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2022 NSCA NATIONAL CONFERENCE

July 6-9, 2022 | New Orleans & Online

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› KNOWLEDGE
› ADVANCEMENT
› COMMUNITY

CONFLICT OF INTEREST STATEMENT

I have no actual or potential conflict of interest
in relation to this presentation.

Do the Work: Health, Fitness, and Strength and Conditioning Research and Practical Application for First Responders

Dr. Robert Lockie, TSAC-F*D
California State University, Fullerton

LEARNING OBJECTIVES

- Comprehend the current research analyzing the health and fitness of first responders, and how this can influence their performance during their training academy and what they do when working in the field.
- Identify how health and fitness changes for first responders from the training academy to the workforce, and what training practices could be applied for trainees/cadets/recruits and incumbent first responders.
- Recognize the practical application of the current literature relative to the health and fitness of first responders, and the positive role that strength and conditioning practitioners can play in the job performance and lives of first responders.

FIRST RESPONDERS

COLLABORATIONS

- LA County Sheriff's Department
- LA County Fire Department
- Santa Ana College Fire Technology
- Colorado State Patrol
- Stillwater Police Department
- CSUF University Police and ROTC
- Wellness Solutions
- Oklahoma State University
- Tactical Research Unit – Bond University, Australia
- Southern California University of Health

OVERVIEW

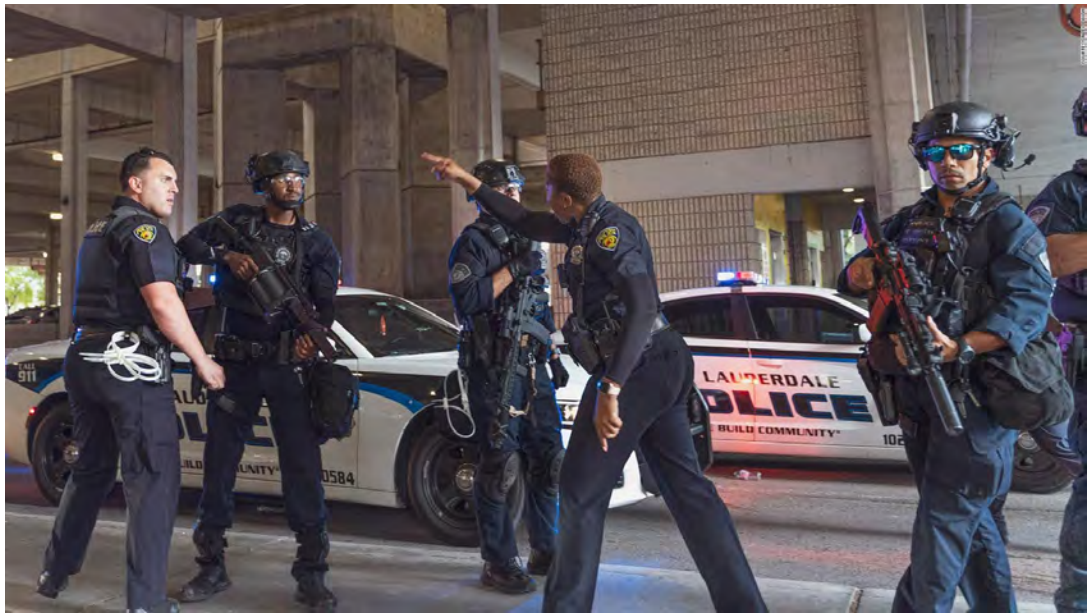
- Research and practical applications → bridging the gap
- Performance and strength and conditioning needs
  - Recruits/cadets/trainees
  - Incumbent personnel
- Academy training
- Health and wellness programs and potential impact of strength and conditioning
- Our changing society → recruitment and retention

LET'S START FROM THE BEGINNING

INTRODUCTION

- Candidate: a person who applies for a job
- Cadet: a young trainee
- Trainee: a person undergoing training for a particular job or profession
- Recruit: a person newly enlisted in the armed forces (and police) and not yet fully trained

VS.



The Hiring Process

APPLYING	**If the filing period is not yet open,** we encourage interested applicants to complete a job interest card at bit.ly/LACo-interestcard, so they can be notified once the bulletin is posted. **Once the filing period is open,** interested applicants must complete a Los Angeles County employment application at: https://www.governmentjobs.com/careers/lacounty
TESTING	Once posted, the bulletin will include the pertinent information with respect to study guides and additional resources, if any. Since the final exam plan has not been determined, we encourage interested applicants to review the job classification* for Fire Fighter Trainee to have an idea of the minimum requirements and basic competencies of the job. Please use the link below to view the current requirements noted on the class specification. bit.ly/firefightertrainee
BACKGROUND INVESTIGATION	Criminal history for each candidate will be individually assessed. The Department complies with its obligations under all local, state, and federal laws when making hiring decisions.
MEDICAL EVALUATION	A pre-placement medical evaluation is administered after a conditional offer of employment is made, and is designed to determine an applicant's ability to safely perform the essential functions of the job with or without reasonable accommodation. The Department complies with its obligations with all local, state, and federal laws when making hiring decisions.

CANDIDATE PHYSICAL ABILITY TEST (CPAT)

CPAT Details

Participants in the CPAT must navigate eight separate events on a closed course within a span of 10 minutes and 20 seconds. Each event simulates a physical skill or function that firefighters experience on the job.

- Stair Climb
- Hose Drag
- Equipment Carry
- Ladder Raise and Extension
- Forcible Entry
- Search
- Rescue Drag
- Ceiling Breach and Pull

During the test, candidates wear a helmet, gloves and 50-lb weighted vests, designed to simulate the weight of firefighter personal protective equipment. For the stair climb – the first event – candidates will don an additional 25-lb weight, to simulate the carrying of a hose pack into a high-rise fire.

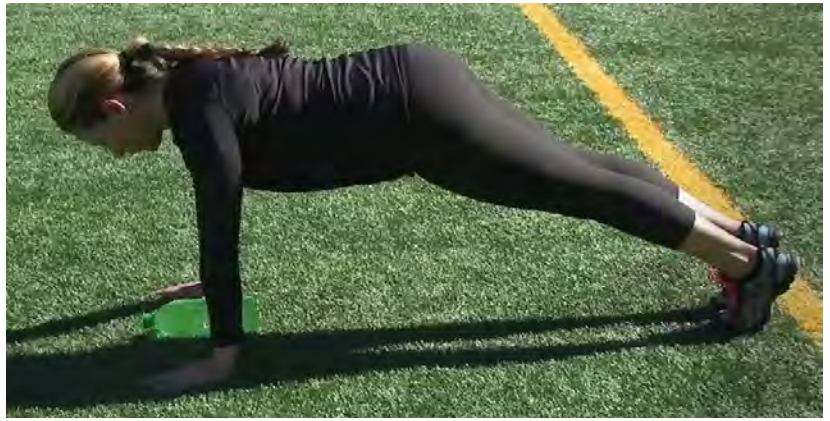
Candidates will be accompanied by a test proctor, who will call out directions for the test events and score the candidate's success in real time.

Each event must be completed **exactly as prescribed** – if a candidate fails any component of the test, they will fail the entire test. Candidates also fail if they do not complete the eight events within the 10-minute, 20-second time limit.

Firefighter Candidate Testing Center. Candidate Physical Ability Test. Available at: https://www.fctconline.org/cpat/. Accessed May 30, 2022.

Robinson, A. Why Southern California police are struggling to hire more cops. Available at: https://www.ocregister.com/2018/03/26/why-southern-california-police-are-struggling-to-hire-more-cops/. Accessed May 30, 2022.

- Los Angeles County Sheriff's Department (LASD) → Validated Physical Ability Test (VPAT)
  - Push-ups
  - 75-yard run
  - Sit-ups
  - 20-m multistage fitness test (beep test)



- Can be agency-specific
- For example:
  - Riverside PD: at least 30 push-ups in 1 minute, at least 30-sit-ups in 1 minute, run 1.5 miles in 13 minutes
  - Orange County Sheriff's Department: at least 30 push-ups in 2 minutes, at least 30-sit-ups in 2 minutes, run 1.5 miles in 14 minutes

GENERAL FITNESS VS. JOB-SPECIFIC FITNESS

- General fitness: qualities that could relate to job performance
  - Muscular endurance (push-ups, sit-ups), lower-body power (vertical jump), aerobic fitness (1.5 mile run, multistage fitness test)
- Job-specific fitness: tests that relate to tasks completed by first responders
  - CPAT for firefighter trainees
  - Occupational physical ability tests for police cadets/recruits → typically exit examinations (Work Sample Test Battery in California)

WHY TEST GENERAL FITNESS?

GRADUATION VS. SEPARATION/ATTRITION

- Physical capacity to successfully complete and graduate from academy
- Cadets/recruits/trainees may separate from academy (i.e., they do not graduate) for different reasons
  - Personal reasons (e.g., they no longer want to work in the field)
  - Physical training session failures
  - Injury
  - Failure in academics or scenario-based training
- Cadets/recruits/trainees that separate can create a financial burden to the agency
  - Orr et al. (2016): $85,000 to recruit and train a potential police officer in NSW, Australia

Orr, RM, Ford, K, Stierli, M. Implementation of an ability-based training program in police force recruits. *J Strength Cond Res* 30(10): 2781-2787, 2016.

FITNESS AND ACADEMY GRADUATION LAW ENFORCEMENT

	GRAD (n = 330)	SEP: Personal Reasons (n = 28)	SEP: Fitness or Injury (n = 18)	SEP: Academic or Scenario Failure (n = 25)
Age (years)	26.67 ± 5.19	29.35 ± 8.02	29.59 ± 6.88	32.70 ± 9.01*
Height (m)	1.75 ± 0.09	1.74 ± 0.10	1.63 ± 0.04§	1.74 ± 0.08
Body Mass (kg)	80.69 ± 14.38	74.57 ± 14.52	79.50 ± 16.27	80.00 ± 12.54
Push-ups (no.)	42.48 ± 15.09	39.48 ± 14.01	34.63 ± 16.44	40.38 ± 12.24
Sit-ups (no.)	36.19 ± 9.04	35.78 ± 8.72	33.13 ± 7.59	34.29 ± 10.39
75-yard Pursuit Run (s)	16.97 ± 1.32	17.60 ± 1.21	17.94 ± 1.37*	17.69 ± 1.28*
Medicine Ball Throw (m)	5.84 ± 1.22	5.52 ± 1.35	5.73 ± 1.29	5.96 ± 1.01
Vertical Jump (cm)	53.60 ± 12.53	51.58 ± 13.43	47.94 ± 11.69	53.34 ± 11.83
MSFT shuttles (no.)	52.75 ± 16.69	41.54 ± 10.74*	39.94 ± 13.03*	46.08 ± 11.19

Lockie RG, Balfany K, Bloodgood AM, Moreno MR, Cesario KA, Dulla JM, Dawes JJ, Orr RM. The influence of physical fitness on reasons for academy separation in law enforcement recruits. *Int J Environ Res Public Health* 16(3):372, 2019.

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WHY? TAKE HOME MESSAGES

- Hidden curriculum → physical training used in part to instill discipline
- Cumulative stress → training staff imparting psychological stress
- Training approach → if running a feature of academy training, aerobic fitness (i.e., multistage fitness test performance) becomes more important

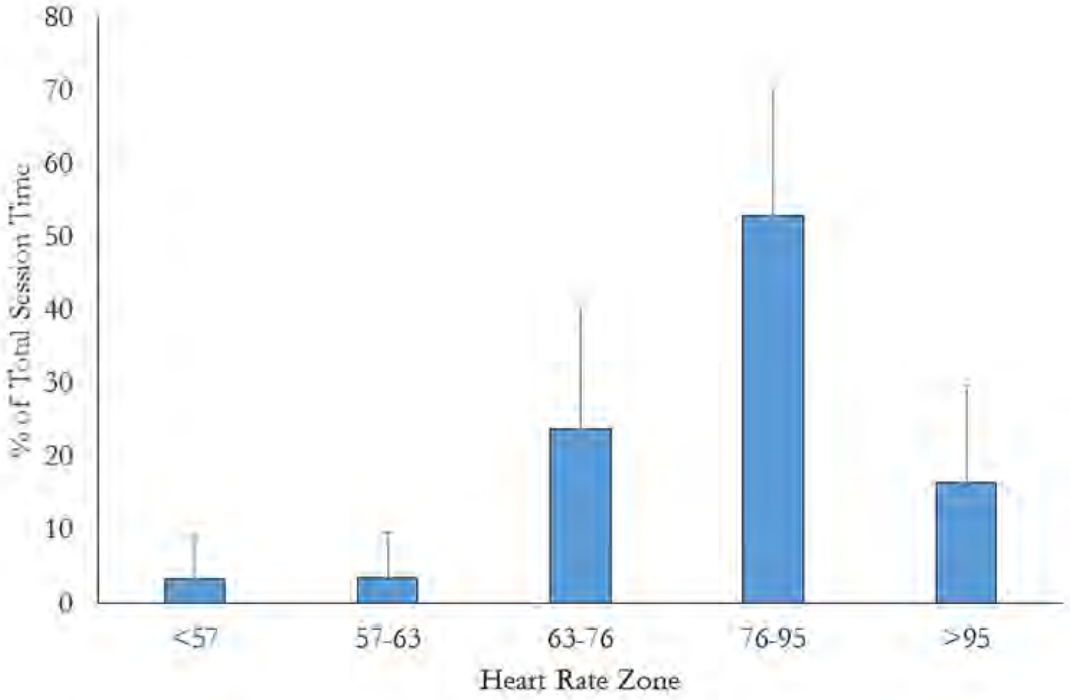

FIGURE 1. PERCENTAGE OF TOAL SESSION TIME SPENT IN DIFFERENT HEART RATE ZONES BY CUSTODY ASSISTANT RECRUITS DURING A PSYCHOLOGICAL STRESS SESSION DURING THE FIRST DAY OF ACADEMY TRAINING

Lockie RG, Cesario KA, Bloodgood AM, Moreno MR. Heart rate response to psychological stress: Importance of stress education for law enforcement recruits. *TSAC Report* (51): 4-7, 2018.

FITNESS AND ACADEMY GRADUATION FIRE DEPARTMENT

	Graduated (n = 261)	Released due to Injury (n = 10)	Released due to Performance (n = 34)
Illinois Agility Test (s)	18.33 ± 1.43	18.84 ± 0.63	19.34 ± 1.14*
Push-ups (no.)	63.17 ± 22.76	61.22 ± 26.40	52.24 ± 23.06*
Pull-ups (no.)	12.21 ± 6.34	12.60 ± 6.13	7.88 ± 5.72*
BOMBT (m)	9.74 ± 1.52	9.10 ± 2.08	7.83 ± 2.14*
Leg Tuck (no.)	12.15 ± 5.69	14.78 ± 5.89	9.68 ± 6.19
$\dot{V}O_{2max}$ ($ml \cdot kg^{-1} \cdot min^{-1}$)	46.54 ± 5.89	43.21 ± 4.54	42.67 ± 5.01*
Deadlift (kg)	144.85 ± 14.46	142.88 ± 10.14	132.22 ± 17.68*
Farmer's Carry (s)	28.73 ± 4.16	28.41 ± 2.87	30.46 ± 4.16*

Lockie RG, Orr RM, Montes F, Ruvalcaba TJ, Dawes JJ. The impact of physical fitness on reasons for academy release in firefighter cadets. *J Strength Cond Res* (under review).

