Unconventional Sports Medical Coverage

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Primary Care Sports Medicine
Detroit Medical Center
7/18/18

Disclosure

- I cover all these things
  - And get paid for none of them……

TOUGH MUDDER

CIRQUE DU SOLEIL.

Detroit Roller Derby

DETROIT RUGBY FOOTBALL CLUB EST. 1968

Cross
Forging Elite Fitness

Topics

- Rugby
- Roller Derby
- Obstacle Races
- Circus Arts
- CrossFit

Objectives

- Have an understanding of these sports
- Learn common injury patterns
- Understand current research/research gaps

RUGBY

Background

- Rugby union most played full-contact team sport in the world
- Participation/popularity in North America rapidly spreading
- Included in 2016 Olympics

Background

- High speed, aggressive nature of the competition
- Higher incidence of injury
  - Importance of governing body proactively manage injury risk
    - "Drive player welfare best practice"
- Studies often implemented at international competitions
  - Rugby World Cup, every 4 years
- WR convened Rugby Injury Consensus Group 2006

Original article

Rugby World Cup 2015: World Rugby injury surveillance study

Colin W Fuller,[1,2] Aileen Taylor,[1] Simon P T Kemp,[3] Martin Raftery[1]

- *Fuller CW, Taylor A, Kemp SPT, et al. Br J Sports Med 2017;51:51–57.*
- 7 weeks of collection
- "Injury"
  - Sustained during RWC 2015 that prevented the player from taking a full part in all training activities and/or match play for more than 1 day following the day of onset of the illness

Results

- Incidence of injury
  - 90.1 match injuries/ 1000 player-match-hours (backs: 100.4; forwards: 81.1)
  - 1.0 training injuries/1000 player-training-hours (backs: 0.9; forwards: 1.2)
- Mean severity of injuries:
  - 29.8 days-absence (backs: 30.4; forwards: 29.1) during matches
  - 14.4 days-absence (backs: 6.3; forwards: 19.8) during training

Injury Location

- During matches
  - Muscle-strain (23.1%)
  - Ligament-sprain (23.1%)
  - Head/ face (22.0%)
  - Knee (16.2%)
- During training
  - Lower limb (80.0%)
  - Muscle-strain (60.0%)

Table 6 The most common match injuries and the match injuries causing most days-absence

Most common injuries				Injuries causing most days-absence			
Injury	n	Per cent	Days-absence	Injury	Days-absence	Per cent	n
Concussion	24	13.9	184	Knee ligament	1507	29.3	17
Knee ligament	17	9.8	1507	Hamstring strain	669	13.0	16
Hamstring strain	16	9.2	669	Shoulder dislocation	321	6.2	2
Calf muscle strain	7	4.0	133	Achilles tendon	188	3.6	1
Quadriceps haematoma	7	4.0	20	Concussion	184	3.6	24
Ankle lateral ligament	5	2.9	122	Quadriceps strain	168	3.3	4
All injuries	173	100	5151	All injuries	5151	100	173

Table 8 Match injuries sustained as a function of match activity

	Proportion of match injuries, % (95% CI)		
Match activity	Backs	Forwards	All players
Collision*	20.5 (12.0 to 28.9)	13.4 (6.0 to 20.8)	17.1 (11.4 to 22.7)
Kicking	3.4 (0 to 7.2)	0.0 (–)	1.8 (0 to 3.7)
Lineout	0.0 (–)	3.7 (0 to 7.7)	1.8 (0 to 3.7)
Maul	1.1 (0 to 3.4)	6.1 (0.9 to 11.3)	3.5 (0.8 to 6.3)
Ruck	2.3 (0 to 5.4)	9.8 (3.3 to 16.2)	5.9 (2.3 to 9.4)
Running	18.2 (10.1 to 26.2)	18.3 (9.9 to 26.7)	18.2 (12.4 to 24.0)
Scrum	0.0 (–)	6.1 (0.9 to 11.3)	2.9 (0.4 to 5.5)
Being tackled	31.8 (22.1 to 41.5)	17.1	24.7 (18.2 to 31.2)
Tackling	20.5 (12.0 to 28.9)	22.0 (13.0 to 30.9)	21.2 (15.0 to 27.3)
Other	2.3 (0 to 5.4)	3.7 (0 to 7.7)	2.9 (0.4 to 5.5)

*Accidental and non-accidental collisions.

