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Lecture Notes

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A Complex Systems Approach to Injury Prevention Research

Dr. Jason Tee and Dr. Sheree Bekker



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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

Brown et al., J Sci Med Sport, 2015

- €58 due to healthcare utilization and €116 due to missed work

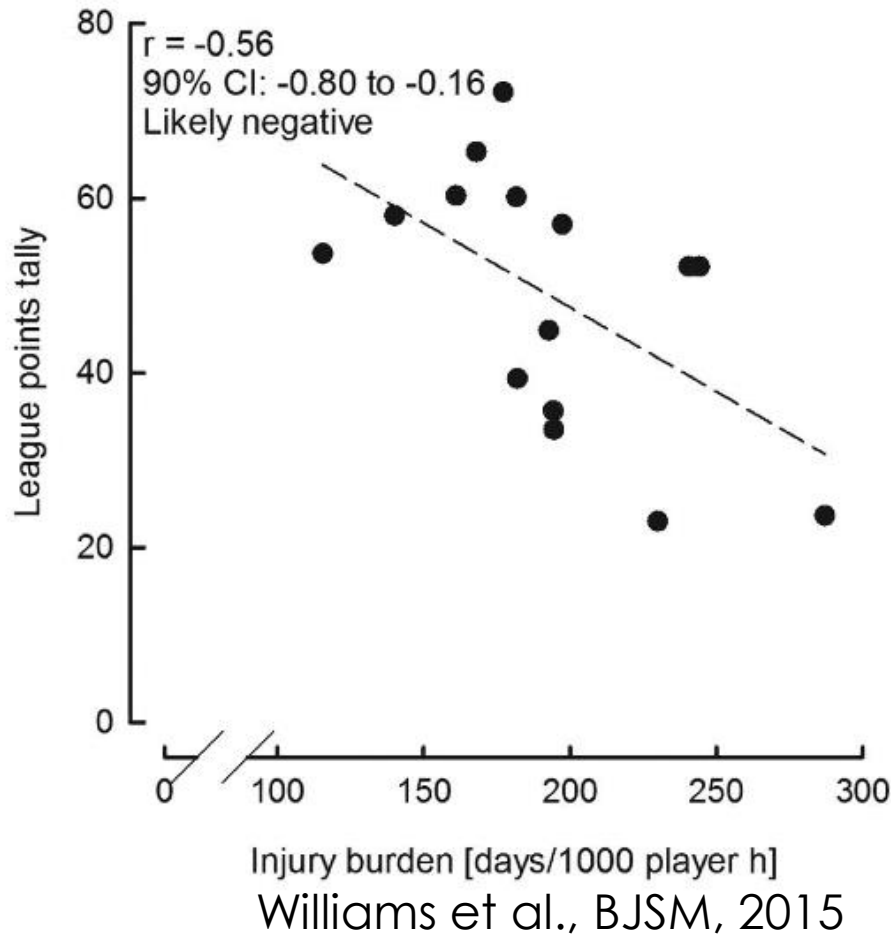
Hespanol Junior et al., Scand J. Med Sci, 2015



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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)



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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”



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Injury prevention programs are effective

Effect of specific exercise-based football injury prevention programmes on the overall injury rate in football: a systematic review and meta-analysis of the FIFA 11 and 11+ programmes

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

The FIFA 11+ prevention programme reduces football injuries by 39%,



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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 Trewartha¹

The Activ8 prevention programme reduces rugby match injuries by 72%,



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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 Hägglund^{2,4}