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WHY? TAKE HOME MESSAGES

- Physical demands associated with firefighting job tasks
- Numerous fitness capacities contribute to these job tasks
- Not to say people with lesser strength, anaerobic, or aerobic fitness cannot do the job → must maximize what they have!

TABLE 3. Correlations between physical attributes and CPAT time.*

	R value	*p* Value
Absolute $\dot{V}O_2max$	−0.602	<0.001
Chest press 1 RM	−0.485	<0.001
WAnT mean power	−0.664	<0.001
WAnT relative mean power	−0.598	0.002
WAnT total work	−0.664	<0.001
WAnT relative total work	−0.598	0.002
WAnT fatigue index	0.559	0.005
HR at finish of stair mill task	0.523	0.007
Isometric finger strength	−0.500	0.009
Diastolic BP at finish of stair mill task	0.507	0.009

*$\dot{V}O_2max$ = maximum oxygen uptake; WAnT = Wingate anaerobic cycling test; 1 RM = 1 repetition maximum; HR = heart rate; BP = blood pressure.

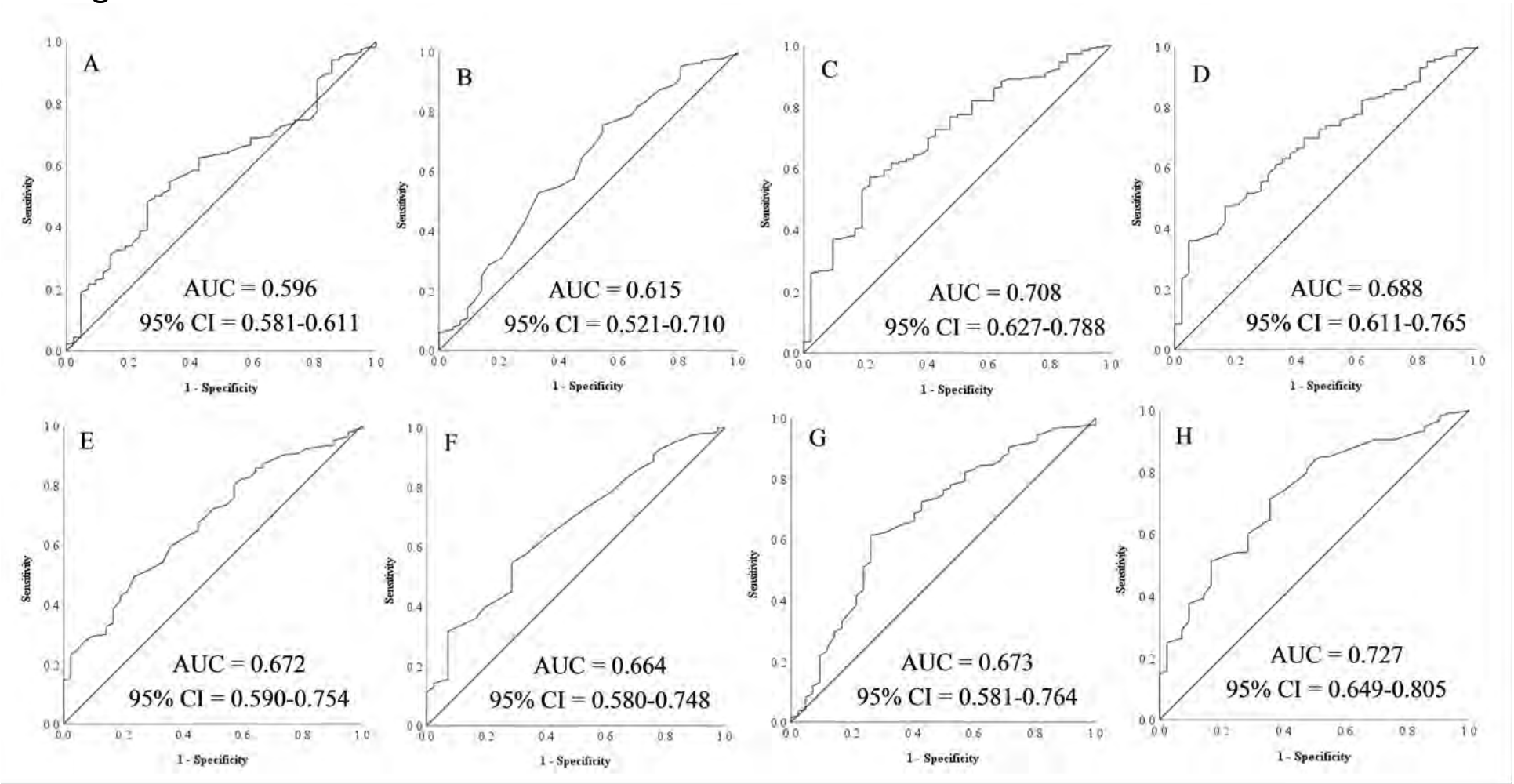
Sheaff AK, Bennett A, Hanson ED, Kim YS, Hsu J, Shim JK, Edwards ST, Hurley BF. Physiological determinants of the Candidate Physical Ability Test in firefighters. *J Strength Cond Res* 24(11):3112-3122, 2010.

FITNESS = GUARANTEED SUCCESS?

- Greater fitness does not guarantee success
- Lesser fitness may not guarantee failure
- Challenge of creating cut scores for a fitness test → false positives and false negatives
- Should not be arbitrarily set

	Status of Cadet/Recruit/Trainee: Graduated	Status of Cadet/Recruit/Trainee: Separated	
Fitness Test Result Cut Score	**True Positive**	**False Positive**	Row entries for determining positive predictive value
	False Negative	**True Negative**	Row entries for determining negative predictive value
	Sensitivity	Specificity	

Receiver operating curves, diagonal reference line, and area under the curve (AUC) values for (A) combined grip strength, (B) vertical jump, (C) 75-yard pursuit run, (D) 2-kg medicine ball throw, (E) push-ups, (F) sit-ups, (G) arm ergometer, and (H) 20-m multistage fitness test.



Lockie, RG, Dawes, JJ, Dulla, JM, and Orr, RM. Extending research on law enforcement academy graduation and fitness: A research note on receiver operating characteristic curves. *J Strength Cond Res*, doi: 10.1519/JSC.0000000000004268. Online ahead of print.

FITNESS AND ACADEMY GRADUATION LAW ENFORCEMENT – A DIFFERENT PERSPECTIVE

	Graduated Females	Separated Males	*p* value
Vertical Jump (cm)	43.56 ± 5.13	51.99 ± 8.69*	<0.001
Maximal Push-ups (no.)	29.26 ± 7.52	34.78 ± 9.87*	0.001
Sit-ups in 60 s (no.)	38.82 ± 5.99	34.88 ± 6.11*	<0.001
2.4 km run (min)	13.94 ± 1.44	13.95 ± 2.12	1.000
300 m sprint (s)	60.49 ± 4.66	55.45 ± 5.98*	<0.001

Dawes, JJ, Johnson, Q, Terrance, T, Orr, RM, Lockie, RG. (2020). Differences in selected measures of fitness between police cadets that pass or fail training academy. *43rd National Strength and Conditioning Association National Conference and Exhibition*, Virtual Conference, July 8-11.

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INDIRECT BENEFITS OF FITNESS/STRENGTH AND CONDITIONING → TAKE HOME MESSAGES

- Better habits and organization
  - "Sloppy with their fitness, sloppy in other areas"
- More effective recovery from fitness and physically demanding skills training
  - Could influence study habits, academic and skills testing
- Maximizing what the cadet/recruit/trainee has → appropriate physical training/strength and conditioning programs

COLORADO STATE PATROL ACADEMY

- 27-week academy
- Assessment and risk profile
- Zero week incorporating teaching and movement coaching
- Weeks 13-14: defensive tactics
- Multifaceted, periodized program
- Not always just about improving fitness

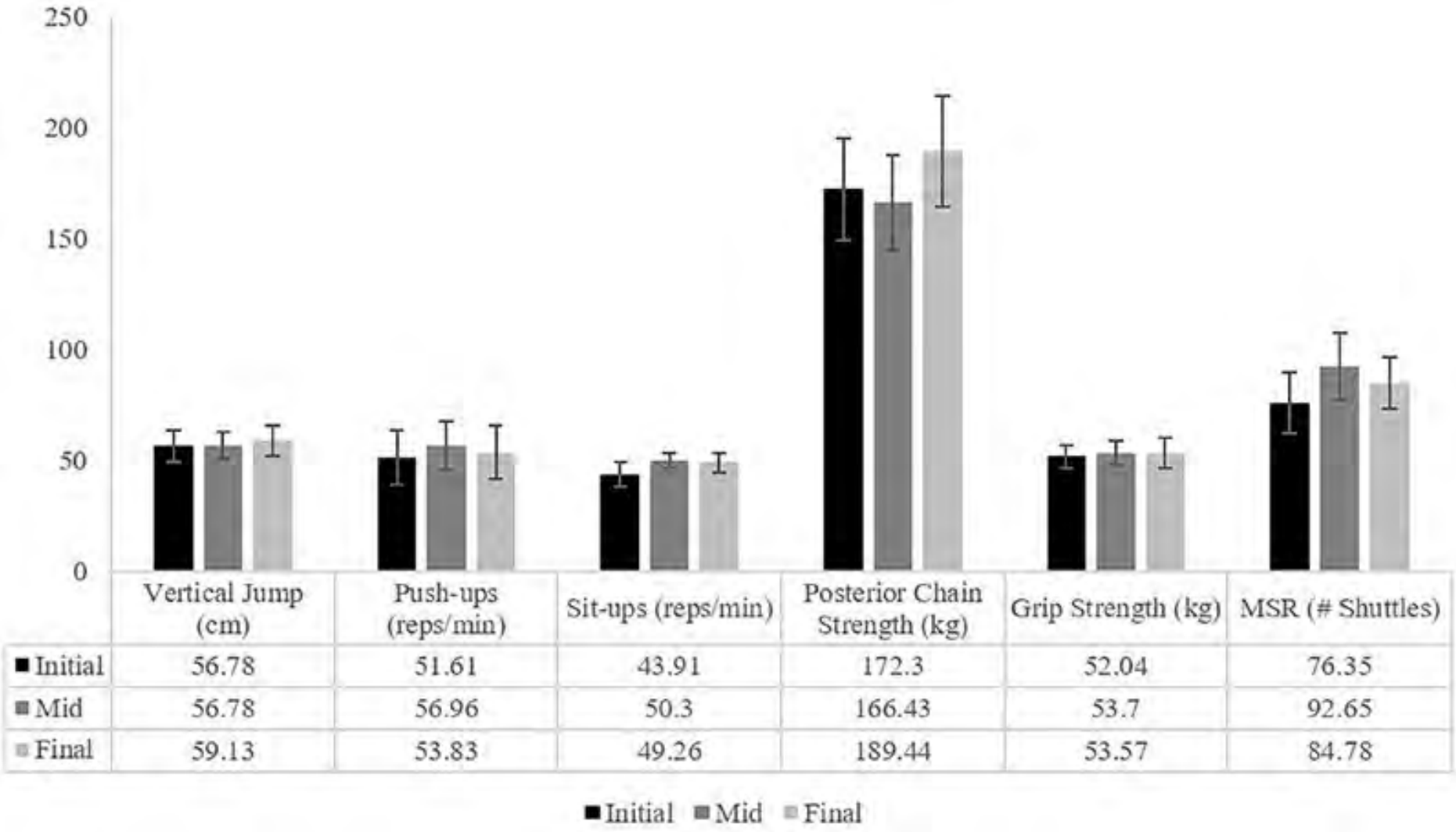
Holmes RJ, Kornhauser CL. Building Injury Free Tactical Athletes: A Repeatable Model for Police Academy Recruit Training. *TSAC Annual Training*. Norfolk, VA, 2018.

Lockie RG, MacLean ND, Dawes JJ, Pope RP, Holmes RJ, Kornhauser CL, Orr RM. The impact of formal strength and conditioning on the fitness of police recruits: A retrospective cohort study. *Int J Exerc Sci* 13(4):1615-1629, 2020.

COLORADO STATE PATROL ACADEMY SAMPLE TRAINING WEEK

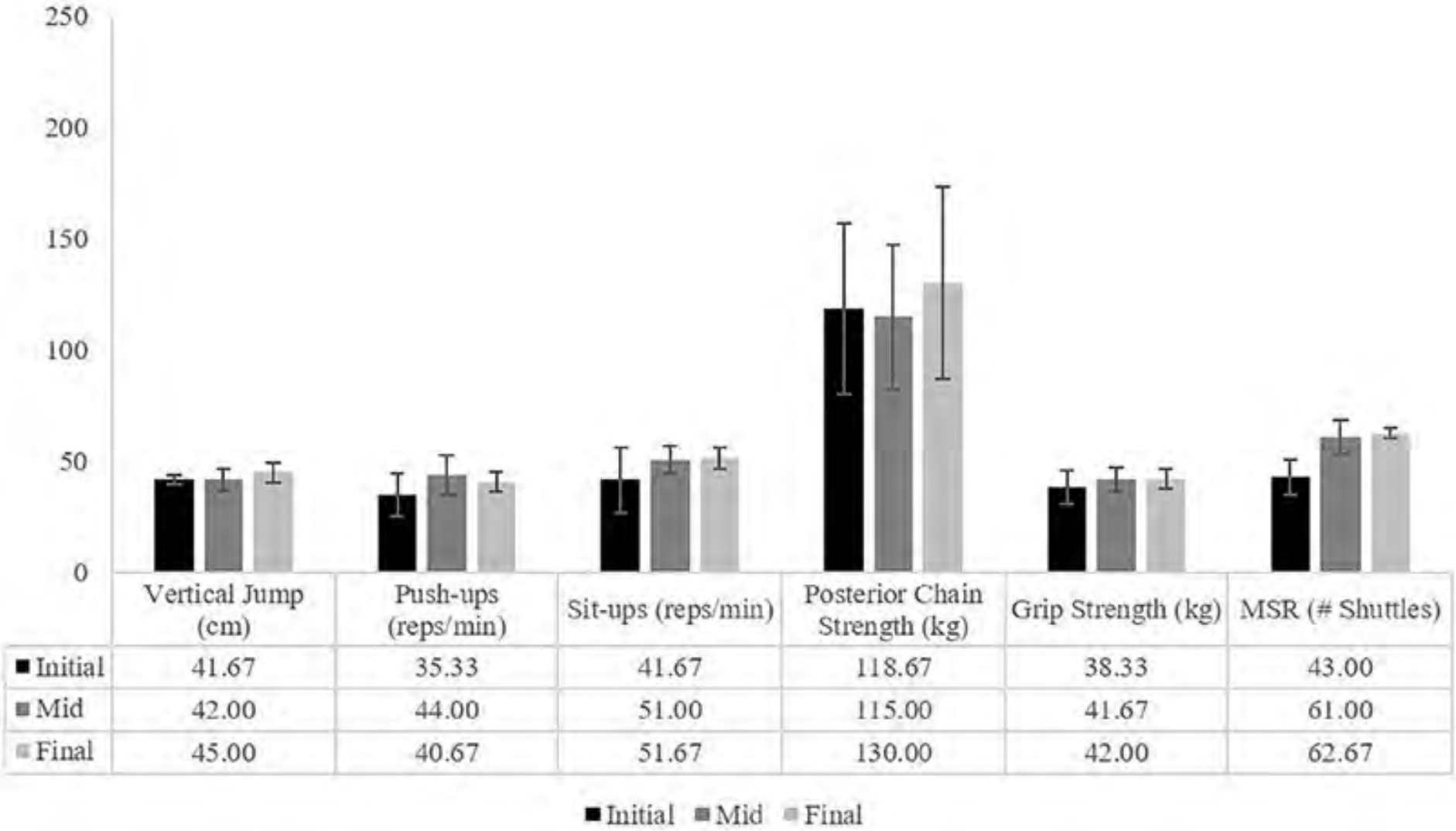
Day	Tuesday	Wednesday	Thursday	Friday
Exercise Routine	3 x Power Clean/Front Squat 5 x Bent Over Rows 7 x Push-ups	Burpee Pullups for Maximum Repetitions	10 x Sprints 10 x Suicide Sprints Beep Test	21 x 15 x 9 Wall Throws with Ball / Broad Jump Burpees / Kettlebell Swings / Front Squats

Lockie RG, MacLean ND, Dawes JJ, Pope RP, Holmes RJ, Kornhauser CL, Orr RM. The impact of formal strength and conditioning on the fitness of police recruits: A retrospective cohort study. *Int J Exerc Sci* 13(4):1615-1629, 2020.



