Shoulder and Elbow Injuries in High School Softball and Baseball Players

Letter to the Editor / Response

Dear Editor:

It was with great interest that we read the recent article by Shanley et al titled "Shoulder Range of Motion Measures as Risk Factors for Shoulder and Elbow Injuries in High School Softball and Baseball Players."[1] We were somewhat confused by some of the results and feel that additional clarification might help with comparison to the current literature and for planning future studies.

The overall upper extremity injury rate is reported as 2.5 injuries per 1000 athlete-exposures (AEs). It is further reported that the upper extremity injury rate for pitchers was 1.1 per 1000 AEs and 1.4 per 1000 AEs for nonpitchers. This is confusing. How can the overall injury rate be substantially higher than the injury rate for either pitchers or nonpitchers? The overall injury rate should approximate the average of the injury rate between pitchers and nonpitchers, likely lying closer to that of nonpitchers given that there were substantially more nonpitchers in the study (195 nonpitchers vs 51 pitchers).

An additional and related concern is the reported lack of difference in the injury rate between pitchers and nonpitchers ($P = .57$). It is reported that 12 of 51 pitchers sustained injuries (24%), while only 15 of 195 nonpitchers sustained injuries (8%). This is a marked and statistically significant difference in injury prevalence between groups ($P < .01$). The lack of difference in the injury rate between pitchers and nonpitchers implies that exposures must have been markedly greater in pitchers. Twelve injuries in 51 pitchers for an injury rate of 1.1 per 1000 AEs equates to 10,909 AEs ((12/1.1)*1000) and 214 AEs per pitcher (10,909/51). By contrast, 15 injuries in 195 nonpitchers for an injury rate of 1.4 per 1000 AEs equates to 10,714 AEs ((15/1.4)*1000) and 55 AEs per nonpitcher (10,714/195). Why would pitchers have almost 4 times more AEs than nonpitchers? They would be expected to have fewer AEs given the rest requirements between starts for baseball pitchers.

With respect to injury risk, it is reported that a loss of internal rotation (IR) range of motion (ROM) $\geq 25°$ was associated with increased injury risk for the entire cohort (relative risk [RR], 3.7) and for baseball players alone (RR, 4.8). It is further reported that pitchers with a loss of IR ROM $\geq 25°$ were at greatest risk (RR, 9.7). Because only 3 of 103 softball players had a loss of IR ROM $\geq 25°$ and none of these 3 were injured, it would appear that it was baseball pitchers with a loss of IR ROM $\geq 25°$ who were at highest risk. However, it is not clear if baseball pitchers with a loss of IR ROM $\geq 25°$ were at greater risk than baseball pitchers without a loss of IR ROM $\geq 25°$. Presumably, there was an inadequate sample size to answer that question. The lingering question is whether loss of IR ROM is an independent risk factor or whether baseball pitchers are simply at increased risk of injury versus other players.

We would like to commend the authors for providing valuable prospective data on injury risk in throwing athletes in which much of our current knowledge and clinical practice is based on retrospective and anecdotal observations. Hopefully, further clarification of the data will add to our knowledge base.

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1. Shanley E, Rauh MJ, Michener LA, Ellenbecker TS, Garrison JC, Thigpen CA. Shoulder range of motion measures as risk factors for shoulder and elbow injuries in high school softball and baseball players. *Am J Sports Med*. 2011;39(9):1997-2006.

Authors' Response:

Thank you for the opportunity to respond to the letter by Dr McHugh and Mr Tyler that references our article "Shoulder Range of Motion Measures as Risk Factors for Shoulder and Elbow Injuries in High School Softball and Baseball Players."[2] This study was designed to prospectively identify shoulder ROM factors that placed high school softball and baseball players at increased risk of upper extremity injury. The authors of the letter questioned the relationship of the reported upper extremity injury rates for the overall cohort (2.5 injuries per 1000 AEs), pitchers (1.1 per 1000 AEs), and nonpitchers (1.4 per 1000 AEs). In our study, injury occurrence was documented per player and exposures prospectively from the

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beginning to the end of the season for both games and practices. These injury rates were calculated as post hoc analyses as requested. We were only able to calculate crude injury rates for both position groups, as high school athletes often play multiple positions daily. Thus, a limitation of the injury rates is that the denominator used for pitchers and position players is not as sensitive as noted by the letter. We agree the injury rates reported for pitchers and position plays may be underestimated or overestimated, respectively, but they provide the most accurate data reported available. The frequency of injury per position was also reported to provide the most complete picture of injury occurrence.

The second concern raised by the letter was the following: "An additional and related concern is the reported lack of difference in the injury rate between pitchers and nonpitchers ($P = .57$). It is reported that 12 of 51 pitchers sustained injuries (24%), while only 15 of 195 nonpitchers sustained injuries (8%)." The reported P value was based on the injury incidence rate per AE, not proportions. The P value stated by McHugh and Tyler in their letter may be significant but is a basic estimate and does not account for the more accurate denominator of exposure for risk of injury. They state that the prevalence of injury between groups was significant; however, the focus of this prospective cohort was the incidence of injury in these athletes, and prevalence was not calculated exclusively for each player position studied, nor was it reported in our article. The additional comment regarding the number of exposures is difficult to address, as the authors appear to have calculated these exposures using a different methodology than that used in our original study. In this study, each school's athletic trainer documented the exposures for each athlete during each practice and during each game. As noted before, many of the players in this study played multiple positions throughout the season and during individual competitions. Position injury rates were difficult to assess, as most pitchers also played a field position even on days they pitched. Thus, for these players, some nonacute injuries were classified by the position on the day the injury was reported and not by the position at which it might have initially developed or incurred.[1] Specific and actual exposure information is published in a prior article, "Incidence of Injuries in High School Softball and Baseball Players."[1] This article provides a full description of the methodology and reported both initial and subsequent/recurrent injuries.[1]

Finally, the letter to the editor states, "Because only 3 of 103 softball players had a loss of IR ROM $\geq 25^\circ$ and none of these 3 were injured, it would appear that it was baseball pitchers with a loss of IR ROM $\geq 25^\circ$ who were at highest risk." Injury risk was determined by the RR, which allowed us to compare the likelihood of a player who is exposed to a risk factor (side-to-side IR deficit $\geq 25^\circ$) and incurs an injury as compared with a player who has not been exposed (side-to-side deficit $< 25^\circ$) and incurs an injury. The RR for the overall cohort was affected by the lack of softball injuries in the exposed softball players included in the cohort. The higher RR reported in the baseball athletes when compared with the overall cohort is reflective of the increased risk in baseball that is associated with IR loss. The pitchers with a side-to-side IR deficit $\geq 25^\circ$ were accurately reported at 9.7 times greater risk as compared with pitchers with side-to-side deficits $< 25^\circ$. Overall, our conservative approach to calculating injury incidence and RR was based on the desire to identify a sensitive screening tool in preventing arm injuries in high school baseball and softball players. The results of this study strongly suggest that high school baseball and softball players who have a side-to-side IR deficit $\geq 25^\circ$ are at greater risk for injury. In fact, if they are pitchers and display this preseason ROM deficit, their injury risk doubles compared with other players. Therefore, we feel this provides evidence to guide preseason ROM screening as part of an injury prevention program.

We welcome the thorough review provided by Dr McHugh and Mr Tyler and appreciate their interest in our work to decrease arm injury in throwing athletes. We hope the information presented clarifies the methodology and results of this prospective study.

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