



Overuse Injuries in Adolescent Baseball Pitchers

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Epidemic of Adolescent Pitching Injuries?

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Tommy John Surgery Epidemic?

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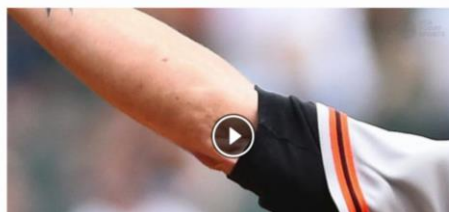
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How high school pitchers try to avoid Tommy John surgery



Tommy John surgery epidemic

By LARRY GREEN | July 26, 2014 10:41 AM ET

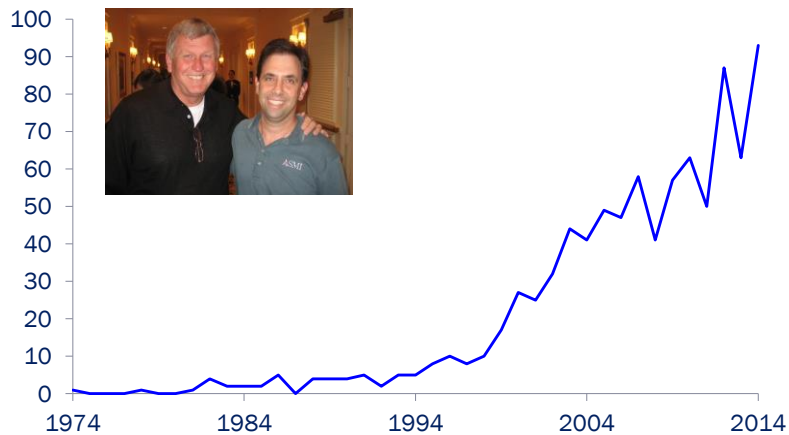
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Epidemic of Adolescent Pitching Injuries?

- National Database
- Professional Database
- ASMI Database

UCL Surgeries in Professional Baseball

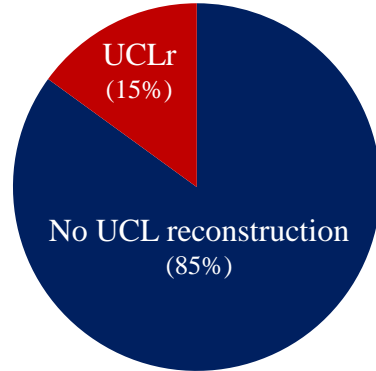


www.BaseballHeatMaps.com

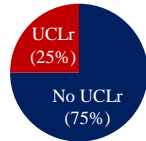
Prevalence of UCL Surgery in Pro Pitchers



Minor League (n=2324)

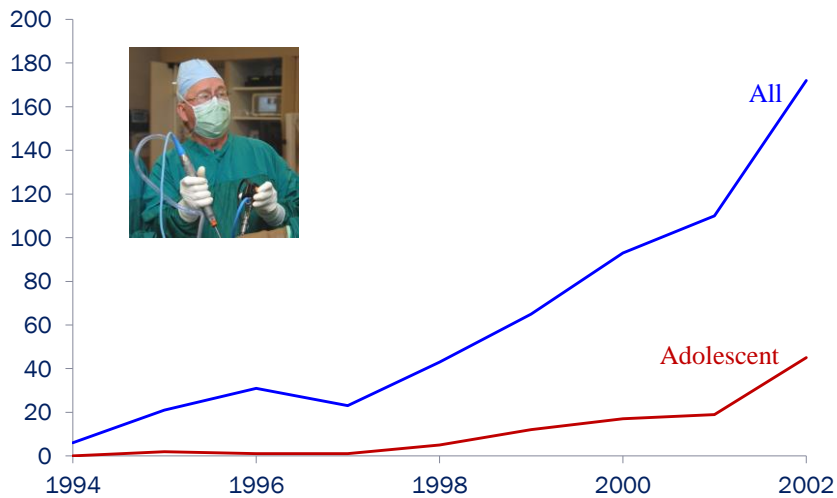


Major League (n=382)

