

FIELD GUIDE

TO REDUCING SERIOUS KNEE INJURIES



**How sport programs can keep young athletes
in the game and active for life**

Produced by the National ACL Injury Coalition



INTRODUCTION

Serious knee injuries are on the rise among teen athletes. As a sport organization leader, you can help keep them on the field – and active for life.



Healthy knees are the levers of life, the joints that can unlock the joy of sport and myriad health benefits of regular movement. Injuries to the anterior cruciate ligament (ACL) involve surgery and a long, costly recovery, with no guarantee of a full return to form. ACL injuries increase the odds of early [arthritis](#) and of knee replacement – preventing active lifestyles and shortening lifespans. The trend among high school athletes is

not good: [ACL injuries have risen 26% over the past 15 years](#), according to research by the National ACL Injury Coalition, a group of medical, academic, sport and public health organizations convened by Hospital for Special Surgery and Aspen Institute. [Knee injury is the new brain injury crisis](#), demanding our collective attention.

THE PROBLEM

Youth athletes are not prepared for the physical demands of sport programs today.

- Many adolescents in agility sports are at risk of serious knee injuries due to major deficiencies in lower body strength and control.
- Most coaches and athletes are unaware that the risk of life-altering knee injuries can be dramatically reduced with simple exercises, done regularly.
- Research suggests that just [1 in 5 high school coaches](#) implement programs proven to reduce risk – this [Implementation Problem](#) has delayed progress in reducing injury rates.

THE SOLUTION

The first thing you can do is recognize that simple exercises done regularly – called Neuromuscular Training (NMT) – can reduce risk of non-contact ACL injury by 50-80%.

- While knee injury has many contributing factors, there is a strong connection between non-contact ACL injury risk and improvable deficits in lower body strength and control.
- Two decades of research shows that NMT reduces risk of serious knee injury by improving movement patterns. The result is less force on sensitive knee structures and an enhanced ability to land, stop and cut on demand and under control.

BENEFITS

Neuromuscular Training results in:

- **Fewer serious knee injuries**
Rates of ACL injury [drop by over half](#).
- **Fewer injuries, period.**
Teams report fewer [knee sprains](#), [ankle sprains](#), [total injuries](#), [and total days missed to injury](#).
- **Improved physical performance**
Better [acceleration/deceleration ability](#), [motor control](#), [lower leg strength](#).
- **Winning (!)**
Teams that implement NMT [win more](#)
- **Healthcare Savings**
[Help families](#) save thousands in [medical costs](#) for surgery and physical therapy.
- **Active communities**
Prevent the [arthritis](#) that undermines active lifestyles into adulthood



NATIONAL ACL INJURY COALITION

Hospital for Special Surgery (HSS) and the Aspen Institute, through its Project Play initiative, have partnered to form the first national coalition to reduce ACL injuries. We envision a sports ecosystem in which young athletes learn to move better and face fewer threats of serious injury, so they can remain active for life.

- [Press Release](#)
- [Summary: 2023 Convening](#)
- [Podcast: Coalition Strategy](#)
- [Coalition website](#)

FIELD GUIDE AT A GLANCE



STEP 1: UNDERSTAND THE CHALLENGE

Know who is at risk of knee injury and why Neuromuscular Training (NMT) is needed

- Which athletes in our program face the highest risk of knee injury?
- What do your coaches, staff and parents know about knee injury?
- How much priority has our organization placed on injury prevention?



STEP 2: SELECT YOUR NMT SOLUTION

Select the tool(s) that best fit your organization

- Identify the solution to be piloted in your organization
- Identify the initial team(s) and time period to pilot the program
- Confirm equipment and resource needs for a pilot



STEP 3: PREPARE THE ENVIRONMENT

Build buy-in and readiness to implement NMT

- Review ways to prepare coaches, staff and key stakeholders
- Support coach completion of a prep course or workshop before starting NMT
- Share materials with coaches, athletes, etc. to raise awareness and build buy-in



STEP 4: PILOT WITH EARLY ADOPTERS

Start with a small, targeted group and study what works

- Ensure elements of pilot are in place and anticipate needed areas of support
- Capture baseline data on session completion and injury rates
- Discuss how implementation is working and document learning.



