KC Royals Pitcher Analysis

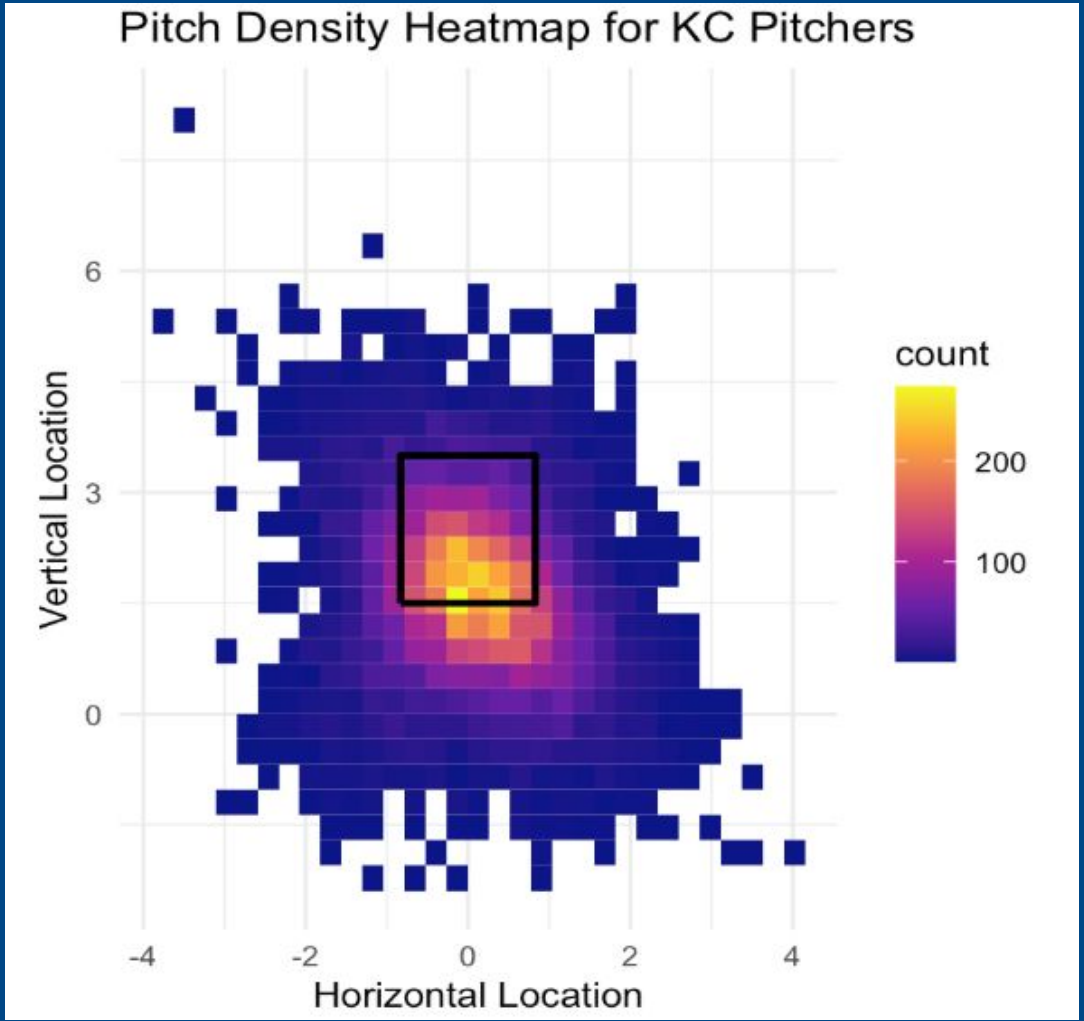
RStudious Wizards

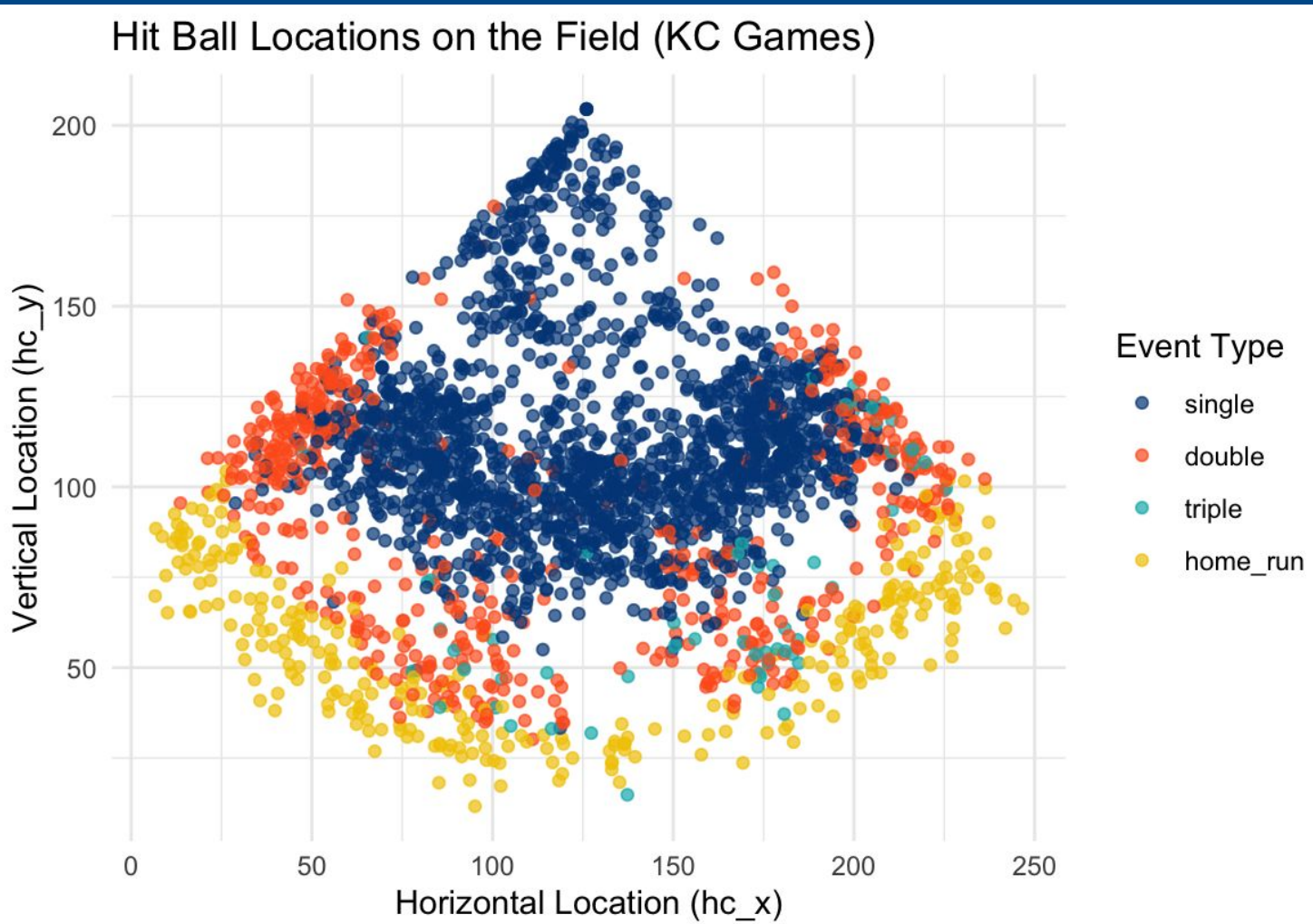
Research Question:

How do statistics like pitch speed, location, and spin rate contribute to the pitchers' overall success?

Dataset Cleaning & Focus on Pitchers

- Dataset Cleaning:
  - We filtered and cleaned the dataset to include only data specific to the Kansas City Royals
  - Ensured the dataset reflects only pitching-related statistics
- Focus on Pitchers:
  - After cleaning, we focused on analyzing the performance of the pitchers
  - Variables: Average hit distance, average release speed, average effective speed, average normalized acceleration, and average normalized velocity, hit coordinates.


