

University of Michigan - Michigan Sabermetrics Team

Reds Hackathon 2024: Pitcher Role Reversal

Converting Relievers into Starters

Members: Emma Bluman, John Ilyevsky, Daniel Mueller, Rohan Patel, and Christopher Putnam

Submitted on: February 5, 2024

TABLE OF CONTENTS

Introduction	3
Research Question	3
Methods	4
Pitch Mix	4
Stamina	6
Tree Models	8
Tree Model #1	8
Tree Model #2	9
Results	11
Reliever Selection Process	11
Starter Adjusted Stuff and Location Model	11
Starter Comparables Model	12
Pitcher Analysis: David Bednar	13
Pitcher Analysis: Seth Martinez	13

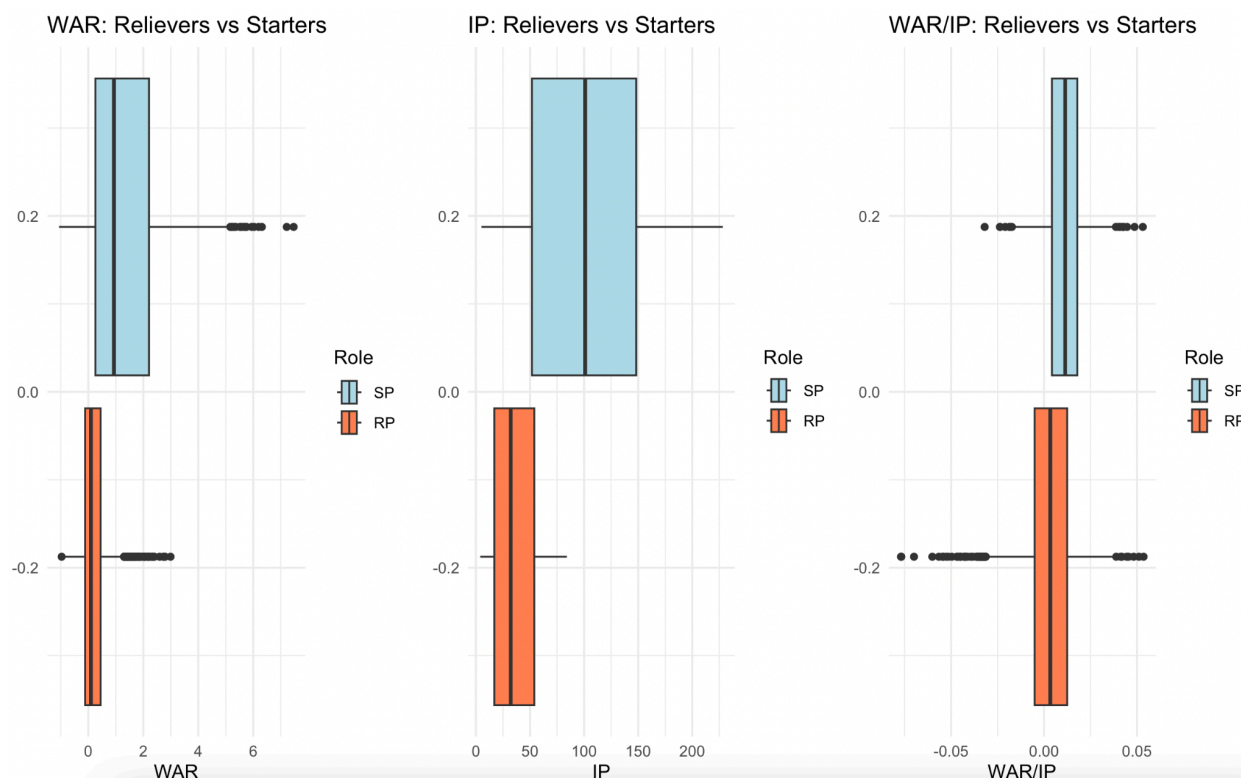
Introduction

The Reds Hackathon 2024 challenges teams to find characteristics that make pitchers successful in particular roles, and then apply those findings to find pitchers who could be better off in another role.

