

Injury Exploration

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Introduction

- Lower body soft tissue injuries (STI) make up approximately 60% of all injuries across sports.
- Lower body STIs involve damage to the muscles, ligaments, and tendons from the midsection down.
- Looked for relationships between injuries and force plate characteristics
- Double-leg countermovement jump testing using force plates is widely available, relatively inexpensive, easy to test, and collects a variety of movement characteristics.

Research Questions



**WHICH FORCE PLATE
COUNTERMOVEMENT JUMP
CHARACTERISTICS ARE
RELATED TO LOWER BODY STI?**



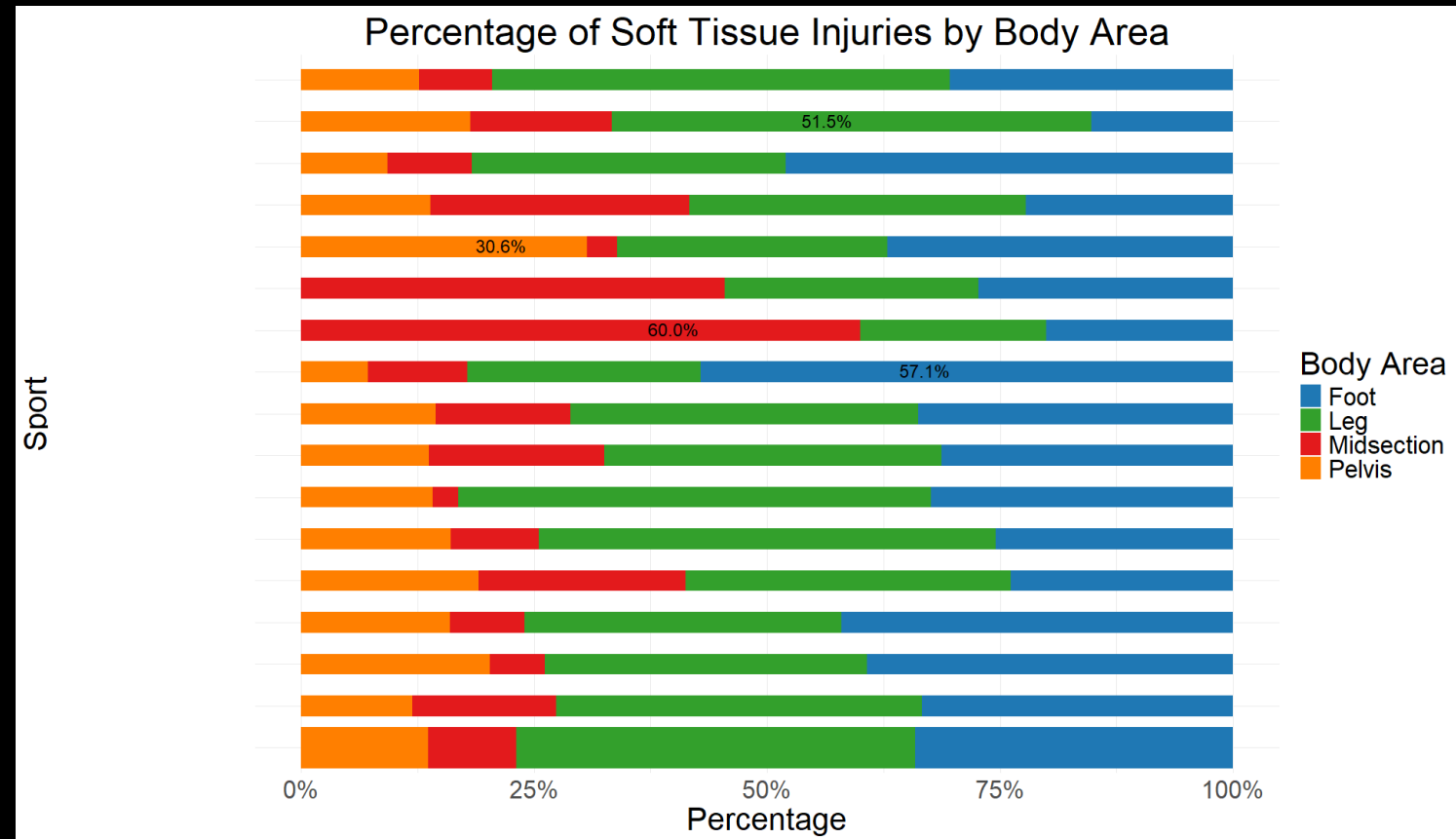
**CAN INJURIES BE ANTICIPATED
USING FORCE PLATE DATA?**



**WILL THESE INSIGHTS AID IN INJURY
PREVENTION?**

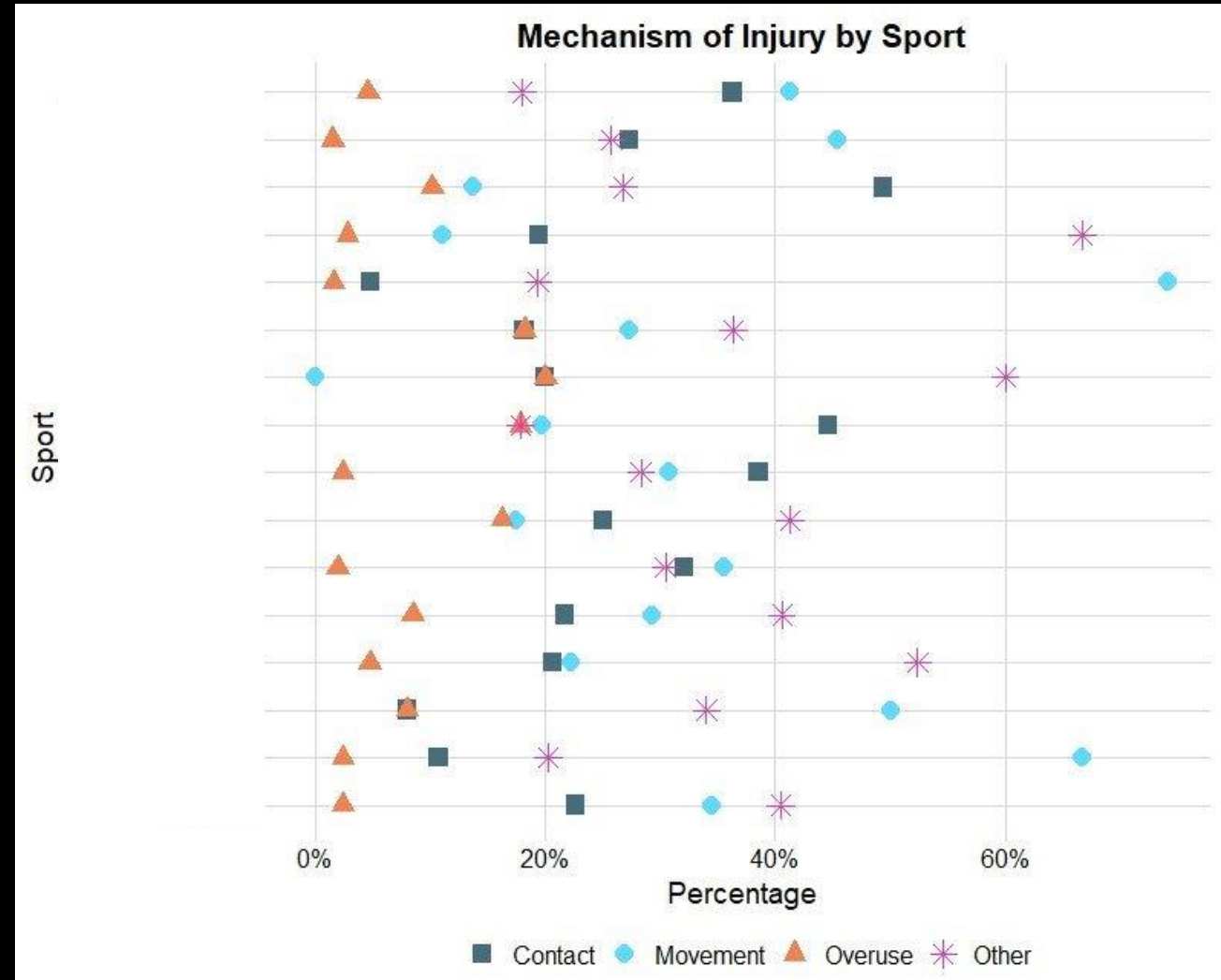
Exploratory Analysis

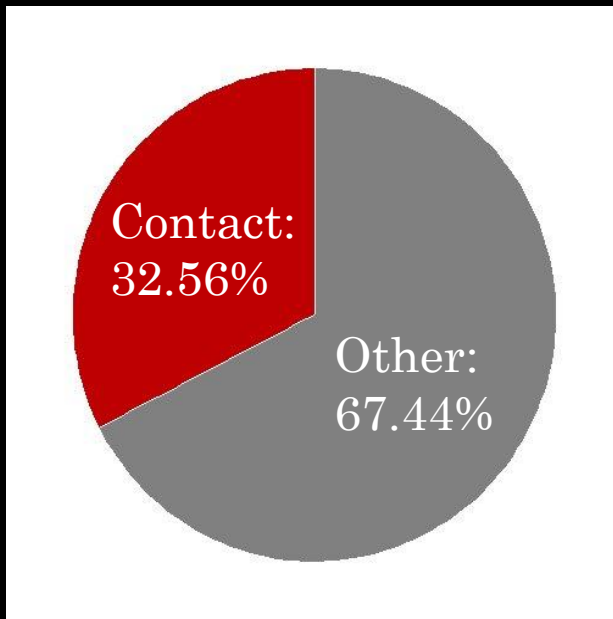
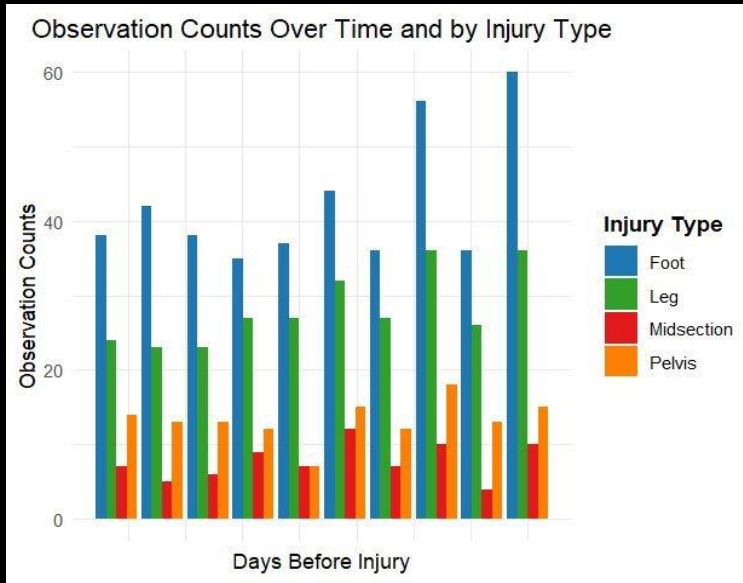
- Demands for each sport.
 - Grouped sports with similar demands for analysis.
- Distribution of Injuries
- Correlation & linear relationship analysis.
- Looked for relationships between force plate metrics and injury.
 - Conducted by Sport, Injury Type, and Side of Body.



Exploratory Analysis

- Analysis on the Mechanism of Injuries
- **Movement:** Jump, Run, Acceleration
- **Contact:** With Ground, Tackled, Fall, Landing
- **Overuse:** Overload, Repetitive Use
- **Other:** Unknown, Misc., Other
- Large number of Contact & Other Injuries throughout sports





