



# **Evidence Summary: Softball**

**Peter Polyzotis, CEP, R.Kin, MSc**

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Author: Peter Polyzotis

Editors: Sarah A Richmond, Amanda Black

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For any questions regarding this report, contact:

BC Injury Research and Prevention Unit  
F508 – 4480 Oak Street  
Vancouver, BC V6H 3V4  
Email: [bcinjury1@cw.bc.ca](mailto:bcinjury1@cw.bc.ca)  
Phone: (604) 875-3776  
Fax: (604) 875-3569  
Website: [www.injuryresearch.bc.ca](http://www.injuryresearch.bc.ca)

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**Evidence Synthesis Tool**

<b>SPORT:</b>	Softball	<b>Target Group:</b>	Youth; High School; Collegiate; Adult Recreational	
<b>Injury Mechanisms:</b>	Sliding, pitching, hit by batted ball; hit by pitched ball; collision with another player; other non-contact injuries.			
<b>Incidence/Prevalence</b>	<b>Risk/Protective Factors</b>	<b>Interventions</b>	<b>Implementation/Evaluation</b>	<b>Resources</b>
<p><b>Overall</b>            0.1/1000 AE's for <u>youth</u>            5.6/1000 AE's for <u>high school</u>            4.3/1000 AE's at the <u>collegiate</u>            level (games) 2.67/1000 AE's at            the <u>collegiate</u> level (practices)            No rate for <u>adult</u> recreational            level, but it is higher than any of            the other sub-groups around            6.9/1000 AE's. 1 injury occurs in            every 13.9 games (7.2% of            games). (Hosey et al., 2000;            Marshall et al., 2007; Pollock et            al., 2005; Janda et al., 1990;            Spinks et al, 2007; Shanley et al.,            2011).</p> <p><b>Sliding Injuries</b></p> <p><b>Collegiate</b>            0.89 per 1000 AE's. Sliding            injuries account for 23% of all            game injuries. 9% of all game            injuries are due to contact with a            fixed base and 43% of these            injuries results in ankle ligament            sprains. (Marshall et al., 2007;            Hosey et al., 2000)</p>	<p>There is a lack of literature that            examines specific risk factors for            injury in softball.</p> <p><b>Alcohol Use</b>            The use of alcohol during softball            play was reported for 34% of            injured players. (Pollack et al.,            2005; Janda et al., 1993)</p>	<p><b>Breakaway Bases</b>            Breakaway bases have been            shown to reduce sliding injuries            by 95-98%. This would eliminate            about 56% of all injuries. (Pollack            et al., 2005; Janda et al., 1993;            Janda et al., 1990)</p> <p><b>Neuromuscular Training</b>            A neuromuscular training            program may reduce ACL injuries            in females if the training includes            plyometrics, balance, and            strengthening exercises            performed once per week for at            least 6 weeks. (Marshall et al.,            2007)</p>	<p><b>Cost-Effectiveness</b>            Health care spending was also            examined, and the use of            breakaway bases resulted in a            99% saving on health care.            (Pollack et al., 2005; Janda et al.,            1993; Janda et al., 1990)</p>	

**Adult Recreational**

Injuries occur in 9.5/1000 slides and 4.9/1000 AE games. 40-71% of recreational adult softball injuries are due to sliding. Nearly half (49%) of the sliding injuries occur at second base. (Pollack et al., 2005; Janda et al., 1993; Janda et al., 1990)

**Collegiate**

Shoulder strains and shoulder tendinitis were common chronic/overuse injuries that accounted for almost 10% of practice injuries. (Marshall et al., 2007) The injury rate from being struck by a batted-ball is 0.5 per 1000 game AE's. Approximately 11% of all game injuries involved being hit by a batted ball. (Marshall et al., 2007) Approximately 9% of all game injuries involved being hit by a pitch. (Marshall et al., 2007)

Approximately 18.3% of all game injuries involved contact with another player. Non-contact ACL injury often is associated with a planted foot and deceleration, resulting in a valgus knee position. Knee internal derangement accounted for 8.7% of game injuries. (Marshall et al., 2007)

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# Review of Sport Injury Burden, Risk Factors and Prevention

