

Sport and Exercise Medicine

How do I avoid injuries?



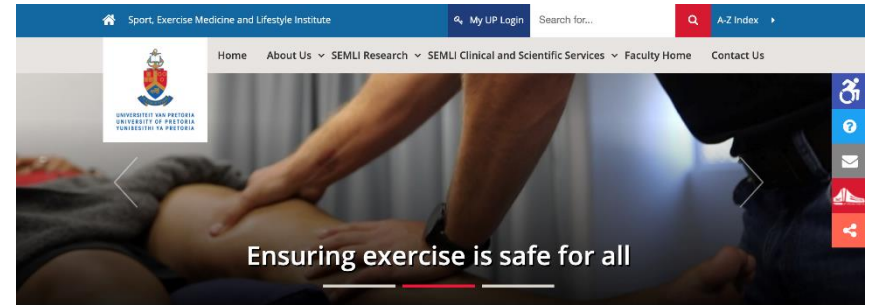
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Director: IOC Research Centre, University of Pretoria, South Africa

Sport, Exercise Medicine and Lifestyle Institute (SEMLI)



Sport, Exercise Medicine and Lifestyle Institute

The University of Pretoria has identified sport, exercise medicine and lifestyle interventions for chronic disease as one of its four main strategic niche areas for research activity in the next decade. To realise this strategic goal the Sport, Exercise Medicine and Lifestyle Institute (SEMLI) was established in June 2015, under the directorship of Professor Martin Schwellnus.

The vision of the SEMLI is to be an international leader in scientific, translational research that promotes health and well-being in the population through lifestyle interventions, reducing exercise-related injuries and medical complications, and promoting sporting excellence. This will be achieved on a platform characterised by world class scientific and clinical service delivery, education, and the use of modern technology. Fundamental to the success of the Institute is its unique multi-disciplinary approach to research and scientific/clinical services, allowing constant interaction and collaboration between expert specialists, and fostering an invaluable culture of research informing best clinical practice, and vice versa.

A key component of the research activity in the SEMLI is to focus on the human being as a whole in society through research activities that range from studying the human genome to conducting population based epidemiological studies. There is also an emphasis on utilising existing and developing new technology, such as wearable devices, smart phones, online technology, and cloud-based applications, to conduct research, deliver education and provide specialist services in the fields of sport, exercise medicine and lifestyle interventions for chronic disease.

Research at SEMLI:

<https://www.up.ac.za/Sport-Exercise-Medicine-and-Lifestyle-Institute>

Disclosure

Neither I, Martin Schweltnus, nor any family member(s), have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation.

This conference in 2018.....

**What was main the
message?**

**The “drug” every doctor should
prescribe to every patient every day
is
regular physical activity**

“The drug everyone should take!”

Are there any negative side effects of this drug (physical activity)?

Yes!!!– Exercise paradox

When we promote regular physical activity it is our responsibility (as health professionals) to reduce the risk of any negative side effects

As with any drug we prescribe....

Side effect 1: Risk of injury

Participation in physical activity and sport is

as...
de...
And...

- 50-60%
- with
- 30-50%
- over
- -----

50% of exercise-related injuries are preventable

program
running



Today.....

Principles



Prevention of exercise-related injuries

Presentation outline

Principles for injury prevention

1. Pre-exercise (session)
 - a. Warm-up
 - b. Stretching (before training)
2. Regular training
 - a. Regular stretching – flexibility training
 - b. Proprioceptive training (e.g. balance)
 - c. Muscle strength training
 - d. Combined training exercise
3. Correct sports “equipment”
4. Training volume and progression
5. Optimum nutrition
6. Optimum psychological status
7. Chronic disease, allergies and drugs



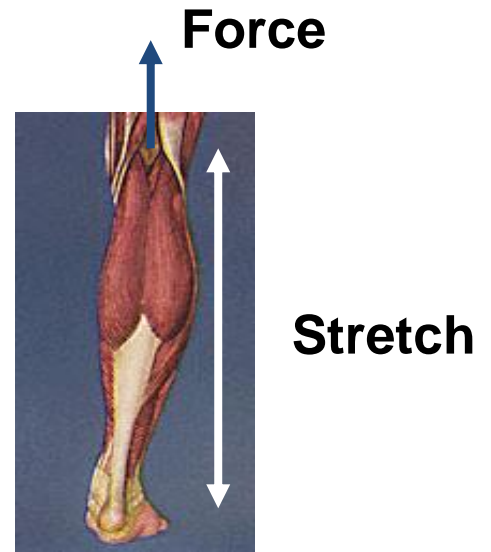
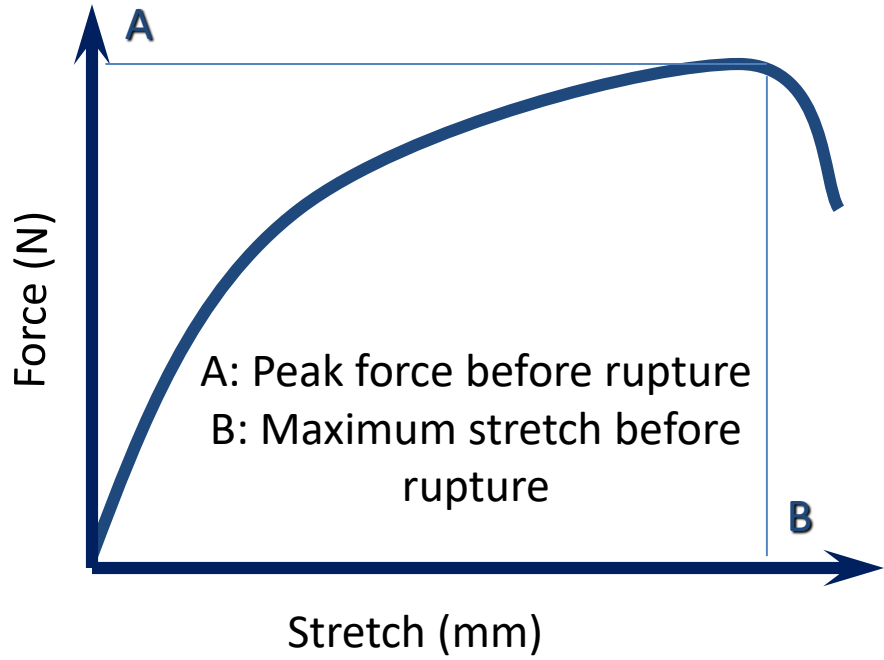
1a. Pre-exercise warm up

1. Increase body (muscle) temperature by 1°C
2. Active (muscle action) vs. passive (apply heat)
3. General (whole body) vs. local (in muscle / tendon)
4. Does warm-up reduce injury risk?
5. Does warm-up affect sports performance?



