Is Covid-19 to Blame? Explaining Decreased Attendance in the 2021-22 NBA and NHL Seasons

Giancarlo Arcese, Dr. Benjamin Anderson

Colgate University

New York State Economics Association
October 8^{th}, 2022

Overview

- Today I am presenting my senior thesis I completed in April of this year.
- The thesis seeks to analyze whether Covid-19 activity impacted attendance to professional sports matches, specifically for the 2021-22 NBA and NHL Seasons.
- Here, "Covid-19 activity" is measured in two ways:
  1. The lag weekly new Covid-19 cases/deaths (*CBSA level).
  2. The type of Covid-19 policy in place (home team level).
- These two Covid-19 variables, along with several control variables, are implemented in an OLS regression model to assess the impact Covid-19 activity had match attendance.
- This presentation will proceed by outlining the empirical and theoretical groundwork leading up to the model, present the full model and its results, and finish by discussing the results and their implications.

Feel free to ask any questions along the way!

*CBSA - Core Based Statistic Area, defined by the OMB

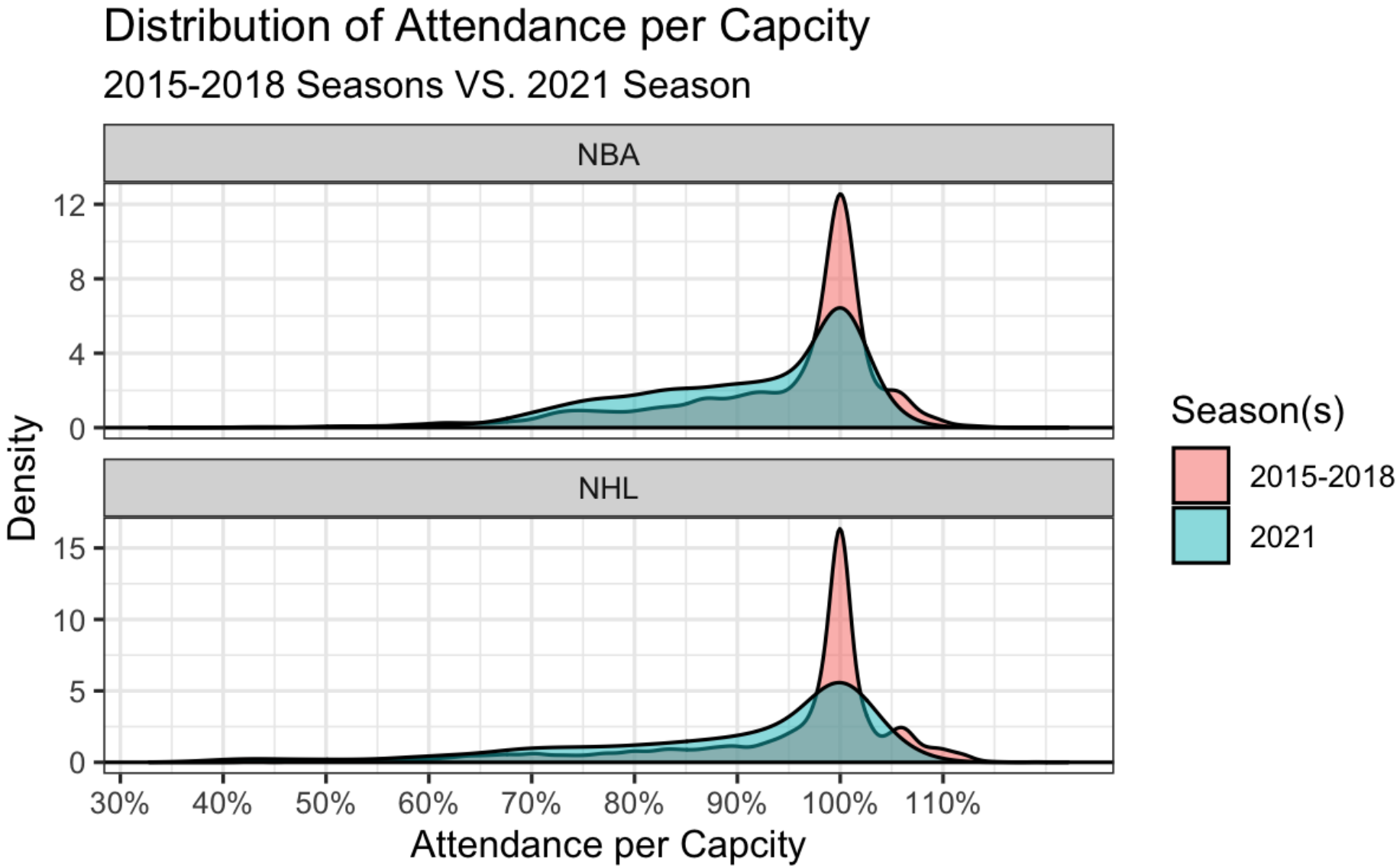
