Prevention of Pediatric Overuse Injuries

Tamara C. Valovich McLeod, PhD, ATC, FNATA
John P. Wood, D.O., Endowed Chair for Sports Medicine

Professor and Director, Athletic Training Programs
Research Professor, School of Osteopathic Medicine in Arizona
Director, Athletic Training Practice-Based Research Network

Overview

- Pediatric sports participation and overuse injuries
- Role of sports medicine professionals
- Position/Consensus Papers
- Recommendations
- Conclusions

Sports Participation

- ~30 million children and adolescents participating in organized sports in the US (Hergenroder, 1998; NIH, 1992)
- 2014-2015 school year = 7,807,047 high school students participating in interscholastic athletics (NFHS, 2006, 2011, 2015)
  - 4,519,312 males and 3,287,735 females
  - Over half of all enrolled students are competing in high school activities

Enhanced physical and psychosocial development

+ Cardio-respiratory fitness	+ Blood lipids	+ Selected psychological measures	+ Body comp	+ Bone mineral density

Establish good health habits at an early age

Bigger, faster, stronger: The rising cost of youth sports

Rob Carr/Getty Images

Costs for youth sports set to spiral ... again

Kelley Holland | @KKelleyHolland

SFGATE http://www.sfgate.com/sports/article/Paying-to-play-is-new-normal-for-youth-athletes-4902034.php

The New York Times | http://nyti.ms/1Cw02Bv

YOUR MONEY

The Rising Costs of Youth Sports, in Money and Emotion

JAN. 16, 2015

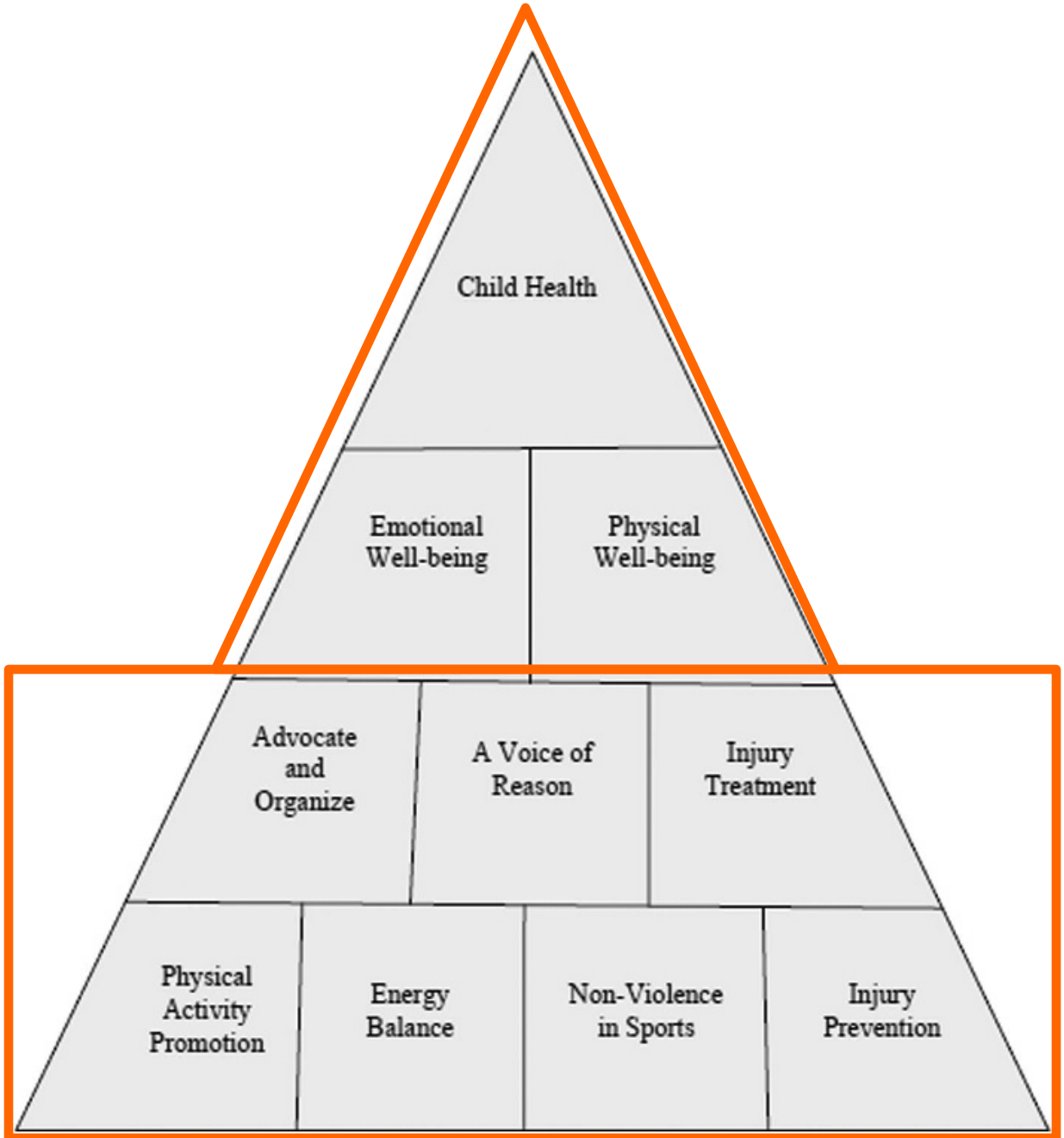
Wealth Matters

By **PAUL SULLIVAN**

...e as we sat
...e. My son kept
...e other sport.

