



# Optimizing Success for the US Artistic Gymnastics Teams at the Paris 2024 Olympics

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## Introduction

- 2024 United States Olympic & Paralympic Committee Data Challenge Competition:
  - Objective:** Determining the highest scoring combination of 5 male and 5 female gymnasts
- Goals:
  - Exploring the relationship and correlation between different apparatuses
  - Creating a model for generating medal outcomes for all competition events
  - Using the model to pick the best teams

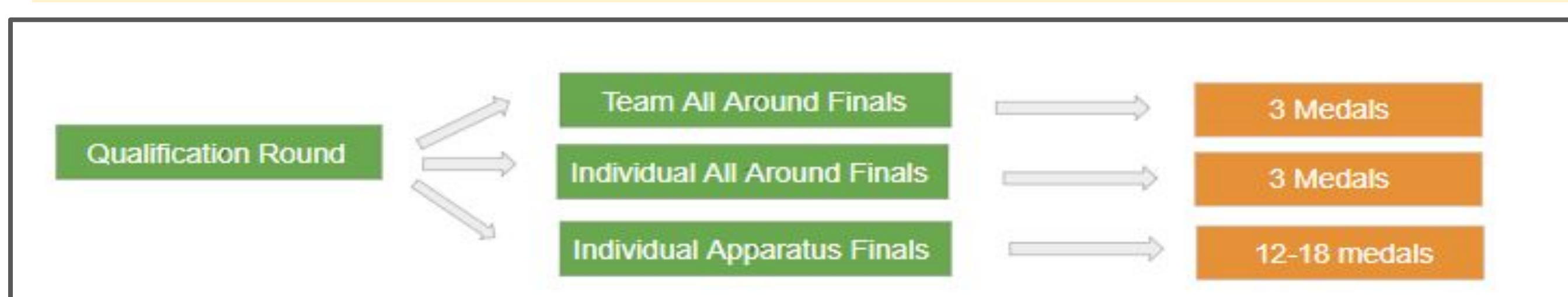
## Data

- Data from 39 competitions held between 2022-2023 for 109 countries and 1,917 individuals
  - Athlete's *score* for an *apparatus* in a *round* in a *competition*
- Men's Apparatuses (6):**
  - Floor Exercise, Pommel Horse, Still Rings, Vault, Parallel Bars, High Bar
- Women's Apparatuses (4):**
  - Floor Exercise, Uneven Bars, Balance Beam, Vault
- The 12 countries that qualified have been determined
- Important Variables:** Name, Country, Apparatus, Round, and Scores
- Score triad:** total score, execution score, difficulty score
- 3 data groups:** US data, 11 other qualifying countries, remaining countries
- 3 finals:** individual apparatuses, individual all around, team all around

