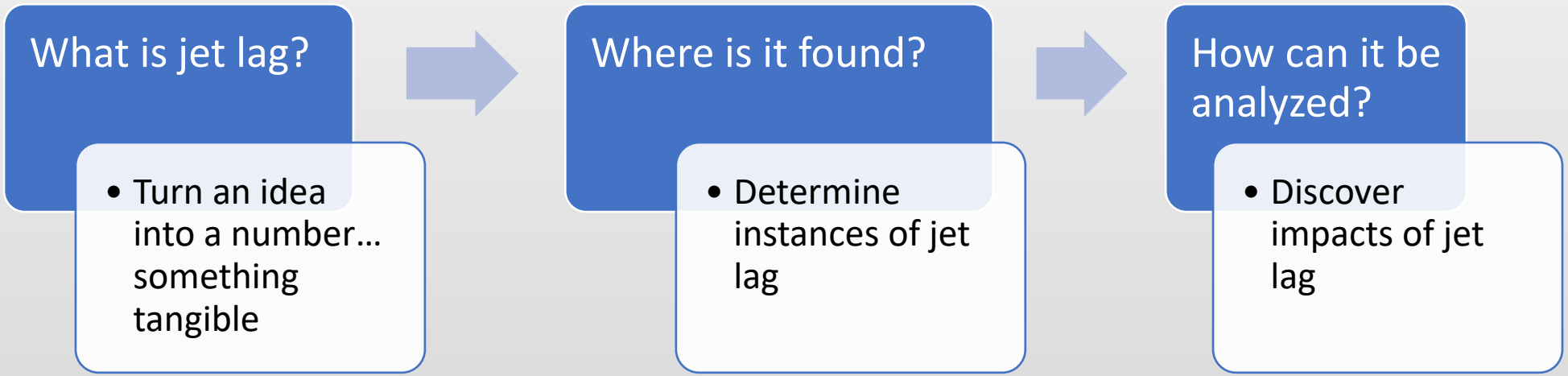
Impact of Jet Lag on MLB Team Performance

Jonathan Grossman | Science Seminar


What is jet lag?
• Turn an idea into a number… something tangible
Where is it found?
• Determine instances of jet lag
How can it be analyzed?
• Discover impacts of jet lag

Jet Lag in Sports

- All major sports leagues travel between time zones
- Disruptions in circadian rhythms
- Peak physical performance required
- Possible statistical advantage/disadvantages

Definition:

a condition that is characterized by various psychological and physiological effects (such as fatigue and irritability), occurs following long flight through several time zones, and probably results from disruption of circadian rhythms in the human body

Why MLB?

- NHL – 82 games/team/season
- NBA – 82 games/team/season
- NFL – 16 games/team/season
- **MLB – 162 games/team/season**

Research Design – Overview

- Data sample: 2016–2019 MLB regular season games (n = 19,436)
  - API: MySportsFeeds.com
- Determine if/when jet lag
  - Create and apply a jet lag equation
- Determine jet lag's impacts on performance:
  - Win percentage
  - Runs scored per game
  - Runs Allowed per game
- Test for significance

Code algorithms to sort through data and calculate desired values (python)

Research Design – Data Analysis

Part I

How does jet lag, in any form, impact a team's performance?

Part II

How does eastward jet lag impact a team's performance compared to westward jet lag?

Research Design – Gathering Data

CODE

Game Date	Game Time	Away Team Abbr.	Away Team Name	Home Team Abbr.	Home Team Name	Away Score Total	Home Score Total
4/17/16	17:35:00 GMT	MIL	Brewers	PIT	Pirates	3	9
4/17/16	17:35:00 GMT	WAS	Nationals	PHI	Phillies	2	3
4/17/16	18:10:00 GMT	DET	Tigers	HOU	Astros	4	5
4/17/16	18:10:00 GMT	LAA	Angels	MIN	Twins	2	3
4/17/16	18:15:00 GMT	CIN	Reds	STL	Cardinals	3	4
4/17/16	18:20:00 GMT	COL	Rockies	CHC	Cubs	2	0
4/17/16	20:05:00 GMT	KC	Royals	OAK	Athletics	2	3
4/17/16	20:40:00 GMT	ARI	Diamondbacks	SD	Padres	7	3
4/17/16	00:05:00 GMT	SF	Giants	LAD	Dodgers	1	3
4/18/16	15:05:00 GMT	TOR	Blue Jays	BOS	Red Sox	4	3
4/18/16	23:05:00 GMT	NYM	Mets	PHI	Phillies	5	2
4/18/16	23:10:00 GMT	MIL	Brewers	MIN	Twins	4	7
4/18/16	23:10:00 GMT	WAS	Nationals	MIA	Marlins	1	6
4/18/16	23:10:00 GMT	COL	Rockies	CIN	Reds	5	1
4/18/16	00:09:00 GMT	CHC	Cubs	STL	Cardinals	5	0
4/18/16	00:10:00 GMT	LAA	Angels	CWS	White Sox	7	0
4/18/16	02:15:00 GMT	ARI	Diamondbacks	SF	Giants	9	7
4/19/16	17:10:00 GMT	MIL	Brewers	MIN	Twins	6	5
4/19/16	22:10:00 GMT	SEA	Mariners	CLE	Indians	2	3
4/19/16	23:05:00 GMT	TOR	Blue Jays	BAL	Orioles	4	3
4/19/16	23:05:00 GMT	NYM	Mets	PHI	Phillies	11	1
4/19/16	23:05:00 GMT	OAK	Athletics	NYY	Yankees	3	2
4/19/16	23:10:00 GMT	WAS	Nationals	MIA	Marlins	8	0
4/19/16	23:10:00 GMT	LAD	Dodgers	ATL	Braves	1	8
4/19/16	23:10:00 GMT	TB	Rays	BOS	Red Sox	3	0
4/19/16	23:10:00 GMT	COL	Rockies	CIN	Reds	3	4
4/19/16	23:15:00 GMT	DET	Tigers	KC	Royals	6	8

19,436 x 8 Excel spreadsheet containing data from every MLB regular season game (2016–2019)

Research Design – Jet Lag Equation

$$Jet\ lag = \frac{\Delta\ miles\ travelled\ *\ \Delta\ time\ zones}{\Delta\ time\ between\ events}$$

Jet Lag Equation Breakdown

$$Jet\ lag = \frac{\Delta\ miles\ travelled\ *\ \Delta\ time\ zones}{\Delta\ time\ between\ events}$$

$\Delta\ miles\ travelled$: distance travelled from prior game

$\Delta\ time\ zones$: number of hours gained/lost from travel (positive if westward, negative if eastward)

$\Delta\ time\ between\ events$: number of hours since previous game start

Jet lag = 0 if team has not travelled since previous game

Jet lag > 0 if team is experiencing westward jet lag since previous game

Jet lag < 0 if team is experiencing eastward jet lag since previous game

Larger value (very positive or very negative) = severe jet lag since previous game

Jet Lag Equation Breakdown

$$Jet\ lag = \frac{\Delta\ miles\ travelled\ *\ \Delta\ time\ zones}{\Delta\ time\ between\ events}$$

⇧ *miles travelled* = ⇧ *jet lag*

⇧ *hours gained/lost* = ⇧ *jet lag*

⇧ *time between events* = ⇩ *jet lag*

Realistic range of *jet lag* values:
[-3000, 3000]

Saturday: 7:00 Houston Time

@

Sunday: 7:00 Houston Time

@

KC jet lag experienced: 0

Monday: 7:00 Oakland Time

@

KC jet lag experienced: 125.8837011

Research Design – Calculating Jet Lag

Game Date	Game Time	Away Team Abbr.	Away Team Name	Home Team Abbr.	Home Team Name	Away Score Total	Home Score Total	Away Calculated JL	Home Calculated JL	Win Margin – positive means home wins, negative away
4/17/16	17:35:00 GMT	MIL	Brewers	PIT	Pirates	3	9	0	0	6
4/17/16	17:35:00 GMT	WAS	Nationals	PHI	Phillies	2	3	0	0	1
4/17/16	18:10:00 GMT	DET	Tigers	HOU	Astros	4	5	0	0	1
4/17/16	18:10:00 GMT	LAA	Angels	MIN	Twins	2	3	0	0	1
4/17/16	18:15:00 GMT	CIN	Reds	STL	Cardinals	3	4	0	0	1
4/17/16	18:20:00 GMT	COL	Rockies	CHC	Cubs	2	0	0	0	-2
4/17/16	20:05:00 GMT	KC	Royals	OAK	Athletics	2	3	0	0	1
4/17/16	20:40:00 GMT	ARI	Diamondbacks	SD	Padres	7	3	0	0	-4
4/17/16	00:05:00 GMT	SF	Giants	LAD	Dodgers	1	3	0	0	2
4/18/16	15:05:00 GMT	TOR	Blue Jays	BOS	Red Sox	4	3	0	0	-1
4/18/16	23:05:00 GMT	NYM	Mets	PHI	Phillies	5	2	0	0	-3
4/18/16	23:10:00 GMT	MIL	Brewers	MIN	Twins	4	7	25.07832483	0	3
4/18/16	23:10:00 GMT	WAS	Nationals	MIA	Marlins	1	6	0	0	5
4/18/16	23:10:00 GMT	COL	Rockies	CIN	Reds	5	1	-8.91664019	-10.63639344	-4
4/18/16	00:09:00 GMT	CHC	Cubs	STL	Cardinals	5	0	0	0	-5
4/18/16	00:10:00 GMT	LAA	Angels	CWS	White Sox	7	0	0	144.4858317	-7
4/18/16	02:15:00 GMT	ARI	Diamondbacks	SF	Giants	9	7	0	0	-2
4/19/16	17:10:00 GMT	MIL	Brewers	MIN	Twins	6	5	0	0	-1
4/19/16	22:10:00 GMT	SEA	Mariners	CLE	Indians	2	3	0	0	1
4/19/16	23:05:00 GMT	TOR	Blue Jays	BAL	Orioles	4	3	0	-12.90683949	-1
4/19/16	23:05:00 GMT	NYM	Mets	PHI	Phillies	11	1	0	0	-10
4/19/16	23:05:00 GMT	OAK	Athletics	NYY	Yankees	3	2	-150.4508935	0	-1
4/19/16	23:10:00 GMT	WAS	Nationals	MIA	Marlins	8	0	0	0	-8
4/19/16	23:10:00 GMT	LAD	Dodgers	ATL	Braves	1	8	-81.2896335	0	7
4/19/16	23:10:00 GMT	TB	Rays	BOS	Red Sox	3	0	0	0	-3
4/19/16	23:10:00 GMT	COL	Rockies	CIN	Reds	3	4	0	0	1

Jet lag equation applied to both home and away teams in all 19,436 games (MLB, 2016–2019)

Analysis – Part I

Impact of Jet Lag on MLB Team Performance

How does jet lag, in any form, impact a team's performance?

i) H_o: There is no relationship between jet lag and MLB teams' probability to win.

H_a: Experiencing jet lag will on average decrease teams' probability to win.

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ii) H_o: MLB teams score the same runs per game on average with and without jet lag.

H_a: Experiencing jet lag will on average decrease teams' runs scored per game.

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iii) H_o: MLB teams allow the same runs per game on average with and without jet lag.

H_a: Experiencing jet lag will on average increase teams' runs allowed per game.