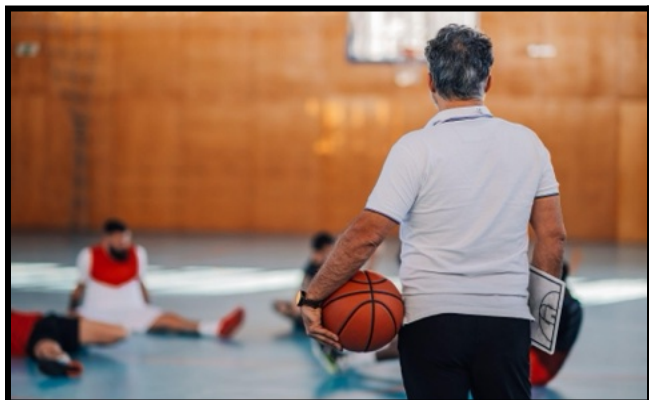
STEP 5: INTRODUCE TO MORE TEAMS

Refine approach and add athletes.

- Distill learnings from pilot into a model for broader adoption
- Expand to more teams and groups
- Continue to capture insights

ABOUT THIS GUIDE

The Program Director's Field Guide offers a pathway to introduce Neuromuscular Training (NMT) into the program you oversee.



It is a resource for local sport leaders like you, committed to athlete health and safety. The Field Guide walks leaders through a process for identifying a NMT program, then introducing and sustaining it across your organization.

This guide offers strategies for supporting the coaches, teachers, staff and volunteers who work directly with youth athletes.

WHO SHOULD USE THIS GUIDE

The Field Guide is for leaders of organizations that deliver school and youth sports programs in communities. It's for anyone in a position to drive organizational strategy and initiatives that support health, wellbeing, and performance. This category includes Athletic Directors, Club Directors, Executive Directors, Program Directors, Directors of Coaching, Athletic Trainers, S&C Coaches, Department Heads, P.E. teachers, and coaches.

The Field Guide is optimized for organizations serving youth 13+, the age at which rates of knee injuries begin to grow dramatically. However, neuromuscular training is important and effective [for pre-adolescents](#). The principles and practices can be applied to youth of middle school and elementary school ages.

HOW TO USE THIS GUIDE

This guide has been organized into five steps. Apply them as you see fit.

STEP 1 | UNDERSTAND THE CHALLENGE



- Which athletes in our program face the greatest risk of knee injury?
- What do our coaches, staff and parents know about knee injury?
- How much priority has our organization placed on injury prevention?

WHO IS MOST AT RISK?

Agility sports and female athletes most at risk

The coalition reviewed [High School RIO](#) injury data for 12 major girls and boys sports from 2007 to 2022. The average annual ACL injury rate grew 26% and rates were highest in agility sports. However, rates in girls' sports grew 32%, compared to 15% for boys' sports. Among girls' sports, soccer had the highest average annual rate, followed by basketball and lacrosse. Girls' volleyball and lacrosse grew a staggering 97% and 83%, respectively. Previous research found that girls injure the ACL [four times more than boys](#) in sex comparable sports. [Read our report.](#)

Non-contact ACL injuries are more common in girls

A non-contact injury occurs without the player making physical contact with a teammate or opponent. Of all ACL injuries in girls sports, 58% were non-contact. The rate was highest in girls' lacrosse, where 80% were non-contact. [Learn more.](#)



WHEN DO NON-CONTACT ACL INJURIES OCCUR?

Sudden changes of speed and direction

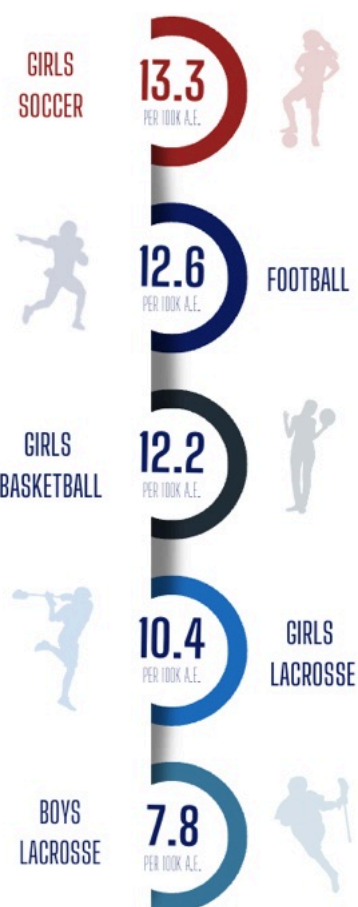
Non-contact ACL injuries occur most often during agility moments that involve pivoting or rotating around the knee, such as stopping on a dime, cutting and landing from a jump.

