

Background

Extreme conditioning programs, such as CrossFit, have gained increased popularity in recent years. Despite the potential benefit of improved fitness, increased injury rates have been alluded to via anecdotal reporting and the nature of CrossFit training.

CrossFit encompasses 10 domains of fitness including: cardiorespiratory endurance, stamina, strength, flexibility, power, speed, coordination, agility, balance, and accuracy. These domains of fitness are trained through a variety of exercise modes including powerlifting, Olympic weightlifting, gymnastics, and running . A typical CrossFit regimen is encompassed by 10-15 minutes of warm up/skill work, followed by 15-25 minutes of strength/power work and 15-30 minutes of high intensity interval training/aerobic work.

Purpose

The focus of the systematic review was to ascertain the characteristics and the occurrence of musculoskeletal injuries sustained by CrossFit participants.

Methods

Four databases and Google Scholar were searched from inception to February 2017. The search strategy followed Cochrane Collaboration guidelines. The Downs and Black Risk of Bias Checklist was utilized to evaluate methodological quality.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was implemented during the examination and reporting phases

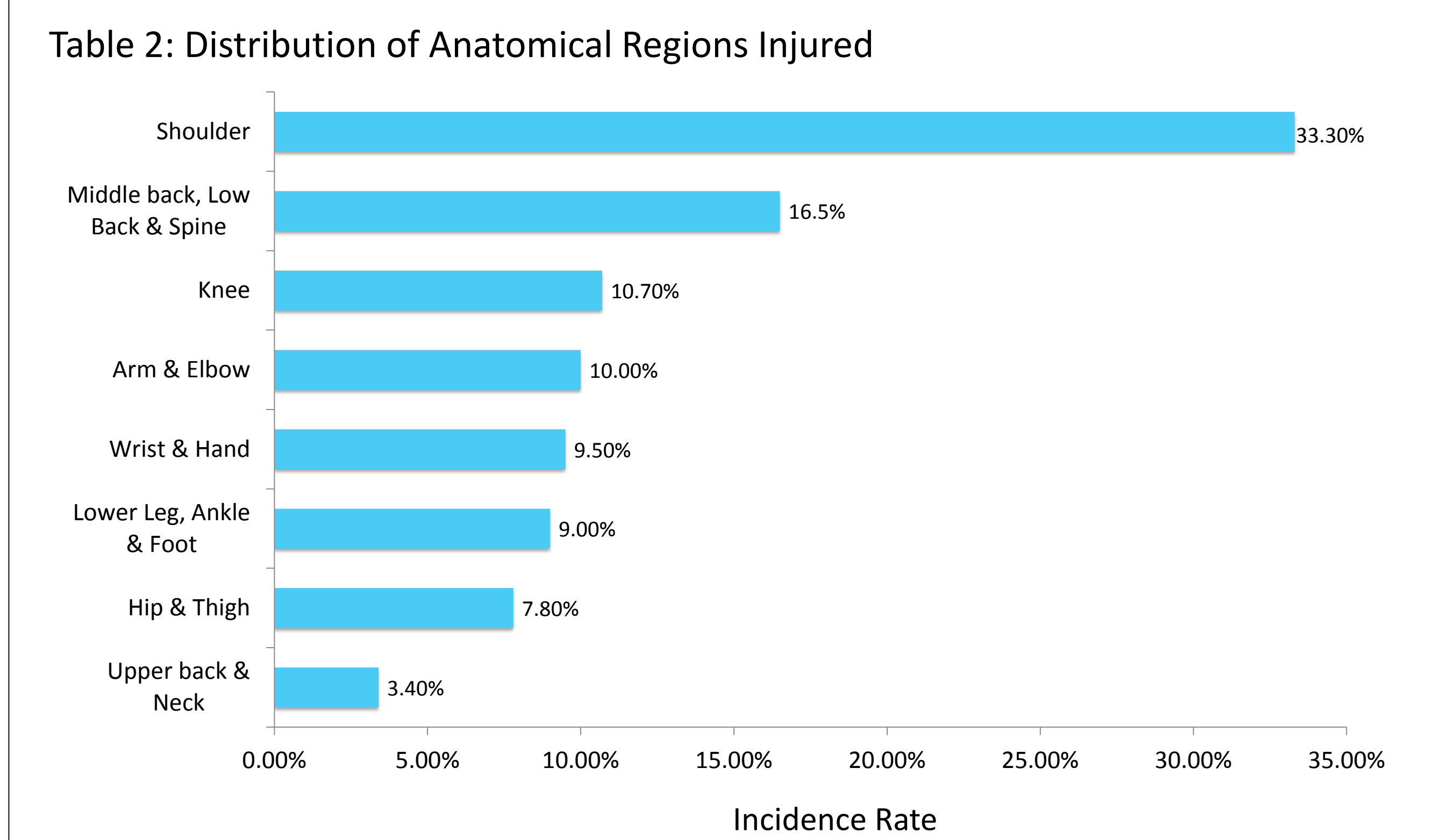
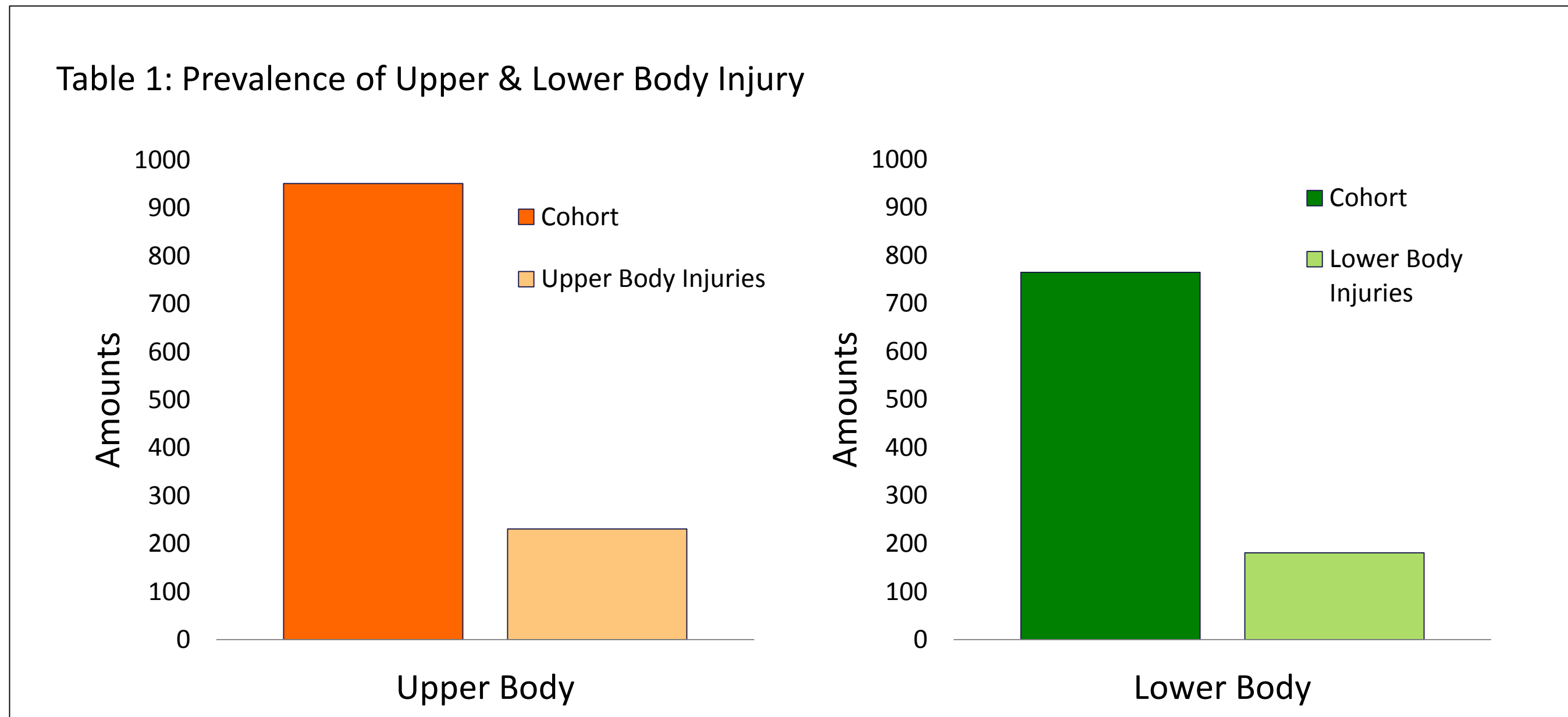
- Included studies satisfied the criteria in the following aspect:
1. All studies were included if they illustrated data representing characteristic and/or injury occurrence rates related to CrossFit
 2. Literature only depicting musculoskeletal injuries
 3. Published in English
 4. No publication year, gender, age or populations were excluded
 5. Studies examining human patients at any stages of injury or recovery