Current Literature – Jet Lag on Sport Performance

- Jet-lagged MLB teams found to demonstrate weakened offense and defense performance (Song et al., 2017)
- Swimmers found to swim 6% slower when experiencing jet lag (Anderson et al., 2018)
- 2008 Beijing games – six Australian swimmers exhibited 10%-15% decreased testosterone levels when sleeping less (Rosa et al., 2016)

Data and Statistical Analysis

Jet Lag Effect on Win Percentage by Team (2016–2019)

	Team Abbr.	No Lag Win	Lag Win %	Effect of Lag on Win %	Games Won/Lost Due to Lag	P-value
NL East	ATL	0.516239316	0.403225806	-0.11301351	-18.30818859	0.045285
	MIA	0.424496644	0.46	0.035503356	5.751543624	0.686871
	NYM	0.501689189	0.410714286	-0.090974903	-14.73793436	0.096544
	PHI	0.468120805	0.365384615	-0.10273619	-16.64326278	0.077006
	WAS	0.567839196	0.549019608	-0.018819588	-3.048773278	0.397316
NL Central	CHC	0.570409982	0.620689655	0.050279673	8.145307026	0.811382
	CIN	0.432098765	0.407407407	-0.024691358	-4	0.337279
	MIL	0.539019964	0.479591837	-0.059428127	-9.627356569	0.138717
	PIT	0.475849732	0.436781609	-0.039068122	-6.32903584	0.248537
	STL	0.545126354	0.489361702	-0.055764652	-9.033873569	0.158051
NL West	ARI	0.505300353	0.524390244	0.019089891	3.092562268	0.626652
	COL	0.496254682	0.513043478	0.016788797	2.719785051	0.627788
	LAD	0.607705779	0.58974359	-0.01796219	-2.909874714	0.380564
	SD	0.428571429	0.395061728	-0.0335097	-5.428571429	0.284102
	SF	0.473043478	0.397260274	-0.075783204	-12.27687909	0.110684
AL East	BAL	0.414839798	0.345454545	-0.069385252	-11.24041085	0.158365
	BOS	0.587837838	0.535714286	-0.052123552	-8.444015444	0.224765
	NYY	0.58557047	0.557692308	-0.027878162	-4.516262261	0.347899
	TB	0.513377926	0.54	0.026622074	4.31277592	0.64095
	TOR	0.469491525	0.482758621	0.013267095	2.149269433	0.576521
AL Central	CWS	0.442028986	0.368421053	-0.073607933	-11.92448513	0.090448
	CLE	0.590664273	0.566666667	-0.023997606	-3.887612208	0.333962
	DET	0.406028369	0.390243902	-0.015784466	-2.55708355	0.392773
	KC	0.430357143	0.420454545	-0.009902597	-1.604220779	0.430776
	MIN	0.49382716	0.530864198	0.037037037	6	0.733358
AL West	HOU	0.597845601	0.681318681	0.08347308	13.52263894	0.93486
	LAA	0.480427046	0.418604651	-0.061822395	-10.01522801	0.142445
	OAK	0.534391534	0.432098765	-0.102292769	-16.57142857	0.042363
	SEA	0.481675393	0.6	0.118324607	19.16858639	0.97301
	TEX	0.502702703	0.419354839	-0.083347864	-13.50235397	0.068389
MLB		0.502739566	0.479385965		-121.7443823	0.018072

n = 17,156 n = 2,280

No Lag Win %	Lag Win %	P-value
0.502739566	0.47938596	0.018072

P-value in context:

The probability of obtaining these results given that jet lag does not decrease a team's chance to win is 0.018072

YES – statistically significant decrease

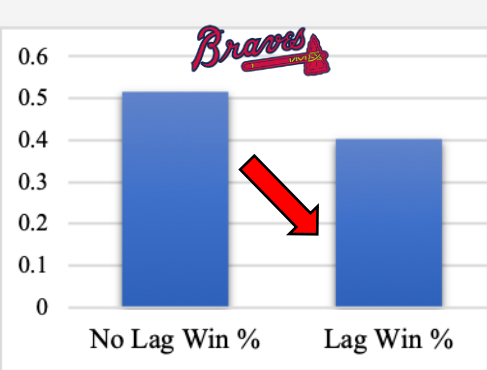
Noteworthy statistics:

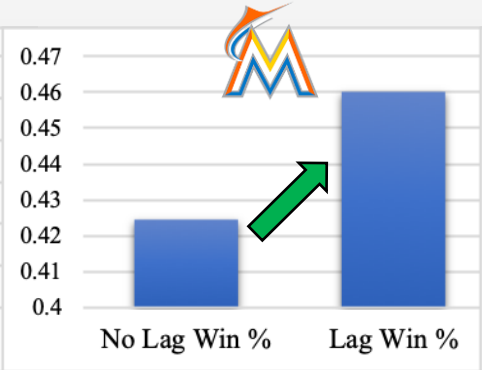
Between 2016–2019, among all 30 MLB teams, the estimated net impact of jet lag is **121.75 games lost**

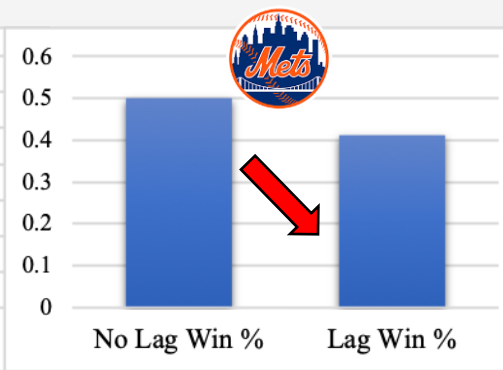
Within the NL and AL, **the division that lost the most games due to jet lag was East**, followed by Central and then West with the least games lost due to jet lag

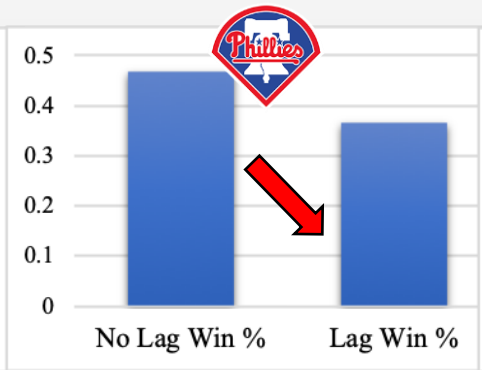
Suggests that teams playing on the **east coast are most impacted by jet lag, west coast are least impacted**

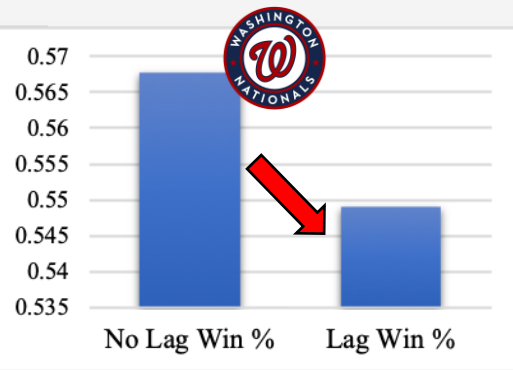
Jet Lag Effect on Win Percentage by Team (NL, 2016–2019)

