Fastball Velocity and Elbow Varus Torque in Professional Baseball Pitchers

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Ball Velocity

- Correlate to performance?
- Increase joint stress, injury risk?
Ball Velocity $\rightarrow$ Performance

Qualified pitchers in Major League Baseball (2015-2017)  
Slowik JS, et al. *J Athl Tr* 2019
Ball Velocity ➔ Performance

Qualified pitchers in Major League Baseball (2015-2017)  
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Ball Velocity → Injury

![Graph showing the relationship between median fastball velocity in MLB, innings 1-3, and the number of Tommy John surgeries in professional baseball from 2008 to 2018.](image-url)
Fastball Velocity and Elbow Varus Torque


452 professional baseball pitchers

Biomechanics Database
Fastball Velocity and Elbow Varus Torque


**Biomechanics Database**
- Healthy for past 12 months
- At least 5 mph range in fastballs during testing

452 professional baseball pitchers

64
Fastball Velocity and Elbow Varus Torque

- Ball velocity from radar gun
- Elbow varus torque
  - 240 Hz Motion Analysis system
  - ASMI BioPitch software
Fastball Velocity and Elbow Varus Torque

- Ball velocity from radar gun
- Elbow varus torque
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- Statistics
  - Within subject
    - Mixed linear model with random intercepts
  - Across subjects
    - Mean velocity and mean torque for each pitcher
    - Simple linear regression
Within subject

\[ p<0.01, R^2=0.96 \]
Across subjects

\[ p = 0.03, \ R^2 = 0.08 \]
Conclusions

• Within a pitcher, the faster fastballs are more stressful ($R^2=0.96$)

• While faster pitchers apply more elbow torque in general, there is great variability from pitcher-to-pitcher ($R^2=0.08$)

• In order to minimize cumulative elbow stress (and injury risk?):
  • Optimize mechanics
  • Vary intensity and velocity during game
    (Note: varying velocity used effectively by many Hall of Fame pitchers)