

## THE INCIDENCE AND NATURE OF NON-CONTACT INJURIES IN U.S. WOMEN'S RUGBY-7S

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The aim of this study was to prospectively determine non-contact injury incidence and mechanisms among U.S. amateur women's Rugby-7s. Non-contact injuries occurred frequently among the U.S. women population (26.5/1000ph; 29% of all injuries; n=167). The incidence of non-contact injuries occurred at similar rates among backs (58%, 23.9/1000ph, CI:19.1-29.6) and forwards (42%, 19.3/1000ph, CI:14.4-25.3; RR:1.04, p=0.816). Non-contact injuries resulted in 58.4 mean days absence from play. This study demonstrates a greater proportion of match injuries among U.S. amateur women Rugby-7 participants were related to non-contact mechanism when compared to International women participants. Therefore, U.S. women Rugby-7 players would benefit from prevention programs to minimize non-contact injury risks.

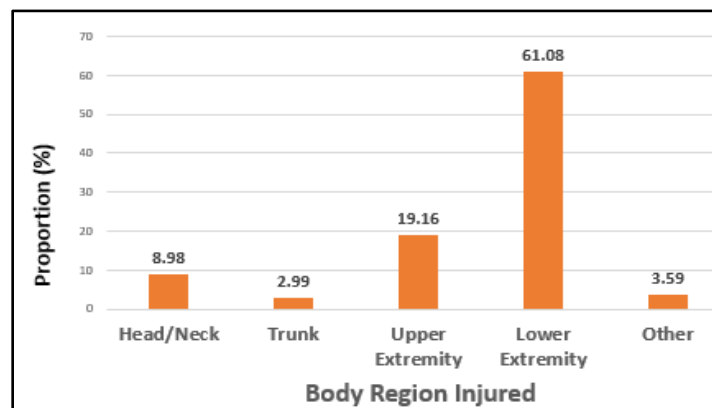
**KEYWORDS:** Rugby-7s, rugby sevens, non-contact, females, sports injuries.

**INTRODUCTION:** Rugby-7s has seen a recent surge in popularity in the U.S and world-wide. The U.S. has grown from an estimated 80,000 members (2010) to greater than 1.5 million participants (2016). Female participation have been integral to this growth with a total world-wide participation estimated to be approximately 1.7 million. Despite this tremendous growth, there is limited data on Rugby-7s particularly on the injury epidemiology of women's Rugby-7s (Lopez et al., AJSM 2012; OJSM 2014; Ma, et al, MSSE 2016). A previous study on U.S. women rugby players identified non-contact injuries as the most severe injuries within its population and particularly among backs (Ma, et al., MSSE 2016). Identifying factors that result in non-contact injuries may guide injury prevention efforts to minimize future risk. These data will be beneficial in this fast-paced format, especially with the high injury rates found among international women competitions (95.4-188 injuries/1000 player hours (ph) (Fuller CW, Taylor A, & Raftery M, 2017; Gabb N, Trewartha G, Kemp S, & Stokes KA, 2014). The aim of this study was to report injury incidence and nature of non-contact injuries in women's U.S. Rugby-7s.

**METHODS:** A prospective epidemiological study on U.S. women's Rugby-7s players match injury incidence and non-contact mechanisms as risk factors were determined using the Rugby Injury Survey & Evaluation (RISE) report methodology. The study and injury definitions were compliant with the statement for epidemiological studies in rugby union (Lopez et al., 2012, 2014; Fuller et al., 2007). The injury data were collected from 10,328 U19 to elite U.S. women players (age: 18-