Research Question

We decided to approach this prompt by identifying characteristics that make a starting pitcher effective, and then apply that to find traditional relievers that would be more effective as starters.

We believe that answering this question will provide the most value to an organization. As visualized below, starting pitchers provide more value (WAR), bulk (IP), and value per appearance (WAR/IP). This results in starters getting paid significantly more than relievers. If you convert a reliever, you get the most value by getting the production of a starter at the price of a reliever.



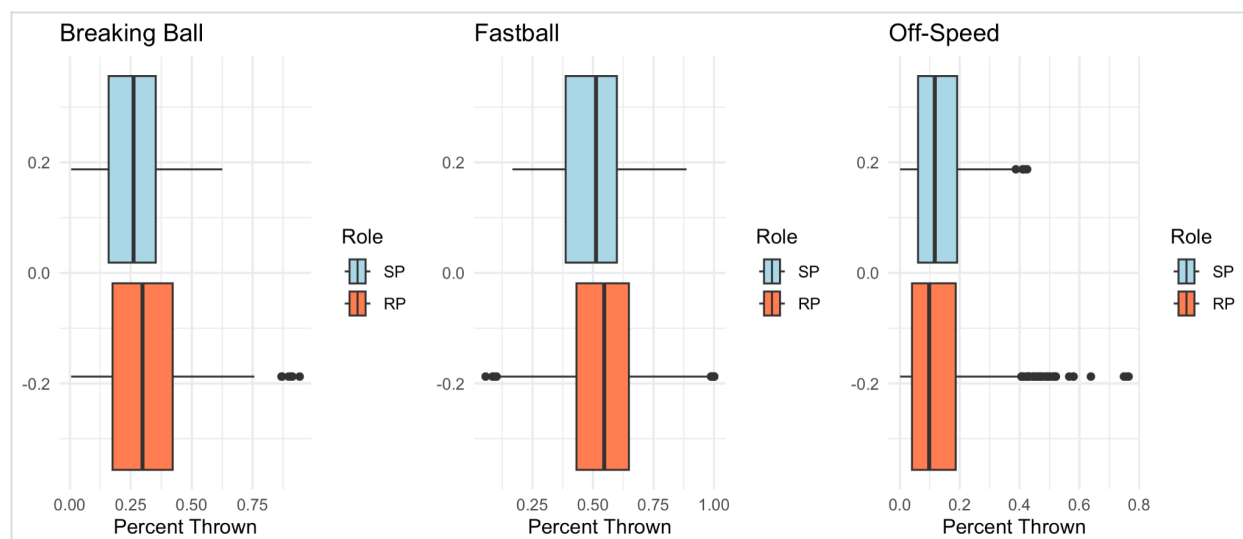
Methods

We determined the two factors that differentiate starting pitchers from relief pitchers: pitch mix and workload. Starters tend to have more pitches in their arsenal, allowing them to see hitters multiple times in an outing. Additionally, being a starter requires heavier workloads and sustained success through later innings. Below we go into detail into how we find these differences and apply them to find relievers that would be effective as starters.

Pitch Mix

As shown below, starters tend to have a more balanced pitch mix than relievers. Relievers tend to get away with throwing fewer pitch types, and higher percentage off-speed/breaking balls than

starting pitchers since they typically only face a hitter once per outing. To successfully decipher which relievers would be successful as starters, we must find relief pitchers who have a diverse enough pitch arsenal that allows them to go through a lineup multiple times.