Summary

- Overall incidence at RWC 2015 similar to 2007 and 2011
  - But incidence for backs was 25% higher than for forwards
- Severity of injuries has increased from RWC 2007 through 2011 to RWC 2015
  - Possible increase severity of a few specific injuries?
  - Possibly longer, more conservative TRP protocol?
- Concussion and knee ligament injuries at RWC 2015 increased compared to 2007 and 2011

Original article

RISUS study: Rugby Injury Surveillance in Ulster Schools

H A P Archbold,[1] A T Rankin,[2] M Webb,[3] R Nicholas,[1] N W A Eames,[1] R K Wilson,[4] L A Henderson,[1] G J Heyes,[1] C M Bleakley[5]

*Archbold HAP, Rankin AT, Webb M, et al. Br J Sports Med 2017;**51**:600–606.*

- Prospective injury surveillance study
- 825 adolescent rugby players
  - 28 schools
  - Mean age 16.9 years

Results

- 426 total injuries reported across the season
- 36.8% of participants (304/825) suffered at least one injury during the season
- Incidence 29.06 per 1000 match hours
  - No catastrophic injuries
- Over 50% occurred in tackle situations or during collisions (270/426)
  - Few reported during set plays

Injury Locations

- 3 most common locations
  - Head/face (n=102, 23.9%)
  - Clavicle/shoulder (n=65, 15.3%)
  - Knee (n=56, 13.1%).
- Most common diagnosis
  - Sprain (n=133, 31.2%)
  - Concussion (n=81, 19%)
  - Muscle injury (n=65, 15.3%)

Risks

- Higher risk of injury with:
  - Older age (AHR 1.45; 1.14 to 1.83)
  - Heavier weight (AHR 1.32; 1.04 to 1.69)
  - Playing representative rugby (AHR 1.42; 1.06 to 1.90)
  - Undertaking regular strength training (AHR 1.65; 1.11 to 2.46)
- Lower risk of injury with:
  - Playing for a lower ranked team (AHR 0.67; 0.49 to 0.90)
  - Wearing a mouthguard (AHR 0.70; 0.54 to 0.92)

Time Loss

- 208/424 resulted in absence from play 28+ days
  - Concussion most significant time out from play (n=33; 15.9%)
  - Shoulder dislocation (n=22; 10.6%)
  - Knee sprains (n=19, 9.1%)
  - Ankle sprains (n=14, 6.7%)
  - Hand/finger/thumb (n=11; 5.3%)

Concussion

- Increased incidence from 4 to 13 injuries/1000 player-match-hours over past 10 years
  (In elite (15-a-side) rugby union)

- 2012
  - Pitch-side protocol for elite rugby
- 2015
  - Matchday concussion management protocol integrated into Laws of the Game
  - Referred to as the 'Head Injury Assessment (HIA) process'

Concussions in Community-Level Rugby: Risk, Knowledge, and Attitudes

R. Kyle Martin, MD,[†‡] Travis J. Hrubeniuk, BKin,[†§] Christopher D. Witiw, MD,[||] Peter MacDonald, MD, FRCSC,[†‡] and Jeff Leiter, PhD*[†‡§]

- Sports Health 2017
- Cross-sectional survey
- Senior division rugby players registered in the Province of Manitoba

Results

- 284/464 surveys were returned; Response rate of 61.2%

Table 2. Impact of concussions[a]

	Total % (n/N)	% Male (n/N)	% Female (n/N)
Experienced signs and symptoms of concussion	38.5 (106/275)	30.2 (51/169)	51.9 (55/106)
Diagnosed with a concussion	50.0 (53/106)	56.9 (29/51)	43.6 (24/55)
Missed time from school and/or work	26.5 (27/102)	21.6 (11/51)	31.4 (16/51)
Missed time from rugby	39.8 (41/103)	37.3 (19/51)	42.3 (22/52)

[a]Data limited to the subset of players who participated in the prior season (275 of 284 total participants).

Knowledge-Based Questions

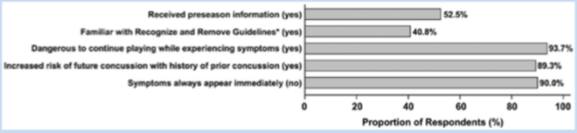


Figure 2. Participant responses to knowledge-based questions specific to concussion in the sport of rugby. *Guidelines as outlined by the World Rugby Organization.