Among athletes with poor neuromuscular control

Research demonstrates a strong connection between non-contact ACL injury and widespread but improvable deficits in lower body strength and control. Assessments of school-age youth have found the vast majority struggle to control their knees during tests of basic sports movements.

ACL INJURY RATES

BY SPORT & GENDER | PER 100K EXPOSURES



SOLUTIONS: START WITH NEUROMUSCULAR TRAINING

Neuromuscular training (NMT) improves lower body strength and control, resulting in less force on the knees and an improved ability to accelerate, stop and cut on demand.

HOW IT WORKS

Reduces the force of ground impact by improving neuromuscular control. NMT helps youth improve strength, refine movement patterns and build muscle memory for sports and physical activity movements. The result is less pressure on sensitive knee structures.

WHAT IS REQUIRED

30-60 minutes per week, spread across sessions that typically last 10-15 minutes each. Athletes start in pre-season and continue throughout the season as a warm up, at home, like homework, or as part of a strength program. Whether on the field, at home, or in a gym, the key is consistency.



KEY ELEMENTS

NMT targets landing mechanics and lower body strength, with defining features that include:

- | | |
|---|---|
| ☐ Lunges | ☐ Middle- and/or high school-aged participants |
| ☐ Heel/calf raises | ☐ 30-60 mins/week, spread across multiple sessions |
| ☐ Hamstring exercises | ☐ Starts in pre-season and continues in-season |
| ☐ Landing stabilization exercises (x1-5) | ☐ The coach/person leading NMT has completed training in ACL injury prevention |
| ☐ Verbal cues for correct technique | |

THE IMPLEMENTATION PROBLEM

Research on high school coaches found that while more than half of coaches are aware of injury prevention programs, just one in five used them and less than 10 percent used them as designed. Why?

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

Drawn from Minnig, et al., (2022). Barriers and facilitators to the adoption and implementation of evidence-based injury prevention training programmes: a narrative review. <https://doi.org/10.1136/bmisem-2022-001374>

STEP 2 | SELECT YOUR NMT SOLUTION



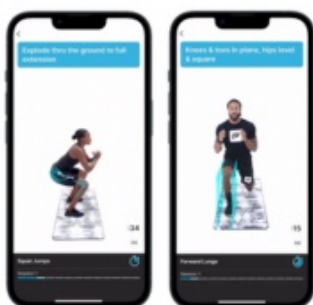
- Identify the NMT program to be piloted in your organization
- Identify an initial team and time period to pilot the program
- Confirm equipment and resource needs for a pilot

RECOMMENDED NMT PROGRAMS

Implementation begins with identifying the Neuromuscular Training program that best suits your coaches and players. Here, we present several quality programs to consider.

PROGRAMS FOR ANY SPORT

RIIP REPS REDUCE INJURY, IMPROVE PERFORMANCE



Through a mobile app, athletes complete four short (7-8 min) sessions per week as a warmup before practice, or at home, like homework. Built-in audio, text and visual cues focus on mechanics. Exercises progress over time.

Coaches and organization leaders enroll teams for free. Athlete progress can be tracked by coaches.

Powered by Hospital for Special Surgery

Mode: App-delivered

Equipment & Space:

No equipment required.

Coach: Monitors progress in the app and actively supports completion.

Learn more:

[Riipreps.com](https://riipreps.com)

[Enroll your organization](#)



REMAIN IN THE GAME



Athletes access programs via a free mobile app and complete approximately 10 minutes of selected exercises at every practice. Coaches provide programs to athletes, using sample routines or combining exercises for custom playlists.

