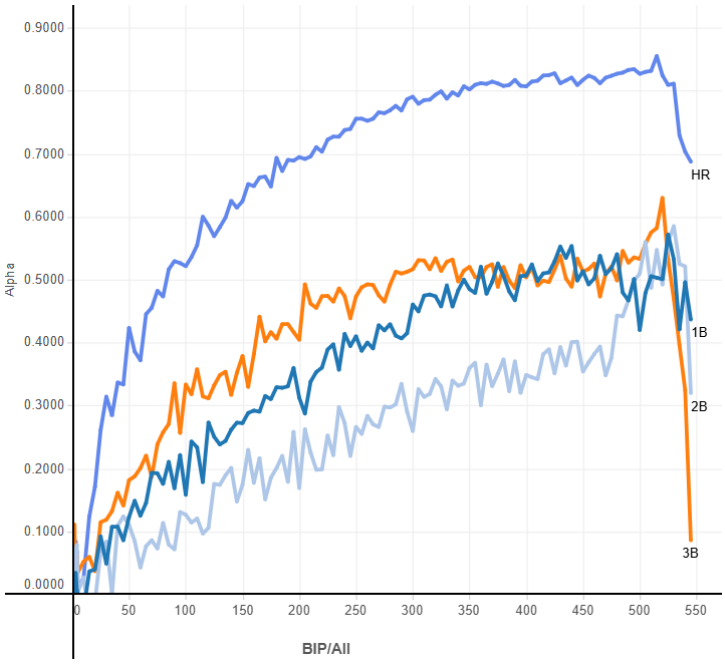
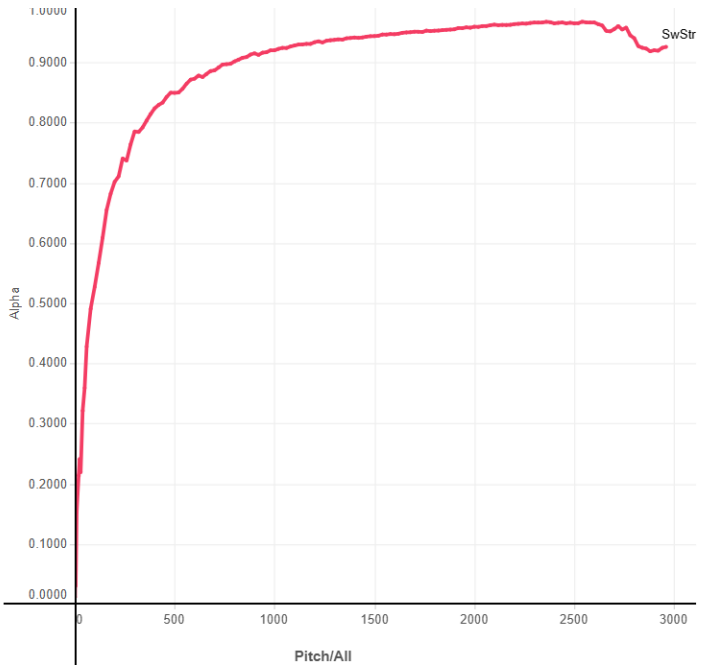
Why Teams Should Use a Different Approach with RISP

Hitting with runners in scoring position (RISP) is one of the best opportunities in a baseball game to score a run. RISP is when the hitting team has a runner on 2nd or 3rd base. Just putting the ball in play with RISP can be the difference between winning and losing. But hitting a 3-run homer or a grand slam can put a game basically out of reach. I conducted research to see if MLB teams should have their players change their approach with RISP to put the ball in play but lose some power. I looked at data from hitters from 2021-2023. I looked at different splits with RISP, including home or away, score difference, two outs or under two outs, and two strikes or under two strikes. I used a variety of metrics, including the new bat speed and swing length metrics for the other part of my research that looks at the current 2024 season.