CrossFit: The Characteristics and Occurrence Rates of Sustained Injuries - A Systematic Review

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Results



Downs & Black Risk of Bias Checklist						
Article	Reporting (10)	External Validity (3)	Internal Bias (7)	Confounding (6)	Power (1)	Total (27)
Chachula	7	2	3	0	0	12
Davis	5	1	2	0	0	8
Friedman	6	3	2	0	0	11
Hak	7	2	3	0	0	12
Montalvo	5	2	3	0	0	10
Summit	7	2	3	0	0	12
Weisenthal	9	2	3	0	0	14
Zumwalt	7	3	3	0	0	13

Results

Author	Chachula	Hak	Montalvo	Weisenthal	Summitt**	Friedman*	Davis*	Zumwalt*	Total
Cohort	54	132	191	386	187	1	1	1	953
Participants Injured	24	97	50	75	44	1	1	1	293
Total Injuries	40	186	62	84	44	1	1	1	419
Participants w/ Prior Injury	36				17				
Upper Body Injuries (n=231)									
Shoulder	9	48	14	21	44	1			137
Arm & Elbow	4	25	5	7					41
Wrist & Hand	4	19	11	5					39
Upper Back & Neck		5	4	5					14
Lower Body Injuries (n=181)									
Middle Back, Low Back, & Spine	11	36	8	13					68
Hip & Thigh	3	15	2	12					32
Knee	5	17	10	11			1		44
Lower Leg, Ankle, & Foot***	4	16	6	10				1	37

* = case study
** = only looked at shoulder injuries
*** = includes ankle, shin, and Achilles

Clinical Relevance

CrossFit is a diverse training program that can be physically taxing, despite mentions of its scalability. Gradual CrossFit training progressions should be encouraged to avoid injury. It is important to evaluate for improper form and mechanics as they can lead to injury. The findings from this review suggest that injury rates in CrossFit are similar to other competitive sports and training methods.

Conclusions

The most prevalent upper body injury was shoulder, followed by the arm/elbow. In the lower body, the middle/low back and spine was the most frequently injured, followed by the knee. The established injury prevalence for upper body was 24.3%, and 23.7% for lower body. Additional research is essential to further determine the injury characteristics and occurrence associated with CrossFit.

Acknowledgements / References

We would like to acknowledge Leila Ledbetter and the Duke University library for their assistance in developing our search strategy. References: 1) Weisenthal BM, Beck CA, Maloney MD, et al. Injury Rate and Patterns Among CrossFit Athletes. Orthop J Sports Med 2014;2(4). 2) Montalvo A, Shaefer H, Rodriguez B, et al. Retrospective Injury Epidemiology and Risk Factors for Injury in CrossFit. Journal of sports science & medicine 2017;16(1):53-59. 3) Hak PT, Hodzovic E, Hickey B. The nature and prevalence of injury during CrossFit training. J Strength Cond Res 2013. 4) Davis R. Acute Patella Subluxation in CrossFit Athlete. International Journal of Exercise Science: Conference Proceedings; 2016. 5) Friedman MV, Stensby JD, Hillen TJ, et al. Traumatic Tear of the Latissimus Dorsi Myotendinous Junction: Case Report of a CrossFit-Related Injury. Sports Health 2015;7(6):548-52. 6. Zumwalt M. Acute Achilles Tendon Rupture From Cross Fit Training. Journal of Bone Reports & Recommendations 2015. 7) Chachula LA, Cameron KL, Svoboda SJ. Association of Prior Injury With the Report of New Injuries Sustained During CrossFit Training. Athletic Training & Sports Health Care: The Journal for the Practicing Clinician 2016;8(1):28-34 7p. 8) Summitt RJ, Cotton RA, Kays AC, et al. Shoulder Injuries in Individuals Who Participate in CrossFit Training. Sports Health 2016;8(6). Photo Credit: <https://s-media-cache-ak0.pinimg.com/736x/d7/b2/3c/d7b23ccd940a63bdc69d02d5c4a2dbf.jpg>