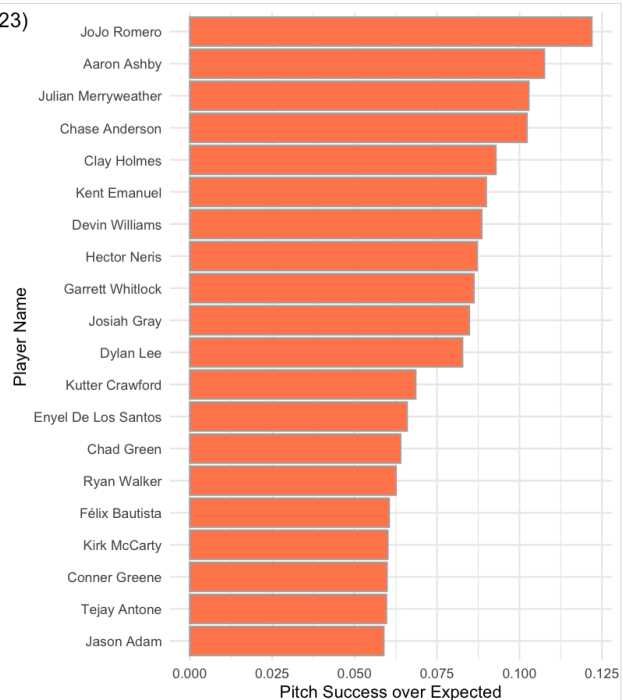
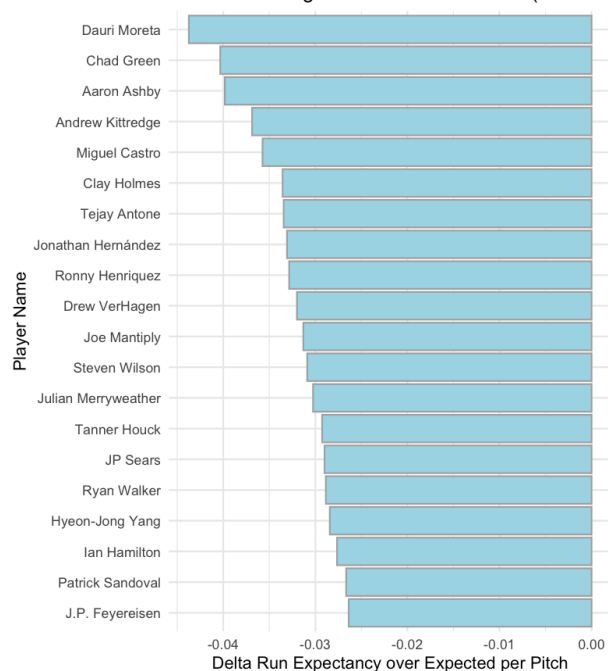


With the data we had, we thought it made most sense to separate all pitches into one of three categories: fast-ball, breaking-ball, and off-speed (lines 85 - 88 of our workbook for more detail). We then found the average percentages thrown for each starter compared to each reliever for each of these categories. We recognize that using the broader classifications fails to consider pitchers who have multiple pitches in one category (i.e. sinkers and cutters are both fastballs), but we believe that this approach will eliminate relievers who rely heavily on two or fewer pitches. We used a threshold at the 10th quantile rankings (removing low-end starter outliers) to determine the minimum percentage of each pitch type that a reliever has to have a qualifying pitch mix.