Hosted by The Osteoarthritis Action Alliance (OAAA) at the University of North Carolina at Chapel Hill and endorsed by the National Athletic Trainers' Association (NATA)

Mode: App-delivered

Equipment & Space:

No equipment required

Coach: Designs protocol/playlist and actively supports completion

Learn more:

[Remain in the Game](#)

[Coaches' Guide](#)

[YouTube video library](#)

SPORT-SPECIFIC PROGRAMS

11+



Warmup designed for soccer, ages 13+, that can be completed two ways:

1. The full program of exercises, in order, before practice/competition (15-20 mins)
2. Parts 1 & 3 before practice/competition (7-10 mins) then Part 2 after (7-10 mins)

Each section can be progressed up in levels of difficulty. Coaches supervise and provide error-correcting feedback.

Sport: Soccer, ages 13+

Mode: Person-led team warm up

Setup: Field w/ six parallel cones, 5-6 meters apart. Done in pairs.

Coach: Uses the program as warm-up before practice and actively supports completion.

Learn more:

[Poster with exercises](#)

[Program manual](#)

[YouTube video library](#)

11+ KIDS



A free, adapted version of the 11+ designed as a warmup for youth soccer, ages 6-13.

Participants complete seven exercises, in order, before each practice.

Each exercise can be progressed up in levels of difficulty. Coaches lead warmup and provide error-correcting feedback.

Sport: Soccer, ages 6-13

Mode: Person-led team warm up

Setup: Field w/ six parallel cones, 5-6 meters apart. Done in pairs.

Coach: Uses the program as warm-up before practice and actively supports completion.

Learn more:

[Poster with exercises](#)

[YouTube video library](#)

STEP 3 | PREPARE THE ENVIRONMENT



- Review ways to prepare coaches and key stakeholders
- Support coach completion of a prep course or workshop before starting
- Share materials with coaches, etc. to raise awareness and build buy-in

PRE-WORK FOR COACHES

Coaches educated in ACL Injury Prevention are more likely to implement NMT. Courses teach the causes of ACL injury, how to identify and correct movement deficiencies. Some also teach how to use NMT as a warm-up. [Online courses](#) and [in-person workshops](#) are both shown to be effective.

Gather your coaches, review training materials and support their completion of a course or workshop before introducing NMT tools with athletes.



ONLINE COURSES*

Course	Provider	Cost	Link	Sport(s)
ACL Injury Prevention	NFHS	Free	Course	All
How to Lead an Effective Warm Up in Soccer	US Youth Soccer	Free	Course	Soccer

*See appendix for more

IN-PERSON WORKSHOPS

If your organization prefers an in-person training for coaches, live workshops are best accessed through local providers. Work with your staff to identify a provider in your area that can help arrange an in-person workshop for coaches to learn the foundations of ACL Injury Prevention. Common providers include physical therapists, orthopedic clinics, sports medicine providers and children's hospitals. If available, consider having your athletic trainer conduct a live workshop with coaches and athletes.



MESSAGING FOR STAKEHOLDERS

To build buy-in from athletes, coaches and parents, you'll need to communicate the importance of NMT, the solutions that will be implemented, and plans to pilot. Consider the following actions:

- ☐ **Host orientation(s)**
Organize in-person or virtual orientation(s) with the coaches, athletes and/or parents to review the problem, solution and plan for action.
- ☐ **Rally support from champions**
Senior leadership, colleagues, trusted voices and champions can reinforce key messages leading to more buy-in. Think principals, senior coaches and community members. Use our talking points (refer to below).
- ☐ **Distribute materials to raise awareness**
Share news media coverage, coalition materials and your chosen NMT program to inform, build awareness and drive engagement among your target coaches, players and stakeholders.



HELPFUL MATERIALS TO RAISE AWARENESS

NEWS MEDIA	COALITION MATERIALS
• PBS Newshour Why ACL injuries are more common in female athletes than male counterparts • TIME Let's Start Treating Knee Injuries Like Brain Injuries • Yahoo Inside the ACL epidemic plaguing women's soccer and the high stakes search for cures	• Website National ACL Injury Coalition • Analysis Teen Knee Injuries Rise 26% • Presentation Slides ACL Injury At a Glance • Talking Points Key Messages about ACL

STEP 4 | PILOT WITH EARLY ADOPTERS



- Ensure elements of pilot are in place and anticipate areas of support
- Capture baseline data on session completion and injury rates
- Discuss the quality and sustainability of implementation. Document learning.

