Concept Review:
Throwing Programs

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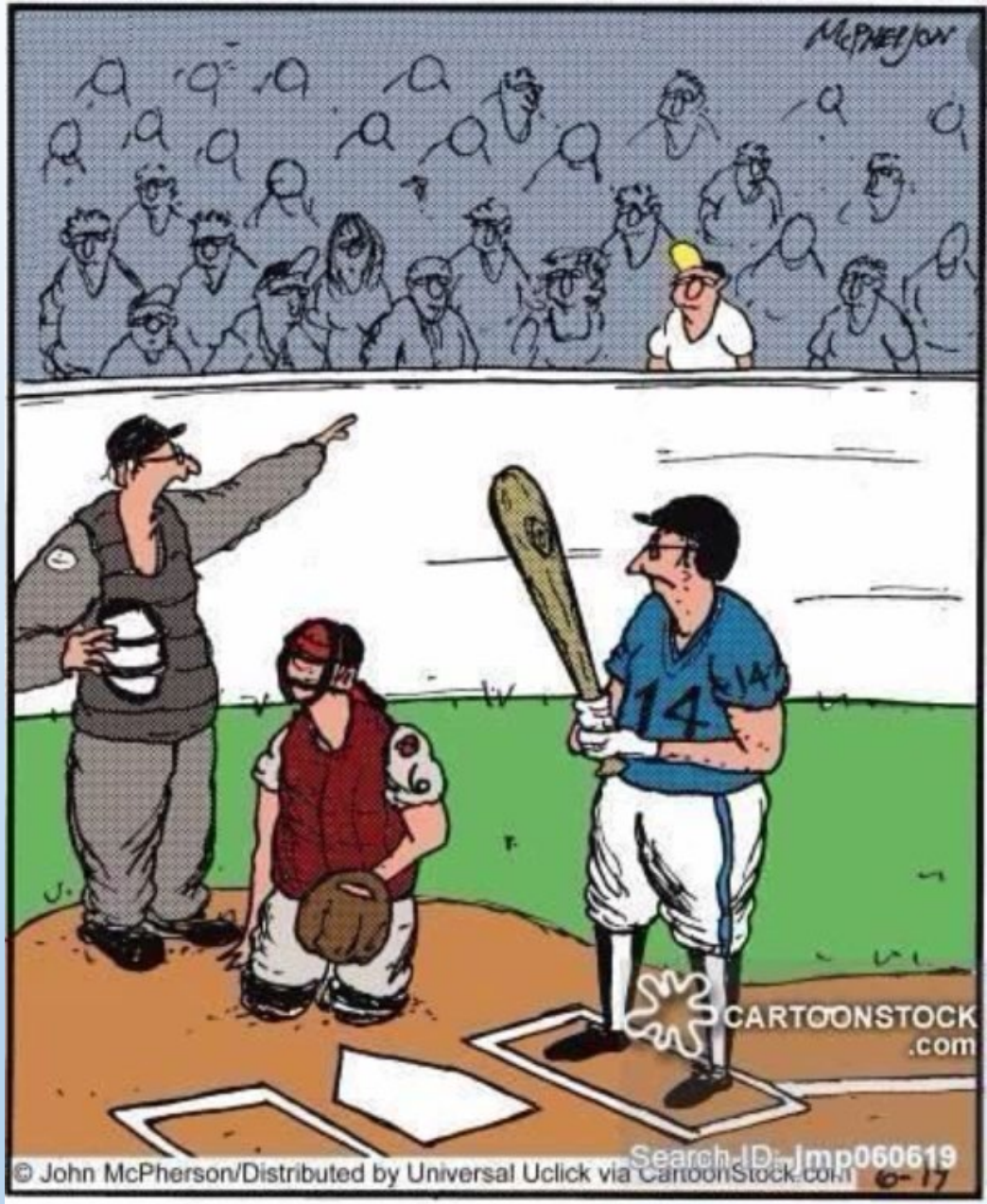


"Whoa! Time out. The loud guy in the white shirt is right — that was a ball. My mistake. Sorry everyone. Thank you, sir."