Attendance Stats/Graphs

Season-level Attendance Statistics

		Attendance per Capacity						Attendance per Capacity Home-level Variance			
	Season	Mean	Median	Min	Max	σ	σ^2	Mean	Min	Max	σ
NBA	2015-16	0.940	0.998	0.463	1.150	0.124	0.015	0.005	0.000	0.022	0.006
	2016-17	0.940	0.998	0.328	1.132	0.117	0.014	0.005	0.000	0.022	0.007
	2017-18	0.947	0.991	0.496	1.101	0.091	0.008	0.005	0.000	0.013	0.005
	2018-19	0.943	0.991	0.521	1.105	0.095	0.009	0.004	0.000	0.021	0.005
	2021-22	0.910	0.945	0.428	1.098	0.110	0.012	0.006	0.000	0.027	0.006
NHL	2015-16	0.951	1.000	0.483	1.222	0.118	0.014	0.005	0.000	0.031	0.007
	2016-17	0.946	1.000	0.433	1.123	0.126	0.016	0.004	0.000	0.023	0.007
	2017-18	0.952	1.000	0.422	1.127	0.118	0.014	0.004	0.000	0.024	0.007
	2018-19	0.956	0.993	0.533	1.145	0.104	0.011	0.004	0.000	0.027	0.007
	2021-22	0.894	0.954	0.368	1.073	0.148	0.022	0.006	0.000	0.016	0.005

2021-22 attendance is down, for both the NBA and NHL. Greater variance too.

Attendance Stats/Graphs



Motivation

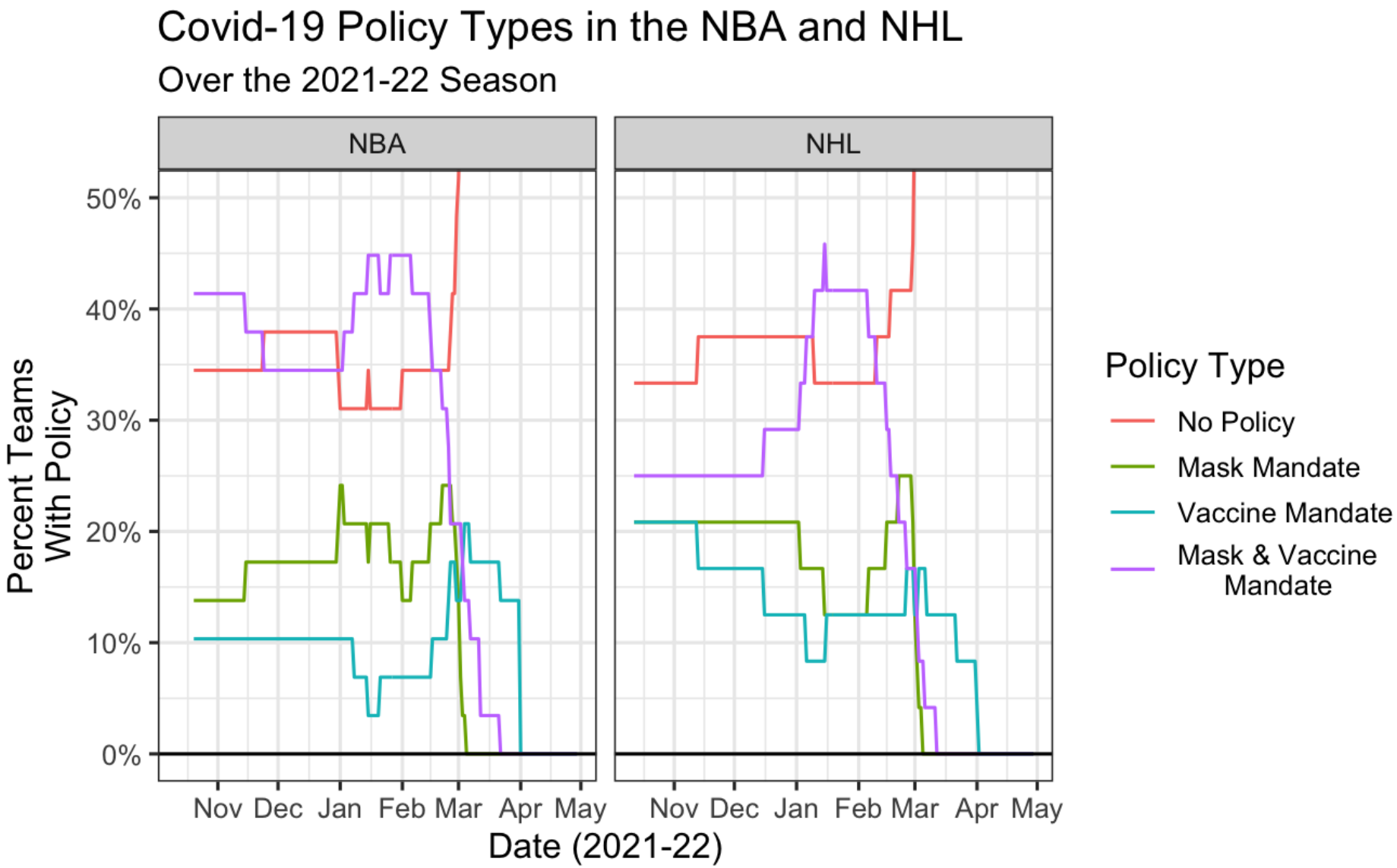
Why might we be interested in studying this decrease in attendance in the 2021-22 season?

