Injury risk management in rugby – Applications of single team epidemiology

Dr. Jason Tee
epidemiology [ep”ɪ-de”me-ol’o-je]

The science concerned with the study of factors determining and influencing the frequency and distribution of disease, injury and other health related events and their causes in a defined human population for the purpose of establishing programs to prevent and control their development and spread.
Epidemiology of rugby

Williams et al., Sports Med 2013
Epidemiology of rugby

**Injury incidence among team sports**

- **Collision sports**
  - Rugby: high incidence
  - Ice hockey: moderate incidence
  - Rugby League: moderate incidence

- **Contact sports**
  - Soccer: moderate incidence
  - Basketball: low incidence
  - Australian rules football: low incidence
Importance for state of the game

Law modifications

Education programs

Hendricks et al., BJSM, 2014

Current challenges

Sport Collision Injury Collective
www.SportCIC.com

1st March 2016

Anne Longfield OBE, Childrens Commissioner for England
Professor Sally Holland, Children’s Commissioner for Wales
Tam Baillie, Children's Commissioner for Scotland
Koula Woasouma, Children’s Commissioner for Northern Ireland
Dr. Niall Muldoon, Ombudsman for Children for Northern Ireland

Professor Dame Sally Davies, Chief Medical Officer for England
Dr. Ruth Hussey OBE, Chief Medical Officer for Wales
Dr. Catherine Calderwood, Chief Medical Officer for Scotland
Dr. Michael McBride, Chief Medical Officer for the Republic of Ireland

Rt Hon Nicky Morgan, Secretary of State for Education for England
Huw Lewis AM, Minister for Education and Skills in Wales
Rt Hon Angela Constance, Secretary of State for Education and Lifelong Learning for Scotland
John O'Dowd MLA, Minister for Education in Northern Ireland
Jan O’Sullivan, Minister for Education for the Republic of Ireland

Rt Hon Jeremy Hunt, Secretary of State for Health for England
Rt Hon Shona Robison, Cabinet Secretary for Health, Wellbeing and Sport in Scotland
Mark Drakeford AM, Minister for Health and Social Services in Wales
Simon Hamilton MLA, Minister for Health, Social Services and Public Safety in Northern Ireland
Leo Varadkar, Minister for Health for the Republic of Ireland

Rt Hon John Whittingdale, Secretary of State for Culture, Media and Sport in England
Ken Skates AM, Deputy Minister for Culture, Sport and Tourism in Wales
Jamie Hepburn MSP, Cabinet Secretary for Health, Wellbeing & Sport in Scotland
Caral Ni Chuilin MLA, Minister for the Department of Culture, Arts and Leisure in Northern Ireland
Paschal Donohoe, Minister for Transport, Tourism and Sport in the Republic or Ireland.
epidemiology

Classical epidemiology studies require

- Huge sample sizes (entire population)
- Significant resources
- Long time spans
- Governing body responsibility
**FAST**

**PRACTITIONER**

IMMEDIATE DECISION-MAKING

HAS DIRECT APPLICATION

FAST, AUTOMATIC, INTUITIVE, NON-INVASIVE

Service provision to players/coaches

Informing coach/medical decisions

Case studies

Dashboard analytics

FEEDS DATA TO RESEARCH

**SLOW**

**RESEARCHER**

QUALITY CONTROL, EXPLORATORY, VALIDATION

HAS INDIRECT APPLICATION

SLOW, DELIBERATE, FOCUSED, EFFORT

Provides evidences for system

Establishing signal and noise

Cost-benefit analyses

Statistics

PROVIDES EVIDENCE BASED TO DAILY SYSTEMS

Reference: Aaron J Courts, USPP, in press

Designed by ©YLM SportScience
Injury vs. Performance

Williams et al., BJSM, 2015
Injuries affect team performance negatively in professional football: an 11-year follow-up of the UEFA Champions League injury study

Injury vs. performance

Football

Basketball

Track and field

American Football

@JasonCTee
Injury vs. Performance

- What are these teams doing wrong?
- What is this team doing right?
- How do we get from here to here?

Williams et al., BJSM, 2015
Injury risk management model

Fuller et al., BJSM, 2012
Risk estimation

Comparison of injury rate of a single professional rugby union team with population norms

<table>
<thead>
<tr>
<th>Category</th>
<th>Injury Incidence (n/1000h exposure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School (UK)</td>
<td>40</td>
</tr>
<tr>
<td>Academy (UK)</td>
<td>40</td>
</tr>
<tr>
<td>Level 2 Club</td>
<td>40</td>
</tr>
<tr>
<td>Level 1 Club</td>
<td>80</td>
</tr>
<tr>
<td>International</td>
<td>140</td>
</tr>
<tr>
<td>Investigation Team</td>
<td>200</td>
</tr>
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</table>
## Targeting Interventions

Perhaps the training prescription isn’t right?

<table>
<thead>
<tr>
<th>Injury Burden (total days lost)</th>
<th>3056</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Injury circumstances (% total injury burden)</strong></td>
<td></td>
</tr>
<tr>
<td>Match</td>
<td>52.7</td>
</tr>
<tr>
<td>Training</td>
<td>47.3</td>
</tr>
<tr>
<td><strong>Injury Mechanism % (% total injury burden)</strong></td>
<td></td>
</tr>
<tr>
<td>Contact</td>
<td>49.9</td>
</tr>
<tr>
<td>Non-Contact</td>
<td>50.1</td>
</tr>
</tbody>
</table>
The training sweet spot

Tee, unpublished observations

@JasonCTee
What do players actually have to do in matches?