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



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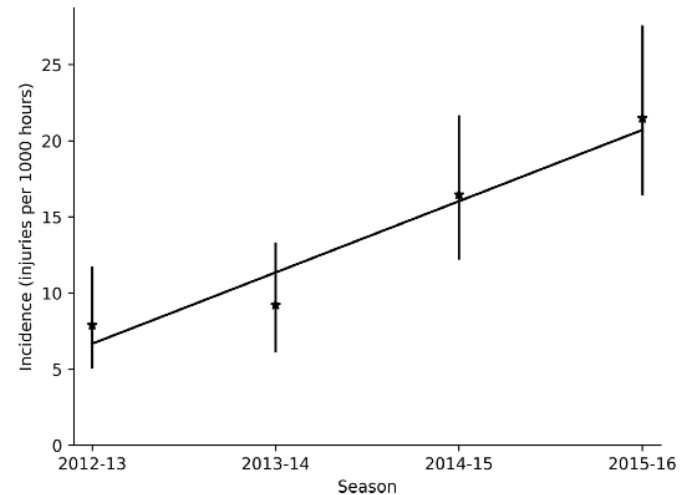


Figure 1 The match injury incidence (95% CI) of concussion in club and international rugby combined across the four seasons.

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



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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^{a,*}, Warren Young^{a,b}, Caroline F. Finch^a

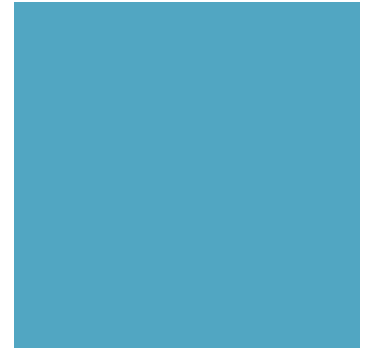
On average 1 exercise was performed in its original form, 4 were performed in modified form (out of 15 exercises)



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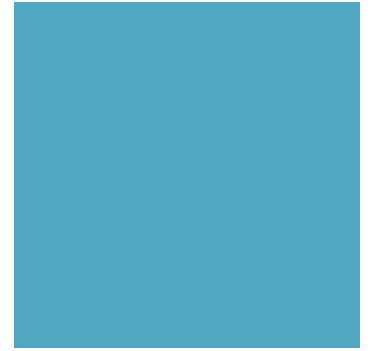
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How do we connect research with practice?



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Simple solutions don't work for complex problems?



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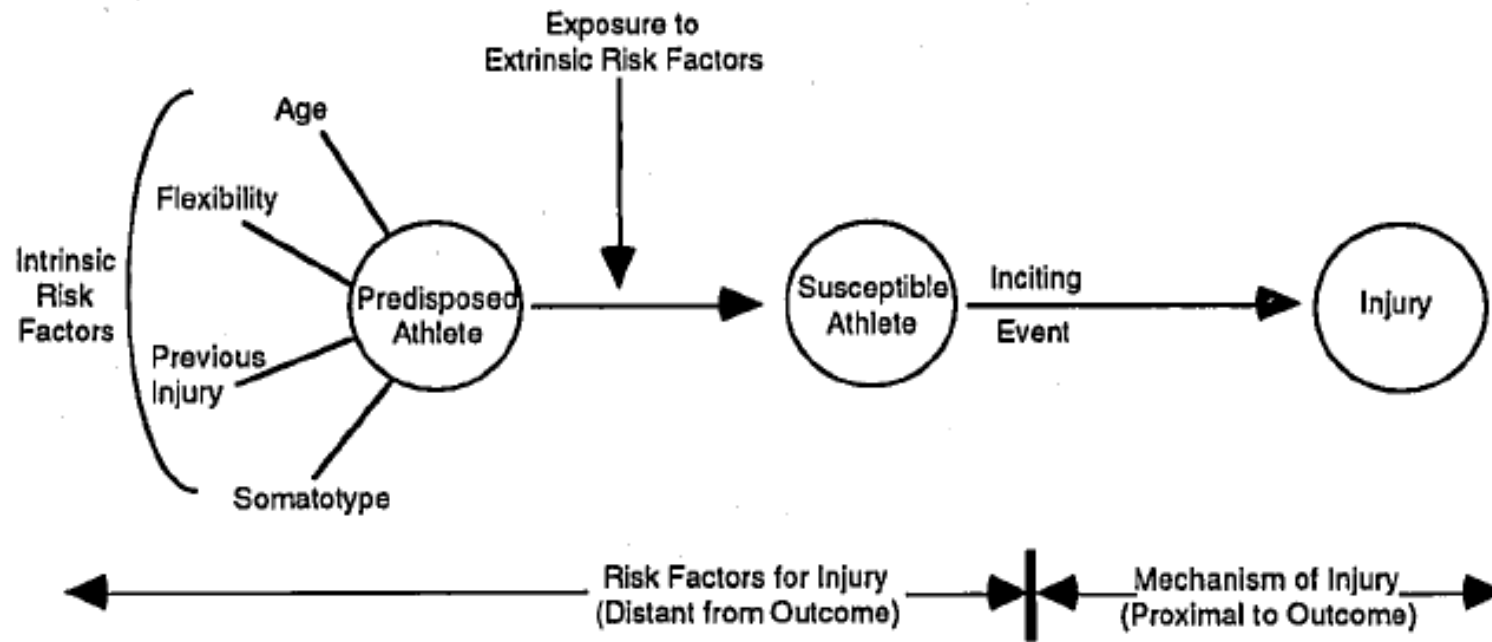
■ Sheree Complexity explanation