Pitch Density Heatmap for KC Pitchers
Vertical Location
6
3
0
-4
-2
0
2
4
Horizontal Location
count
200
100


Hit Ball Locations on the Field (KC Games)
Vertical Location (hc_y)
200
150
100
50
0
50
100
150
200
250
Horizontal Location (hc_x)
Event Type
single
double
triple
home_run

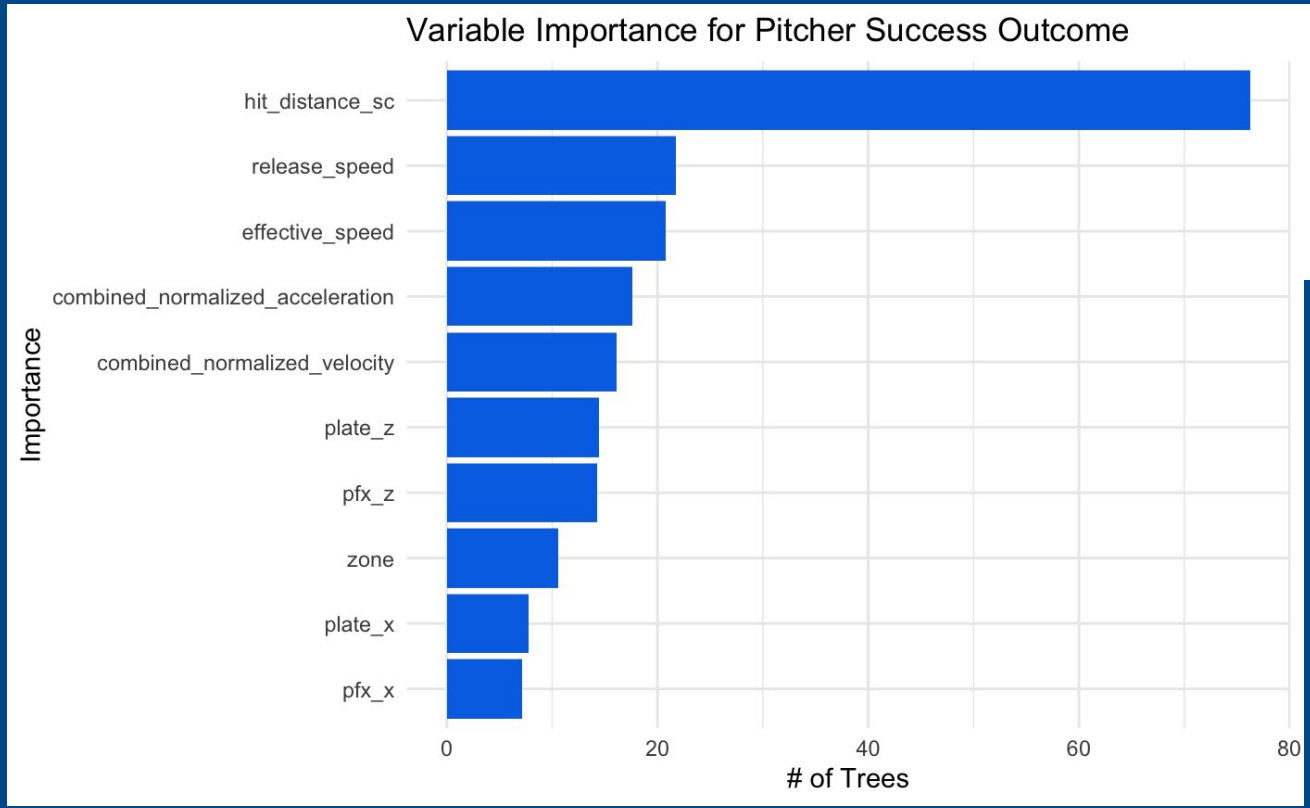
Predicting Pitcher Success - events

Success (1):

- Strikeout
- Field Out
- Double Play
- Strikeout Double Play
- Force Out
- Fielder's Choice Out
- Field Error
- Catcher Interference
- Truncated Plate Appearance

Fail (0):