## Methods

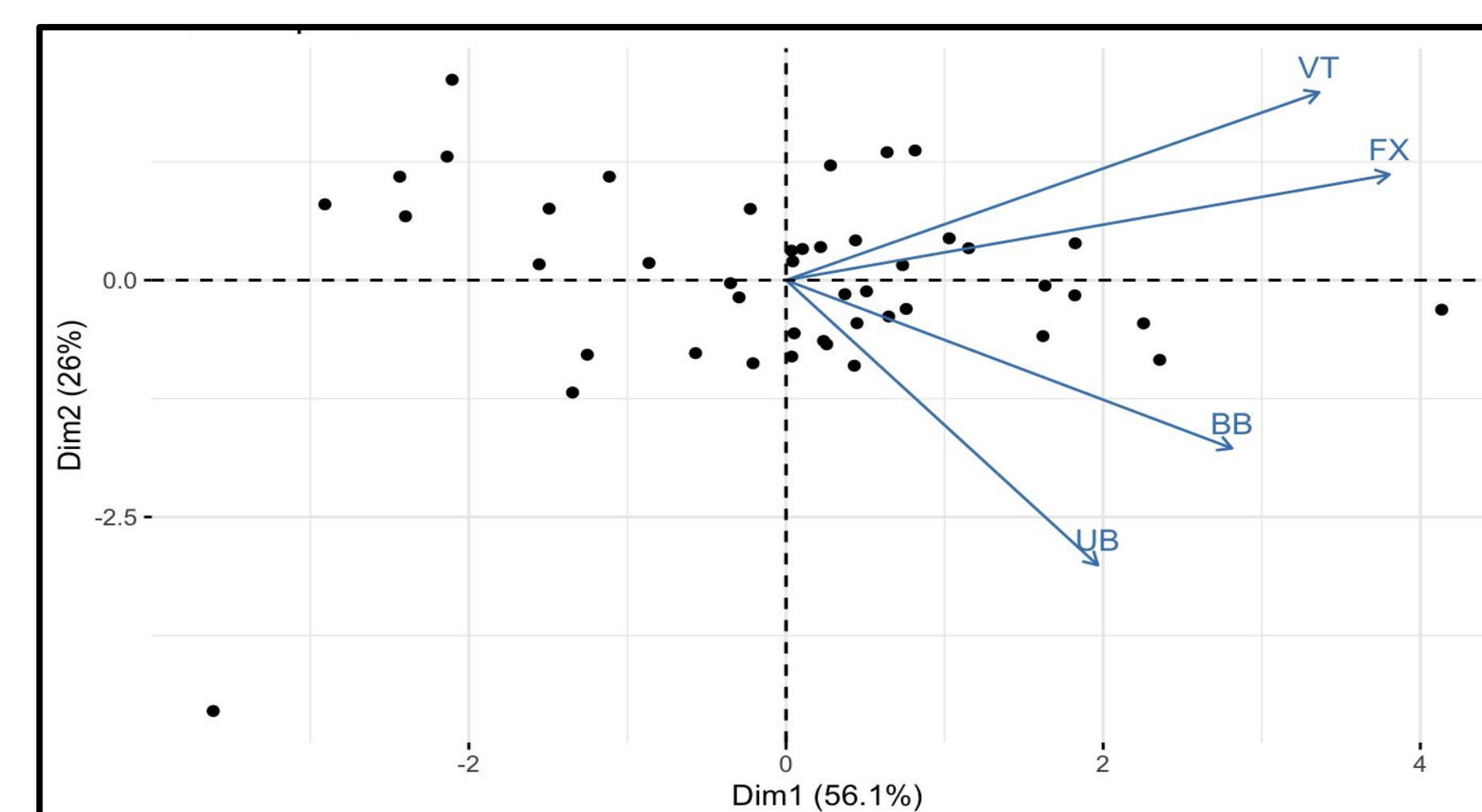
- Predict medal outcomes for a certain US team given historical data and other fixed nations
- Simulation** using random sampling to model competition rounds
- For one round of the simulation:**
  - Qualifying: For all 84 athletes, randomly sample the score triad
    - From the athlete's score distribution or their country's if individual data is not available
  - Determine which players advance to final rounds
    - 2 athletes/country for individual apparatuses & all around
    - 3 athletes for team all around; top 8 teams
  - For each final event, sample scores using Linear Mixed Effects for qualifying athletes
    - $Score \sim (1|FullName) + (1|Country) + (1|Gender) + Apparatus$
    - The name, country, and gender are fixed effects; the apparatus is a random effect
  - Determine winners
  - Count USA medals
- Model Outcome:** Average medal count over 100 rounds of simulation

Flowchart of the simulation model and the total number of medal winners for each event.