Attitudes/Influences

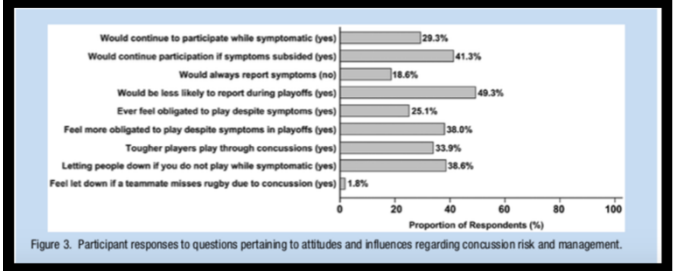


Figure 3. Participant responses to questions pertaining to attitudes and influences regarding concussion risk and management.

Summary

- Concussions common
  - Over 1/3 reported concussion symptoms in year prior
    - Higher than prior studies suggesting incidence 11-25%
      - 2.08 concussions per 1000 player match hours
      - 8.1 concussions per 1000 playing hours
- Females > males
  - Consistent with evidence that greater risk/longer to recover
- Knowledge-attitude discord
  - Willing to continue symptomatic despite understanding the danger
    - Underlying culture of being commended for "playing injured" or a desire to appear "tough"
- Community-level athlete vulnerable cohort
  - 27% reported missed time school/work
    - Realistic potential for substantial loss of productivity

ROLLER DERBY

Background

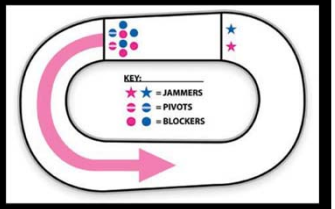
- 1935 in Midwest
  - Leo Seltzer

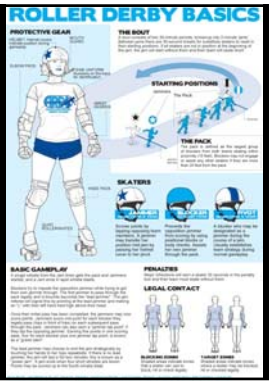
Background

- Revival in 2000s
- Fastest-growing women sport in America
- First/largest organization is **Women's Flat Track Derby Association**
- Worldwide
  - 404 full-member leagues, 54 apprentice leagues, 30,000 skaters
    - Brand new skaters to Olympic gold medalists
  - 3 competitive divisions
  - International bracketed tournament annually for top 2 divisions

Background

- Full contact
- Oval track (though often flat)
- Bout consists of two 30 min halves
  - 2 minute "jams"
- 2 teams of 5 skaters
  - 3 blockers
  - A jammer
  - A pivot





Background

- WFTDA acknowledges importance of concussion safety
  - Risk management committee
  - Rules and safety protocols
    - Concussion protocol
  - WFTDA safety manual
  - www.wftda.com
- Additional safety
  - Minimum skills requirement for new skaters to be eligible to play
    - 180 degree turns
    - Skate on 1 foot
    - Able to safely accept and deliver hits

Background

- With increased popularity/participation, comes increased injuries
- Female athletes
  - Higher risk of sustaining concussion and exhibiting more severe symptoms
  - Ice hockey, lacrosse, soccer (in comparable rules sports)
- Pertinent to roller derby as full contact!
- Research lacking

INTERNATIONAL JOURNAL OF INJURY CONTROL AND SAFETY PROMOTION, 2018
https://doi.org/10.1080/17457300.2018.1431946

Taylor & Francis
Taylor & Francis Group

Check for updates

Incidence and predictors of roller derby injuries among female roller derby athletes

Michelle L. Cathorall[a]* and Andrew A. Peachey[b]

[a]Department of Applied Health, Southern Illinois University Edwardsville, Edwardsville, IL, USA; [b]Department of Health Sciences, James Madison University, Harrisonburg, VA, USA

- First study of woman's roller derby injuries
- Electronic questionnaire sent to women's roller derby leagues
  - Collect data from March to June 2015

Results

- 48.7% (679/1395) reported having at least 1 injury in the previous 12 months
- Most common injuries
  - Ankles (22.5%)
  - Knees (21%)
  - Head (11%)
    - Of the head injuries, 75% were diagnosed with a concussion

