Citation:
Tee, JC (2016) FMS and its role in predicting injury. In: Sports Science Institute of South Africa, 17 February 2016 - 19 February 2016, Johannesburg, South Africa.

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FMS and its role in predicting injury

SSISA Wellness and Fitness Convention 2016

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LIONS

UNIVERSITY OF JOHANNESBURG

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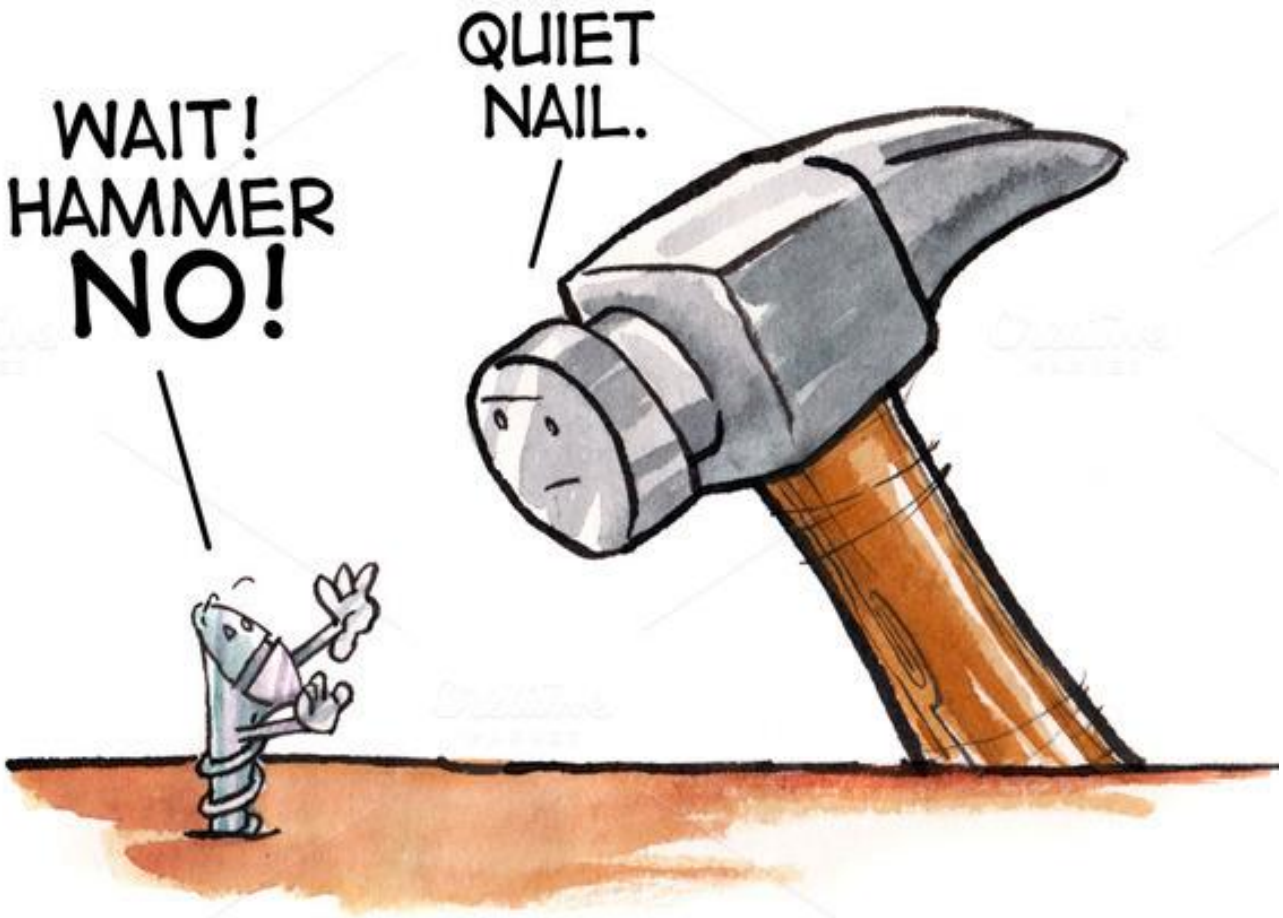
NRF