...o pick one
...her spot on

The Pyramid of Sports Medicine and Child Health



Stovitz, *BJSM*, 2010

Long-Term Athletic Development

Long-term athletic development pathways should accommodate for the highly individualized and non-linear nature of the growth and development of youth
Youth of all ages, abilities and aspirations should engage in long-term athletic development programs that promote both physical fitness and psychosocial wellbeing
All youth should be encouraged to enhance physical fitness from early childhood, with a primary focus on motor skill and muscular strength development
Long-term athletic development pathways should encourage an early sampling approach for youth that promotes and enhances a broad range of motor skills
Health and wellbeing of the child should always be the central tenet of long-term athletic development programs

Long-Term Athletic Development

Youth should participate in physical conditioning that helps reduce the risk of injury to ensure their on-going participation in long-term athletic development programs
Long-term athletic development programs should provide all youth with a range of training modes to enhance both health- and skill-related components of fitness
Practitioners should use relevant monitoring and assessment tools as part of a long-term physical development strategy
Practitioners working with youth should systematically progress and individualize training programs for successful long-term athletic development
Qualified professionals and sound pedagogical approaches are fundamental to the success of long-term athletic development programs

Pediatric Sport-Related Injury

- >3 million injuries annually that cause time lost from organized sport (Hergenroeder, 1998)
  - More than 35% of all medical visits in 5-17 year olds and
  - More than 20% of all emergency department visits in 5-24 year olds
  - Estimated cost (1996) of these visits was over **$1.3 billion** annually
- 12 million student athletes between the ages of 5-22 will suffer a sports related injury this year (Janda, 2004)
  - Resulting in **20 million** lost days of school

Overuse Injuries

- 52% of injuries presenting to a sports medicine center were overuse injuries
  - Tennis, swimming, soccer, dance, track, runner, gymnastics, and cheerleading
- Females higher rate (63% vs. 40%)
- Males on team sports 5.3x higher rate of overuse than non-team sports
- High-overuse sport = 10x male and 3.6x female risk for overuse

Stracciolini, CJSM, 2015

Overuse Injuries

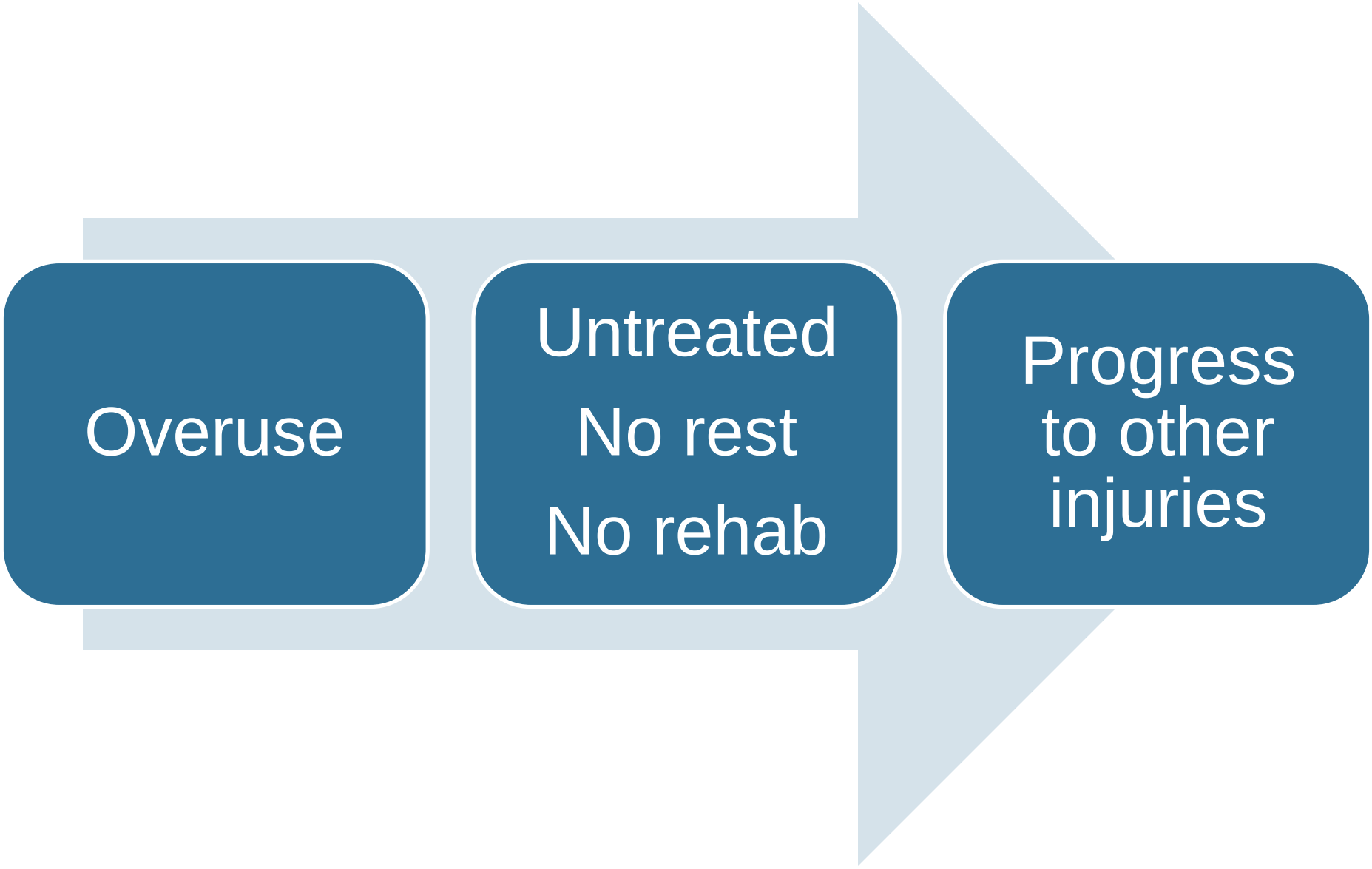
	Overuse	Traumatic
Females	**62.5%**	37.5%
Males	41.9%	**58.2%**