INITIATE THE PILOT

Now, it's time for the pilot team and coach you've identified to use the program, as designed. If this is a new process for coaches and players, there will be growing pains. A few things to ensure as they begin:

- ☐ **A documented, clear protocol** exists for when, where and what the NMT program requires
- ☐ **Communication of the program, rationale and protocol** occurs in advance of the first session.
- ☐ **Clarity around the coach or individual responsible** for driving completion with the team.
- ☐ **Training in ACL injury prevention** is completed by the coach or individual driving completion.

PROVIDE APPROPRIATE SUPPORT

Should conflicts arise, support may be needed. Possible areas to anticipate:



- ☐ **Technical assistance** related to prescribed exercises or questions about program content.
- ☐ **Access** to additional resources, such as equipment, transportation or facility space, if needed.
- ☐ **Administrative sign off** for use of mobile applications that request student information.
- ☐ **Troubleshooting** unique situations, such as conflicts with individual rehab, team S&C programs

CAPTURE INSIGHTS AND STUDY WHAT WORKS

In order to make NMT sustainable, it is important to capture data, insights and reflections around this initial effort. The aim is to capture insights that help you expand to more groups. Our recommendations:

- ☐ **Designate a person to check-in** on the status of implementation. Watch a live NMT session.
- ☐ **Capture baseline data on session completion**, including frequency,
- ☐ **Capture in-season injury data**, including time-loss injuries such as ankle sprains.
- ☐ **Reflect with a designated group of advisors** on what you are learning from the pilot.

STEP 5 | INTRODUCE TO MORE TEAMS

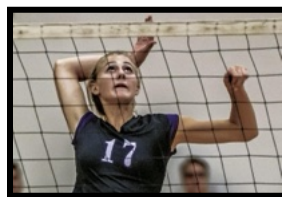


- Distill learnings from pilot into a model for broader adoption
- Expand to more teams and groups
- Continue to capture insights

CREATE A SCALABLE MODEL

After the pilot ends, the first step will be to refine the approach for long-term sustainability. Using insights from check-ins, observations and any data collection, you will want to work with your coaches and staff to develop a template that can be used with other teams in your organization. Suggested materials would include:

- ☐ **The model protocol**, including if NMT works best as a pre-practice warm up, or homework, etc.
- ☐ **How to best communicate the program**, rationale and protocol to players and parents.
- ☐ **When the first NMT session is conducted**, and by whom, when and where.
- ☐ **Tasks of the coach**, staff member or person responsible for driving completion with the team.



EXPAND TO MORE TEAMS OR GROUPS

With a scalable model and learning process in place, you are ready to expand NMT to other teams and coaches in your organization. You will want to consider factors related to how likely implementation will be embraced and honored. This includes:

- ☐ **Differences in a new team's** seasonality, schedules, sport, etc.
- ☐ **Prior history or awareness of ACL injury**, and belief in NMT as a solution.
- ☐ **Interest and/or engagement with the findings from the pilot.**
- ☐ **Readiness to drive implementation**, including coursework and program knowledge.

CONTINUE TO CAPTURE INSIGHTS

It will be important for you, or an identified staff person, to continue to capture insights from coaches, players and other stakeholders about how this process is working. Key actions include:

- ☐ **Ongoing observations and/or check-ins** with those implementing NMT
- ☐ **Regular capture of injury data**, including knee and ankle injuries, total injuries and days missed.
- ☐ **Discussion of challenges and opportunities** for sustaining NMT with teams

APPENDIX

PROGRAMS & RESOURCES

- Neuromuscular Training (NMT) Programs: [See List](#)
 - Prep Courses and In-Person Workshops: [See List](#)
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EVIDENCE

- Report: [Teen Athlete Knee Injuries Rise 26%](#) – National ACL Injury Coalition
 - Study: [ACL tears in school-age children and adolescents over 20 years](#)
 - Statement: [Prevention of ACL Injuries](#) – National Athletic Trainers Association (NATA)
 - Study: [Evidence-Best Practice Guidelines for Preventing ACL Injuries](#)
 - Study: [Barriers to adoption injury prevention programs](#)
 - Study: [Factors influencing coach adoption of injury prevention programs](#)
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TOOLS & TEMPLATES

- [Implementation Checklist](#)
 - [Sample Time Loss Injury Tracking Spreadsheet](#)
 - [ACL Injury at a Glance](#) – National ACL Injury Coalition
 - [Talking Points](#) – National ACL Injury Coalition
-