The Functional Movement Screen



Functional Movement Screen

– Cook et al., N Am J Sports Phys Ther 2006

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

Improves training prescription

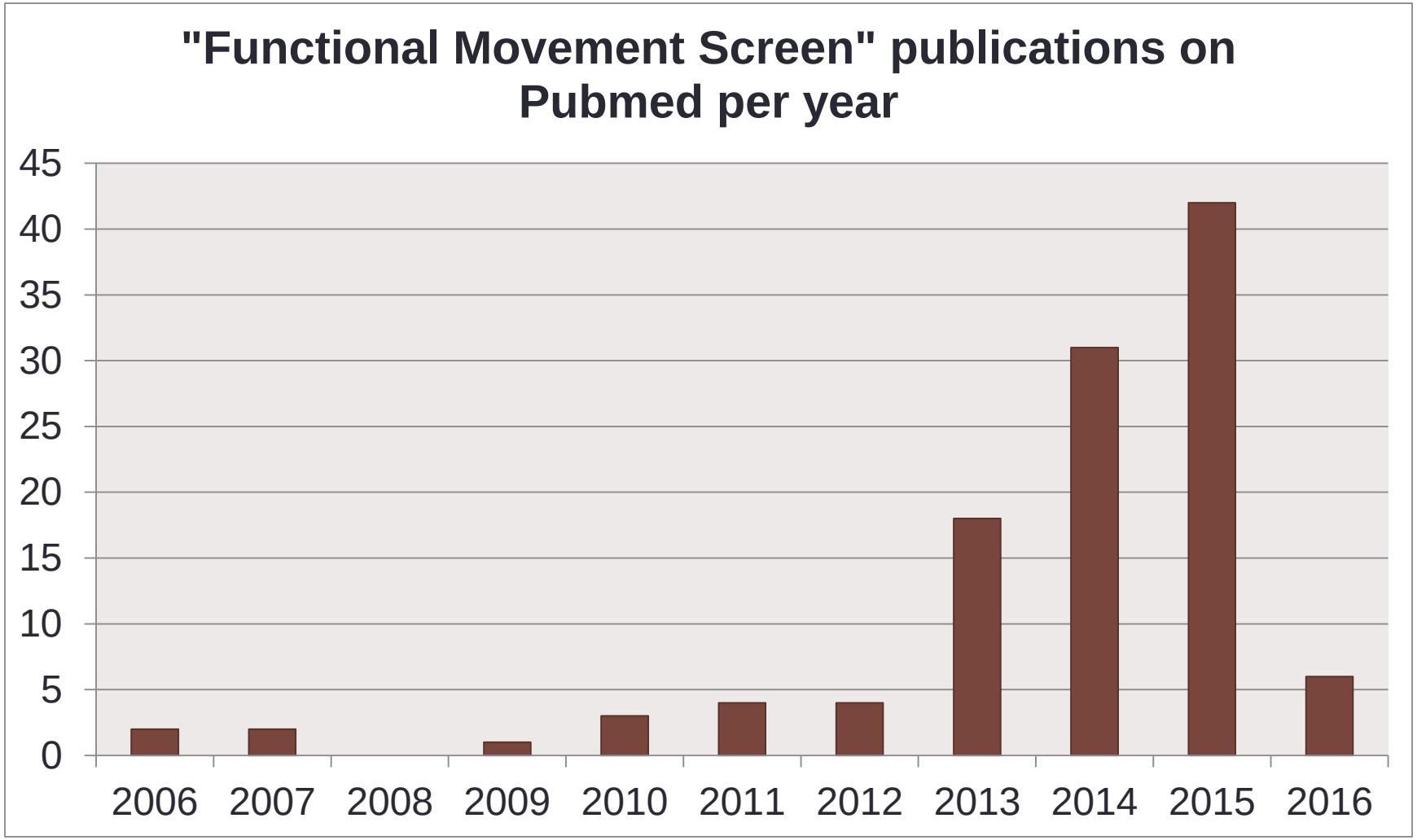
FMS assesses **quality of movement** in discreet movement patterns with particular regard to **mobility and stability** –