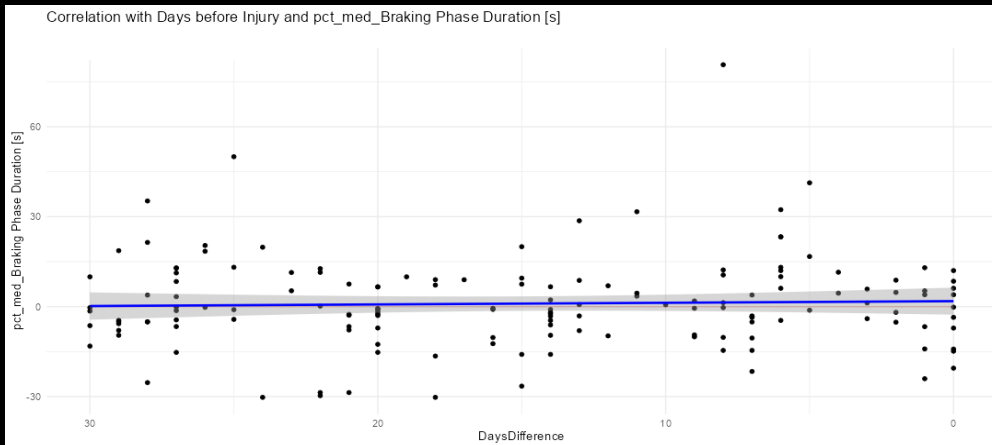
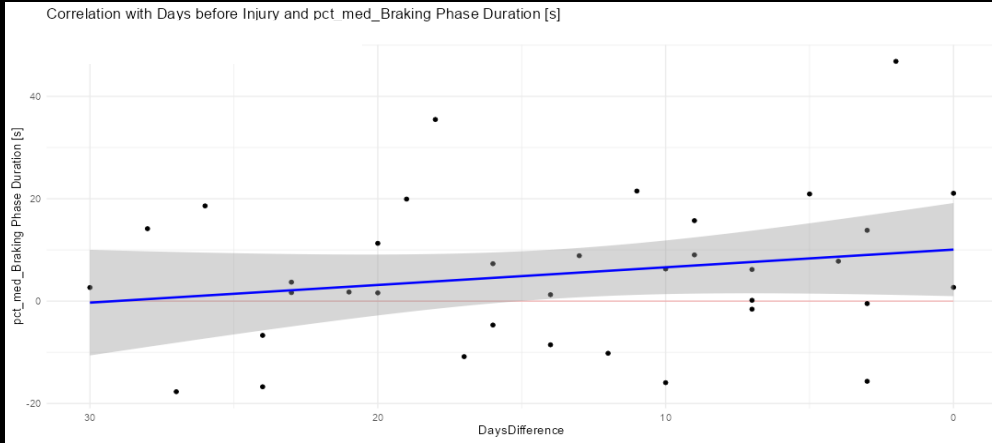
Limitations

- The number of observations of injuries and force plate tests were low for some sports.
- Contact STIs represented approximately one-third of all observed injuries.
 - The randomness of contact injuries introduces excess variability.
- Variations in injury reporting.
- Not controlling for landings on jumps restricted the use of other potentially relevant metrics for predicting injuries.

Methods

- All force plate data was collected using double-leg countermovement jumps
- Injury timeframes were specified as a 6-month period leading up to injury.
- Sports were grouped by similar demands for analysis.
 - Two Similar Field Sports; Two Similar Court Sports.
 - These relationships were compared using data from force plate jumps collected in the month preceding an injury event to the average jump results from the previous five months.
- A Cox-PH model was run on the Court Sport injuries.
 - Baseline values for athletes were the first 3 months of the injury timeframe.
 - Jump height and flight time test results from the 3 months prior to injury were compared to baseline values.

