldier-field-bag-restrictions/
https://www.nbcsports.com/chicago/bears/nfl-covid-19-update-football-fans-will-have-wear-masks-games



Question 1
How has the lack of attendance brought on by COVID affected home team performance?

Question 2
When is the right time for teams to fully reopen their venues?

5

This leads to a couple of questions: How has the lack of attendance brought on by COVID affected home team performance? And when is the right time for teams to fully reopen their venues? The impact these questions have on the world of sports and society as a whole are very important. If sports teams perform significantly worse at their home venues without fans, teams have more than just their revenue to worry about when trying to gets fans back in the stands. Also. as teams try to get their stadiums fully reopened, the impact can be greatly negative towards society if done too early potentially prolonging the spread of COVID and causing unneeded death. We will now focus on the first question around team performance.

Method: Sports Analysis

Baseball (MLB) / American Football (NFL) / Soccer (La Liga, Premier League) / Basketball (NBA) / Hockey (NHL)

Key Assumption

Ties are not considered as a home team win

KPI

Drop in home team win rate during COVID

Data Source

sports-reference.com

Measurements

Win rates pre and during COVID

Proportion tests to measure significance

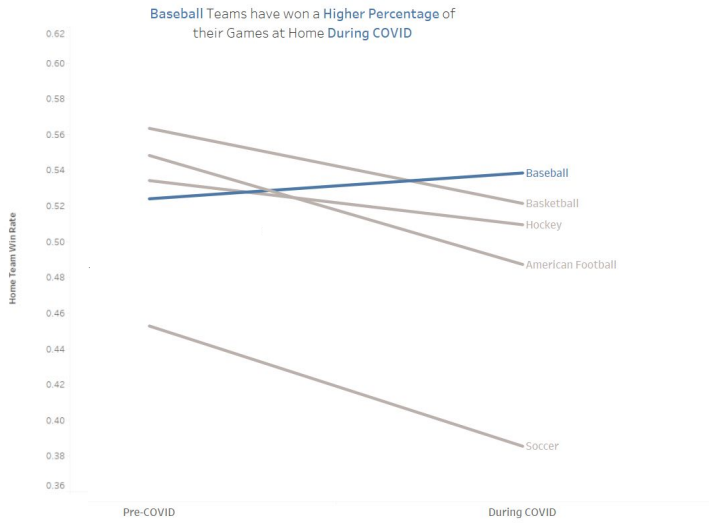
6

We used data from a reputable website that specializes in gathering sports related data, sports-reference.com. Looking at 5 major sports, the main kpi that we evaluated was how did home teams fare before and after the start of COVID. We conducted Proportion tests to evaluate significance to give further validity to our findings.

Our Analysis

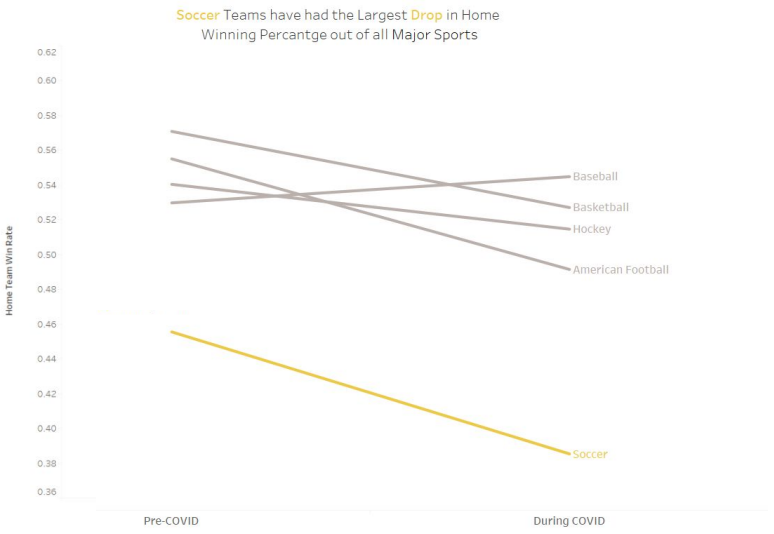
And here is our analysis

Baseball is the only sport where teams have done **Better** with **Limited/No Attendance** although it is not statistically significant