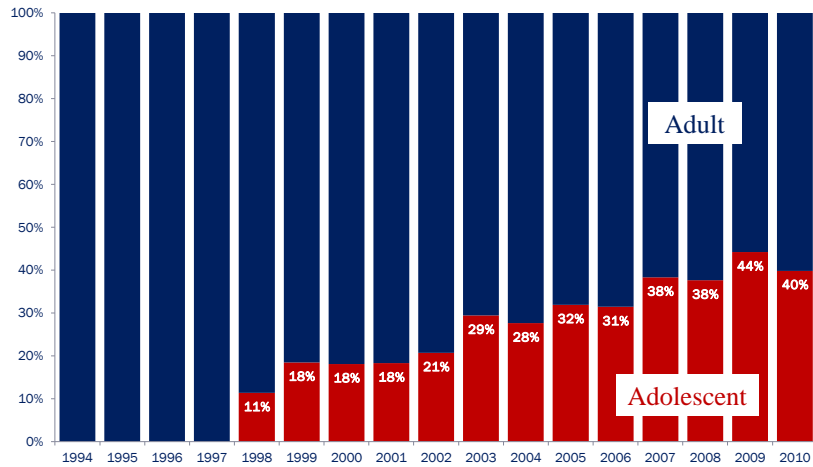


Conte et al, 2015

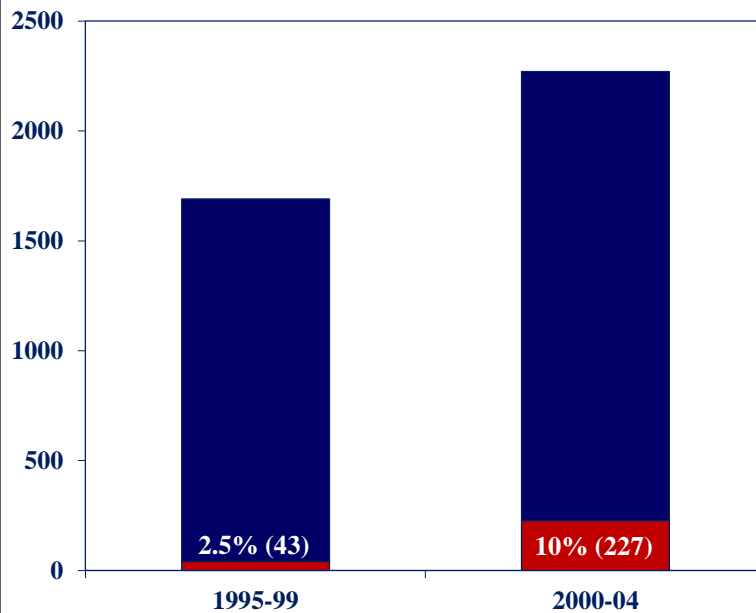
UCL Surgeries on Pitchers at ASMOC



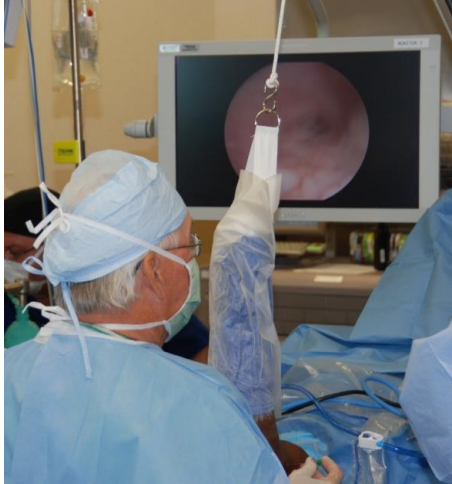
UCL Surgeries on Pitchers at ASMOC



Shoulder Surgeries by Dr. Andrews



Surgeries from Pitching



- Repetition
- Self-inflicted
- Overuse



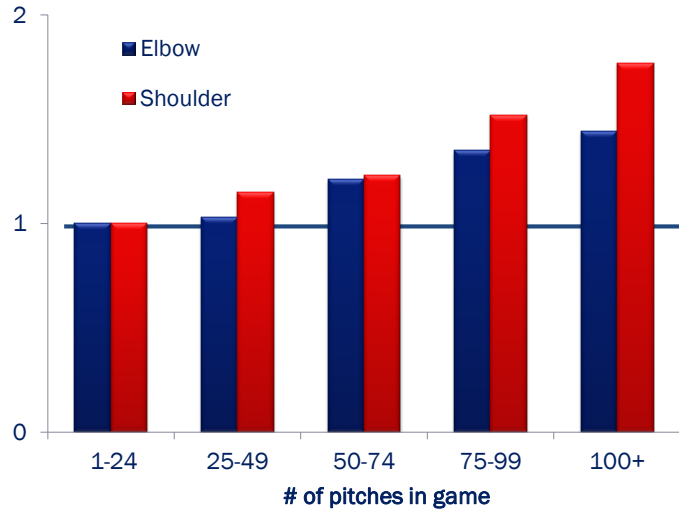
Rick Factors for Pain

Effect of pitch type, pitch count, and pitching mechanics on risk of elbow and shoulder pain in youth baseball pitchers

