



# The ACL Injury Crisis in Youth Soccer: What can Coaches and Program Leaders Do?

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Aspen Institute | Sports & Society



National ACL Injury Coalition

Learn more at  
*[As.pn/aclcoalition](https://as.pn/aclcoalition)*



# ASPEN INSTITUTE SPORTS & SOCIETY

[projectplay.org](https://projectplay.org)



THOUGHT  
LEADERSHIP



RESEARCH



CONVENING

**PLAYER**



**LEARNING SPECIALIST**



**COACH**



**RESEARCHER**



**COACH DEVELOPER**



**ADVOCATE**

# National ACL Injury Coalition

As ACL injuries mount, Hospital for Special Surgery (HSS) and Aspen Institute partner with experts and sport organizations to keep youth on the field and active for life



Learn more  
***[As.pn/aclcoalition](https://As.pn/aclcoalition)***





## CRISIS



**Life changing  
injury on the rise  
in teens athletes**

## RISK



**Soccer:  
Greatest risk of  
non-contact ACL's**

## SOLUTIONS



**Start with  
Neuromuscular  
Training**

## ISSUE



**We're not  
doing the  
exercises**



**National ACL Injury Coalition**

Learn more at  
***As.pn/aclcoalition***

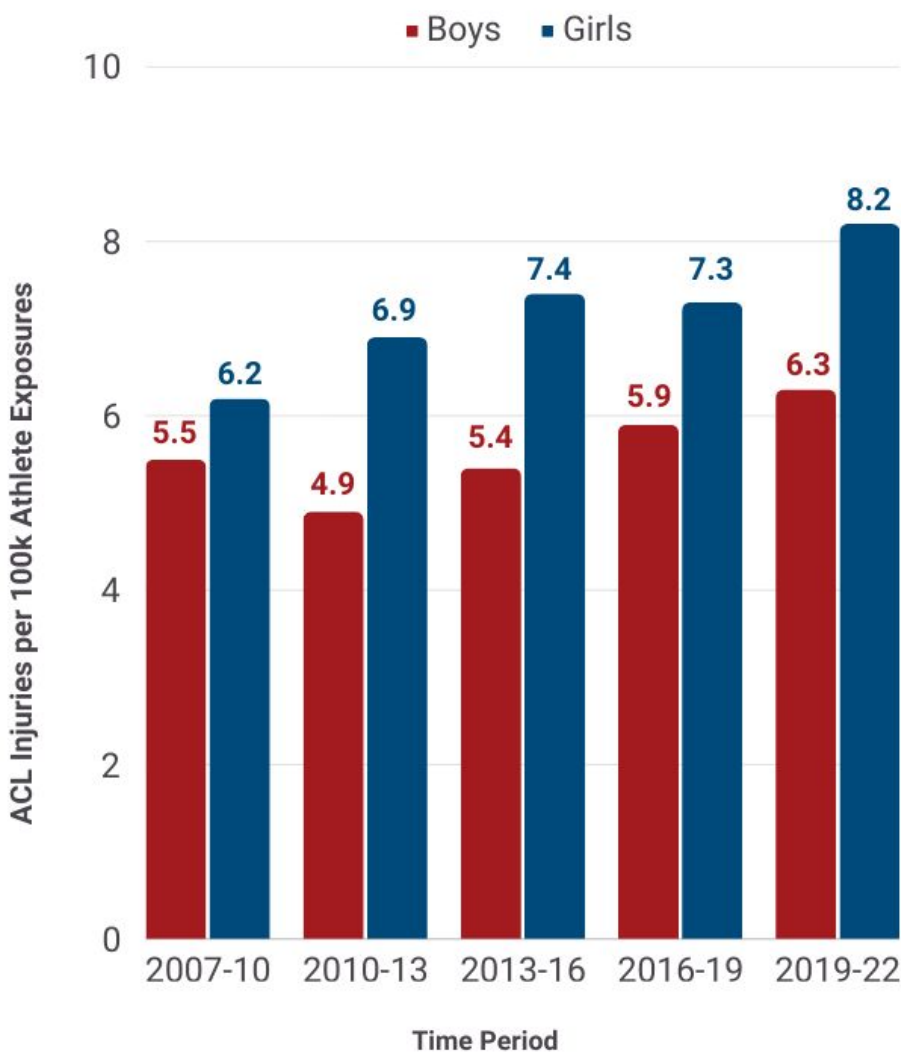


# THE STATE OF ACL INJURY



**+26%**

**GROWTH IN ANNUAL ACL INCIDENCE RATE SINCE 2007  
AMONG HIGH SCHOOL ATHLETES**



## AVERAGE ANNUAL ACL INJURY RATE

This High School RIO data shows the average annual ACL incidence rate (per 100,000 athlete exposures) for boys and girls high school sports participants across 12 sports and five three-year periods from 2007 to 2022.



