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Stress urinary incontinence prevalence and risk factors in female rugby players: a common health problem across four nations

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ABSTRACT

Objectives Female athletes engaging in high-impact sports have a higher prevalence of experiencing stress urinary incontinence (SUI). However, the prevalence of sport-specific SUI and associated risk factors in female rugby players is relatively unknown. We aimed to determine the prevalence of general and rugby-related SUI and identify associated risk factors and inciting events in female rugby players.

Methods Observational, cross-sectional study of 396 female rugby players (age 28±8 years, mass 80±18 kg, height 1.90±0.19 m, playing years 7±6 years) participating in rugby across UK and Ireland completed an electronic questionnaire regardless of SUI status.

Results 63 to 88% of players had SUI, and 43% had rugby-related SUI. There was an association with players reporting a change in incontinence status due to playing rugby (p<0.001). Players who experienced constipation (OR 2.33 (95% CI 1.49 to 3.66)), had given birth (OR 2.36 (95% CI 1.18 to 4.73)) or who had a higher body mass index (BMI) (OR 1.04 (95% CI 1.01 to 1.08)), were identified as having increased odds of rugby-related SUI. For rugby-specific risk factors, playing as a forward (OR 1.97 (95% CI 1.29 to 3.01)) increased the odds, whereas playing at a national compared with amateur level (OR 0.44 (95% CI 0.20 to 0.97)) decreased the odds of rugby-related SUI. The most prevalent inciting SUI events were being tackled (75%), tackling (66%), running (63%) and jumping/landing (59%).

Conclusion Rugby-related SUI was prevalent in female rugby players. Risk factors were having constipation, a high BMI, being postpartum, playing position and level. Player welfare strategies addressing pelvic floor dysfunction and postpartum rehabilitation are warranted.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Stress urinary incontinence (SUI) is a common health problem in female athletes participating in high-impact sports compared with athletes in low-impact sports.

⇒ There is limited understanding of the specific prevalence of rugby-related SUI in female rugby players, risk factors and the nature of the inciting event (tackle, running, rucks, line-out, etc).

WHAT THIS STUDY ADDS

⇒ 4 in 10 female players experience rugby-specific SUI, and general SUI prevalence increased once players started playing rugby.

⇒ Players who experienced constipation, had given birth, had a higher body mass index or played as a forward were identified as having increased odds of rugby-related SUI, while playing at a national compared with amateur level decreased the odds.

⇒ The most prevalent inciting events for rugby-related SUI were the tackle event (tackled and tackling), running and jumping/landing at all levels of play.

⇒ Most players do not modify their rugby activities due to rugby-related SUI, but of those that do, 71% perceive it to impact their performance negatively.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ There is a need for education on SUI and management strategies targeted at lower playing levels of rugby and in postpartum return-to-rugby guidelines.

⇒ The results provide practitioners with the initial guidance on the inciting events of rugby-related SUI. This can help guide individual pelvic floor muscle training treatment strategies.

INTRODUCTION

Rugby is a high-impact, collision sport involving contact and non-contact multi-directional activities. Player welfare has typically used time-loss injuries to inform priorities within the women's game. However, non-time-loss health problems also deserve consideration as they can impact participation and performance. One such health problem is stress urinary incontinence (SUI), an involuntary leakage of urine on effort or exertion,[1] occurring through an increase in intra-abdominal pressure (IAP) without the necessary increase in urethral closure pressure.[1 2] High-impact non-contact sports, such as running and trampolining,

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expose the pelvic floor muscles (PFM) to indirect impact being transferred through the lower limb and report a high prevalence of SUI in female athletes.[3–5] Whereas, rugby has frequent high impact, contact activities (eg, tackling)[6] that expose players to impacts directly to the trunk and pelvis regions. Therefore, rugby potentially exposes the PFMs to direct impacts and or impacts in close proximity to the muscles, as well as to impacts being transferred from the upper or lower body regions. Small cohort studies show SUI prevalence in rugby to range from 30% to 54%,[7 8] but such studies have not used two validated questionnaires to assess different SUI aspects (eg, irritative symptoms severity[9]) within a large cohort of female rugby players.

Different movements produce varying magnitudes of IAP. For example, running, a rapid and repetitive force-producing movement, exhibits higher maximum IAP but lower cumulative IAP than lifting weights, requiring sustained force production. Consequently, the incidence of SUI may differ across rugby activities due to different movement demands. At the amateur level, being tackled is the most common inciting event (88%).[7] However, it is not known if the inciting events are similar across rugby playing levels, where the demands of the game may differ. Understanding inciting events and risk factors for this prevalent health problem will enable clinicians to prevent, screen for and manage it.