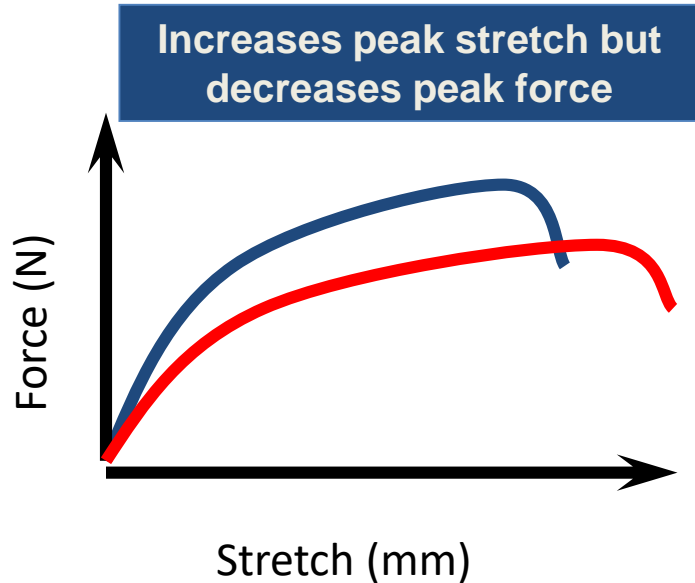
Soft tissue strain injury

Measurements in laboratory - force vs stretch

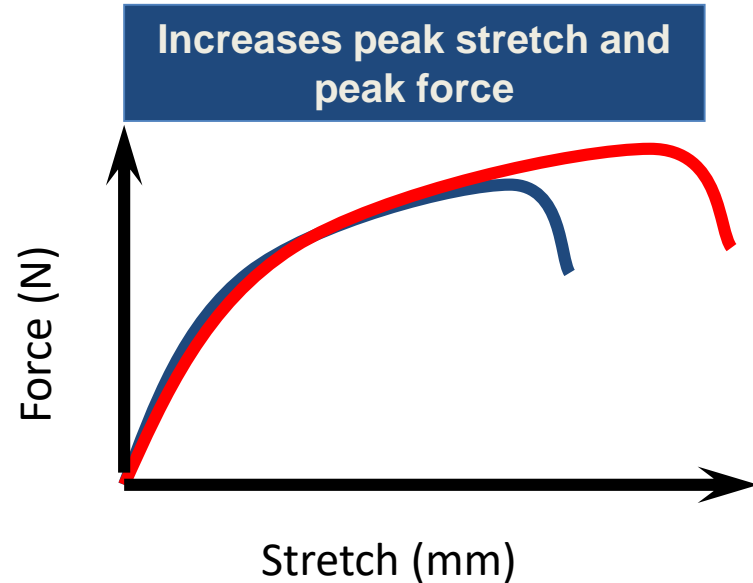


Does pre-contraction warm-up influence the mechanical properties of a muscle (in a laboratory)?

Passive warm-up



Active warm-up



Evidence: Pre-exercise warm-up and injury prevention

1. Very little scientific data
2. Difficult to isolate effects of warm-up (increased tissue temperature) alone
3. Muscle contraction that increases tissue temperature is associated with other effects (muscle contraction, neuromuscular control)
4. Programs combine warm-up with several other elements (e.g. strength / balance activity, stretching, neuromuscular control exercises) may be effective in the prevention some injuries

1b. Pre-exercise stretching

1. Types of stretching (Static, Ballistic, PNF)
2. Is there an “optimum” joint ROM?
3. Does pre-exercise stretching reduce injury risk?
4. Does pre-exercise stretching affect performance?



Types of stretching

1. Ballistic stretching
2. Static stretching
Stretch the muscle, hold it for a time period, and repeat the stretch at regular intervals
3. Assisted stretches
Proprioceptive neuromuscular facilitation-PNF, neural



Evidence: Pre-exercise stretching and injury prevention

1. Pre-exercise stretching session does not prevent the most common injuries
2. Stretching is not harmful and if an athlete likes to stretch they can continue (? Effect on performance)



Does pre-exercise warm-up / stretching affect performance?

(Effects of timing before activity)

	Stretch (immediately before)	Stretch (30 min before)	Active warm-up (immediately before)	Active warm-up (30 min before)	Stretch and warm-up (immediately before)	Stretch and warm-up (30 min before)
Agility	-	-	-	-	✓	✓
Sprint	-	-	X	X	-	X
Vertical jump	-	-	-	-	-	-