	Vertical Jump (cm)	Push-ups (reps/min)	Sit-ups (reps/min)	Posterior Chain Strength (kg)	Grip Strength (kg)	MSR (# Shuttles)
Initial	56.78	51.61	43.91	172.3	52.04	76.35
Mid	56.78	56.96	50.3	166.43	53.7	92.65
Final	59.13	53.83	49.26	189.44	53.57	84.78

Mean male recruit (n = 23) fitness parameters from the initial (week 0), mid (week 14), and final (week 27) assessment periods in a 27-week police training academy.



	Vertical Jump (cm)	Push-ups (reps/min)	Sit-ups (reps/min)	Posterior Chain Strength (kg)	Grip Strength (kg)	MSR (# Shuttles)
Initial	41.67	35.33	41.67	118.67	38.33	43.00
Mid	42.00	44.00	51.00	115.00	41.67	61.00
Final	45.00	40.67	51.67	130.00	42.00	62.67

Mean female recruit (n = 3) fitness parameters from the initial (week 0), mid (week 14), and final (week 27) assessment periods in a 27-week police training academy.

COLORADO STATE PATROL ACADEMY

- Weeks 18-19: Programming Education and Self-Direction Transition
  - Students will learn the process of programming their own exercise routines and will begin to use what they have learned to work out on their own, but still under instructor supervision
- Weeks 20-21
  - Training sessions are “hands off”
  - Recruits responsible for individual programming
  - Focus on programming they enjoy

The Job

RECRUIT/CADET VS. INCUMBENT FIRST RESPONDERS

- The job of the recruit/cadet/trainee is to train; the incumbent first responder must perform their job tasks effectively
- Firefighters → recommended to have a minimum aerobic capacity of 42 $ml \cdot kg^{-1} \cdot min^{-1}$
- Police officers generally do not have to maintain fitness when employed (although recommended)
- Fitness can be important → however, tactical decisions can limit application of fitness

National Fire Protection Association. NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments, 2022. Available at: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1582. Accessed on September 9, 2021.

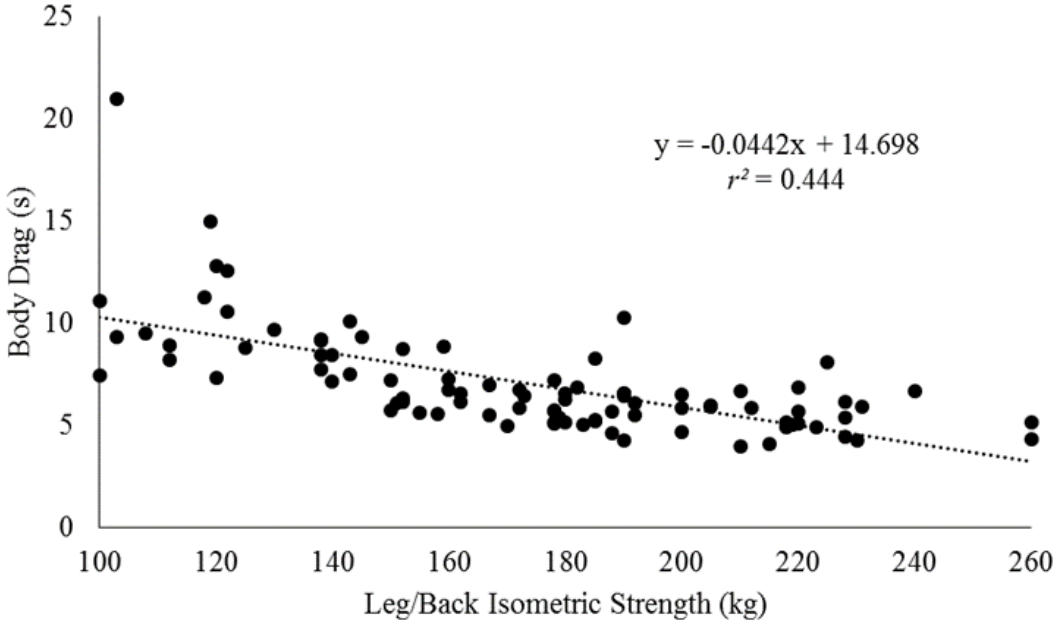
165-LB (74.84-KG) BODY DRAG FOR CALIFORNIAN LAW ENFORCEMENT RECRUITS (WORK SAMPLE TEST BATTERY)

165-LB (74.84-KG) BODY DRAG FOR FIREFIGHTER CANDIDATES (CANDIDATE PHYSICAL ABILITY TEST)

Relationships between Isometric Strength and the 74.84-kg (165-lb) Body Drag Test in Law Enforcement Recruits

by
Robert G. Lockie[1], Matthew R. Moreno[1], Megan B. McGuire[1], Tomas J. Ruvalcaba[1], Ashley M. Bloodgood[1], Joseph M. Dulla[2,3], Robin M. Orr[3], J. Jay Dawes[4]

		Body Drag Time
Grip Strength	*r*	-0.599*
	p	<0.001
Relative Grip Strength	*r*	-0.261*
	p	0.013
Leg/Back Strength	*r*	-0.666*
	p	<0.001
Relative Leg/Back Strength	*r*	-0.322*
	p	0.002



Lockie, RG, Moreno, MR, McGuire, MB, Ruvalcaba, TR, Bloodgood, AM, Dulla, JM, Orr, RM, Dawes, JJ. Relationships between isometric strength and the 74.84-kg (165-lb) body drag test in law enforcement recruits. *J Hum Kinet* 74: 5-13. 2020.

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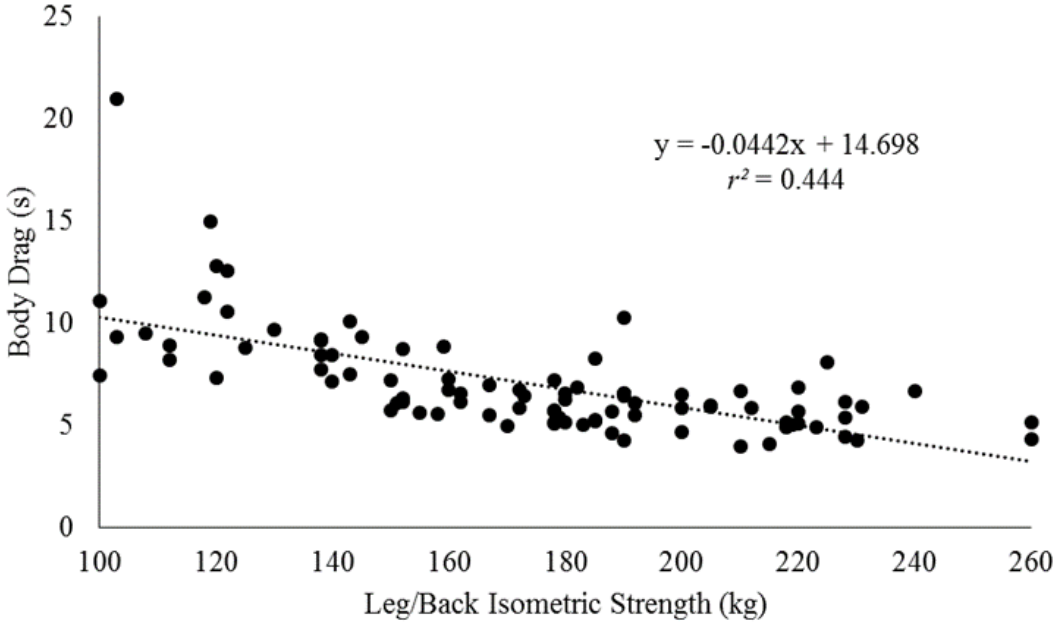

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THE FIRST RESPONDER

- Decreased physical activity → decreased physical fitness
- Long hours, shift work
- Disrupted sleep
- Poor dietary choices → obesity
- Stress
- Load carriage
- Injuries

Soteriades ES, Smith DL, Tsismenakis AJ, Baur DM, Kales SN. Cardiovascular disease in US firefighters: A systematic review. Cardiol Rev 19(4):202-215, 2011.
Zimmerman FH. Cardiovascular disease and risk factors in law enforcement personnel: A comprehensive review. Cardiol Rev 20(4):159-166, 2012.

LOS ANGELES COUNTY
SHERIFF

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Southern Counties News
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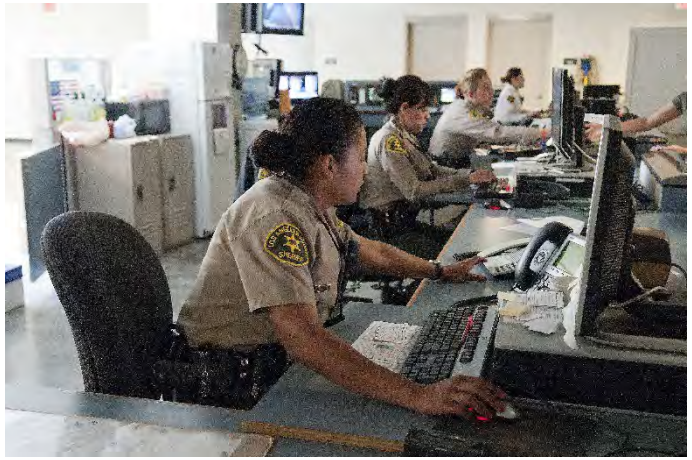
POLICE



Descriptive data (mean ± SD) for age, height, body mass, and the Work Sample Test Battery tasks in recruits (REC), and deputy sheriffs who had spent ≤24 months (DS24), 25-47 months (DS2547), and ≥48 months (DS48+) working in custody.

Variables	REC (n = 253)	DS24 (n = 20)	DS2547 (n = 23)	DS48+ (n = 21)
Age (years)	26.69 ± 5.26	30.30 ± 6.36*	30.30 ± 5.35*	36.33 ± 6.26*§ϕ
Height (m)	1.75 ± 0.10	1.74 ± 0.07	1.74 ± 0.09	1.71 ± 0.10
Body mass (kg)	79.69 ± 12.29	88.99 ± 13.68	85.46 ± 15.08	83.79 ± 19.35
99-yard Obstacle Course (s)	18.49 ± 1.63	18.83 ± 1.60	19.13 ± 1.81	20.64 ± 2.25*
165-lb Body Drag (s)	5.41 ± 3.19	4.64 ± 0.84	5.08 ± 0.68	6.17 ± 1.77
6-foot Chain Link Fence Climb (s)	7.83 ± 1.20	7.60 ± 1.62	7.69 ± 1.89	9.78 ± 2.41*§ϕ
6-foot Solid Wall Climb (s)	7.75 ± 1.37	7.63 ± 2.09	7.86 ± 1.82	9.83 ± 4.45*§ϕ
500-yard Run (s)	89.20 ± 7.99	100.75 ± 15.08*	108.09 ± 38.80*	113.19 ± 18.76*

Lockie RG, Orr RM, Moreno MR, Dawes JJ, Dulla JM. Time spent working in custody influences Work Sample Test Battery performance of Deputy Sheriffs compared to recruits. *Int J Environ Res Public Health* 16(7):1108, 2019.

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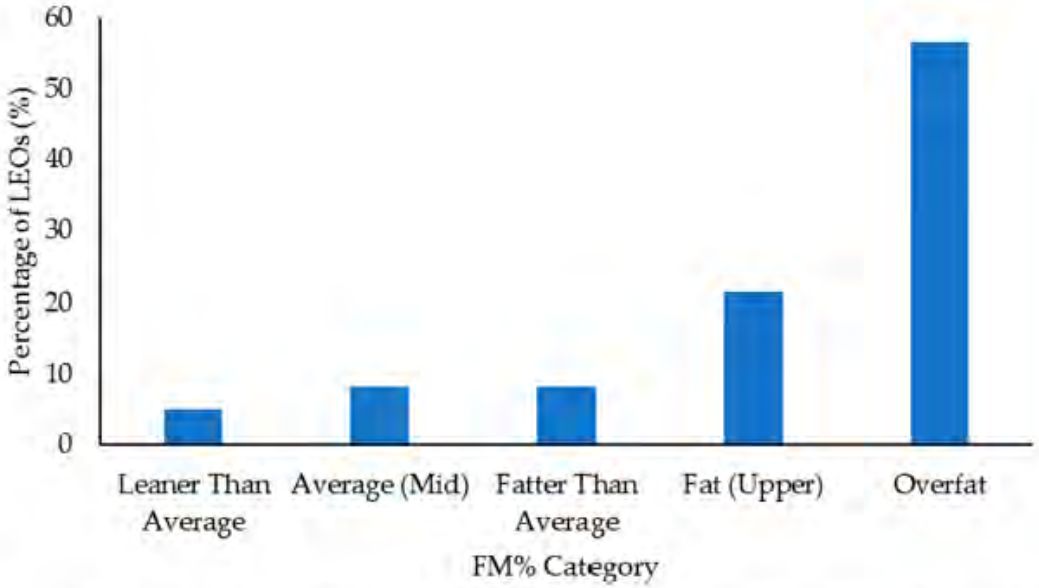

Figure 2. Percentage of law enforcement officers (LEOs) in this sample (n = 60) classified according to the percentage of fat mass (FM%) categories.

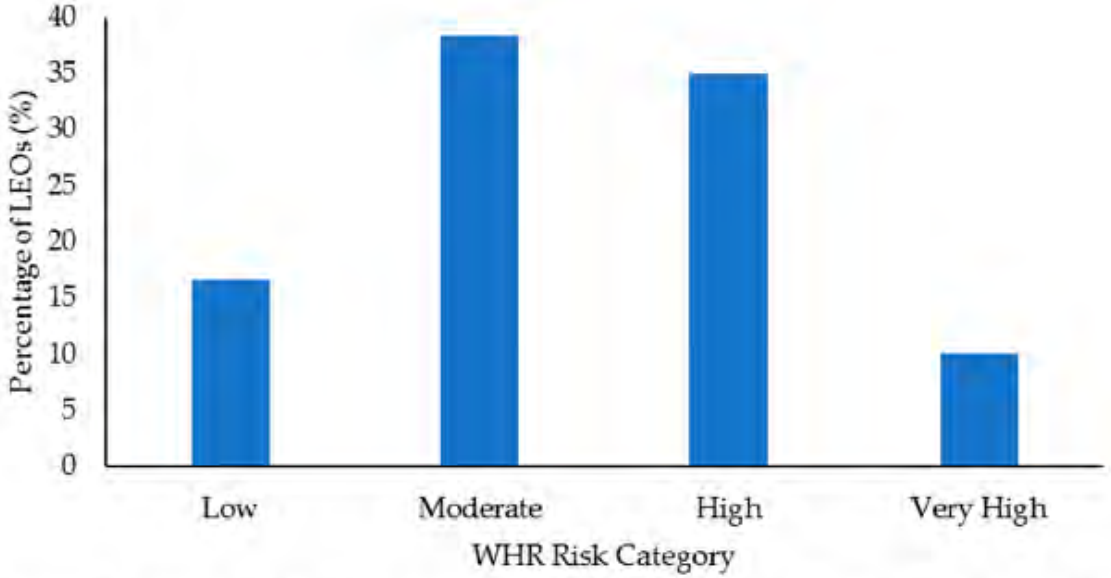

Figure 3. Percentage of law enforcement officers (LEOs) in this sample (n = 60) classified according to the waist-to-hip ratio (WHR) cardiovascular disease risk categories.