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Understanding injuries

1994



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

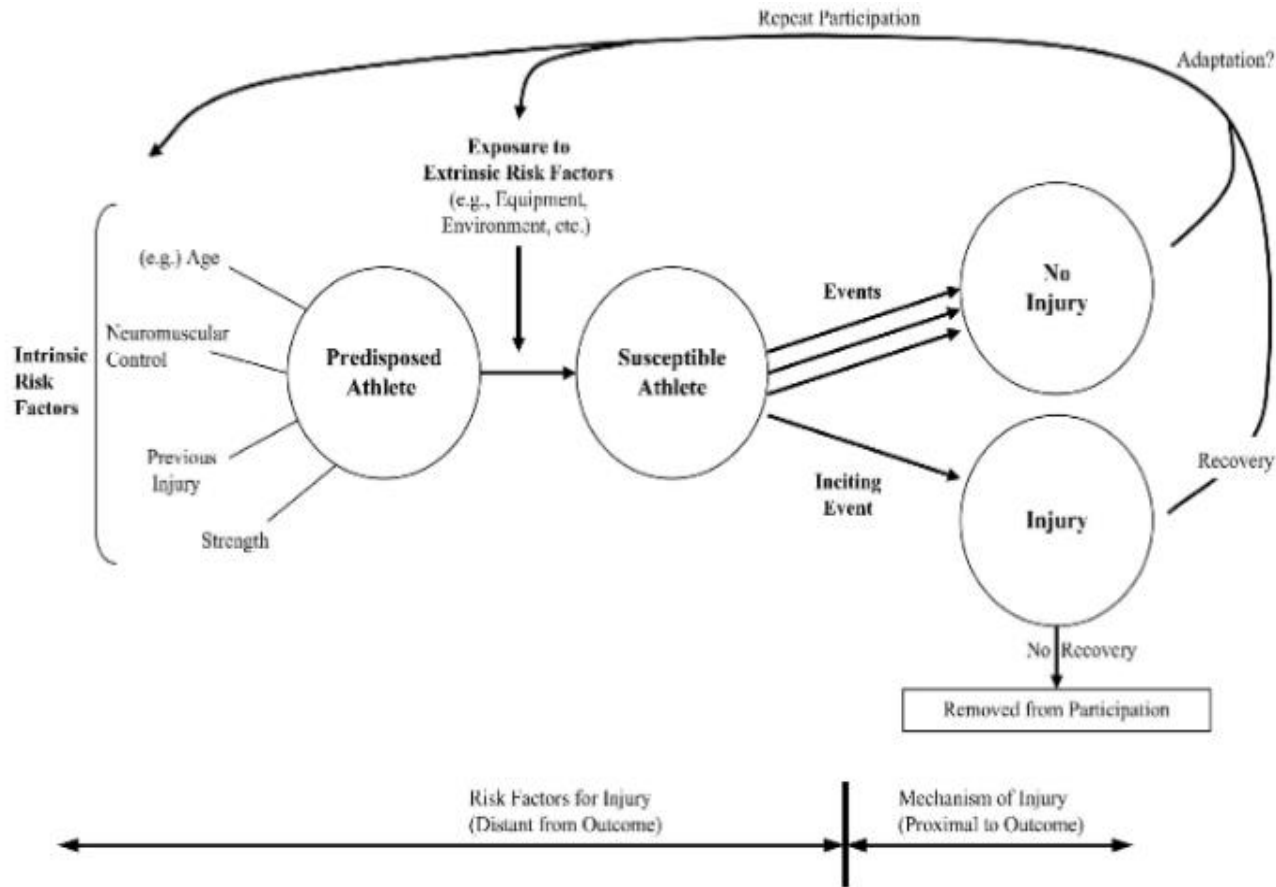


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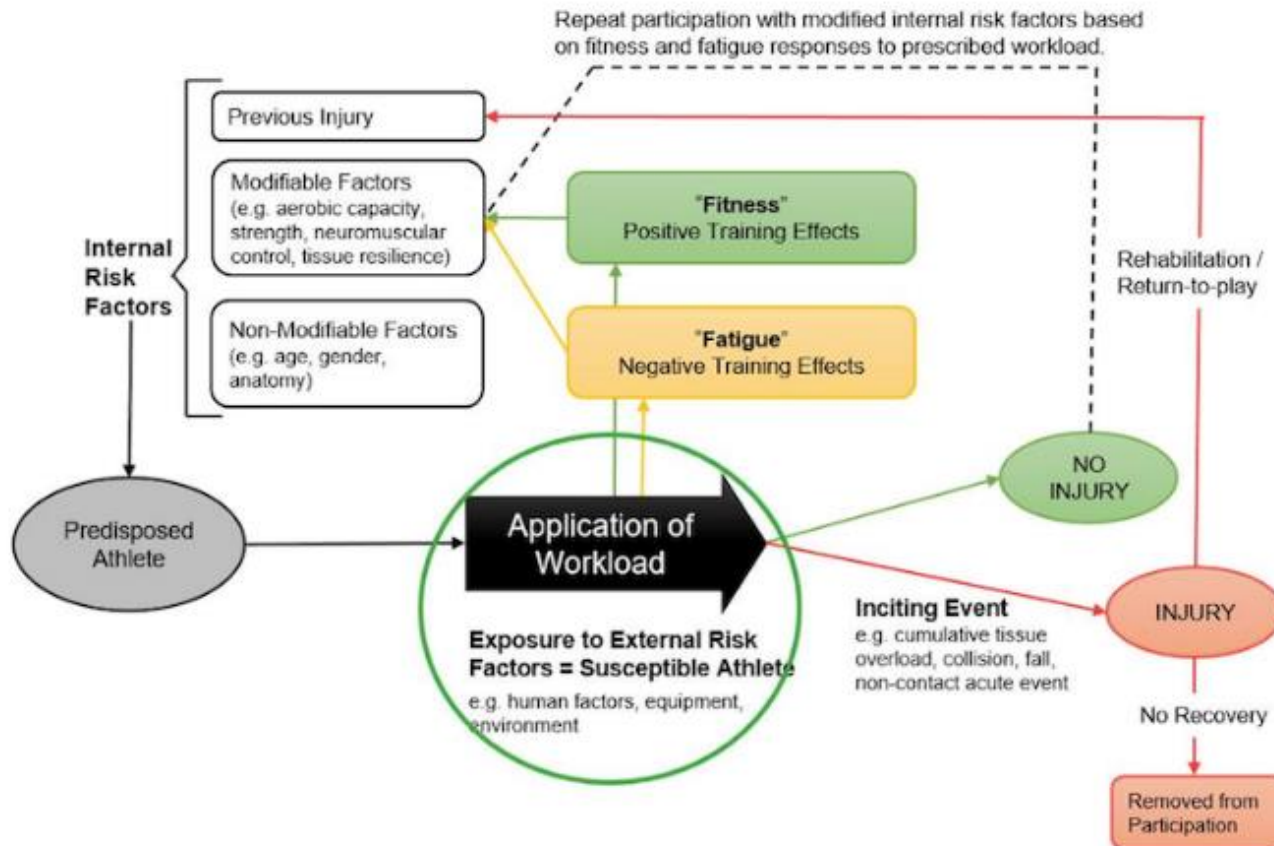
Understanding injuries