2a. Regular training and injury prevention

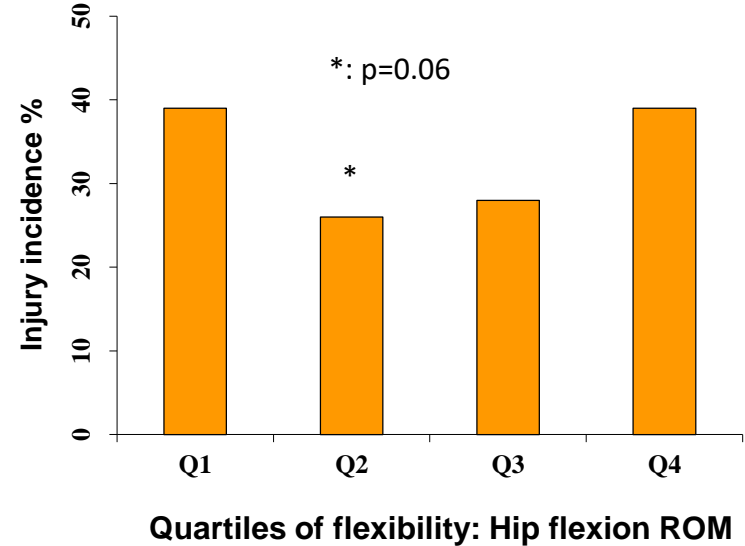
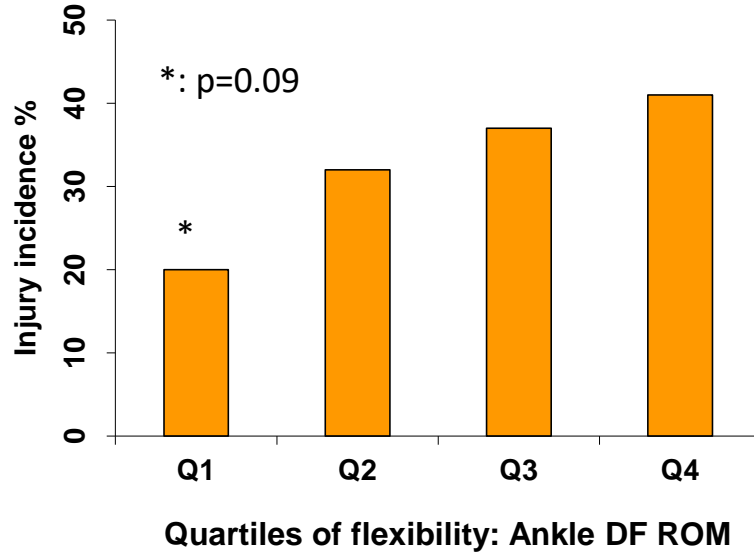
Stretching (flexibility training)

Summary

1. Usually is part of a multi-component exercise routine - not isolated
2. PNF stretching is preferred if ROM is required in a very inflexible muscle
3. Static stretching: 3 stretches held for 30 seconds
4. Stretch 3 times per day (high risk inflexible areas)
5. General muscular active warm up and then stretch
6. Stretch a relaxed muscle

Is there a relationship between joint ROM and injury risk?

Is it joint specific?



2b. Regular training and injury prevention (Proprioception training)

Summary

1. Usually consists of balance training
2. Most data on ankle sprains
3. Main results: Effective in preventing ankle sprains
4. Also studied wrt general lower limb injuries, knee and ACL injuries – not as effective



2c. Regular training and injury prevention

Muscle strength (endurance) training

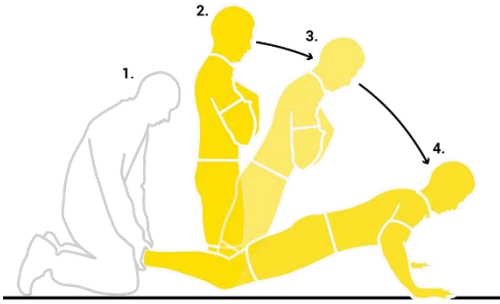
Summary

1. General vs. sports specific
2. Examples of sport specific muscle strength programs
 - Walking / jogging: Hip / pelvic, core muscle strength
 - Sprinting: Hamstring eccentric muscle strength
 - Jumping landing sports: Ankle, knee, hip stabilizer
 - Sprinting / cutting: Hamstring and groin muscle eccentric strength
 - Cricket bowling / throwing / overhead sports: Core stability, shoulder