Lockie RG, Rodas KA, Dawes JJ, Dulla JM, Orr RM, Moreno MR. How does time spent working in custody influence health and fitness characteristics of law enforcement officers? *Int J Environ Res Public Health* 18(17):9297, 2021.

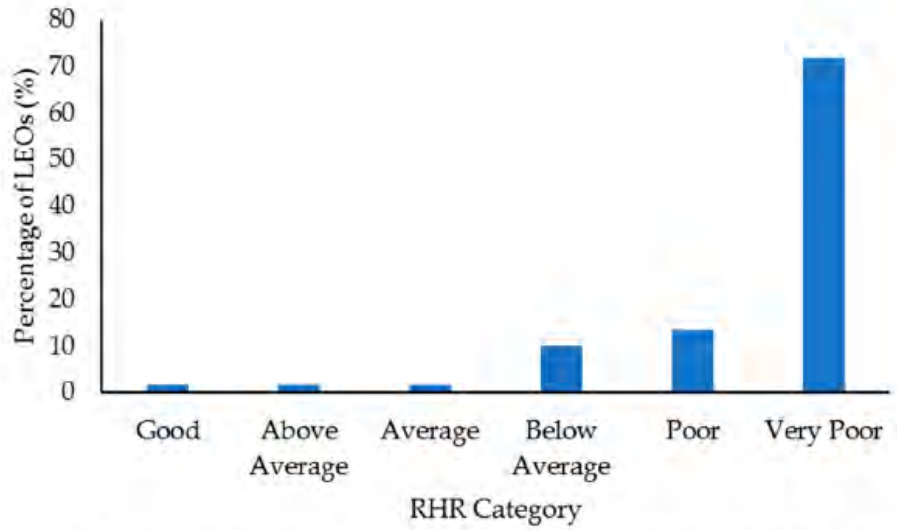

Figure 4. Percentage of law enforcement officers (LEOs) in this sample (n = 60) classified according to the resting heart rate (RHR) categories.

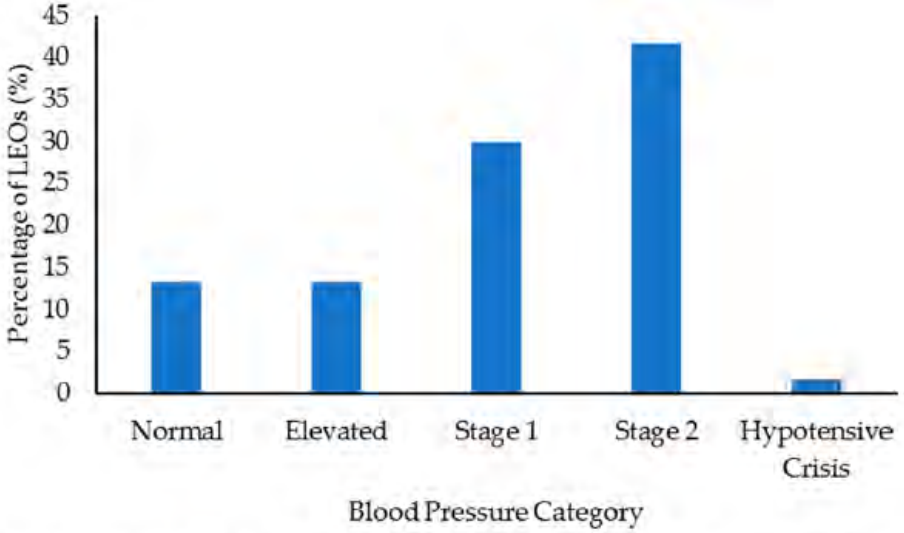

Figure 5. Percentage of law enforcement officers (LEOs) in this sample (n = 60) classified according to the blood pressure standards.

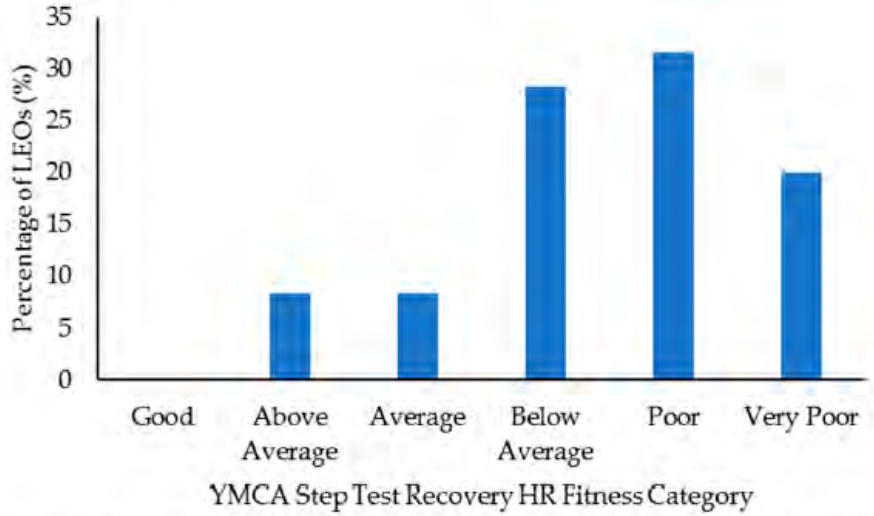

Figure 8. Percentage of law enforcement officers (LEOs) in this sample (n = 60) classified according to the YMCA step test recovery heart rate (HR) categories.

Lockie RG, Rodas KA, Dawes JJ, Dulla JM, Orr RM, Moreno MR. How does time spent working in custody influence health and fitness characteristics of law enforcement officers? *Int J Environ Res Public Health* 18(17):9297, 2021.

TABLE 2. Longitudinal changes in body composition, aerobic fitness, muscular power, muscular strength, and muscular endurance.

Measure[a]	W1	W14	W38	Test Statistics[b]	Sig. Pairwise Comparisons[c]
Body composition					
Body mass (kg)	87.18 ± 1.87	84.55 ± 1.56	87.11 ± 1.74	$F_{2,52} = 13.229$, $P < 0.001$, $\eta^2_p = 0.337$	W1 > W14; W14 < W38
BMI (kg·m^{-2})	26.98 ± 0.58	26.58 ± 0.45	27.13 ± 0.53	$F_{2,52} = 4.906$, $P = 0.011$, $\eta^2_p = 0.159$	W14 < W38
WHR	0.85 ± 0.01	0.83 ± 0.01	0.88 ± 0.01	$F_{2,52} = 19.012$, $P < 0.001$, $\eta^2_p = 0.422$	W1 > W14; W1 and W14 < W38
Est. BF (%)	17.77 ± 0.78	12.30 ± 0.60	14.65 ± 0.67	$F_{2,52} = 103.104$, $P < 0.001$, $\eta^2_p = 0.799$	W1 > W14 and W38; W14 < W38
Est. FFM (kg)	71.61 ± 6.43	74.18 ± 6.19	74.33 ± 6.40	$F_{2,52} = 24.276$, $P < 0.001$, $\eta^2_p = 0.483$	W1 < W14 and W38
Aerobic fitness					
Est. Abs. $\dot{V}O_{2max}$[d] (L·min^{-1})	2.97 ± 0.75	3.88 ± 0.57	3.79 ± 0.54	$F_{2,52} = 35.461$, $P < 0.001$, $\eta^2_p = 0.577$	W1 < W14 and W38
Est. Rel. $\dot{V}O_{2max}$ (mL·kg^{-1}·min^{-1})	36.07 ± 0.82	46.26 ± 0.88	44.19 ± 1.06	$F_{2,52} = 105.325$, $P < 0.001$, $\eta^2_p = 0.802$	W1 < W14 and W38; W14 > W38
Rel. HR_{15s} (%)	84.77 ± 1.67	65.89 ± 1.25	69.55 ± 1.66	$F_{2,52} = 124.570$, $P = 0.001$, $\eta^2_p = 0.827$	W1 > W14 and W38; W14 < W38
Muscular power ($n = 25$)					
CMJ height (cm·kg^{-1})	0.49 ± 0.02	0.49 ± 0.02	0.48 ± 0.02	$F_{2,48} = 2.508$, $P = 0.092$, $\eta^2_p = 0.095$	—
CMJ power (W·kg^{-1})	41.40 ± 2.08	39.32 ± 2.48	37.12 ± 1.93	$F_{2,48} = 2.413$, $P = 0.100$, $\eta^2_p = 0.091$	—
CMJ force (N·kg^{-1})	21.32 ± 0.41	21.30 ± 0.53	21.60 ± 0.48	$F_{2,48} = 0.212$, $P = 0.810$, $\eta^2_p = 0.009$	—
CMJ velocity (cm·s^{-1}·kg^{-1})	2.71 ± 0.12	2.65 ± 0.14	2.47 ± 0.10	$F_{2,48} = 3.292$, $P = 0.046$, $\eta^2_p = 0.121$	W1 > W38
Muscular strength ($n = 26$)					
Avg. HG (%)	62.02 ± 1.77	62.18 ± 1.71	59.61 ± 1.58	$F_{2,50} = 3.292$, $P = 0.045$, $\eta^2_p = 0.116$	W14 > W38
Est. 1-RM bench press (%)	111.87 ± 5.22	122.07 ± 4.89	115.99 ± 4.92	$F_{2,50} = 17.868$, $P < 0.001$, $\eta^2_p = 0.417$	W1 < W14 and W38; W14 > W38
Est. 1-RM squat[d] (%)	106.68 ± 4.79	140.65 ± 4.35	138.00 ± 4.11	$F_{2,40.1} = 144.212$, $P < 0.001$, $\eta^2_p = 0.852$	W1 < W14 and W38
Muscular endurance					
$Push\text{-}up_{max}$ (%)	42.69 ± 2.51	58.24 ± 3.39	48.43 ± 2.81	$F_{2,52} = 27.005$, $P < 0.001$, $\eta^2_p = 0.509$	W1 < W14 and W38; W14 > W38
$Plank_{max}$ (%)	62.56 ± 4.51	83.77 ± 3.55	61.22 ± 4.14	$F_{2,52} = 22.423$, $P < 0.001$, $\eta^2_p = 0.463$	W1 < W14; W14 > W38

[a]Descriptive statistics are presented as mean ± SE. $N = 27$, unless otherwise noted.
[b]Test statistics are results of *post hoc* RM ANOVA tests.
[c]Statistically significant *post hoc* pairwise findings determined using $P < 0.05$.
[d]Greenhouse–Geisser correction applied.

Cornell DJ, Gnacinski SL, Meyer BB, Ebersole KT. Changes in health and fitness in firefighter recruits: An observational cohort study. *Med Sci Sports Exerc* 49(11):2223-2233, 2017.

HEALTH AND WELLNESS PROGRAMS

- Multi-faceted
  - Health and fitness testing, strength and conditioning, alcohol and drug use interventions, nutrition, body weight management, injury prevention, stress management, trauma resilience
- Voluntary, but can be incentivized
  - e.g., attainment of certain fitness standards = extra pay

Day RS, Jahnke SA, Haddock CK, Kaipust CM, Jitnarin N, Poston WSC. Occupationally tailored, web-based, nutrition and physical activity program for firefighters: Cluster randomized trial and weight outcome. J Occup Environ Med 61(10):841-848, 2019.

Kuhns, JB, Maguire, ER, Leach, NR. Health, Safety, and Wellness Program Case Studies in Law Enforcement, 2015. Available at: https://www.publicsafety.gc.ca/lbrr/archives/cnmcs-plcng/cn36413-eng.pdf. Accessed September 29, 2021.

Lockie, RG, Orr, RM, Dawes, JJ. Slowing the path of time: Age-related and normative fitness testing data for police officers from a health and wellness program. *J Strength Cond Res* 36(3): 747-756, 2022.

Lockie, RG, Orr, RM, Dawes, JJ. Fit (and healthy) for duty: Blood lipid profiles and physical fitness test relationships from police officers in a health and wellness program. *Int J Environ Res Public Health* 19(9): 5408, 2022.

EXAMPLE: WELLNESS SOLUTIONS AND ANAHEIM PD

- Anaheim PD: ~400 sworn personnel
- In 2018, 305 employees signed up to the program
- Incentives: $200 per year toward a gym membership or fitness equipment, up to 12 hours of paid leave
- Individual training sessions, nutrition consultations, educational seminars

James, E. Officers stay healthy with Anaheim Police Department's popular wellness program. Available from: https://behindthebadge.com/officers-stay-healthy-anaheim-police-departments-popular-wellness-program/. Accessed May 30, 2022.

Descriptive data (mean ± SD) for law enforcement officers who participated in a health and wellness program in 2018, 2019, and 2020. The number of officers (n) with data per year is also noted for each variable in respective order.