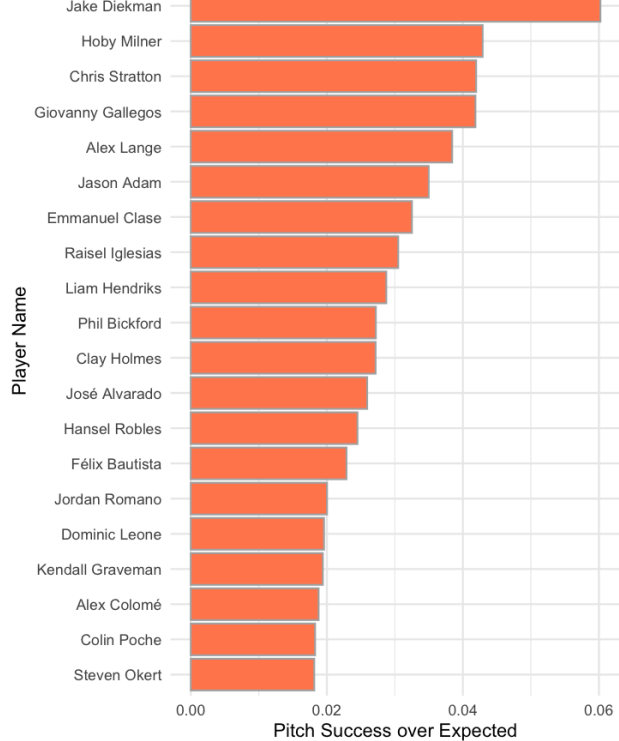
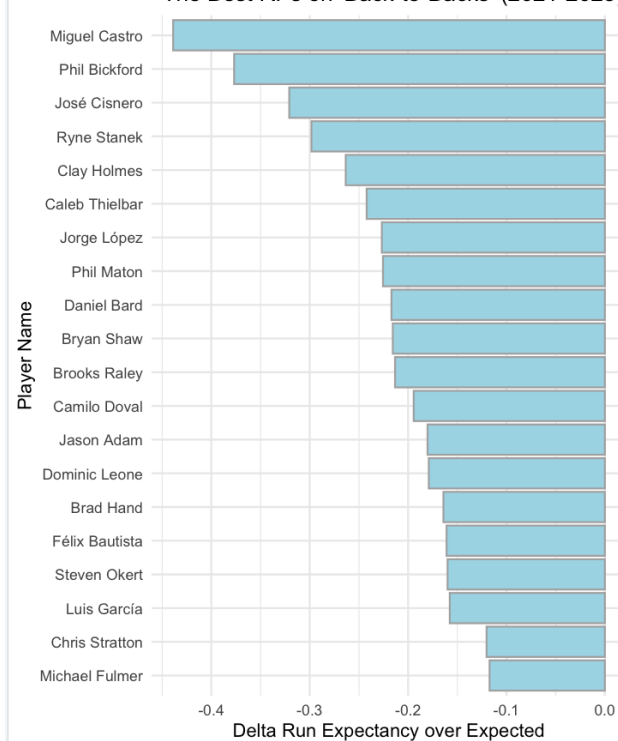
Stamina

Workload is an important factor for relievers transitioning to starters. Relievers who can handle a larger workload in a shorter period are likelier to succeed as a starter. To measure this, we focused on success in back-to-back outings, outings three days in a row, and instances where a reliever threw 75 pitches in a week. To measure the success of pitchers in these situations, we analyzed how pitchers typically performed compared to the scenarios above. Success was measured using two variables: Delta Run Expectancy (DRE) and Pitch Success. Pitch Success is a variable we developed to exclude factors outside the pitcher's control (lines 261 - 295 of workbook); DRE provides insight into how each pitch affects game outcome. Looking at our results, we found three days in a row insignificant since so few pitchers have done it. Our final analysis looks at back-to-backs and 75 pitches in a week. Our final output from this model is below.

The Best RPs when Throwing 75+ Pitches in a Week (2021-2023)



The Best RPs on 'Back-to-Backs' (2021-2023)