Regular training and injury prevention

Muscle strength (endurance) training

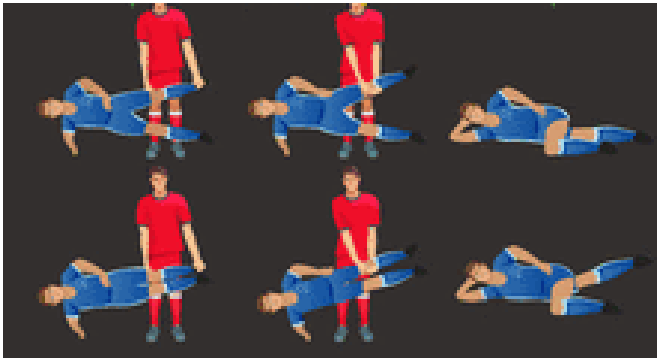
Nordic hamstring eccentric strength



Hip, pelvic and core stability muscle strength



Groin injury prevention program



2d. Regular training and injury prevention

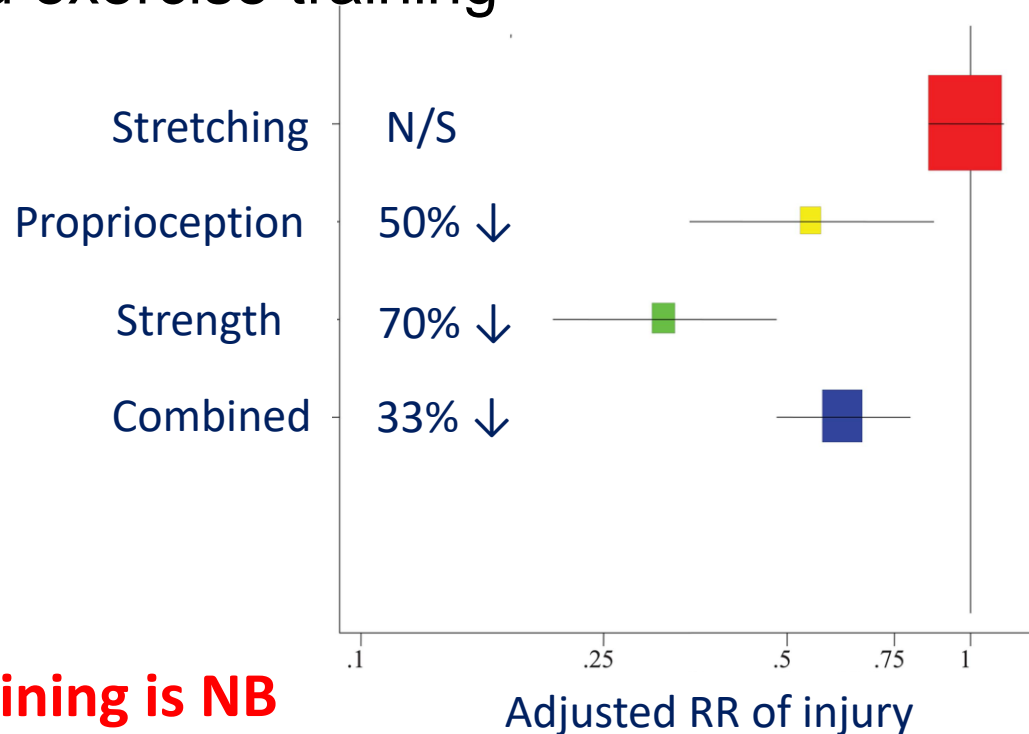
Combined exercise training

1. Systematic review and meta-analysis

2. 25 studies

3. Main findings:

- Stretching: no protective effect, RR=0.961
- **Proprioceptive training**: protective effect, RR=0.48
- **Strength training**: greatest protective effect, RR=0.315
- **Combined (multiple components)**: protective effect, RR=0.625



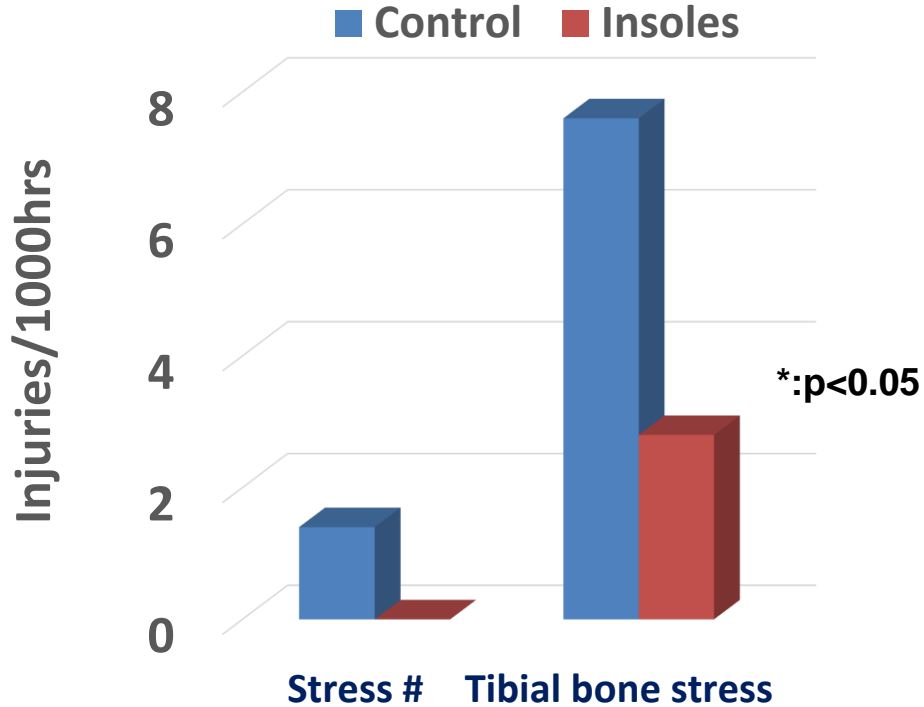
Strength and proprioception training is NB

3. Correct Sports “equipment”

Multiple examples



Does a soft “shock absorbing” insert decrease the risk of stress fractures?



Ankle braces to reduce the risk of a subsequent ankle sprain in sport

Cochrane Database of Systematic Reviews

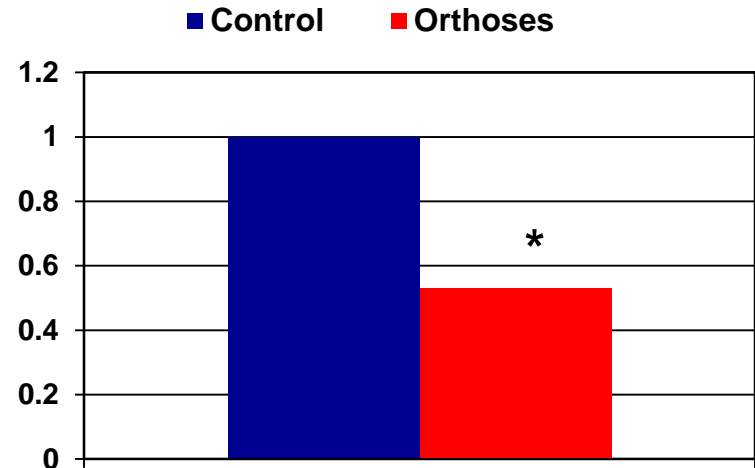


The Cochrane Library

Therapeutic recommendation: The use of an external ankle “orthoses” reduces the risk of ankle sprain in sport by > 50%

Odds Ratio of ankle sprain injury in sport

Multiple clinical trials

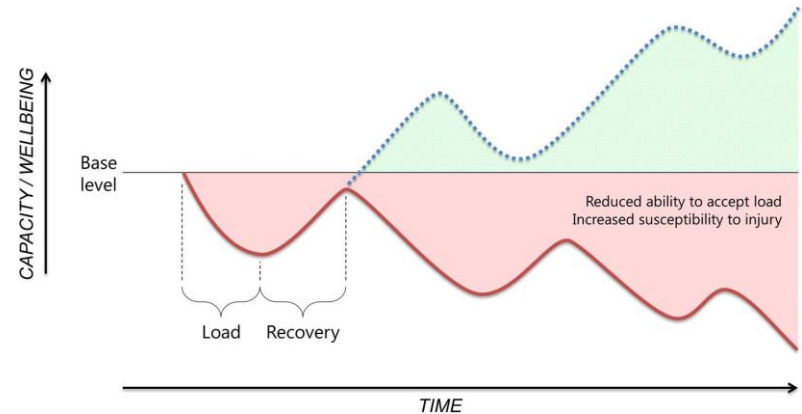
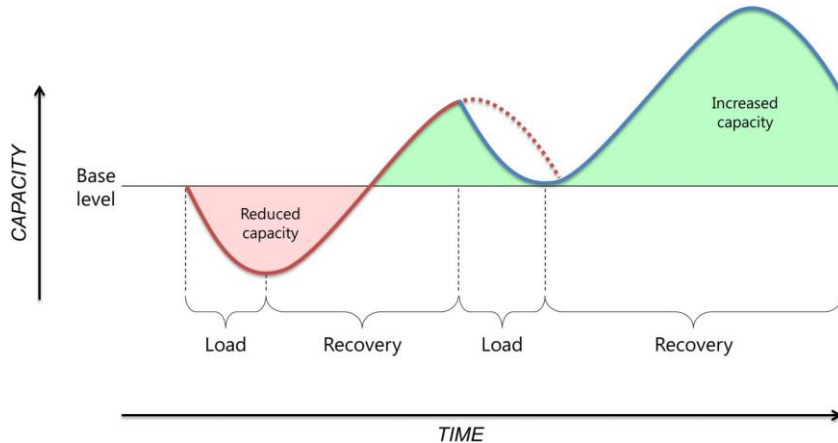