	2018	2019	2020
Age (years; n = 209, 238, 186)	39.48 ± 8.49	38.81 ± 8.66	40.76 ± 7.81
Body Mass (kg; n = 209, 237, 186)	86.62 ± 17.28	85.90 ± 14.70	86.08 ± 15.07
BF% (n = 209, 235, 186)	22.54 ± 9.29	22.15 ± 8.56	21.24 ± 8.28
Systolic BP (mmHg; n = 209, 238, 186)	124.69 ± 9.30	123.43 ± 9.53	133.32 ± 12.50*§
Diastolic BP (mmHg; n = 209, 238, 186)	78.98 ± 6.59	79.62 ± 6.50	81.19 ± 9.74
Estimated $\dot{V}O_{2max}$ ($ml \cdot kg^{-1} \cdot min^{-1}$; n = 208, 231, 10)	53.89 ± 9.22	53.71 ± 8.94	56.25 ± 8.99
Sit-and-Reach (cm; n = 208, 237, 184)	30.01 ± 8.80	30.36 ± 8.39	31.43 ± 8.01ϕ
Push-ups (repetitions; n = 208, 234, 181)	43.94 ± 18.40	45.96 ± 18.30	48.36 ± 18.60
Vertical Jump (cm; n = 205, 233, 184)	56.73 ± 13.35	57.12 ± 11.28	54.92 ± 13.10
Grip Strength (kg; n = 209, 238, 185)	91.43 ± 21.09	94.50 ± 22.29	98.72 ± 21.06ϕ
Sit-ups (repetitions; n = 189, 192, 155)	41.40 ± 11.70	45.15 ± 24.62	43.56 ± 10.21
Bench Press Ratio ($kg \cdot body\ mass^{-1}$; n = 209, 237, 183)	1.12 ± 0.31	1.11 ± 0.31	1.12 ± 0.27

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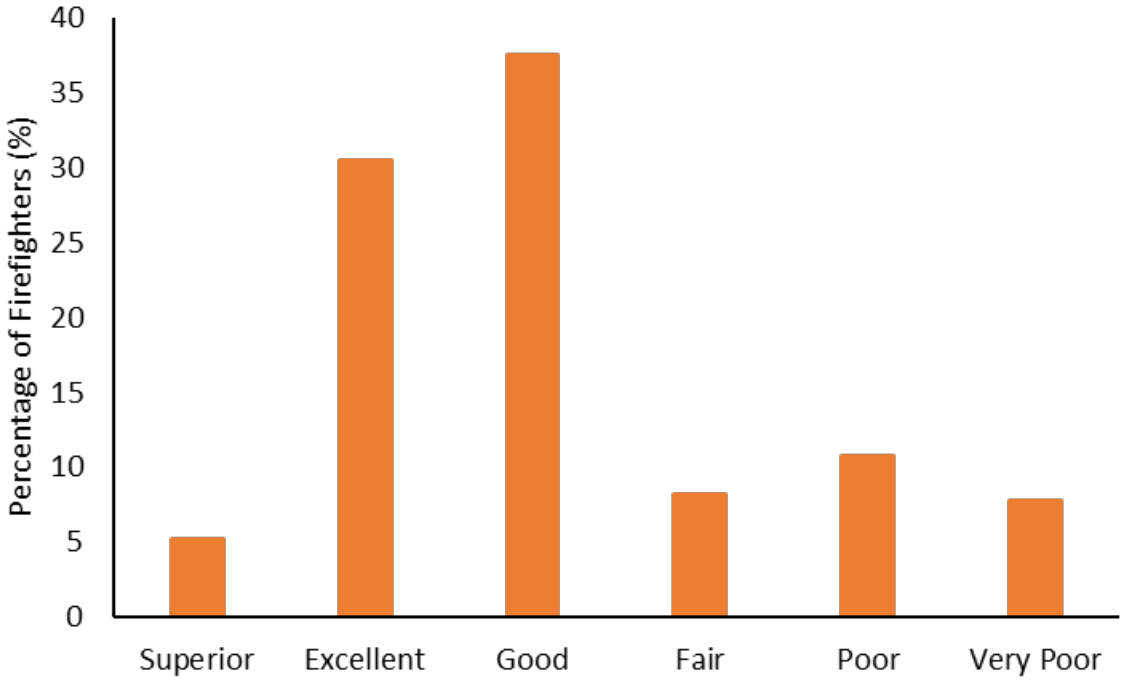
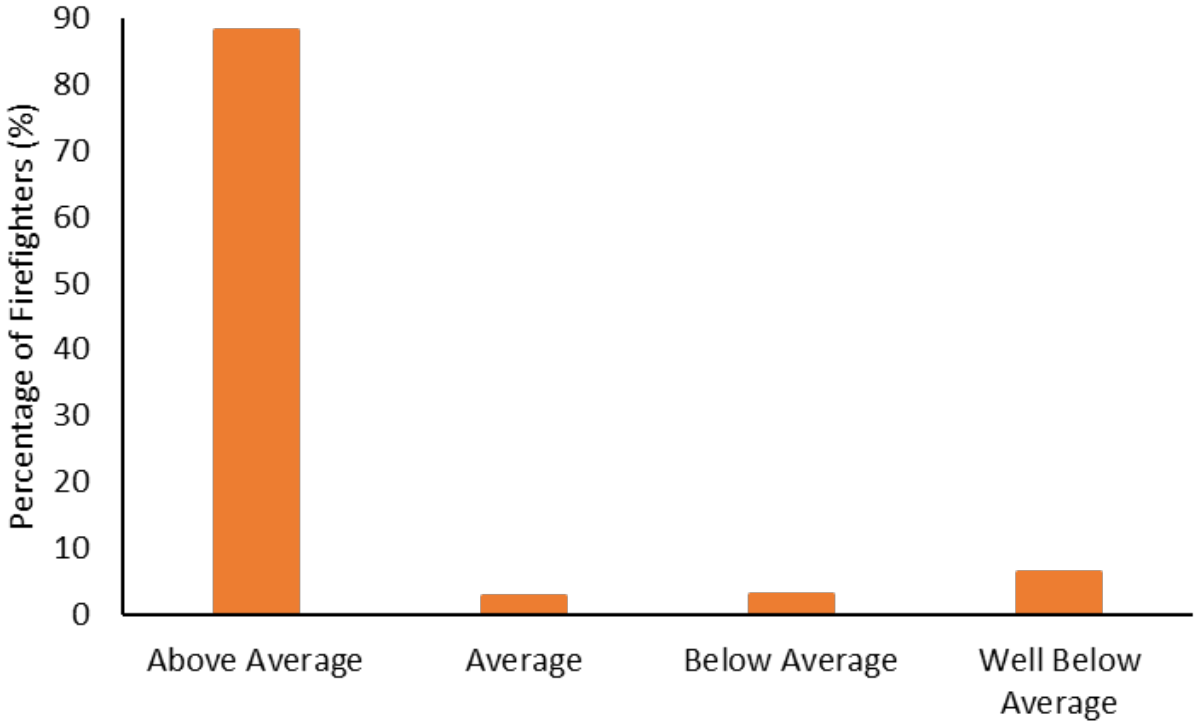
SACFIT AND FIREFIGHTERS



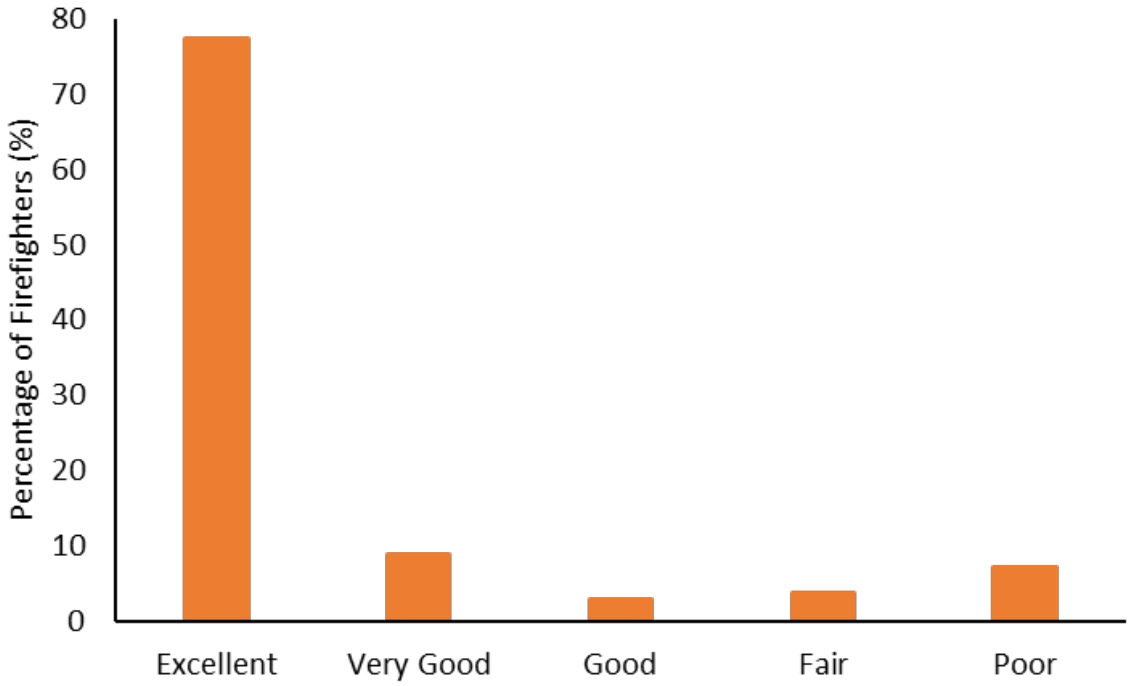
Percentage of firefighters (258 males, 12 females) classified according to estimated $\dot{V}O_{2max}$.



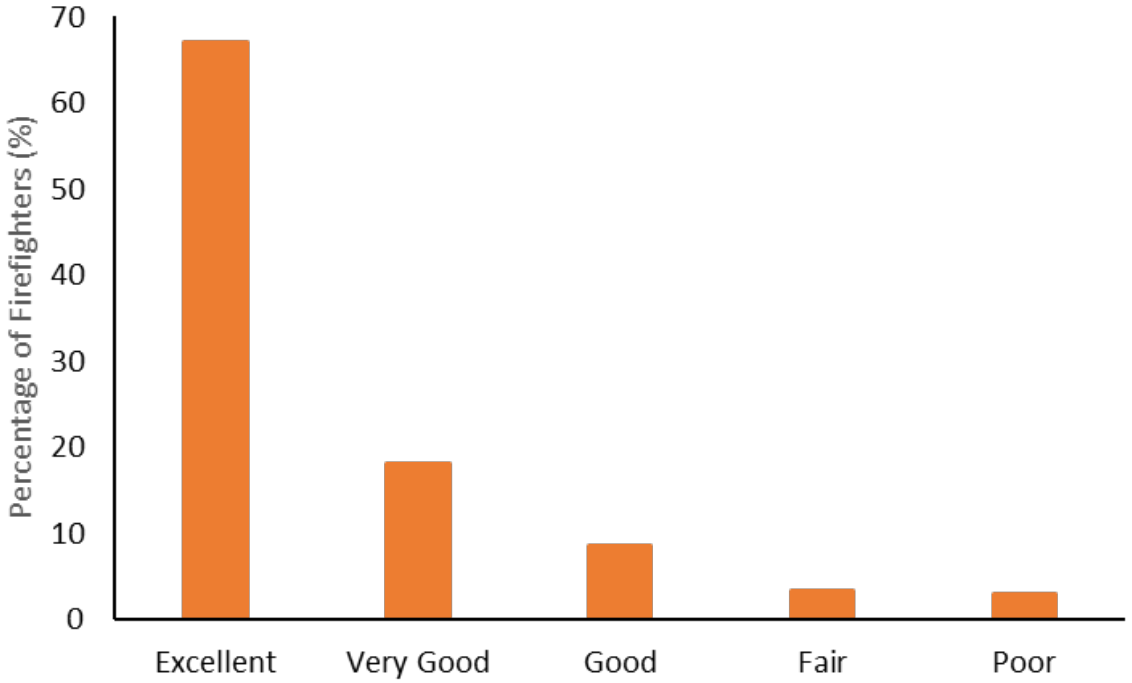
Percentage of firefighters (258 males, 12 females) classified according to relative 1RM leg press.

Lockie, RG, Dulla, JM, Higuera, D, Ross, K, Orr, RM, Dawes, JJ, Ruvalcaba, TJ. (2022). Fit but not healthy? Body composition and fitness characteristics of firefighters participating in a health and wellness program. *45th National Strength and Conditioning Association National Conference and Exhibition*, New Orleans, USA, July 6-9.

SACFIT AND FIREFIGHTERS



Percentage of firefighters (258 males, 12 females) classified according to push-up repetitions.



Percentage of firefighters (258 males, 12 females) classified according to sit-and-reach.

Lockie, RG, Dulla, JM, Higuera, D, Ross, K, Orr, RM, Dawes, JJ, Ruvalcaba, TJ. (2022). Fit but not healthy? Body composition and fitness characteristics of firefighters participating in a health and wellness program. *45th National Strength and Conditioning Association National Conference and Exhibition*, New Orleans, USA, July 6-9.

IMPLICATIONS → TAKE HOME MESSAGES

- Participants generally displayed good health and fitness relative to general population
  - Healthy worker effect; less healthy officers were less likely to participate in the program
- Departments should view the data such as these data as positive outcomes for their personnel
  - Fitness (as a group) at least maintained when participating within program
  - Many participants have good fitness profiles relative to the general population
  - Participants with poorer fitness profiles should benefit for participating in program

Chowdhury R, Shah D, Payal AR. Healthy worker effect phenomenon: Revisited with emphasis on statistical methods - A review. Indian J Occup Environ Med 21(1):2-8, 2017.
Kirkeleit J, Riise T, Bjørge T, Christiani DC. The healthy worker effect in cancer incidence studies. Am J Epidemiol 177(11):1218-1224, 2013.
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2:20

FIT BUT NOT HEALTHY?

- Although personnel may display positive fitness characteristics, are they healthy?
- Blood pressure, body composition (body fat %), cardiovascular disease risk, injuries
- The job is still the job
  - Stress, decreased physical activity, shift work, disrupted sleep, obesity

Lockie, RG, Dulla, JM, Higuera, D, Ross, K, Orr, RM, Dawes, JJ, Ruvalcaba, TJ. (2022). Fit but not healthy? Body composition and fitness characteristics of firefighters participating in a health and wellness program. *45th National Strength and Conditioning Association National Conference and Exhibition*, New Orleans, USA, July 6-9.

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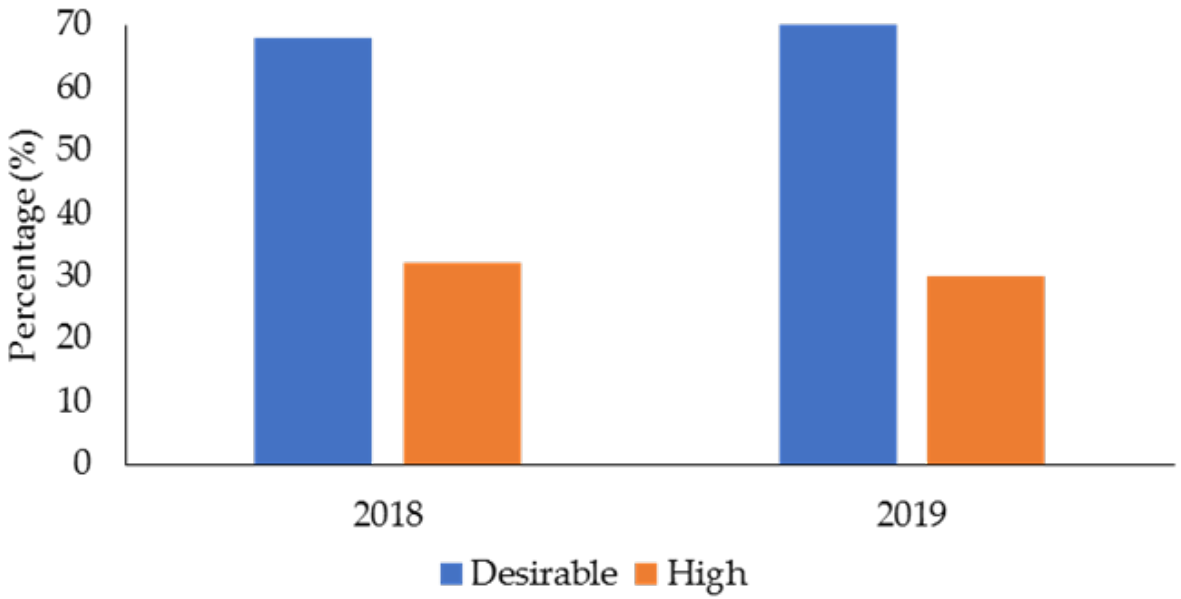
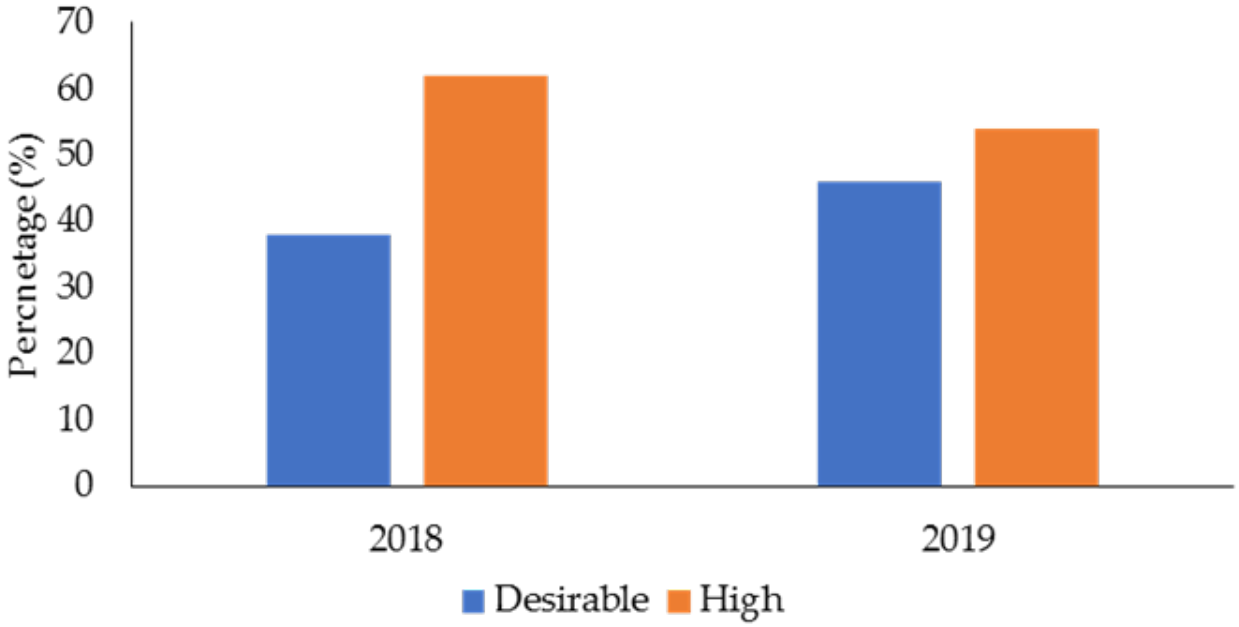
Soteriades ES, Smith DL, Tsismenakis AJ, Baur DM, Kales SN. Cardiovascular disease in US firefighters: A systematic review. Cardiol Rev 19(4):202-215, 2011.