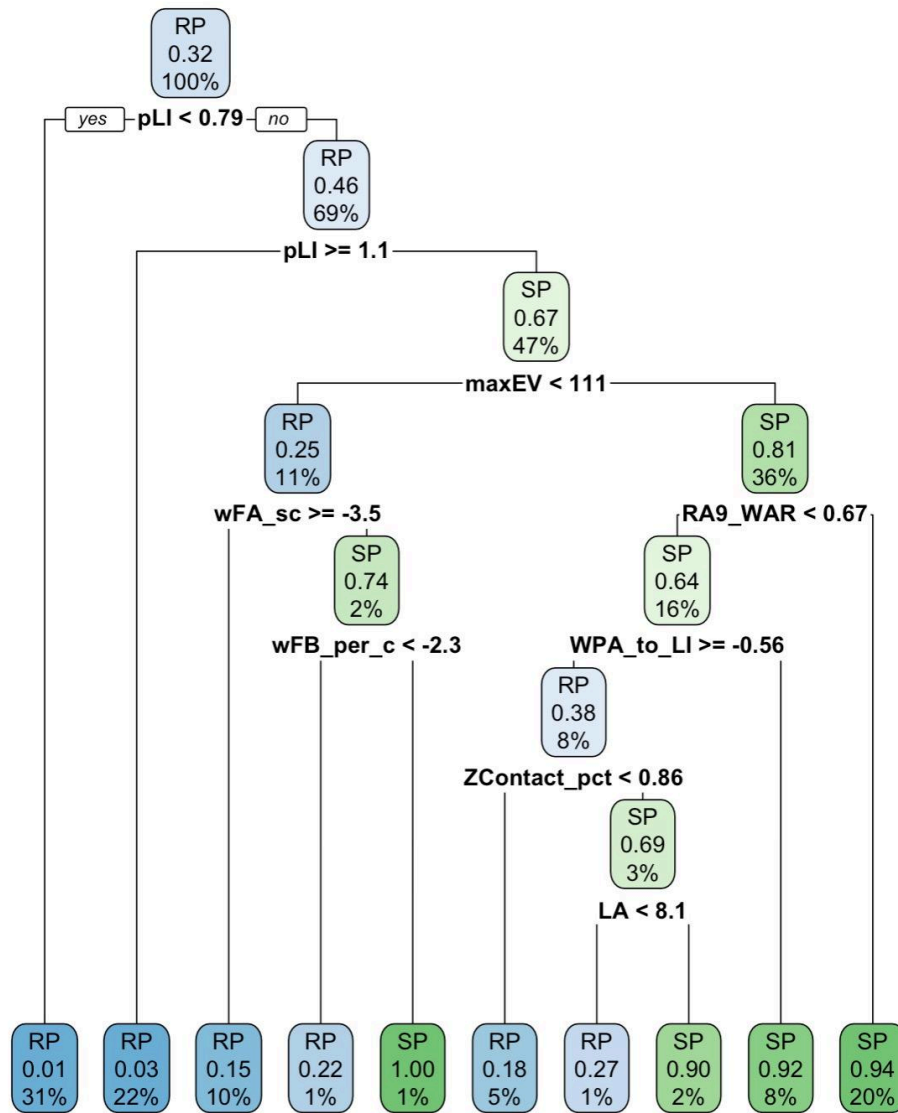


Tree Models

We also created two different tree models to decipher the most important values differentiating starters from relievers. We used 2021-2022 data to train our tree model and 2023 to test the model. To make this model more accurate you could have used data from years before 2021 so there is more data to train on; however, you lose the value of using data that represents the recent trends in pitcher usage.