1. Natural step forward in the literature:
   - Reade et al. (2020) $\rightarrow$ Belarussian Premier League
   - Reade and Singleton (2021) $\rightarrow$ European Football
   - Humphreys et al. (2021) $\rightarrow$ WTP for Covid-19 preventative measures.
2. New Covid-19 policies to analyze (masks, vaccines, etc.).
3. No stadium capacity restrictions (in the U.S.).
4. Fans may have new perspectives on Covid-19 (Omicron).

Why not the 2020-21 season?

1. Heavy capacity restrictions.
2. Reduced season length. NBA: 82 $\rightarrow$ 72, NHL: 82 $\rightarrow$ 56
3. Worse data documentation.

Covid-19 Policies



Data Outline

Basic Data Structure

Date	Home	Match Stats	CBSA	Covid Data
2022-02-14	Wild	...	Minneapolis	...
2022-02-14	Sharks	...	San Jose	...
2022-02-15	Devils	...	NYC	...
2022-02-15	Penguins	...	Pittsburgh	...

Data Outline

Basic Data Structure

Date	Home	Match Stats	CBSA	Covid Data
2022-02-14	Wild	...	Minneapolis	...
2022-02-14	Sharks	...	San Jose	...
2022-02-15	Devils	...	NYC	...
2022-02-15	Penguins	...	Pittsburgh	...

Unique Obsv. Vars

- Date (day) and the home team uniquely identify observations.

Data Outline

Basic Data Structure

Date	Home	Match Stats	CBSA	Covid Data
2022-02-14	Wild	...	Minneapolis	...
2022-02-14	Sharks	...	San Jose	...
2022-02-15	Devils	...	NYC	...
2022-02-15	Penguins	...	Pittsburgh	...

Unique Obsv. Vars — Day-Home Level

- Date (day) and the home team uniquely identify observations.
- Match Stats are variables at the day-home level, such as the away team, bettings odds, or attendance. Source $\rightarrow$ ESPN (mostly).

Data Outline

Basic Data Structure

Date	Home	Match Stats	CBSA	Covid Data
2022-02-14	Wild	...	Minneapolis	...
2022-02-14	Sharks	...	San Jose	...
2022-02-15	Devils	...	NYC	...
2022-02-15	Penguins	...	Pittsburgh	...
Unique Obsv. Vars		Day-Home Level		Week-CBSA Level

- Date (day) and the home team uniquely identify observations.
- Match Stats are variables at the day-home level, such as the away team, bettings odds, or attendance. Source $\rightarrow$ ESPN (mostly).
- The Covid-19 data is at the weekly-CBSA level and contains data on new cases and deaths. Source $\rightarrow$ The New York Times.

Data Outline

Basic Data Structure

Date	Home	Match Stats	CBSA	Covid Data
2022-02-14	Wild	...	Minneapolis	...
2022-02-14	Sharks	...	San Jose	...
2022-02-15	Devils	...	NYC	...
2022-02-15	Penguins	...	Pittsburgh	...

Unique Obsv. Vars | Day-Home Level | Week-CBSA Level

- Date (day) and the home team uniquely identify observations.
- Match Stats are variables at the day-home level, such as the away team, bettings odds, or attendance. Source $\rightarrow$ ESPN (mostly).
- The Covid-19 data is at the weekly-CBSA level and contains data on new cases and deaths. Source $\rightarrow$ The New York Times.
- 5 total seasons of data. 4 controls (2015-2018), 1 with Covid-19 (2021-22).

Covid-19 Stats/Graphs

League-level Covid-19 Statistics

		Lag Weekly New Cases (per thousand)					Lag Weekly New Deaths				
	Type	Mean	Median	Min	Max	σ	Mean	Median	Min	Max	σ
NBA	Normal	26.13	7.67	-1.34	586.49	62.50	133	86	-2295	1803	204
	Imputed	26.29	7.95	0.24	586.49	62.51	137	86	0	1803	178
NHL	Normal	26.85	8.54	0.00	586.49	63.23	151	97	-2295	1803	265
	Imputed	27.07	8.69	0.46	586.49	63.23	156	98	0	1803	241

Notes:

- Using 1 week lag to better encapsulate fan reactions.
- Negative values lead us to impute the data.