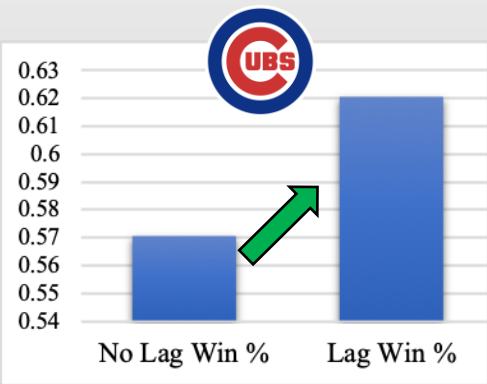


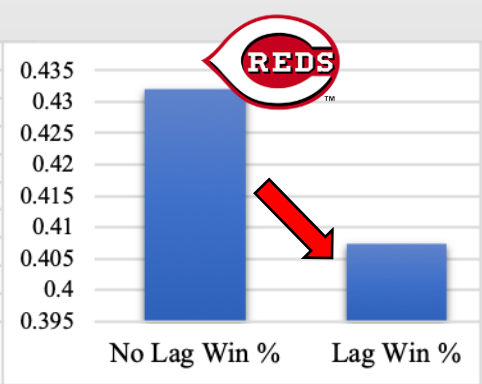


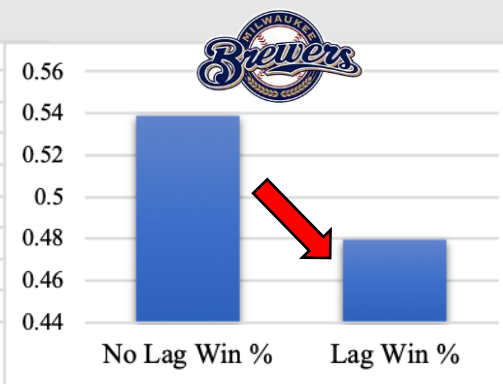


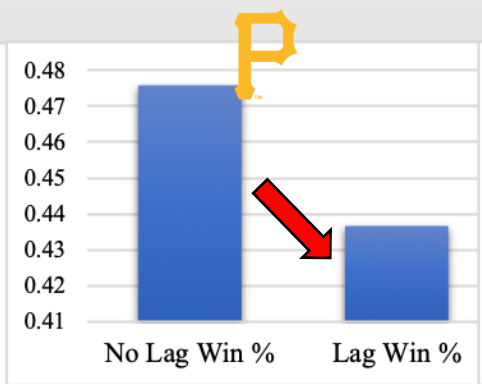


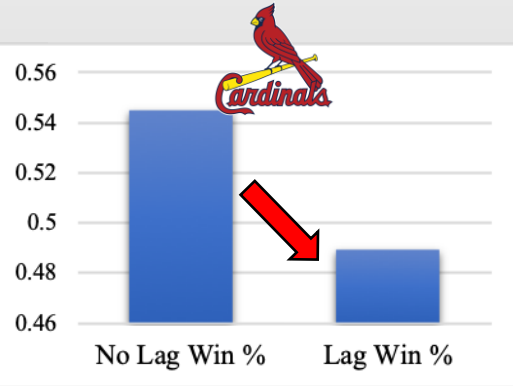


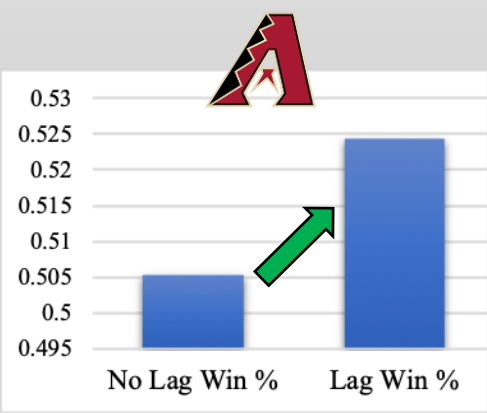


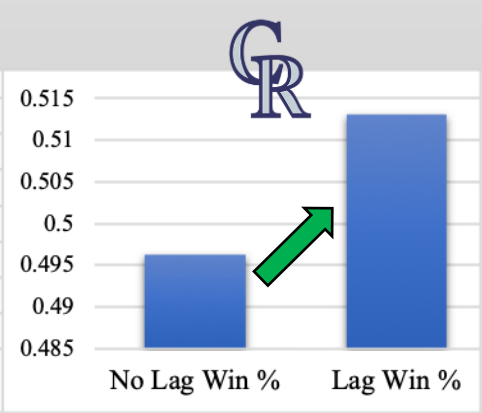


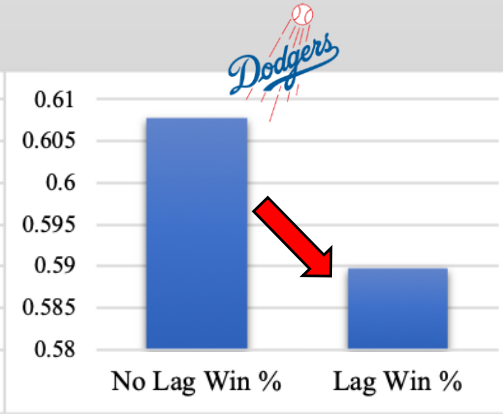


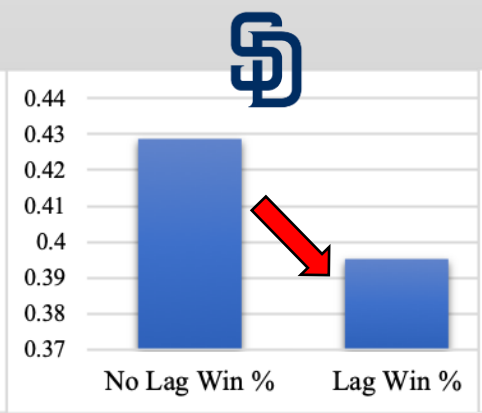


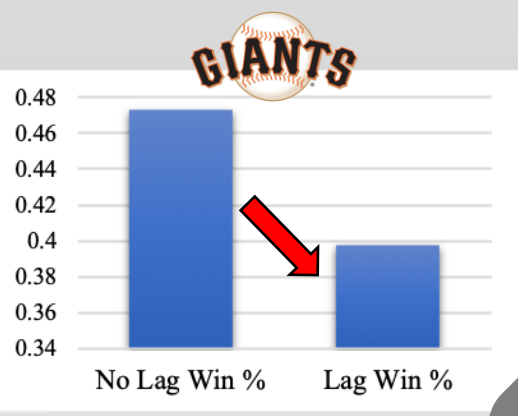




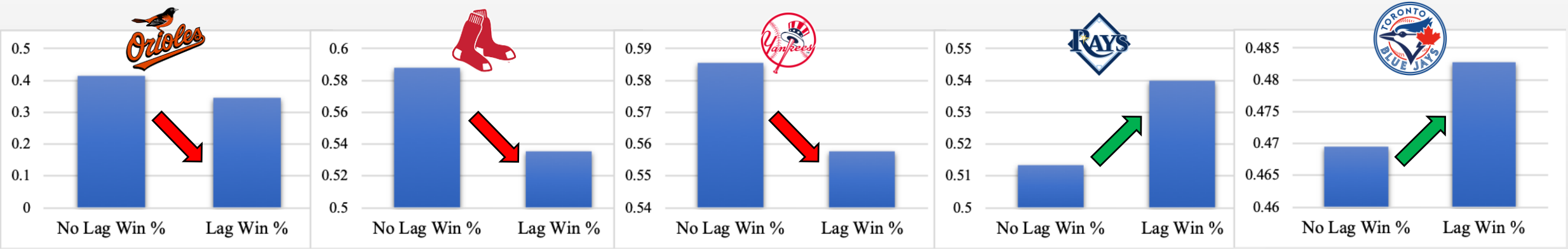


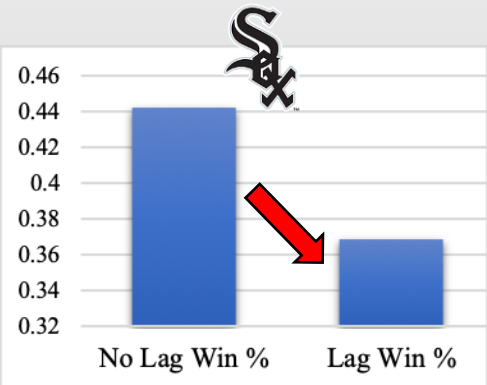


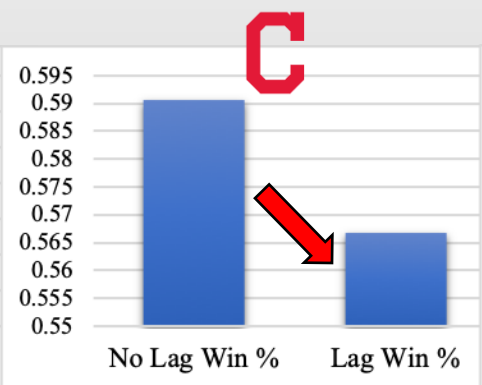


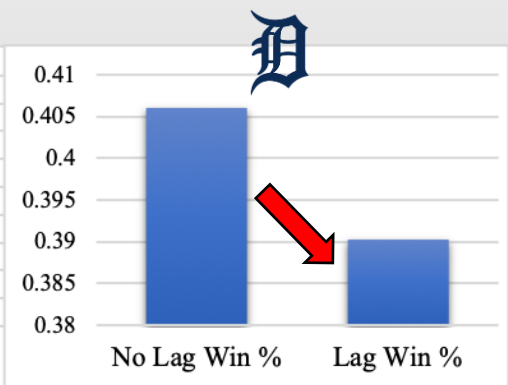


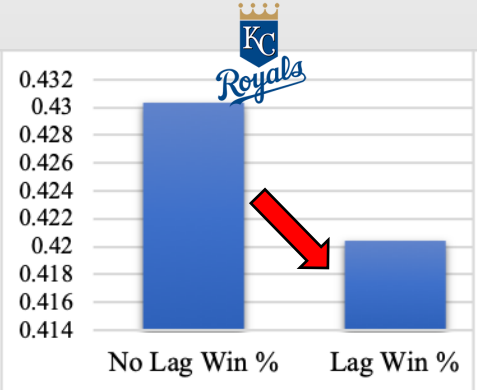
Jet Lag Effect on Win Percentage by Team (AL, 2016–2019)

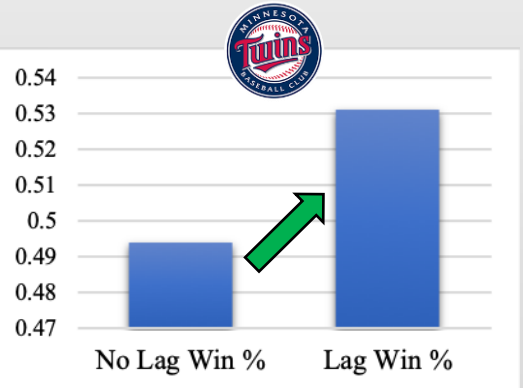


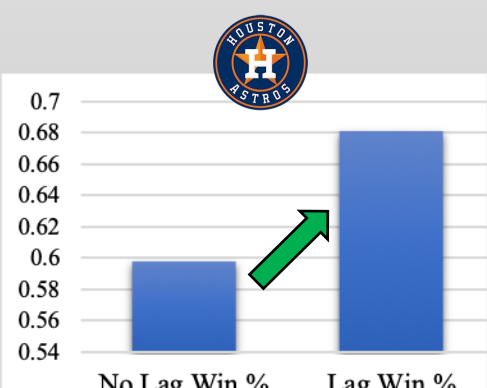


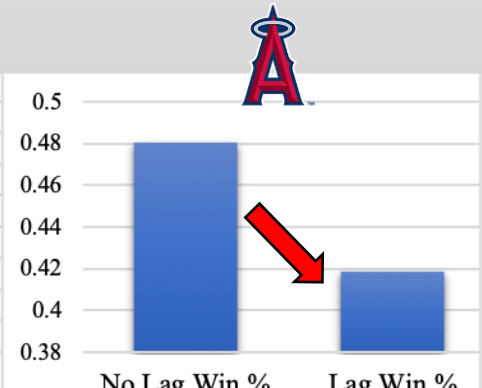


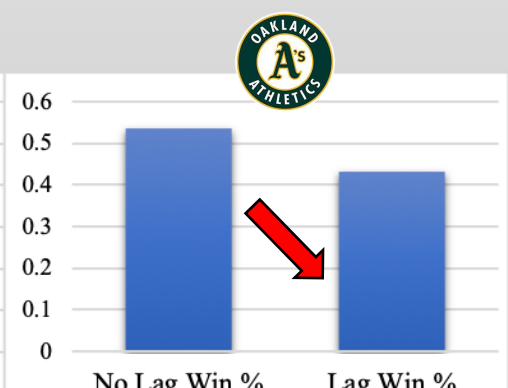


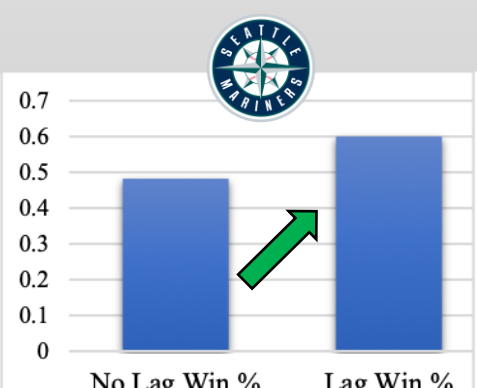


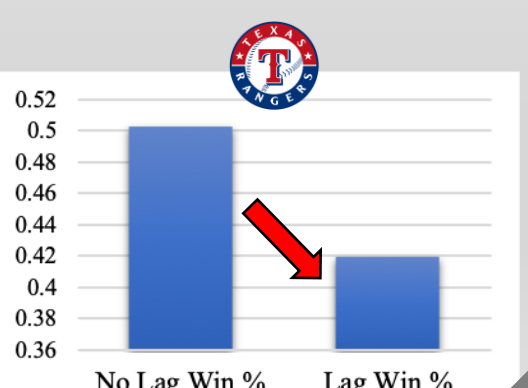




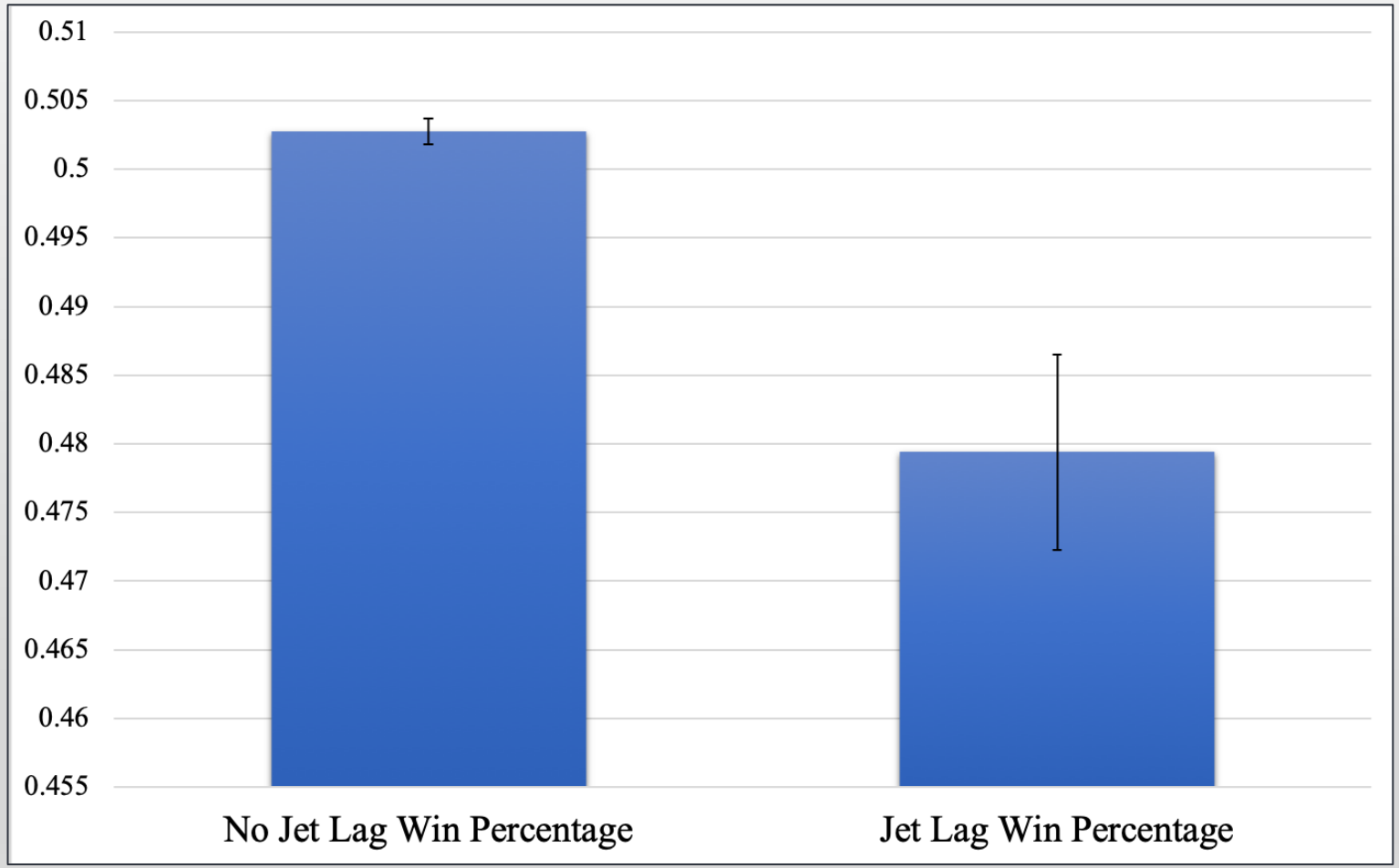








Jet Lag Effect on Win Percentage (MLB, 2016–2019)



n = 17,156 n = 2,280

No Lag Win %	Lag Win %	P-value
0.502739566	0.47938596	0.018072

P-value in context:

The probability of obtaining these results given that jet lag does not decrease a team's chance to win is 0.018072

YES – statistically significant decrease

Jet Lag Effect on Runs Scored per Game by Team (2016–2019)

	Team Abbr.	No Lag r/g	Lag r/g	Effect of Lag on r/g	P-value
NL East	ATL	4.711111111	3.935483871	-0.77562724	
	MIA	4.087248322	4.02	-0.067248322	
	NYM	4.420608108	4.571428571	0.150820463	
	PHI	4.268456376	3.980769231	-0.287687145	
	WAS	5.040201005	4.431372549	-0.608828456	
NL Central	CHC	4.879003559	5.32183908	0.442835522	
	CIN	4.430335097	4.37037037	-0.059964727	
	MIL	4.520871143	4.43877551	-0.082095633	
	PIT	4.391071429	4.459770115	0.068698686	
	STL	4.752707581	4.563829787	-0.188877794	
NL West	ARI	4.738515901	4.719512195	-0.019003706	
	COL	5.095505618	4.930434783	-0.165070835	
	LAD	4.882661996	5.076923077	0.19426108	
	SD	4.029982363	3.975308642	-0.054673721	
	SF	3.982608696	4.726027397	0.743418702	
AL East	BAL	4.401349073	4.290909091	-0.110439982	
	BOS	5.285472973	5.553571429	0.268098456	
	NYY	5.166107383	4.865384615	-0.300722767	
	TB	4.409698997	4.28	-0.129698997	
	TOR	4.447457627	4.568965517	0.12150789	
AL Central	CWS	4.230072464	4.452631579	0.222559115	
	CLE	4.982046679	4.533333333	-0.448713345	
	DET	4.141843972	4.463414634	0.321570663	
	KC	4.194642857	4.056818182	-0.137824675	
	MIN	4.982363316	4.802469136	-0.17989418	
AL West	HOU	5.179533214	4.978021978	-0.201511236	
	LAA	4.553380783	4.174418605	-0.378962178	
	OAK	4.69664903	4.777777778	0.081128748	
	SEA	4.495636998	5.026666667	0.531029668	
	TEX	4.837837838	4.580645161	-0.257192677	
MLB		**4.606668221**	**4.580701754**		**0.359461**

n = 17,156 n = 2,280

No Lag r/g	Lag r/g	P-value
4.606668221	**4.58070175**	**0.359461**

P-value in context:

The probability of obtaining these results given that jet lag does not decrease a team's runs scored per game is 0.359461