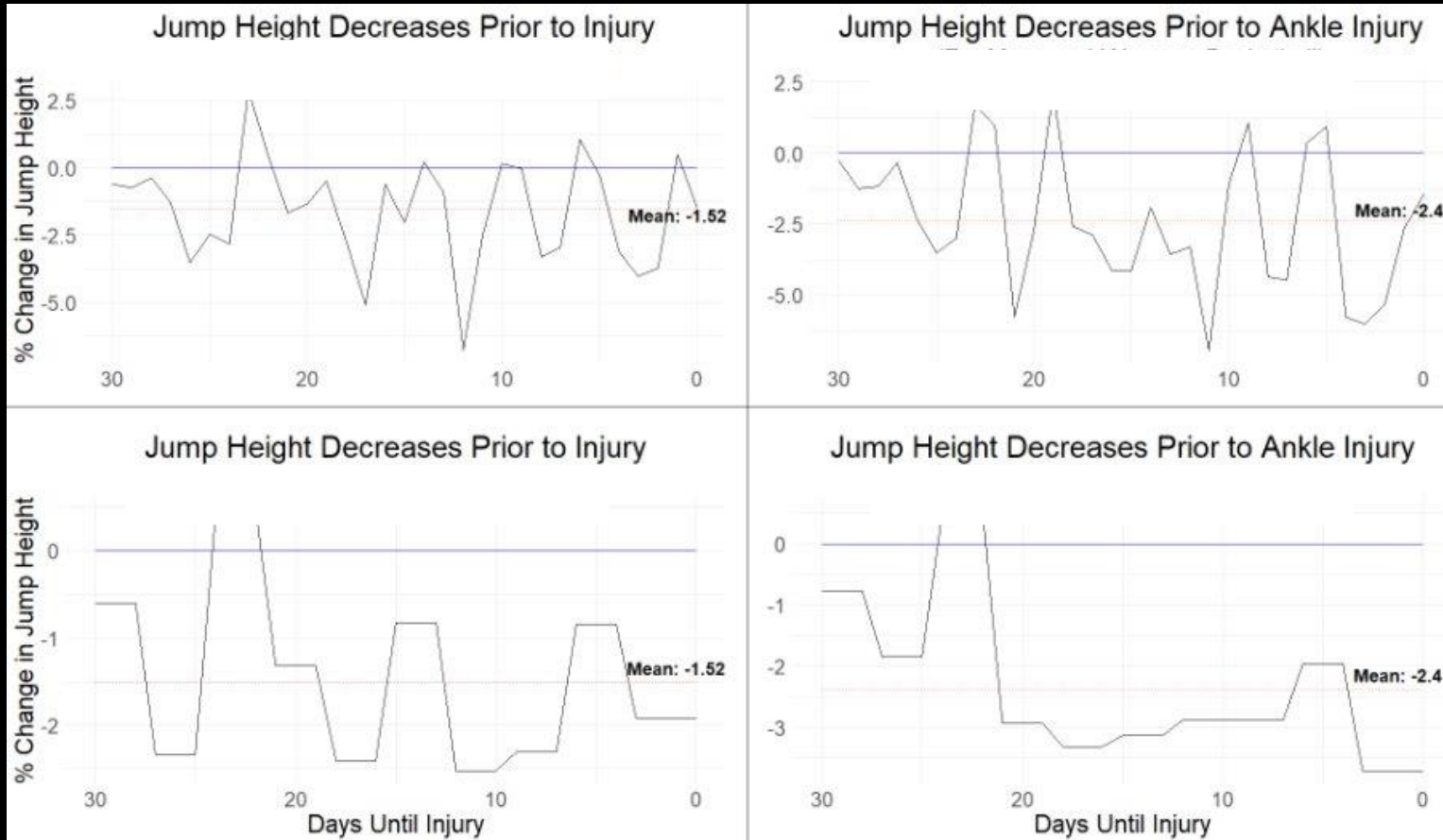
Results



- Small relationships somewhat existed for Single-Team analysis.
 - Relationships were weak and inconsistent.
- These small relationships disappeared when analyzing between teams with similar sport-specific demands.
- Correlation and linear relationship analysis returned near-zero results for most sports and injuries.
 - Any statistically significant relationships were further investigated by grouping similar sports but still yielded no results.
- Asymmetry analysis returned similar results.
 - Conducted using asymmetry force plate metrics.