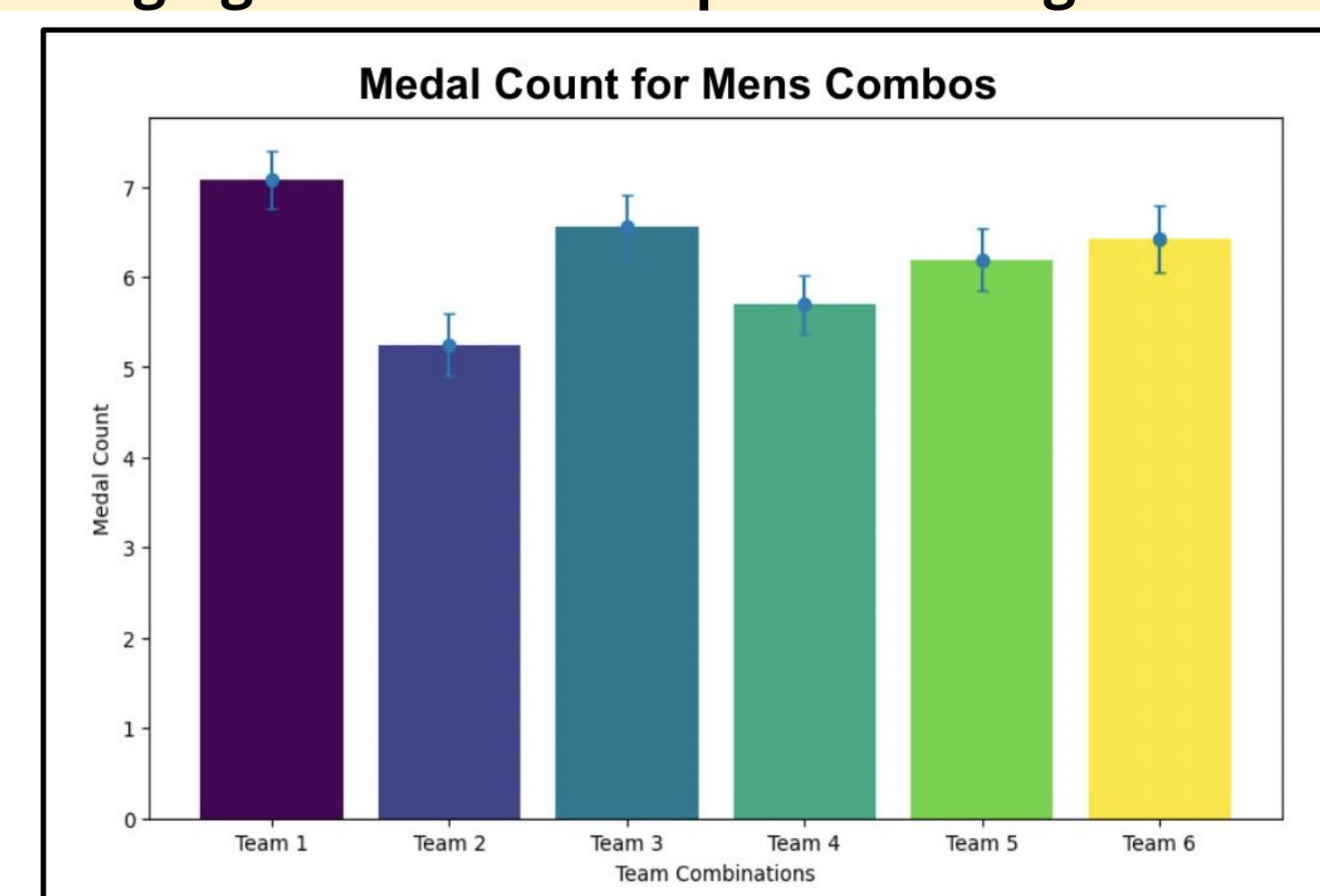


## Results

The apparatuses are positively correlated with each other.



Team 1 resulted in the highest expected medal count, averaging ~7.08 out of 38 possible weighted medals.