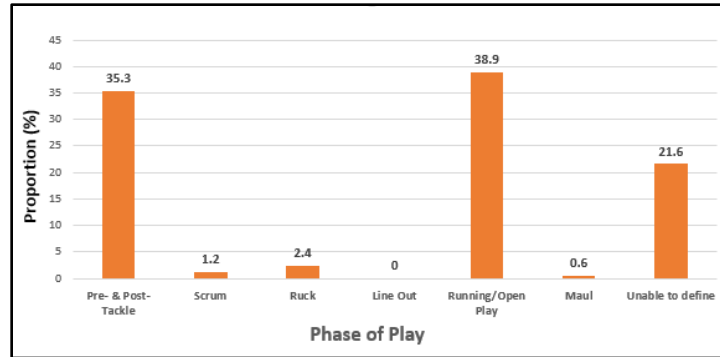
50 years) on 852 teams involving 1,895 matches in 80 USA Rugby sanctioned tournaments (98 days of tournament play) (2010-2015). Exposures were calculated based on 14-minute matches (7 minutes per half) for regular pool play and 20-minute matches (10 minutes per half) for tournament fixture matches. Injuries were defined as medical attention (no absence from play), time-loss (not able to return to play the same day), and overall (combining medical attention and time-loss) (Fuller et al., 2007). Follow-ups were conducted at 1, 3, and 6-months to obtain severity (days absent before return to full-contact training and/or competition). Non-contact injuries were defined as no contact with an opposing player or collision-type mechanism, and further subdivided into classic-non-contact (CNC) while in play, i.e.: accidents, with no foreseeable way to prevent injury (i.e. cutting, changing direction, sprinting); or other non-contact (ONC), influenced by another factor not related to match play (excessive celebration, slips or trips off or around the pitch) (Marshall, 2010). Observations with missing data were excluded. Statistical analysis was performed with Stata v15.1. Results are presented as means, percentage frequencies, and incidence per 1000 player-match hours (ph). T-tests compared means, z-tests compared proportions, and rates were calculated using the Mantel-Haenszel method. Exact confidence intervals were used to evaluate and compare rate-ratios. Significance was set at  $p < 0.05$ .

**RESULTS:** A total exposure of 6285.1 ph were seen from 2010-2015. Non-contact causes of injury occurred frequently (Overall,  $n=167$ , 26.5/1000ph, CI 22.7-30.9; Medical Attention,  $n=123$ , 19.6/1000ph, CI 16.3-23.3; Time-loss,  $n=44$ , 7.0/1000ph, 5.1-9.4). Non-contact injuries accounted for 29% of the total injuries over the study period. Most non-contact injuries were classic-non-contact (CNC) (92%,  $n=153$ ) versus other non-contact (ONC) (8%,  $n=14$ ;  $p < 0.001$ ). Overall non-contact injuries (time-loss and medical attention) were found at similar rates among backs (58%, 23.9/1000ph, CI:19.1-29.6) versus forwards (42%, 19.3/1000ph, CI:14.4-25.3; RR:1.04,  $p=0.816$ ). CNC time-loss injuries were observed at similar rates among positions (backs 6.1/1000ph; forwards 5.9/1000ph, RR:1.03,  $p=0.933$ ). Non-contact time-loss injuries resulted in 58.4 mean days absent from sport (CNC 58d; ONC 60d).