Things to consider

- The approach
- Surface
- Weight
- Distance
- Velocity
- Time
- Volume
- RPE

The approach

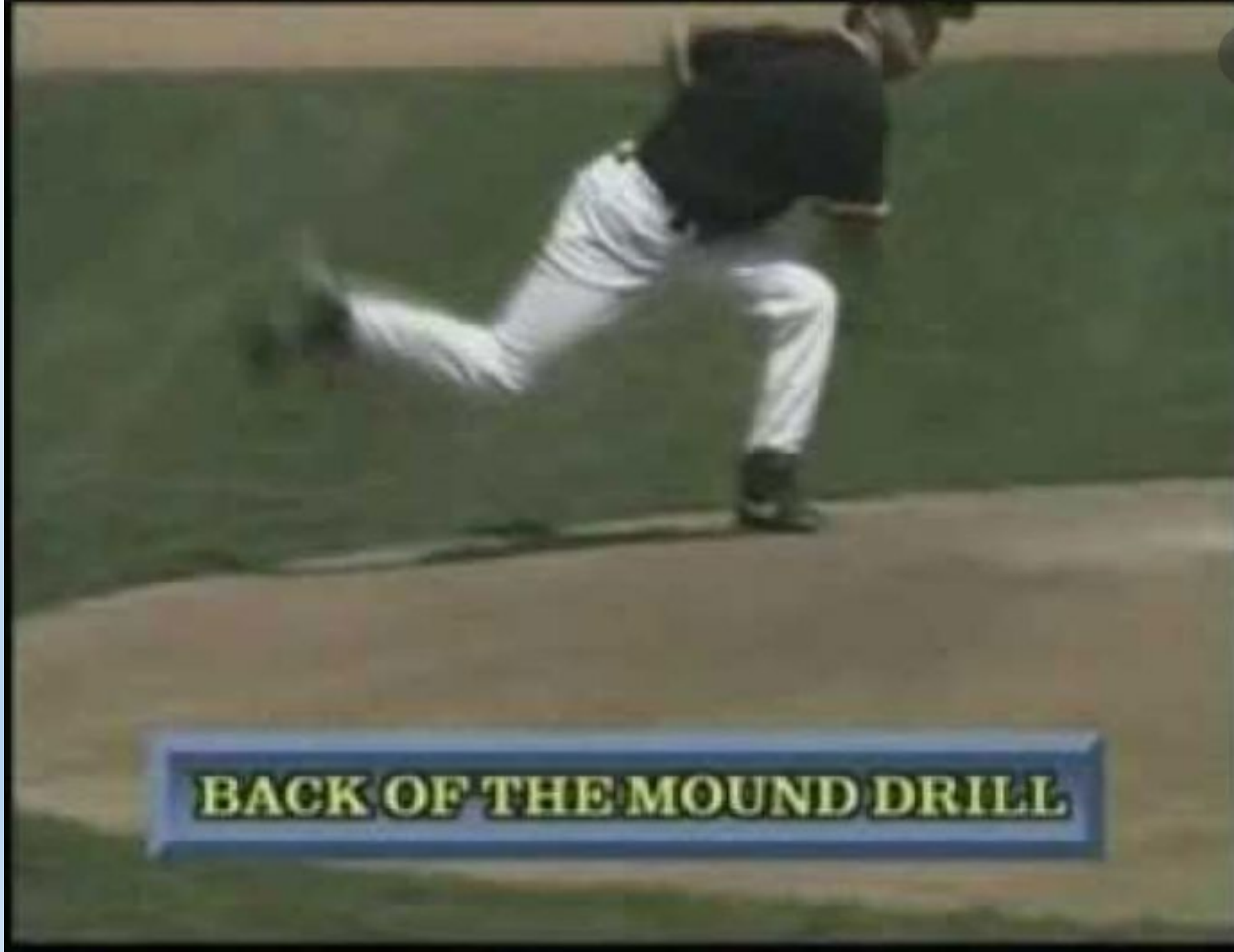
- Stretch
- Wind up
- 3 step
- 5 step
- Crow hop (Increases ball velocity and joint Velocities. Fleisig et al 2016)

Surface

- Down-Slope (10-11 inch mounds have more stress than 5-7 inch mounds for the shoulder and elbow) Diffendaffer et al 2019.
- Flat (JOSPT 2011, Dowling et al.)
  - No consensus on velocity and distance or velocity carry over to mound(too many variables)
  - Can increase range of motion, speed (pelvis, trunk, elbow), and arm torque (elbow varus and shoulder IR)
  - Past 180 ft throws become less efficient (increased torques, and changed kinematics)

Surface

- Up-Slope



Weight

- “Weighted Balls” range from 4oz and up
- MLB is a 9 inch circumference 5oz ball
- The only age it is less than 5oz is when it is a tee ball (9 inch circumference, 4oz ball).
- Repetitions
  - Throwing is an exercise, but it is hard to do it as traditional S&C. % of 1RM is too variable, > 10 reps 1RM is relatively inaccurate.