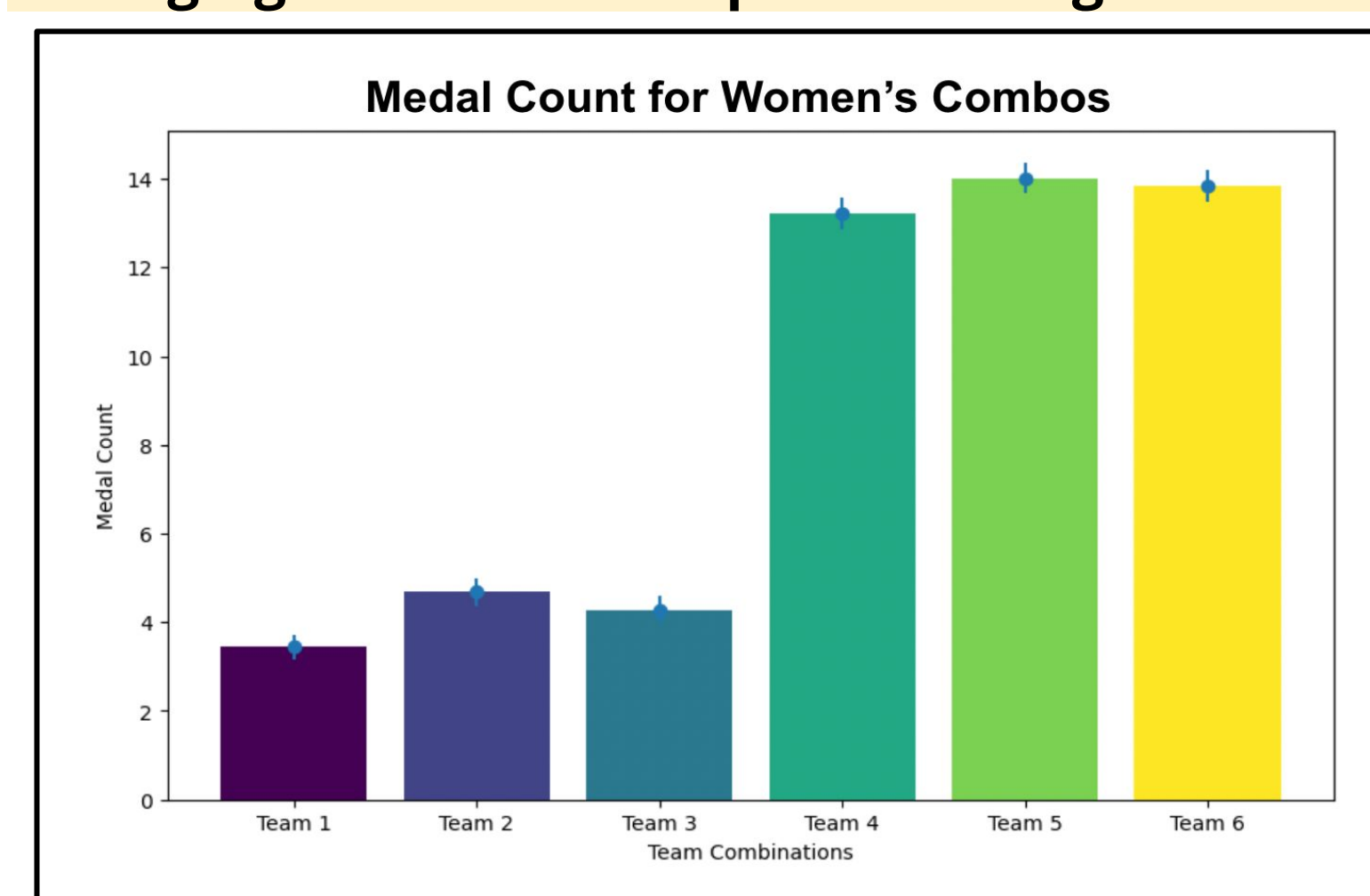


### Top 2 Teams

Curran Phillips, Brody Malone, Paul Juda, Frederick Richard

Curran Phillips, Brody Malone, Paul Juda, Asher Hong

Team 5 resulted in the highest expected medal count, averaging ~13.8 out of 28 possible weighted medals.