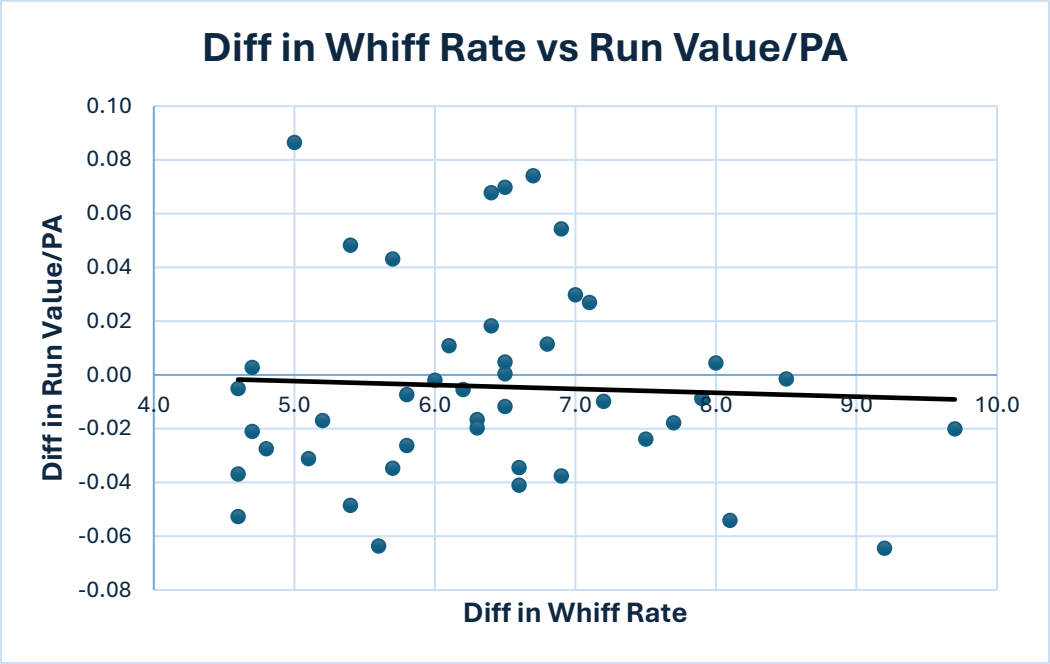
Getting Data, Sample Size, and Run Value:





These curves are from work done by Sean Dolinar and Jonah Pemstein looking at when stats stabilize. Stabilization answers the question of how many pitches before whiff% changes very little or not at all. I got data on all the hitters from 2021 to 2023, with at least 200 BIPs from Baseball Savant's Statcast search. I removed bunts and bunt attempts. I chose 200 BIPs since the HR curve is close to flattening with 200 BIPs. I chose 3 years because I wanted whiff rate to be really close to stabilizing since that stat is integral to the project. Three years of data gets hitters to have at least 700 pitches with 2 strikes, and the curve is close to flattening out at 700 pitches. To determine hitters that used a 2-strike approach, I calculated the difference in whiff rates from under 2 strikes and 2 strikes of MLB players from 2021 to 2023. I identified all the players that had greater than a 4.5% difference in whiff rate as 2 strike hitters. I chose 4.5% because the average difference for the entire MLB from 2021 to 2023 was 1.5%, so I thought players with a

difference more than 3% higher than 1.5% would likely be hitters that use a 2-strike approach. I identified 44 players as using a 2-strike approach and I got a variety of stats without 2 strikes and with 2 strikes using Baseball Savant's Statcast search. Next, I looked at the difference in these stats, (under 2 strikes stats compared to 2 strikes stats), for these 44 players to see how the 2-strike approach compared to not using a 2-strike approach.



I made a scatterplot with a trendline in Excel to see if there was a correlation between diff in whiff rate and diff in Run Value/PA from these 44 players. As diff. in whiff rate goes up, the diff in run value/PA goes down. This means, generally, the less a hitter whiffs with 2 strikes, the closer his run value/PA is to without 2 strikes, and in some cases, it is higher than without 2 strikes. But the correlation appears to be weak, and this data is not only with RISP, which is what I wanted to look at. I included data without RISP to maximize the number of pitches with 2 strikes. Also, a lot of the stats without RISP are similar to the stats with RISP. Next, I'll share how some of this data was used for testing a 2-strike approach with RISP.