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



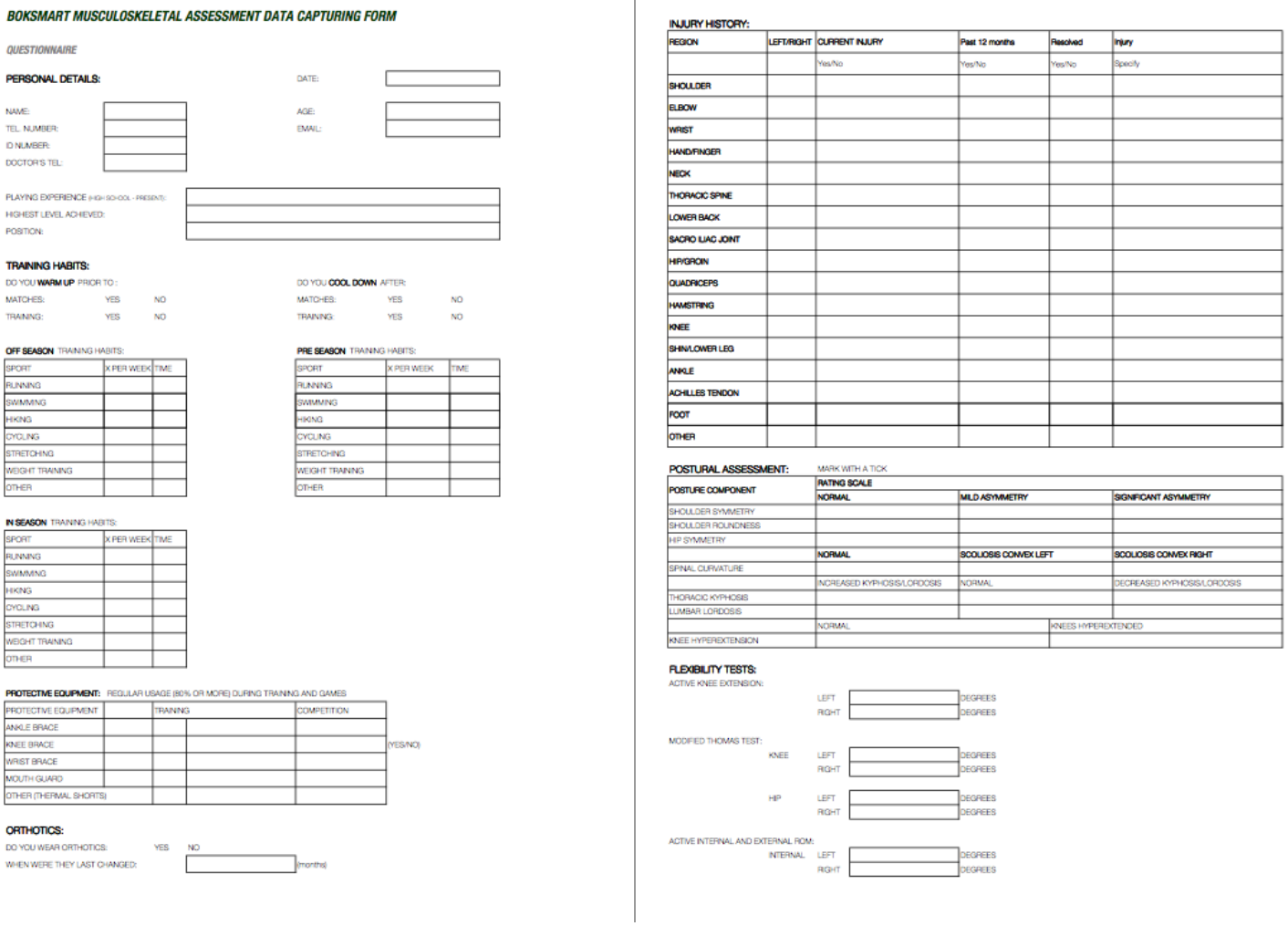
What's the appeal?