SciMedCentral
Annals of Sports Medicine and Research

Research Article

Sudden Impact: Concussion in Female Roller Derby Athletes

Anna L. Hoskins and Roderick S. Hooker*
Division of Family Medicine, University of Washington, USA

*Corresponding author
Roderick S. Hooker, Email: rodhooker@msn.com

Submitted: 14 July 2015
Accepted: 11 August 2015
Published: 13 August 2015

- Survey adult female athletes
- 2014 *Roller Con* international roller derby conference

Results

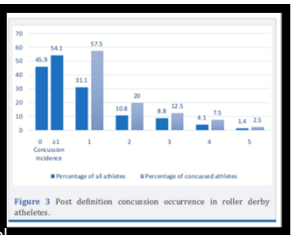
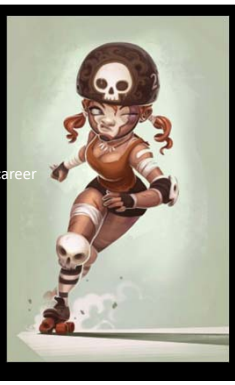


Figure 3 Post definition concussion occurrence in roller derby athletes.

- 35.1% baseline concussion occurrence
  - prior to reading medical definition
- 54.1% concussion occurrence
  - after reading definition
  - 22 athletes changed response (29.7%)
- 58.1% affirmed their league had protocol
  - Of those, 62.8% included baseline testing
- 55.4% had not read WFTDA's safety manual

Take Away



- Overall
  - 1 concussion per player
    over a mean of 3.6 years in sport participation
  - Over half reported at least 1 concussion in their career
    - Some as many as 5; 10% reporting 3+
- With education, self-reporting increases from baseline
- WFTDA safety manual has a protocol and graded return

OBSTACLE RACES

Background

- Outdoor obstacle races popular/fast-growing
  - 1 million participants 2014
- Modeled after military-style obstacle courses
  - Tough Mudder
  - Warrior Dash
  - Spartan Race

Injuries

- 2013 drowning West Virginia “walk the plank”
- Same 2013 event
  - 20 patients sent to ER
  - Included heart attacks, electrical shock, hypothermia, and a variety of orthopedic and head injuries
- Pennsylvania event June 2013
  - 38 patients were seen in the ER
  - Problems included heat injuries, syncope, rhabdomyolysis, seizures, asthma, broken bones, dislocations, and other orthopedic
- 2 reported episodes of heat stroke
- Many injuries

Tough Mudder Michigan 2018

- 7700 runs Saturday, 1600 Sunday
- 75 med tent visits Saturday, 40 Sunday

- Diabetic athlete/insulin pump
- WGBT/lightning
- Afib, Syncopal event; hypoglycemia/dehydration, Cardiac arrest
- Migraine, Concussion, C-spine clearance
- Lacerations; head, knee, finger, vaginal
- 4 shoulder dislocations
- Rib fracture, 2 fracture dislocation, 2 Ankle fractures, Prox tib fracture, 2 nasal fracture
- Back strain, Hip flexor, 3 gastroc/calf strain
- ACL, MCL, Achilles rupture

Tough Mudder Injuries, Triathlon Drownings, and Team Rhabdomyolysis in the Navy

E. Randy Eichner, MD, FACSM

Address for correspondence: E. Randy Eichner, M.D., FACSM, 321 Baudin Way, Sonoma, CA; E-mail: reichner1@comcast.net.

1537-890X/1302/66-67
Current Sports Medicine Reports

- Call for a governing body, better safety standards, protocols, etc

Circus Arts

Background

- Human circus/Modern circus artists
- Performing arts that closely resemble sport
  - Artists trained in gymnastics and aerosport
- Worldwide registry
  - 500 companies in 19 countries dedicated to circus arts
  - 216 circus schools and 19 federations

Cirque Du Soleil

- 1000+ artists
  - 17 shows
  - Performance Medicine team; 2-3 AT/PT
  - Artists
    - Tethered and untethered aerial maneuvers
    - Diving
    - Swimming
    - Martial arts
    - Dance
    - Chinese acrobatics

Injury Patterns and Injury Rates in the Circus Arts

An Analysis of 5 Years of Data From Cirque du Soleil

Ian Shrier,*† MD, PhD, Willem H. Meeuwisse,‡ MD, PhD, Gordon O. Matheson,§ MD, PhD, Kristin Wingfield,‖ MD, Russell J. Steele,† PhD, François Prince,¶ PhD, James Hanley,† PhD, and Michael Montanaro#