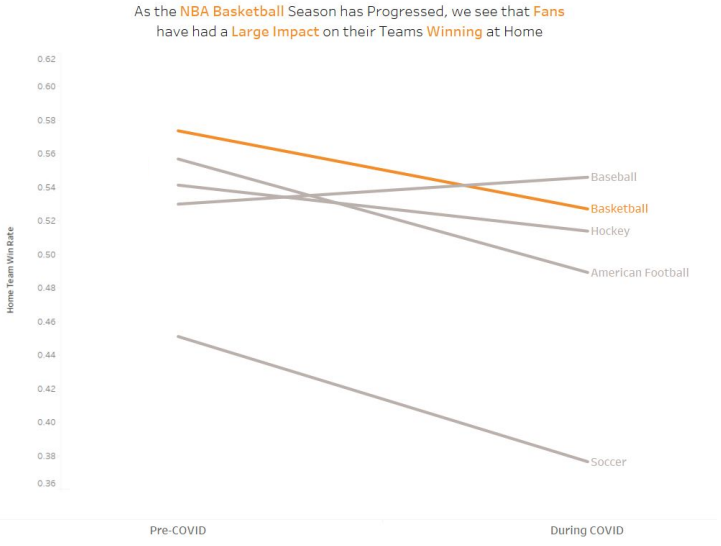
Starting with baseball from the 2015 season forward, we actually discovered that home teams were performing *better* during COVID than before, the only sport where this was the case. That being said, these results were not statistically significant. However, this still means that fans in the stands likely *do not* have a major impact when it comes to baseball.

Soccer teams have gone from winning **46%** of their home games pre-COVID to **Under 40%** during COVID



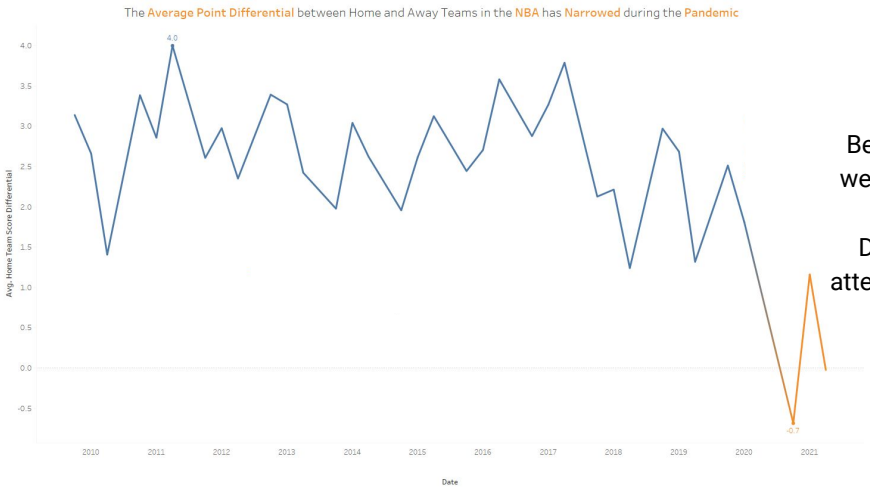
Next we look at soccer or as the rest of the world likes to call it, football from the 2015 season to present day. We did not consider ties to count as home wins which is why the home team win rates are relatively low. With soccer, we actually see the biggest impact of not having fans with the home teams winning under 40% of their games now as to 46% before the pandemic.