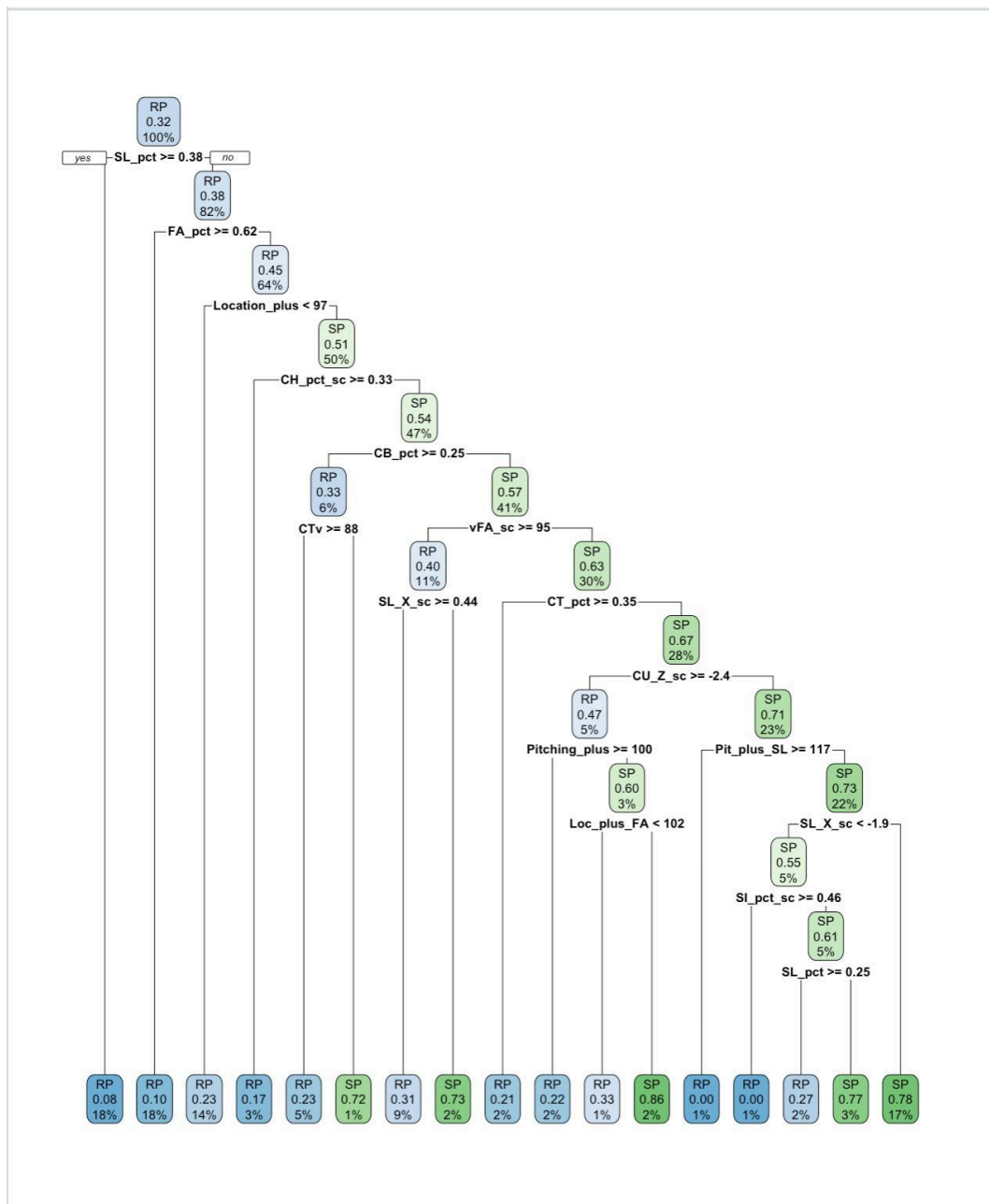
Tree Model #1

Our first tree model had the computer decipher which statistics differentiate starters from relievers. We removed all bulk statistics, so it uses performance and situational factors to predict starter versus reliever. From this, we tagged all 2023 relief pitchers that were tagged as starters and used it towards our final output.



Tree Model #2

The second model we chose takes a more in-depth look into pitch mix. It looks at percentage thrown of each pitch type and the Location+, Stuff+, Pitcher+, and movement of each pitch type.