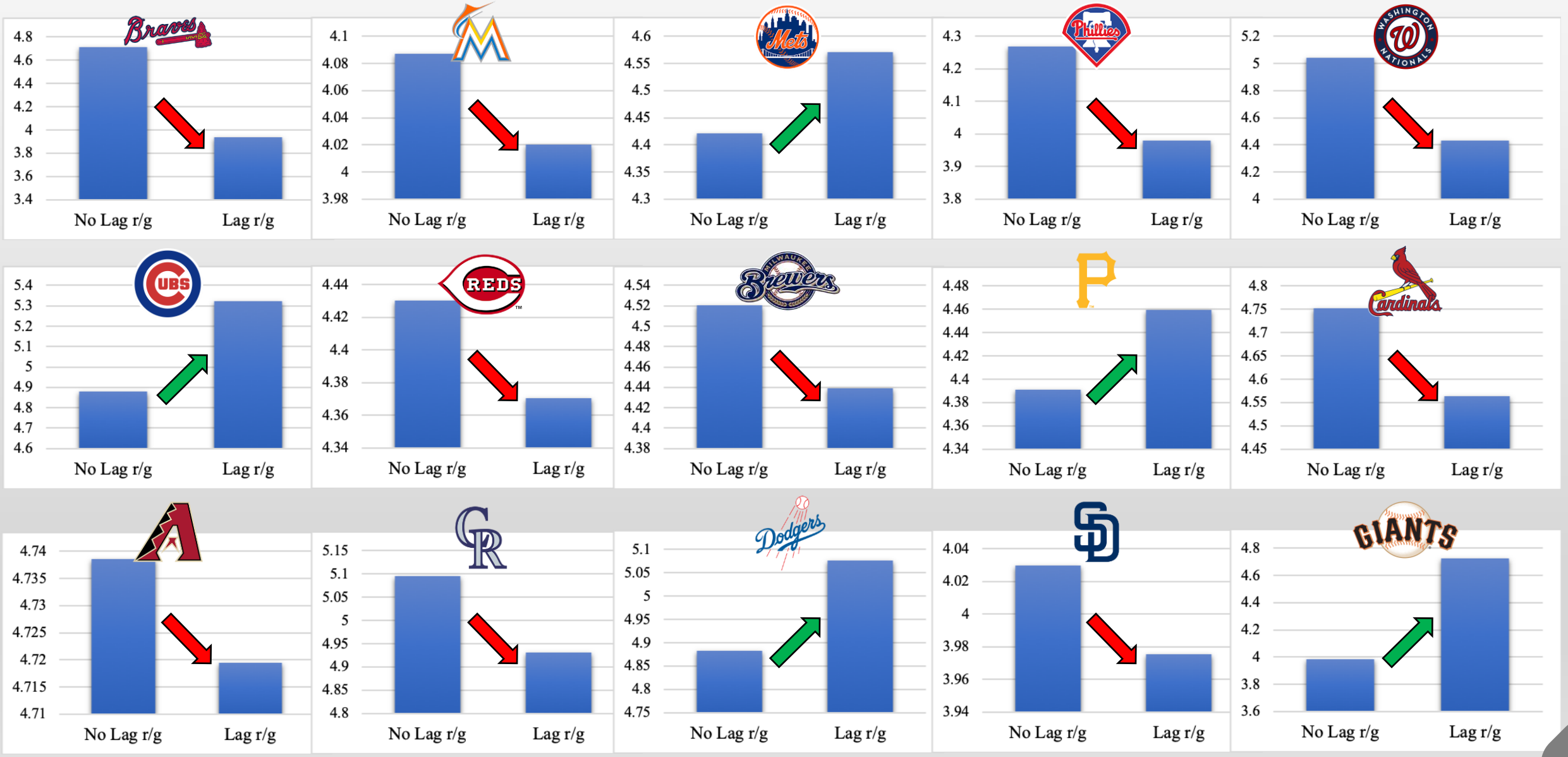
NO – not statistically significant decrease

Noteworthy statistics:

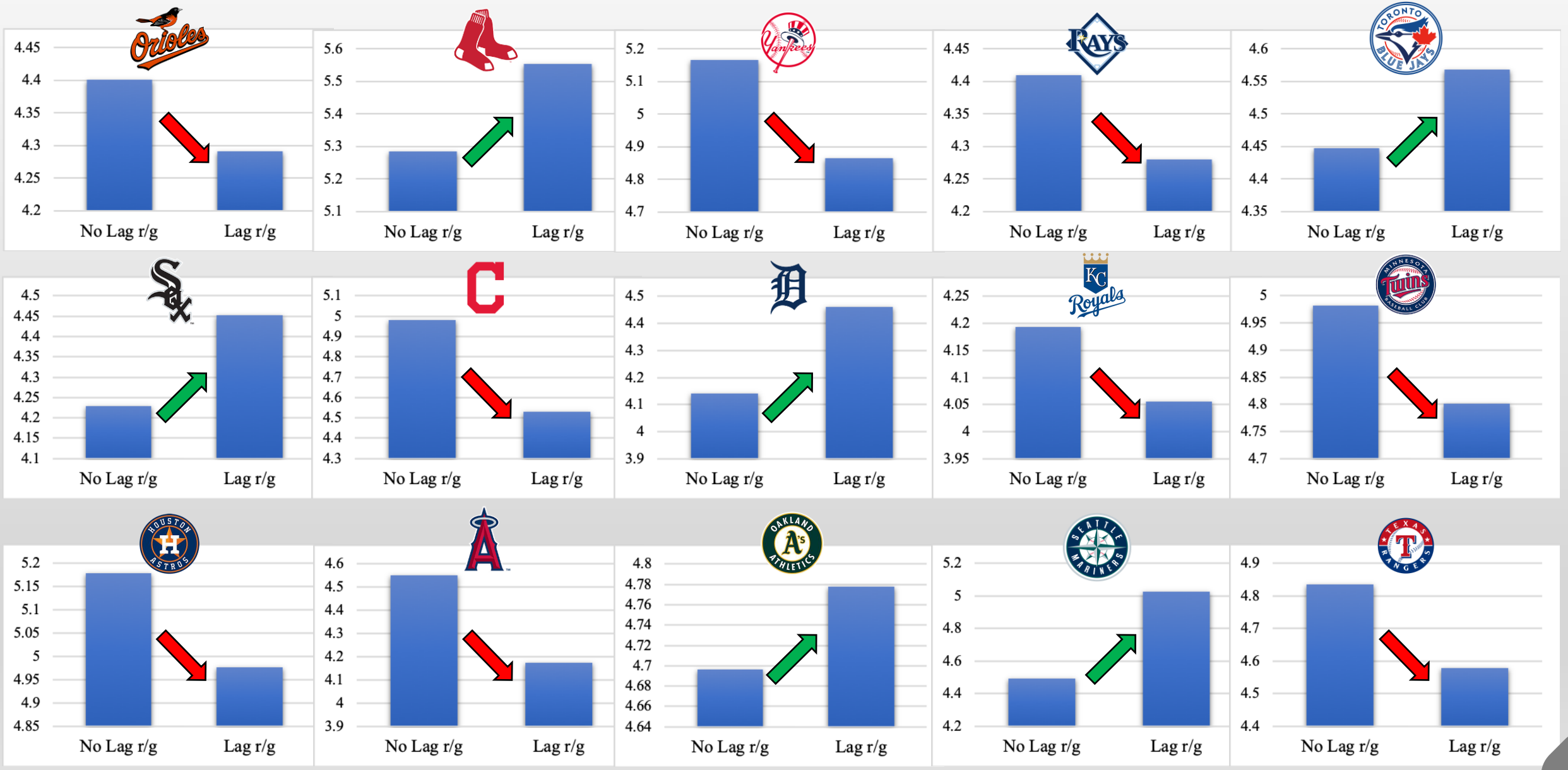
Between 2016–2019, **19 out of 30 MLB teams scored fewer runs per game** when experiencing jet lag

Teams in the NL East had the worst effects of lag on runs scored per game, scoring an average of 0.31 fewer runs per game when experiencing jet lag

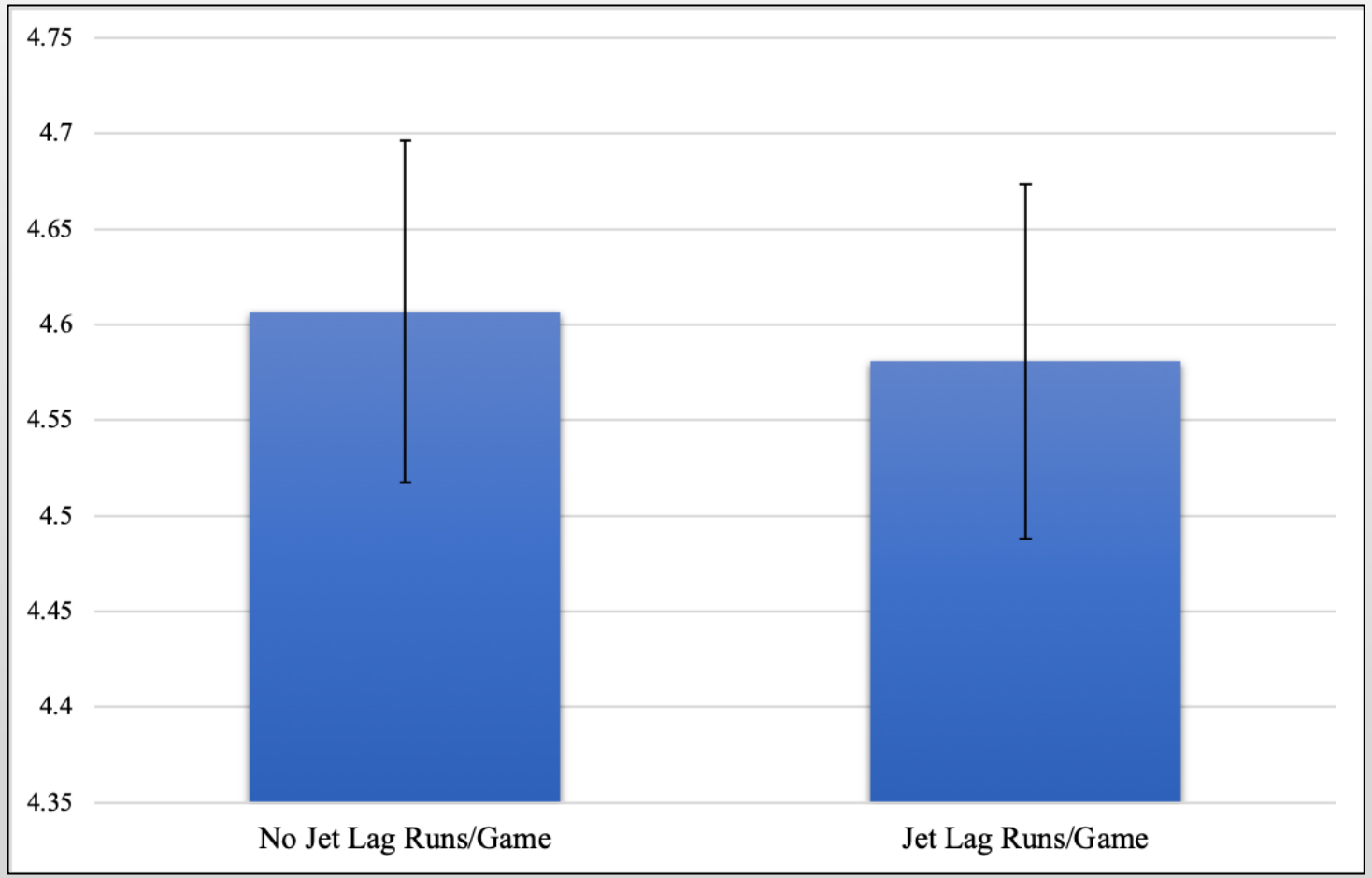
Jet Lag Effect on Runs Scored per Game by Team (NL, 2016–2019)



Jet Lag Effect on Runs Scored per Game by Team (AL, 2016–2019)



Jet Lag Effect on Runs Scored Per Game (MLB, 2016–2019)



n = 17,156 n = 2,280

No Lag r/g	Lag r/g	P-value
4.606668221	4.58070175	0.359461

P-value in context:

The probability of obtaining these results given that jet lag does not decrease a team's runs scored per game is 0.359461

NO – not statistically significant decrease

Jet Lag Effect on Runs Allowed per Game by Team (2016–2019)