Movement and impact characteristics of South African professional rugby union players

J C Tee, MSc (Exercise Science); Y Coopoo, DPhil, FACSM

Fig. 4. Distance covered in high-intensity and low-speed zones by tight forwards, loose forwards, scrumhalves, inside backs and outside backs. (# and θ indicate significant difference from tight forwards and scrumhalves, respectively (p<0.05).)
How is this reflected in training?
So how did we do?

<table>
<thead>
<tr>
<th>Injury Burden</th>
<th>3056</th>
<th>3647</th>
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</thead>
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<td></td>
<td></td>
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</table>

<table>
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<tr>
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<th>52.7</th>
<th>72.5</th>
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<td></td>
</tr>
<tr>
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<td>27.5*</td>
</tr>
</tbody>
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<th>71.8</th>
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</thead>
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<td></td>
<td></td>
</tr>
<tr>
<td>Non-Contact</td>
<td>50.1</td>
<td>28.2*</td>
</tr>
</tbody>
</table>

* indicates significant difference between 2012 and 2013, p <0.05.
GO BACK AND START AGAIN
Injuries are complicated

Meeuwisse et. al., Clin J Sport Med, 1994
Injuries are complicated

Meeuwisse et. al., Clin J Sport Med, 2007
Injuries are complicated

2016

Windt and Gabbett, BJSM, 2016
Predicting injuries is near impossible

- Coin toss: 50%
- ECC hamstring strength in dynamometer: 56%
- FMS: 58%
- Knee angle during drop jump: 60%

@JasonCTee
Bahr (2016); Dorrel et al. (2015)
Injuries are complex and multifactorial

One intervention is unlikely to make a significant difference
Use every tool in the box!!!
Correct training prescription
Complex systems model

Bittencourt et al., BJSM, 2016
Multi-disciplinary approach to managing team injury risk

Physiotherapist
- treating injuries through "hands on" modalities

Sport Scientist
- Optimising performance through interpretation of physical performance data

S&C coach / Biokineticist
- Prescription of training to improve performance and prevent injury.
  - Aerobic / Anaerobic conditioning

Doctor
- Diagnosing injuries and developing injury management plans

Technical / Tactical coaches
- Directing technical and tactical training activities
  - Tactical training
  - Skills
  - Game plan

Physiological monitoring
- Training load monitoring
- Psychological monitoring
- Screening
- Rehabilitation

Strength / power training
- Return to play

Technical coaching
- Periodisation
- Planning training activities

Diagnosis
- Treatment/therapy
Current research on multi-disciplinary approach

Question: Who should be responsible for implementing injury prevention strategies in professional sport?

- S&C / Fitness Coach: 9%
- Physio: 5%
- Dr: 0%
- All of the above: 86%

86 votes • Final results
Current research on multi-disciplinary approach

England won the 1966 World Cup with n=7 technical and support staff

* n=7 x PhD
Current research on multi-disciplinary approach

International Journal of Sports Physiology and Performance

Ahead of Print

INVITED BRIEF REVIEW

Two Training-Load Paradoxes: Can We Work Harder and Smarter, Can Physical Preparation and Medical be Team-Mates?

Authors: Tim J. Gabbett¹ Rod Whiteley²

AFFILIATIONS
¹Gabbett Performance Solutions, Brisbane, Australia. ²Aspetar Orthopaedic and Sports Medicine Hospital, Doha, Qatar. *Correspondence to: Dr. Rod Whiteley Aspetar Orthopaedic and Sports Medicine Hospital Doha, Qatar Email: Rodney.whiteley@aspetar.com

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We have observed that in professional sporting organisations the staff responsible for physical preparation and medical care typically practice in relative isolation and display tension in regards their attitudes toward training load prescription (much more, and much less training respectively). Recent evidence shows that relatively high chronic training loads, when they are appropriately reached, are associated with reduced injury risk and better performance. Understanding this link between performance and training loads removes this tension, but requires a better understanding of the relationship between the acute:chronic workload ratio (ACWR), and it’s association with performance and injury. However there remain many questions to be answered in the area of ACWR, and we are likely at an early stage of our understanding of these parameters and their inter-relationships. This opinion paper explores these themes and makes recommendations for improving performance through better synergies within support staff approaches. Further, aspects of the ACWR which remain to be clarified, the role of shared decision-making, risk:benefit estimation, and clearer accountability are discussed.
Multi-disciplinary approach to managing team injury risk

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  - Planning training activities

- Strength / power training
- Return to play

- Physiological monitoring

- Psychological monitoring
  - Screening
  - Rehabilitation

- Training load monitoring
  - Diagnosis
  - Treatment/therapy
Successes - Screening

Preseason Functional Movement Screen Component Tests Predict Severe Contact Injuries in Professional Rugby Union Players

Jason C. Tee,¹ Jannie F.G. Klingbiel,² Robert Collins,²,³ Mike I. Lambert,⁴ and Yoga Coopoo¹
How does FMS predict contact injuries?

- Dysfunctional movement pattern
- Poor tackle technique
Successes – Tackle injuries

Interventions

- Specific strength program
- Increased exposure to contact skills training
Successes - Monitoring

Resting heart rate

Sleep hours

Injury risk based on change in resting heart rate from baseline

- All injury risk
- Non-contact injury risk

Non-contact Injury risk based on reported sleep hours.
Effectiveness of the multi-disciplinary approach
Effect on performance

Relationship between weekly injury burden and team win rate in Super Rugby

Team win rate (%) vs Injured Days per Week
Single team injury research

PERFORMANCE and ETHICAL MOTIVATIONS

Focused on CONTEXTUAL problems and solutions

Provides information to INFORM large scale epidemiological studies
Single team injury research

Every team represents a unique & individual COMPLEX system

Applied injury research requires an understanding of how multiple risk factors interact in an emergent pattern

Multi-disciplinary teams are best equipped to affect complex systems
Thank you for your attention!!!

Are there any questions?