Functions Explained:

I wanted to see how the rest of the league would perform if they used a 2-strike approach. To test this, I used data from 2023 from pybaseball, a Python package for baseball data analysis, in Google Colab, and I made multiple functions. The "win_score" function looks at every plate appearance (PA) in a data frame and it averages the win probability added and run value from each PA, and it calculates how often a run scores from all the PAs. Win Probability added looks at the difference in win expectancy before and after the plate appearance. Win expectancy is the probability of an average team winning the game based on the inning, score, and base-out situation (how many guys on base and where and how many outs). Run Value is the difference in run expectancy before and after the plate appearance. Run expectancy estimates how many runs

an average team will probably score in the particular base-out situation. The “approach_test” function tests how all the plays in a data frame would have turned out if each player used a 2-strike approach. I looked at the top 10 most popular outcomes with RISP and 2 strikes and calculated the difference between under 2 strikes and 2 strikes of those outcomes divided by balls in play (BIP) for the 44 players with a 2-strike approach, except for strikeouts and walks, (which were in the top 10 most popular outcomes with RISP). I then averaged the differences for those 8 outcomes for the 44 players that used a 2-strike approach. For strikeouts and walks, I compared the walk rate and strikeout rate of the players with a 2-strike approach to a group of players that together had a similar average whiff rate without 2 strikes and did not use a 2-strike approach based on their diff. in whiff%. To get the hitters without a 2-strike approach, I looked at the players that had a difference in whiff rate, (between under 2 strikes and 2 strikes), of 1.5% or less. To get a subset of those players that had a similar whiff rate with under 2 strikes, I kept deleting players with the smallest whiff rate from the group until the average whiff rate with under 2 strikes was about 29%, (the average whiff rate of the hitters using a 2-strike approach). For the hitters using a 2-strike approach, on average, compared to under 2 strikes, (without a 2-strike approach), with 2-strikes, singles/BIP was 1.6% higher, doubles/BIP was 1.1% lower, triples/BIP was 0.1% higher, and homers/BIP was 2.3% lower, field outs/BIP was .17 lower, GIDP/BIP was 0.005 lower, Sac Fly/BIP was 0.002 lower, and Force Out/BIP was 0.001 lower. Compared to the similar players I identified, the hitters with a 2-strike approach had a BB% about 0.42% lower and K% about 5.4% lower. The “approach_test” function uses the above percentages to modify a given play-by-play data frame. The function adds singles, triples, and strikeouts using the respective percentages above and the number of balls in play and plate appearances in the data frame. The function removes doubles, homers, field outs, GIDPs, sac flies, force outs, and walks using the respective percentages above and the number of balls and plate appearance in the data frame. It uses random plays from the data frame to add plays. The K’s and walks removed are replaced with non-adjusted plays, (plays that were not in the top 10 outcomes), from the data frame. The BIPs removed are replaced with non-adjusted balls in play, (BIPs that were not in the top 10 outcomes), from the data frame. It then calculates the win probability added, run value, and how often a run scores from every PA using the “win_score” function. It does this 10 times since there is randomness. I found running the loop more than 10 times did not make much of a difference in the results. The average win probability added, run value, and percentage scored are calculated and returned at the end.

Testing Using a Different Approach with RISP:

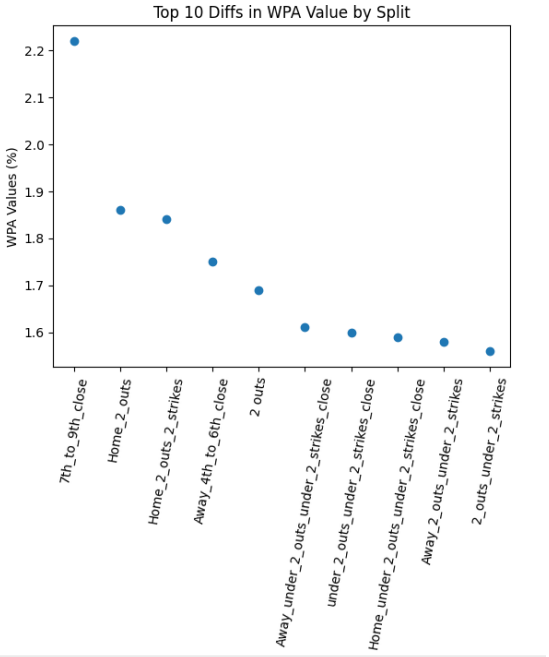
I loaded in pitch-by-pitch data from all pitches from 2023 and I edited it to make it play by play data. I dropped rows with bunts and bunt attempts, NA values for delta home win expectancy, and where a hitter that used a 2-strike approach, (based on my Excel spreadsheet) was hitting. I replaced NA values for if a runner was on base with 0 to indicate no runner was on the base. After that, I got a lot of splits on the data: RISP, RISP and 2 strikes, etc. Note every split in the code after RISP is with RISP, but I did not put “RISP” in every variable name as I thought that would be repetitive. For 52 of the splits I got, I calculated the average win probability added, run value, and how often a run scores from all the PAs using the “win_score” function. I then tested how these values would change if every batter in these splits used a 2-strike approach. I