Kiesel et al., (2007) **Can Serious Injury in Professional Football be Predicted by a Preseason Functional Movement Screen?**
N Am J Sports Phys Ther **2**:3

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 Consclusion. 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



BOKSMART MUSCULOSKELETAL ASSESSMENT DATA CAPTURING FORM

QUESTIONNAIRE

PERSONAL DETAILS: DATE:

NAME: AGE:
TEL. NUMBER: EMAIL:
ID NUMBER:
DOCTOR'S TEL:

PLAYING EXPERIENCE (HIGH SCHOOL - PRESENT):
HIGHEST LEVEL ACHIEVED:
POSITION:

TRAINING HABITS:

DO YOU **WARM UP** PRIOR TO : DO YOU **COOL DOWN** AFTER:
MATCHES: YES NO MATCHES: YES NO
TRAINING: YES NO TRAINING: YES NO

OFF SEASON TRAINING HABITS:

SPORT	X PER WEEK	TIME
RUNNING		
SWIMMING		
HIKING		
CYCLING		
STRETCHING		
WEIGHT TRAINING		
OTHER		

PRE SEASON TRAINING HABITS:

SPORT	X PER WEEK	TIME
RUNNING		
SWIMMING		
HIKING		
CYCLING		
STRETCHING		
WEIGHT TRAINING		
OTHER		

IN SEASON TRAINING HABITS:

SPORT	X PER WEEK	TIME
RUNNING		
SWIMMING		
HIKING		
CYCLING		
STRETCHING		
WEIGHT TRAINING		
OTHER		

PROTECTIVE EQUIPMENT: REGULAR USAGE (80% OR MORE) DURING TRAINING AND GAMES

PROTECTIVE EQUIPMENT		TRAINING		COMPETITION	
ANKLE BRACE					(YES/NO)
KNEE BRACE					
WRIST BRACE					
MOUTH GUARD					
OTHER (THERMAL SHORTS)					

ORTHOTICS:

DO YOU WEAR ORTHOTICS: YES NO
WHEN WERE THEY LAST CHANGED: (months)

INJURY HISTORY:

REGION	LEFT/RIGHT	CURRENT INJURY	Past 12 months	Resolved	Injury
		Yes/No	Yes/No	Yes/No	Specify
SHOULDER					
ELBOW					
WRIST					
HAND/FINGER					
NECK					
THORACIC SPINE					
LOWER BACK					
SACRO ILIAC JOINT					
HIP/GROIN					
QUADRICEPS					
HAMSTRING					
KNEE					
SHIN/LOWER LEG					
ANKLE					
ACHILLES TENDON					
FOOT					
OTHER					

POSTURAL ASSESSMENT: MARK WITH A TICK

POSTURE COMPONENT	RATING SCALE		
	NORMAL	MILD ASYMMETRY	SIGNIFICANT ASYMMETRY
SHOULDER SYMMETRY			
SHOULDER ROUNDNESS			
HIP SYMMETRY			
	NORMAL	SCOLIOSIS CONVEX LEFT	SCOLIOSIS CONVEX RIGHT
SPINAL CURVATURE			
	INCREASED KYPHOSIS/LORDOSIS	NORMAL	DECREASED KYPHOSIS/LORDOSIS
THORACIC KYPHOSIS			
LUMBAR LORDOSIS			
	NORMAL	KNEES HYPEREXTENDED	
KNEE HYPEREXTENSION			