4. Training volume and progression

How much is too much? (Part 1)

International Olympic Committee consensus statement on load in sport and risk of injury

Torbjørn Soligard,¹ Martin Schwellnus,² Juan-Manuel Alonso,³ Roald Bahr,^{3,4,5} Ben Clarsen,^{4,5} H Paul Dijkstra,³ Tim Gabbett,^{6,7} Michael Gleeson,⁸ Martin Häggglund,⁹ Mark R Hutchinson,¹⁰ Christa Janse van Rensburg,² Karim M Khan,¹¹ Romain Meeusen,¹² John W Orchard,¹³ Babette M Pluim,^{14,15} Martin Raftery,¹⁶ Richard Budgett,¹ Lars Engebretsen^{1,4,17}



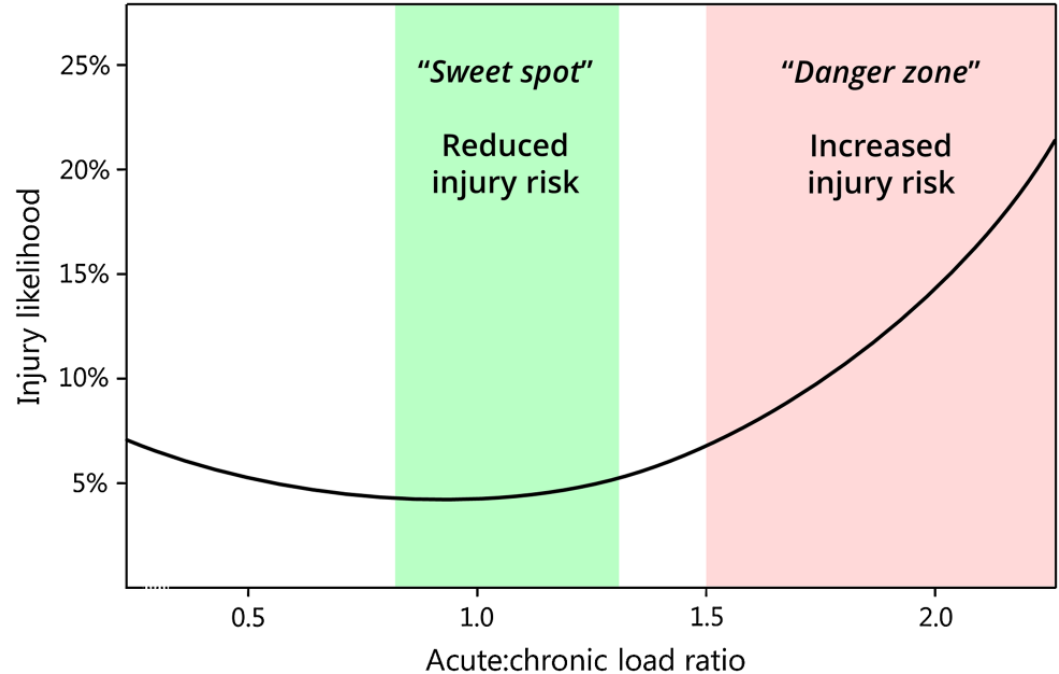
Soligard T, Schwellnus M, et al. Br J Sports Med 2016;50:1030–1041

Training volume and progression

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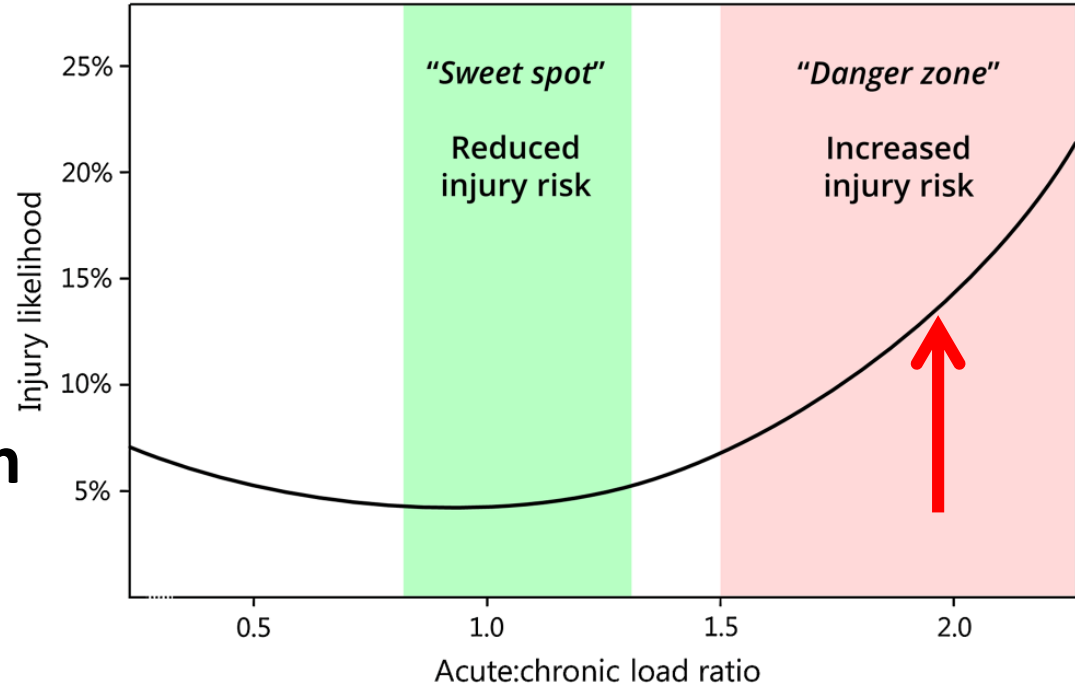


How to progress safely with exercise to reduce the risk of injury?