	Upper Extremity	Spine	Lower Extremity
Females	15.1%	**11.3%**	**65.5%**
Males	29.8%	8.2%	53.7%

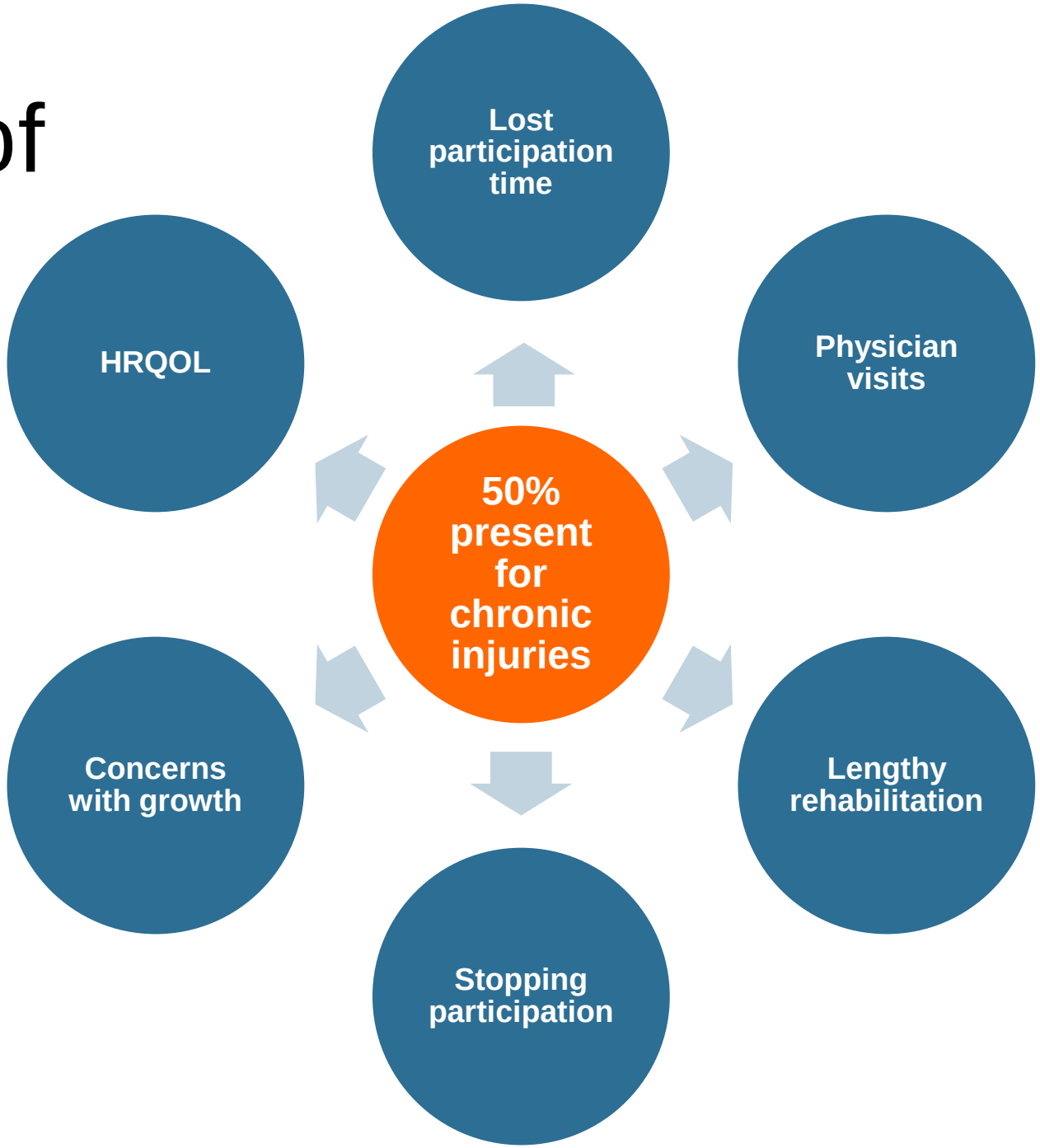
Stracciolini, AJSM, 2014

- Children (5-12) vs. Adolescents (13-17)
  - Children more traumatic (UE)
  - Adolescents more overuse (54.5% vs. 49.2%)