FLEXIBILITY TESTS:

ACTIVE KNEE EXTENSION:
LEFT DEGREES
RIGHT DEGREES

MODIFIED THOMAS TEST:
KNEE LEFT DEGREES
RIGHT DEGREES
HIP LEFT DEGREES
RIGHT DEGREES

ACTIVE INTERNAL AND EXTERNAL ROM:
INTERNAL LEFT DEGREES
RIGHT DEGREES

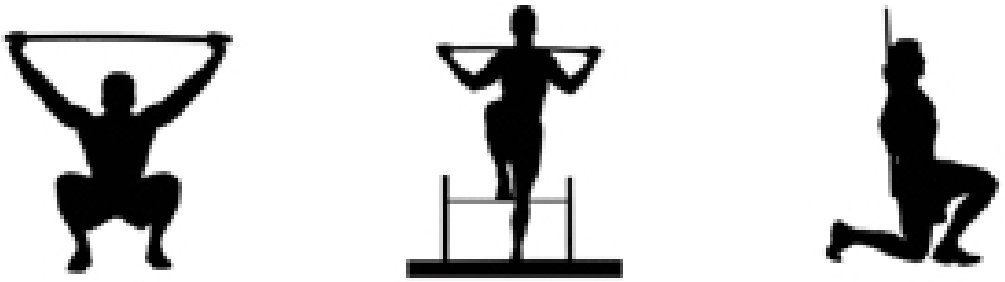
How much information can you use?

- 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

FMS™
Functional Movement Systems



BUT… Does it do what it says?

Authors	Population	FMS cut-off	Predictor	Relative Risk (95CI)
Kiesel et al., (2007)	American Football Players	14	✓	**4.2** (1.8 to 9.7)
Kiesel et al., (2014)	American Football Players	14	✓	**1.9** (1.2 to 3.0)
Chorba et al., (2010)	Female College Athletes (multisport)	14	✓	**1.9** (1.0 to 3.6)
O'Connor et al., (2011)	Military	14	✓	**1.7** (1.1 to 2.6)
Letafatkar et al., (2014)	Active students	17	✓	**1.3** (0.8 to 2.0)
Garrison et al., (2015)	College Athletes (multisport)	14	✓	**2.2**
Tee et al., (In press)	Rugby Union	13	✓	**3.0** (1.6 to 5.9)
Butler et al., (2015)	Firefighters	14	✓	Not available

BUT… Does it do what it says?

Authors	Population	FMS cut-off	Injury Predictor	Risk Ratio (95CI)
Hoover et al., (2008)	Recreational half-marathon runners	14	✗	Not available
Hotta et al., (2015)	Competitive runners	15	✗	0.8 (0.7 to 1.0)
Warren et al., (2015)	College Athletes (multisport)	-	✗	< 1.0
Kodesh et al., (2015)	Female Military	14	✗	Not available

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

Kraus et al., (2014) **Efficacy of the functional movement screen: a review.** JSCR 28:12

Most FMS studies suffer from poor design

Table 2. Study quality and threats to validity

Authors	Prospective?	Blinding of Participants	Blinding of Data Collectors	Blinding of Outcome Assessors	ROC Analysis Conducted?	AUC Reported	Threats to [illegible]	
Kiesel et al[15]	No	Unreported	Unreported	Unreported	Yes	[illegible]		
Kiesel et al[16]	Yes	Unreported	Unreported					
Chorba et al[3]	Yes							2/7
					[illegible]	No	Statistical reporting	3/7
				No	Yes	Yes	Limited	5/7
		Unreported	Unreported	Unreported	Yes	No	Statistical reporting	3/7

AUC, area under the curve; ROC, receiver operator characteristic.
[a]Used other statistical methodology to determine cut score.

Meta-analysis - the FMS provides a level of discriminatory accuracy only slightly above chance.