"Here. He won't be expecting this."

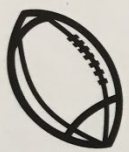
SIZE

27.5
YOUTH
AGE: FEMALES & MALES 8 & UNDER

28.5
INTERMEDIATE
AGE: FEMALES 9+ MALES 9-11

29.5
OFFICIAL
AGE: MALES 12+ - PRO

SIZE


PEE WEE
AGE: 6+


JUNIOR
AGE: 9+


YOUTH
AGE: 12+


OFFICIAL
AGE: 14+

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

GRIP
DURABILITY
FEEL

SIZE


SIZE 3
AGE: 8 & UNDER


SIZE 4
AGE: 8-12


SIZE 5
AGE: 13+

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

TOUCH
CONTROL
FLIGHT

PERFECTION

BEACH ELITE

VCOR

LEXUM

RALLY

12U LIGHT

SOFTLIGHT

SOFTLIGHT OVERSIZED

	PERFECTION	BEACH ELITE	VCOR	LEXUM	RALLY	12U LIGHT	SOFTLIGHT	SOFTLIGHT OVERSIZED
Outdoor/Indoor	Indoor	Outdoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
Level of Play	Elite Game Play	Elite Game Play	Elite Game Play	Game Play	Practice	Game Play	Youth Practice	Youth Practice
Price	$$$	$$$	$$$	$$	$$	$$	$	$
Durability	★★★	★★★	★★★	★★★	★★	★★★	★★	★★
Feel	★★★	★★★	★★★	★★★	★★	★★★	★★	★★
Air Retention	★★★	★★★	★★★	★★★	★★★	★★★	★★	★★
Sizes Available	Official	Official	Official	Official	Official	12U	10U	8U

Distance

- 120’
- 180’
- 180’+
- Max distance
- Total distance thrown
- Weighted ball training and

“long toss” increased distance thrown.

(Peters et al 2018)

Distance

The use of longer distances for conditioning and rehabilitation may be beneficial in increasing shoulder range of motion and arm speed; however, precaution needs to be taken, as throwing longer distances are accompanied by an increase in arm rotation, arm speed, and elbow torque, with a decrease in arm slot.

Dowling et al, 2018

Elbow varus torque increased significantly as pitchers increased their arm rotation during the arm cocking phase, increased the rotational velocity of their arm during the arm acceleration phase of throwing, and decreased arm slot at ball release. Thus, shoulder flexibility, arm speed, and elbow varus torque (and likely injury risk) are interrelated and should be considered collectively when treating pitchers.