2007



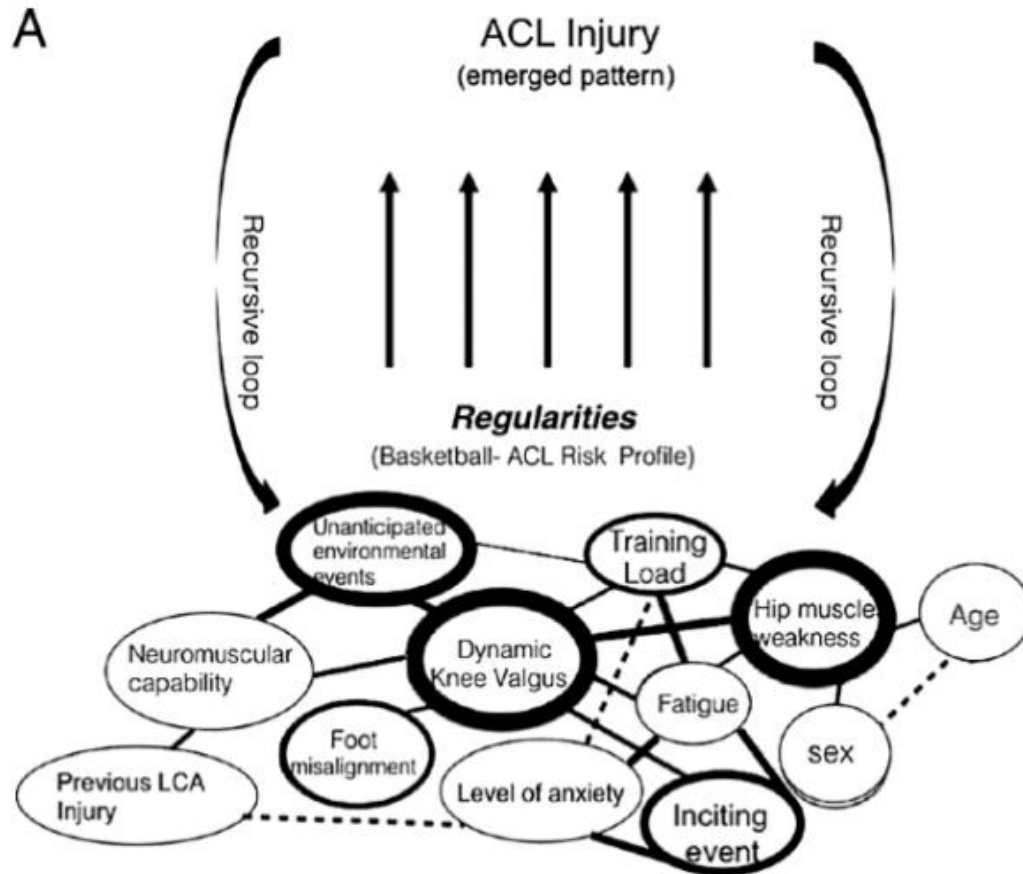
Understanding injuries

2016



Understanding injuries as a complex system

2016



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Bittencourt et al., BJSM, 2016