Zimmerman FH. Cardiovascular disease and risk factors in law enforcement personnel: A comprehensive review. Cardiol Rev 20(4):159-166, 2012.

POLICE OFFICER BLOOD LIPIDS



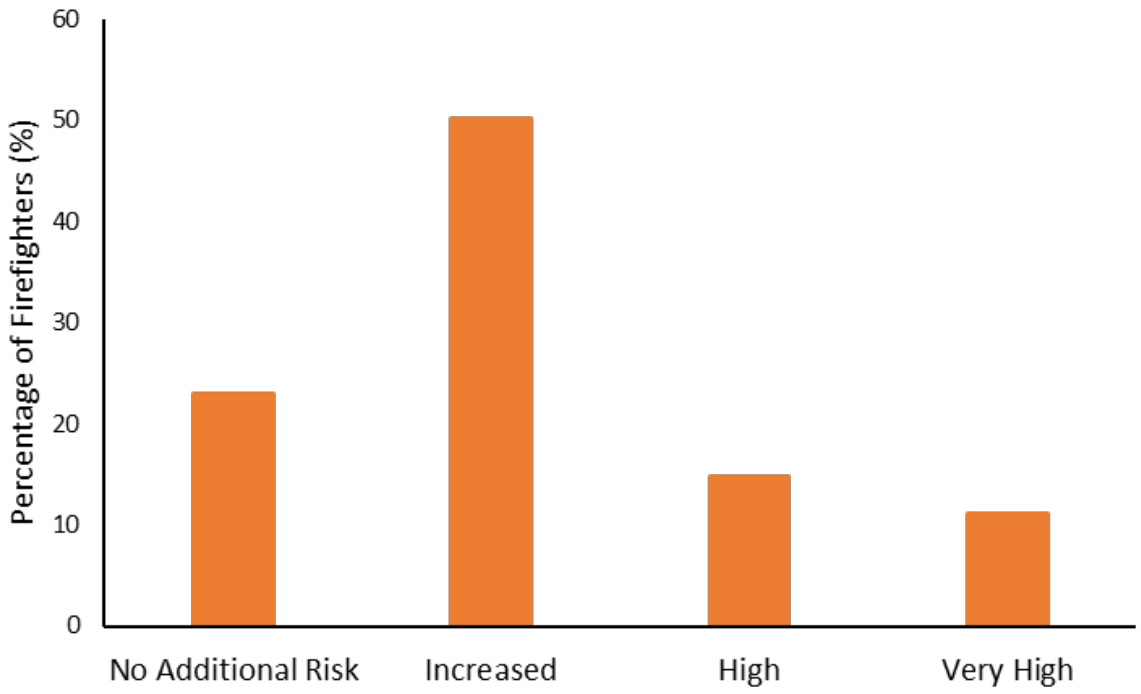
Percentage of police officers from a health and wellness program in 2018 (169 males, 39 females) and 2019 (194 males, 43 females) classified according to the categories for total cholesterol.



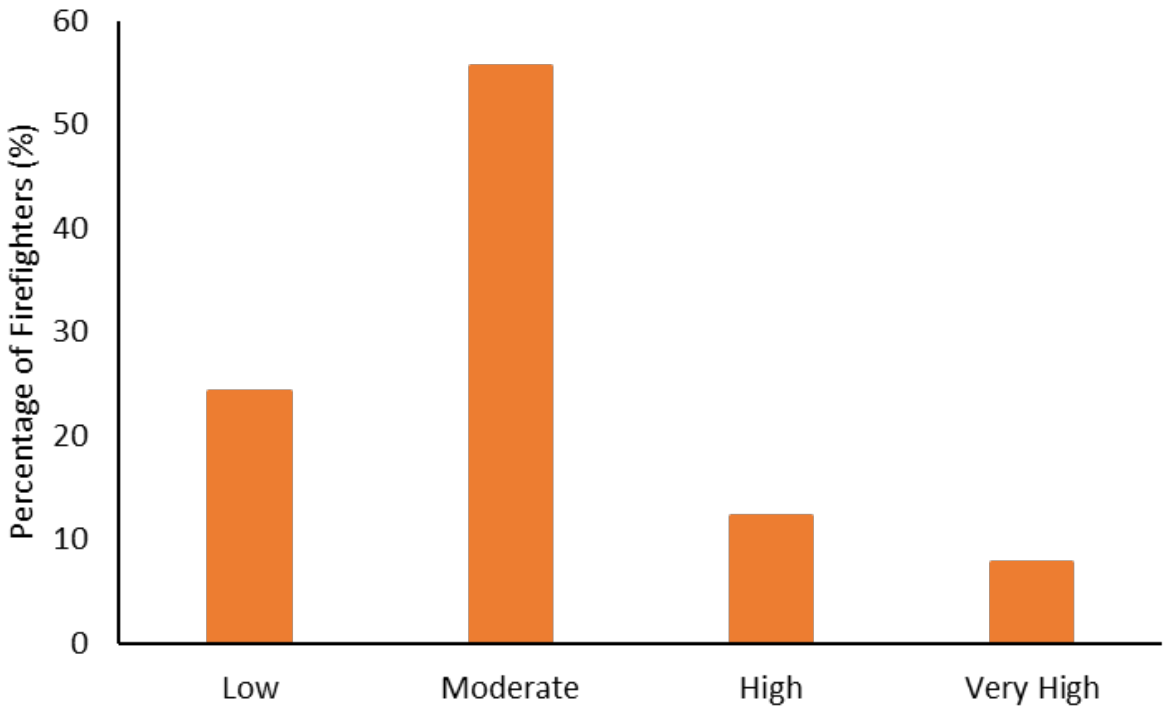
Percentage of police officers from a health and wellness program in 2018 (169 males, 39 females) and 2019 (194 males, 43 females) classified according to the categories for low-density lipoproteins.

Lockie, RG, Orr, RM, Dawes, JJ. Fit (and healthy) for duty: Blood lipid profiles and physical fitness test relationships from police officers in a health and wellness program. *Int J Environ Res Public Health* 19(9): 5408, 2022.

SACFIT AND FIREFIGHTERS



Percentage of firefighters (258 males, 12 females) classified according to cardiovascular disease risk relative to waist circumference and body mass index.



Percentage of firefighters (258 males, 12 females) classified according to cardiovascular disease relative to waist-to-hip ratio.

Lockie, RG, Dulla, JM, Higuera, D, Ross, K, Orr, RM, Dawes, JJ, Ruvalcaba, TJ. (2022). Fit but not healthy? Body composition and fitness characteristics of firefighters participating in a health and wellness program. *45th National Strength and Conditioning Association National Conference and Exhibition*, New Orleans, USA, July 6-9.

EXAMPLE PROGRAMMING – STILLWATER PD

- Dr. Jay Dawes from Oklahoma State University
- Small department → allowed 1-hour to workout (~40 minutes considering time to shower, change, etc.)
- 4-day work schedule
  - Most officers won't visit station on days off
- Training programs need to be flexible
  - Shift work, job demands
  - Aerobic training: pick some up on off days; shorter duration efforts spaced out in a session
- Making best 'bad decision'

BRIDGE

SPD Jump Start: 3 Day Program

Day 1				
Total Body				
Movement Prep - 5min				
Glute Bridge				
10 reps				
Heel to Glute - with Arm Reach (Ipsi)				
5 reps*				
Inverted Hamstring - In Place				
5 reps*				
Reverse Lunge - with Lateral Flexion				
5 reps*				
Pillar March - Linear				
20 yd				
Strength Block 1				
Split Squat - Dumbbell				
lbs	12 reps*	5 RPE		
lbs	10 reps*	6 RPE		
lbs	8 reps*	7 RPE		
Dorsiflexion Stretch - Half Kneeling				
lbs	12 reps*	5 RPE		
lbs	10 reps*	6 RPE		
lbs	8 reps*	7 RPE		
Row - Standing 1 Arm Cable				
12 reps*	5 RPE			
10 reps*	6 RPE			
8 reps*	7 RPE			
Strength Block 2				
Romanian Deadlift - 1 Leg Dumbbell				
lbs *	8 reps*	6 RPE		
lbs *	8 reps*	6 RPE		
lbs *	8 reps*	6 RPE		
Overhead Press - 1 Arm high split Kettlebell				
lbs	6 reps*	80 %Diff		
lbs	8 reps*	80 %Diff		
lbs	0 reps*	0 %Diff		
Straight Leg Hamstring Stretch (Rope)				
5 reps*				
5 reps*				

Day 2				
Total Body				
Movement Prep - 10min				
DNS Star Pattern				
5 reps*				
Leg Cradle				
5 reps*				
Inverted Hamstring - In Place				
5 reps*				
Lateral Squat				
5 reps*				
Reverse Lunge - with Rotation				
5 reps*				
Pillar March - Lateral				
20 yd				
20 yd				
Pillar Skip - Lateral				
20 yd				
20 yd				
Conditioning				
Free Choice Cardio				
5:00				
Strength Block 1				
Row (TRX)				
lbs	12 reps	7 RPE		
lbs	12 reps	7 RPE		
lbs	12 reps	7 RPE		
Squat – Landmine				
lbs	12 reps	5 RPE		
lbs	10 reps	6 RPE		
lbs	8 reps	7 RPE		
Shoulder Circles (Dowel)				
5 reps				
5 reps				
5 reps				
Conditioning				
Free Choice Cardio				
5:00	0 mi			

Day 3				
Total Body				
Movement Prep - 5min				
DNS Star Pattern				
5 reps*				
Reverse Lunge - with Rotation				
5 reps*				
Inverted Hamstring - In Place				
5 reps*				
Reverse Lunge, Elbow to Instep – In Place with Rotation				
5 reps*				
Pillar March - Straight Leg Linear				
20 yd				
Strength Block 1				
Bent Over Row - 1 Arm / Leg Dumbbell (handlimes on bench)				
lbs	8 reps*	6 RPE		
lbs	8 reps*	6 RPE		
lbs	8 reps*	6 RPE		
Romanian Deadlift - Dumbbell				
lbs *	8 reps	6 RPE		
lbs *	8 reps	6 RPE		
lbs *	8 reps	6 RPE		
Lat Stretch - Rack				
5 reps				
5 reps				
Conditioning				
Free Choice Cardio				
5:00	0 mi			
Strength Block 2				
Lateral Squat - Dumbbell				
lbs *	8 reps*	6 RPE		
lbs *	8 reps*	6 RPE		
lbs *	8 reps*	6 RPE		
Push Up - Eccentric				
8 reps	7 RPE			
8 reps	7 RPE			
8 reps	7 RPE			

- De-conditioned officer
- Lots of mobility work
- Short intervals of conditioning spaced out in a session

TABLE 1. THE BORG RATING OF PERCEIVED EXERTION SCALE (5)

RATING	PERCEIVED EXERTION
6	No Exertion
7	Extremely Light
8	
9	Very Light
10	
11	Light
12	
13	Somewhat Hard
14	
15	Hard
16	
17	Very Hard
18	
19	Extremely Hard
20	Maximal Exertion

TABLE 2. THE MODIFIED CATEGORY-RATIO RATING OF PERCEIVED EXERTION AND FATIGUE SCALE (1,15,21)

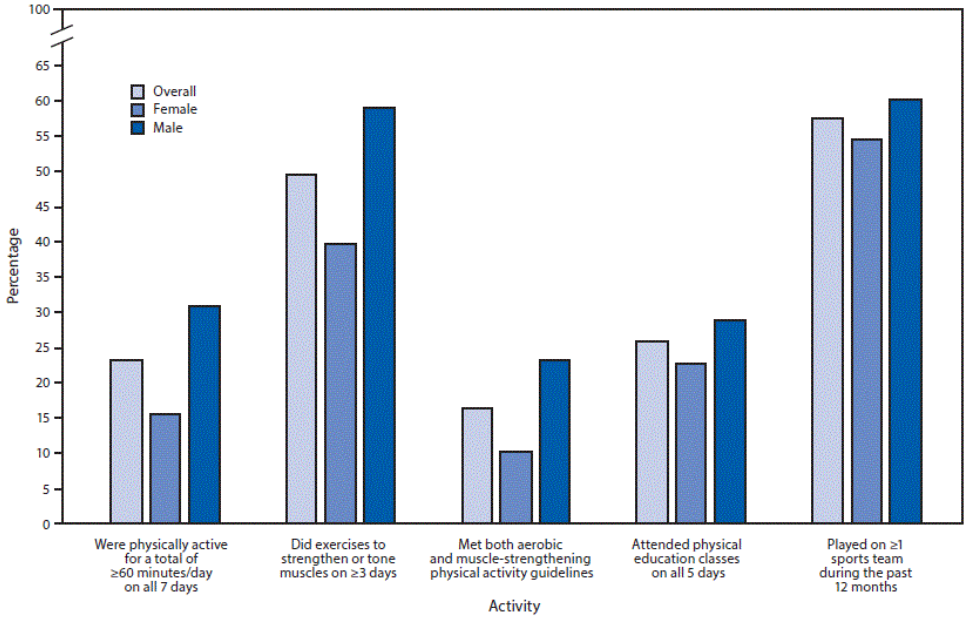
RATING	DESCRIPTOR
0	Rest Not Fatigued at All
1	Very, Very Easy
2	Easy
3	Moderate A Little Fatigued
4	Somewhat Hard
5	Hard Moderately Fatigued
6	
7	Very Hard Very Fatigued
8	
9	
10	Maximal Total Exhaustion

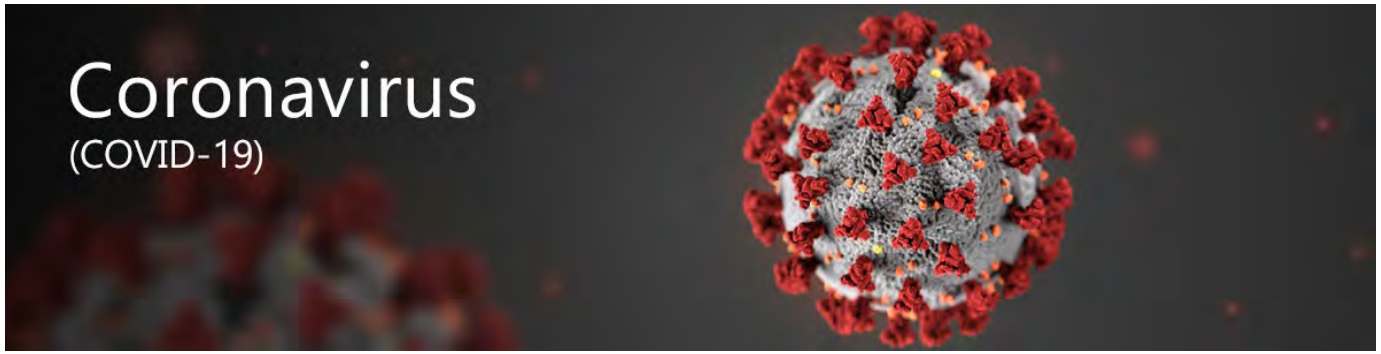
McGuire, M., Moreno, M., and Lockie, R. Practical exercise programming for Wildland Fire Suppression Aids. *TSAC Report* (54), 22-35. 2019.