From †McGill University, Montreal, Quebec, Canada, ‡University of Calgary, Calgary, Alberta, Canada, §Stanford University, Stanford, California, ‖Center for Sports Medicine, Saint Francis Memorial Hospital, San Francisco, California, ¶Université de Montréal, Montreal, Quebec, Canada, and #Concordia University, Montreal, Quebec, Canada

The American Journal of Sports Medicine, Vol. 37, No. 8
DOI: 10.1177/0363546508331138

Methods

- Cohort Study
- Cirque du Soleil injury data/work records
- 2004-2009
- "Injury"
  - Any work-related condition recorded in electronic database that required visit to show therapist
- Recorded treatments, missed performances, injury rates

Results

- 1376 artists sustained 18,336 total injuries
  - Similar across sex and performance vs training
- Overall injury rate 9.7% (95% CI)
  - NCAA women's gymnastics 15.2 (per 1000)
- Most minor
  - 80% required <7 treatments and <1 missed performance
- Rate of injury leading to >15 missed performances
  - 0.74 (95% CI) Acrobats (highest group)
    - Much lower than NCAA women's gymnastics

CROSSFIT

Background

- Founded 2000
- Over 10,000 affiliates worldwide
- 10 year Reebok sponsorship
- Annual CrossFit Games

Background

- "Constantly varied, high intensity, functional movement"
- Incorporates
  - Ballistic gymnastics
  - Olympic weightlifting
  - Traditional exercises

Background

- Workouts Of the Day (WODs)
  - Typically around 20 minutes
  - Include combination of exercises
  - Performed in rapid succession
    - Emphasis on maximum repetitions in a certain amount of time or
    - Finishing a certain number of repetitions in shortest time possible
- Each WOD scalable to allow participation across fitness levels
  - "Mod your WOD"

Benefits

- Smith et all reported significant improvements in fitness following Crossfit programming
- *Smith MM, Sommer AJ, Starkoff BE, Devor ST. Crossfit-based high intensity power training improves maximal aerobic fitness and body composition. J Strength Cond Res. 2013;27:3159-3172.*
  - Improved metabolic capacity and improved fitness
    - Improved VO2max and body composition with 10 week program
    - Improved work capacity after 6 week program
    - Noted in both sexes and across all levels of fitness

Concerns

- Criticism involves random regiment/lack of individualization
- Questions regarding safety
  - High intensity and competitive nature
- Concern regarding loss of good/proper form during timed workouts

CHAMP

- Consortium for Health and Military Performance (CHAMP)
  - Collaborative workshop
    - Department of Defense (DoD)
    - American College of Sports Medicine (ACSM)
  - Suggested potential benefits BUT highlighted significant risk of injury in those involved in extreme conditioning programs such as CrossFit
  - Data relatively limited
  - Recommendations include further research

The Nature and Prevalence of Injury during CrossFit training

- ***Journal of Strength and Conditioning Research Publish Ahead of Print DOI:*** *Mr. Paul Taro Hak MBChB, MRCS. Specialist Registrar, All Wales Trauma and Orthopaedic Training Program, Cardiff, UK. Dr. Emil Hodzovic MBChB. Foundation Trainee, All Wales Training Program, Cardiff, UK. Mr. Ben Hickey, MBChB, MRCS. Specialist Registrar, All Wales Trauma and Orthopaedic Training Program, Cardiff, UK.*
- Observational study design
- Online questionnaire/Cross-sectional data
- "Injury"
  - Injury sustained during training which prevented the participant training, working or competing in any way and for any period of time

Results

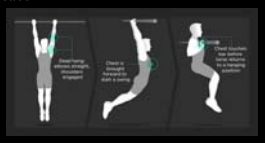
- 97 (73.5%) participants had sustained an injury that had prevented them from working, training or competing
- 186 total injuries reported
  - 9 participants (7.0%) had sustained an injury that required surgery
  - No reports of rhabdomyolysis
- Injury rate 3.1 injuries per 1000 hours trained
  - Calculated from duration of training/participation
- Most common injury locations
  - Shoulder
  - Spine
  - Arm/elbow

Comparison

- Broadly similar rates reported for sports including
  - Weightlifting
  - Powerlifting
  - Gymnastics
- Lower than that reported in contact sports such as Rugby League/Rugby Union