Researching injuries

1987 – Sequence of prevention

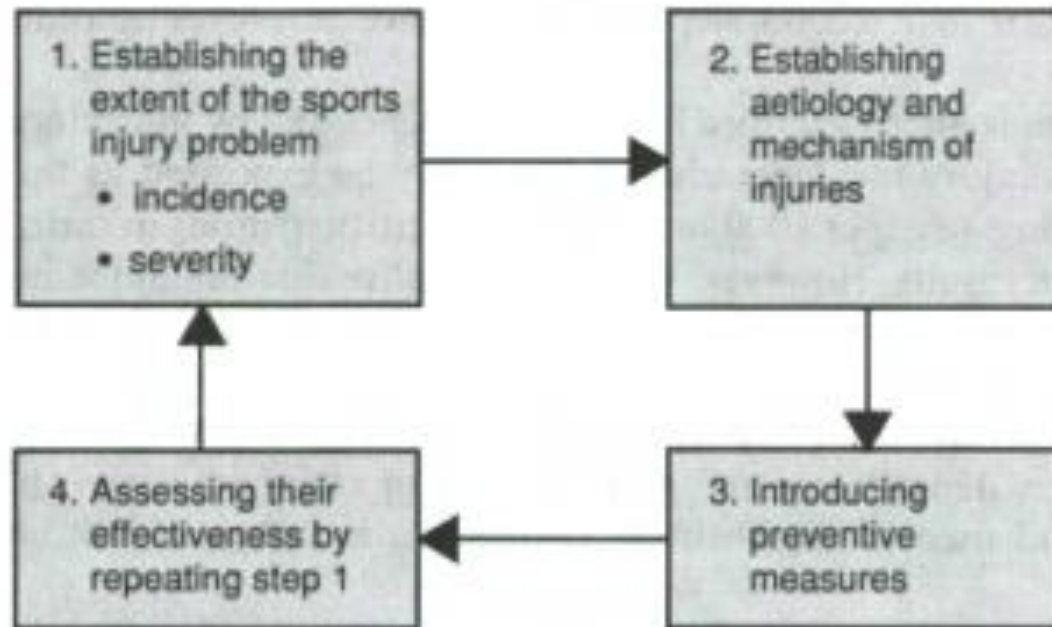


Fig. 1. The 'sequence of prevention' of sports injuries (van Mechelen et al. 1987).



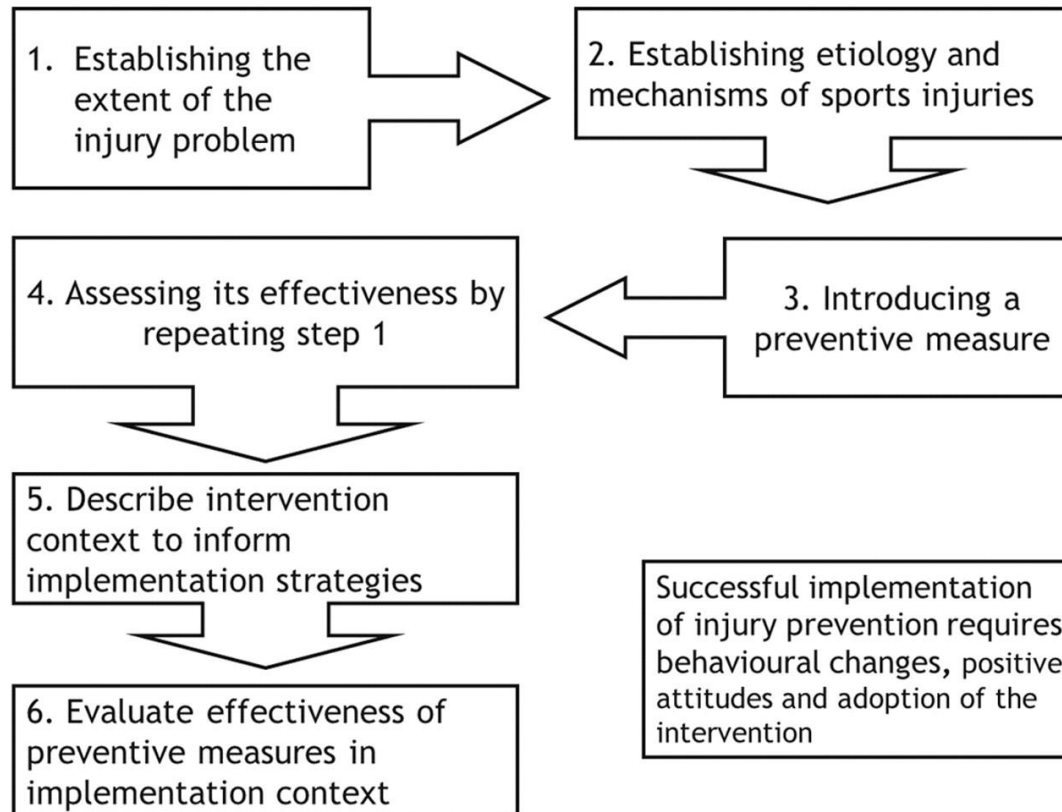
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Researching injuries

