

Pre-Hab for EMS

Integrating Self-Myofascial Release, Dynamic & Static Stretching into EMS Injury Prevention

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Professional Biography



Dr. Chief Kane Nixon, Ed.D., NASM CPT, CES

25 Years of Fire Service Tenure: Served across all operational ranks and divisions; currently the Deputy Fire Chief of Planning for the Arizona Fire & Medical Authority (AFMA).

Educator: Holds a Doctorate of Education (Ed.D.) in Educational Leadership. Actively serving as Adjunct Faculty at Northern Arizona University (NAU) and Glendale Community College (GCC), with nearly two decades of academic curriculum design and instructional delivery experience.

Specialized Fitness Credentials: Dually certified by the National Academy of Sports Medicine (NASM) as a Certified Personal Trainer (CPT) and Corrective Exercise Specialist (CES).

Safety & Advocacy Leadership: Creator and champion of the *iCare Model* (Intentional Care through thoughts, words, and actions); Political Action Committee (PAC) Director for the Arizona Fire District Association (AFDA); and Arizona State Lead Advocate for the National Fallen Firefighters Foundation (NFFF). Chairman of the Scholars Alliance for Fire and EMS with Science to the Station.

EMS & Fire Injury Landscape

THE MUSCULOSKELETAL EPIDEMIC

- **Private EMS Burden:** CDC/NIOSH surveillance indicates that approximately **16,900 acute nonfatal injuries** are treated in emergency departments annually among private-sector EMS clinicians.
- **Fire-Based EMS Scale:** National Fire Protection Association (NFPA) reports that over **50% of active-duty firefighter injuries** occur during non-fire emergencies, primarily medical/EMS scenes.
- **Sprain & Strain Prevalence:** Strains, sprains, and muscle pain constitute **58%** of non-fire emergency firefighter injuries, and **24%** of private clinician injuries.
- **Primary Mechanism:** Overexertion and bodily reactions during lifting, lowering, and maneuvering patients account for **31%** of acute clinical injuries.



Figure 1: Ergo-mechanical spinal loading during patient lifts and gurney transitions.

Economic & Operational Toll

Injury Metric Category	Direct/Indirect Cost Estimate	Operational & Agency Impact Variables
Medically Consulted Claim	\$48,000 per Injury	Direct cost including immediate medical treatment, imaging, diagnostics, and indemnity payments (National Safety Council [NSC], 2024).
Firefighter Annual Toll	\$1.6B – \$5.9B Nationally	Translates directly to an estimated loss of \$50,000 to \$200,000 per department annually, or up to \$5,500 per individual (NIST, 2019).
Overexertion Claim	\$17,454 Direct Average	Mean cost of workers' comp claims specifically resulting from patient lifting, physical overexertion, or repetitive bodily reactions.
The Indirect Multiplier	2.0x to 4.0x Direct Cost	Mandatory overtime backfills (1.5x/2.0x base), cascading operational fatigue among remaining crews, and escalating Experience Modification Rates (E-Mod).

Rehab to Pre-Hab Shift



The Reactive Rehab Loop

Waiting for physical failure before initiating therapeutic intervention. This classic model allows the **Cumulative Injury Cycle** to run unhindered:

- > Tissue Trauma → Inflammation → Muscle Spasm
- > Development of dense, inelastic myofascial micro-adhesions
- > **Davis's Law in Action:** Soft tissue models along lines of stress, reinforcing postural distortion and joint imbalances.



The Proactive Pre-Hab Model

Treating the EMS responder as an **Industrial Athlete**. This model preemptively corrects neurological and mechanical pathways daily:

- > Disrupts the cumulative cycle prior to loading under patient weight
- > Down-regulates hypertonic, overactive structural muscles
- > Addresses postural distortion patterns (Upper/Lower Crossed Syndrome)
- > Improves multi-planar joint range of motion (ROM) and tissue compliance.

Physiology of SMR

THE NEUROLOGY OF AUTOGENIC INHIBITION

- > **Sensory Receptors:** Skeletal muscle contains **Muscle Spindles** (sensing rate of length change) and **Golgi Tendon Organs [GTO]** (sensing muscular tension).
- > **Autogenic Inhibition:** Applying localized, external pressure stimulates GTOs, sending inhibitory sensory signals to the central nervous system forcing the muscle to relax.
- > **The 30-Second Rule:** Constant pressure must be sustained for a **minimum of 30 to 90 seconds** to allow GTO inhibitory impulses to override muscle spindle excitation.
- > **Outcome:** This dampens alpha motor neuron activity, shutting off overactive 'knots' (trigger points) to restore normal tissue extensibility.