	Team Abbr.	No Lag ra/g	Lag ra/g	Effect of Lag on ra/g	P-value
NL East	ATL	4.6	5.129032258	0.529032258	
	MIA	4.843959732	4.72	-0.123959732	
	NYM	4.488175676	4.767857143	0.279681467	
	PHI	4.731543624	5.346153846	0.614610222	
	WAS	4.185929648	3.862745098	-0.32318455	
NL Central	CHC	4.023131673	4.045977011	0.022845339	
	CIN	4.982363316	5.296296296	0.313932981	
	MIL	4.344827586	4.714285714	0.369458128	
	PIT	4.696428571	5.356321839	0.659893268	
	STL	4.276173285	4.265957447	-0.010215838	
NL West	ARI	4.508833922	4.682926829	0.174092907	
	COL	5.18164794	4.939130435	-0.242517505	
	LAD	3.695271454	4.256410256	0.561138803	
	SD	4.765432099	5.456790123	0.691358025	
	SF	4.31826087	5.424657534	1.106396665	
AL East	BAL	5.246205734	5.8	0.553794266	
	BOS	4.390202703	4.25	-0.140202703	
	NYY	4.251677852	4.596153846	0.344475994	
	TB	4.195652174	4.24	0.044347826	
	TOR	4.747457627	5.327586207	0.58012858	
AL Central	CWS	4.873188406	5.536842105	0.663653699	
	CLE	3.944344704	3.866666667	-0.077678037	
	DET	5.15070922	5.146341463	-0.004367756	
	KC	4.960714286	4.863636364	-0.097077922	
	MIN	4.975308642	4.75308642	-0.222222222	
AL West	HOU	4.034111311	3.615384615	-0.418726695	
	LAA	4.68683274	4.604651163	-0.082181577	
	OAK	4.46031746	5.098765432	0.638447972	
	SEA	4.802792321	4.413333333	-0.389458988	
	TEX	5.063063063	5.258064516	0.195001453	
MLB		**4.579389135**	**4.785964912**		**0.002529**

n = 17,156 n = 2,280

No Lag ra/g	Lag ra/g	P-value
4.579389135	**4.78596491**	**0.002529**

P-value in context:

The probability of obtaining these results given that jet lag does not increase a team's runs allowed per game is 0.002529

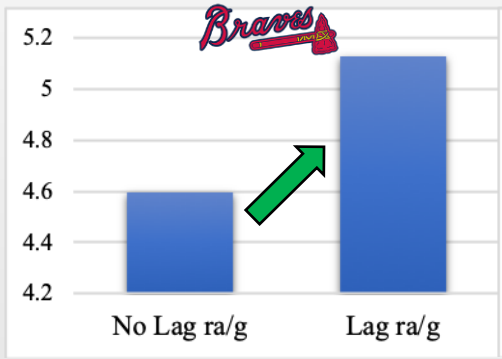
YES – statistically significant increase

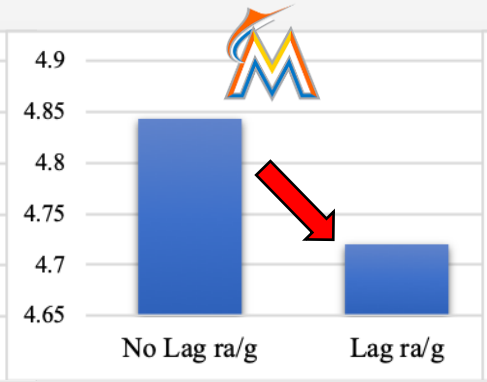
Noteworthy statistics:

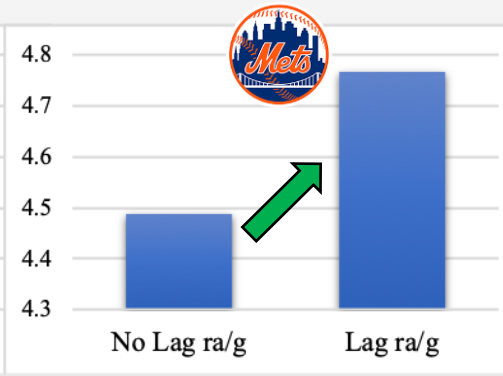
Between 2016–2019, **18 out of 30 MLB teams allowed more runs per game** when experiencing jet lag

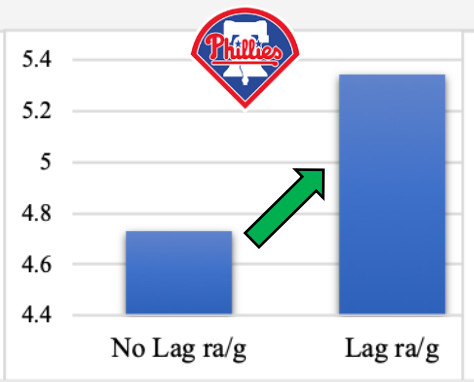
Teams on average, when experiencing jet lag, allowed roughly 4.5% more runs per game

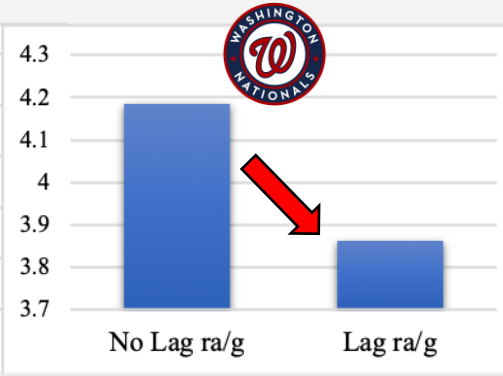
Jet Lag Effect on Runs Allowed per Game by Team (NL, 2016–2019)

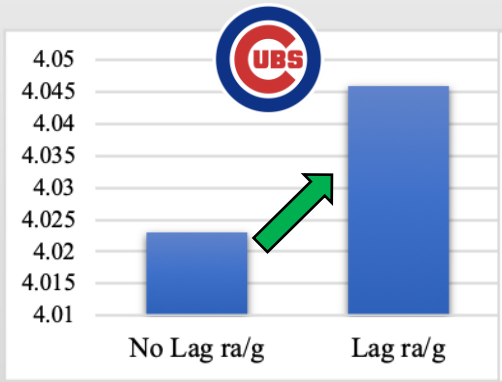


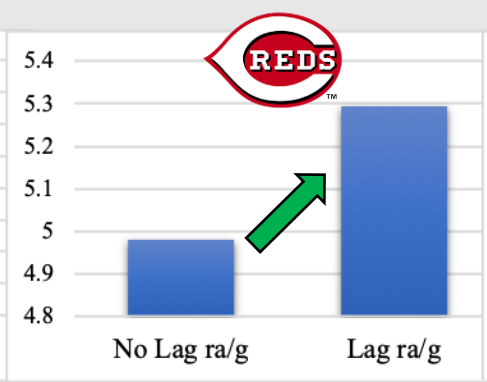


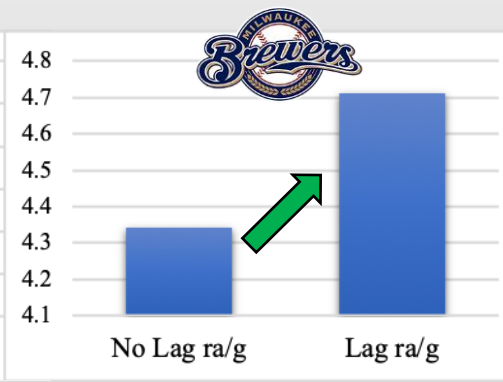


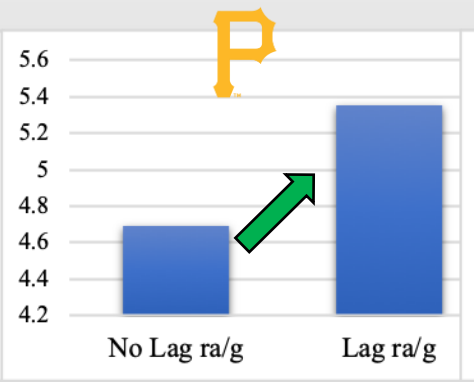


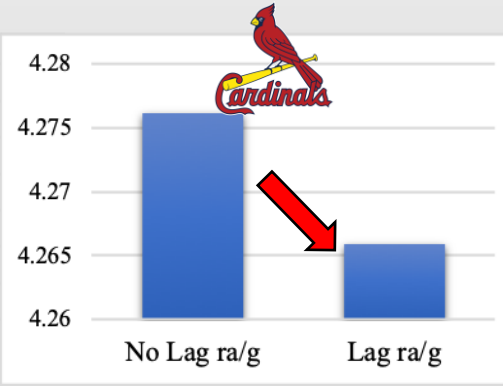


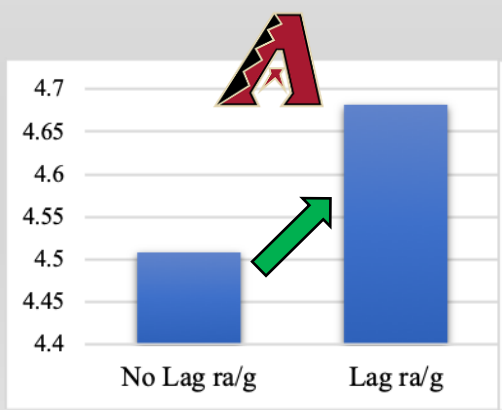


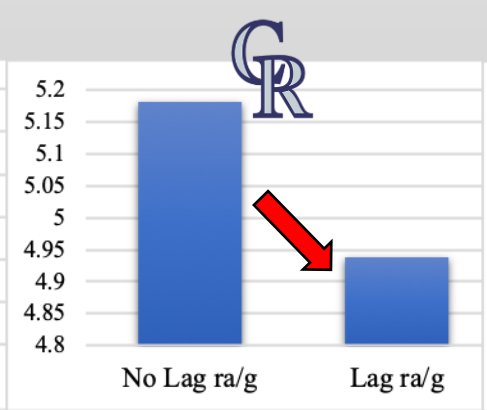


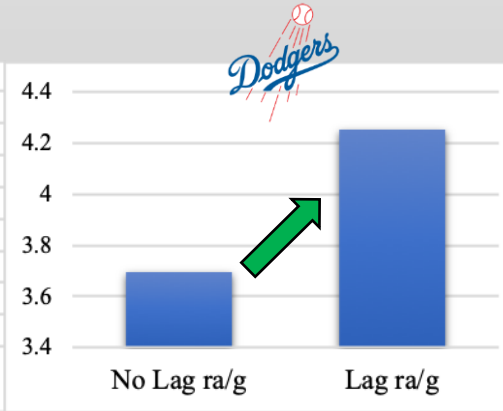


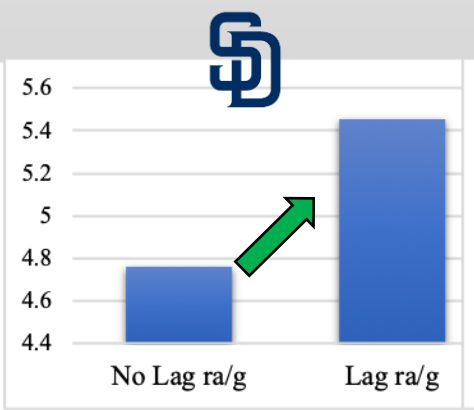


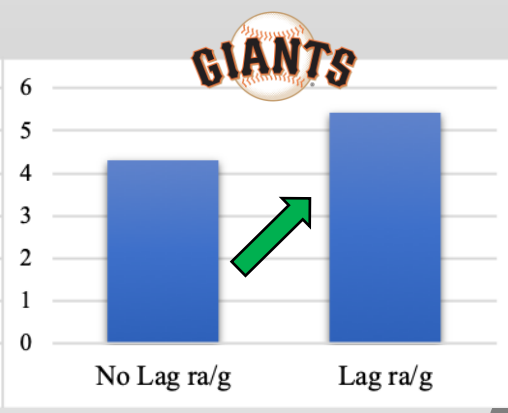




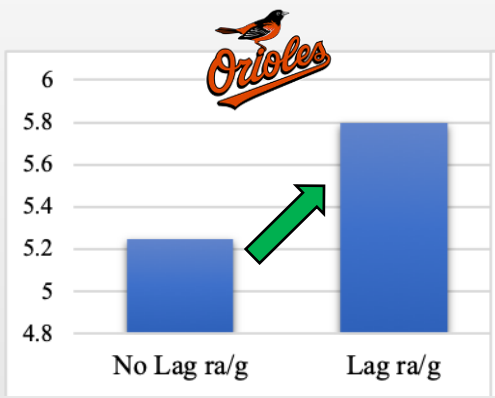


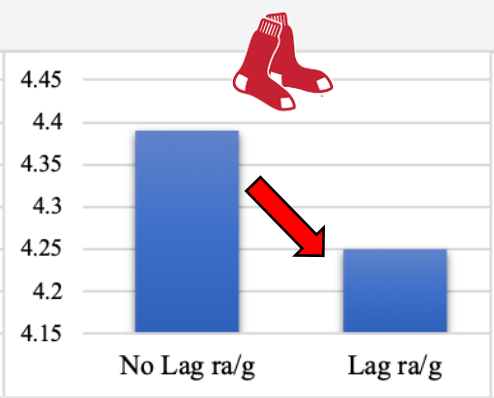


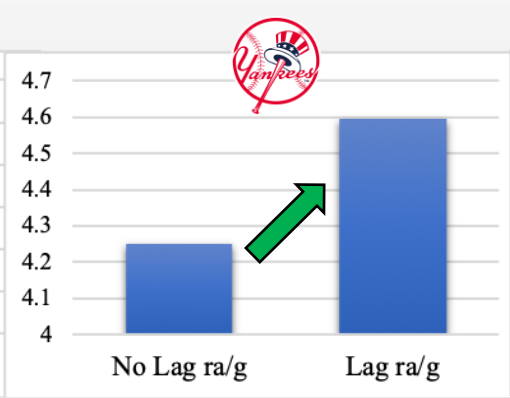


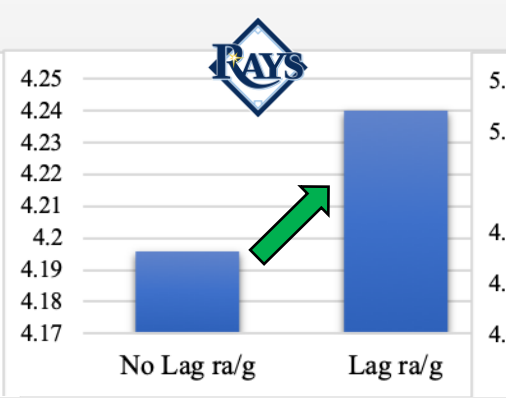


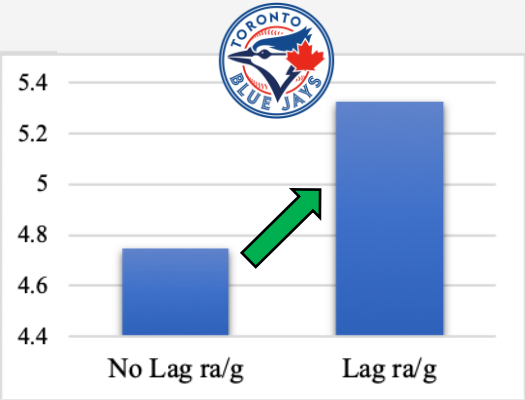
Jet Lag Effect on Runs Allowed per Game by Team (AL, 2016–2019)