Stracciolini, AJSM, 2013


Overuse
Untreated
No rest
No rehab
Progress to other injuries

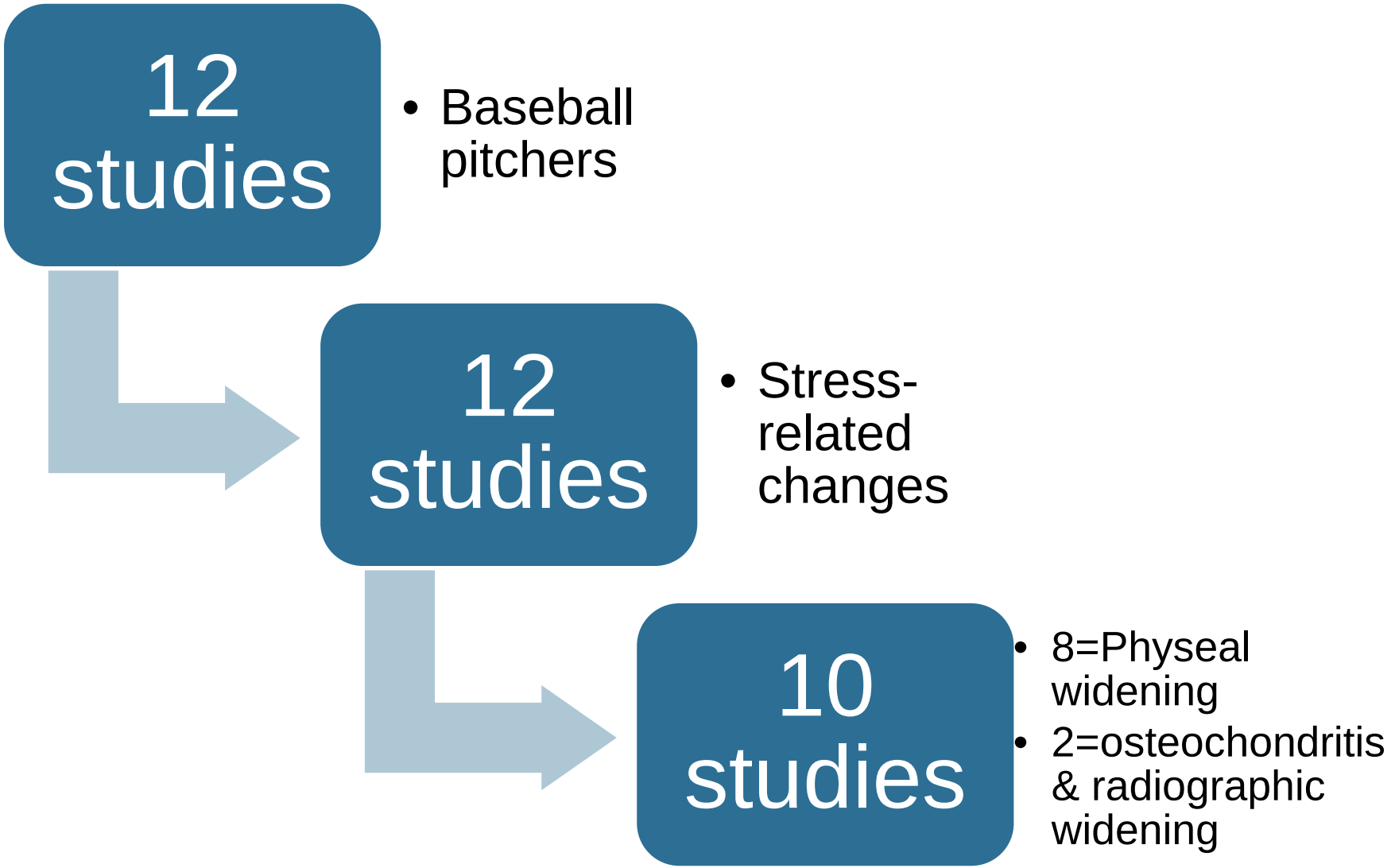
The Downside of Injuries



Growth and Development

- Children and adolescents physiologic status is defined by growth
  - Onset of puberty occurs at ~ 10.5 years for girls and ~ 12.5 years for boys
- Injuries in this age group occur in patterns distinct from adults
- Due to growth, may be susceptible to overuse injuries

Physeal Injuries



Caine, *BJSM*, 2006

Dropping Out

- 8% annual drop out rate from sports due to injuries in Australia (Grimmer, 2000)
- Elbow OCD in elite female gymnasts (Jackson, 1989)
  - Only one still participating after 3 yr follow-up
- Gymnasts with spine injury (Katz, 2003)
  - All ceased or reduced participation due to back pain
- Athletes with ACL injury retire from active participation at a higher rate than athletes without this injury (Thelin, 2006)

Overtraining - Burnout

TABLE 6. Symptoms of Overtraining Syndrome/ Burnout[180,187,188]

Fatigue	Insomnia	Loss of appetite
Depression	Irritability	Weight loss
Bradycardia or tachycardia	Agitation	Lack of mental concentration
Loss of motivation or interest	Decreased self-confidence	Heavy, sore, stiff muscles
Hypertension	Anxiety	Restlessness
Sleep disturbances	Nausea	Frequent illness

(DiFiori, *CJSM,* 2014)

TABLE 7. Diagnosis of Overtraining Syndrome/Burnout[180,192]

History

- Decreased performance persisting despite weeks to months of recovery
- Disturbances in mood
- Lack of signs/symptoms or diagnosis of other possible causes of underperformance
- Lack of enjoyment participating in sport
- Inadequate nutritional and hydration intake

Presence of potential triggers: (a) increased training load with adequate recovery, (b) monotony of training, (c) excessive number of competitions, (d) sleep disturbance, (e) stressors in family life (parental pressure), (f) stressors in sporting life (coaching pressure and travel demands), (g) previous illness.