2006 –

Translating research into Injury prevention practice (TRIPP)



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Current research
approaches produce
singular solutions to
be adopted in all
contexts

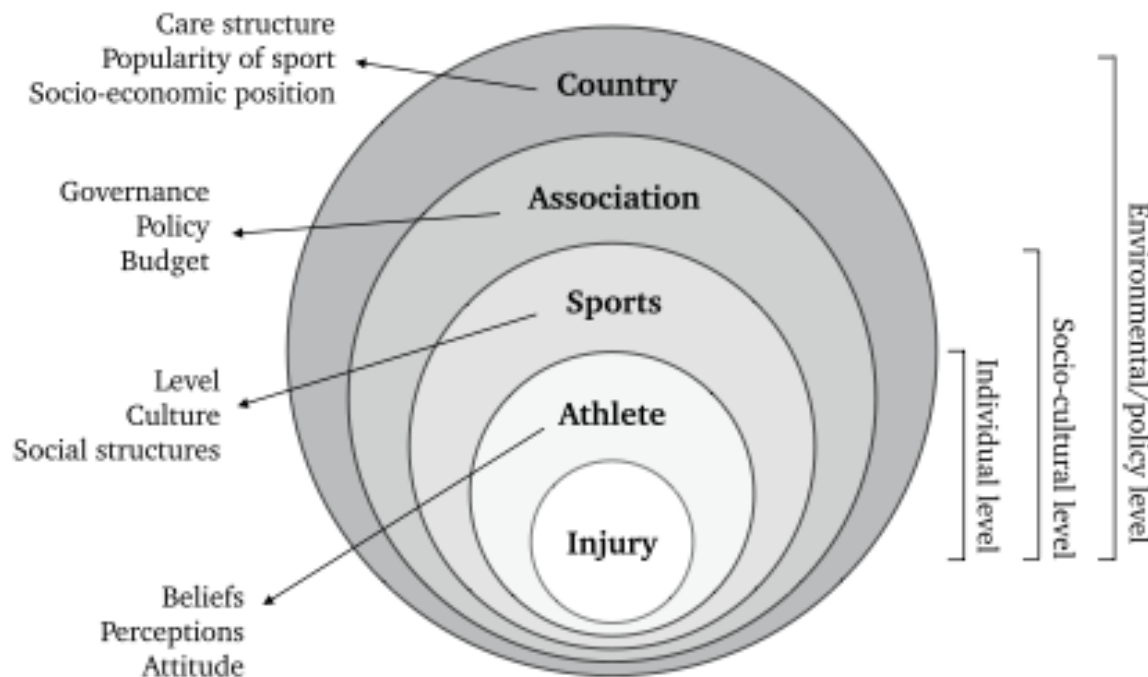


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Problem 1: Injury contexts are unique, and not interchangeable



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



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Problem 2: Injury contexts are dynamic, constantly changing

Forwards

Backs

stature

A

cm

cm

body mass

B

kg

kg

bench press (absolute)

C

kg

kg

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

Barnes et al., Int. J Sports Med. 2014

JRT



~~"What works?"~~

"What works in
what context, and
why?"