Basketball teams **Win 4% More** of their home games when allowing **Full Capacity**



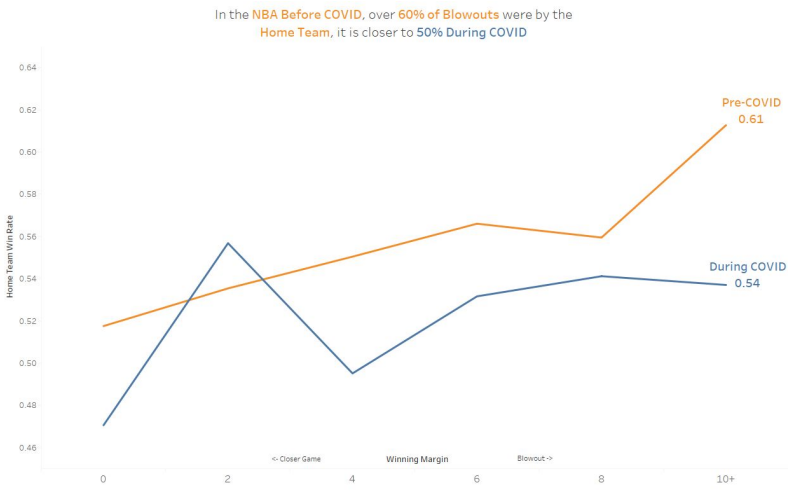
10

Now, we will set our focus to basketball and the NBA. The NBA season is in full swing and many teams are trying to expand their attendance capacities as the playoffs approach in late May. For the NBA we see that home teams are winning 4% less of their total games during the pandemic as to before. This is a statistically significant number and one that would make sense to any fan who has been involved in the atmosphere of a sold-out NBA game.



Before COVID, **Home Teams** were averaging about **3 More Points per Game**
During COVID with limited attendance, **Home Teams** have **Lost About 70%** of their **advantage**

Digging a little deeper, we see that home teams in the NBA have seen their average margin of victory go from around 3 points to less than 1 meaning their margin of victory has shrunk by around 70%.



A possible reason for this discrepancy is that **Without Fans**, Home Teams face **Less Embarrassment** when getting **Blown Out**

12

(Original Slides is right after the end of the presentation, feel free to change)

Next we look at soccer or as the rest of the world likes to call it, football from the 2015 season to present day. We did not consider ties to count as home wins which is why the home team win rates are relatively low. With soccer, we actually see the biggest impact of not having fans with the home teams winning under 40% of their games now as to 46% before the pandemic.