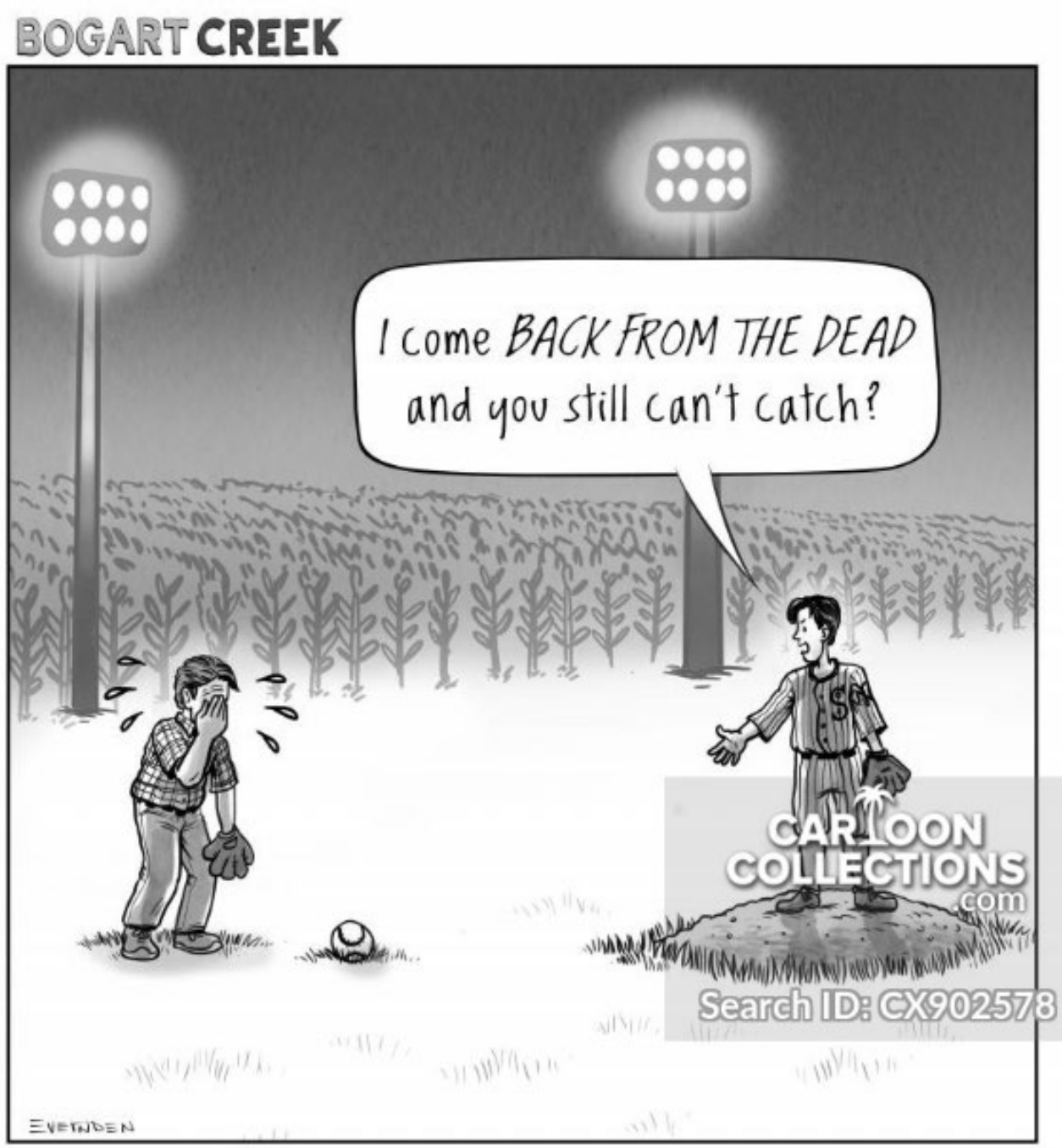
Camp et al, 2017

Velocity

- 50% effort
- 75% effort
- 90% effort
- (~90mph ~340ft)
- MPH
  - Ball velocity and elbow torque do not necessarily correlate (Leafblad, et al 2019, Ling, et al 2019.)
  - Within an individual pitcher, higher ball velocity was strongly associated with higher elbow-varus torque (Slowik, et al 2019) (1.62-Nm increase per 2.24 mph increase in ball velocity)
  - Velocity with long toss and weighted ball training did not change (Peters, et al 2018, Marsh, et al 2018)
- Are the mph on flat ground or on a down-slope?

Time

- Rest Time
- Time of the Activity



Field of Broken Dreams.

Volume

- Train them for the event or over train them?
- Where do you want your stress to be
- What is the most stressful throw?
- ACWR
- 20% decrease
- 30% increase

Volume (Gabbett, T. J. (2018))

- It is clear large spikes increase injury risk, though risk does not directly dictate outcomes…plenty of athletes with low ACWR's will get injured and many will survive ACWR's much larger than 1.5, however, between 0.8 and 1.3, the measures of risk are consistently much lower.
- 1.5 is not a magic number
- High chronic workloads and can reduce players' risk of injury when encountering sudden increases in workload
- Several 'moderators' (including playing experience, lower body strength, and maximal aerobic speed) can influence different players risk from exposure to the same ACWR.

	DAILY THROWING ACTIVITIES	FLAT GROUND WORK	# throws	distance in ft	velocity	% increase	RPE
WEEK 1	(25 throws @45 feet) x 2 sets		50	2,250			
	No Throw Day						
	(25 throws @45 feet) x 2 sets		50	2,250			
	No Throw Day						
	(25 throws @45 feet) x 2 sets		50	2,250			
	No Throw Day						
	Rehab OFF						
WEEK 2	(25 throws @45 feet) x 2 sets		50	2,250			
	No Throw Day						
	(25 throws @45 feet) x 2 sets		50	2,250			
	No Throw Day						
	(25 throws @45 feet) x 2 sets		50	2,250			
	No Throw Day						
	Rehab OFF						
WEEK 3	(10 throws @45 feet, 15 throws @60 feet) x 2 sets		50	2,700		20%	
	No Throw Day						
	(10 throws @45 feet, 15 throws @60 feet) x 2 sets		50	2,700			
	No Throw Day						
	(10 throws @45 feet, 15 throws @60 feet) x 2 sets		50	2,700			
	No Throw Day						
	Rehab OFF						
WEEK 4	(25 throws @60 feet) x 2 sets		50	3,000		11%	
	No Throw Day						
	(25 throws @60 feet) x 2 sets		50	3,000			
	No Throw Day						
	(25 throws @60 feet) x 2 sets		50	3,000			
	No Throw Day						
	Rehab OFF						

