

## KEY FINDINGS

### The Injury Problem

- Firefighters in the lowest fitness tier were 2.2 times more likely to be injured than those in the highest
- 773 injuries recorded over 5 years at a single metropolitan fire department
- 67% of all injuries were sprains and strains — and 30% resulted in lost work time

### How the Study Was Done

- Retrospective cohort of career firefighters in Tucson, AZ, 2005–2009
- 799 employees tracked through annual physicals and injury surveillance records
- Aerobic fitness (VO<sub>2</sub>max) divided into three tiers: high fit (>48), moderate (43–48), least fit (<43 mL/kg/min)
- Fitness level linked to injury risk over time using time-to-event statistical modeling

### What's At Stake

- Low aerobic fitness doesn't just slow you down — it directly increases risk of getting hurt
- Every 3.5 mL/kg/min gain in VO<sub>2</sub>max reduces injury risk by 14%
- Exercise alone accounts for roughly one-third of all on-duty injuries in the fire service
- 30% of injuries in this study resulted in lost work time — a direct cost to your department



## The Association of Aerobic Fitness: With Injuries in the Fire Service

### SUMMARY:

#### Why This Matters to You

You already know fitness matters for firefighting performance. This study shows it matters just as much for staying off the injured list. Researchers tracked nearly 800 career firefighters over five years, linking annual fitness data to on-duty injury records. The bottom line: low aerobic fitness directly predicts injury — and training intentionally is how you prevent it.

## Fitness and Injury Risk: What the Numbers Show

### FINDINGS:

#### The Most Important Things to Know

- Low fitness dramatically raises injury risk: Firefighters in the lowest fitness tier (VO<sub>2</sub>max <43 mL/kg/min) were 2.2 times more likely to sustain any injury than those in the highest tier (>48 mL/kg/min) — and 2.6 times more likely to suffer a sprain or strain.
- Even moderate fitness leaves you vulnerable: Those in the middle fitness tier (43–48 mL/kg/min) were still 1.38 times more likely to be injured than the most fit group — there is no safe "good enough" threshold.
- Every fitness gain counts: Improving aerobic capacity by just one metabolic equivalent (approximately 3.5 mL/kg/min) reduces the risk of any injury by 14% — small, consistent gains deliver real protection.
- Younger firefighters carry the greatest risk when unfit: Those under 30 in the lowest fitness tier were 3.4 times more likely to be injured than their most fit peers — the protection gap is widest early in a career.

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## Big Picture: What Actually Works

### FIRE STATION TALKS

- Aerobic fitness is a direct injury prevention tool, not just a performance metric. Firefighters in the lowest fitness tier reached their first injury nearly two years sooner than those in the highest tier.
- The injury gap exists at every fitness level. Even the middle tier was 38% more likely to be injured than the most fit group. Improving always helps — there is no plateau where fitness stops protecting you.
- Most on-duty injuries are sprains and strains — and they're preventable. 67% of injuries in this study were sprains and strains. They are the predictable outcome of carrying inadequate fitness into a physically demanding job.
- Exercise is both the risk and the remedy. On-duty exercise caused roughly a third of all injuries — yet firefighters who exercise regularly are about half as likely to sustain a non-exercise injury. The answer is better-structured training, not less of it.
- Intentional training means training with a specific purpose. Arbitrary workouts don't build the aerobic base needed. Consistent, planned cardiovascular training moves you out of the high-risk tier.

## Key Actions: To Reduce Your Injury Risk

### TAKEAWAYS

- Know your fitness tier — and act on it. The NFPA recommends a minimum VO<sub>2</sub>max of 42 mL/kg/min — below that threshold, you're in the highest-risk injury tier. Get tested and know where you stand.
- Train aerobically, consistently. VO<sub>2</sub>max — cardiovascular endurance — is what this study measured and what drives the protection. Sustained cardio work builds the base; sporadic hard efforts don't.
- Don't wait until you're injured. The least fit firefighters reached their first injury nearly two years sooner than the most fit. The protection compounds over a career — build it now. Firefighters under 30 in the lowest fitness tier were 3.4 times more likely to be injured — the biggest protection gap is when habits are still forming.

## Data Sources:

POPLIN, G.S., ROE, D.J., PEATE, W., HARRIS, R.B., & BURGESS, J.L. (2014). THE ASSOCIATION OF AEROBIC FITNESS WITH INJURIES IN THE FIRE SERVICE. AMERICAN JOURNAL OF EPIDEMIOLOGY, 179(2), 149-155.

## What Chiefs Can Do: About Injury Prevention

### TAKING THE LEAD

- Treat aerobic fitness as an injury prevention program. The lowest fitness tier had 2.2 times the injury rate of the highest. Investing in fitness programming directly reduces workers' compensation costs, lost time, and staffing gaps.
- Unstructured on-shift exercise isn't enough. A program designed to progressively build VO<sub>2</sub>max gives members the specific physiological protection this research identifies.
- Track fitness levels annually and act on the data. Know which members fall below the NFPA minimum of 42 mL/kg/min and have a plan to support improvement — not just document it.
- Prioritize fitness support for new firefighters. Those under 30 in the lowest fitness tier were 3.4 times more likely to be injured — early-career habits set the pattern for the entire career.
- Structure on-duty exercise to reduce the injuries it causes. Exercise causes roughly a third of all on-duty injuries. Peer fitness trainers and proper programming reduce that risk while building aerobic protection.
- Connect fitness data to injury surveillance. If injury rates aren't declining, the fitness program isn't working. Tracking both together lets you course-correct before patterns become costs.

## Conclusion

LOW AEROBIC FITNESS IS A DIRECT PREDICTOR OF ON-DUTY INJURY. FIREFIGHTERS IN THE LEAST FIT TIER WERE 2.2 TIMES MORE LIKELY TO BE INJURED AND REACHED THEIR FIRST INJURY NEARLY TWO YEARS SOONER THAN THEIR MOST FIT PEERS. EVERY 3.5 ML/KG/MIN GAIN IN VO<sub>2</sub>MAX CUTS INJURY RISK BY 14%. INTENTIONAL, CONSISTENT AEROBIC TRAINING ISN'T OPTIONAL — IT'S HOW YOU STAY ON THE JOB AND OFF THE INJURED LIST.

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