Key Insights for the NBA

4% ↓ Home Win Rates

70% ↓ Home Winning Margin

7% ↓ Blowouts Won by the Home Team

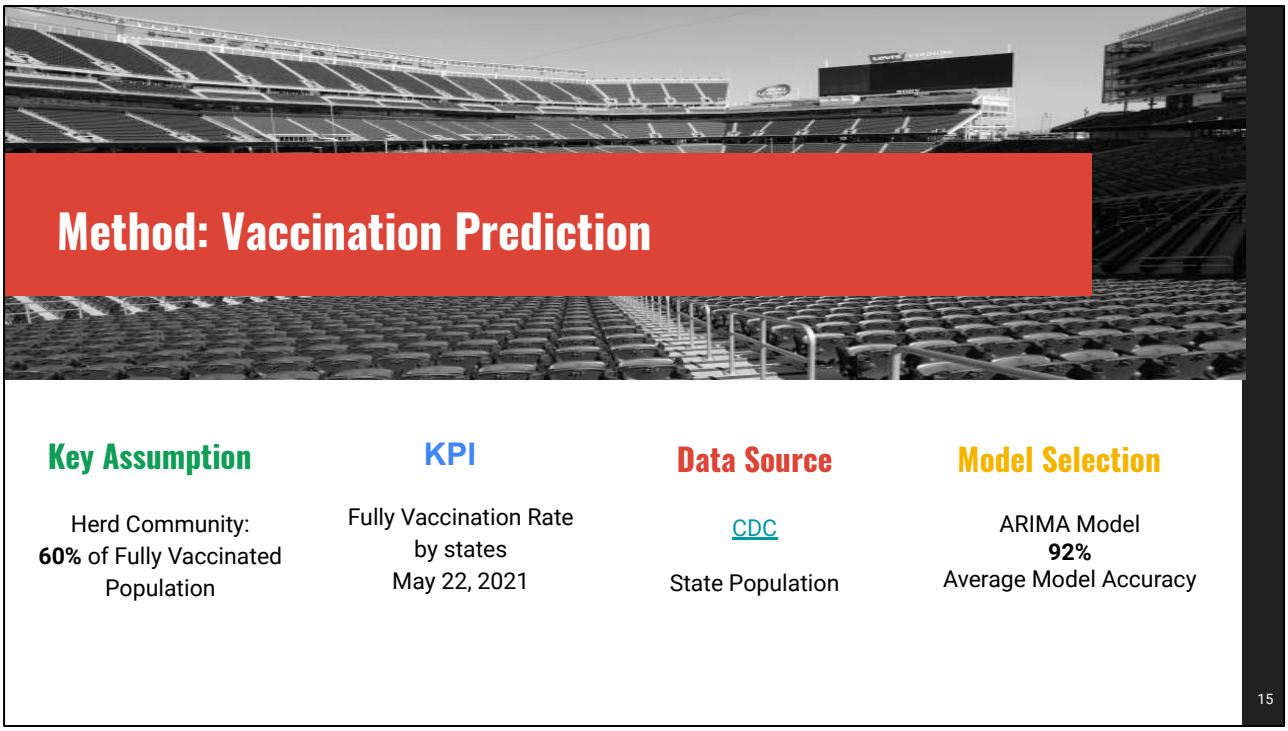
13

So we see that in several sports including basketball, there is a significant decrease in the outcomes for home teams with limited attendances. This is important to teams looking to optimize their chances of winning, especially in the NBA with the playoffs nearing. Because of the still present dangers of the Coronavirus however, it may not be the right thing to do for sports teams to reopen until herd immunity in their area is reached. Herd immunity makes it harder for the coronavirus, or any disease for that matter, to spread. So, we decided to use data on vaccination rates to predict when the states that host NBA teams will reach herd immunity as a tool that NBA teams and policy makers can use to reopen their stadiums to larger numbers of people safely and responsibly.

Question 1
How has the lack of attendance brought on by COVID affected home team performance?

Question 2
When is the right time for teams to fully reopen their venues?

This leads to the next questionwhich is when is the right time for teams to fully reopen their venues?



Method: Vaccination Prediction

Key Assumption	KPI	Data Source	Model Selection
Herd Community: **60%** of Fully Vaccinated Population	Fully Vaccination Rate by states May 22, 2021	CDC State Population	ARIMA Model **92%** Average Model Accuracy

15

To answer this question, we used vaccination data from the CDC. Our goal was to predict the percent of people in a given state that are fully vaccinated by certain dates. We have chosen 20 states that host NBA team to conduct our analysis.

We assumed a fully vaccinated rate of 60%, combining with roughly another 10% of population who got immunity from past infections, would lead to herd immunity following the CDC guidelines.

We also assumed that as newer guidelines are issued, the younger demographic of people in this country will soon have access to the vaccines.

We chose the ARIMA technique for the prediction with an 92% average model accuracy

Our Analysis

On to our analysis

Since the NBA season starts on May 22, it's still **Risky** for fans to go back to stadium based on prediction

Predicted Number of Fully Vaccinated People by May 22

	State	Pred. Number of Immunity Population	% of Population
1.	Wisconsin	3,005,675	51.36%
2.	Ohio	5,984,999	51.09%
3.	New York	9,488,640	49.16%
4.	Massachusetts	3,377,740	48.87%
5.	Minnesota	2,729,531	47.83%
6.	Michigan	4,533,959	45.37%
7.	Pennsylvania	5,509,101	43.03%
8.	Oregon	1,788,054	41.69%
9.	Oklahoma	1,585,092	39.72%
10.	North Carolina	4,170,764	38.98%
11.	Colorado	2,287,165	38.81%

Made in Google Data Studio

Since the NBA season playoff starts on May 22, we build this table showing the % of population that vaccinated that will be achieved by each state. As we can see here, none of the states in analysis has achieved 60% vaccination rate. It's still too risky for fans to go back to arenas by the start of the playoffs based on our predictions.

