FMS and its role in predicting injury

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Jason Tee
twitter: @JasonCTee
Email: jasonctee@gmail.com
The Functional Movement Screen
Functional Movement Screen

Tests balance, strength and range of motion simultaneously; providing a holistic, integrative assessment of the players’ quality of movement.
FMS was not designed as an injury predictor

Implements training prescription

FMS assesses quality of movement in discreet movement patterns with particular regard to mobility and stability – Mike Boyle, StrengthCoach.com

Assists trainers in determining to what level particular movement patterns can be trained.

Principle: Don’t add strength to dysfunction
Growing scientific interest

"Functional Movement Screen" publications on Pubmed per year

- 2006: 1
- 2007: 2
- 2008: 3
- 2009: 1
- 2010: 2
- 2011: 3
- 2012: 3
- 2013: 16
- 2014: 40
- 2015: 41
- 2016: 4
What’s the appeal?


**Results.** A score of 14 or less on the FMS™ was positive to predict serious injury with specificity of 0.91 and sensitivity of 0.54. The odds ratio was 11.67, positive likelihood ratio was 5.92, and negative likelihood ratio was 0.51.

**Discussion and Conclusion.** The results of this study suggest fundamental movement (as measured by the FMS™) is an identifiable risk factor for injury in professional football players. The findings of this study suggest professional football
Alternative to traditional screenings
How much information can you use?

• Traditional screenings may provide more problems than solutions.
• The more you measure, the more there is to be corrected – challenges resources.
• Traditional screenings do not quantify risk
FMS is popular because -

- Reliable
- No fancy equipment
- Qualification
- Quick test (≈ 10 mins)
- Stratifies athletes into high and low risk groups
## BUT… Does it do what it says?

<table>
<thead>
<tr>
<th>Authors</th>
<th>Population</th>
<th>FMS cut-off</th>
<th>Predictor</th>
<th>Relative Risk (95CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiesel et al., (2007)</td>
<td>American Football Players</td>
<td>14</td>
<td>✓</td>
<td><strong>4.2</strong> (1.8 to 9.7)</td>
</tr>
<tr>
<td>Kiesel et al., (2014)</td>
<td>American Football Players</td>
<td>14</td>
<td>✓</td>
<td><strong>1.9</strong> (1.2 to 3.0)</td>
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<tr>
<td>Chorba et al., (2010)</td>
<td>Female College Athletes (multisport)</td>
<td>14</td>
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<td><strong>1.9</strong> (1.0 to 3.6)</td>
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<tr>
<td>O'Connor et al., (2011)</td>
<td>Military</td>
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<td>✓</td>
<td><strong>1.7</strong> (1.1 to 2.6)</td>
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<tr>
<td>Letafatkar et al., (2014)</td>
<td>Active students</td>
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<td>✓</td>
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<td>Garrison et al., (2015)</td>
<td>College Athletes (multisport)</td>
<td>14</td>
<td>✓</td>
<td><strong>2.2</strong></td>
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<tr>
<td>Tee et al., (In press)</td>
<td>Rugby Union</td>
<td>13</td>
<td>✓</td>
<td><strong>3.0</strong> (1.6 to 5.9)</td>
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<tr>
<td>Butler et al., (2015)</td>
<td>Firefighters</td>
<td>14</td>
<td>✓</td>
<td>Not available</td>
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</table>
**BUT… Does it do what it says?**

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<th>Risk Ratio (95CI)</th>
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<tr>
<td>Hoover et al., (2008)</td>
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<tr>
<td>Hotta et al., (2015)</td>
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<td>Warren et al., (2015)</td>
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<td>&lt; 1.0</td>
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<td>Kodesh et al., (2015)</td>
<td>Female Military</td>
<td>14</td>
<td>✗</td>
<td>Not available</td>
</tr>
</tbody>
</table>

The ability of FMS total to predict injury is supported by moderate scientific evidence

Most FMS studies suffer from poor design.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Prospective?</th>
<th>Blinding of Participants</th>
<th>Blinding of Data Collectors</th>
<th>Blinding of Outcome Assessors</th>
<th>ROC Analysis Conducted?</th>
<th>AUC Reported</th>
<th>Threats to Validity</th>
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<tbody>
<tr>
<td>Kiesel et al.</td>
<td>No</td>
<td>Unreported</td>
<td>Unreported</td>
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<td>Yes</td>
<td>No</td>
<td>2/7</td>
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<td>Yes</td>
<td>No</td>
<td>3/7</td>
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<tr>
<td>Chorba et al.</td>
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<td>Yes</td>
<td>Limited</td>
<td>No</td>
<td>5/7</td>
</tr>
</tbody>
</table>

AUC, area under the curve; ROC, receiver operator characteristic.

*Used other statistical methodology to determine cut score.

Factor structure

Sum score is not a unidimensional construct, treat as 7 independent tests. 
*Kazman et al, (2014) JSCR 28:3*

Adding non-significant data to significant data will diminish predictive power.

*Hotta et al., 2015, JSCR 29:10*
Using FMS across different populations

Different sports have different injury profiles.

Component tests that predict injury in one group of athletes may be irrelevant in another group.
Injury definitions

Severity
- Medical report
- Time loss
- Duration

Mechanism
- Contact vs. non-contact

Deep squat, in-line lunge and active straight leg raise predict contact injury in rugby union players
Tee et al., (in review)
How does FMS predict contact injuries?

Model: Disadvantageous tackle positions

Poor tackle technique = ↑ Risk of injury (Burger et al., 2015)

Dysfunctional movement patterns (low-FMS) may make it more difficult for players to get into the “ideal” tackle position

@JasonCTee #FitCon2016
How does FMS predict contact injuries?

Dysfunctional movement pattern

Poor tackle technique
So use FMS?

These teams do…
Not just injuries

FMS has been linked to long term improvements in performance.

Subjects: 121 Elite T&F athletes

Methods: Longitudinal 2010 to 2011

Results: +0.41% performance improvement in Hi-FMS group
         +1.98% performance improvement in athletes who scored 3 for deep squat

Interpretation: High FMS scorers improve performance through improved ability to express force
               OR through less days missed due to injury
Improve program prescription

• Whole team analysis may reveal deficiencies in training program
• Design team program to correct trends
• e.g. – Whole team scores 2 on ASLR may indicate hamstring/hip flexor mobility insuffient
Take home messages

Scientific research has not conclusively validated the use of FMS to predict injury

This is possibly due to inadequate research design

FMS remains popular among elite S&C practitioners

Future research must focus on differentiating injury profiles in different sporting populations
Thanks for listening!

Jason C Tee
Email: jasonctee@gmail.com
Twitter: @JasonCCTee