TABLE 3. SUMMARIZED TRAINING PARAMETERS FOR EXERCISE SESSIONS BASED ON EXERCISE GOAL AND RPE/CR-F

	RPE ≤ 11 / CR-F ≤ 3	RPE 12 – 15 / CR-F 4-6	RPE ≥ 16 / CR-F ≥ 7
STRENGTH	3 – 4 sets x 6 – 8 repetitions at 75 – 85% maximum effort	2 – 3 sets x 5 – 6 repetitions at 65 – 75% maximum effort	1 – 2 sets x 5 – 6 repetitions at 65 – 75% maximum effort
ENDURANCE	5 sets x 10 – 12 repetitions at 35 – 65% maximum effort	3 sets x 8 – 10 repetitions at 35 – 65% maximum effort	3 sets x 6 – 8 repetitions at 35 – 50% maximum effort
TRUNK/ STABILITY	3 – 4 sets x 45 – 60 s at bodyweight	2 – 3 sets x 45 – 60 s at bodyweight	2 – 3 sets x 30 – 45 s at bodyweight
FLEXIBILITY	3 sets x 4 – 5 min at bodyweight	3 sets x 4 – 5 min at bodyweight	2 sets x 5 min at bodyweight

CHANGES TO SOCIETY





Your Air Force

Air Force's enlisted recruitment pipeline is drying up, general warns

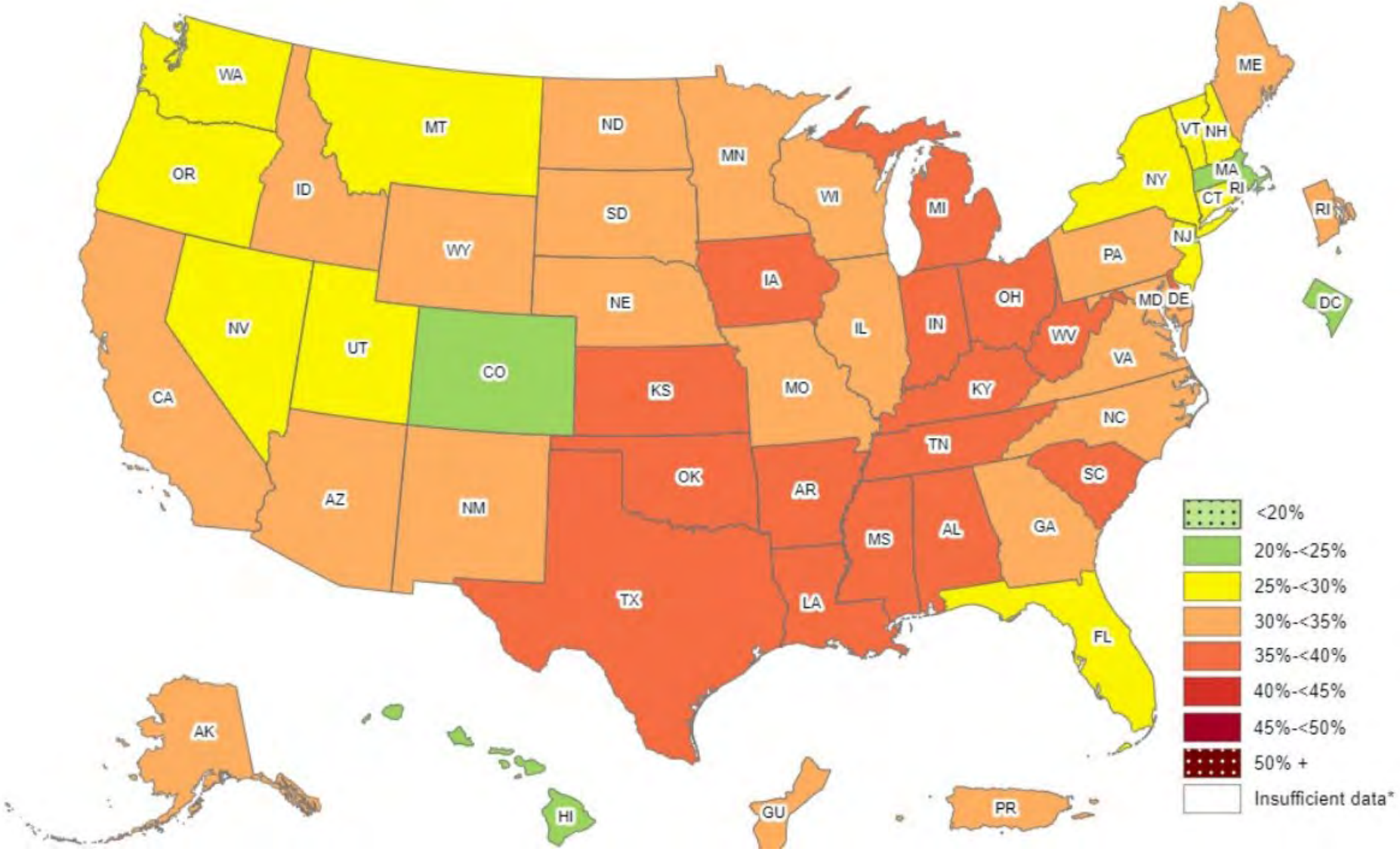
By Rachel S. Cohen

Friday, Jan 21

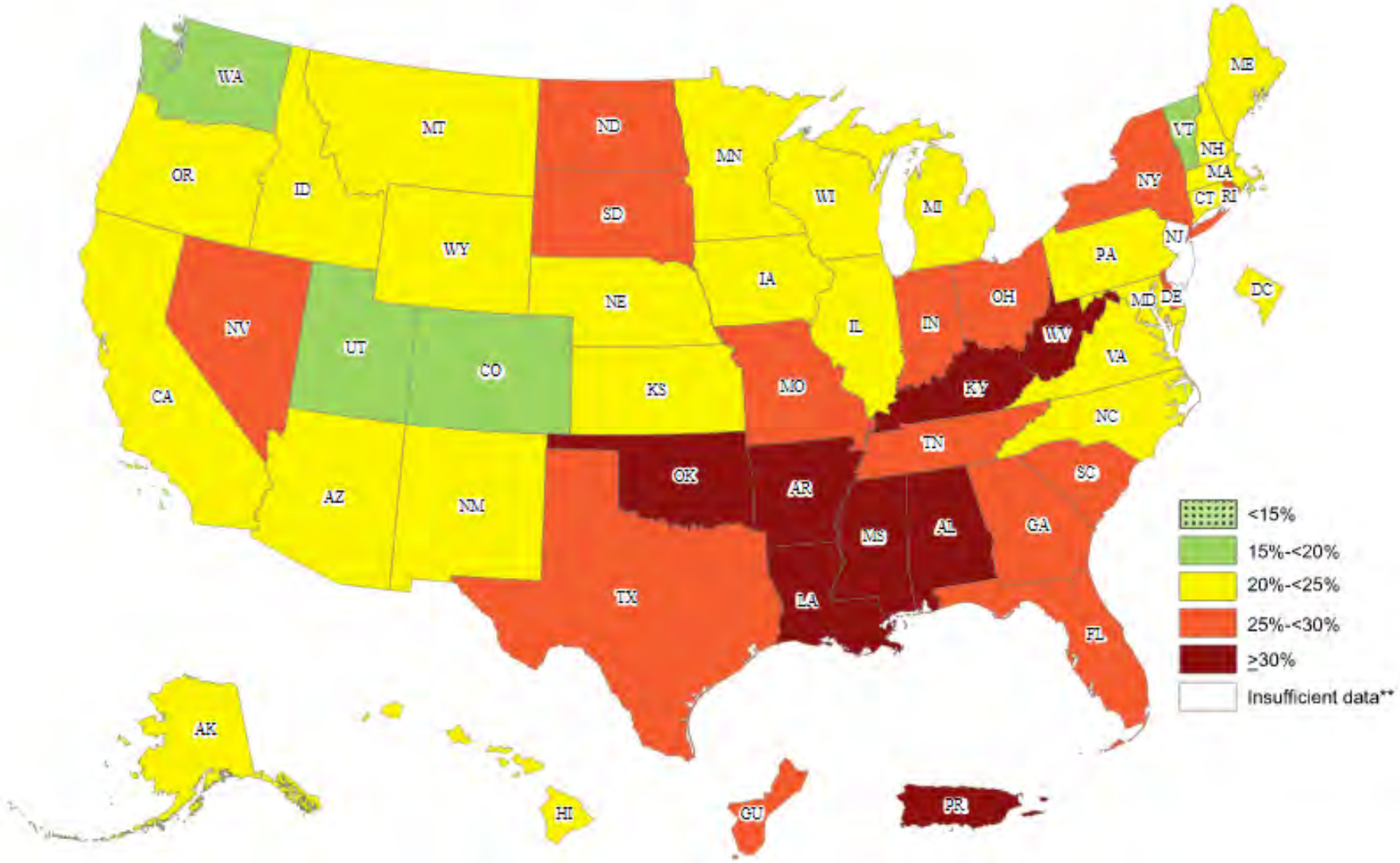
Shrinking Army worries lawmakers as military recruitment, retention woes continue

By SVETLANA SHKOLNIKOVA
STARS AND STRIPES • May 5, 2022

Cohen, RS. Air Force's enlisted recruitment pipeline is drying up, general warns. Available at: https://www.airforcetimes.com/news/your-air-force/2022/01/21/air-forces-enlisted-recruitment-pipeline-is-drying-up-general-warns/. Accessed on May 30, 2022.
Shkolnikova, S. Shrinking Army worries lawmakers as military recruitment, retention woes continue. Available at: https://www.stripes.com/branches/army/2022-05-05/army-soldiers-recruitment-retainment-budget-5907615.html. Accessed on May 30, 2022.



Centers for Disease Control and Prevention. Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2020. Available at: https://www.cdc.gov/obesity/data/prevalence-maps.html#overall. Accessed on May 30, 2022.



Centers for Disease Control and Prevention. Prevalence of Self-Reported Physical Inactivity Among US Adults by State and Territory, BRFSS, 2017–2020. Available at: https://www.cdc.gov/physicalactivity/data/inactivity-prevalence-maps/index.html#overall. Accessed on May 30, 2022.

THE STATE OF RECRUITMENT: A CRISIS FOR LAW ENFORCEMENT

IACP
International Association of Chiefs of Police

78% of agencies reported having difficulty in recruiting qualified candidates

65% of agencies reported having too few candidates applying to be law enforcement officers

75% of agencies reported that recruiting is more difficult today than it was five years ago

50% of agencies reported having to change agency policies in order to increase the chances of gaining qualified applicants

25% of agencies reported having to reduce or eliminate certain agency services, units, or positions because of staffing difficulties

---

1 Bureau of Labor Statistics, U.S. Department of Labor, "Police and Detectives," *Occupational Outlook Handbook*, **https://www.bls.gov/ooh/protective-service/police-and-detectives.htm** (accessed June 12, 2019).

2 Shelley Hyland, *Full-Time Employees in Law Enforcement Agencies, 1997-2016*, Statistical Brief NCJ 251762 (Bureau of Justice Statistics, August 2018), **https://www.bjs.gov/content/pub/pdf/ftelea9716.pdf**.

3 Jon Shane, "Organizational Stressors and Police Performance," *Journal of Criminal Justice 38*, no. 4 (June 2010): 807–818.

POLICE EXECUTIVE RESEARCH FORUM

Police Executive Research Forum. PERF Special Report: Survey on Police Workforce Trends, 2021. Available at: https://www.policeforum.org/workforcesurveyjune2021. Accessed May 30, 2022.

	Percent Change Between Time Periods by Agency Size		
Agency Size	Hiring Rate Change	Resignation Rate Change	Retirement Rate Change
0-49	3% (10.09 to 10.42)	11% (5.15 to 5.70)	49% (2.48 to 3.69)
50-249	8% (7.51 to 8.08)	28% (3.69 to 4.73)	59% (2.87 to 4.55)
250-499	-29% (8.10 to 5.77)	22% (2.81 to 3.42)	19% (3.23 to 3.85)
500+	-36% (8.65 to 5.52)	21% (3.93 to 4.76)	27% (3.43 to 4.35)

Politics and Government

Minneapolis police staffing woes worse than anticipated

Brandt Williams Minneapolis February 5, 2021 12:23 a.m.

February 2021 – Minneapolis

NEWS · CRIME/PUBLIC SAFETY

Applicants scarce for open law enforcement positions

UPDATED: Sat., April 24, 2021

Twitter | Facebook | Email | Reddit

Spokane police Capt. Tracie Meidl films a police recruitment video in Riverfront Park on April 15. (COLIN MULVANY/THE SPOKESMAN-REVIEW)

By Colin Tiernan
colint@spokesman.com
(509) 459-5039

People driving through downtown Denver during the last month have been seeing a strange advertisement.

Above a dentist's office and a sushi restaurant, there's a billboard – for the Spokane County Sheriff's Office.

"HIRING 40 LATERAL OFFICERS," the billboard reads. "$15K HIRING BONUS."

You can find ads just like it in Portland and the Seattle area. Spokane County

April 2021 – Spokane

Phoenix police can't fill hundreds of vacant positions, putting our safety at risk

Opinion: A federal investigation is further eroding morale and reputation within the Phoenix Police Department when recruitment and retention are already bad.

Britt London opinion contributor

Published 6:23 a.m. MT Aug. 17, 2021 | Updated 9:29 a.m. MT Aug. 23, 2021

View Comments

August 2021 – Phoenix

Pennsylvania police departments battling hiring crisis for new officers

Published: Apr. 10, 2022, 7:00 a.m.