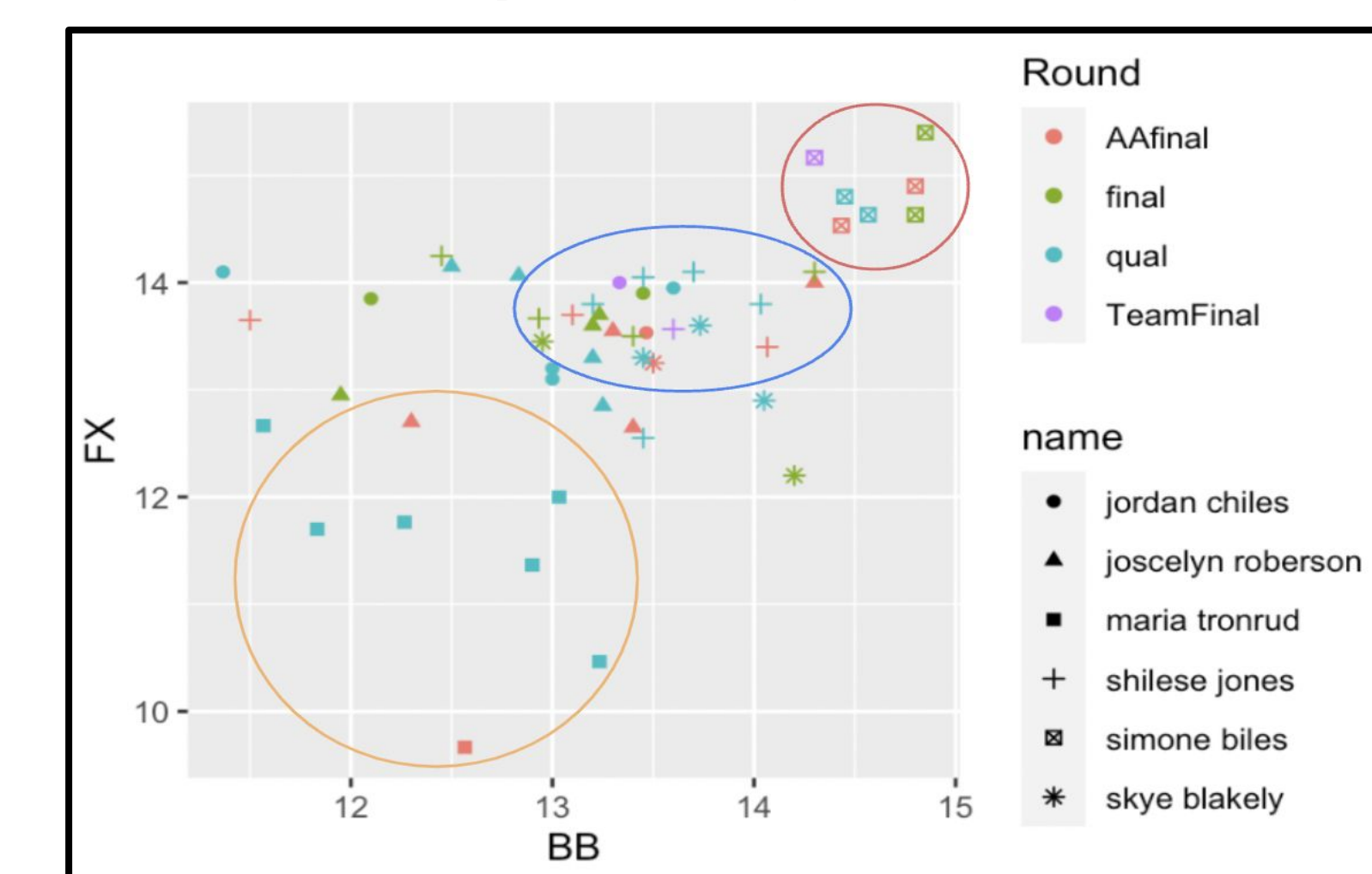


### Top 2 Teams