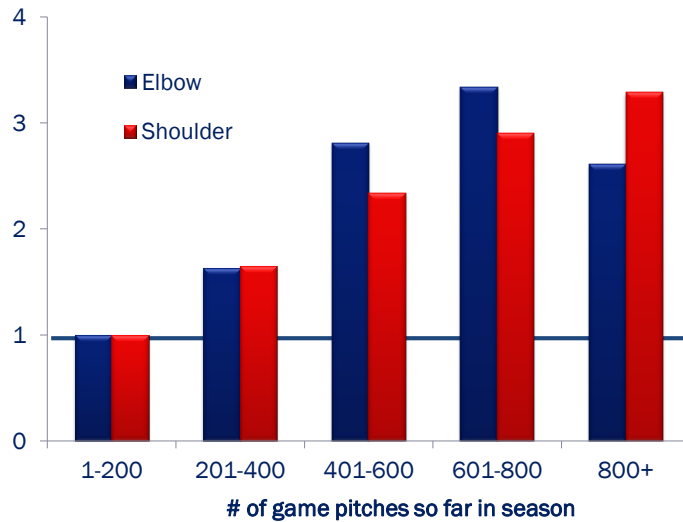
Lyman et al, *Am J Sports Med* 2002

- Spring 1999
- 476 youth pitchers (age 9-14 yrs)
- Pain questionnaire the day after every game
- Pitch counts from each game

Rick Factors for Pain



Rick Factors for Pain



Rick Factors

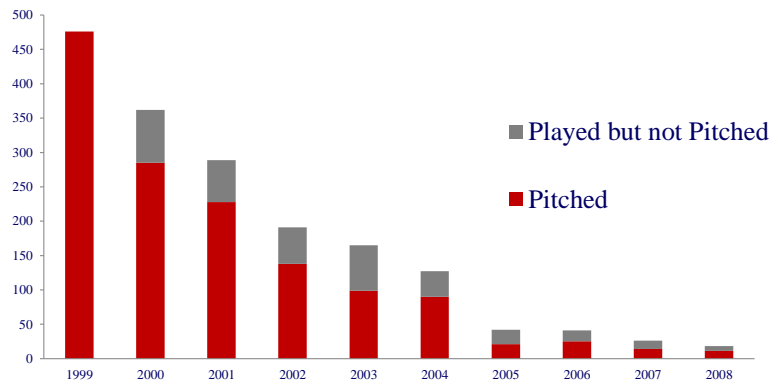
Risk factors → Pain → Injury?

- 1999 - 2008
- Alabama
- 481 youth pitchers



Fleisig GS, et al. 2011.

ASMI 10-Year Study



ASMI 10-Year Study

About 5% of youth pitchers will have a serious arm injury by age 20.

$$\text{Injuries} = 24 / 481 = 5\%$$

ASMI 10-Year Study

More than 100 innings/yr more than **triples** the risk of arm injury.

Study showed 3.5 times risk ($p = 0.05$)

USA Baseball study

- Mueller, et al. at UNC
- Funded by Yawkey Foundation
- 5-year study (2006-2010)
 - Little Leaguers (n=410) for 5 years
 - High school (n=293) for 4 years
 - NCAA pitchers (n=629) for 3 years

USA Baseball study

- High School Pitchers
 - Overlapping leagues → Elbow pain, Shoulder pain
 - Showcase → Shoulder pain, Elbow injury
 - Pitching with tiredness → Shoulder injury

Amount of Pitching

- Olsen et al, 2006
 - Adolescent pitchers (14-20 yrs)
 - 66 elbow surgery
 - 29 shoulder surgery
 - 45 healthy