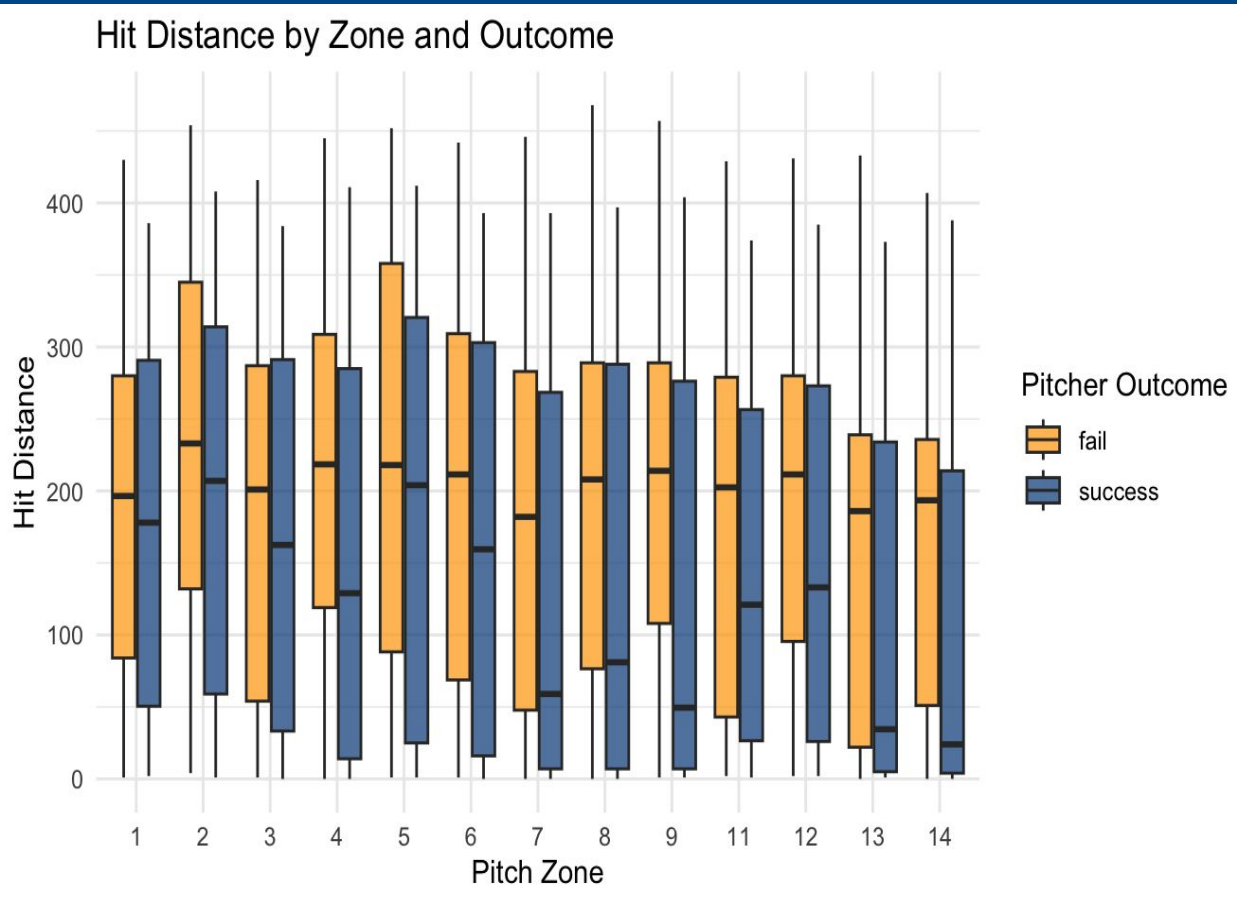
- Single
- Double
- Triple
- Home Run
- Walk
- Hit by Pitch
- Fielders' Choice
- Sac Bunt
- Sac Fly
- Sac Fly Double Play

