

Hartford HealthCare  
Sports Medicine



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# Baseline Assessments Of High School Athletes Registry: NFHS Presentation

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# Background

- United States: 250,000 ACL injuries yearly
  - Athletes ages 15- 25
  - Approximately 1 in 60 adolescent athletes
  - 94% undergo ACL reconstruction
  - Loss in playing time: 9-12 months
  - Cost of diagnosis and treatment: \$38,121 to \$88,538 per injury
- Long term complications
  - Negative psychological affects on athletes
  - Up to 29% will have a secondary ACL injury
  - Meniscal tears
  - Up to 45% will develop osteoarthritis within 10 years

# What can we do?

## Before Injuries Occur


- Preventative programs exist
- **Need a deeper understanding of what factors to target**
- **Need to be able to test these factors in the field**
- Need more research on effectiveness of programming

## After Injuries Occur

- More research on return to play protocols and guidelines
- **Determine metrics that are easy to complete in the field to guide return to sport guidelines**

# Return to Play Testing Protocol

- Current return to play is guided by
  - MD recommendation &
  - ACL Battery testing performed by PTs and/or ATCs
- Testing includes:
  - Functional Movement Screen
  - Hop Test Series
    - 6-m Single limb hop test
    - Single limb triple hop test
    - Single limb cross over hop test
  - Landing Error Scoring System (LESS)
  - Strength testing
  - 3D motion analysis of dynamic movement

A red bracket on the right side of the slide groups the 'Hop Test Series' and 'Landing Error Scoring System (LESS)' items from the testing protocol list.

Can be completed in the field with minimal cost

## Research Proposal Goals

- Create a database of baseline and recurring testing of athlete biomechanics on the aforementioned tests
- Understand what a healthy adolescent athlete looks like considering factors like: age, gender, sport etc
- Determine if any of the identified tests can predict injury for an athlete
- Compare right side to left side performance and determine any asymmetries that can lead to an injury
- Implement programming individualized to prevent injury

# Methods

- Subjects: at least 300 high school athletes ages 13-18
  - Currently 234 enrolled
- Must play for the high school sports teams in which our sports medicine team services
  - Includes varsity, junior varsity and freshman teams
- Must be free of injury at the time of enrollment
- Completed:
  - Demographic/Injury History form
  - FMS
  - Hop series
  - LESS Test

## Demographics collected

- Name, DOB, Grade in School
- Medical history
  - Updated each time a new test will occur
- Race, gender, ethnicity
- Sports participating and # seasons participate
  - In school and out of school participation
- Dance/no Dance
  - If yes, frequency and type
- Position(s) played for sport

## Tests Completed

- FMS (scored out of 21)
- LESS (Scored out of 19)
- Hop Series
  - Single Hop
  - Triple Hop
  - Crossover Hop
  - 6 meter timed Hop
- For each hop series test a limb symmetry index was calculated

$$\frac{Distance_{Max}}{Distance_{Min}} * 100\%$$

- Single, triple and crossover hop was also normalized to height for analysis



# Statistics

- Shapiro-Wilk Test for Normality
  - Everything was non-normally distributed
- Kruskal-Wallis test to look at
  - Age
  - Gender
  - Single sport vs multisport
  - Primary sport
  - Race
  - Ethnicity

## Variables Analyzed

- Single hop limb symmetry
- Triple hop limb symmetry
- Crossover hop limb symmetry
- 6m hop time limb symmetry
- FMS Score
- LESS Score
- LESS Risk
- Overall Risk
- Single hop distance (normalized to body height)
- Triple hop distance (normalized to body height)
- Crossover hop distance (normalized to body height)
- 6m hop time

## Results: Demographics

222 Eligible entries

	<b>Male (n=129)</b>	<b>Female (n=93)</b>
Age (years old)	15.84±1.14	15.92±1.18
Height (inches)	68.58±6.67	64.34±3.00
Weight (lbs)	164.83±37.18	130.08±19.59

## Results: Gender

Test	Male (n=129)	Female (n=93)	P-value
Single Hop LSI	94.7±4.5	92.7±6.1	0.017
Single Hop Risk	0.64±0.73	0.90±0.82	0.042
Overall Risk	1.03±0.62	0.86±0.58	0.045
Single Hop Norm.	0.95±0.39	0.79±0.13	<0.001
Triple Hop Norm.	3.00±1.04	2.46±0.39	<0.001
Cross Hop Norm.	2.70±1.03	2.15±0.40	<0.001
6m Hop Time	2.04±0.43	2.32±0.42	<0.001

## Results: Youngest 25% and Oldest 25%

Test	Young (n=55)	Old (n=55)	P-value
FMS	14.3±2.6	15.7±2.1	0.002
LESS	6.9±2.7	5.5±2.8	0.026
LESS Risk	0.75±0.65	0.40±0.50	0.007
Overall Risk	1.20±0.57	0.67±0.50	<0.001

## Results: Single vs Multisport

Test	Single Sport (n=73)	Multi Sport (n=118)	P-value
LESS Risk	0.61±0.49	0.48±0.60	0.045
Single Hop Norm.	0.89±0.51	0.90±0.17	0.015
Triple Hop Norm.	2.72±1.35	2.84±0.52	0.008
Cross Hop Norm.	2.42±1.27	2.53±0.58	0.010

## Female Sports

- 6m LSI
  - Lacrosse  $88.23 \pm 4.66$       Soccer  $94.69 \pm 3.84$       p-value 0.031
- Single Hop Norm.
  - Volleyball  $0.60 \pm 0.06$       Soccer  $0.85 \pm 0.13$       p-value 0.049
- 6m Hop Time
  - Field Hockey  $1.84 \pm 0.15$       Softball  $2.51 \pm 0.20$       p-value 0.022
- Primary limitation: sample size of some sport teams

## Male Sports

- Single Hop Norm
  - Football  $0.89 \pm 0.19$       Soccer  $1.06 \pm 0.14$       p-value 0.011
- 6 meter hop time
  - Baseball  $1.60 \pm 0.19$       Football  $2.15 \pm .50$       p-value 0.003
- Primary limitation: sample size of some sport teams



## Results: Race

- Initially, overall risk score was significant
  - Once we account for completing multiple comparisons, nothing was significant
- No significant differences

## Results: Ethnicity

- No significant differences for any variable of interest

## Future Direction

- Resume enrollment at local high schools as Covid-19 precautions allow
- Continue testing enrolled participants through graduation
- Investigate the potential impact of
  - Previous injury history
  - Injuries that occurred during data collection
  - Sport type

# Plans for Dissemination

## **Complete:**

- Kristen Renner, Stefanie Bourassa. 2020. Baseline Assessment High School Athlete: Normative Functional Movement Values. American College of Sports Medicine. Digital meeting due to Covid-19.

## **Future Goals:**

- Submit to ACSM again next year investigating some of our Future Directions questions
- Peer reviewed manuscript of Normative results
- Peer reviewed manuscript of our participants who were injured while in the study



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