SUI risk factors have been examined in different sports[4 8 10–14] but have received limited attention in female rugby players. Training duration per week increased the risk of rugby players experiencing SUI, but increasing body mass index (BMI) and age did not.[7] This contrasts with other populations where a higher BMI and age are associated with SUI.[15] Playing position may also affect SUI risk due to different game demands and physical characteristics associated with positions but has not been explored. Other risk factors in non-rugby populations include having given birth (postpartum), a vaginal delivery compared with a caesarean section[4 16] and bowel dysfunction.[2 17 18] Exploring general risk factors (eg, BMI, mode of delivery) and rugby-specific factors (eg, position, playing level, training exposure) in a large cohort, as well as the effect SUI has on rugby participation, will provide a more comprehensive understanding of this health problem. The aims of this study were threefold. First, to determine the prevalence of general SUI and rugby-related urine leakage in female players, and second, to identify risk factors for SUI in female rugby players. Finally, to understand the impact of SUI on rugby participation.

METHODS

Participants

Female rugby players (n=396; age 28±8 years, body mass 80±18 kg, BMI 28.5±7.4 kg.m^2, height 1.90±0.19 m, playing years 7±6 years) from England, Ireland, Scotland and Wales completed an online survey after providing voluntary, informed consent. Players were eligible to participate if they were female (assigned female sex at birth) rugby players over 18 years old and played rugby (15 and 7-aside) within the UK and Ireland at any level. All data were anonymised and stored on a general data protection regulation-compliant online system. This international research project was supported by the English Rugby Football Union (RFU), Irish RFU, Scottish Rugby Union and Welsh Rugby Union.

Equity, diversity and inclusion statement

The research team included eight women and one man, consisting of junior, mid-career and senior researchers and clinicians. The international research group is based in the UK, Ireland and Norway.

Survey

This observational, cross-sectional study was developed according to the CHERRIES guidelines. An open questionnaire was created by pelvic health physiotherapists (GMD and KB), rugby medical staff (JP, YC, ML, KL and PO'H) and human movement and sports medicine experts (MM-R and ISM) using round table discussions. Patients (players) were involved in the study design by providing feedback on the questionnaire. Specifically, the questionnaire was piloted among players (n=10) to test its face validity and usability. They were asked to rate their agreement that they understood the questions and that the overall questionnaire was suitable for the given purpose using an 11-point Likert scale (0–10). The questionnaire was deemed 100% suitable. The functionality of the survey for mobile phone and computer use was tested within the survey software (www.qualtrics.com; version June 2022). A bespoke survey website address was generated and disseminated via social media, researcher contacts and word of mouth during international rugby campaigns. As the survey was disseminated on social media, the response rate could not be determined. The survey took approximately 5 min to complete. Players provided informed consent at the start of the survey and were informed that they could stop at any time. Once a response was submitted, participants could not withdraw their response as it was anonymised. The survey was available from October 2022 to February 2023.

The questionnaire was divided into six sections: demographics, Urinary Distress Inventory Short Form (UDI-6), International Consultation on Incontinence Questionnarire-Urinary Incontinence Short Form (ICIQ-UI SF), rugby-related SUI, the impact of SUI on participation and the pelvic floor. The UDI-6 assessed the type of incontinence and overall impact of quality of life (QoL) to explore further when urinary incontinence occurred and the degree of bother.[19] The UDI-6 consists of six items with responses ranging from 0 'not at all', 1 'slightly', 2 'moderately' and 3 'greatly', with a mean of all six items calculated. The mean is multiplied by 33 to put the score on a scale of 0–100. Higher scores in UDI-6 indicate higher disability. The ICIQ-UI SF assessed UI using three sections: urinary frequency (0–5), urinary

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severity (according to the amount of urine leakage; 0–6) and whether QoL is impacted (0–10).[20] The total ICIQ-UI SF score results from the sum of these three sections, ranging from 0 to 21 points.

Bespoke questions assessed rugby-related SUI. The rating scale used a four-item response from the ICIQ-UI SF (question 4).[20] Only participants who reported leaking during rugby were categorised as having rugby-related SUI. Participants were asked if they suffered general SUI in the years before participating in rugby and if they leaked during everyday activities. Only those who reported rugby-related SUI were asked what rugby-related activities caused leakage and its impact on participation. Rugby-related activities consisted of 13 items derived from round table discussions. Due to the logical ordering required for certain items of the questionnaire, no randomisation of the item ordering occurred.

Data extraction and statistical analysis

Only data from participants who completed all questions were used for further analysis. The completeness rate based on consented participants (n=620) was 64%. Duplicate entries were checked by IP address and age. No duplicates were recorded. Means±SD and prevalence reported as frequency (n) and percentage (%) were calculated for reporting the prevalence of general and rugby-related SUI.