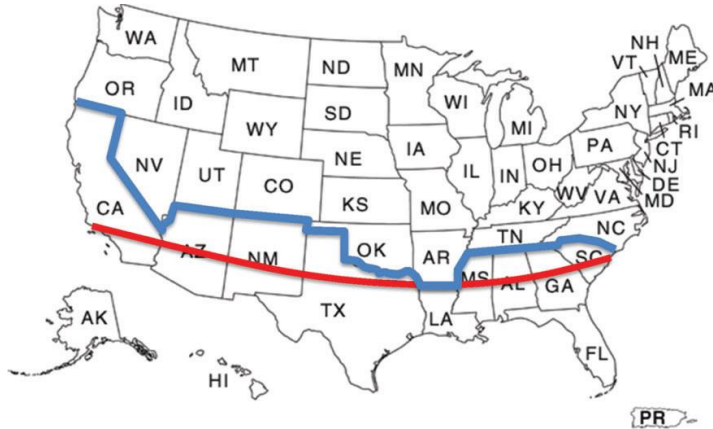


Amount of Pitching

- > 80 pitches/game **4 times**
- > 8 months/year **5 times**
- Pitched fatigued **36 times**

Warm-Weather vs. Cold-Weather

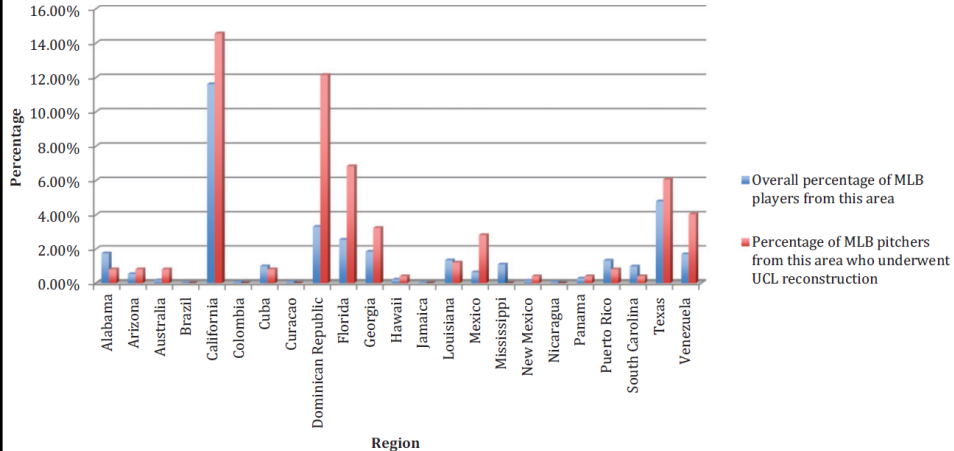
Warm-Weather → Year-Round Pitching → Injuries?