If your average weekly exercise time in the last 4 weeks was 20 min/ week
And you plan to increase your exercise in the next week to 40 min
Then your weekly increase (acute: chronic load ratio) = $40/20$
= 2.0

How to progress safely with training?

**A “safer” progression
is 1.2-1.5
i.e. 24-30 min in the
next week**



5. “Optimum” nutrition

Example 1: General nutrition and injury risk

Adolescents reaching daily recommendation for fish, fruit and vegetable intake

Had **64% lower risk** (OR) of injury (multiple regression model)

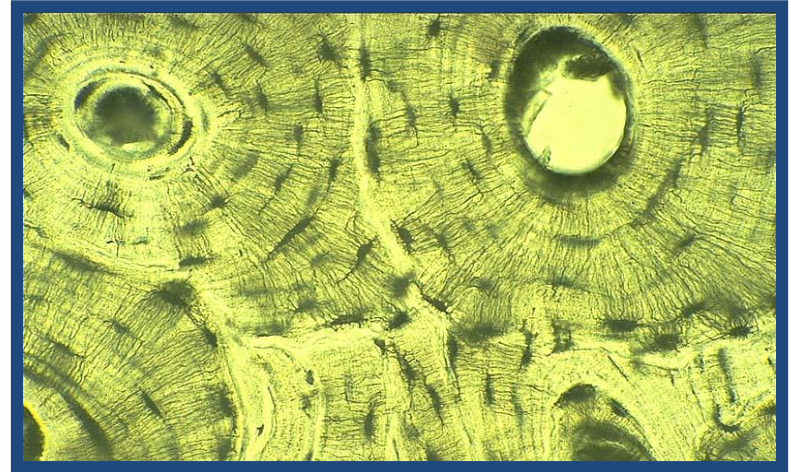


“Optimum” Nutrition

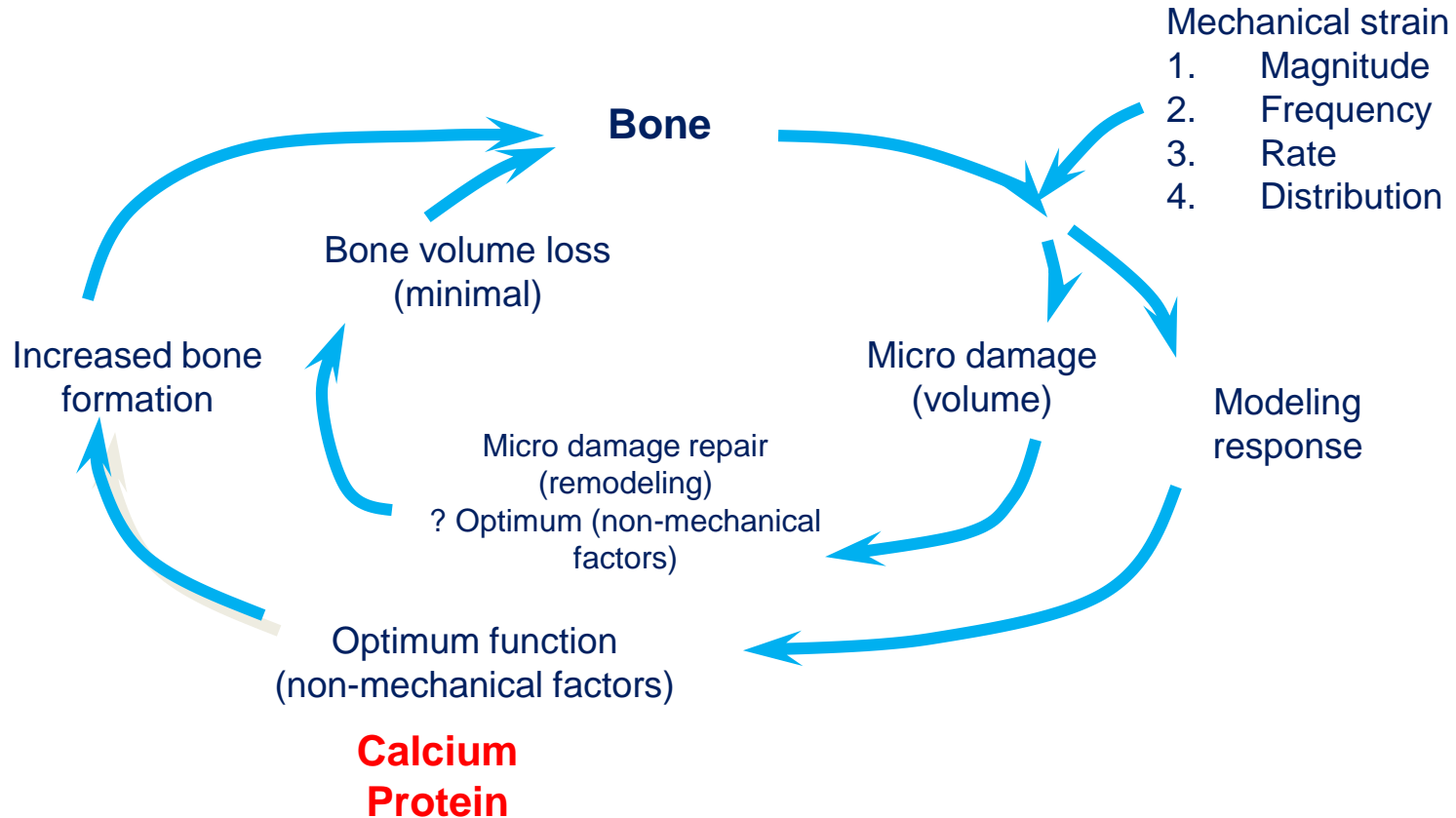
Example 2: Poor bone health

- Low calorie intake
- Low calcium intake
- Low protein intake

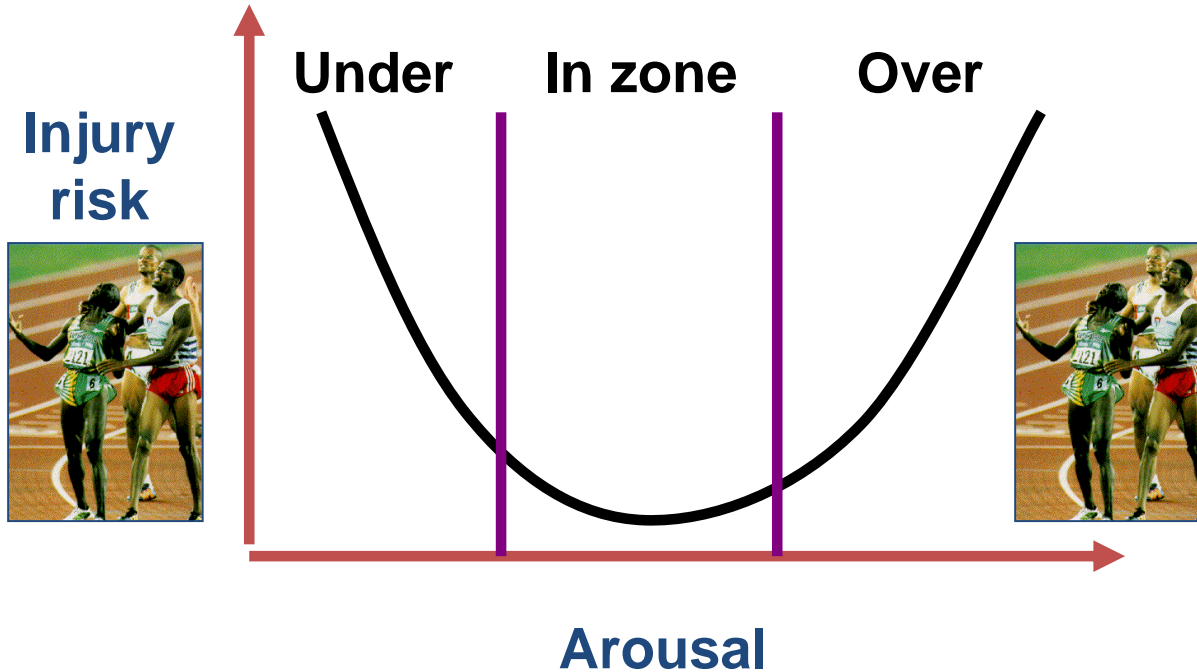
Are linked to an increased risk of bone stress injuries



Pathogenesis of bone stress injuries in athletes



6. “Optimum” psychological status



7. Drugs, chronic disease and allergies

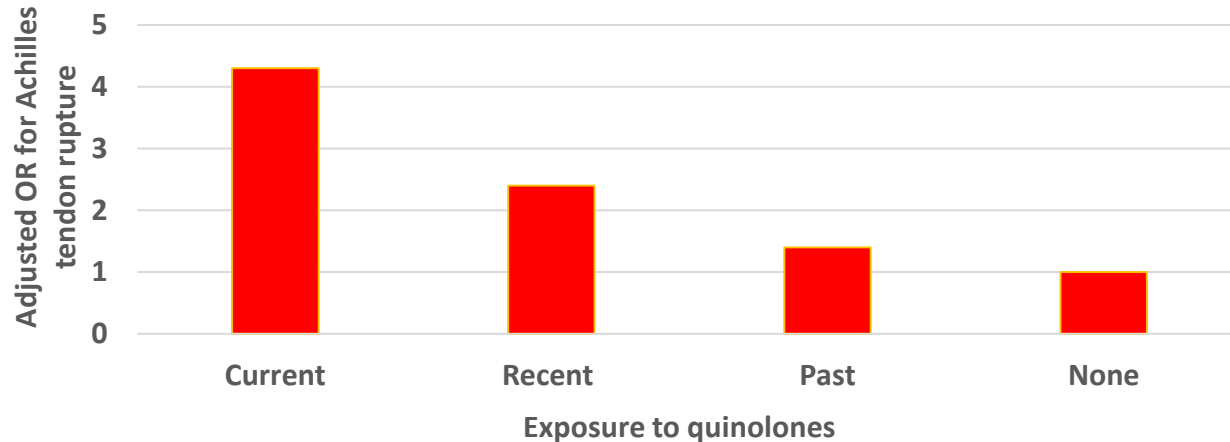
- Drugs and injury risk
- Chronic diseases and injury risk
- Allergies and injury risk