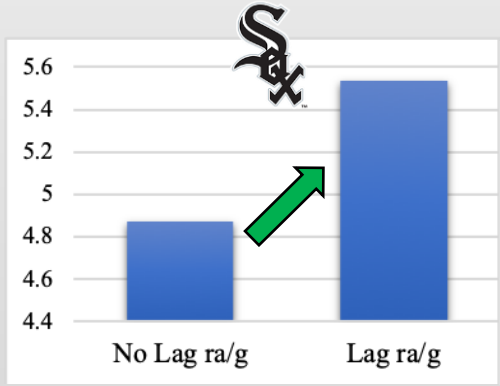


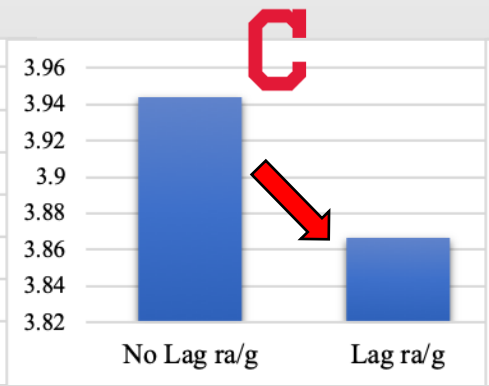


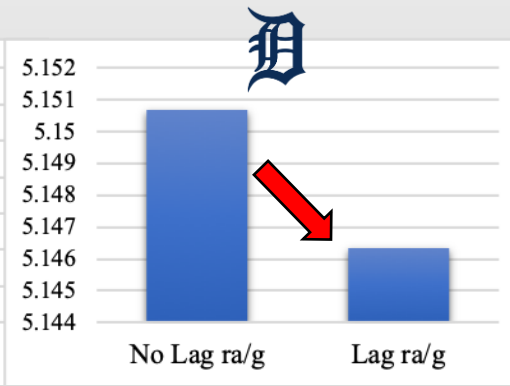


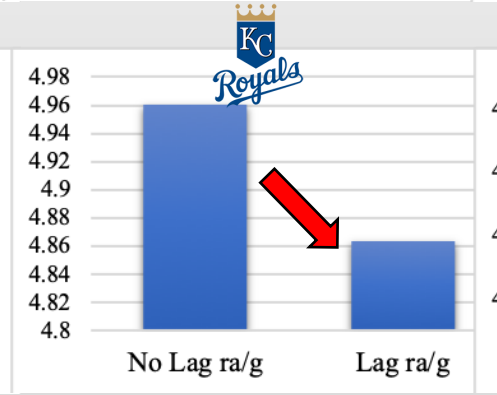


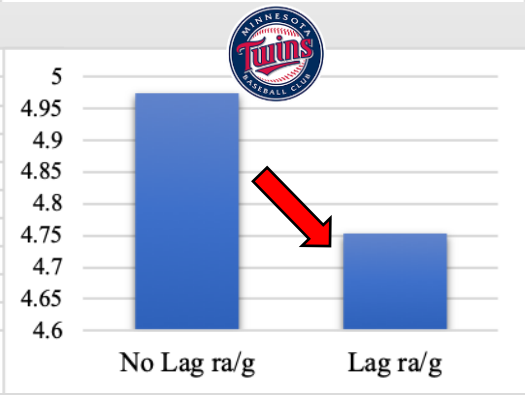


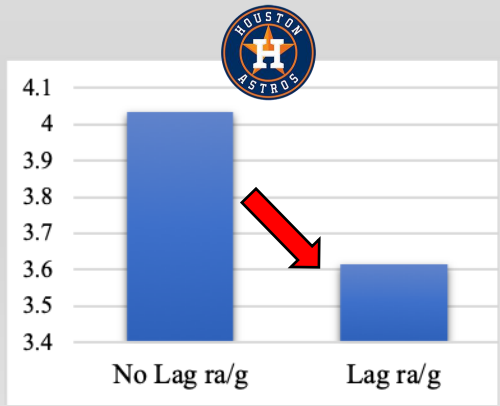


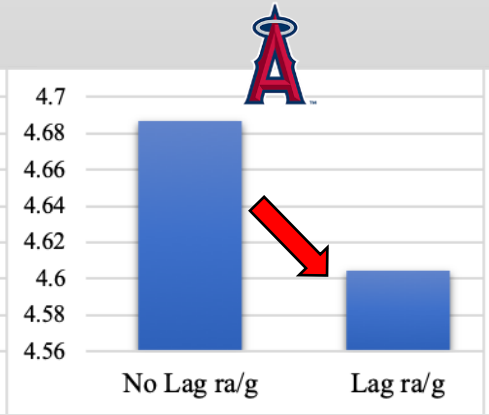


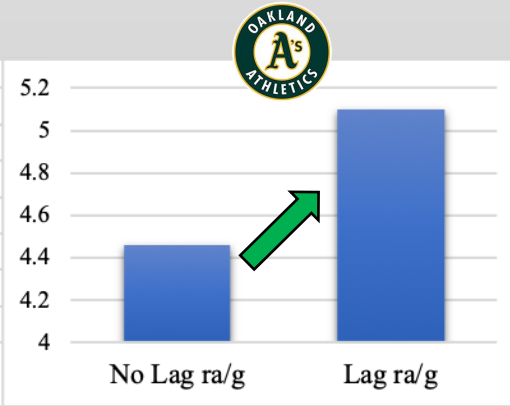


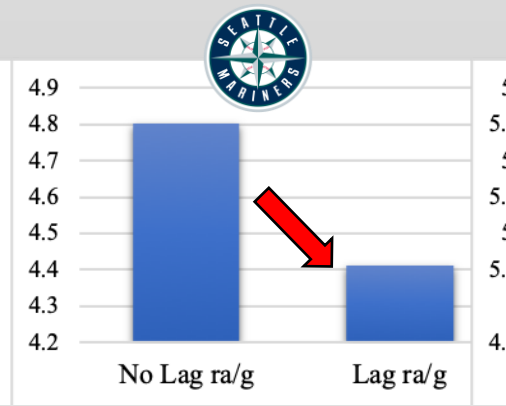


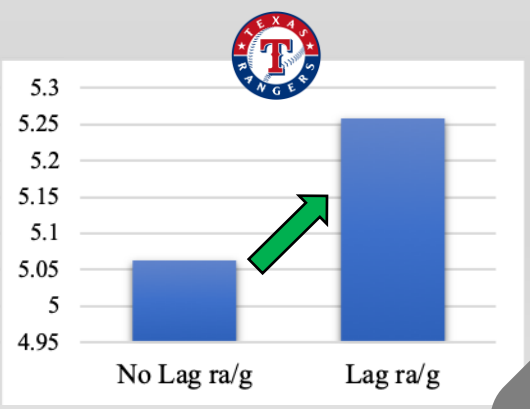




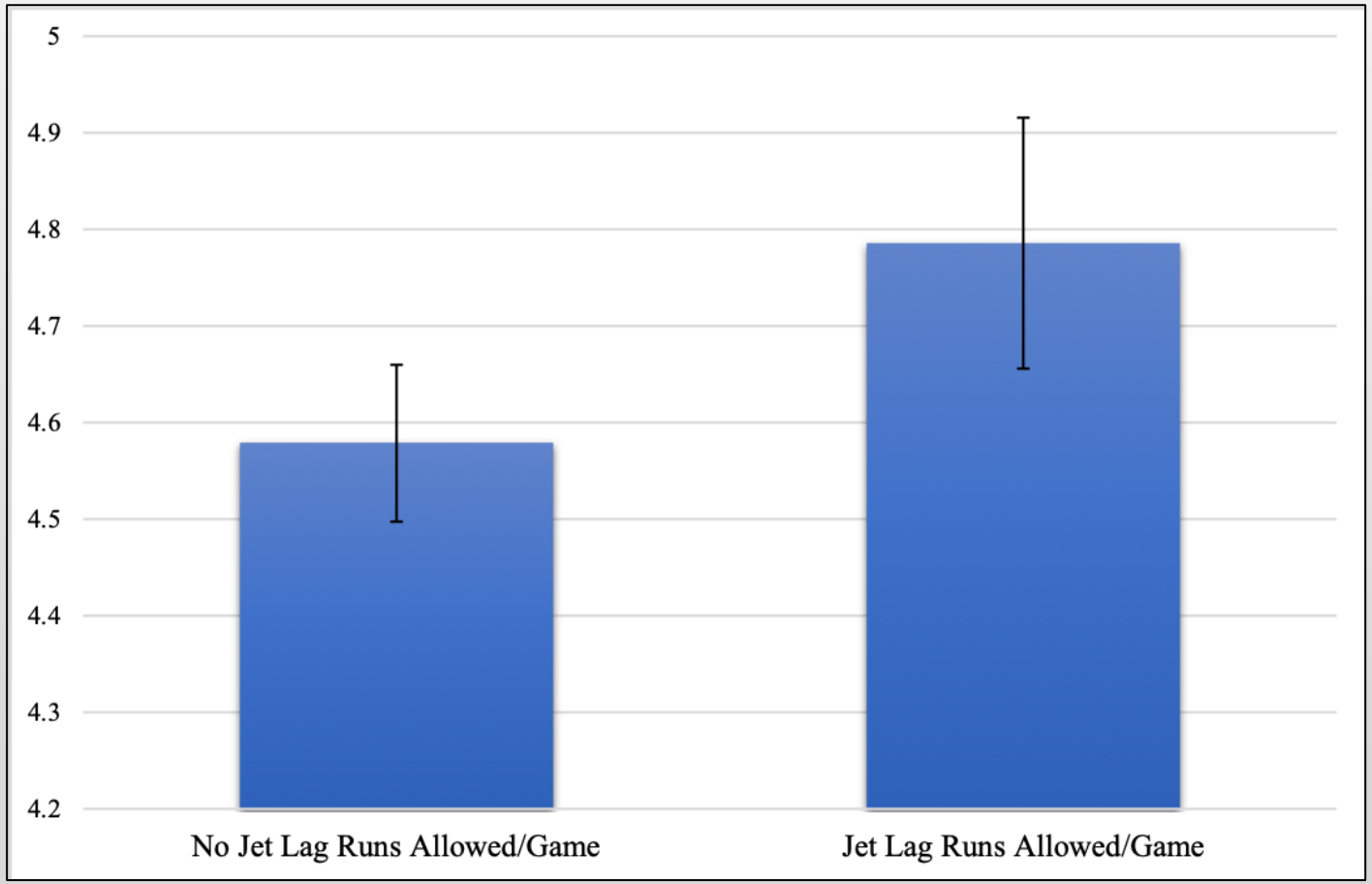








Jet Lag Effect on Runs Allowed Per Game (MLB, 2016–2019)



n = 17,156 n = 2,280

No Lag ra/g	Lag ra/g	P-value
4.579389135	**4.78596491**	**0.002529**

P-value in context:

The probability of obtaining these results given that jet lag does not increase a team's runs allowed per game is 0.002529

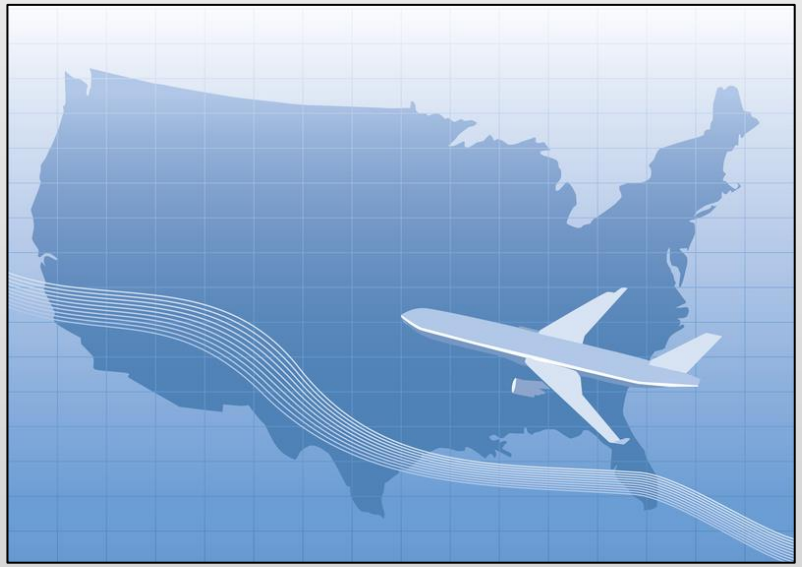
YES – statistically significant increase

Part I – KEY FINDINGS/CONCLUSIONS

How does jet lag, in any form, impact a team's performance?

