A Complex Systems Approach to Injury Prevention Research

Dr. Jason Tee and Dr. Sheree Bekker
Injury prevention – an economic argument

Professional leagues

In 2015 the following was spent on salaries for injured players

- Major League baseball - $700 million
- NFL - $450 million
- NBA - $350 million
- English Premier League - $300 million

Amateur players

Significant personal financial and social burden of injury

- $731 per injury in amateur rugby
- €58 due to healthcare utilization and €116 due to missed work
Injury vs. Performance

**Similar results in**
- **Football**
  (Hagglund et al., BJSM, 2013)
- **Track and Field**
  (Raysmaith and Drew, J Sci Med Sport, 2016)
- **Basketball**
  (Podlog et al., J Sci Med Sport, 2013)
Systematic review
Drew, Raysmith and Charlton, BJSM, 2013

“Injuries have a detrimental impact on team and individual athletic success.”

“Injury prevention should therefore be a priority for maximising athletic performance”
Injury prevention programs are effective.


Kristian Thorborg,¹,² Kasper Kühn Krommes,¹,³ Ernest Esteve,⁴,⁵ Mikkel Bek Clausen,⁶ Else Marie Bartels,⁷ Michael Skovdal Rathleff³,⁸,⁹

The FIFA 11+ prevention programme reduces football injuries by 39%.
Injury prevention programs are effective

Reducing musculoskeletal injury and concussion risk in schoolboy rugby players with a pre-activity movement control exercise programme: a cluster randomised controlled trial

Michael D Hislop,^1^ Keith A Stokes,^1^ Sean Williams,^1^ Carly D McKay,^1^ Mike E England,^2^ Simon P T Kemp,^2^ Grant Trewartha^1^

The Activ8 prevention programme reduces rugby match injuries by 72%,
Injury outcomes aren’t improving

Hamstring injuries have increased by 4% annually in men’s professional football, since 2001: a 13-year longitudinal analysis of the UEFA Elite Club injury study

Jan Ekstrand,1,2,3 Markus Waldén,1,2 Martin Hägglund2,4

On average, a professional rugby union player is more likely than not to sustain a concussion after 25 matches

James Rafferty,1 Craig Ranson,2 Giles Oatley,3 Mohamed Mostafa,4 Prabhat Mathema,5 Tom Crick,6 Isabel S Moore7

Figure 1  The match injury incidence (95% CI) of concussion in club and international rugby combined across the four seasons.
Uptake/adoption of injury prevention programs is disappointing.

Evidence-based hamstring injury prevention is not adopted by the majority of Champions League or Norwegian Premier League football teams: the Nordic Hamstring survey.

Roald Bahr,¹,² Kristian Thorborg,³,⁴ Jan Ekstrand⁵

83% of clubs did not adopt the injury prevention intervention.
Uptake/adoption of injury prevention programs is disappointing.

The delivery of injury prevention exercise programmes in professional youth soccer: Comparison to the FIFA 11+

James O’Brien\textsuperscript{a,\,*}, Warren Young\textsuperscript{a,\,b}, Caroline F. Finch\textsuperscript{a}

On average 1 exercise was performed in its original form, 4 were performed in modified form (out of 15 exercises)
How do we connect research with practice?
Simple solutions don’t work for complex problems?
Sheree Complexity explanation
Understanding injuries

Meeuwisse et. al., Clin J Sport Med, 1994
Understanding injuries

2007

Meeuwisse et. al., Clin J Sport Med, 2007
Understanding injuries

2016

Windt and Gabbett, BJSM, 2016
Understanding injuries as a complex system

Bittencourt et al., BJSM, 2016
Researching injuries

1987 – Sequence of prevention

Fig. 1. The ‘sequence of prevention’ of sports injuries (van Mechelen et al. 1987).

1. Establishing the extent of the sports injury problem
   - incidence
   - severity

2. Establishing aetiology and mechanism of injuries

3. Introducing preventive measures

4. Assessing their effectiveness by repeating step 1
Researching injuries

2006 – Translating research into Injury prevention practice (TRIPP)

1. Establishing the extent of the injury problem
2. Establishing etiology and mechanisms of sports injuries
3. Introducing a preventive measure
4. Assessing its effectiveness by repeating step 1
5. Describe intervention context to inform implementation strategies
6. Evaluate effectiveness of preventive measures in implementation context

Successful implementation of injury prevention requires behavioural changes, positive attitudes and adoption of the intervention

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Current research approaches produce singular solutions to be adopted in all contexts.
Problem 1: Injury contexts are unique, and not interchangable

A socioecological framework for sports injuries – Bolling et al., Sports Medicine, 2018

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Problem 2: Injury contexts are dynamic, constantly changing

20% increase in body mass and strength of rugby players in 12 years
Lombard et al., JSCR, 2015

High speed running increased by 30% in 7 years in the English Premier League
“Who works?”

“What works in what context, and why?”
Solutions

- Better understanding of context – qualitative
- Ipsative
- Practitioner based
- Multi-site
Ipsative research

Step 1. Establish the extent of the injury problem (Injury Audit)

Step 2. Establish aetiology and mechanism of injuries

Step 3. Introduce preventive measures

Step 4. Assess program effectiveness (Repeat injury audit)

Tee et al., JSAMS, 2018

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The TIP Cycle was developed as part of the FC Barcelona Muscle Injury Guide 2018 and is specifically aimed at the sports team medicine/performance practitioner. By progressing through the 3 phases, teams can develop a dynamic, context-specific approach.

1. (Re)-EVALUATE
   - What is the current injury situation?
   - What is the injury prevention situation?

2. IDENTIFY
   - What are the injury risk factors and mechanisms?
   - What are the barriers & facilitators to delivering injury prevention?

3. INTERVENE
   - Plan the content and delivery of injury prevention strategies
   - Introduce injury prevention strategies

Design: @DrJames