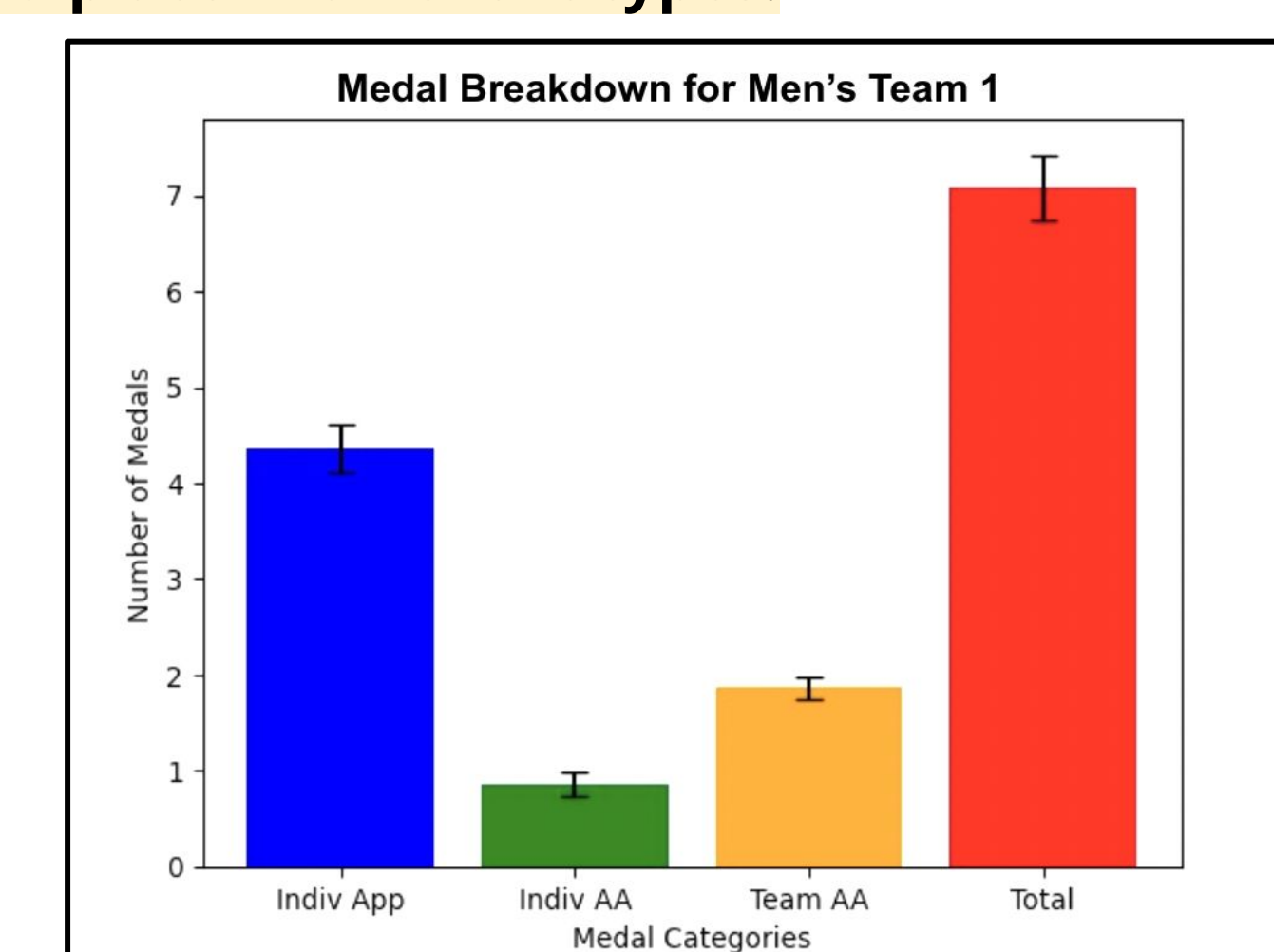
Simone Biles, Shilese Jones, Jade Crey, Konnor McClain