1. On average, experiencing jet lag decreases an MLB team's probability of winning a game.

2. On average, experiencing jet lag increases the number of runs an MLB team will allow.



Analysis – Part II

Impact of Jet Lag on MLB Team Performance

How does eastward jet lag impact a team's performance compared to westward jet lag?

i) H_o: There is no relationship between win percentage and type of jet lag.

H_a: MLB teams' win percentages will be different on average when experiencing east vs. westward jet lag.

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ii) H_o: MLB teams score the same runs per game on average with eastward and westward jet lag.

H_a: MLB teams' runs scored per game will be different on average when experiencing east vs. westward jet lag.

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iii) H_o: MLB teams allow the same runs per game on average with eastward and westward jet lag.

H_a: MLB teams' runs allowed per game will be different on average when experiencing east vs. westward jet lag.

Eastward vs. Westward Jet Lag

Eastward

- West → east w/ time zone change
- “Losing” time
- Negative number in equation

Westward

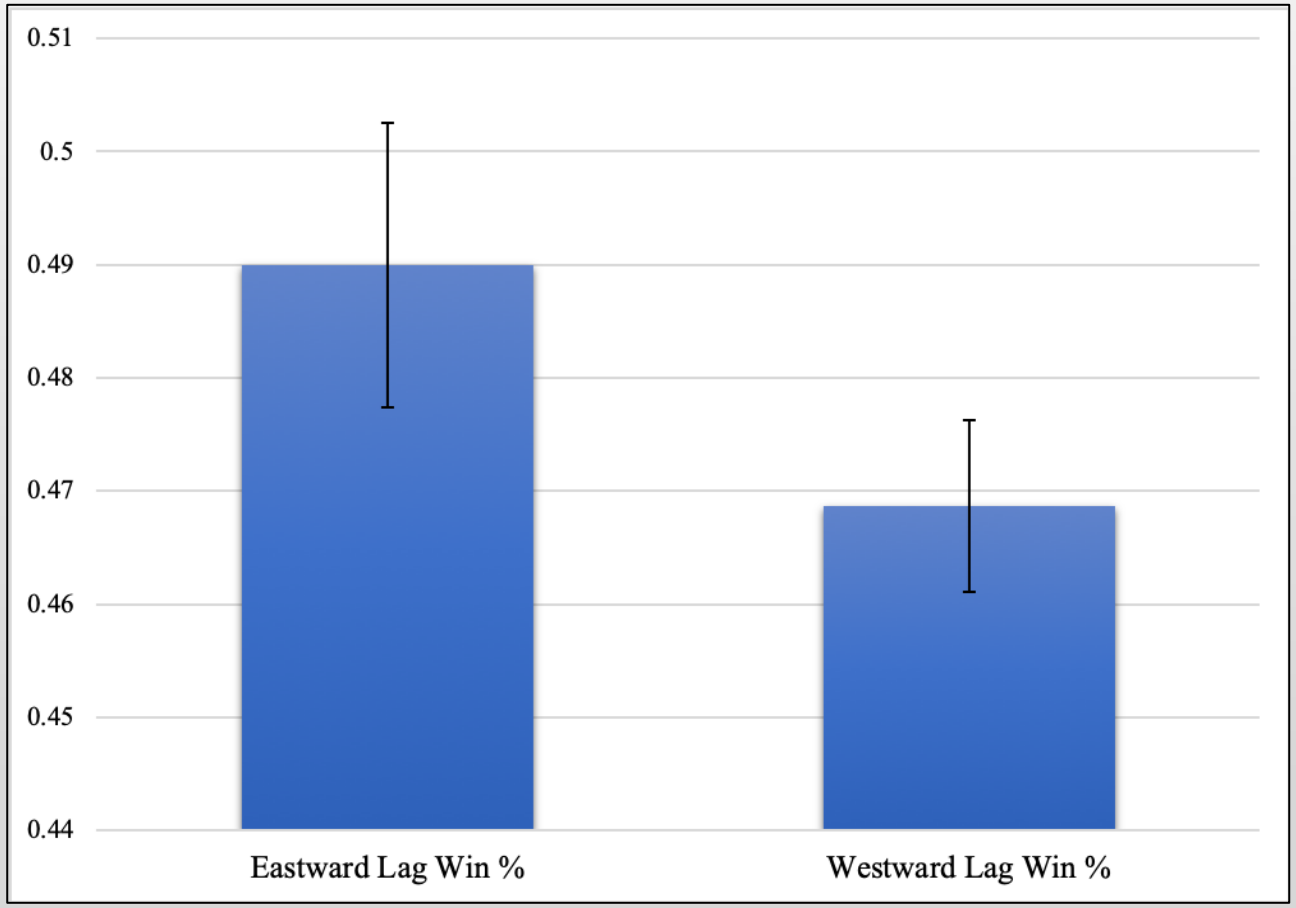
- East → west w/ time zone change
- “Gaining” time
- Positive number in equation

Current Literature – Eastward vs. Westward

- Eastward jet lag shown to be worse for MLB teams only defensively (Song et al., 2017)
- Eastward jet lag decreases physical performance more so than westward jet lag
  - 20-meter sprint times significantly worse travelling east compared to west (Fowler et al., 2017)
  - Fatigue ratings (opinion-based) significantly worse travelling east vs. west (Fowler et al., 2017)

Data and Statistical Analysis

Eastward vs. Westward Jet Lag Effect on Win Percentage (MLB, 2016–2019)



n = 1,147 n = 1,133

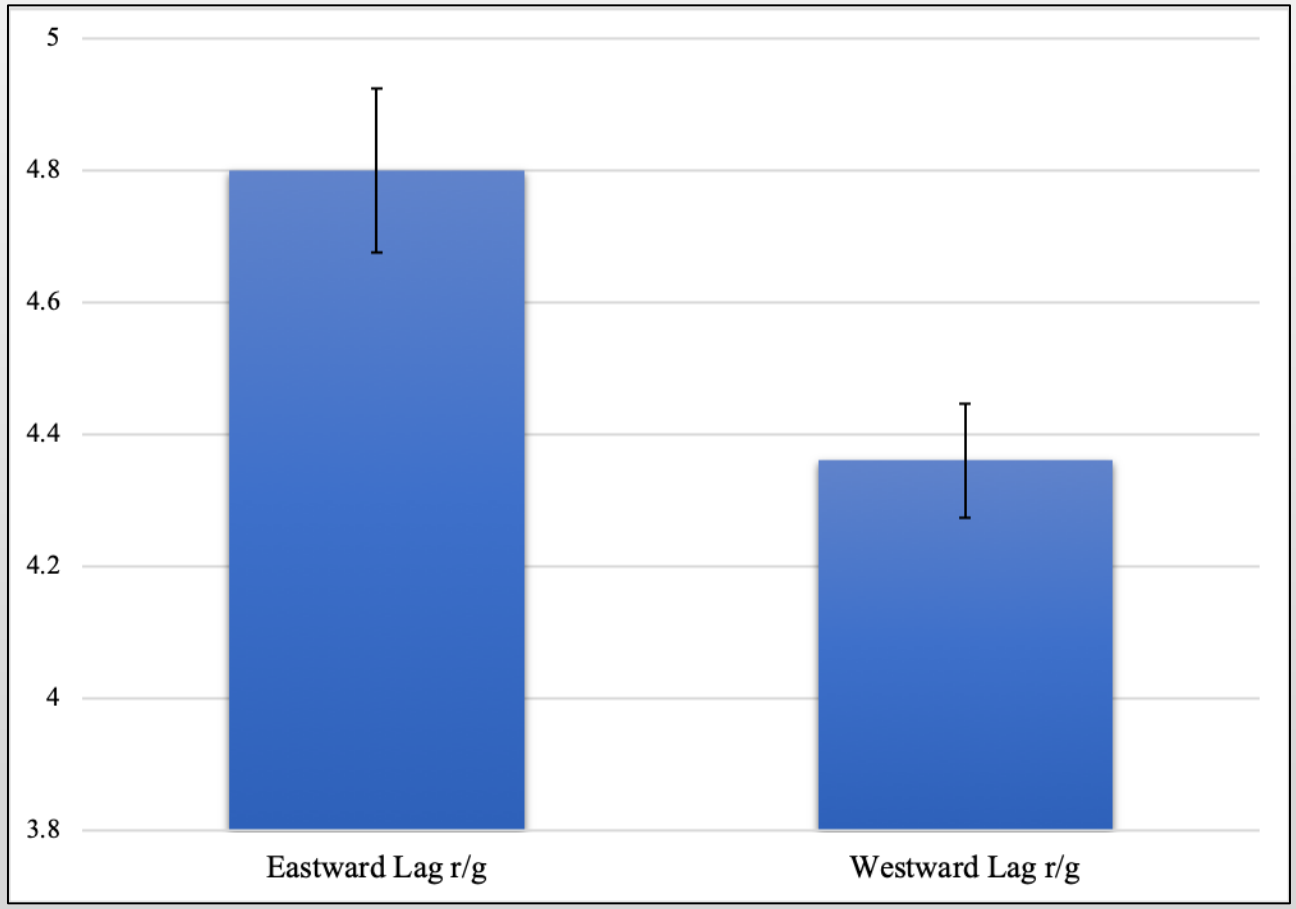
Eastward Lag Win %	Westward Lag Win %	P-value
0.489973845	0.468667255	0.154339

P-value in context:

The probability of obtaining these results given that there is no difference between eastward and westward jet lag's impacts on win percentage is 0.154339.

NO – not statistically significant difference

Eastward vs. Westward Jet Lag Effect on Runs Scored Per Game (MLB, 2016–2019)



n = 1,147 n = 1,133

Eastward Lag r/g	Westward Lag r/g	P-value
4.798605057	4.360105914	0.000598

P-value in context:

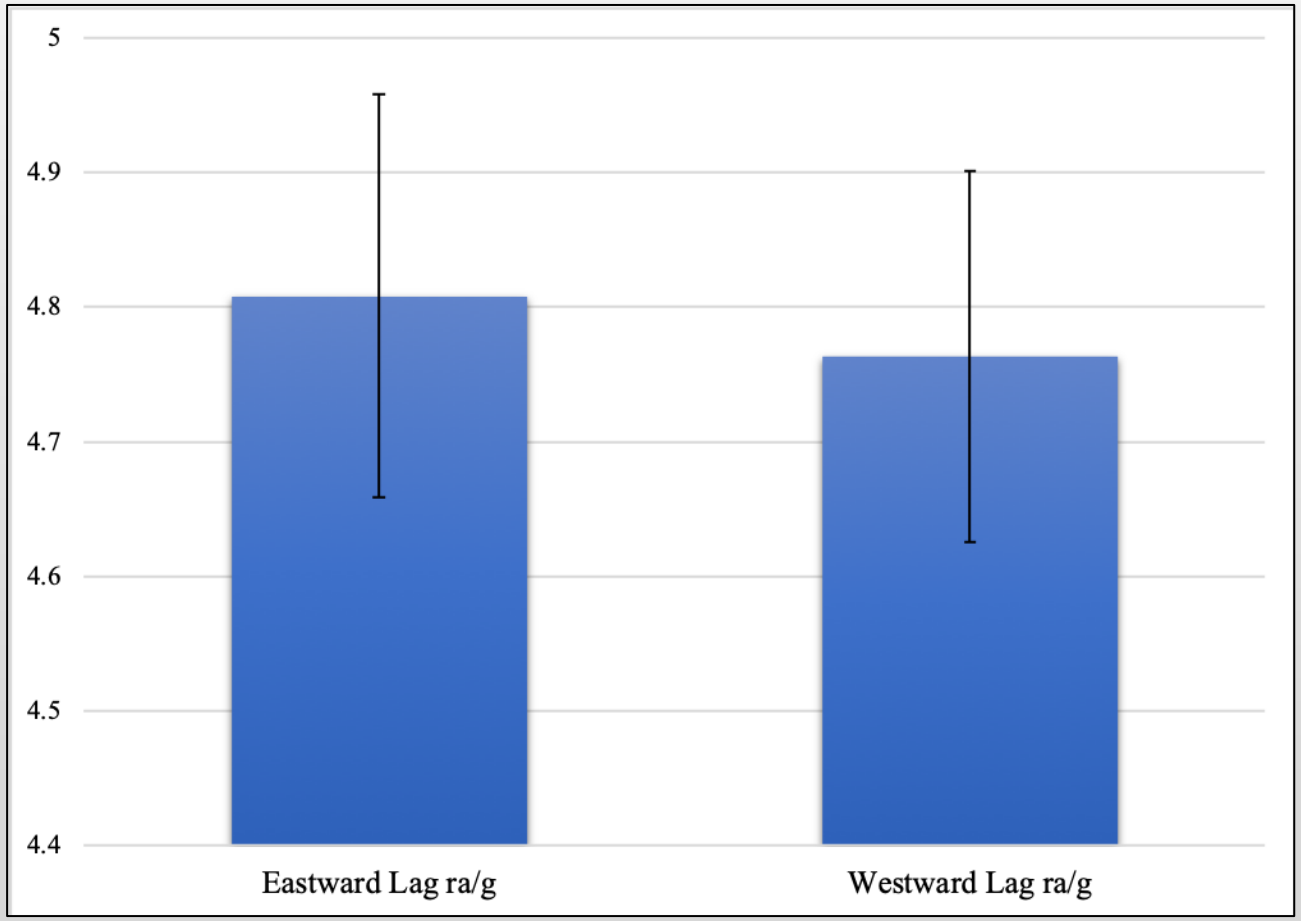
The probability of obtaining these results given that there is no difference between eastward and westward jet lag's impacts on runs scored per game is 0.000598.