## Softball

### Incidence and Prevalence

The overall injury rate in softball is 0.1 injuries per 1000 athlete exposures (AE's) for youth ages 7-13 years (Spinks & McClure, 2007), 5.6 injuries per 1000 AE's for high school (Shanley, Rauh, Michener, & Ellenbecker, 2011); and 4.3 injuries per 1000 AE's at the collegiate level for games, and 2.67 injuries per 1000 for collegiate level practices (Hosey & Puffer, 2000; Marshall, Hamstra-Wright, Dick, Grove, & Agel, 2007). An overall injury rate for adult participants was not available in the literature, but this sub-group has the highest injury rate. A conservative estimate of the overall injury rate for adults is 6.9 injuries per 1000 AE's. This is based off of research demonstrating that sliding injuries occur a rate of 4.9 injuries per 1000 AE's (Pollack, Canham-Chervak, Gazal-Carvalho, Jones, & Baker, 2005) and that sliding injuries account for 40% (Pollack et al., 2005) to 71% (Janda, Wojtys, Hankin, Benedict, & Hensinger, 1990) of all recreational adult softball injuries. Therefore, 71% of all injuries could be due to sliding and 29%, from other causes. As such, proportionally 4.9 injuries per 1000 AE's are due to sliding and 6.9 injuries per 1000 AE's are due to all causes. The 71% value was chosen to reflect a conservative estimate of the overall injury rate. If the 40% value is used then the overall injury rate could be as high as 12.3 injuries per 1000 AE's. (Hosey & Puffer, 2000; Janda et al., 1990; Marshall et al., 2007; Pollack et al., 2005; Shanley et al., 2011; Spinks & McClure, 2007)

Various mechanisms of injury have been documented in the literature and these include injuries from sliding, pitching, being hit by a ball, making contact with another player, or the ground.

#### **Sliding Injuries - Collegiate**

In female collegiate athletes, the rate of sliding injuries is estimated at 0.89 injuries per 1000 AE's. Sliding injuries account for 23% of all game injuries. Nine percent of all game injuries are due to contact with a fixed base and 43% of these injuries results in ankle ligament sprains (Marshall et al., 2007).

#### **Sliding Injuries - Adults**

Forty to seventy-one percent of recreational adult softball injuries are due to sliding. Most injuries occur during rapid deceleration against stationary bases. Injuries occur at a rate of in 9.5 injuries per 1000 slides and 4.9 injuries per 1000 AE games. Nearly half (49%) of the sliding injuries occur at second base. Roughly 83% of players are injured sliding foot first; however, higher injury rates are seen with head first slides (25% of all slides) compared with foot first slides (63% of all slides); the injury rates reported for these injuries were 19.5 and 10.0 per 1000 slides respectively (Janda et al., 1993, 1990; Pollack et al., 2005).

## **Pitching Injuries – High School**

While upper extremity injuries are common in softball at 2.9 injuries per 1000 AE's (Shanley, Michener, Ellenbecker, & Rauh, 2012), there have been no studies examining pitching as a specific mechanism of injury. At this time, more research is needed to explain the causes of upper extremity injuries in softball athletes. (Marshall et al., 2007; Shanley et al., 2011; 2012)

## **Pitching Injuries – Collegiate**

Shoulder strains and shoulder tendinitis are common chronic/overuse injuries that account for almost 10% of practice injuries (Marshall et al., 2007). Furthermore, 5.5% of practice injuries that resulted in 10+ days of activity time loss were attributable to shoulder tendinitis. A common misconception is that the windmill motion of softball pitching creates less stress on the arm than the overhead motion of baseball pitching. The stress is comparable to that of professional baseball players. At this time, more research is needed to explain the causes of upper extremity injuries in softball athletes (Marshall et al., 2007).

## **Hit by a Ball – Youth / High School**

Approximately 11% of all game injuries involve being hit by a batted ball. The injury rate from being struck by a batted-ball is 0.5 injuries per 1000 game AE's (Marshall et al., 2007). Only 2.6% (7/241) of injuries to pitchers involve a batted ball to the head, compared with 8% for batters (24/303) and 9% for third basemen (10/96) (Marshall et al., 2007).

## **Hit by a Ball – Collegiate**

Approximately 9% of all game injuries involve being hit by a pitch (Marshall et al., 2007).

