Prevention of Injury and Protection of the Health of the Athlete

The sequence of prevention

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Disclosure


• **Miscellaneous**: TCCC, Masterfood, Donjoy, WHO, EC, CDC, GR, MRC, Finish Academy Sci., EHFA, Pfizer, Eli Lilly, Nike, .......

• **Paid positions**: director EVALUA Nederland B.V., shareholder Evalua international Ltd., non-executive board member ArboUnie B.V., UMCG, UWV
Outline

• The sequence of prevention

• A comparison

• The sequence applied

• What’s next?
‘The sequence’ 1984 - 1986
3.2 Preventiessequentie
‘The sequence’ - 1987

How can sports injuries be prevented?

Hoe kunnen sportblessures voorkomen worden?
‘The sequence’ - 1987

Schema 2.2.1. Preventiesequentie

1. Vaststellen van de omvang
   van het sportblessure-
   probleem
   - sportblessureincidentie
   - mate van ernst van
   sportblessures

2. Onderzoek naar etiologie
   en blessuremechanisme

3. Introductie van een preventieve maatregel

4. Bepaling van de effectiviteit van een preventieve maatregel door herhaling
   van stap 1
Fig. 1. The ‘sequence of prevention’ of sports injuries (van Mechelen et al. 1987).
Incidence, Severity, Aetiology and Prevention of Sports Injuries
A Review of Concepts

Willem van Mechelen, Hynek Hlobil and Han C.G. Kemper
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Contents

82 Summary
84 1. Sports Injury Incidence: Theoretical Considerations
1.1 The Definition of Sports Injury
1.2 Sports Injury Incidence
1.3 Research Design
87 2. Sports Injury Data
2.1 Sports Injury Incidence: The Netherlands as an Example
2.2 Other Comparisons
Sequence of prevention

1. Identify the magnitude of the problem:
   - Incidence
   - Severity

2. Identify aetiological factors and injury mechanism

3. Introduce preventive measures

4. Evaluate effect

RCT
Winne Meeuwisse - 1994

Assessing Causation in Sport Injury:
A Multifactorial Model

Willem H. Meeuwisse, M.D.

University of Calgary Sport Medicine Centre, Calgary, Alberta, Canada

Clinical Journal of Sport Medicine
Sequence of prevention – a comparison

Step 1
Step 2
Step 4
Step 3
Step 1

Identify the magnitude of the problem: incidence and severity
Step 2

Identify aetiological factors and injury mechanism
Step 3

Where is the 250 mark?
Step 4

Evaluate effect: RCT
### Translating Research into Injury Prevention Practice

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Approach [1]</th>
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A new framework for research leading to sports injury prevention

Caroline Finch

Journal of Science and Medicine in Sport (2006) 9, 3–9
Step 5+6
Step 1 & 2

Step 3 & 4

Effective widespread implementation?
What’s it like for disability sports?

HARD TO TELL
athletic injuries abled (=1) vs disabled (=2) sports 1992-2019: 99% vs. 1%

1: n = 44,211
2: n = 442
1992-2019 seq. of prevention publication counts for steps 1-4, 5&6 abled vs disabled sports

- **Step 1**: 44211
- **Step 2**: 44211
- **Step 3**: 44211
- **Step 4**: 44211
- **Step 5 & 6**: 44211

Legend:
- Orange: 1992-2019 44211
Step 1 & 2

Step 3 & 4

Effective widespread implementation?
step 1 re-visited

identify the magnitude of the problem:
- incidence
- severity

Challenges,
next to definitional issues:
- overuse versus acute
- real time data collection
Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) Overuse Injury Questionnaire

Benjamin Clarsen, Grethe Myklebust, Roald Bahr

The Oslo Sports Trauma Research Center questionnaire on health problems: a new approach to prospective monitoring of illness and injury in elite athletes

Benjamin Clarsen,¹ Ola Rønsen,² Grethe Myklebust,¹ Tonje Wåle Flørenes,¹ Roald Bahr¹
Effectiveness of online tailored advice to prevent running-related injuries and promote preventive behaviour in Dutch trail runners: a pragmatic randomised controlled trial

Luiz Carlos Hespanhol,¹,² Willem van Mechelen,¹,³,⁴,⁵ Evert Verhagen¹,⁴,⁶
Intervention effect on running injuries
(linear probability mixed model)

After 6 months

-16%
95% CI -23 to -9*

-3%
95% CI -10 to 4

Abs. diff: -13%
95% CI -23 to -3*
Step 2 re-visited

identify aetiological factors and injury mechanism
Line of reasoning

NMT $\rightarrow$ postural control $\rightarrow$ injury status
Step 2 re-visited

Challenge:

• Postural control
  - How does it work?