Week	Cases
Week 1	1000
Week 2	-512
Week 3	2000

Impute $\rightarrow$

Week	Cases
Week 1	1000
Week 2	1500
Week 3	2000

Covid-19 Stats/Graphs

League-level Covid-19 Statistics

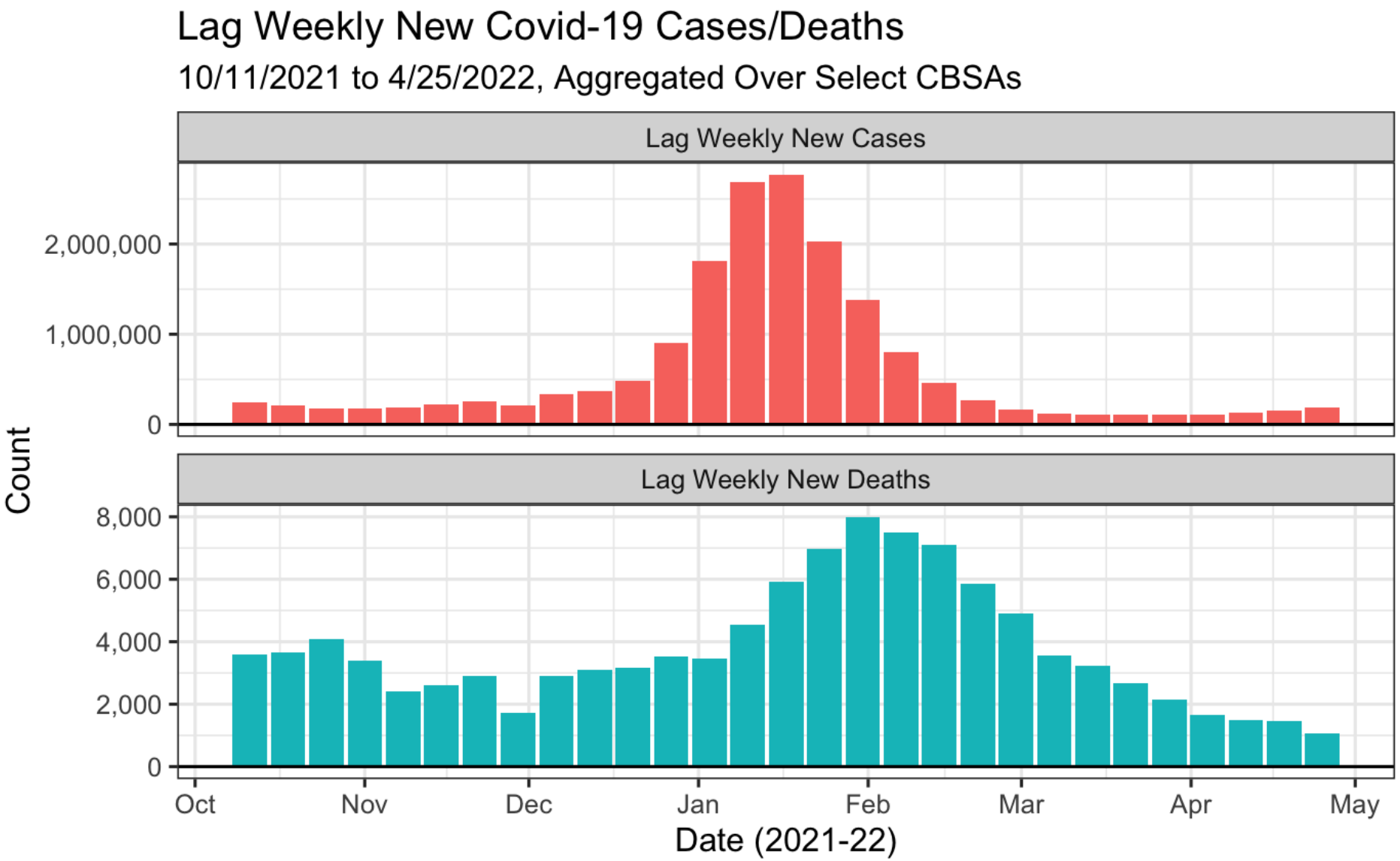
		Lag Weekly New Cases (per thousand)					Lag Weekly New Deaths				
	Type	Mean	Median	Min	Max	σ	Mean	Median	Min	Max	σ
NBA	Normal	26.13	7.67	-1.34	586.49	62.50	133	86	-2295	1803	204
	Imputed	26.29	7.95	0.24	586.49	62.51	137	86	0	1803	178
NHL	Normal	26.85	8.54	0.00	586.49	63.23	151	97	-2295	1803	265
	Imputed	27.07	8.69	0.46	586.49	63.23	156	98	0	1803	241

Observations:

- Case and death data are heavily right-skewed.
- Extreme standard deviations:
  - Omicron spike.
  - Differences in CBSA populations.

Need to control for differences in CBSA populations $\rightarrow$ Convert to quartiles.

