THE PREVALENCE AND CAUSE OF NON-CONTACT INJURY MECHANISMS IN U.S. MEN'S RUGBY-7S

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The aim of this study was to prospectively report non-contact injury incidence and causes in U.S. men's Rugby-7s players (n=446) over 2010-2015, using the Rugby Injury Survey & Evaluation (RISE) methodology. Non-contact injuries (time-loss 25%; medical attention 75%) had higher rates among backs (62%; 28.4/1000ph) than forwards (38%; 23.2/1000ph; RR:1.22; p=0.05). Non-contact injuries resulted in an average of 48.7days (d) absence from sport (classic non-contact 48.1d; other non-contact 77.0d). Acute injuries (85%) were most common during attempts to elude a tackle (31%) and in running/open play (48% overall; from 35% in 2010, 41% in 2011, 52% in 2012, 43% in 2013, 46% in 2014, 70% in 2015). Most non-contact injuries (44%) occurred during the first two tournament matches. These results provide much needed data on Rugby-7s, impacting emerging countries. **KEYWORDS**: rugby-7s, risk factors, males, sports injuries.

INTRODUCTION: Rugby-7s is a faster paced format compared to Rugby-15s, and an Olympic sport, that is found to have high international injury rates in both genders (107-188 injuries/1000 player hours (ph) (Cruz-Ferreira A, Cruz-Ferreira E, Santiago L & Taborda-Barata L, 2016; Fuller CW, Taylor A, & Molloy MG, 2010; Gabb N, Trewartha G, Kemp S, & Stokes KA, 2014). There is limited epidemiological data on Rugby-7s. There is also a lack of knowledge on the biomechanics involved in match injury in the expanding U.S. rugby-playing population (Lopez et al., 2012, 2014, 2016). Given the open format of Rugby-7s there may be an increased risk of non-contact injury to players during open and running play, which includes the need for quick changes in direction and speeds in order to evade attempts by players around the tackle (pre and post) (Cruz-Ferreira et al., 2016, Fuller et al., 2010, Lopez et al., 2012). The aim of this study was to report men's injury incidence and nature of non-contact risk factors in U.S. Rugby-7s.

METHODS: A prospective epidemiological study was conducted on match injuries and causes in U.S. men's Rugby-7s players, using the Rugby Injury Survey & Evaluation (RISE) report methodology, compliant with the best practices in research (Lopez et al., 2012, 2014, 2016; Fuller et al., 2007). Injury data were collected from 6,768 U19 to elite U.S. male players (age: 13-49 years) on 564 teams involving 1,261 matches (Men=3,238) in 57 USA Rugby sanctioned tournaments (72 days) (2010-2015). 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 injury severity (days absent before return to full-contact training and/or competition). Non-

contact injuries were defined as resulting from no contact with an opposing player or collision-type mechanism, and further subdivided into: (1) classic-non-contact (CNC) that occurs while in play, (i.e. cutting, changing direction, sprinting); or (2) other non-contact (ONC) that occurs out of play influenced by another factor (excessive celebration, slips or trips off or around the pitch) (Marshall, 2010). Observations with missing data were excluded from the sample. Total exposure was calculated, minutes per player for tournaments from exact match and final schedules. Injury data are presented as proportions and incidence per 1000 player-match hours (ph). Injury rate ratios (RRs) were used to compare incidence of injury between non-contact subclassifications (CNC vs ONC), playing position (backs vs forwards), and surface type (grass vs artificial turf). Severity is presented as mean days absent and compared using Mann-Whitney U-test. Significance was set at <0.05. Statistical analysis was performed with Stata v15.1.

RESULTS: Non-contact injuries occurred frequently (31%; n=446) over the study period (classic-non-contact 98%, n=403; other non-contact 2%, n=8). Non-contact injuries (time-loss 25%; medical attention 75%) were at higher rates among backs (62%; 28.4/1000ph, CI:24.9-32.1) than forwards (38%; 23.2/1000ph, CI:19.7-27.2; RR:1.22, p=0.051). Non-contact injuries resulted in 48.7 mean days absence (CNC 48.1 days; ONC 77.0 days; p=0.374). Most non-contact injuries were acute injuries (overall=85%) as compared to overuse. Meanwhile, recurrent injuries were reported at 33% (9.5/1000ph, CI:8.0-11.2). Figure 1 shows among body regions, non-contact lower extremity injuries (63%) comprised of the greatest proportion of non-contact injuries in U.S. amateur Rugby-7s followed by upper extremity injuries (25%). Trunk non-contact injuries were the least common compared to other boy region injuries.