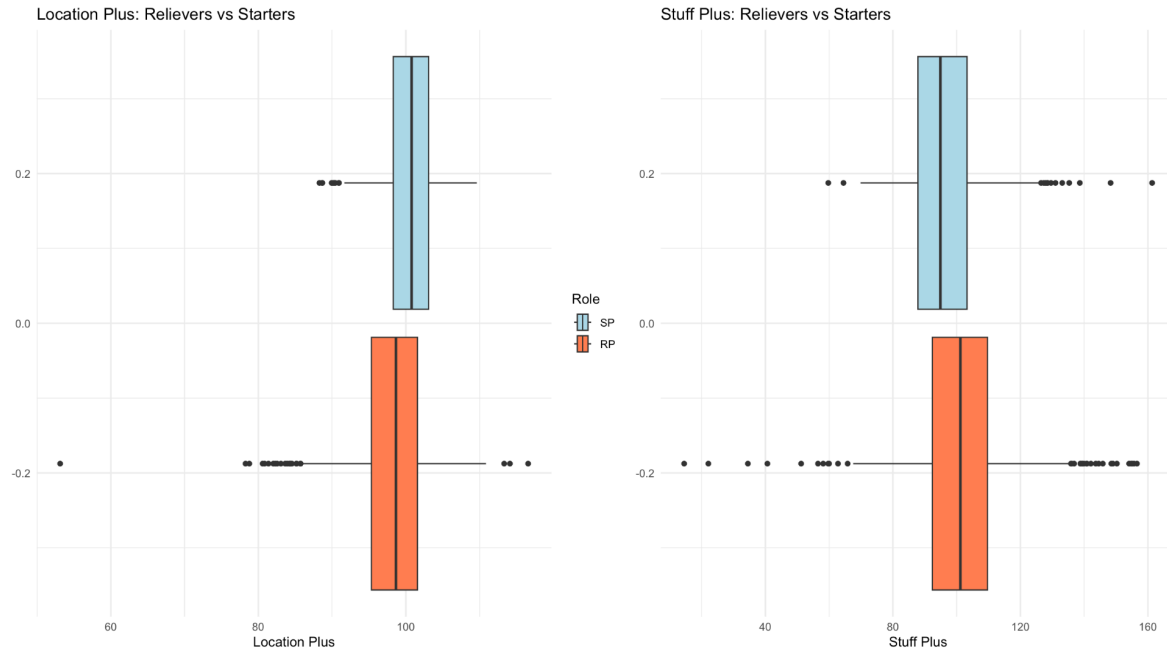
Results

Reliever Selection Process

To find relievers that would be successful starters we decided to combine our three methods by assigning qualifier points to each relief pitcher. Each tree diagram was worth 1.5 points. Having a qualifying pitch mix was worth 1 point. Having 8 successful back-to-back outings in 2023 was worth 0.75 points, whereas having 15 over the past three years was worth 0.25 and the same for being successful while throwing 75 pitches in a five-day span. All relief pitchers with more than 2 qualifier points while having a qualifying pitch mix are considered in our final analysis explained below.

Starter Adjusted Stuff and Location Model

To see, roughly, how relievers would perform as starters, we looked at Stuff+, Location+, and Pitching+ averages for all starters and all relievers for the years 2021-2023.



Then, we performed the calculation of the starter average minus the reliever average for each statistic. A negative value means relievers, generally, perform better than starters in that category, and vice versa. We found the Stuff+ difference averaged -5.63, Location+ difference averaged 2.34, and Pitching+ difference averaged -0.02. Using these differences, we converted individual reliever Stuff+, Location+, and Pitching+, to those of a starter by adding the difference of each statistic.

Name	Qualifier Points	IP	G	IP/G	Starter Adjusted Stuff Plus	Starter Adjusted Location Plus	Starter Adjusted Pitching Plus
David Bednar	3	67.1	66	1.0	112.23	103.56	106.17
Giovanny Gallegos	3	55	56	1.0	95.52	102.57	100.23
Grant Anderson	3.5	35.2	26	1.3	100.06	101.78	99.66

Jacob Webb	2.75	53.2	54	1.0	108.97	102.43	105.22
Rafael Montero	2.25	67.1	68	1.0	100.04	107.80	106.74
Robert Garcia	3.5	32	25	1.3	96.79	105.77	102.64
Seth Martinez	5	43	35	1.2	101.36	103.07	102.18

Not every pitcher is the same, so taking averages might not be completely accurate in determining how a reliever will perform as a starter. However, we believe this gives a good idea of how the transition would look.