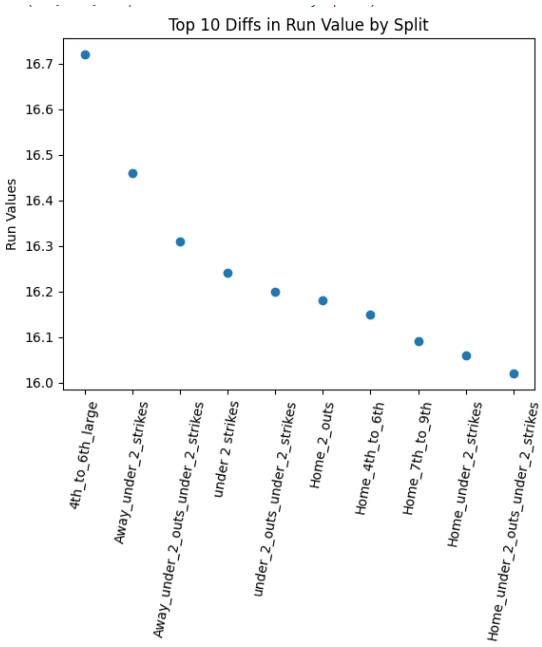
was even able to test using a 2-strike approach with under 2 strikes since some of the splits are without 2 strikes. I tested this by using the "approach_test" function. (I did not test splits that had less than 3000 rows of data using "approach_test" or "win_score"). I put the results in a table with the differences. Below is the first 30 rows of the table, (and only first 4 columns), sorted by Diff in WPA: (Note: every row is with RISP, but I did not want to put RISP over 50 times):

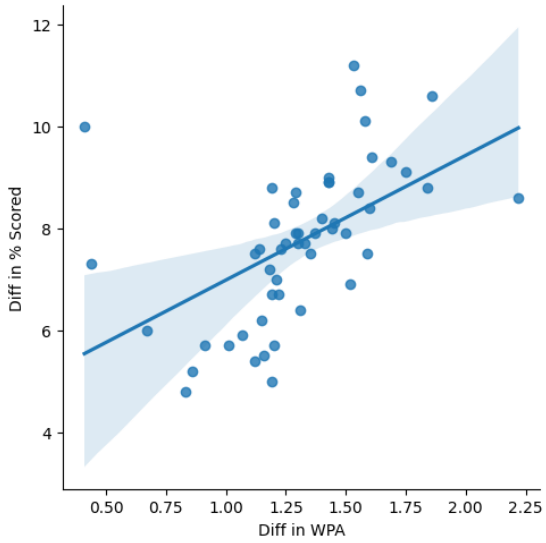
	Diff in WPA	Diff in Run Value	Diff in % Scored	Size of Dataframe
7th_to_9th_close	2.22	15.92	8.6	4614
Home_2_outs	1.86	16.18	10.6	9373
Home_2_outs_2_strikes	1.84	14.80	8.8	5065
Away_4th_to_6th_close	1.75	15.77	9.1	4188
2 outs	1.69	15.65	9.3	19028
Away_under_2_outs_under_2_strikes_close	1.61	15.76	9.4	3524
under_2_outs_under_2_strikes_close	1.60	15.73	8.4	6968
Home_under_2_outs_under_2_strikes_close	1.59	15.65	7.5	3444
Away_2_outs_under_2_strikes	1.58	15.47	10.1	4382
2_outs_under_2_strikes	1.56	15.42	10.7	8690
4th_to_6th_close	1.55	15.46	8.7	8321
Home_2_outs_under_2_strikes	1.53	15.27	11.2	4308
2_outs_2_strikes	1.52	13.84	6.9	10338
Away_2_outs	1.50	15.07	7.9	9655
Home_7th_to_9th	1.45	16.09	8.1	4748
Home	1.44	15.59	8.0	20434
Home_under_2_strikes	1.43	16.06	9.0	9689
Away_under_2_strikes	1.43	16.46	8.9	9727
under 2 strikes	1.43	16.24	8.9	19416
Home_4th_to_6th_close	1.40	15.33	8.2	4133
RISP	1.37	15.65	7.9	41404
Home_under_2_outs_under_2_strikes	1.35	16.02	7.5	5381
under_2_outs_under_2_strikes	1.33	16.20	7.7	10726
Away_4th_to_6th	1.31	15.62	6.4	6676
Away	1.30	15.68	7.7	20970
Away_under_2_outs_under_2_strikes	1.30	16.31	7.9	5345
Away_1st_to_3rd	1.29	15.41	8.7	6442
7th_to_9th	1.29	15.71	7.9	9260
Away_1st_to_3rd_close	1.28	15.04	8.5	5372
4th_to_6th	1.25	15.91	7.7	13653