Erickson et al., 2014

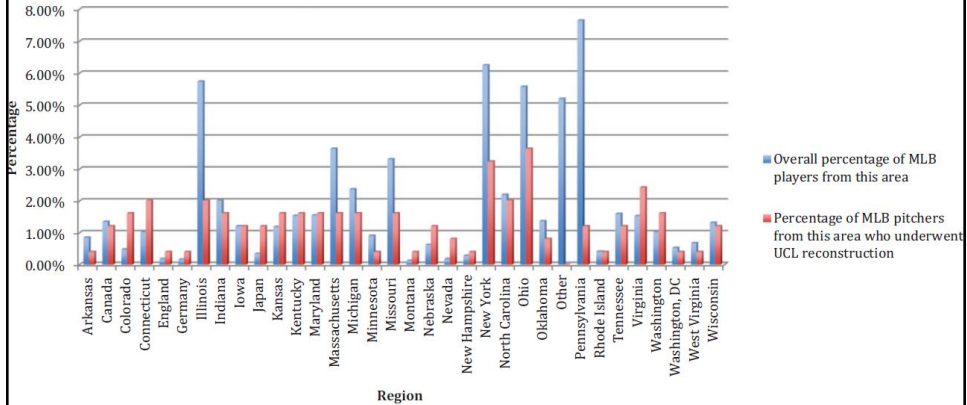
Warm-Weather vs. Cold-Weather

Warm Weather Areas



Warm-Weather vs. Cold-Weather

Cold Weather Areas



Amount of Pitching

- Too much pitching → Injury



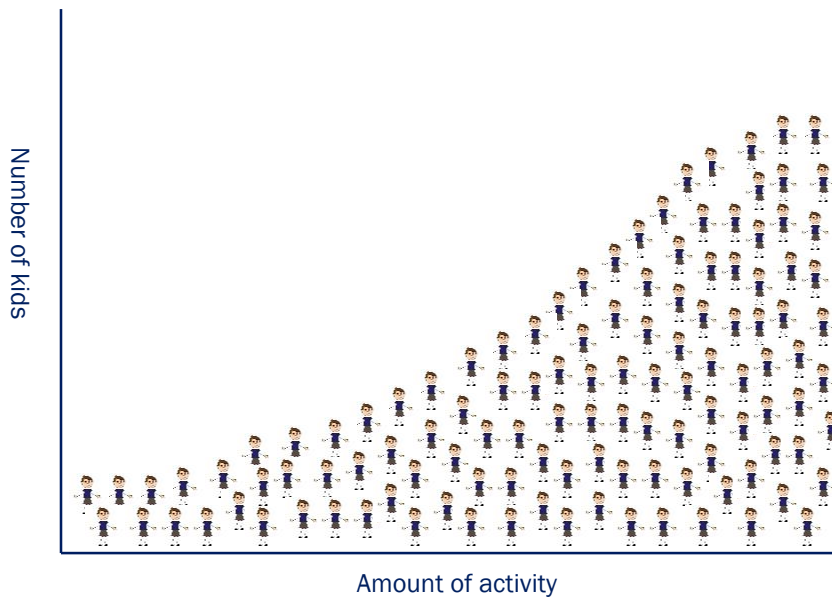
Amount of Pitching

- Excessive pitching is not natural
- Throwing is natural

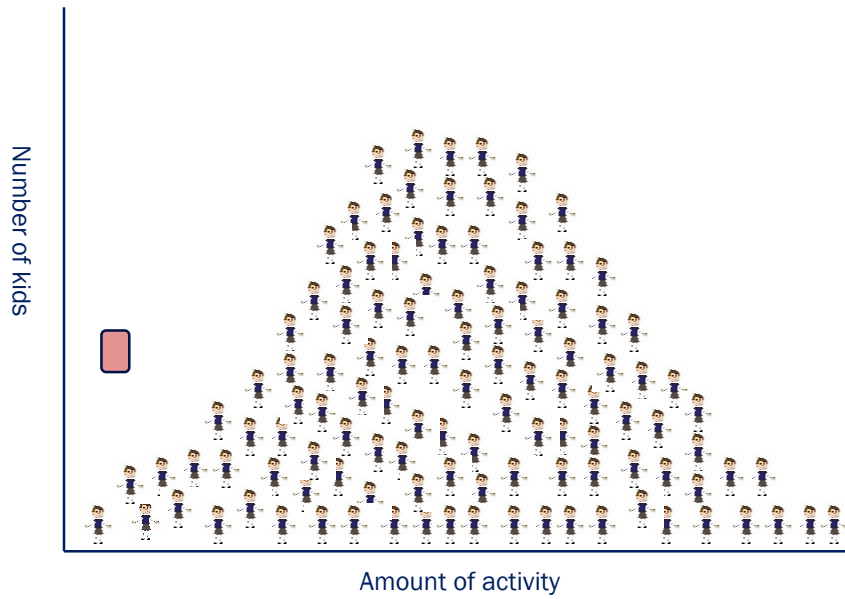


- Avoid too much competitive pitching
- Avoid too little throwing and physical activity