Covid-19 Stats/Graphs



Model

The primary regression is defined as the following:

$$\begin{aligned}\text{Attendance per Capacity}_{ijg} = \beta_0 + \beta_1 \text{Quartile}(\text{Lag}(\text{Cases/Deaths}_{ig})) + \ & \mathbf{\Phi Policy}_{ih} \\ + \mathbf{\Gamma} X_{ijg} + \beta_2 \text{Home Rank}_{is} + \beta_3 \text{Away Rank}_{js} & \\ + \delta_i + \delta_j + \epsilon_{ijg} &\end{aligned}$$

Where i = Home level, j = Away level, g = game level, and:

$$\mathbf{\Phi Policy}_{ih} \in \{\text{Masks}_{ig},\ \text{Vaccines}_{ig},\ \text{Masks}_{ig} \times \text{Vaccines}_{ig}\}$$

$$\mathbf{\Gamma} X_{ijg} \in \{\text{Odds}_{ijg},\ \delta_g^{day},\ \delta_g^{month},\ \delta_g^{season},\ \delta_g^{month} \times \delta_g^{2021-22}\}$$

Variable(s):

Model

The primary regression is defined as the following:

$$\begin{aligned}\text{Attendance per Capacity}_{ijg} = \beta_0 + \beta_1 \text{Quartile}(\text{Lag}(\text{Cases/Deaths}_{ig})) + \mathbf{\Phi Policy}_{ih} \\ + \mathbf{\Gamma} X_{ijg} + \beta_2 \text{Home Rank}_{is} + \beta_3 \text{Away Rank}_{js} \\ + \delta_i + \delta_j + \epsilon_{ijg}\end{aligned}$$

Where i = Home level, j = Away level, g = game level, and:

$$\mathbf{\Phi Policy}_{ih} \in \{\text{Masks}_{ig},\ \text{Vaccines}_{ig},\ \text{Masks}_{ig} \times \text{Vaccines}_{ig}\}$$

$$\mathbf{\Gamma} X_{ijg} \in \{\text{Odds}_{ijg},\ \delta_g^{day},\ \delta_g^{month},\ \delta_g^{season},\ \delta_g^{month} \times \delta_g^{2021-22}\}$$

Variable(s): Lag Weekly New Cases/Deaths Quartile

Model

The primary regression is defined as the following:

$$\begin{aligned}\text{Attendance per Capacity}_{ijg} = \beta_0 + \beta_1 \text{Quartile}(\text{Lag}(\text{Cases/Deaths}_{ig})) + \; & \boldsymbol{\Phi}\textbf{Policy}_{ih} \\ + \boldsymbol{\Gamma} X_{ijg} + \beta_2 \text{Home Rank}_{is} + \beta_3 \text{Away Rank}_{js} & \\ + \delta_i + \delta_j + \epsilon_{ijg} &\end{aligned}$$

Where i = Home level, j = Away level, g = game level, and:

$$\boldsymbol{\Phi}\textbf{Policy}_{ih} \in \{\text{Masks}_{ig},\ \text{Vaccines}_{ig},\ \text{Masks}_{ig} \times \text{Vaccines}_{ig}\}$$

$$\boldsymbol{\Gamma} X_{ijg} \in \{\text{Odds}_{ijg},\ \delta_g^{day},\ \delta_g^{month},\ \delta_g^{season},\ \delta_g^{month} \times \delta_g^{2021-22}\}$$

Variable(s): Policy Indicators

Model

The primary regression is defined as the following:

$$\begin{aligned}\text{Attendance per Capacity}_{ijg} = \beta_0 + \beta_1 \text{Quartile}(\text{Lag}(\text{Cases/Deaths}_{ig})) + \ & \mathbf{\Phi Policy}_{ih} \\ + \ & \mathbf{\Gamma} X_{ijg} + \beta_2 \text{Home Rank}_{is} + \beta_3 \text{Away Rank}_{js} \\ + \ & \delta_i + \delta_j + \epsilon_{ijg}\end{aligned}$$

Where i = Home level, j = Away level, g = game level, and:

$$\mathbf{\Phi Policy}_{ih} \in \{\text{Masks}_{ig},\ \text{Vaccines}_{ig},\ \text{Masks}_{ig} \times \text{Vaccines}_{ig}\}$$

$$\mathbf{\Gamma} X_{ijg} \in \{\text{Odds}_{ijg},\ \delta_g^{day},\ \delta_g^{month},\ \delta_g^{season},\ \delta_g^{month} \times \delta_g^{2021-22}\}$$

Variable(s): Betting Odds, day of week fixed effects, month fixed effects, season fixed effects, month-2021-22 season interaction.

Model

The primary regression is defined as the following:

$$\begin{aligned}\text{Attendance per Capacity}_{ijg} = \beta_0 + \beta_1 \text{Quartile}(\text{Lag}(\text{Cases/Deaths}_{ig})) + \ & \mathbf{\Phi Policy}_{ih} \\ + \mathbf{\Gamma} X_{ijg} + \ & \beta_2 \text{Home Rank}_{is} + \beta_3 \text{Away Rank}_{js} \\ + \delta_i + \delta_j + \epsilon_{ijg}\end{aligned}$$

Where i = Home level, j = Away level, g = game level, and:

$$\mathbf{\Phi Policy}_{ih} \in \{\text{Masks}_{ig},\ \text{Vaccines}_{ig},\ \text{Masks}_{ig} \times \text{Vaccines}_{ig}\}$$

$$\mathbf{\Gamma} X_{ijg} \in \{\text{Odds}_{ijg},\ \delta_g^{day},\ \delta_g^{month},\ \delta_g^{season},\ \delta_g^{month} \times \delta_g^{2021-22}\}$$

Variable(s): Home team rank, away team rank.