Testing (if indicated by history)

- Consider laboratory studies: complete blood count, comprehensive metabolic panel, erythrocyte sedimentation rate, C-reactive protein, iron studies, creatine kinase, thyroid studies, cytomegalovirus and Ebstein-Barr virus titers.
- Profile of Mood States (POMS): A psychometric tool for a global measure of mood, tension, depression, anger, vigor, fatigue, and confusion.[169]

(DiFiori, *CJSM,* 2014)

How Does Recent Sport-Related Injury Affect HRQOL?

- Adolescents with a self-reported recent injury demonstrated lower HRQOL compared to their uninjured peers
  - Physical functioning
  - Pain
  - Social functioning
  - Global HRQOL
- Indicate injuries affect areas outside the expected physical component of health

(Valovich McLeod, *J Athl Train.* 2009)


YOUTH SPORTS SAFETY
ALLIANCE


STOP
SPORTS
INJURIES


THE ASPEN INSTITUTE


YOUTH SPORTS
NATIONAL
SAFETY
FOUNDATION


National Youth Sports
Health & Safety Institute
AMERICAN COLLEGE OF SPORTS MEDICINE
SANFORD


SAFE
KIDS
WORLDWIDE

Journal of Athletic Training 2011;46(2):206–220

www.nata.org/jat

National Athletic Trainers' Association Position Statement: Prevention of Pediatric Overuse Injuries

Tamara C. Valovich McLeod, PhD, ATC*; Laura C. Decoster, ATC†; Keith J. Loud, MDCM, MSc‡; Lyle J. Micheli, MD§; J. Terry Parker, PhD, ATC‖; Michelle A. Sandrey, PhD, ATC¶; Christopher White, MS, ATC#

POSITION STATEMENT

Overuse Injuries and Burnout in Youth Sports: A Position Statement from the American Medical Society for Sports Medicine

John P. DiFiori, MD, Holly J. Benjamin, MD,† Joel Brenner, MD, MPH,‡ Andrew Gregory, MD,§ Neeru Jayanthi, MD,¶ Greg L. Landry, MD,‖ and Anthony Luke, MD, MPH***

(*Clin J Sport Med* 2014;24:3–20)