**+32%**

**GIRLS**

**+83%**

**GIRLS**  
***LACROSSE***

# ANNUAL ACL INJURY RATES

PER 100K ATHLETE EXPOSURES



3.2 GIRLS VOLLEYBALL  
2.8 SOFTBALL  
1.5 CHEERLEADING



4.2 BOYS WRESTLING  
3.0 BOYS BASKETBALL  
0.9 BASEBALL

*AN ATHLETE EXPOSURE IS DEFINED AS ONE ATHLETE PARTICIPATING IN ONE PRACTICE OR COMPETITION*

Source: High school RIO

# ACL Injury | Life changing and career threatening



- 3 in 4 require surgery
- 9-12 month recovery period
- Psych toll: Depression & Anxiety
- \$38,000 average lifetime costs
- 58% experience financial burden
- 55% return to competitive sport
- 7x greater risk of *knee replacement*

# ACL Injury | Life changing and career threatening

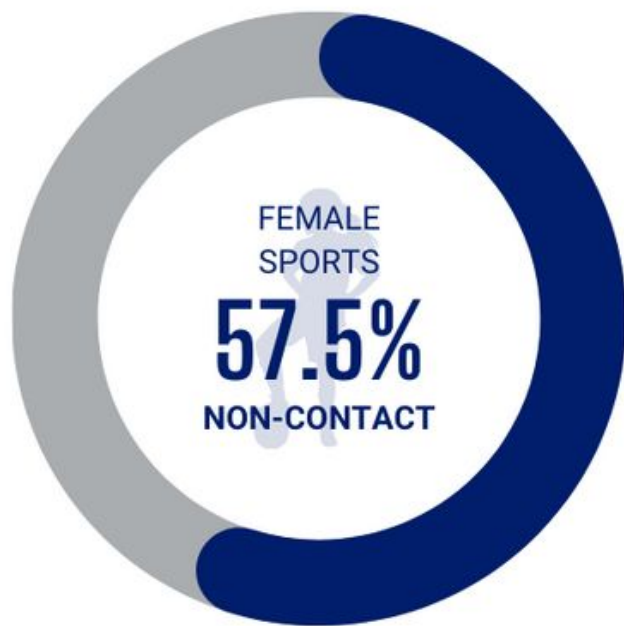
## PSYCHOLOGICAL EFFECTS

In a 2019 study, 62% of female soccer athletes quit playing two years after ACL injury due to lack of trust in reconstructed knee or fear of new injury

([Fälstrom, et al., 2019](#))



# ACL INJURY MECHANISM



Source: High school RIO







**88%**

Single Leg Squat (L)

**88%**

Single Leg Squat (R)

**79%**

Vertical jump  
loading & launch

**74%**

Vertical jump  
landing phase

## ACL Injury | Start with neuromuscular training



# ACL Injury | “Petushek Scale”

## Clinical Sports Medicine Update

### Evidence-Based Best-Practice Guidelines for Preventing Anterior Cruciate Ligament Injuries in Young Female Athletes



#### A Systematic Review and Meta-analysis

Erich J. Petushek,<sup>\*,†‡</sup> PhD, Dai Sugimoto,<sup>§,||</sup> PhD, ATC, Michael Steelmiller,<sup>§</sup> PhD, Grace Smith,<sup>\*,†‡</sup> BA, and Gregory D. Myer,<sup>§,||</sup> PhD  
Investigation performed at Michigan State University, East Lansing, Michigan, USA

**Background:** Injury prevention neuromuscular training (NMT) programs reduce the risk for anterior cruciate ligament (ACL) injury. However, variation in program characteristics limits the potential to delineate the most effective practices to optimize injury risk reduction.