Model

The primary regression is defined as the following:

$$\begin{aligned}\text{Attendance per Capacity}_{ijg} = \beta_0 + \beta_1 \text{Quartile}(\text{Lag}(\text{Cases/Deaths}_{ig})) + \ & \mathbf{\Phi Policy}_{ih} \\ + \mathbf{\Gamma} X_{ijg} + \beta_2 \text{Home Rank}_{is} + \beta_3 \text{Away Rank}_{js} & \\ + \ \delta_i \ + \ \delta_j \ + \epsilon_{ijg} &\end{aligned}$$

Where i = Home level, j = Away level, g = game level, and:

$$\mathbf{\Phi Policy}_{ih} \in \{\text{Masks}_{ig},\ \text{Vaccines}_{ig},\ \text{Masks}_{ig} \times \text{Vaccines}_{ig}\}$$

$$\mathbf{\Gamma} X_{ijg} \in \{\text{Odds}_{ijg},\ \delta_g^{day},\ \delta_g^{month},\ \delta_g^{season},\ \delta_g^{month} \times \delta_g^{2021-22}\}$$

Variable(s): Home team fixed effects, away team fixed effects.

Key Results

Regression Results. Standard Errors Clustered at Home Team Level

	Attendance per Capacity			
	NBA		NHL	
Variable	Cases	Deaths	Cases	Deaths
2021-22 Season	-5.02** (2.36)	-5.59** (2.52)	-5.67** (2.82)	-6.92** (3.18
Quartile 2	-1.40 (0.92)	-0.43 (0.94)	-0.46 (1.15)	1.07 (1.52)
Quartile 3	-0.11 (0.99)	-0.33 (0.66)	-0.49 (1.37)	1.14 (1.56)
Quartile 4	-0.20 (0.97)	-0.37 (1.14)	0.38 (1.68)	3.10 (2.25)
Masks	2.84 (2.16)	2.73 (2.13)	8.19* (4.30)	8.17* (4.25)
Vaccines	2.48 (2.89)	2.42 (2.94)	-14.28** (6.24)	-14.76** (6.37)
Masks × Vaccines	-5.00 (3.48)	-4.84 (3.52)	7.26 (6.24)	7.40 (8.03)
2021-22 Season × November	1.06 (3.48)	1.36 (1.10)	1.95 (1.73)	2.28 (1.72)
2021-22 Season × December	1.66 (1.19)	1.99* (1.16)	0.29 (2.19)	0.36 (1.89)
2021-22 Season × January	0.18 (1.60)	0.88 (1.56)	-0.91 (2.38)	-1.19 (1.71)
2021-22 Season × February	2.66* (1.38)	3.24** (1.56)	-0.21 (2.27)	-1.27 (1.90)
2021-22 Season × March	4.01*** (1.42)	4.60*** (1.51)	3.86 (2.89)	4.30 (2.90)
2021-22 Season × April	5.80** (2.27)	6.16*** (2.22)	-1.58 (2.51)	-0.64 (3.09)
Observations	5,951	5,951	4,726	4,726
Adjusted R^2	0.54	0.54	0.63	0.63
Note:				*p<0.1; **p<0.05; ***p<0.01

Key Results

Regression Results. Standard Errors Clustered at Home Team Level

	Attendance per Capacity			
	NBA		NHL	
Variable	Cases	Deaths	Cases	Deaths
2021-22 Season	-5.02** (2.36)	-5.59** (2.52)	-5.67** (2.82)	-6.92** (3.18
Quartile 2	-1.40 (0.92)	-0.43 (0.94)	-0.46 (1.15)	1.07 (1.52)
Quartile 3	-0.11 (0.99)	-0.33 (0.66)	-0.49 (1.37)	1.14 (1.56)
Quartile 4	-0.20 (0.97)	-0.37 (1.14)	0.38 (1.68)	3.10 (2.25)
Masks	2.84 (2.16)	2.73 (2.13)	8.19* (4.30)	8.17* (4.25)
Vaccines	2.48 (2.89)	2.42 (2.94)	-14.28** (6.24)	-14.76** (6.37)
Masks × Vaccines	-5.00 (3.48)	-4.84 (3.52)	7.26 (6.24)	7.40 (8.03)
2021-22 Season × November	1.06 (3.48)	1.36 (1.10)	1.95 (1.73)	2.28 (1.72)
2021-22 Season × December	1.66 (1.19)	1.99* (1.16)	0.29 (2.19)	0.36 (1.89)
2021-22 Season × January	0.18 (1.60)	0.88 (1.56)	-0.91 (2.38)	-1.19 (1.71)
2021-22 Season × February	2.66* (1.38)	3.24** (1.56)	-0.21 (2.27)	-1.27 (1.90)
2021-22 Season × March	4.01*** (1.42)	4.60*** (1.51)	3.86 (2.89)	4.30 (2.90)
2021-22 Season × April	5.80** (2.27)	6.16*** (2.22)	-1.58 (2.51)	-0.64 (3.09)
Observations	5,951	5,951	4,726	4,726
Adjusted R^2	0.54	0.54	0.63	0.63
Note:				*p<0.1; **p<0.05; ***p<0.01

The 2021-22 variable is negative and significant, as expected.