  - Need:
    - to differentiate between morphological, physiological, and functional changes
    - to search for measures other than postural sway, etc.
    - link this ‘other measure’ to outcome in epi studies
Step 3 and 4 re-visited

- RCT
- Evaluate effect
- Introduce preventive measures
The impact of adherence on sports injury prevention effect estimates in randomised controlled trials: Looking beyond the CONSORT statement

Evert A.L.M. Verhagen\textsuperscript{a,*}, Maarten D.W. Hupperets\textsuperscript{a,b}, Caroline F. Finch\textsuperscript{b}, Willem van Mechelen\textsuperscript{a}


RR full adherence vs. no adherence

RR: 0.63 (95% CI: 0.43–0.99)
Conclusions

- Highly effective NMT intervention

- However, adherence strongly affects outcome
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A new framework for research leading to sports injury prevention

Caroline Finch*

Journal of Science and Medicine in Sport (2006) 9, 3–9
The Implementation of Musculoskeletal Injury-Prevention Exercise Programmes in Team Ball Sports: A Systematic Review Employing the RE-AIM Framework

James O’Brien · Caroline F. Finch


• RE-AIM:
  – Reach, Efficacy, Adoption, Implementation, Maintenance

• assessed the reporting of RE-AIM components

• scarce information specific RE-AIM components

• major reporting gaps program adoption & maintenance
Step 3 & 4 + TRIPP 5 & 6 re-visited

Challenges:

• Design interventions that are actually executed
  ▪ report on implementation process (qualitatively)
  ▪ alternative delivery modes

• We need to deliver proof societal relevance
  ▪ cost-benefit
  ▪ cost-effectiveness
  ▪ PROMs
The sequence applied in disability sports
an example step 1 & 2

Risk of Injuries in Paralympic Track and Field Differs by Impairment and Event Discipline

A Prospective Cohort Study at the London 2012 Paralympic Games

Cheri A. Blauwet,*† ‡ MD, Daniel Cushman,§ MD, Carolyn Emery,‖¶ MSc, PhD, Stuart E. Willick,§ MD, Nick Webborn,†# MBBS, MSc, Wayne Derman,‡** ‡‡ MBChB, PhD, Martin Schwellnus,‡ ‡‡ §§ MD, PhD, Jaap Stomphorst,† |||| MD, and Peter Van de Vliet,¶¶ PhD

Investigation performed at the London 2012 Paralympic Games

- 10 day event
- 977 athletes competing in athletics
- databases (2) driven injury data collection
- athlete impairment & event discipline: IPC-athlete database
- IRs (injuries per 1000 athlete-days) by: impairment, event discipline, sex & age
Results

• overall IR: 22.1 injuries per 1000 athlete-days (95% CI, 19.5-24.7)

• track disciplines: ambulant athletes vs. other impairment categories
  – ambulant athletes with cerebral palsy lower incidence of injuries: (IR, 10.2; 95% CI, 4.2-16.2)

• Athletes seated throwing vs. athletes in wheelchair racing: higher incidence of injuries (IR, 23.7; 95% CI, 17.5-30.0 vs. 10.6; 95% CI, 5.5-15.6)

• In both track and field disciplines the majority of injuries did not result in time loss from competition or training

• Ambulant athletes: greatest proportion of injuries to the thigh (16.4% of all injuries; IR, 4.0), predominantly in track athletes

• Wheelchair or seated athletes: greatest proportion of injuries to the shoulder/clavicle (19.3% of all injuries; IR, 3.4), predominantly in field athletes
When van Mechelen's sequence of injury prevention model requires pragmatic and accelerated action: the case of para alpine skiing in PyeongChang 2018

Cheri Blauwet, 1,2 Nick Webborn, 3 James Kissick, 4 Jan Lexell, 5 Jaap Stomphorst, 6 Peter van de Vliet, 7 Dimitrije Lazarovski, 8 Wayne Derman 9,10

total acute para alpine ski event injuries
Sochi 2014 Paralympic Winter Games vs.
PyeongChang 2018 Paralympic Winter Games
Pragmatic approach

• course setting: less aggressive lines & ‘waves’ instead of jumps

• snow preparation phase:
  – development snow contingency plan
  – continuous course grooming
  – implementing new methods of snow preparation

• translation of ‘lessons learnt’ from Olympic Winter Games to Paralympic Winter Games

• crafting pre-competition schedules: more practice days prior to competition start

• pre-Games technical & medical briefings

• earlier start times: advantage of excellent snow conditions
Longer follow-up study (1 year)
What’s next?

Complex systems approach for sports injuries: moving from risk factor identification to injury pattern recognition—narrative review and new concept

N F N Bittencourt,¹ W H Meeuwisse,² L D Mendonça,³ A Nettel-Aguirre,⁴ J M Ocarino,⁵ S T Fonseca⁵

Web of determinants

Emerging Pattern
(Injury or Adaptation)

Regularities
(Risk or Protective Profile)

Recursive loop

Recursive loop

Web of determinants
Context Matters! Revisiting the First Step of the ‘Sequence of Prevention’ of Sports Injuries

Caroline Bolling¹ · Willem van Mechelen¹,²,³,⁴ · H. Roeline Pasman¹ · Evert Verhagen¹,²

https://doi.org/10.1007/s40279-018-0953-x
To sum up

• ‘the sequence’ provides a useful framework for the prevention of sports injuries

• Paralympic Sports is lagging behind

• Implementation: ‘the difficult one’

• Context matters