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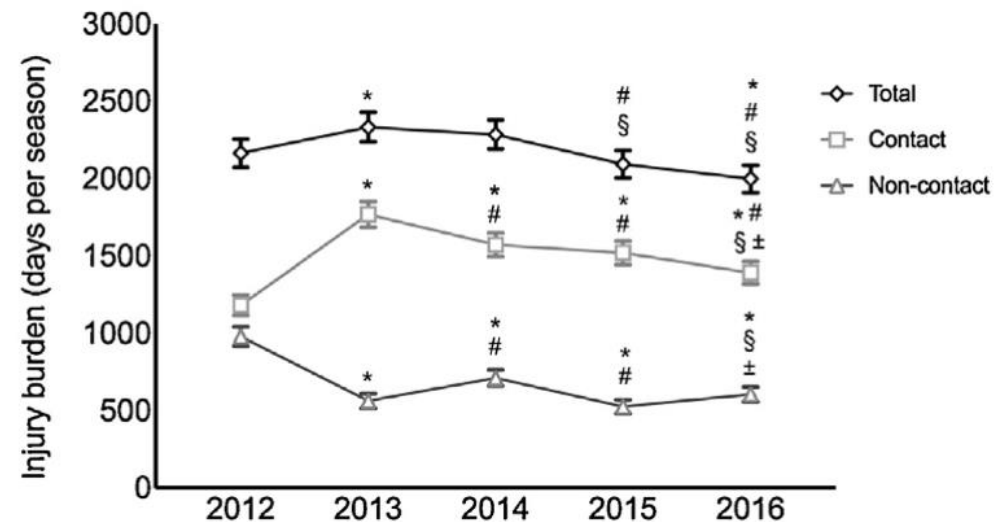
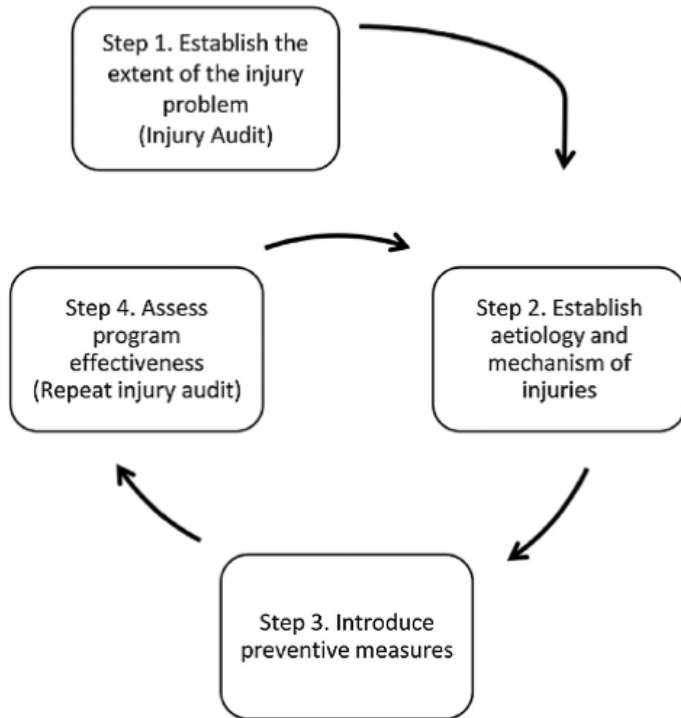
Solutions

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



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Ipsative research



Tee et al., JSAMS, 2018



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Ipsative research

The Team-sport Injury Prevention (TIP) Cycle

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.



(Re)-EVALUATE

What is the current injury situation?

What is the injury prevention situation?



IDENTIFY

What are the injury risk factors and mechanisms?

What are the barriers & facilitators to delivering injury prevention?



INTERVENE

Plan the content and delivery of injury prevention strategies

Introduce injury prevention strategies