Key Results

Regression Results. Standard Errors Clustered at Home Team Level

	Attendance per Capacity			
	NBA		NHL	
Variable	Cases	Deaths	Cases	Deaths
2021-22 Season	-5.02** (2.36)	-5.59** (2.52)	-5.67** (2.82)	-6.92** (3.18
Quartile 2	-1.40 (0.92)	-0.43 (0.94)	-0.46 (1.15)	1.07 (1.52)
Quartile 3	-0.11 (0.99)	-0.33 (0.66)	-0.49 (1.37)	1.14 (1.56)
Quartile 4	-0.20 (0.97)	-0.37 (1.14)	0.38 (1.68)	3.10 (2.25)
Masks	2.84 (2.16)	2.73 (2.13)	8.19* (4.30)	8.17* (4.25)
Vaccines	2.48 (2.89)	2.42 (2.94)	-14.28** (6.24)	-14.76** (6.37)
Masks × Vaccines	-5.00 (3.48)	-4.84 (3.52)	7.26 (6.24)	7.40 (8.03)
2021-22 Season × November	1.06 (3.48)	1.36 (1.10)	1.95 (1.73)	2.28 (1.72)
2021-22 Season × December	1.66 (1.19)	1.99* (1.16)	0.29 (2.19)	0.36 (1.89)
2021-22 Season × January	0.18 (1.60)	0.88 (1.56)	-0.91 (2.38)	-1.19 (1.71)
2021-22 Season × February	2.66* (1.38)	3.24** (1.56)	-0.21 (2.27)	-1.27 (1.90)
2021-22 Season × March	4.01*** (1.42)	4.60*** (1.51)	3.86 (2.89)	4.30 (2.90)
2021-22 Season × April	5.80** (2.27)	6.16*** (2.22)	-1.58 (2.51)	-0.64 (3.09)
Observations	5,951	5,951	4,726	4,726
Adjusted R^2	0.54	0.54	0.63	0.63
Note:				*p<0.1; **p<0.05; ***p<0.01

Quartile variables are insignificant, and are unexpectedly positive in some cases.

Key Results

Regression Results. Standard Errors Clustered at Home Team Level

	Attendance per Capacity			
	NBA		NHL	
Variable	Cases	Deaths	Cases	Deaths
2021-22 Season	-5.02** (2.36)	-5.59** (2.52)	-5.67** (2.82)	-6.92** (3.18
Quartile 2	-1.40 (0.92)	-0.43 (0.94)	-0.46 (1.15)	1.07 (1.52)
Quartile 3	-0.11 (0.99)	-0.33 (0.66)	-0.49 (1.37)	1.14 (1.56)
Quartile 4	-0.20 (0.97)	-0.37 (1.14)	0.38 (1.68)	3.10 (2.25)
Masks	2.84 (2.16)	2.73 (2.13)	8.19* (4.30)	8.17* (4.25)
Vaccines	2.48 (2.89)	2.42 (2.94)	-14.28** (6.24)	-14.76** (6.37)
Masks × Vaccines	-5.00 (3.48)	-4.84 (3.52)	7.26 (6.24)	7.40 (8.03)
2021-22 Season × November	1.06 (3.48)	1.36 (1.10)	1.95 (1.73)	2.28 (1.72)
2021-22 Season × December	1.66 (1.19)	1.99* (1.16)	0.29 (2.19)	0.36 (1.89)
2021-22 Season × January	0.18 (1.60)	0.88 (1.56)	-0.91 (2.38)	-1.19 (1.71)
2021-22 Season × February	2.66* (1.38)	3.24** (1.56)	-0.21 (2.27)	-1.27 (1.90)
2021-22 Season × March	4.01*** (1.42)	4.60*** (1.51)	3.86 (2.89)	4.30 (2.90)
2021-22 Season × April	5.80** (2.27)	6.16*** (2.22)	-1.58 (2.51)	-0.64 (3.09)
Observations	5,951	5,951	4,726	4,726
Adjusted R^2	0.54	0.54	0.63	0.63
Note:				*p<0.1; **p<0.05; ***p<0.01

NBA Policy → Individual policy variables are positive, but their interaction is negative, and all are insignificant.