Drugs and injuries

Intrinsic risk factors for tendon injuries

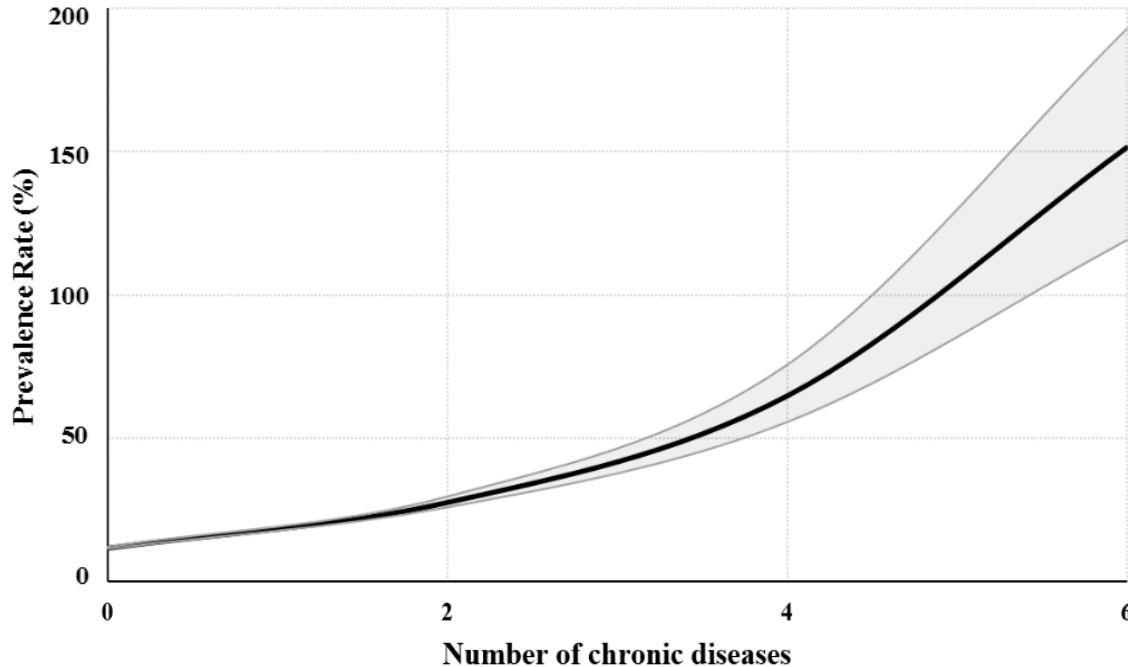
Quinolone antibiotic use

- 1367 cases of Achilles tendon (AT) rupture 50 000 control patients
- Medical history (including GPO visits, corticosteroid use, history of musculoskeletal disorders, chronic disease) and particularly antibacterial agent use and quinolone use was documented
- Adjusted Odds Ratio (OR) and 95% CI for AT rupture



Chronic disease and injuries

A history of chronic disease as an independent risk factors associated with RRIs in 56km race entrants

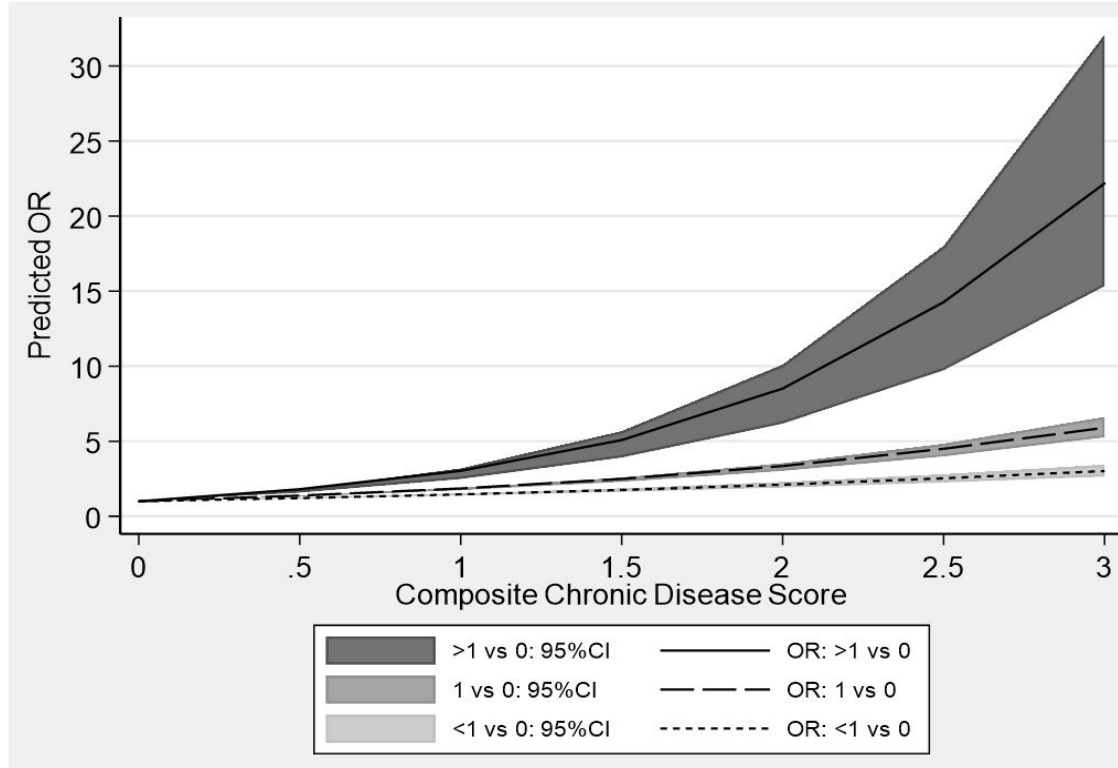


Higher chronic disease composite score

For every two additional chronic diseases (PR=2.05 times increase risk of RRI) ($p < 0.0001$)

Chronic disease and injuries

Independent risk factors associated with multiple RRIs



Higher chronic disease composite score

Increase risk of multiple RRI in high vs. very low risk category (OR=2.5 times) ($p < 0.0001$)

Allergies and injuries

Independent risk factors associated with **multiple RRIs** (multi-variate model: **75 401** consenting race entrants)

Participants

- 75 401 race entrants

Multiple RRI risk categories:

- Average number of injuries in the preceding 12 months over 4 years
- Four multiple Injury Risk (MIR) categories as follows:
 - Very Low (never injured; avg=0) (n=64 825; 86%)
 - Low (avg<1) (n=5240; 6.9%)
 - Intermediate (avg=1) (n=5035; 6.7%)
 - High (avg>1) (n=301; 0.4%)

Independent risk factors associated with “high” risk of multiple RRIs:

- **Running for >20years**: OR=2.5 (95%CI:1.7–3.7; p<0.0001)
- History of **chronic disease** (composite score; CCDS=1: OR=2.4 (95%CI:2.2–2.6; p<0.0001)
- History of **allergies**: OR=4.5 (95%CI:3.4–6.1; p<0.0001)

Summary:

Prevention of exercise-related injuries

1. Exercise-related injury risk can be reduced – on average by 50%
2. Identifying risk factors for exercise-related injury must be part of counselling to promote physical activity
3. Once individual risk factors are identified, principles of injury prevention can be explored
4. Designing an individualized injury prevention program should be part of the exercise prescription for health(exercise is medicine)

Thank you for your attention

Questions?