**Purpose:** To evaluate the common and effective components included in ACL NMT programs and develop an efficient, user-friendly tool to assess the quality of ACL NMT programs.

**Study Design:** Systematic review and meta-analysis.

**Methods:** Study inclusion required (1) a prospective controlled trial study design, (2) an NMT intervention aimed to reduce incidence of ACL injury, (3) a comparison group, (4) ACL injury incidence, and (5) female participants. The following data were extracted: year of publication, study design, sample size and characteristics, and NMT characteristics including exercise type and number per session, volume, duration, training time, and implementer training. Analysis entailed both univariate subgroup and meta-regression techniques using random-effects models.

**Results:** Eighteen studies were included in the meta-analyses, with a total of 27,231 participants, 347 sustaining an ACL injury. NMT reduced the risk for ACL injury from 1 in 54 to 1 in 111 (odds ratio [OR], 0.51; 95% CI, 0.37-0.69). The overall mean training volume was 18.17 hours for the entire NMT (24.1 minutes per session, 2.51 times per week). Interventions targeting middle school or high school-aged athletes reduced injury risk (OR, 0.38; 95% CI, 0.24-0.60) to a greater degree than did interventions for college- or professional-aged athletes (OR, 0.65; 95% CI, 0.48-0.89). All interventions included some form of implementer training. Increased landing stabilization and lower body strength exercises during each session improved prophylactic benefits. A meta-regression model and simple checklist based on the aforementioned effective components (slope = -0.15,  $P = .0006$ ; intercept = 0.04,  $P = .51$ ) were developed to allow practitioners to evaluate the potential efficacy of their ACL NMT and optimize injury prevention effects.

**Conclusion:** Considering the aggregated evidence, we recommend that ACL NMT programs target younger athletes and use trained implementers who incorporate lower body strength exercises (ie, Nordic hamstrings, lunges, and heel-calf raises) with a specific focus on landing stabilization (jump/stop and hold) throughout their sport seasons.

**Clinical Relevance:** Clinicians, coaches, athletes, parents, and practitioners can use the developed checklist to gain insight into the quality of their current ACL NMT practices and can use the tool to optimize programming for future ACL NMT to reduce ACL injury risk.

**Keywords:** neuromuscular training; pediatric sports medicine; injury prevention; biomechanics; decision support

Knee injuries are the most common severe<sup>13</sup> and season/career-ending sport injury.<sup>7,†</sup> The anterior cruciate ligament

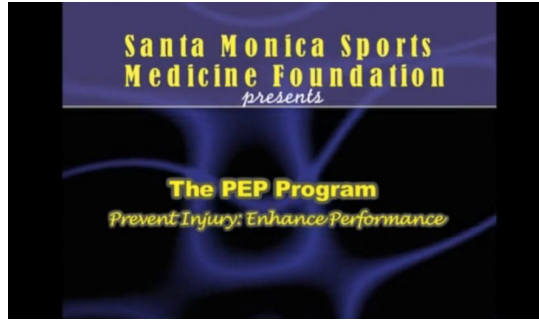
(ACL) sustains the majority of these traumatic knee injuries, and surgical reconstruction is the common treatment approach (ie, 80%).<sup>14</sup> One ACL injury currently costs \$38,000, which includes long-term costs; thus, the economic burden to society is substantial.<sup>15</sup> Women's basketball, soccer, gymnastics, and lacrosse are the highest risk sports for ACL injury.<sup>30,39</sup> Women are approximately 3 times more

The American Journal of Sports Medicine  
2019;47(7):1744-1753  
DOI: 10.1177/0000000000000000  
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- Lunge(s): **1 point**
- Hamstring exercise(s): **1 point**
- Heel/calf raise(s): **1 point**
- Landing stabilization exercises: **1-5 points**
- Middle/high school athletes: **1 point**
- Pre-season → In-season: **1 point**
- Facilitator trained in ACL injury prevention: **1 point**



# ACL Injury | Start with neuromuscular training



- Investigation of ACL Prevention began mid-90s
- **Key finding: Simple exercises done regularly significantly reduce risk of non-contact ACL injury**
- Improve lower body strength & control  
Refine movement patterns  
Reduce force of ground impact
- 30-60 min/week, across 2-3 days/week



# ACL Injury | Benefits of Neuromuscular Training

## Fewer serious knee injuries

88% fewer ACL injuries for 14-18 year old female soccer athletes, and 53% fewer ACL injuries overall.