WEEK 5	(10 throws @60 feet, 15 throws @75 feet) x 2 sets		50	3,450		15%	
	No Throw Day						
	(10 throws @60 feet, 15 throws @75 feet) x 2 sets		50	3,450			
	No Throw Day						
	(10 throws @60 feet, 15 throws @75 feet) x 2 sets		50	3,450			
	No Throw Day						
	Rehab OFF						
WEEK 6	(25 throws @75 feet) x 2 sets		50	3,750		8.70%	
	No Throw Day						
	(25 throws @75 feet) x 2 sets		50				
	No Throw Day						
	(25 throws @75 feet) x 2 sets		50				
	No Throw Day						
	Rehab OFF						
WEEK 7	(10 throws @75 feet, 15 throws @90 feet) x 2 sets		50	4,200		12%	
	No Throw Day						
	(10 throws @75 feet, 15 throws @90 feet) x 2 sets		50				
	No Throw Day						
	(10 throws @75 feet, 15 throws @90 feet) x 2 sets		50				
	No Throw Day						
	Rehab OFF						
WEEK 8	(25 throws @90 feet) x 2 sets		50	4,500		7%	
	No Throw Day						
	(25 throws @90 feet) x 2 sets		50				
	No Throw Day						
	(25 throws @90 feet) x 2 sets		50				
	No Throw Day						
	Rehab OFF						
WEEK 9	(10 throws @90 feet, 15 throws @105 feet) x 2 sets		50	4,950		10%	
	No Throw Day						
	(10 throws @90 feet, 15 throws @105 feet) x 2 sets		50				
	No Throw Day						
	(10 throws @90 feet, 15 throws @105 feet) x 2 sets		50				
	No Throw Day			14,850			
	Rehab OFF						

WEEK 10	(25 throws @105 feet) x 2 sets			50	5,250		6%
	LIGHT Daily throw up to 60-75 feet		~25		1,500 - 1,875		
	(25 throws @105 feet) x 2 sets			50			
	LIGHT Daily throw up to 60-75 feet		~25				
	(25 throws @105 feet) x 2 sets			50			
	No Throw Day				18,750 - 19,500		26% - 31%
	Rehab OFF						
WEEK 11	(10 throws @105 feet, 15 throws @120 feet) x 2 sets	Flatground = 5 FB ONLY		55	6,000		14.00%
	LIGHT Daily throw up to 75-90 feet		~25		1,500 - 1,875		
	(10 throws @105 feet, 15 throws @120 feet) x 2 sets	Flatground = 5 FB ONLY		55			
	LIGHT Daily throw up to 75-90 feet		~25		1,500 - 1,875		
	(10 throws @105 feet, 15 throws @120 feet) x 2 sets	Flatground = 5 FB ONLY		55			
	LIGHT Daily throw		~25		1,500 - 1,875		
	Rehab OFF				22,500 - 23,625		20% - 26%
WEEK 12	(25 throws @120 feet) x 2 sets	Flatground = 10 (FB & 2-4 CH ONLY)		60	6,600		10%
	LIGHT Daily throw (not to exceed 90 feet)		~25		2,250		
	(25 throws @120 feet) x 2 sets	Flatground = 10 (FB & 2-4 CH ONLY)		60			
	LIGHT Daily throw		~25				
	(25 throws @120 feet) x 2 sets	Flatground = 10 (FB & 2-4 CH ONLY)		60			
	LIGHT Daily throw		~25				
	Rehab OFF				26,550		18% - 12.4%
WEEK 13	Long Toss up to 150 feet Max (no more than 15 throws at 150 feet) x 1 set	Flatground = 10-15 (FB & CH)		40	3,150		
	LIGHT Daily throw		~25		3,000		
	Long Toss up to 150 feet Max (no more than 15 throws at 150 feet) x 1 set	Flatground = 10-15 (FB & CH)		40	3,150		
	LIGHT Daily throw		~25		3,000		
	Long Toss up to 150 feet Max (no more than 15 throws at 150 feet) x 1 set	Flatground = 10-15 (FB & CH)		40	3,150		
	LIGHT Daily throw		~25		3,000		
	Rehab OFF				18,450		31%
WEEK 14	LIGHT Daily throw (not to exceed 105 feet)	Flatground = 10-15 (FB, CH & 2-4 CV)					
	1st Rehab BP = 15 Pitch, LIGHT Effort (FB ONLY)						
	LIGHT Daily throw	Flatground = 10-15 (FB, CH & 2-4 CV)					
	LIGHT Daily throw						
	2nd Rehab BP = 15 Pitch, LIGHT Effort (FB ONLY)	Flatground = 10-15 (FB, CH & 2-4 CV)					
	LIGHT Daily throw						
	Rehab OFF						