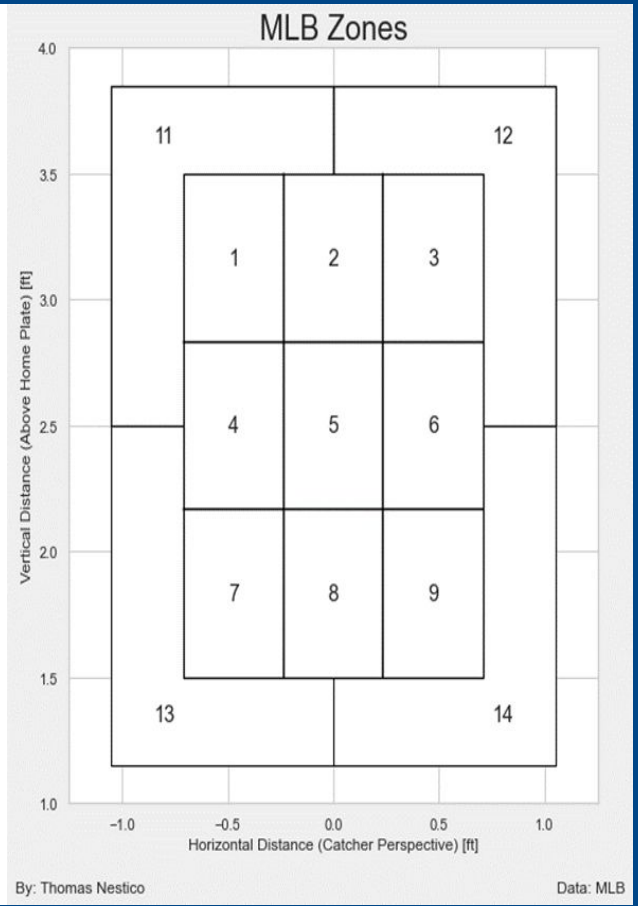


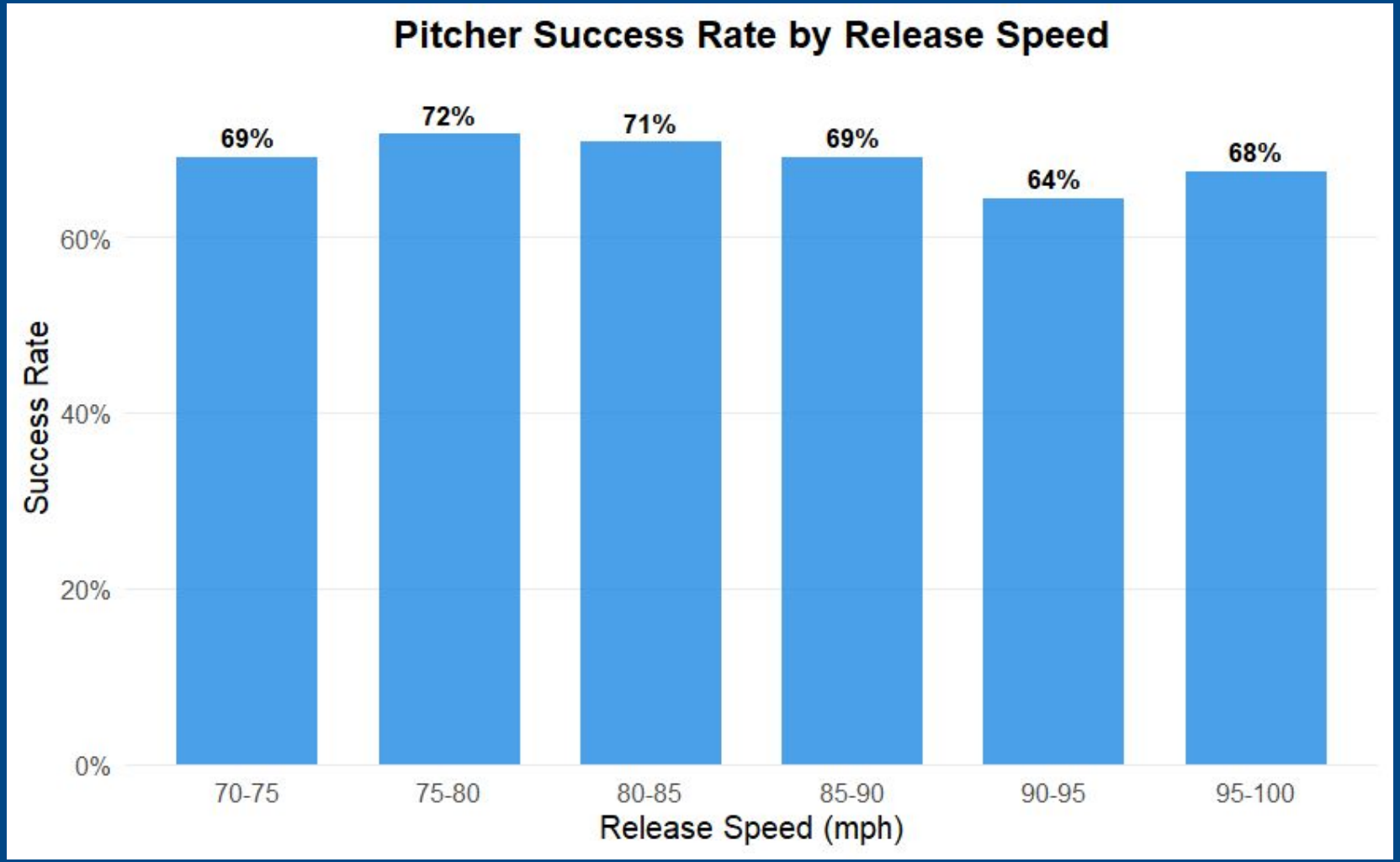

```
Accuracy : 0.8615
95% CI : (0.844, 0.8778)
No Information Rate : 0.6632
P-Value [Acc > NIR] : < 2.2e-16

Kappa : 0.6673

Mcnemar's Test P-Value : < 2.2e-16
```