Date that will Reach 60% Threshold Per State

	State	Date ▲
1.	Ohio	Jun 4
2.	Wisconsin	Jun 5
3.	New York	Jun 10
4.	Massachusetts	Jun 11
5.	Minnesota	Jun 13
6.	Michigan	Jun 18
7.	Oregon	Jun 21
8.	Pennsylvania	Jun 25
9.	Utah	Jun 25
10.	North Carolina	Jul 9
11.	Texas	Jul 10

Made in Google Data Studio

Here are the desired date when each state has reached the 60% fully vaccination rate

Fans can now feel comfortable going back to stadium!

To make sure it's safe for the stadiums to reopen, we need to reach herd immunity and as we mentioned earlier that we are using 60% as our threshold. The table shown here shows for each state, the first date that it will reach 60% vaccination rate based on our model predictions. States should taking into consideration of the desired date before they decide to fully open their stadiums. Luckily for Ohio, they will likely reach herd immunity by early June, but unfortunately, the Cleveland Cavaliers of Ohio probably won't still be playing by that point.

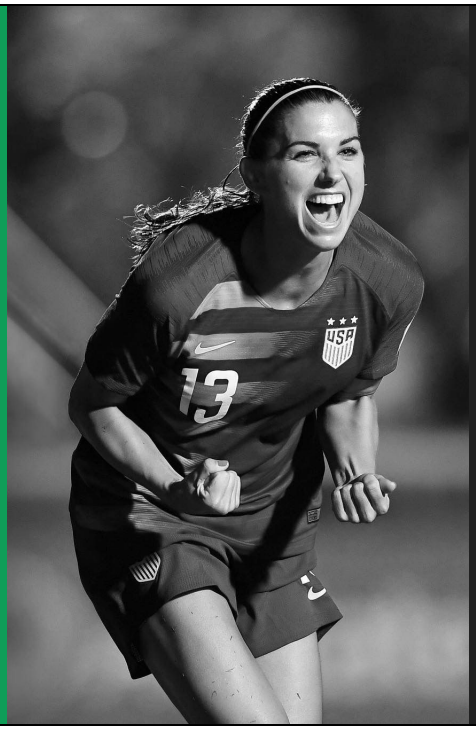
Recommendations

01. When it is safe, sports teams should place an **emphasis on attendance** even if it means subsidizing tickets as fans have a **strong positive effect** on team performance

02. Use our **predictive model** for monitoring when to fully reopen sports stadium can lead to **safe and responsible** reopenings.

Based on our findings, we came up with some recommendations. The first recommendation is that sports teams should place an emphasis on attendance when states are safe to reopen, even if it means subsidizing tickets as fans have a strong positive effect on team performance. In addition, we suggest that sports teams and policy makers use our predictive model for monitoring when to fully reopen sports stadium can lead to safe and responsible reopenings. For fans who lives in states such as Ohio and Wisconsin, they can start to prepare for reopening and send out promotions since they will likely to reach herd immunity soon.

Questions?



That’s all for our presentation, feel free to let us know if there’s any questions.

Reference

1. Data Sources:
    a. Sports Attendance
    b. Vaccination Data
    c. Population Data
2. Supplementary Material:
    a. Github
    b. Sport Game Dashboard (Tableau)
    c. Vaccination Forecast Dashboard (Google Data Studio)

Here you will find all the relevant links used in this project such as data source and dashboard links. Please feel free to click on the link to play around with two individual interactive dashboards built in Tableau and Google Data Studio.