RPE

15 Point Scale

- 6 - 20% effort
- 7 - 30% effort - Very, very light (Rest)
- 8 - 40% effort
- 9 - 50% effort - Very light - gentle walking
- 10 - 55% effort
- 11 - 60% effort - Fairly light
- 12 - 65% effort
- 13 - 70% effort - Somewhat hard - steady pace
- 14 - 75% effort
- 15 - 80% effort - Hard
- 16 - 85% effort
- 17 - 90% effort - Very hard
- 18 - 95% effort
- 19 - 100% effort - Very, very hard
- 20 - Exhaustion

10 Point Scale

- 0 - Nothing at all
- 1 - Very light
- 2 - Fairly light
- 3 - Moderate
- 4 - Somewhat hard
- 5 - Hard
- 6
- 7 - Very hard
- 8
- 9
- 10 - Very, very hard

Research by Borg et al. (1983)[2] found that there is a correlation between an athlete's rate of perceived exertion (RPE) and their heart rate, lactate levels, %VO_2 max and breathing rate.

- MACKENZIE, B. (2003) *Borg Scale* [WWW] Available from: https://www.brianmac.co.uk/borgscale.htm [Accessed 2/12/2019]

BORG, G. (1982) Psychophysical bases of perceived exertion. *Medicine and Science in Sports and Exercise,* 14 (5), p. 377-81

BORG, G. et al. (1983) A category-ratio perceived exertion scale: relationship to blood and muscle lactates and heart rate. *Med. Sci. Sports Exerc*., 15 (6), p. 523-528

BORG, G. (1970) Perceived Exertion as an indicator of somatic stress. *Scandinavian journal of Rehabilitation Medicine*, 2 (2), p. 92-98

BORG, G. (1998) *Borg's perceived exertion and pain scales*. Human kinetics.

EKBLOM, B. and GOLOBARG, A. N. (1971) The influence of physical training and other factors on the subjective rating of perceived exertion. *Acta Physiologica Scandinavica,* 83 (3), p. 399-406.