Comparison

- High prevalence of shoulder injuries (31.8%)
  - 25.8% of total injuries
  - Higher than previously reported for elite/competitive Olympic weightlifters
    - Olympic weightlifting typically only 1 rep max
    - CrossFit high repetition and intensity, emphasis on speed
      - Leading to poor form and at risk position at extremes of fatigue
      - At risk positions; flexion, abduction, internal rotation
        - Technical low squat snatch position
        - "Kipping" motion



Injury Rate and Patterns Among CrossFit Athletes

Benjamin M. Weisenthal,* BA, Christopher A. Beck,† MA, PhD, Michael D. Maloney,‡ MD, Kenneth E. DeHaven,‡ MD, and Brian D. Giordano,‡§ MD

Investigation performed at the University of Rochester School of Medicine and Dentistry, Rochester, New York, USA

The Orthopaedic Journal of Sports Medicine, 2(4), 2325967114531177
DOI: 10.1177/2325967114531177

- Cross-sectional design
- REDCap electronic data 10/2012-2/2013, University of Rochester

Methods

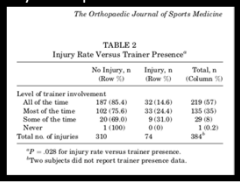
- 3-fold injury criterion
- ''Injury''
  - Any new musculoskeletal pain, feeling, or injury that results from a CrossFit workout and leads to 1 or more of the following options:
    - 1. **Total removal** from CrossFit training and other outside routine physical activities for **>1 week**
    - 2. **Modification** of normal training activities in duration, intensity, or mode for **>2 weeks**
    - 3. Any physical complaint severe enough to warrant a **visit to a health professional**

Results

- 19.4% (75) participants at least 1 injury in 6 months prior
  - 63 participants experienced 1 injury (84%)
  - 10 experienced 2 injuries (13.3%)
  - 2 experienced 3 injuries (2.7%)
- No significant difference in injury rate
  - Across age (n 1⁄4 381; P 1⁄4 .56)
  - Based on length of participation in CrossFit (n 1⁄4 386; P 1⁄4 .099)
  - Based on length of training session (n 1⁄4 384; P 1⁄4 .17)
- Participants with beginners training period reported lower injury rate (18.5%) than those without (25.9%)

Results

- Males significantly more likely > females
- Significant correlation between injury rate and level of coach supervision
- Females significantly more prone to seek coach supervision

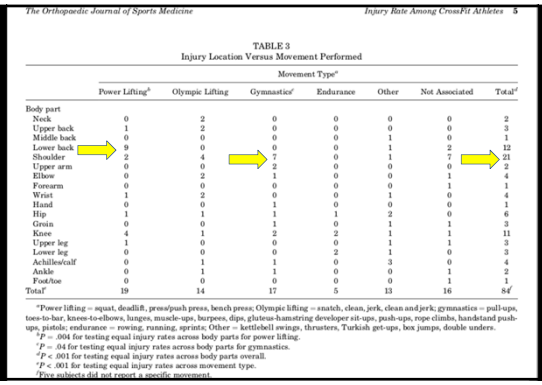


The Orthopaedic Journal of Sports Medicine

TABLE 2
Injury Rate Versus Trainer Presence[a]

	No Injury, n (Row %)	Injury, n (Row %)	Total, n (Column %)
Level of trainer involvement			
All of the time	187 (85.4)	32 (14.6)	219 (57)
Most of the time	102 (75.6)	33 (24.4)	135 (35)
Some of the time	20 (69.0)	9 (31.0)	29 (8)
Never	1 (100)	0 (0)	1 (0.2)
Total no. of injuries	310	74	384[b]

[a]$P = .028$ for injury rate versus trainer presence.
[b]Two subjects did not report trainer presence data.