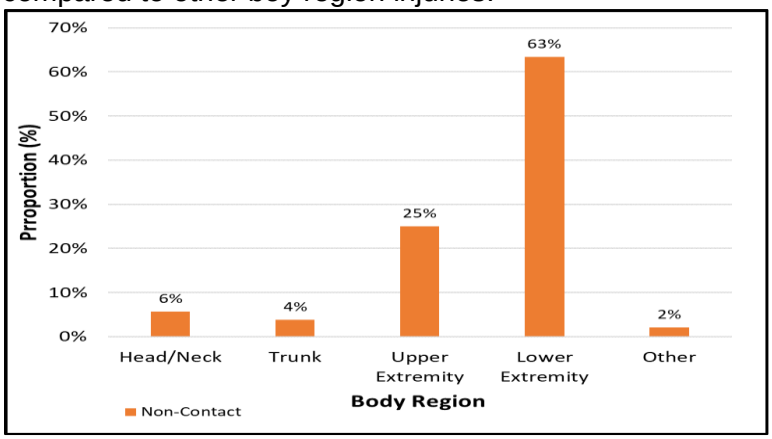

Figure 1. Non-Contact Injuries Among U.S. Men's Rugby-7s Players by Body Region.

Figure 2 shows joint/ligament (39%) injuries as the most common type of match non-contact injury followed by muscle/tendon injuries (38%). Non-contact skin abrasions and lacerations comprised 14% of injuries. Injuries overall were mostly defined as acute (85%). Most non-contact injuries occurred while avoiding/attempting tackles (31%) and running/open play (48%). A gradual increase was noted open/play injuries over the five-year study time-frame (35% in 2010, 41% in 2011, 52% in 2012, 43% in 2013, 46% in 2014, and 70% in 2015). Most non-contact injuries (44%) occurred during the first two matches of the tournaments. Ankles were most commonly injured (17%, 4.9/1000ph), followed by knees (14%, 4.0/1000ph). The most common time-loss injuries were ankle sprains and posterior thigh muscular injuries at 15% each (1.0/1000ph). Non-contact injury incidence among U.S. men Rugby-7 population were not impacted by playing surfaces (grass 28.9/1000 ph; artificial 28.7/1000 ph; RR:1.00, p=0.973).

DISCUSSION: This study prospectively reported non-contact injury incidence in U.S. men's Rugby-7s players over 2010-2015, which found the proportion of non-contact injuries in U.S.

men's Rugby-7s (31%) were higher than elite international Rugby-7s (21.3-27.2%) and a prior study on amateur U.S. Rugby-7s (27.1%) (Cruz-Ferreira et al., 2016, Lopez et al., 2012). This found among the current study all-injuries, backs were injured at higher rates than forwards. Rugby-7s is played at greater speeds, with a higher number of sprints (Cruz-Ferreira et al., 2016; Ross A, Gill N & Cronin J, 2015; Suarez-Arrones LJ et al., 2012). Elite Rugby-7s players may cover a total of 1,400–2,000 m at a mean intensity of 96–120 m·min–1 (Higham et al., 2012). Rugby-7s play has been noted to be comprised of 34.8% standing and walking, 51.5% jogging to cruising and 13.7% involving high-intensity running/sprinting (Portillo et al., 2014). These match activity estimates, emphasize the need for superior aerobic endurance for sprinting match performance.

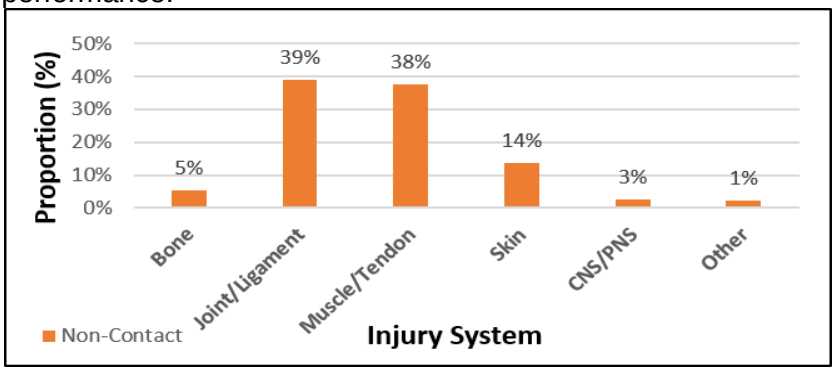

Figure 2: Non-Contact Injuries Among U.S Men Rugby-7s Players by Injured System.