## Fewer injuries, period.

Participants report fewer knee sprains, ankle sprains, total injuries, and total days missed to injury.

## Long Term Physical Mobility

Prevent the arthritis that undermines active lifestyles into adulthood.

## Improved physical performance.

Better acceleration/deceleration ability, motor control, lower leg strength.

## Healthcare Savings.

Save thousands in medical costs for surgery and physical therapy.

## Winning (!)

Teams that implement NMT win more.

# ACL Injury | The Implementation Problem

BARRIERS to implementation		FACILITATORS to implementation	
Coaches <b>lack of confidence</b> in knowledge/ability to implement the program	Difficult / <b>confusing</b> exercises	<b>Knowledge of injury risk</b> and need for proactive action	<b>Simple integration</b> into practice schedule
Perceived <b>time burden</b>	Lack of <b>motivation</b> from athletes	<b>Knowledge</b> of programs and why/how they work	<b>Access to education</b> materials of program
Lack of <b>importance placed on injury prevention</b>	Lack of program <b>flexibility</b>	<b>Motivation</b> to complete program from coaches and athletes	Program can be <b>individualized and progressed</b> through season

**STRATEGIES**

**HOW DO WE  
GET OUR  
ATHLETES DOING  
THE EXERCISES  
PROVEN TO  
REDUCE RISK?**

- **PROTOCOLS**
- **COACH TRAINING**
- **MESSAGING**
- **INCENTIVES**
- **TOURNAMENTS**

# ACL Injury | Programs & Protocols

## WARM UP

**NSDWU at a Glance**

**PART A – STRENGTH (only in training)**

1. The Plank	20–30 sec x 2
2. Side Plank	20–30 sec x 2 each
3. Hamstrings (RDL)	5 each side
4. Balance	20–30 sec x 2 each

**PART B – RUNNING**

5. Running	2–3 x to transverse line
6. Hip Stretch and RDL	To transverse line and back
7. Butt Kicks and Skipping	To transverse line and back
8. Clinging Partner	To transverse line and back
9. Running Forwards and Backwards	To transverse line and back

**PART C – DYNAMIC PREPARATION**

10. Squats	10
11. Single Leg Squats	5 each leg
12. Lunges	5 each leg

**PART D – JUMPING AND LANDING**

13. Jump and Land	
14. Jump, Turn and Land	Do a total of 15–20 jumps. Do a variety of jumps. Ensure quality landings.
15. Lateral Prop and Land	
16. Jump, Push and Land	

**NETBALL SPECIFIC PREPARATION**

17. Prop, Prop and Stick	3 each leg
18. Change of Direction	3 x triangle shapes each side
19. Run and Stop	3 x run and stop

**NetballSmart**  
Visit [www.netballsmart.co.nz](http://www.netballsmart.co.nz) for more NetballSmart resources.

ACC SportSmart

NETBALL NEW ZEALAND

Scan the QR code for video support



**1/ Full program  
before practice**

2-3x/week  
10-15 mins/session

**2/ Abbreviated  
“Power” version  
for matches**

5-7 mins  
Every Match

## WHALEN METHOD



**1/ Dynamic  
elements (Parts 1  
& 3) before practice**

7-10 mins, 2-3x/wk



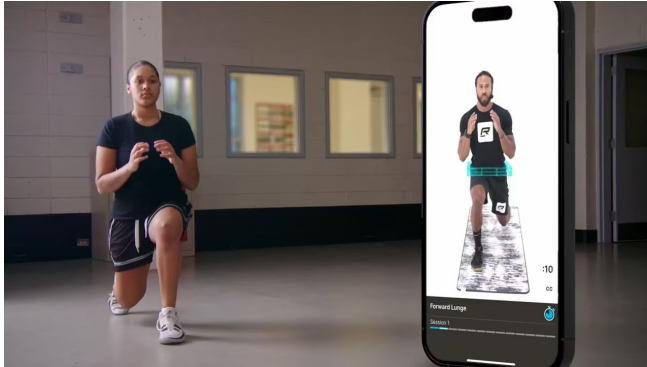
**2/ Strength elements  
(Part 2) after  
practice**