Starter Comparables Model

Given our narrowed-down list, we began using proximity methods to determine which of these relievers' arsenals best resembled successful starters. For each player, we grabbed pitchers throughout the league who threw the same pitches and ran a K-Nearest Neighbor (KNN) model. This model was then used to predict each pitcher's role, labeling them as either a starter or reliever. For parameters to our model, we incorporated usage percentage, weighted runs, velocities, movement, and Pitching+ grades. From there, we narrowed down the list further, selecting only those who were labeled as starters by the KNN model. Taking these players, we calculated the Euclidean distance between their arsenals' metrics and all other pitchers in the league, looking for players who were similar to successful starters. From here, we chose David Bednar and Seth Martinez as our two relievers to be converted to starters, as, from the tables, they both boast impressive comparables. We go into further analysis of each pitcher below.

[[1]]					[[1]]				
	NameASCII	Season	Role	predicted_role		NameASCII	Season	Role	predicted_role
	<char>	<int>	<char>	<fctr>		<char>	<int>	<char>	<fctr>
1:	David Bednar	2023	RP	SP	1:	Seth Martinez	2021	RP	SP
[[2]]					[[2]]				
	NameASCII	Season	Team	Role		NameASCII	Season	Team	Role
	<char>	<int>	<char>	<char>		<char>	<int>	<char>	<char>
1:	Hunter Harvey	2023	WSN	RP	1:	Jake Woodford	2022	STL	RP
2:	Yu Darvish	2021	SDP	SP	2:	Rony Garcia	2022	DET	SP
3:	Shohei Ohtani	2023	LAA	SP	3:	Zach Eflin	2022	PHI	SP
4:	Taijuan Walker	2022	NYM	SP	4:	Garrett Hill	2022	DET	RP
5:	Emilio Pagan	2023	MIN	RP	5:	Hayden Wesneski	2022	CHC	SP
6:	Nathan Eovaldi	2023	TEX	SP	6:	Sean Newcomb	2022	- - -	RP
7:	Yu Darvish	2023	SDP	SP	7:	Carson Spiers	2023	CIN	SP
8:	Nathan Eovaldi	2021	BOS	SP	8:	Joe Ross	2021	WSN	SP
9:	Junior Guerra	2021	LAA	RP	9:	Alec Mills	2022	CHC	RP
10:	Reed Garrett	2023	- - -	RP	10:	Bryan Hoeing	2023	MIA	RP

Pitcher Analysis: David Bednar

Although Bednar is effective in his current role as closer, as we explained above, being a starter offers considerably more value to a team than being a relief pitcher. Bednar's arsenal consists of a four-seam fastball, curveball, and split-finger, which he throws effectively to righties and lefties, will work well as he faces hitters multiple times through the lineup. Our starter-adjusted model puts his Location+ at 103.56 and Stuff+ at 112.23, the best stuff of any finalist. Workload is not a concern for Bednar as he boosted an impressive 67.1 innings in 2023, with half of his appearances coming off of one or fewer rest days. He also proved effective when he had to go up and down; doing it six times in 2023 throwing 9.1 innings and giving up only one earned run. All evidence shows that Bednar would excel as a starter.

Pitcher Analysis: Seth Martinez

Martinez offers a bevy of pitches, including a four-seam fastball, a sweeper, a sinker, and a changeup that he throws to both righties and lefties. Martinez's workload indicates his ability to

handle being a starter. He made 18 of his 35 appearances with 2 or less rest days. He also pitched multiple innings in 11 appearances accumulating 20 innings with a 3.60 ERA. He also went into the third inning twice, throwing 3.1 innings of one-run ball and 2.1 innings letting up no runs. Our model also puts him at an above-average starter-adjusted Stuff+ of 101.36. With all of these indicators, we believe Martinez may find more success as a starter than in his current role.