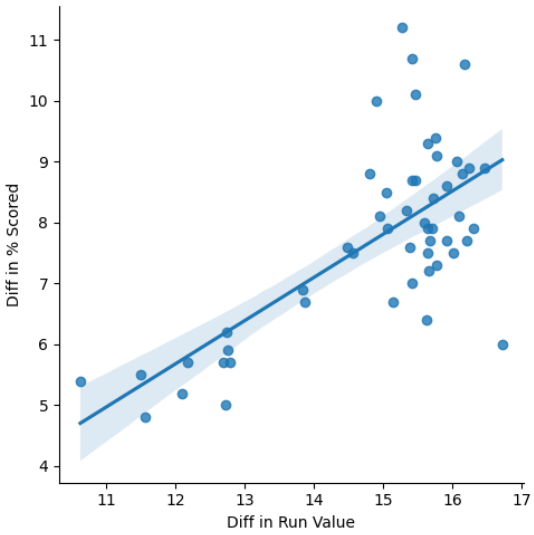
For every split tested, the league would be better off offensively using a 2-strike approach based on Diff in WPA, Diff in Run Value, and Diff in Percent Scored. Therefore, it appears teams should use a different approach with RISP, even without 2 strikes, and especially in close games from the 7th to 9th inning as that results in the biggest increase in WPA. A close game was defined as a score difference of 2 runs or less. (A not close game or large score difference was more than

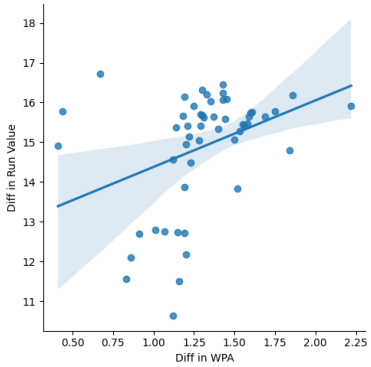
3 runs). Using a different approach with RISP could result in more exciting hits with RISP for fans and more wins for teams late in games.











Correlation Matrix

	Diff in WPA	Diff in Run Value	Diff in % Scored
Diff in WPA	1.000000	0.367439	0.523998
Diff in Run Value	0.367439	1.000000	0.692982
Diff in % Scored	0.523998	0.692982	1.000000

All 3 of these variables are correlated, but Diff in Run Value and Diff in % Scored are the most highly correlated. They are both positively correlated too. Therefore, generally, as Diff in Run Value increases, Diff in Percent Scored increases as well. With a different approach with RISP, generally, the higher the percent scored compared to no approach, the higher the run value compared to no approach.