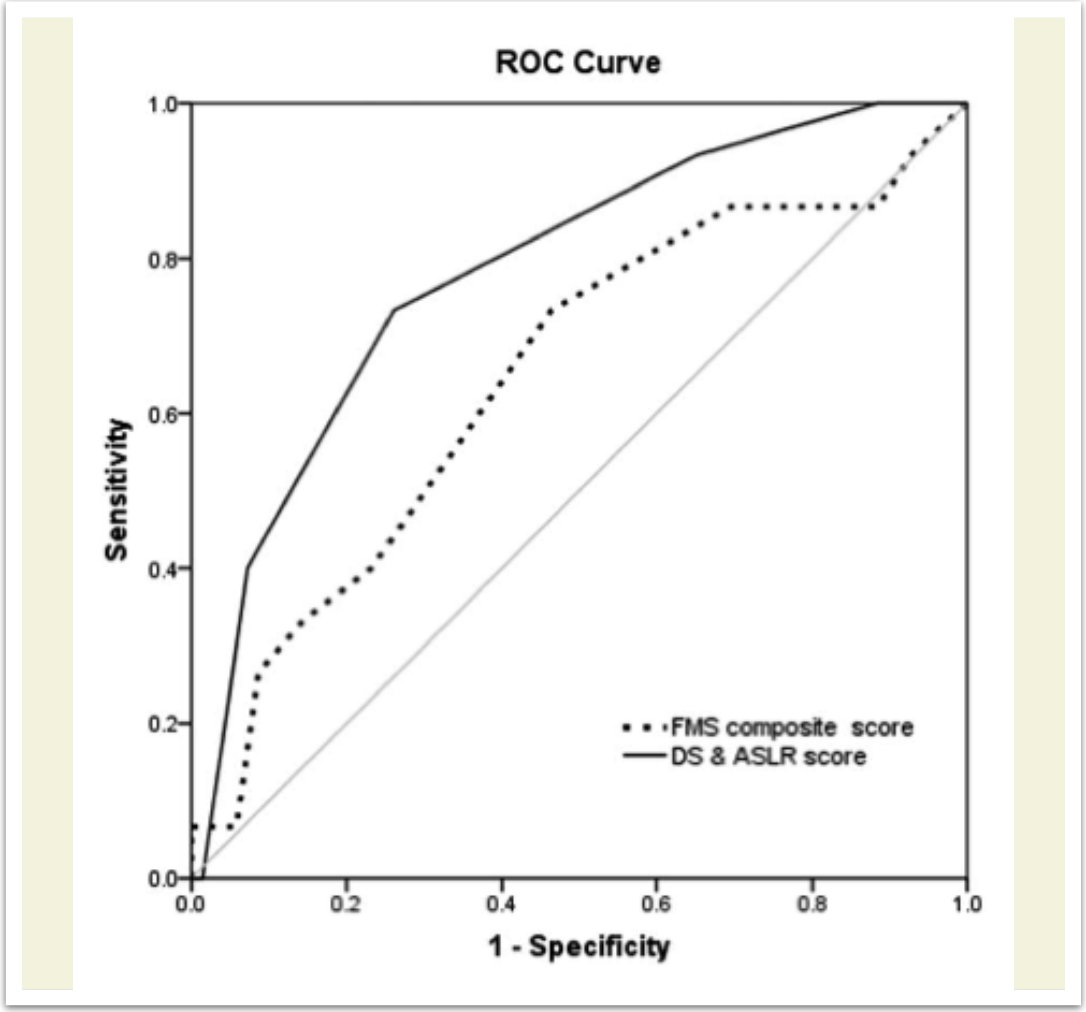
Dorrel et al., (2015) **Evaluation of the Functional Movement Screen as an Injury Prediction Tool Among Active Adult Populations: A Systematic Review and Meta-analysis.** Sports Health 7:6

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.