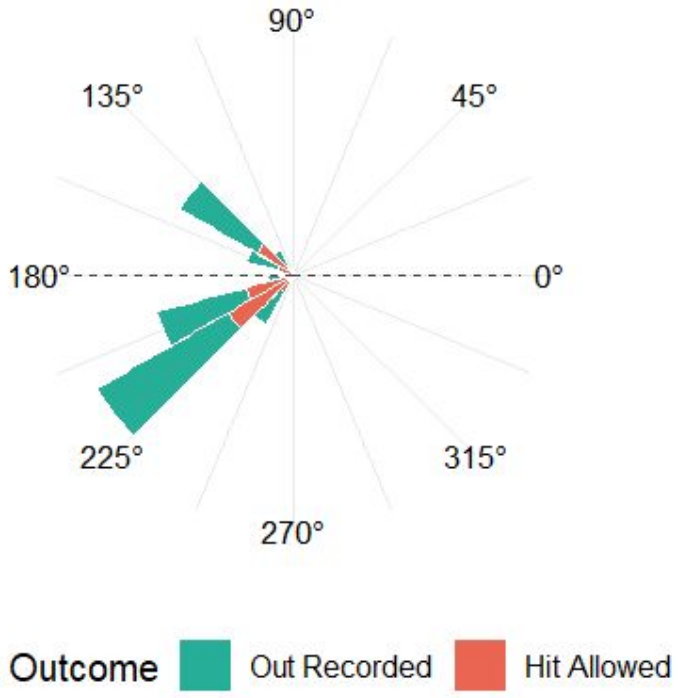

Hit Distance by Zone and Outcome
Hit Distance
400
300
200
100
0
1
2
3
4
5
6
7
8
9
11
12
13
14
Pitch Zone
Pitcher Outcome
fail
success


MLB Zones
Vertical Distance (Above Home Plate) [ft]
4.0
3.5
3.0
2.5
2.0
1.5
1.0
11
12
1
2
3
4
5
6
7
8
9
13
14
−1.0
−0.5
0.0
0.5
1.0
Horizontal Distance (Catcher Perspective) [ft]
By: Thomas Nestico
Data: MLB


Pitcher Success Rate by Release Speed
69%
72%
71%
69%
64%
68%
60%
40%
20%
0%
Success Rate
70-75
75-80
80-85
85-90
90-95
95-100
Release Speed (mph)

4-Seam Fastball Spin Axis Distribution

Successful outs vs. hits allowed | 0° = Topspin, 180° = Pure Backspin



Pitcher	Success (%)	Avg Hit Distance	Avg Release Speed	Avg Effective Speed	Avg Normalized Acceleration	Avg Normalized Velocity
Cole Ragans	70.23	168.47	90.13	89.93	0.65	-0.74
Seth Lugo	69.85	170.08	87.68	87.29	-0.11	0.30
Michael Wacha	67.40	172.71	87.64	88.47	-0.15	0.02
Alec Marsh	66.96	176.38	89.85	89.68	-0.15	0.22
Brady Singer	66.71	162.11	87.50	88.91	-0.33	0.35

Thank you! Go Royals!

```{r}
kc_data <- data_baseball %>%
  filter(home_team == "KC" | away_team == "KC") %>%
  mutate(
    vx0_normalized = scale(vx0),
    vy0_normalized = scale(vy0),
    vz0_normalized = scale(vz0),
    ax_normalized = scale(ax),
    ay_normalized = scale(ay),
    az_normalized = scale(az)
  ) %>%
  mutate(
    combined_normalized_velocity =
    combined_normalized_acceleration
  ) %>%
  # Exclude rows where the batter
  filter(!(batter %in% kc_batters))
  select(
    events, pitcher, batter, relea
    pfx_x, pfx_z, zone, plate_x, p
    woba_value, delta_pitcher_run_
    home_team, away_team, hc_x, hc
  ) %>%
  mutate(pitcher_outcome = case_wh
    events %in% c("strikeout", "fi
    events %in% c("single", "doubl
                  "fielders_choice
  filter(!is.na(pitcher_outcome))
```