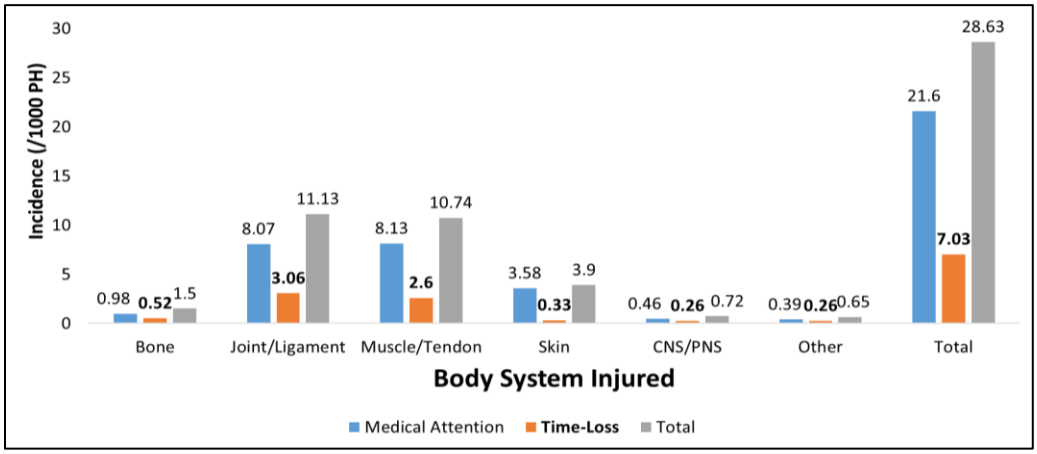

Figure 3. Non-Contact Injuries in U.S Men Rugby-7s Players by Injured System

The current study showed annual incremental increases of open play/running injuries (35% to 70%) over the study period, which were significantly higher than international elite at 19.3% (CI:16.3–22.2) (Cruz-Ferreira et al., 2016). The annual increase in non-contact running injuries, acutely found (85%) lower extremity injuries (63%), especially, among the backs who were significantly injured more often than forwards (p=0.050), emphasizes the noted running demands this sport exposes all levels of play to the increased risk with non-contact injuries. Furthermore, the high rate of non-contact injuries, among ankle/knee (combined 31%) occurring in the first two matches of the day (44%), may reflect the emerging population attempting to approximate international elite playing style and speeds and possibly the lack of or variability of training regimens among U.S. programs. Plyometric interventions may aid in reducing the knee and ankle joint injuries. Players injured attempting to avoid being involved in a tackle or evading a tackle may not be conditioned which may explain the higher muscle/tendon injury rates (38%) in the

current study, as compared to international elite (24.6-33%) studies, but similarly found in amateur U.S. populations (37.5%) (Cruz-Ferreira et al., 2016, Lopez et al., 2012). Institutional support, as provided for other U.S. sanctioned sports, and the biomechanical insights proposed, would help guide strengthening and conditioning programs for U.S. Rugby-7s to decrease the rising non-contact injury rates. Furthermore, understanding injury mechanisms and association with competitive Rugby-7s events, may benefit the rapid growing sport globally. Providing a profile of the injury rates found with non-contact biomechanics among rugby-7s would allow the area to be evaluated for injury prevention.

CONCLUSION: Nearly one half of the non-contact injuries in our series occurred during open running. Injury preventive measures among the U.S. for lower extremity injury rates (63%) occurring early in the tournament, must include conditioning for the intense running demands of Rugby-7s. Training teams must be fluent in maximizing joint forces for impulse direction, with the needed deceleration and acceleration cycles in the quick formatted Rugby-7s play. Biomechanists should focus on sprinting skills with immediate direction changes, avoiding pivoting injuries. To decrease muscle/tendon injury rates (38%), physical conditioning should include repeated bouts of high-intensity running with appropriate work:rest ratios (Portillo et al., 2014) and between match warm-up and proper cool-down. Biomechanists should refine work:rest ratios to allow adaptions to occur to reduce overuse injuries (15%). Strategies to minimize the match thigh, knee, and ankle non-contact injuries in U.S. men Rugby-7s are needed.

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