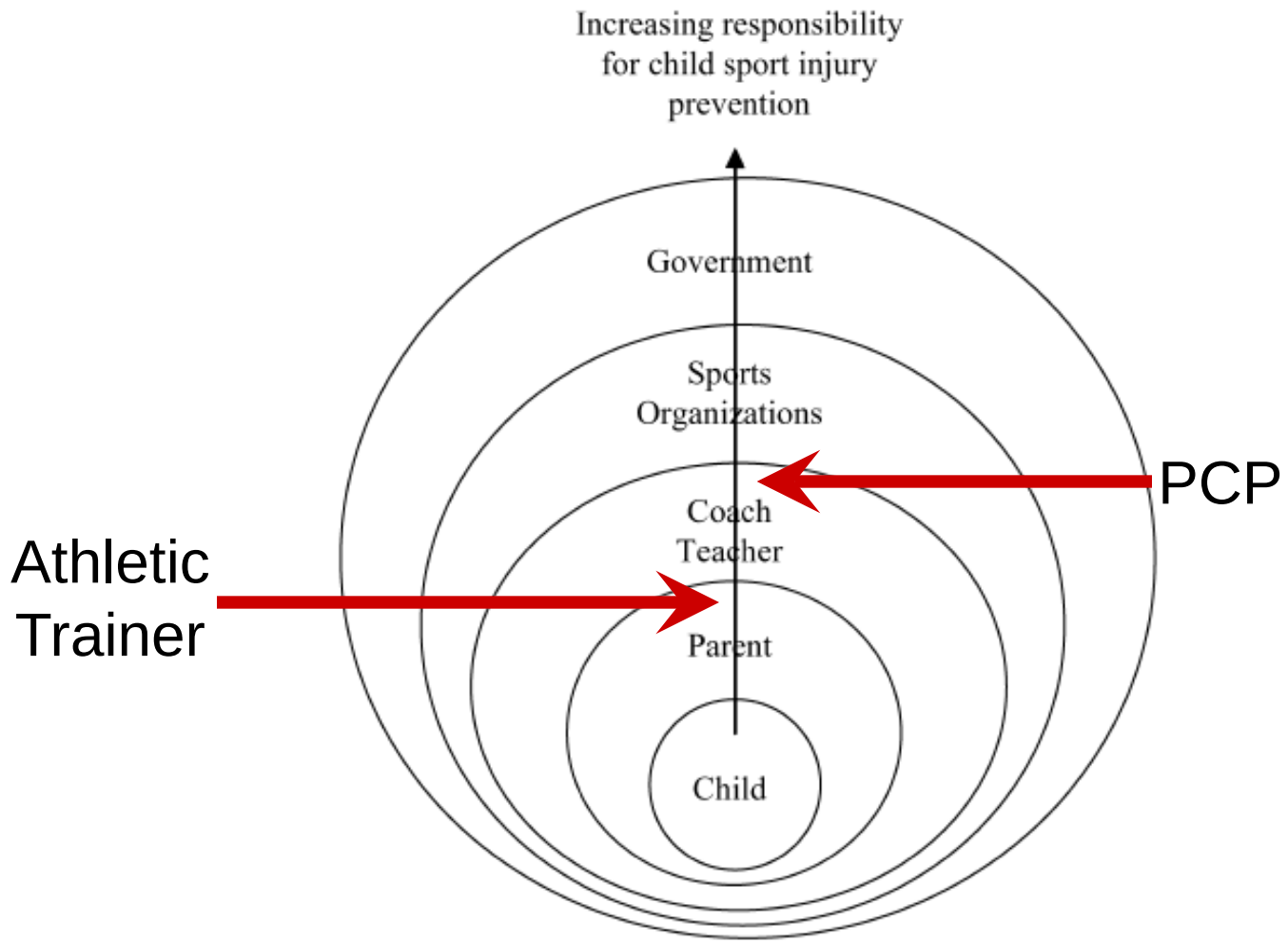


FIGURE 1. Responsibility hierarchy for child sport injury-prevention based on potential influence.

(Emery et al, 2006)

Overuse Injuries

- Growth-related
  - Apophyseal injuries
- Repeated microtrauma
  - Chronic submaximal loading of tissue
  - Stress fractures
  - Tendinopathies
- Combined mechanisms

- Repetitive submaximal loading when rest is not adequate for adaptation to take place
- Muscle-tendon unit, bone, bursa, NV, physis
- Apophyseal and physeal stress injuries unique to youth athlete

Valovich McLeod, JAT, 2011

DiFiori, CJSM, 2013

High Vs. Low Risk

- High Risk
  - Can result in significant time loss
  - Stress fx
  - Physeal stress injuries
  - OCD
  - Apophyseal injuries
  - Effort thrombosis (TOC)