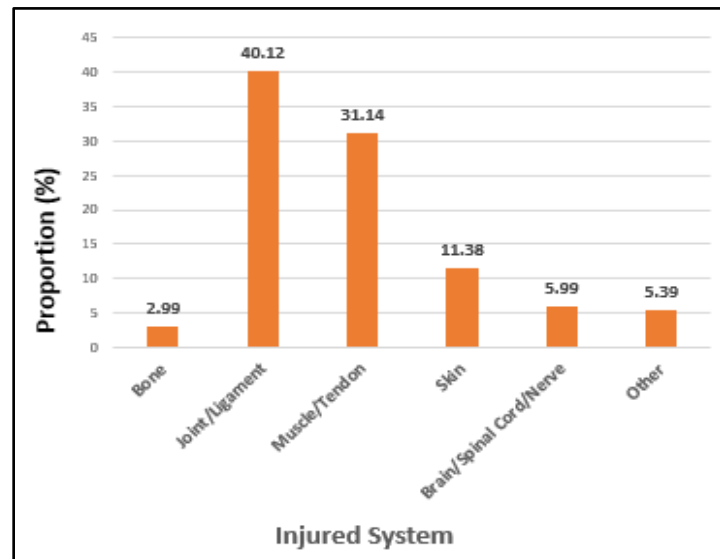


**Figure 1. Non-Contact Injuries and Body Region among U.S. Women's Rugby-7s.**

Injuries overall were mostly acute (90%) and occurred during attempted tackling (pre- and post-tackle involvement) (35%) and running/open play (39% overall; from 50% in 2010, 36% in 2011, 48% in 2012, 28% in 2013, 37% in 2014, 58% in 2015). Most injuries (70%) occurred during the first two matches of the tournaments. Recurrent injuries were observed at 40% of all injuries (10.0/1000ph, CI:7.7-12.8). The five most commonly injured body parts overall were the knee (23%), ankles (17%), shoulder (9%), anterior thigh/quads (8%), and hand/fingers (8%). Of the top two injuries, knees were more commonly injured (23%, 5.9/1000ph, CI:4.1-8.1) than ankles (17%, 4.3/1000ph, CI:2.8-6.3).



**Figure 2. Proportion of Non-Contact Injuries and Phase of Play among U.S. Women's Rugby-7s.**



**Figure 3: Proportion of Non-Contact Injuries and Body System among U.S Women's Rugby-7s.**

The most common time-loss injuries were ankle sprains (18%). A larger proportion of non-contact injuries occurred on artificial playing surfaces (21.6%; 36.6/1000ph) as compared to grass (14.6%; 24.7/1000ph, RR:1.48,  $p=0.044$ ).

**DISCUSSION:** The current study's severity (58.4 mean days absent) re-emphasized the concern with severity among non-contact injuries among the U.S. women's playing population, and highlights the need to evaluate these mechanisms for injury prevention (Ma et al., 2016). The higher proportion of non-contact injury among U.S. female Rugby-7s players (29%) versus elite international women Rugby-7s data (3.8-16.7%; Fuller et al., 2016) suggests the need for prevention protocols among U.S. female athletes to meet Rugby-7s demands (Suarez-Arrones et al., 2014). The movements involved in the open format of Rugby-7s that may result in non-contact injury (i.e. cutting, changing direction, sprinting speeds) need further analysis to evaluate their risk in joint/ligament (40%) and muscle/tendon (31%) injuries. Both the proportion of joint/ligament and muscle/tendon injuries among the U.S. amateur population are similar to those reported among elite women Rugby-7s (joint/ligament: 41.1-62.5%; muscle/tendon: 12.5-28.6%; Fuller et al., 2016). Increasing muscular load tolerance and proprioception during training and including open-field maneuvers may help reduce the risk of lower-extremity soft tissue and ligamentous injuries associated with non-contact mechanisms (Hrysomallis, 2007). These training programs could help with the sudden stops and abrupt changes in direction encountered in Rugby-7s.

The U.S. Rugby-7s multi-game tournament fixture and format is another area for further investigation. Rugby-7s has the potential to reduce neuromuscular function and inhibit a player's full recovery by the start of the next competition, which is relevant given the multiple games played per tournament day. This emphasizes that pre-season and in-season conditioning, and tournament demands must be balanced to avoid overtraining and appropriate in-season conditioning (West et al., 2014). Therefore, with the running demands of Rugby-7s, work:rest ratios should be fine-tuned to compensate for the high-intensity running (Portillo et al., 2014). Due to the current study's finding of 70% of injuries occurring within the first two matches of the tournaments, strength and conditioning teams need to take into consideration the longer breaks between play with the short periods of high running demands in Rugby-7s tournaments. Employing a between match warm-up and proper cool-down may also reduce injuries.

**CONCLUSION:** U.S. Women Rugby-7s players sustained a greater proportion of noncontact injuries than elite international women players. This could be reduced with targeted preseason and in-season training and conditioning to help U.S. women amateur players meet the in-game demands and open field maneuvers involved in the open format of Rugby-7s. Once an injury occurs, the proportion of recurrent injuries (40%) among the U.S. women amateur population highlights the need for proper team and player education on importance of appropriate post-tournament medical care and return to play programs in this population. A review of interventions is needed to help reduce women's U.S. non-contact injury rates.

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