7-10 mins, 2-3x/wk c



# ACL Injury | Programs & Protocols

## HOMework

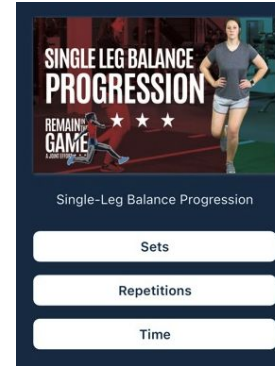


- App-led neuromuscular training for teams
- Self-paced 8-min workouts
- Tracked by coaches and club leaders

**RIIP REPS**



## S&C PROGRAM



- App-led neuromuscular training for teams
- Coaches select exercise routines
- 10 min of exercises at every practice.



**REMAIN IN THE GAME**

# ACL Injury | Coach Training

## ONLINE TRAINING



### How to Lead an Effective Warm Up in Soccer

Free | 30 mins | Online



### ACL Injury Prevention

Free | 30 mins | Online

## IN-PERSON WORKSHOPS

**ACL INJURY PREVENTION WORKSHOP**

Join the Liberty & HSS Women's Sports Medicine Center Team for a workshop to educate young athletes about ACL injury and prevention.

**Tuesday, June 30, 2009, 6:30pm - 8:30pm**  
MSG Training Center  
711 Old Saw Mill River Rd., Tarrytown, NY 10591

Workshop will include:

- Risk factors and mechanisms of ACL injuries
- Prevention strategies for young athletes
- Demonstration of exercises and training techniques by Liberty players
- Hands on training with physical therapists and Liberty athletic trainers\*

**\*\$25 - includes a ticket to the July 9th NY Liberty vs. LA Sparks game**

**SPACE IS LIMITED -**  
Pre-registration is required by June 19th  
Lisa.White@thegarden.com 212-485-7130

\* Comfortable clothes should be worn for exercise practice

**PROUD TO PARTNER WITH**  
HSS SPECIAL SURGERY

UNITED WE PLAY

NEW YORK LIBERTY

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# ACL Injury | Coach Training

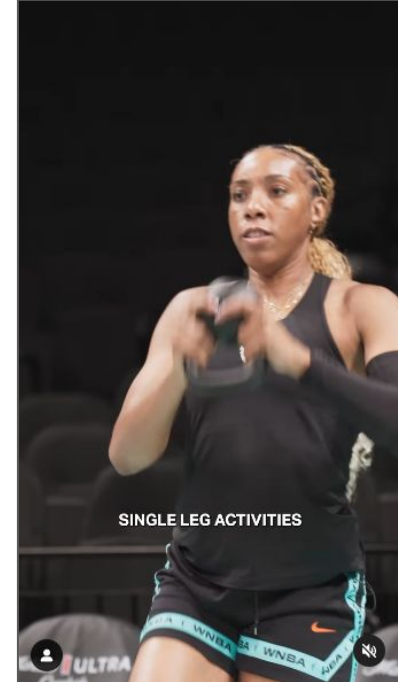
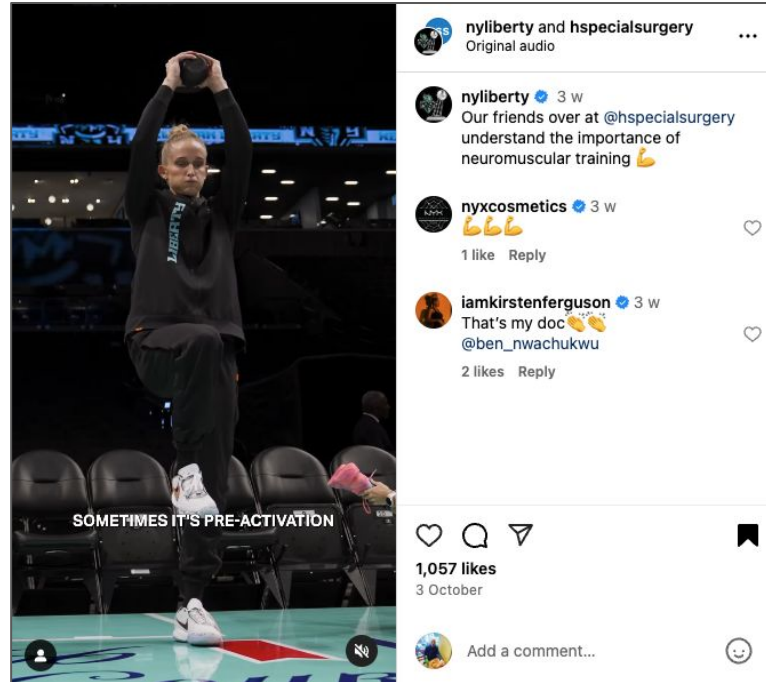
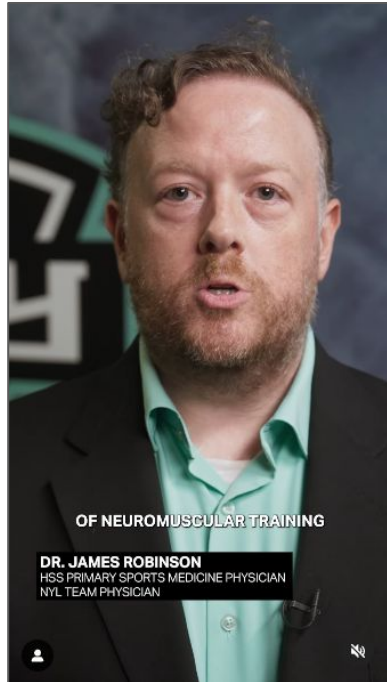
## ONLINE TRAINING