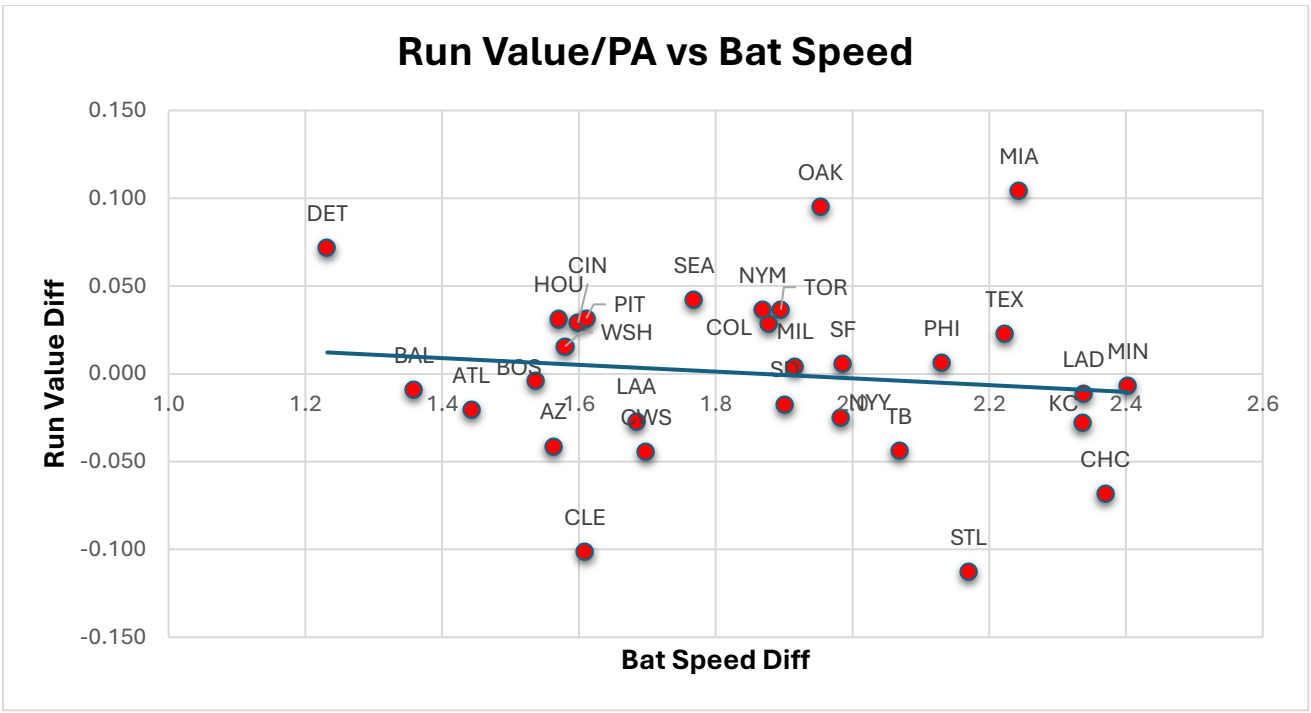
By Teams with most PAs with RISP:

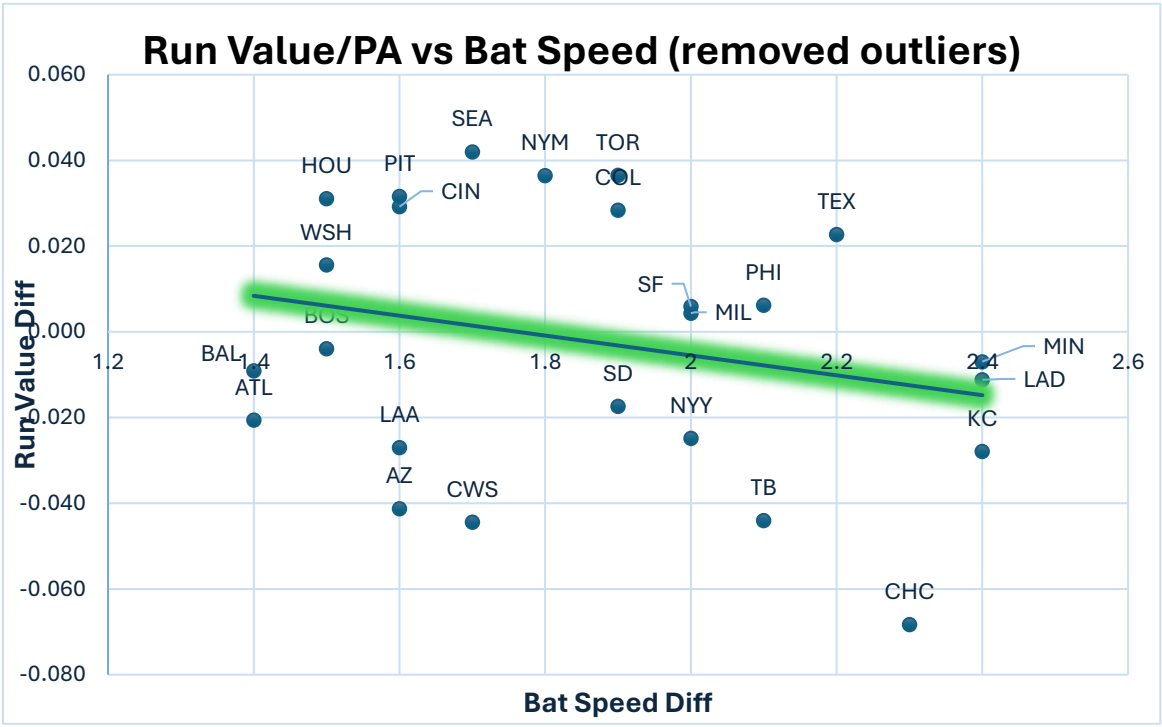
	count
SEA	3106
TEX	3044
AZ	3022

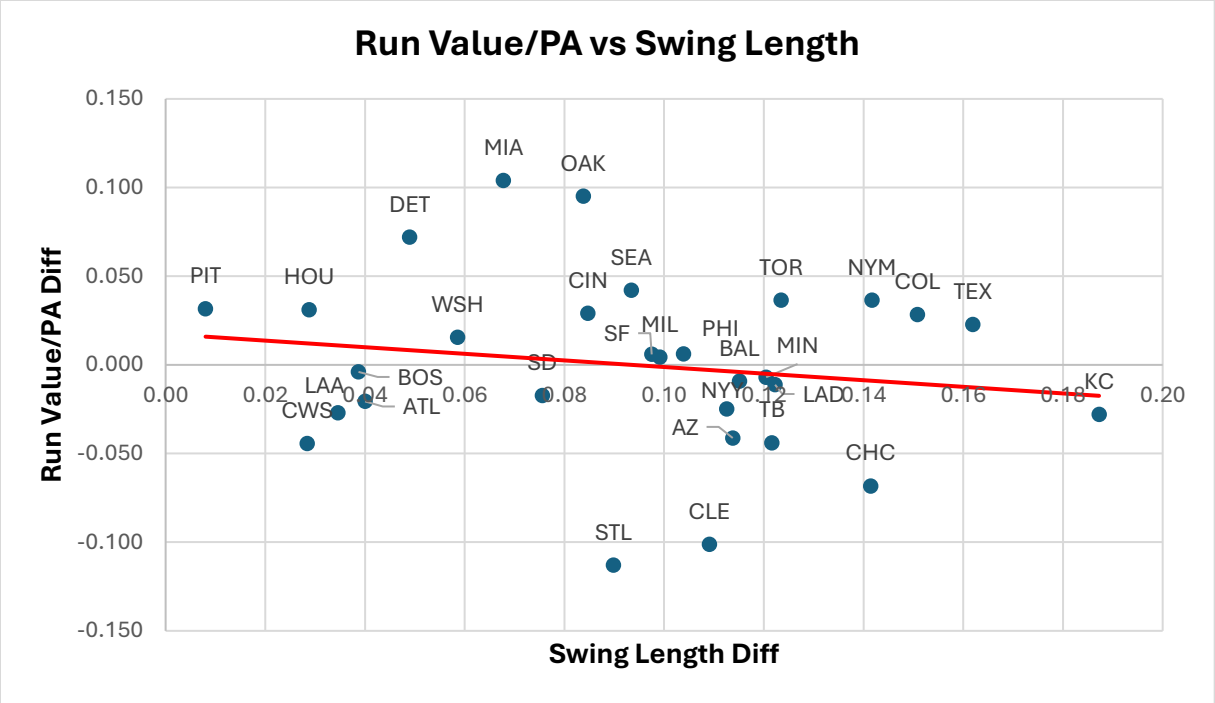
	Diff in WPA	Diff in Run Value	Diff in % Scored	Size of Dataframe
RISP_AZ	1.47	16.59	8.2	3022
RISP_SEA	1.29	14.99	4.8	3106
RISP_TEX	1.19	16.22	8.1	3044

I wanted to test using a 2-strike approach by team instead of by the whole league. I got data from 2022 to increase the sample size. I again made the same modifications as I did to 2023 - dropped bunts and bunt attempts, players that I identified as using a 2-strike approach, etc. Looking at the 2022 season and the 2023 season, the teams that had the most PAs with RISP were the Mariners, Rangers, and Diamondbacks. Using “win_score” and “approach test”, these teams would be better off using a 2-strike approach with RISP based on the results. WPA, Run Value, and how often a runner scored would all be higher based on the table above. With the higher average run value and WPA in RISP, Seattle may have been able to squeeze into a wild card in 2023 if the whole team used a different approach with RISP.