YES – statistically significant difference

Meaning:

There is evidence to show that on average, teams score more runs per game when experiencing eastward jet lag compared to westward jet lag (contradicts literature)

Eastward vs. Westward Jet Lag Effect on Runs Allowed Per Game (MLB, 2016–2019)



n = 1,147 n = 1,133

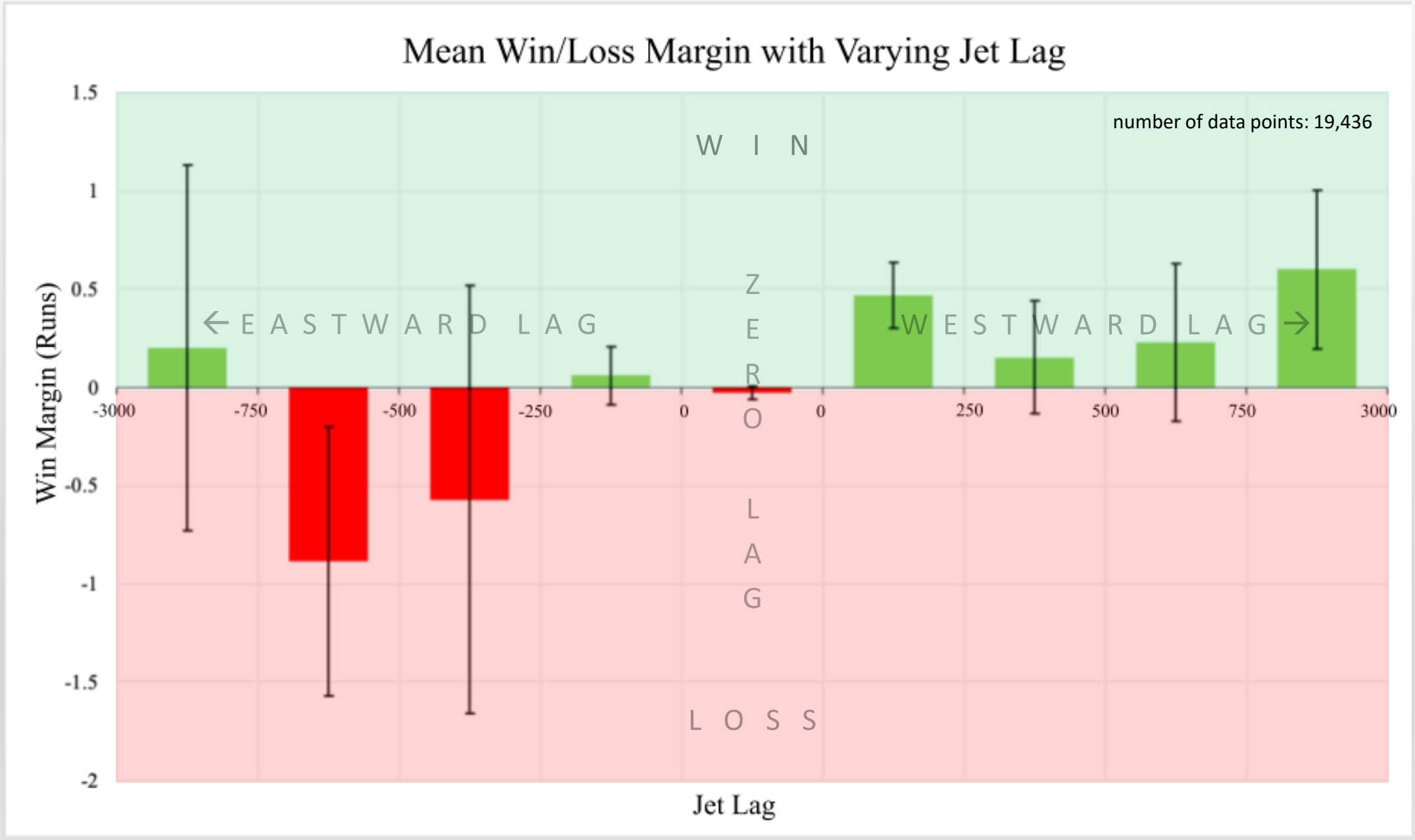
Eastward Lag ra/g	Westward Lag ra/g	P-value
4.808195292	4.763459841	0.373802

P-value in context:

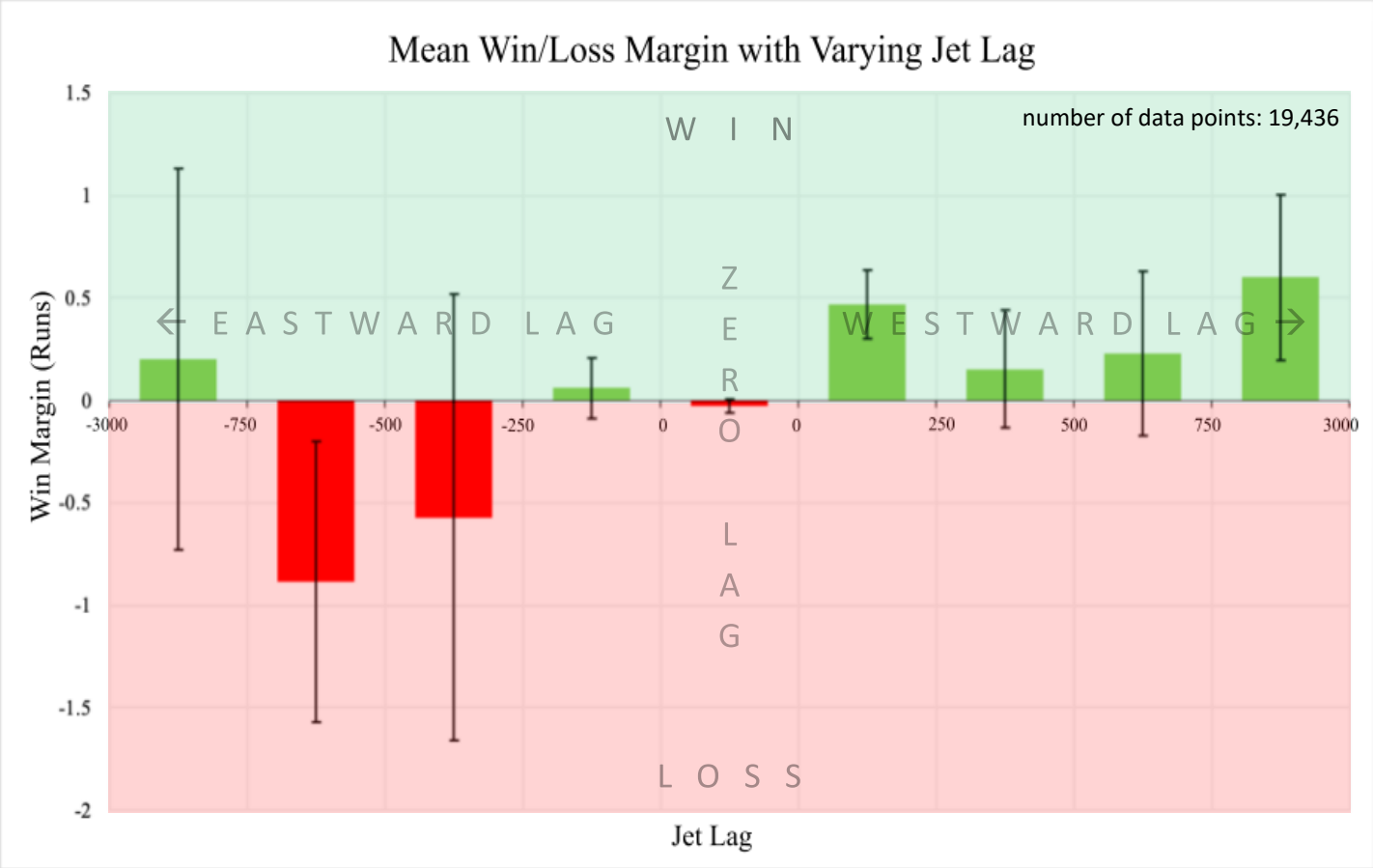
The probability of obtaining these results given that there is no difference between eastward and westward jet lag's impacts on win percentage is 0.373802.

NO – not statistically significant difference

Extent of Jet Lag on Win Margin (MLB, 2016–2019)



Extent of Jet Lag on Win Margin (MLB, 2016–2019)



Interpretation of Data:

Data suggests that teams experiencing eastward jetlag perform worse than westward jet lag

Data suggests westward jet lag increases a team's overall probability to win

No suggestion that the severity of jet lag impacts win margin

Conclusions:

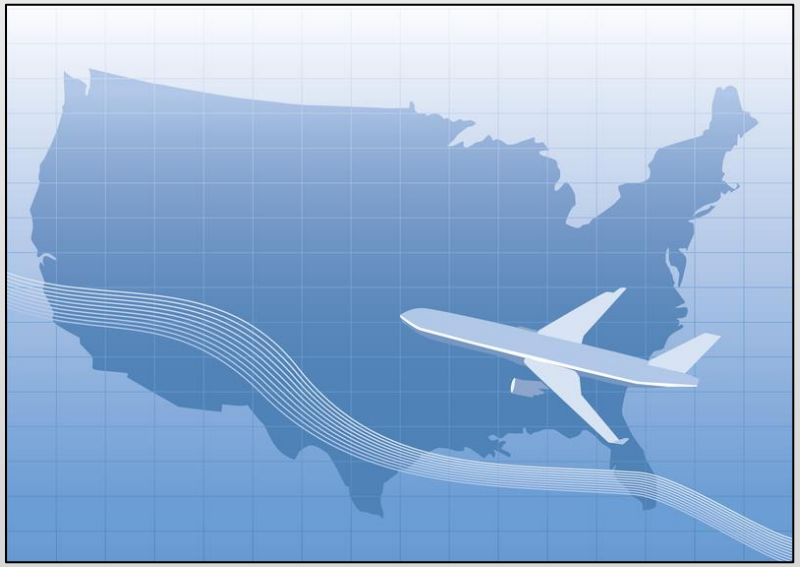
No conclusions can be made due to overlapping error bars

Part II – KEY FINDINGS/CONCLUSIONS

How does eastward jet lag impact a team's performance compared to westward jet lag?

Although there is statistical evidence to show that teams score more runs per game when experiencing eastward jet lag compared to westward jet lag, this contradicts data displayed in previous figure.

No conclusions can be made regarding eastward versus westward jet lag's impact on MLB team performance, or severity of jet lag's impact on team performance.



Final Conclusions

Final **KEY FINDINGS/CONCLUSIONS**

How does jet lag impact MLB team performance?

On average, experiencing jet lag decreases an MLB team's probability of winning a game

On average, experiencing jet lag increases the number of runs an MLB team will allow

No conclusions can be made from this research regarding eastward versus westward jet lag's impact on MLB team performance

Implication of Findings

- MLB is multi-billion dollar industry
- Winning pays
- Understand factors that contribute to winning/losing

Implication of My Research

- Large scale data-analysis
  - Using algorithms to analyze patterns
  - Applications in research, computer science, and engineering
- Jet lag equation
  - First numerical and linear representation of jet lag
  - Application to any trip between two points in time

Works Cited

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Fowler, P. M., Knez, W., Crowcroft, S., Mendham, A. E., Miller, J., Sargent, C., . . . Duffield, R. (2017). Greater Effect of East vs. West Travel on Jet Lag, Sleep, and Team-Sport Performance. The Official Journal of the American College of Sports Medicine. Retrieved from https://opus.lib.uts.edu.au/bitstream/10453/114781/1/Greater%20Effect%20of%20East%20vs.%20West%20Travel%20on%20Jet%20Lag%2c%20Sleep%2c%20and%20Team-Sport.pdf

Song, A., Severini, T., & Allada, R. (2017, January 23). How jet lag impairs Major League Baseball performance. Retrieved from Proceeding of the National Academy of Sciences of the United States of America database.