- “Prior to training, **4.4%** reported incorporating NMT into daily training sessions”
- “After training, **92.7%** of participants reported that they intended to incorporate NMT into their daily training sessions”
- “At 3-month follow-up, **88.9%** of participants reported incorporating NMT into daily training sessions.”

## IN-PERSON WORKSHOPS

- “Coaches in the intervention group participated in a **60-minute educational workshop** .. A total of 399 practices or games were observed over 2 seasons.”
- “**A greater proportion of coaches in the intervention group provided cues** to correct improper technique compared to coaches in the control group.”
- “In addition, more coaches in the intervention group **completed a full NMT program**”

# ACL Injury | Messaging to build awareness and buy-in



<https://www.instagram.com/reel/DAq4RC8SbK8/?igsh=cXNyYTU2c2Q0M3Bm>

# ACL Injury | Messaging to build awareness and buy-in

- **Host orientation(s)**  
Organize meetings with athlete, coaches and others to explain the problem and solution
- **Rally support from champions**  
Draw on trusted voices to reinforce key messages leading to more buy-in.
- **Distribute materials to raise awareness**  
Share news media coverage and coalition materials build awareness and drive engagement among your target coaches, players and stakeholders.





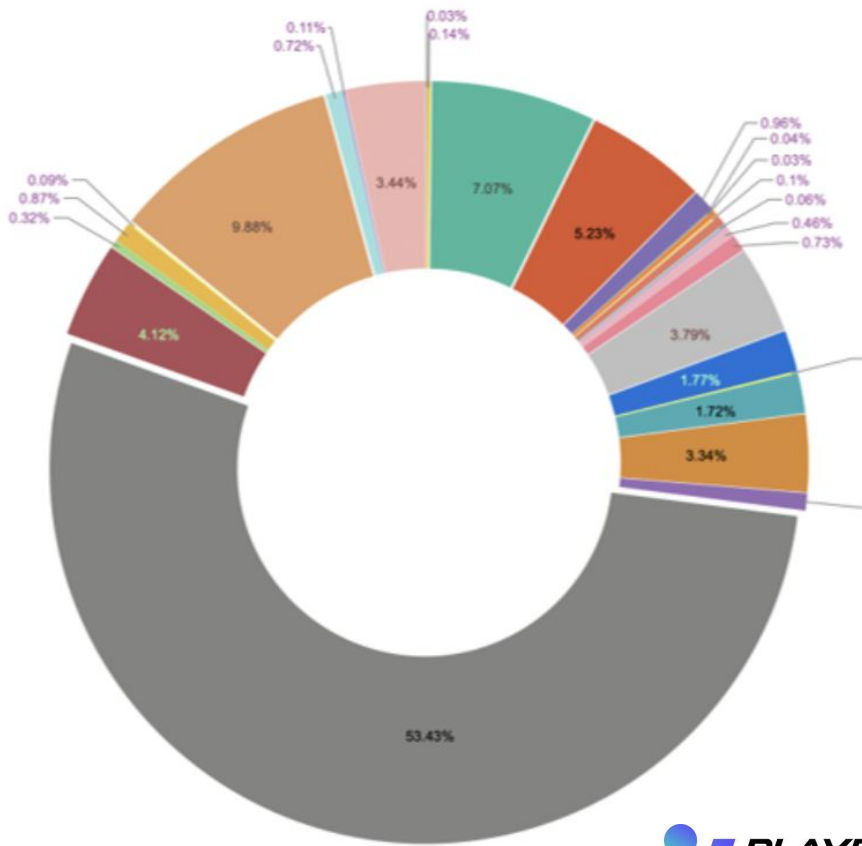
# ACL Injury | Insurance & Incentives



# KNEE INJURIES MOST PREVALENT

Knee is 53% of ALL total injuries in this data subset

Second is 10% (shoulder)



# ACL Injury | Insurance & Incentives

**Credit Program: 7% reduction in annual premium for implementing neuromuscular training**

















- At renewal: Answer “YES” = Initial 2% credit
- Additional 5% credit extended at renewal if policyholder claims stay below loss rate and claim threshold — after two years.
- Pending a claims review, credit can be removed.


# ACL Injury | Tournaments

“The NetballSmart Dynamic Warm-up and Power Warm-up significantly improved player physical capability. Consequently, **time to perform the Power Warm-up before all games at a national intermediate school tournament was incorporated into competition-time**, reducing workload by 25%.”