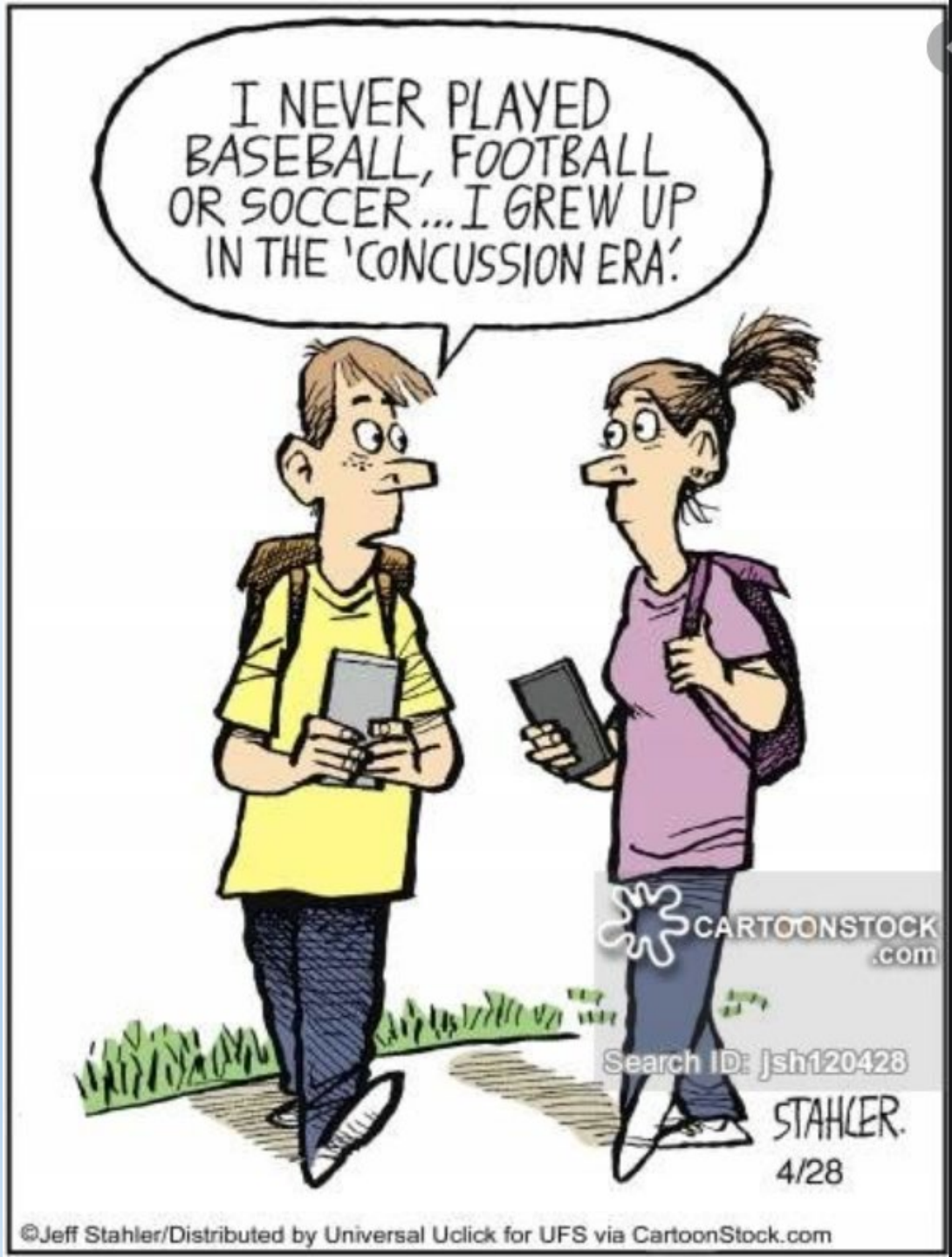
Newer considered measures

- IMUs (Motus, etc.)
- Trackman
- Rapsodo
- Motion Analysis
- Etc, etc, etc.

"I know you struck out the first 26 batters, Fernando, but the computer says we have to take you out."

Other things to consider

- How they throw
- Training memory/learning
- How they where injured
- Their physiologic considerations
- Psychology
- Sleep
- Illness
- Medications
- Etc, etc, etc.



How do we tie all of this together

1. Communication
   - “Defining the Long Toss” epidemiological study Stone et al. (2017)
   - 5 MLB teams, 321 surveys – (pitchers, pitching coaches, medical staff)
   - Interpretation of long toss (P, PC ~ 180’, medical ~ 160’)
   - Long toss - ~ 30% “on a line”, ~ 70% “not on a line”
   - When throwing “on a line” – 28% use a crow hop
   - When throwing “not on a line” – 60% use a crow hop
   - P and PC use “long toss” more for stretching
   - Medical staff view “long toss” more as an interval throwing program

How do we tie all of this together

2. Know your Player
3. Soreness Rules (Axe et al, 2009, Chang et al, 2016)

Soreness rules, all players.[a]

If no soreness, advance one step every throwing day.
If sore during warm-up but soreness is gone within the first 15 throws, repeat the previous workout. If shoulder becomes sore during this workout, stop and take 2 days off. Upon return to throwing, drop down one step.
If sore more than 1 hour after throwing, or the next day, take 1 day off and repeat the most recent throwing program workout.
If sore during warm-up and soreness continues through the first 15 throws, stop throwing and take 2 days off. Upon return to throwing, drop down one step.