2-Strike Approach Overall and New Metrics:


Run Value/PA vs Bat Speed
Run Value Diff
Bat Speed Diff
0.150
0.100
0.050
0.000
-0.050
-0.100
-0.150
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
DET
OAK
MIA
CIN
HOU
SEA
NYM
TOR
PIT
WSH
COL
MIL
SF
PHI
TEX
BAL
ATL
BOS
LAA
AZ
CWS
TB
LAD
MIN
KC
CHC
CLE
STL


Run Value/PA vs Bat Speed (removed outliers)
Run Value Diff
Bat Speed Diff
0.060
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
SEA
NYM
TOR
HOU
PIT
CIN
COL
TEX
WSH
PHI
SF
MIL
BOS
BAL
ATL
MIN
LAD
SD
NYY
KC
LAA
AZ
CWS
TB
CHC



I wanted to look at the new metrics of bat speed and swing length. I took data from this season on all 30 teams on 09/16/24, removed bunts and bunt attempts, and split it by under 2 strikes and 2 strikes. This is with and without RISP since I wanted the sample size to be big enough. Looking at the graphs, generally, the slower a team swings with 2 strikes compared to under 2 strikes, the closer the run value/PA is to under 2 strikes, and in some cases the run value/PA is even better with 2 strikes compared to under 2 strikes. Typically, run value/PA will be worse with 2 strikes since you can strikeout on 1 more pitch compared to under strikes. Getting as close to the run value/PA value without 2 strikes would be a success and being better with 2 strikes would be amazing. But the correlation is not really strong, therefore the benefit may be small. Note, the outliers I identified and removed from the first graph were DET, OAK, MIA, CLE, and STL. Based on the last graph, generally, the slower a team swings with 2 strikes compared to under 2 strikes, the closer the run value/PA is to under 2 strikes, and in some cases the run value/PA is better with 2 strikes. But this relationship is weak so the benefit would be very small.

Miscellaneous Stats:

With RISP how often is there a _ (as a percent):
BIP: 67.6
BIP that is not a homer: 64.8
Home Run: 2.8
XBH: 7.7
Single: 14.1
Single with 2 strikes: 5.4
HR with 2 strikes: 0.9
XBH with 2 strikes: 2.7
Strikeout: 21.7
GIDP: 2.7

What is the avg. change in Win Exp., Run Exp., and Percent of Times a Run Scores for _:
BIP: (0.84, 12.03, 35.4)
BIP that is not a homer: (0.08, 3.65, 32.7)
HR: (18.63, 208.57, 99.9)
HR with 2 strikes: (20.33, 217.11, 99.7)
XBH: (14.31, 161.51, 99.3)
Single: (8.23, 90.3, 76.7)
XBH with 2 strikes: (14.24, 163.79, 99.0)
Single with 2 strikes: (8.26, 96.28, 75.9)
Strikeout: (-4.66, -37.69, 0.1)
GIDP: (-9.8, -61.94, 8.7)

Some miscellaneous stats I was interested in. I used data from the 2023 season for this and did not drop 2-strike hitters. With RISP, there was a BIP (ball in play), 67.6% of the time during the 2023 season. The average win probability added, run value, and percentage scored with RISP, respectively, was 0.84%, 12.03, and 35.4%.

In conclusion, I believe teams would be better off using a different approach with RISP, even without 2 strikes. Teams could perform better with RISP with a different approach, resulting in more wins. I'd like to use bat speed and swing length more in the future to how much hitters should change their swing speed and swing length. Then I could describe what the different approach should be. Attached to the post are my code in GitHub and Excel sheets with data and graphs.

Sources:

Statcast Search CSV Documentation | baseballsavant.com (mlb.com)

Statcast Search | baseballsavant.com (mlb.com)

jldbc/pybaseball: Pull current and historical baseball statistics using Python (Statcast, Baseball Reference, FanGraphs) (github.com)

Sample Size | Sabermetrics Library (fangraphs.com)

Win Expectancy (WE) and Run Expectancy (RE) Stats | Baseball-Reference.com