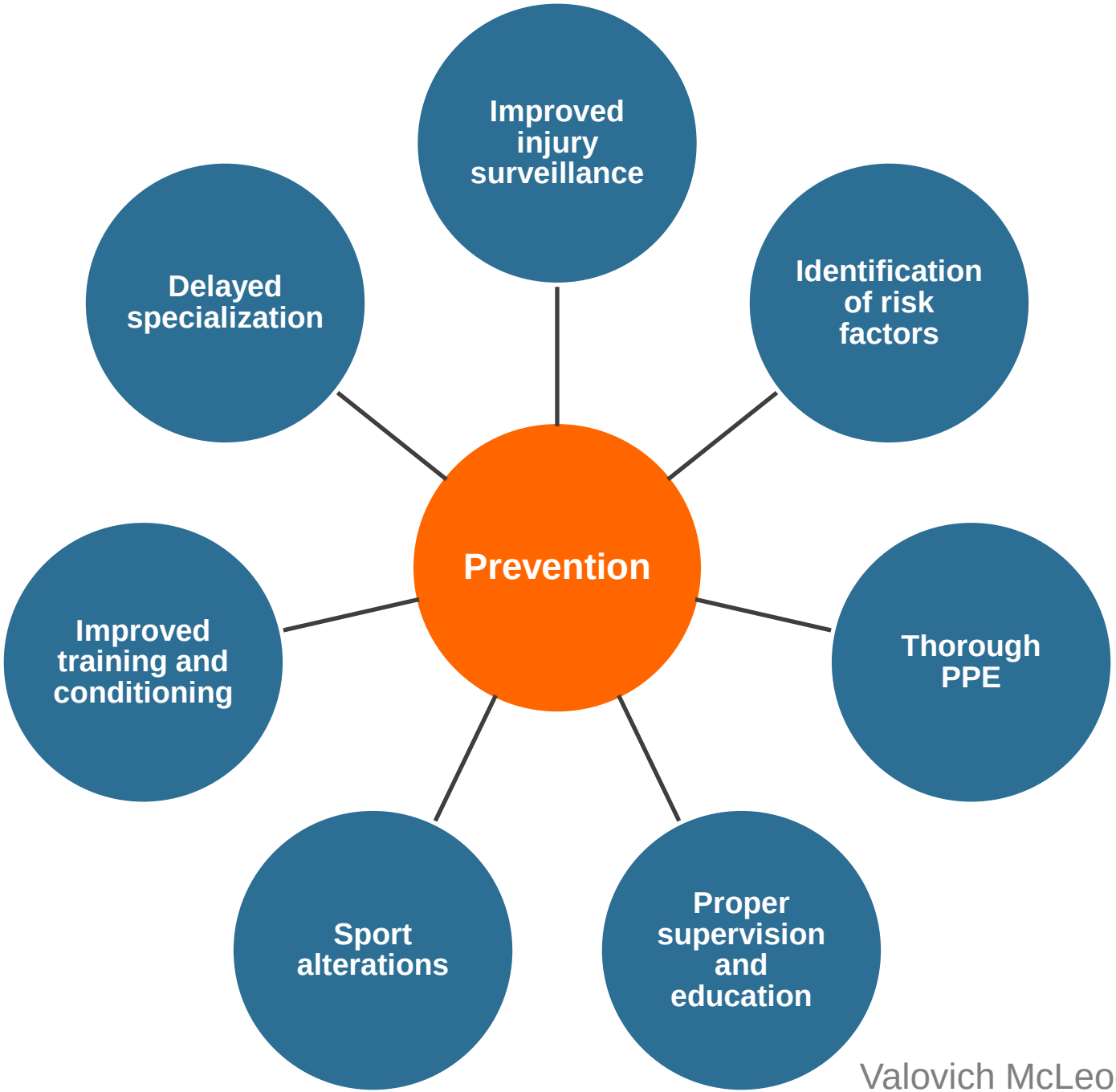
TABLE 3. High-Risk versus Low-Risk Overuse Injuries

Location	High Risk	Low Risk
Hip/Pelvis	Femoral neck (tension-sided)	Femoral shaft stress fracture
Back (lumbar spine)	Pars interarticularis stress fracture	Congenital spondylolysis, pedicle stress fracture
Leg	Anterior cortical tibial stress fracture	Medial tibial stress fracture, fibular shaft stress fracture
Ankle	Medial malleollar stress fracture, talar dome osteochondral defect, talar neck stress fracture	Distal fibular stress fracture
Foot	Tarsal navicular stress fracture, fifth metatarsal proximal diaphyseal stress fracture, sesamoid stress fracture	Second, third, fourth metatarsal stress fractures, cuboid
Knee	Patellar stress fracture, osteochondritis dissecans of femoral condyle or patella	Tibial tubercle and inferior patellar pole apophysitis
Shoulder/arm	Effort thrombosis	Proximal humeral physeal stress fracture
Elbow	Osteochondral dissecans capitellum, apophyseal non-union of medial epicondyle	Medial epicondyle apophysitis
Wrist	Distal radial physeal stress injury	

DiFiori, CJSM, 2013

Preventative Approach

- Advocated by several prominent sports and healthcare organizations
  - American College of Sports Medicine (1993)
  - World Health Organization, International Federation of Sports (1998)
  - American Academy of Pediatrics (2007)
  - International Olympic Committee (2008)
    - **50%** of overuse injuries in active children and adolescents are ***preventable*** (Smith et al, 1993)