Key Results

Regression Results. Standard Errors Clustered at Home Team Level

	Attendance per Capacity			
	NBA		NHL	
Variable	Cases	Deaths	Cases	Deaths
2021-22 Season	-5.02** (2.36)	-5.59** (2.52)	-5.67** (2.82)	-6.92** (3.18
Quartile 2	-1.40 (0.92)	-0.43 (0.94)	-0.46 (1.15)	1.07 (1.52)
Quartile 3	-0.11 (0.99)	-0.33 (0.66)	-0.49 (1.37)	1.14 (1.56)
Quartile 4	-0.20 (0.97)	-0.37 (1.14)	0.38 (1.68)	3.10 (2.25)
Masks	2.84 (2.16)	2.73 (2.13)	8.19* (4.30)	8.17* (4.25)
Vaccines	2.48 (2.89)	2.42 (2.94)	-14.28** (6.24)	-14.76** (6.37)
Masks × Vaccines	-5.00 (3.48)	-4.84 (3.52)	7.26 (6.24)	7.40 (8.03)
2021-22 Season × November	1.06 (3.48)	1.36 (1.10)	1.95 (1.73)	2.28 (1.72)
2021-22 Season × December	1.66 (1.19)	1.99* (1.16)	0.29 (2.19)	0.36 (1.89)
2021-22 Season × January	0.18 (1.60)	0.88 (1.56)	-0.91 (2.38)	-1.19 (1.71)
2021-22 Season × February	2.66* (1.38)	3.24** (1.56)	-0.21 (2.27)	-1.27 (1.90)
2021-22 Season × March	4.01*** (1.42)	4.60*** (1.51)	3.86 (2.89)	4.30 (2.90)
2021-22 Season × April	5.80** (2.27)	6.16*** (2.22)	-1.58 (2.51)	-0.64 (3.09)
Observations	5,951	5,951	4,726	4,726
Adjusted R^2	0.54	0.54	0.63	0.63
Note:				*p<0.1; **p<0.05; ***p<0.01

NHL Policy → Mask and mask-vaccine interaction is positive, while vaccines are markedly negatively and significant.

Key Results

Regression Results. Standard Errors Clustered at Home Team Level

	Attendance per Capacity			
	NBA		NHL	
Variable	Cases	Deaths	Cases	Deaths
2021-22 Season	-5.02** (2.36)	-5.59** (2.52)	-5.67** (2.82)	-6.92** (3.18
Quartile 2	-1.40 (0.92)	-0.43 (0.94)	-0.46 (1.15)	1.07 (1.52)
Quartile 3	-0.11 (0.99)	-0.33 (0.66)	-0.49 (1.37)	1.14 (1.56)
Quartile 4	-0.20 (0.97)	-0.37 (1.14)	0.38 (1.68)	3.10 (2.25)
Masks	2.84 (2.16)	2.73 (2.13)	8.19* (4.30)	8.17* (4.25)
Vaccines	2.48 (2.89)	2.42 (2.94)	-14.28** (6.24)	-14.76** (6.37)
Masks × Vaccines	-5.00 (3.48)	-4.84 (3.52)	7.26 (6.24)	7.40 (8.03)
2021-22 Season × November	1.06 (3.48)	1.36 (1.10)	1.95 (1.73)	2.28 (1.72)
2021-22 Season × December	1.66 (1.19)	1.99* (1.16)	0.29 (2.19)	0.36 (1.89)
2021-22 Season × January	0.18 (1.60)	0.88 (1.56)	-0.91 (2.38)	-1.19 (1.71)
2021-22 Season × February	2.66* (1.38)	3.24** (1.56)	-0.21 (2.27)	-1.27 (1.90)
2021-22 Season × March	4.01*** (1.42)	4.60*** (1.51)	3.86 (2.89)	4.30 (2.90)
2021-22 Season × April	5.80** (2.27)	6.16*** (2.22)	-1.58 (2.51)	-0.64 (3.09)
Observations	5,951	5,951	4,726	4,726
Adjusted R^2	0.54	0.54	0.63	0.63
Note:				*p<0.1; **p<0.05; ***p<0.01

Large and positive coefficients on the 2021-22 season and March/April variables suggest evidence of a comeback effect in the NBA. Not observed in the NHL.

Discussion

Takeaways from results:

- Weekly new cases/deaths did not appear to impact attendance. Robust to different lags and different CBSA-county definitions.
- Policy appeared to only impact attendance in the NHL. Masks appeared to bring in attendance and vaccines drove it away.
- In the NBA, attendance increased towards the end of the season, suggesting fan's may have perceived Covid-19 as less of a threat as time passed. This did not occur in the NHL.

Conclusion:

While attendance overall decreased in both the NBA and NHL during the 2021-22 season, only weak evidence suggests direct Covid-19 activity impacted this decrease. This somewhat agrees with the relevant literature, which too finds weak/inconsistent results.

Going Forward

A few things to consider going forward:

- Adjust case/death data by CBSA population.
- Find an instrument for cases/deaths $\rightarrow$ Bordering counties?
- Add more controls (time of the game, weather, power rankings).
- Track local news/media coverage? GDELT.

Thank You!

Questions?