### Smart Tournament - 10 Top Tips

Prepare - Play - Recover - Repeat  
Be tournament ready with these 10 Top Tips

<b>1 Hydrate</b>  Drink 500ml in the hour before the game. Plus drink during and after each game.	<b>4 Prepare</b>  Shoes with tread, Warm clothes towel, Sunscreen <b>Do not get cold between games!</b>	<b>7 Manage Injuries</b> <b>Remember P.R.I.C.E.D</b> Do not return player to court unless they can comfortably do the full NetballSmart Dynamic Warm-Up 	<b>8 Cool Down</b> <b>Jog or Walk</b>  <b>Layer-Up</b> 
<b>2 Eat</b>  <b>ENERGY IN = ENERGY OUT</b> Eat well to play well  Have a full breakfast, two hours before first game. Protein, Carbohydrates, Fats	<b>5 Warm Up</b> NetballSmart Dynamic Warm Up to start the day. Power Warm Up thereafter 	<b>8 Snacks</b> Eat healthy snacks within 30min of game finishing & 30 min prior to next game 	<b>Hydrate</b>  <b>Stretch</b> 
<b>3 Sleep</b>  Minimum 8 hours, aim 9 - 10 hours technology goes away 30min before sleep time.	<b>6 Share The Load</b>  Coaches: play all team members, share the load, share the fatigue  Improved overall performance of your players and team	<b>10 Team Spirit</b> <b>Celebrate Successes</b>   <b>Have fun and play fair</b> 	

ACC SportSmartNetballSmart

## CRISIS



**Life changing  
injury on the rise  
in teens athletes**

## RISK



**Agility sports  
and Females  
most at risk**

## SOLUTIONS



**Start with  
Neuromuscular  
Training**

## NEED



**Implement NMT  
to Safeguard  
Athlete Health**



**National ACL Injury Coalition**

Learn more at  
***As.pn/aclcoalition***



## Next Steps | Get Involved!

WEBSITE	FIELD GUIDE	CALL TO ACTION	PARTNERSHIP
Learn more about the crisis and solution. Find additional resources & links	Program Director guide for introducing and sustaining NMT in your club	Recommended actions for member associations	Join the movement by lending your voice and making a public commitment



**National ACL Injury Coalition**

Learn more at  
***As.pn/aclcoalition***



# Thank you

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Learn more at  
*[As.pn/ac/coalition](https://aspeninstitute.org/ac/coalition)*



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