April 2022 – Lehigh Valley

February 2022 – Oceanside

March 2022 – Chico

KARE 11 News Weather Near Me VERIFY Watch Live

LAND OF 10,000 STORIES | KARE 11 INVESTIGATES | BREAKING THE NEWS | VAX FACTS

LOCAL NEWS

Fire departments struggle to recruit, retain firefighters - some down more than a dozen

"You're not going to get any sleep, we're going to work you like a dog and you might get cancer and die," fire captain criticizes current recruitment model.

September 2021 – Minneapolis

LOCAL NEWS

LAFD faces staffing shortages, needs more resources, head of firefighter union says

by: Christina Pascucci
Posted: Jan 24, 2022 / 06:45 PM PST
Updated: Jan 24, 2022 / 06:45 PM PST

January 2022 – Los Angeles

Short-staffed and stretched thin: Firefighter shortage hits nearly all departments

By Luca Powell lpowell@record-eagle.com Feb 20, 2022

1 of 5

February 2022 – Traverse City

NEWS

Delta Township Fire Department faces ongoing staff shortage

By Vivian Barrett | March 7, 2022

LIKE TWEET EMAIL PRINT MORE

A nation-wide shortage of firefighter paramedics is hampering the Delta Township Fire Department, leaving it eight people short. Several times, two of the township's three fire stations have closed due to staffing issues.

Delta has been struggling with the shortage since 2019. EMS/Training Capt. Brian Hatfield said the ongoing issue is a lack of people interested in the

Vivian Barrett

Delta firefighter paramedics leave in response to a call.

March 2022 – Delta Township

LOCAL NEWS ›

Pittsburgh firefighters union worried about lack of new recruits

CBS NEWS PITTSBURGH

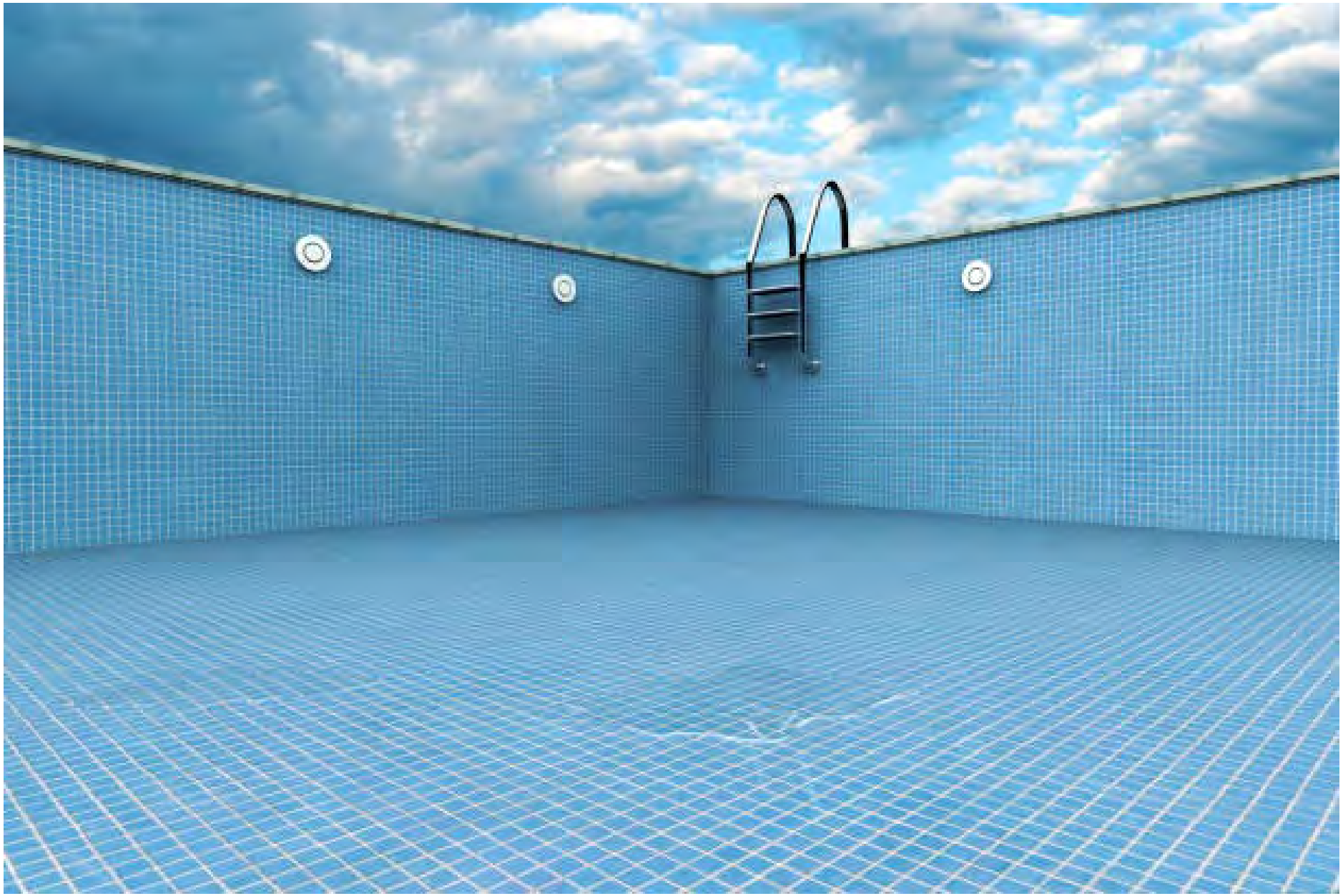
BY ANDY SHEEHAN
MAY 10, 2022 / 6:01 PM / CBS PITTSBURGH

May 2022 – Pittsburgh

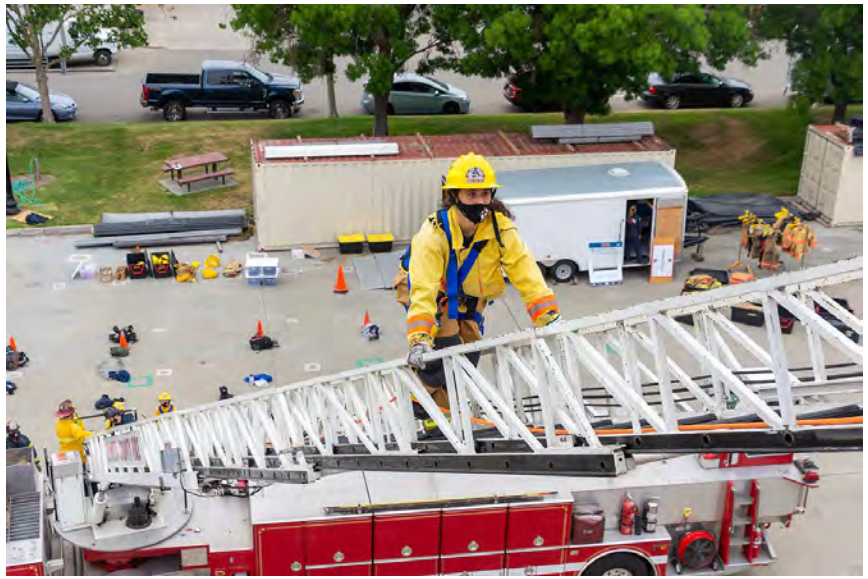
Interview: Cal Fire's staffing shortage, and a bill that could bring in more firefighters

Nicole Nixon
Friday, May 13, 2022 | Sacramento, CA

May 2022 – Sacramento



Fire and Rescue Service



503

Percentile rankings for the 10-repetition maximum deadlift based on 6 firefighter trainee academy classes from one fire department.

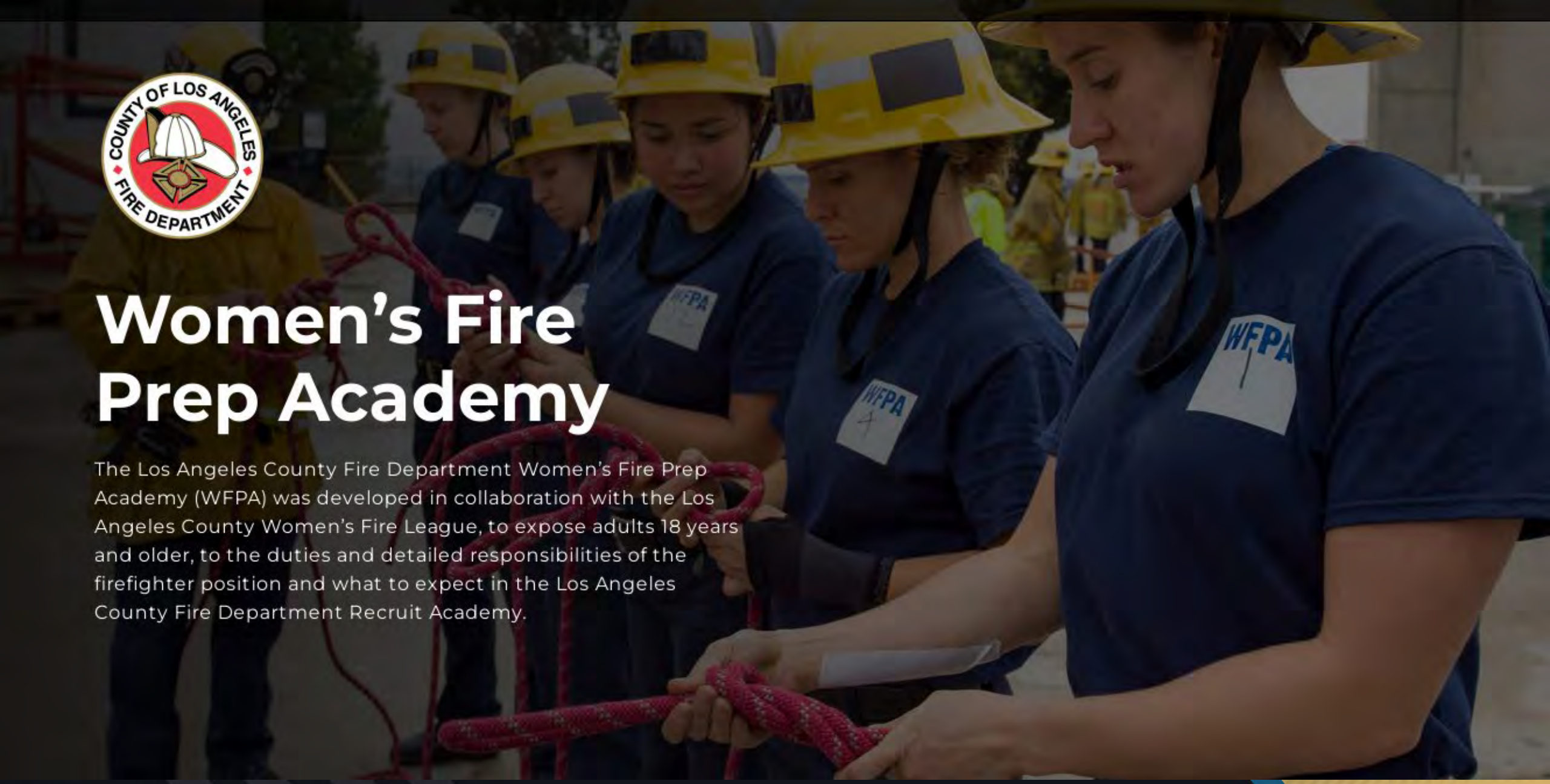
Percentile Rank	Range (kg)	Males (n = 237)	Females (n = 30)
95-100	158.76-185.97	13	1
72	156.49	60	1
60-65	147.42-154.22	29	4
59	145.15	0	1
33-34	140.61-142.88	71	0
10-18	122.47-133.81	53	8
0-9	90.72-120.20	11	15

Lockie, RG, Orr, RM, Montes, F, Ruvalcaba, TJ, Dawes, JJ. Differences in fitness between firefighter trainee academy classes and normative percentile rankings. *Sustainability* 14(11): 6548, 2022.

Percentile rankings for the 4.54-kg backwards overhead medicine ball toss (BOMBT) based on 6 firefighter trainee academy classes from one fire department.

Percentile Rank	Range (m)	Males (n = 238)	Females (n = 31)
90-100	11.34-13.84	29	0
80-89	10.79-11.31	26	0
70-77	10.36-10.67	27	0
60-69	9.91-10.30	26	0
50-59	9.57-9.88	27	0
42-49	9.17-9.48	20	0
30-39	8.81-9.14	34	0
20-29	8.20-8.69	23	3
10-19	7.10-8.14	19	8
0-9	4.02-7.07	7	20

Lockie, RG, Orr, RM, Montes, F, Ruvalcaba, TJ, Dawes, JJ. Differences in fitness between firefighter trainee academy classes and normative percentile rankings. *Sustainability* 14 (11): 6548, 2022.



Women's Fire Prep Academy

The Los Angeles County Fire Department Women's Fire Prep Academy (WFPA) was developed in collaboration with the Los Angeles County Women's Fire League, to expose adults 18 years and older, to the duties and detailed responsibilities of the firefighter position and what to expect in the Los Angeles County Fire Department Recruit Academy.

COMMUNITY COLLEGE TRAINING CLASS COMPLETION BIDDLE PHYSICAL ABILITY TEST (BPAT)

BPAT Task Time	Training Class (n = 6)	No Training Class (n = 23)
Dry hose and charged hose deployment	35.17 ± 6.85	35.83 ± 6.55
Halyard raise, roof walk, and attic crawl	75.00 ± 14.26	76.65 ± 9.09
Roof ventilation and victim removal	57.83 ± 3.92	62.48 ± 6.31
Ladder removal and carry	33.50 ± 4.55	41.35 ± 10.74
Stair climb with hose pack	53.50 ± 6.78	56.48 ± 8.80
Attic crawl and tower descent	67.83 ± 6.62	66.96 ± 9.18
Stair climb with air bottles	35.33 ± 9.22	38.26 ± 9.67
Hose hoist	47.17 ± 6.11	54.48 ± 12.50
Return to ground floor with air bottles	27.67 ± 5.89	25.26 ± 5.20
Total	433.00 ± 37.46	457.74 ± 56.34

Lockie, RG, Ruvalcaba, TJ, Thompson, MB, Viramontes, E, Orr, RM, Dawes, JJ, Dulla, JM. A preliminary comparison of firefighter candidates' Biddle Physical Ability Test performance and success based on training class participation. *Int J Exerc Sci.* in press.

WHAT DOES THIS MEAN? TAKE HOME MESSAGES

- Recruitment → every physically demanding occupation is drawing from the same pool
- Are you getting the 'top prospects' – what are their fitness characteristics?
- Does your physical training affect attrition rate?
  - Make the most of what you have?
  - Ability-based training → keep who you have, diversify workforce
- How do you keep people in the profession?
  - Long-term health and wellness
  - Do your personnel have the tools, or are they being provided with the tools?

Lockie R, Dulla J, Orr R, Dawes J. Importance of ability-based training for law enforcement recruits. *Strength Cond J* 43(3):80-90, 2021.

CONCLUSIONS → TAKE HOME MESSAGES

- Minimize personnel losses during academy training
  - Appropriate physical training/strength and conditioning prior to and during academy
  - Where possible, use scientific principles when designing academy strength and conditioning programs
  - Be aware of culture and hidden curriculum
- Access to health and wellness programs/strength and conditioning once employed
  - Job is not conducive to maintaining/improving fitness
- Even more important at all levels if there are recruitment and retention issues

THANK YOU FOR WATCHING…QUESTIONS?

Email: rlockie@fullerton.edu Twitter: @DrBobLockie