Valovich McLeod, JAT, 2011

Injury Surveillance

- Improved understanding of prevalence, incidence and economic cost
- Increased funding and support
- Participation in surveillance efforts by all athletic healthcare providers
- Development of resources and training improved surveillance

EC= C

(Mountjoy, 2008; FIMS, 1998; Almquist, 2008; DiFiori, 2013)

Preparticipation Physical Examination

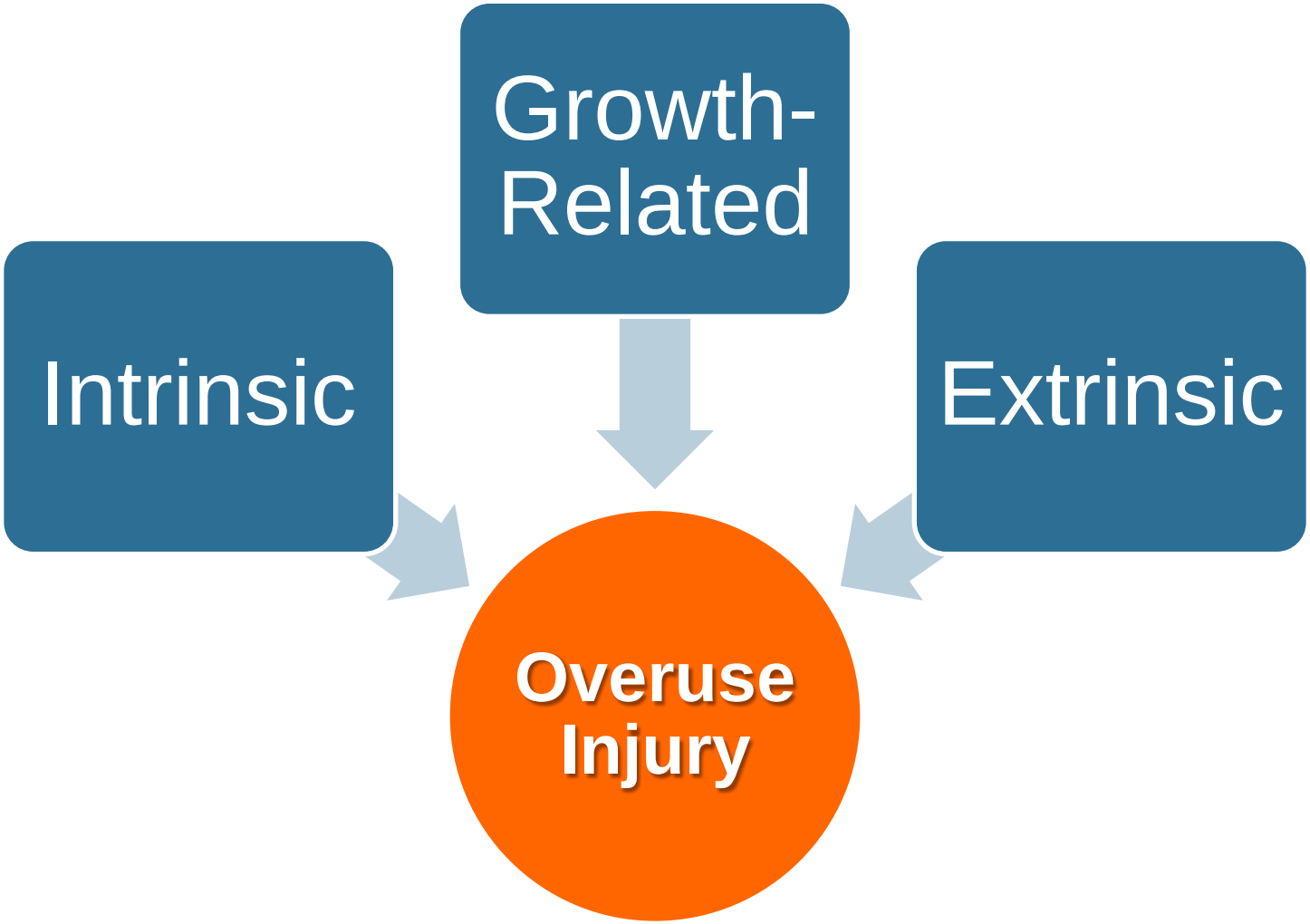
- Screening process
  - Injury history
  - Risk factors
  - Stature/maturity
  - Joint stability
  - Strength
  - Flexibility

Identification of Risk Factors

EC= C

(ACSM, 1993; Dalton, 1992; Hergenroeder, 1998; Caine, 2006; PPE Working Group, 2005)

Risk Factors for Overuse Injuries



Growth-Related Risk Factors

- Growth plate cartilage
- Growth spurt
- Age
- Height
- Tanner stage