## **Other Injuries**

At the collegiate level, approximately 18.3% of all game injuries involve contact with another player. A total of 65% of all injuries were reported as non-contact injuries. Non-contact anterior cruciate ligament (ACL) injury often is associated with a planted foot and deceleration, resulting in a valgus knee position. Knee internal derangement accounted for 8.7% of game injuries (31% of which were ACL injuries) and 5.4% of practice injuries (38% of which were ACL injuries) (Marshall et al., 2007).

Other injuries include contact with the ground (13.6%), non-contact non-throwing injuries (13.4%), throwing non-pitching (5%), contact with a thrown ball, contact with a teammate (1.7%), contact with boundary walls (1.8%), contact with breakaway bases (1.1%) among other causes. (Marshall et al., 2007)

## **Risk and Protective Factors**

## **Sliding Injuries - Collegiate**

There is evidence to support that softball players sustain significantly more sliding injuries than baseball players due to poor sliding technique, a smaller field size that increases the risk for collisions, wearing shorts instead of pants as a uniform, and inadequate equipment (Hosey & Puffer, 2000; Marshall et al., 2007). However, no formal study has been conducted to evaluate these proposed risk factors.

## **All Injuries - Adult**

Not using breakaway bases, poor musculoskeletal conditioning, poor sliding technique, occasional alcohol consumption, and a late decision to slide are factors that have been identified as risk factors that may increase injuries among an adult population (Janda et al., 1990; Pollack et al., 2005). Use of alcohol during softball play was reported for 34% of injured players (Janda et al., 1990; Pollack et al., 2005).

## **Position – Youth / High School**

The risk of an upper extremity (shoulder or elbow) injury to a pitcher is reported as 2.6 times higher (RR = 2.6, 95% CI = 1.3, 5.3,  $P = .005$ ) compared to position players (Shanley et al., 2012).

## **Pitches Thrown – Youth/High School**

Despite the significant differences between softball and baseball with respect to ball weight, pitching surface, and field dimensions, softball and baseball players have similar injury rates and patterns. Shoulder injuries appear to be more common in softball compared to baseball and this may be due to the windmill type pitch; however, more research is needed to determine whether or not the number of pitches thrown is a risk factor (Shanley et al., 2012, 2011).

## **Opportunities for Prevention: Effective Interventions, Cost-Effectiveness, Implementation and Evaluation**

### **Breakaway Bases**

In the adult population, the use of breakaway bases has been shown to reduce sliding injuries by 95-98% (Dick et al., 2007). Conservatively, this would eliminate anywhere from 38% to 67% of all injuries within this sub-group. Adult softball players would benefit most from the use of breakaway bases, considering that adult softball sliding injuries alone greatly surpass the overall incidence of all injuries in any other group playing baseball or softball. The impact of this intervention in the adult population also exceeds the effect at any other level in baseball or softball. For example, in collegiate baseball there was an 80% reduction in sliding injuries

compared to 95-98% reduction in adults (Dick et al., 2007; Hosey & Puffer, 2000; Janda et al., 1993, 1990; Pollack et al., 2005).

In recreational softball leagues, the use of break-away bases should be mandatory. It does not significantly delay play; does not detach during normal base running; and there is no difficulty with judgment calls (Janda et al., 1993, 1990; Pollack et al., 2005).

The Centers for Disease Control and Prevention (CDC) estimated that by changing from stationary to breakaway bases across the United States, approximately 1.7 million injuries per year are prevented and over \$2.0 billion in medical care costs per year is saved. The average costs for a set of three breakaway bases is US\$290/set compared to US\$180/set for standard bases (Janda et al., 1993; Janda, Bir, & Kedroske, 2001).

### **Pitch Limits**

At this time, more research is needed to explain the causes of upper extremity injuries in softball athletes. There is limited information for pitch counts in this population sub-group. No guidelines or recommendations have been made for pitching in softball for youth or high school athletes. In 2007, Little League Baseball published regulations for game pitch counts and pitching rest days by age group. While these regulations became mandatory for baseball in 2010, no guidelines have been established for softball (Shanley et al., 2012).

### **Training Programs (Knee Injuries)**

A neuromuscular training program has been shown to significantly reduce ACL injuries in females if the training includes plyometrics, balance, and strengthening exercises performed once per week for at least 6 weeks (OR=0.40, 95% CI: 0.26, 0.61). (Hewett, Ford, & Myer, 2006; Marshall et al., 2007)

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