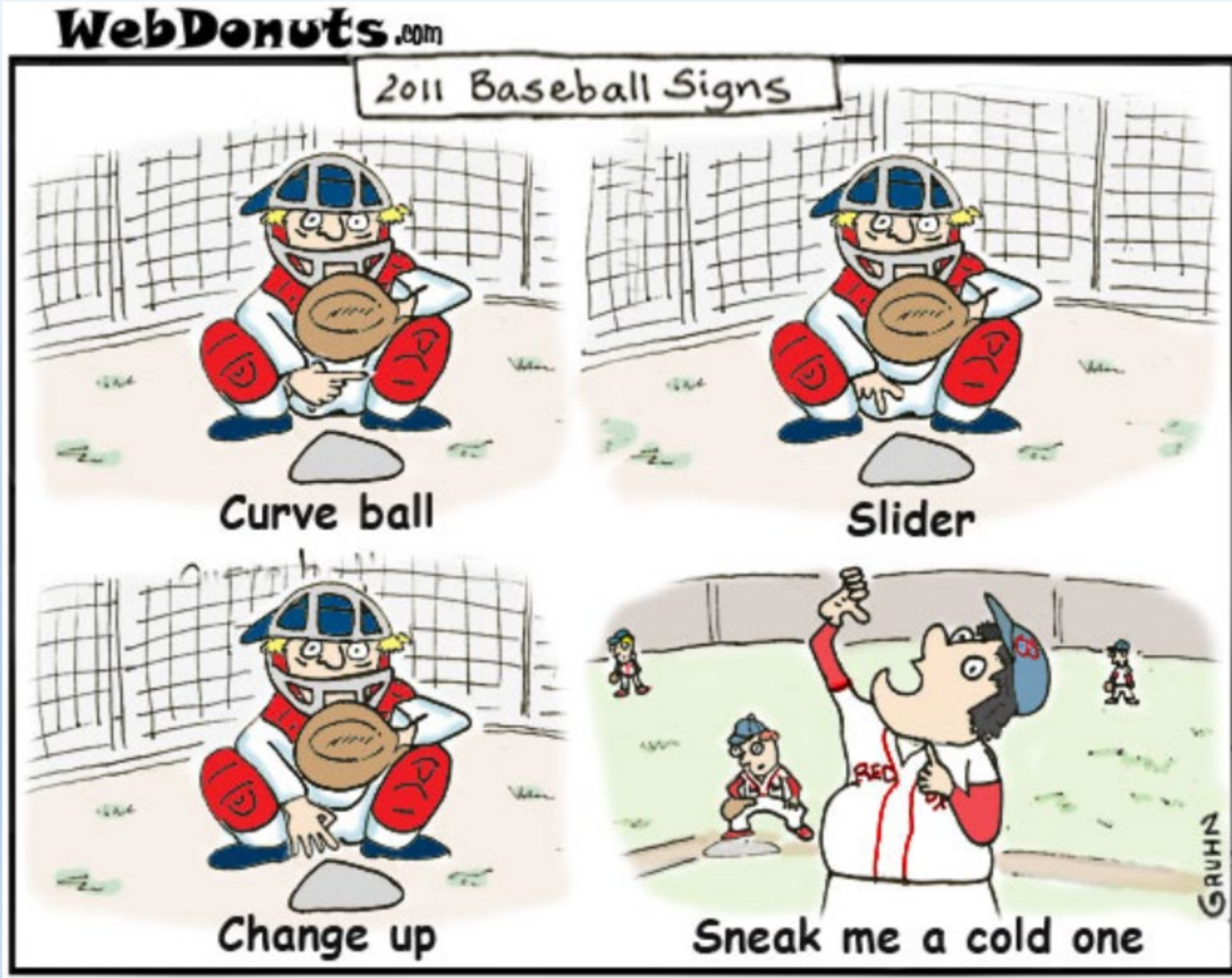
Table. **Pain and Soreness Rules for an Interval Hitting Program**

Presence of soreness	Recommendation
If there is no soreness present	Progress to next step on next day of training
If soreness occurs during warm-up but dissipates in first 15 swings	Repeat previous step that day of training
If soreness occurs during warm-up but does not dissipate in first 15 swings	Stop, take 2 days off and upon returning repeat last step
If soreness continues more than an hour after session was stopped	Take 1 additional day off and repeat last step
If any pain is felt at any time during workout	Take 2-3 days off and report to trainer for reevaluation. Drop 1-2 steps upon return to interval hitting program

How do we tie all of this together

4. Measure Something.
5. Whatever you measure,

measure it as best as you can.



Thank you!

Thank You!

- Dr. Vincent Key
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- Dave Iannicca
- Justin Hahn
- Tony Medina