



**UNIVERSITY OF WEST ATTICA  
SCHOOL OF HEALTH AND CARE SCIENCES  
DEPARTMENT OF PHYSIOTHERAPY**

**DESCRIPTION OF POST-DOCTORAL RESEARCH PROTOCOL**

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**TITLE: Prevention of shoulder girdle injuries in overhead athletes: Diagnostic value of the Arm Care Screen Test (ACS) field test.**

Overhead sports describe sports that require the use of the upper extremity, from the shoulder girdle to the fingers of the hand, above shoulder height for the purpose of throwing the ball in circular/linear movement trajectory in the direction of the opposing team (Burn, McCulloch, Lintner, Liberman, & Harris, 2016; Paraskevopoulos, Simeonidis, Tsolakis, Koulouvaris, & Papandreou, 2021a). The sports that are classified as overhead are mainly throwing sports such as baseball, volleyball, tennis, softball, water polo, handball, badminton, basketball, squash, swimming, track and field (including javelin) even in football in the goalkeeper position (Burn et al., 2016).

Shoulder injuries are common in athletes and particularly in overhead athletes (Lin, Wong, & Kazam, 2018). In baseball for example, 12% to 19% of injuries are to the shoulder (Shanley et al., 2015), while in swimming, shoulder injuries are estimated to be between 23% and 38% within a single year (Walker, Gabbe, Wajswelner, Blanch, & Bennell, 2012). Also, 20% of injuries in volleyball occur in the shoulder area (Briner & Kacmar, 1997), while in tennis, respectively, the occurrence of shoulder injuries reaches 17% (Lin et al., 2018). The most common mechanism for injury is overuse leading to rotator cuff or biceps tendinopathy (Wilk et al., 2009).

Overhead athletes often perform upper extremity movements at high velocity and extreme range of motion leading to adaptive changes corresponding to the demands of their sport, such as altered scapular position, pectoralis major collapse, and loss of medial rotation of the glenohumeral joint (Glenohumeral Internal Rotation Deficit-GIRD) (Kugler et al., 1996). These changes are characteristic of all overhead athletes, increasing the risk of developing pathology in the shoulder area (Burn et al., 2016). The high demands of the sport combined with the high loads placed on the shoulder girdle and the repetitive use of the upper extremity at

extreme angles of the motion trajectory lead to an increased risk of injury in this population (Cools, Johansson, Borms, & Maenhout, 2015; Paraskevopoulos, Simeonidis, Tsolakis, Koulouvaris, & Papandreou, 2021b; Tooth et al., 2020).

To limit injuries, as part of prevention, coaches try to implement exercise programs to improve muscle strength, dynamic stability and range of motion (ROM) of the muscles of the shoulder girdle and scapula (McElheny, Sgroi, & Carr, 2021). When implementing exercise programs due to their lack of individualization in overhead athletes, their effectiveness has been shown to be partially limited (Pamias-Velázquez, Figueroa-Negrón, Tirado-Crespo, & Mulero-Portela, 2016). Assessment of risk factors for injury occurrence is recommended to include population-specific parameters such as assessment of range of motion, strength and balance (Cools et al., 2015; Paraskevopoulos et al., 2021b). However, time-consuming and high-cost assessment procedures (e.g. isokinetic assessment) are not the first choice of coaches or physiotherapists, in the teams they supervise, and are of course not available at all competitive levels or in clubs with a large number of athletes (Moesch et al., 2022). Therefore, it is considered appropriate to propose simpler ways of assessment with the aim of reducing the risk of injury in overhead athletes so that it can be an important tool in the prevention of shoulder girdle injury in athletes of all competitive levels. One of these ways could be the easy-to-use and short-to-administer Arm Care Screen (ACS) Test as a field-based test.

The ACS has been evaluated for its reliability (inter and intra-rater) and has shown excellent results ( $K: >0.76-0.89$ ) (Matsel et al., 2021). Currently, the effectiveness of the ACS has only been examined in baseball athletes with positive results in terms of its sensitivity (0.89-0.85) and overall predictive value in identifying injury predisposition (Matsel et al., 2022).

An important limitation of the above study was that the prevalence of musculoskeletal risk factors was high in this sample limiting confidence in its interpretation in terms of its Positive Predictive Value (0.77-0.94) and Accuracy (specificity) (0.57-0.73) due to oversaturation of risk factors (Matsel et al., 2022). According to the review of the literature, the effectiveness of the ACS test in identifying athletes with increased risk of injury of other sports activities, different competitive categories, ages and in a sample of athletes that will show to the greatest extent equal percentages of risk factors for injury (balanced ratio of injury risk), has not been sufficiently investigated.

Globally, physical therapists play a key role in the delivery of injury prevention and assessment programs to athletes and therefore the aim of this research will be to assess the effectiveness of the ACS in identifying overhead athletes with an increased risk of injury in the shoulder region by category, age group and sport played.

The aim of the present research will be to evaluate the diagnostic value of the ACS by calculating the likelihood ratios (Likelihood ratios), the predictive value (Predictive Value), the sensitivity and the specificity of the ACS in asymptomatic overhead athletes. The present post-doctoral study appears particularly important in order to be able to safely recommend the ACS to coaches and physical therapists who supervise teams with overhead athletes, in order to use it in their athletes, for immediate identification of those at increased risk of injury.