1900s



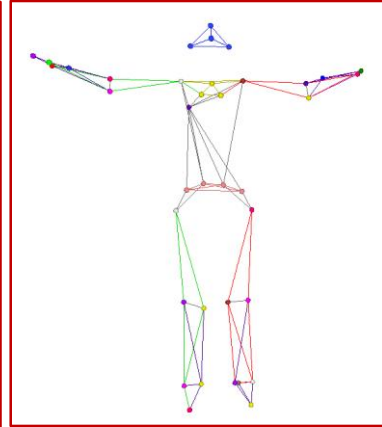
2000's



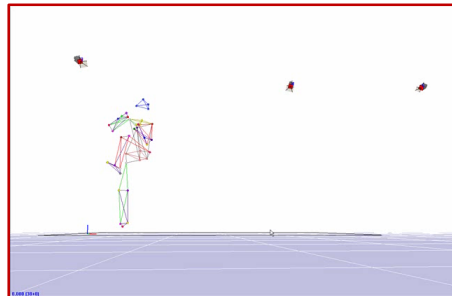
Pitching Biomechanics



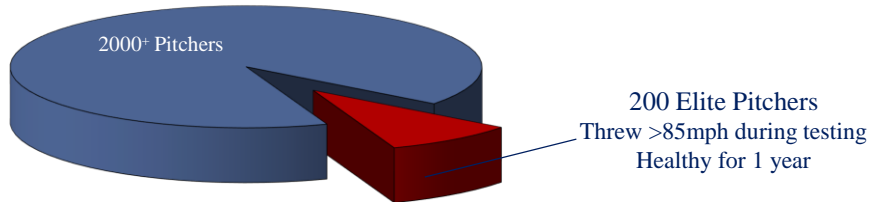
Biomechanics Data Collection



Biomechanics Data Collection



ASMI Throwing Tests: 1989-present



UCL Injury Mechanism



UCL Injury Mechanism

Varus Torque = 100 N-m

UCL provides ~ 55% of varus torque
UCL Torque = 55% of 100 Nm = 55 Nm
UCL strength = 32 Nm

Pitching Mechanics

- Fleisig GS. UAB dissertation 1994.
- Fleisig GS et al. *Am J Sports Med.* 1995.
- Fleisig GS, et al. *J Biomech.* 1999.
- Matsuo T et al. *J Appl Biomech.* 2006.
- Escamilla RF et al. *Am J Sports Med.* 2007.
- Dun S, et al. *Am J Sports Med.* 2008.
- Chu Y, et al. *J Appl Biomech.* 2009.
- Fleisig G, et al. *Sports Biomech.* 2009.
- Fortenbaugh D, et al. *Sports Health.* 2009.
- Robb AJ, et al. *Am J Sports Med.* 2010.
- Urbin MA, et al. *Am J Sports Med.* 2013.
- Fleisig GS, et al. *Sports Biomech.* 2013.

Pitching Mechanics

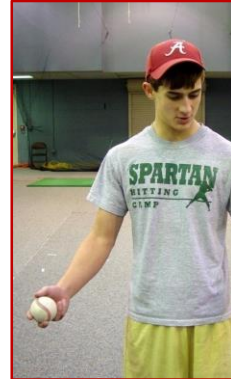
- Improper Mechanics
 - Decreased ball velocity
 - Increased Elbow & Shoulder force & torque

*Curveballs are
dangerous for kids?*

“Curveballs are Dangerous(?)”

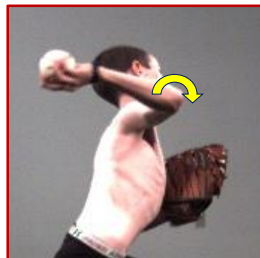


- Doctors
- Trainers
- Coaches
- ASMI



Curveball Biomechanics

- Fleisig GS, et al. Am J Sports Med (2006)
- Dun S, et al. Am J Sports Med (2008)
- Nissen CW, et al. Am J Sports Med (2009)



Elbow Varus Torque

	Age Range	Fastball	Curveball
Dun et al.	10 to 15 yrs	35 Nm*	32 Nm*
Nissen et al.	14 to 18 yrs	60 Nm*	54 Nm*
Fleisig et al.	18 to 22 yrs	82 Nm	79 Nm

* Significant difference between fastball and curveball torques



Curveballs

- Age when a pitcher started throwing curveballs **did not** affect injury risk
 - Olsen et al, 2006
 - Fleisig et al, 2011
 - Register-Mihalik, 2012



Performance after UCLr

- Cain et al, 2010
- Osbahr et al, 2014

	Major League	Minor League	Amateur
Sample size	24	88	144
Return to same level	79%	76%	89%
Time to full competition	12 months		

Return to Play – High School Pitchers

	UCL Surgery (n=218)	Shoulder "SLAP" Repair (n=69)
Returned to Play	92%	77%
Played College or Higher	38%	26%
Played Professional	10%	4%

- Axe et al, unpublished

Conclusion

- High rate of pitching injuries
- Injuries from repetition
- Fatigue → Injury
- Too many pitches → Injury

Pitch Safety Recommendations

- ASMI
- USA Baseball
- Pitch Smart