Results

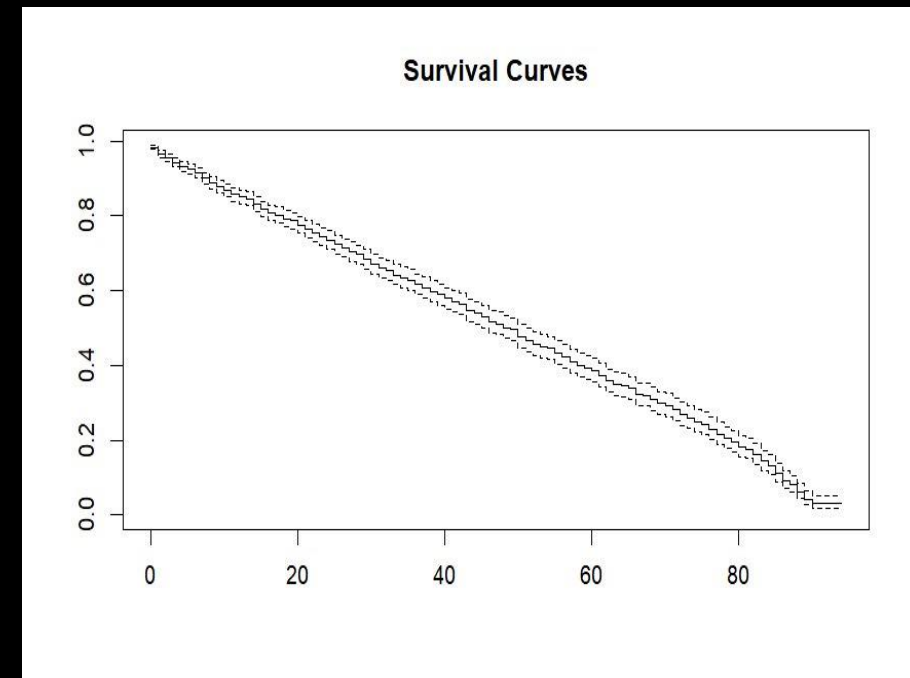
- Most significant relationship found.
- Statistically Significant but not large deviations.
 - 1%-2% changes
- Not enough of a change to be extremely relevant.



Results

- The cox-ph model was designed to predict the "survival time" that passes until an event occurs.
- Modeled the effects of jump height and flight time on Court Sport Injuries.
- Model did not provide significant results
 - All statistical checks within the model provided insignificant values
 - Coefficients for flight time and jump height trended in opposing directions

Cox Proportional-Hazards Model



Literature Support

- One paper found no significant association between the preliminary force plate test and the likelihood of experiencing either an MSKI or a lower body MSKI. ^[2]
- Another research paper found that that only 8% of countermovement jump studies observed an association with injury risk. ^[1]
 - 79% of studies using drop jump were able to observe a relationship, implying that the landing element of jump testing is superior in identifying risk of injury.

[1] Pedley, J. S. (2020) Utility of kinetic and kinematic jumping and landing variables as predictors of injury risk: A Systematic review. Journal of Science in Sport and Exercise

[2] Hando, B. R. (2022) The use of force plate vertical jump scans to identify special warfare trainees at risk for musculoskeletal injury: a large cohort study. The American Journal of Sports Medicine

Looking Forward

- Analyzing contact injuries separately.
 - Would help remove some variation and provide more concrete results.
- Incorporating other data sources from different technologies (wearable IMUs).
 - Allows for comparisons with variables such as training load or decelerations.
 - Previous research found players were 50-80% likely to sustain a preseason injury when training consisted of long and frequent, high-intensity workouts. [3]
 - Another study found that athletes with a lower intermittent aerobic fitness compared to the average were more likely to be injured. [4]
- Controlling for landings in countermovement jumps or analyzing drop jumps.
 - Could potentially help determine relationships using different characteristics.
- Is it still possible to predict injuries using other methods of analysis and testing characteristics?

[3] Gabbett, T. J. (2010) The development and application of an injury prediction model for noncontact, Soft-Tissue injuries in elite collision sport athletes. The Journal of Strength and Conditioning Research

[4] Fort-Vanmeerhaeghe, A., (2020) Higher Vertical Jumping Asymmetries and Lower Physical Performance are Indicators of Increases Injury Incidence in Youth Team-Sport-Athletes. The Journal of Strength and Conditioning Research

Conclusions

- Statistical models did not substantiate significant relationships between force plate characteristics and lower body STIs.
- Countermovement jump characteristics are not a direct indicator of injury.
- Related literature supports the conclusion against a direct relationship between countermovement jump characteristics and lower body STIs.
- Added analysis with differing data sources and analyzing different relationships could help

Questions