Simone Biles, Shilese Jones, Skye Blakely, Jordan Chiles

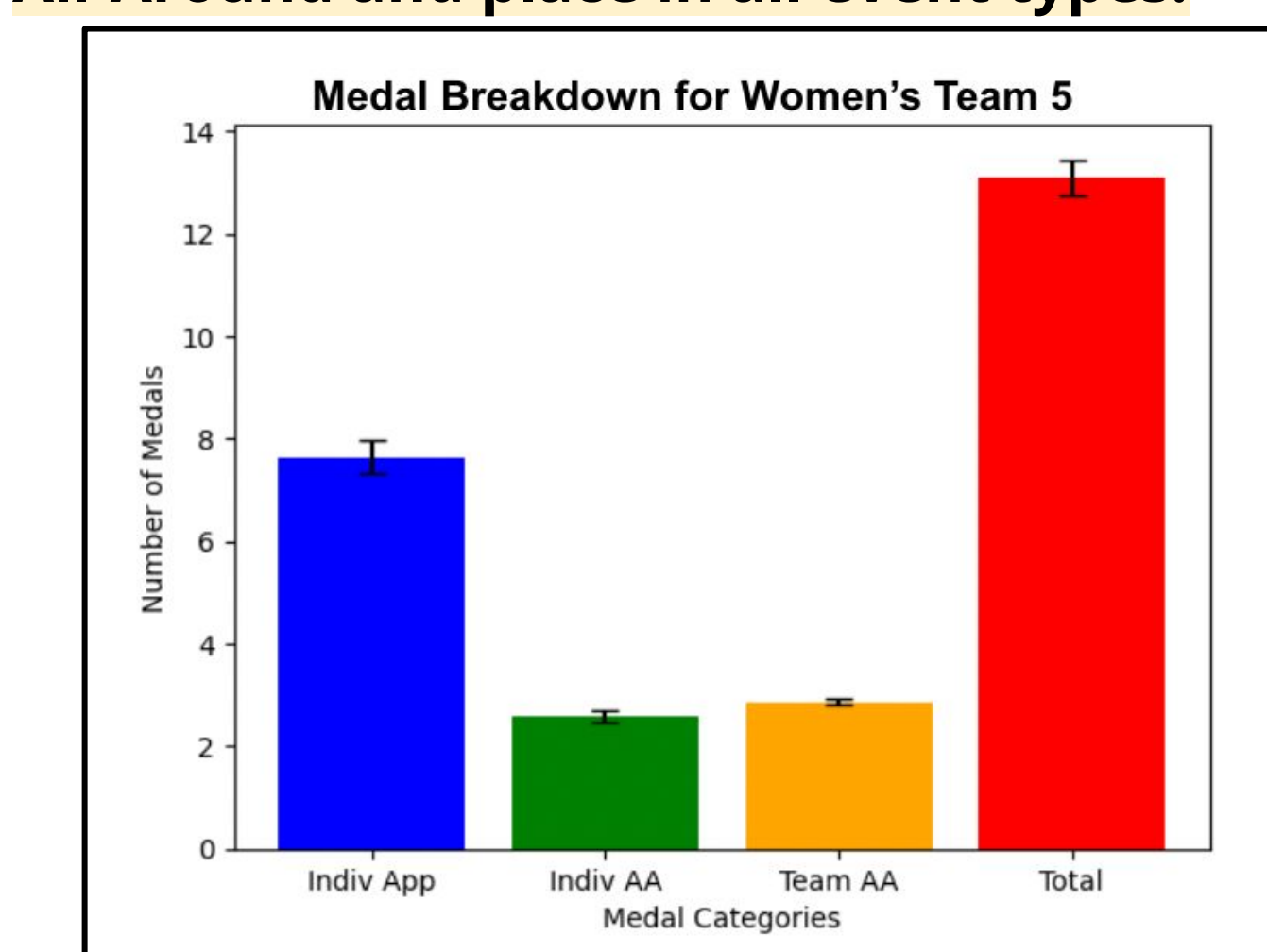
Positive correlation explained by individual athlete clusters.



The men's team is expected win win Silver for All-Around and place in all event types.



The women's team is expected to win Gold in Team All-Around and place in all event types.



## Discussion

- Optimal women's team: Simone Biles, Shilese Jones, Jade Carey, Konnor Macclain, and 1 alternative
- Optimal men's team: Curran Phillips, Brody Malone, Paul Juda, Frederick Richard
- Future works: linear mixed effects model and weighted medal counts

## References

- "2022-2024 Code of Points World Artistic Gymnastics." Federation Internationale De Gymnastique, FIG Executive Committee, [www.gymnastics.sport/publicdir/rules/files/en\\_2022-2024%20RG%20Code%20of%20Points.pdf](http://www.gymnastics.sport/publicdir/rules/files/en_2022-2024%20RG%20Code%20of%20Points.pdf). Accessed 6 Dec. 2023.
- UCSAS 2024 : UCSAS 2024 USOPC Data Challenge, [stats.org/events/ucsas2024/challenge.html](https://stats.org/events/ucsas2024/challenge.html)
- UCSAS. *GitHub*, [github.com/ucsas/gym2024data/tree/main](https://github.com/ucsas/gym2024data/tree/main)