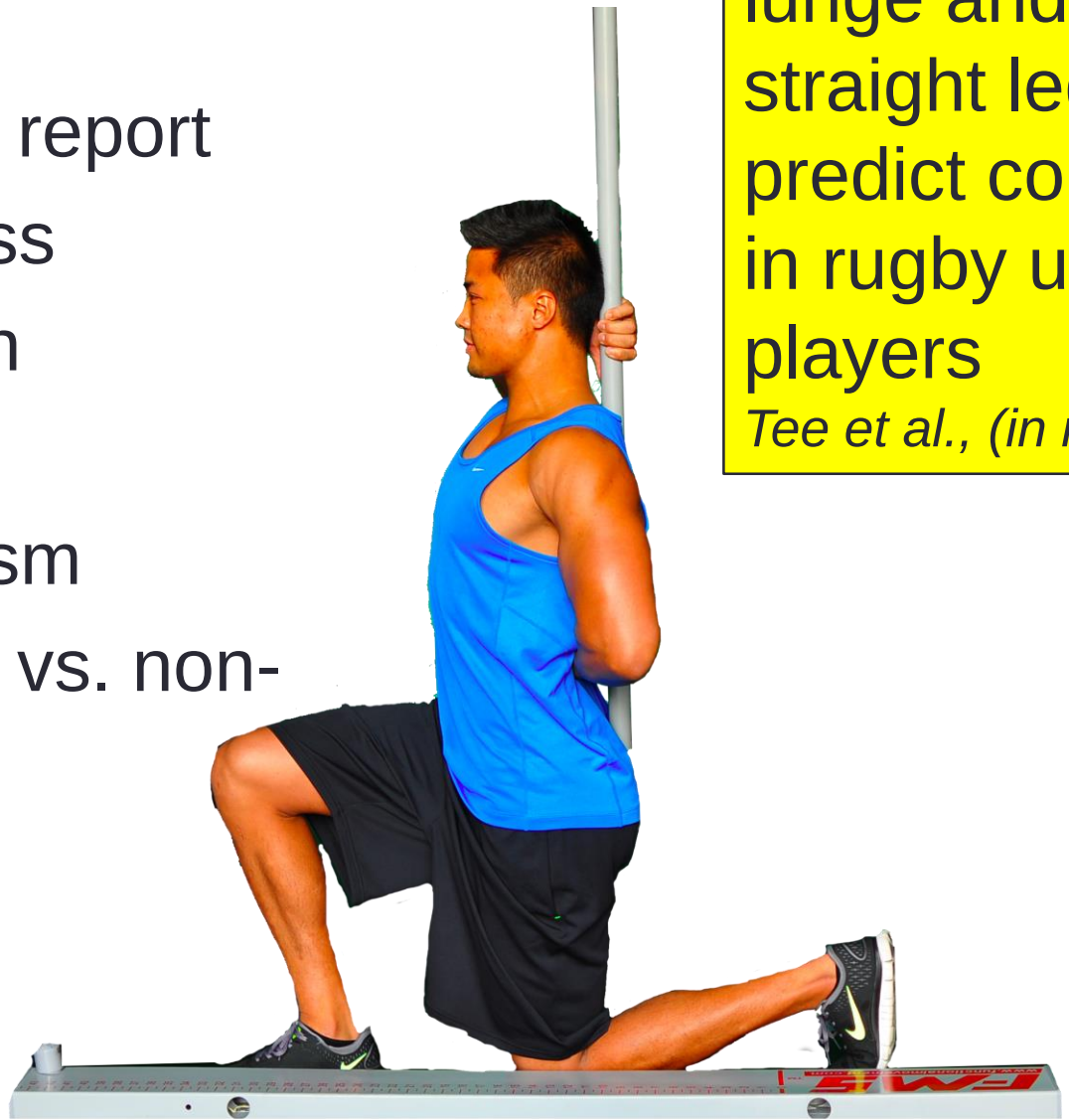
Injury definitions

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

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!

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