The Orthopaedic Journal of Sports Medicine *Injury Rate Among CrossFit Athletes* 5

TABLE 3
Injury Location Versus Movement Performed

	Movement Type[a]						
	Power Lifting[b]	Olympic Lifting	Gymnastics[c]	Endurance	Other	Not Associated	Total[d]
Body part							
Neck	0	2	0	0	0	0	2
Upper back	1	2	0	0	0	0	3
Middle back	0	0	0	0	1	0	1
Lower back	9	0	0	0	1	2	12
Shoulder	2	4	7	0	1	7	21
Upper arm	0	0	2	0	0	0	2
Elbow	0	2	1	0	0	1	4
Forearm	0	0	0	0	0	1	1
Wrist	1	2	0	0	1	0	4
Hand	0	0	1	0	0	0	1
Hip	1	1	1	1	2	0	6
Groin	0	0	1	0	1	1	3
Knee	4	1	2	2	1	1	11
Upper leg	1	0	0	0	1	1	3
Lower leg	0	0	0	2	1	0	3
Achilles/calf	0	1	1	0	3	0	4
Ankle	0	1	1	0	0	1	2
Foot/toe	0	0	0	0	0	1	1
Total[e]	19	14	17	5	13	16	84[f]

[a]Power lifting = squat, deadlift, press/push press, bench press; Olympic lifting = snatch, clean, jerk, clean and jerk; gymnastics = pull-ups, toes-to-bar, knees-to-elbows, lunges, muscle-ups, burpees, dips, gluteus-hamstring developer sit-ups, push-ups, rope climbs, handstand push-ups, pistols; endurance = rowing, running, sprints; Other = kettlebell swings, thrusters, Turkish get-ups, box jumps, double unders.
[b]$P = .004$ for testing equal injury rates across body parts for power lifting.
[c]$P = .04$ for testing equal injury rates across body parts for gymnastics.
[d]$P < .001$ for testing equal injury rates across body parts overall.
[e]$P < .001$ for testing equal injury rates across movement type.
[f]Five subjects did not report a specific movement.

Application

- Overall injury rate 20%
  - Runners 19.4% to 79.3% across epidemiological studies
  - Track and field 42.8% 1 year retrospective
- Shoulders, knees, low back most frequent
  - Mostly during power lifting and gymnastics movements
  - Findings consistent with published injury rates among gymnastics (shoulder)
  - Similar trends in Olympic and power lifting

Table 1. Injury rate comparison to other sport/activity

Sport/Activity	Study	Injury Rate (per 1000 hours)
Elite weightlifting	Raske and Norlin[18]	0.42-0.53 (shoulders only)
Swimming	Parkkari et al[17]	1
Walking	Parkkari et al[17]	1.2
Cycling	Parkkari et al[17]	2
CrossFit	Giordano and Weisenthal[8] Hak et al[11]	2.4 3.1
Triathalon (preseason)	Burns et al[4]	2.5
Running (long distance)	van Gent et al[22]	2.5
Elite weightlifting	Raske and Norlin[18] Calhoon and Fry[6]	2.6-3.3
Gym training	Parkkari et al[17]	3.1
Gymnastics	Parkkari et al[17]	3.1
Running (overall)	Parkkari et al[17]	3.6
Triathalon (competitive season)	Burns et al[4]	4.6
Tennis	Parkkari et al[17]	4.7
Women's soccer (practice)	Hootman et al[13]	5.2
Soccer	Parkkari et al[17]	7.8
Basketball	Parkkari et al[17]	9.1
Men's spring football (practice)	Hootman et al[13]	9.6

Application

- Males higher risk than females
- No age difference
  - Suggests CrossFit can function safely for athletes across groups

Application

- Blend of gymnastics, power lifting Olympic lifting, endurance activity
  - As such, predicted injury rate high
- Would not be true due to
  - Level of supervision
  - Emphasis on instruction before exercise
- Increased supervision
  - Directly related to injury rate
  - Participants need to be aware;
    - Powerlifting at risk for low back, etc

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[Physical Therapy]

Shoulder Injuries in Individuals Who Participate in CrossFit Training

Ryan J. Summitt, PT, DPT,*† Ryan A. Cotton, PT, DHS,† Adam C. Kays, PT, DPT,† and Emily J. Slaven, PT, PhD‡

- Cross-sectional study, electronic survey

Results

- 23.5% (44/187) individuals reported a shoulder injury per the criteria
  - 17 (38.6%) stated injury was an exacerbation of a previous injury sustained prior to starting CrossFit
  - 27 (14.4%) sustained new shoulder injury per the criteria used for this study
- 1 injury requiring surgery

Perceived Cause of Injury

- 25 of 46
  - Attributed gymnastics exercises as the primary cause
- 26 of 46
  - Attributed weightlifting movements

Table 4. Reported primary cause of injury

Movement	Cause of Primary Injury, n*
Push-up	3
Hand stand push-up	1
Hand stand walk	2
Kipping pull-up	5
Butterfly pull-up	2
Toes-to-bar	2
Knees-to-elbow	1
Ring muscle-up	4
Bar muscle-up	2
Ring dips	3
Total, gymnastics	**25**
Bench press	3
Snatch (any variation: power, squat, dumbbell, etc)	10
Overhead press (any variation: strict press, push-press, push-jerk, split-jerk, etc)	13
Total, weightlifting	**26**
Unknown origin	14

*Participants could choose more than 1 option for each injury.