Figure 2: Sustained localized compression of the thoracic paravertebral musculature.



Figure 2.1 Difference between GTO and Muscle Spindle.

Dynamic Stretching

RECIPROCAL INHIBITION & NEURO PRIMING

- > **Reciprocal Inhibition:** Contracting an agonist muscle automatically sends an inhibitory neurological signal to the antagonist, allowing it to relax and lengthen.
- > **World's Greatest Stretch:** Incorporates a forearm runner's lunge with thoracic rotation to dynamically prime hips, core, and thoracic spine.
- > **Neuromuscular Efficiency:** Dynamic stretching raises core temperature and speed of nerve transmission without the acute force deficits associated with static stretching.



Figure 3: Multi-planar dynamic runner's lunge with thoracic rotation ("World's Greatest Stretch").

Static Stretching

STRESS RELAXATION & DOWN-REGULATION

- > **The Physiology:** Sustained elongation of a muscle-tendon unit triggers **autogenic inhibition** via persistent GTO firing and stress relaxation of viscoelastic tissues.
- > **The Timing Constraint:** Most appropriate ****post-workout or post-shift****. Performing static stretching immediately ***before*** explosive lifting can cause acute force production deficits (up to 5-10% loss in power).
- > **The Piriformis Target:** The Supine Figure-Four stretch targets the **piriformis**, glutes, and deep external hip rotators (gemelli, obturator internus) to decompress pelvic structures.



Figure 4: Supine figure-four static stretch for deep gluteal and piriformis elongation.

10-Min Pre-Shift Protocol

Phase 1: SMR Release

Duration: 4 Minutes

Locate hyperirritable trigger points and hold steady pressure to induce autogenic inhibition.

- > **Thoracic Spine:** Enhances rotational and extension range of motion.
- > **Gastrocnemius/Soleus:** Restores ankle dorsiflexion for squat biomechanics.



Phase 2: Dynamic Prep

Duration: 3 Minutes

Target specific occupational structures using reciprocal inhibition and multi-planar motion.

- > **World's Greatest Stretch:** Forearm lunge with thoracic rotation to open hip capsules.
- > **Important:** Static stretching (e.g. Figure-4) is excluded here to avoid power drops.



Phase 3: Neuro Activation

Duration: 3 Minutes

Prime muscular firing patterns through active, dynamic ranges of motion.

- > **Glute Bridges:** Re-activates gluteus maximus, protecting the lumbar spine.
- > **Shoulder Pass-Throughs:** Primes glenohumeral stability for stretcher loading.

Science to the Station



Figure 5: Translational research model bridging kinetic laboratory outcomes with tactical athletes.

TRANSLATIONAL SCIENCE

- > **The Mission:** To foster collaboration and communication between subject matter experts and frontline firefighting & EMS personnel, translating and disseminating evidence-informed health, wellness, and safety education and interventions
- > **Scholars Alliance:** The Fire & EMS Scholars Alliance is a community of academically trained fire and EMS professionals committed to transforming science into service. As a specialized initiative of Science to the Station, we bridge scholarly research and frontline experience to create actionable solutions for the fire and emergency services community.
- > **S2S Conference:** Kansas City, MO
November 3 -5 2026



References

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Core Academic Evidence & Physiological Backing

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Sources & Attributions

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Figure 1 (Paramedic Lift)	http://googleusercontent.com/image_collection/image_retrieval/2665438419077262753_0	Patient loading mechanical spine load evaluation.
Figure 2 (SMR Thoracic)	http://googleusercontent.com/image_collection/image_retrieval/11607360743559713790_0	SMR compression of thoracic extensor fibers.
Figure 3 (Dynamic Lunge)	http://googleusercontent.com/image_collection/image_retrieval/5811473781702723838_0	Agonist/antagonist reciprocal inhibition patterns.
Figure 4 (Figure-Four)	http://googleusercontent.com/image_collection/image_retrieval/14604270159137512739_0	Post-activity static elongation of the piriformis.
Figure 5 (Firefighter STEM)	http://googleusercontent.com/image_collection/image_retrieval/13903803232226434837_0	Translational research application in municipal fire.

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Questions & Discussion

Questions?

Translating Clinical Exercise Science to Fire & Rescue Operations



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