Perceived Cause of Injury

- 33/44 attributed their injuries to a certain cause, including
  - Improper form (n = 11, 33.3%),
  - Too heavy a weight (n = 4, 12.1%),
  - Fatigue (n = 6, 18.2%),
  - Lack of guidance (n = 1, 3%),
  - Exacerbation of previous injury (n = 11, 33.3%).
  - 11 chose the option "I don't know"

Summary

- Gymnastics most often primary cause of shoulder injuries
- Total injuries relatively equal
  - 49% gymnastics movements
  - 51% weightlifting movements
- Important for coaches/participants to be aware of potential risks
  - Overhead lifting motions, including pressing and snatch

Exertional and CrossFit-Induced Rhabdomyolysis

Michelle Meyer, MD, Sneha Sundaram, MD, and Ingeborg Schafhalter-Zoppoth, MD

Abstract: Few publications of exercise-induced rhabomyolysis currently exist in the medical literature besides case reports. However, this condition can be severe, resulting in hospitalization and IV fluid administration to prevent serious sequelae. This report describes a case of exercise-induced rhabdomyolysis caused by a CrossFit workout. A 31-year-old female presented with 2 days of bilateral upper extremity pain and soreness, which began 2 days after she completed a CrossFit workout. Workup revealed an elevated creatine phosphokinase (CPK) of 18 441 U/L, consistent with exercise-induced rhabdomyolysis, and elevated liver function tests and elevated D-dimer, although her renal function was normal. She was hospitalized for 2 days and treated with IV fluids. This case report demonstrates that CrossFit exercises can lead to rhabdomyolysis, highlighting a condition that may be underdiagnosed and underreported.

Key Words: CrossFit, rhabdomyolysis, exercise, female

(*Clin J Sport Med* 2017;0:1–3)

- 31 year old female with worsening bilateral bicep pain, started after first time CrossFit workout
- CPK 1844 u/L, D-dimer 484ng/mL
- Admitted for aggressive fluid administration and serial CPK checks
- Discharged 2 days

Cases

- 3 other case studies
  - May be underreported
- "Uncle Rhabdo"
- Educate athletes
  - Risk factors
    - High intensity or prolonged duration of exercise
    - Eccentric muscle contractions
    - Little previous exercise
    - Hot environments
    - Previous electrolyte imbalance
    - Male sex
    - Low protein or glycogen-loading diets
    - Statin use
    - Creatine supplementation
    - Alcohol

Conclusions

- Rugby has high incidence of severe injury
  - Especially concussion
  - Higher in females
- Heightened awareness needed for community rugby and concussions
  - Propensity to return while symptomatic
  - Knowledge/attitude discord
  - Potential effect on life outside rugby (work, etc)
- Formalized educational protocol needed

Conclusions

- Roller derby reluctant to report
  - Self-reporting increases with education
    - Suggesting it is meaningful in Derby!
    - Educate!

Conclusions

- CrossFit injury rates similar to other high intensity/technically demanding sports
  - Olympic lifting, power lifting
- Injury rates lower than those seen in contact sports
- High prevalence of shoulder and low back
  - Needs to be considered when programming
  - Increased focus on technique and focus on maintaining throughout workouts
    - more important than speed and total reps
- Increased supervision/instruction by CrossFit coaches directly related to injury rate!
- Participants need to be aware of risks and strive to maintain form
  - Be aware of low back while powerlifting, etc
  - Be aware of shoulder while overhead; press and snatch

Call to Action

- Find a fun way to exercise
- Get involved in your community
- Educate your athletes
  - Concussion
  - Rhabdomyolysis, etc
- Consider further research

Resources

- *Archbold HAP, Rankin AT, Webb M, et al. RISUS study: Rugby Injury Surveillance in Ulster Schools. Br J Sports Med 2017;51:600–606.*
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