Logistic regression models were used to assess risk factors (general and rugby related) associated with rugby-related SUI. The dependent variable was if the player had SUI during rugby-related activities (rugby-related SUI; yes, no). Multicollinearity was checked using a threshold of 0.2. The number of pregnancies was related to having given birth. Therefore, the number of pregnancies was removed. For general risk factors, the continuous independent variables were age, time from childbirth to return to play and BMI. Categorical independent variables were smoking (yes, no), incomplete bowel movement (yes, no), pain during sex (yes, no), caffeine intake per day (none, yes and decaffeinated), carbonated 'fizzy' drinks per day (none, yes and sparkling water) and having given birth (yes, no). For sport-specific risk factors, the continuous independent variables were years of playing and training sessions per week. Categorical independent variables were playing position (forwards, backs), rugby training duration per week (<2 hours, 2–4 hours, >4 hours) and playing level (amateur, club, national). All continuous variables were mean-centred before being entered into regression models. The estimated OR and 95% CI were calculated. χ^2 assessed the association between players' playing level and inciting rugby-related SUI events. Significance was set at $p<0.05$. All logistic regressions were undertaken using Python (Python Software Foundation), and the remaining statistical tests (χ^2) were performed using IBM SPSS Statistics V.28.0.

RESULTS

Comparative of general and rugby-related SUI

A total of 396 responses were analysed. Based on the ICIQ-UI SF, 63% (n=250) of players reported urinary incontinence symptoms, while 88% (n=348) reported them based on the UDI-6. There was a mean score from the ICIQ-UI SF of 4±4 and 23±18 for UDI-6. Rugby-related SUI was reported by 43% (n=172) of players. There was an association with players reporting a change in leaking status due to playing rugby ($\chi^2(2)=80.95$, $p\leq0.001$). Before rugby, 11% (n=24) leaked during everyday activities compared with 24% (n=95) leaking since playing rugby.

General risk factors for rugby-related SUI

General factors that increased the odds of a player experiencing rugby-related SUI were higher BMI, experiencing constipation and giving birth (table 1; figure 1; online supplemental table 1). The model explained 11.5% of the variance in rugby-related SUI (sensitivity: 45.5%; specificity: 76.6%, accuracy: 63.8%; AUC: 0.86).

Rugby-related risk factors

Playing in the 'forwards group' increased the odds of a player experiencing rugby-related SUI, while playing at a national standard compared with amateur decreased the odds of a player experiencing rugby-related SUI (table 2; figure 2; online supplemental table 2). The model explained 3% of the variance in rugby-related SUI (sensitivity: 27.7%; specificity: 83.0%, accuracy: 60.0%; AUC: 0.86).

Impact of rugby-related SUI on participation

The tackle event (tackled (75%; n=129 and tackling 66%; n=113), running (63%; n=108) and jumping/landing (59%; n=101) were the most prevalent rugby-related SUI inciting activities (figure 3). There was no association between the three playing levels and the inciting event for rugby-related SUI ($p>0.05$). Over half of the players suffering from rugby-related SUI reported wearing a pad (58%; n=100) at some point during training or playing, whereas only 7% (n=7) reported using urethral support devices while training or playing rugby. Most players (68%; n=104) who reported rugby-related SUI continued to play, making no modifications to how they participated in rugby activities. In those who did modify their participation, one-third (32%) modified both contact and non-contact-related rugby activities (table 3). Of those who report rugby-related SUI and make modifications to the way they play, 71% (n=36) report it to affect performance negatively. Only 1% (n=2) of players stopped playing.

DISCUSSION

Forty-three per cent of players reported rugby-related SUI. A higher BMI, experiencing constipation and having

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Table 1 General risk factors for rugby-related stress urinary incontinence in symptomatic and asymptomatic players (% (n); means±SD)

Risk factor	Level	Symptomatic	Asymptomatic
Smoking	No	88% (152)	88% (197)
	Yes	12% (20)	12% (27)
Incomplete emptying after bowel movement	No	43% (74)	61% (136)
	Yes	57% (98)	39% (88)
Pain during sex	No	48% (82)	45% (100)
	Yes	43% (74)	48% (107)
	N/A	9% (16)	8% (17)
Caffeine intake	None	17% (30)	21% (48)
	Caffeinated drinks	77% (133)	77% (172)
	Decaffeinated drinks	5% (9)	2% (4)
Fizzy drinks	None	39% (67)	46% (103)
	Fizzy drinks	49% (84)	45% (100)
	Sparkling	12% (21)	9% (21)
Body mass index	Mean	30.2±8.5	27.3±6.3
Given birth	No	38% (66)	87% (194)
	Yes	62% (106)	13% (30)
Time to return to play following childbirth (weeks)	Mean	108±157	88±112

given birth increased the odds of players having rugby-related SUI. Playing as a forward increased the odds of experiencing rugby-related SUI, whereas a higher playing standard (national compared with amateur) decreased the odds. The tackle event was the most provocative activity for rugby-related SUI.

Comparison of general and rugby-related SUI

Our study identified that participating in rugby increases the prevalence of general SUI in players' daily lives. The high prevalence of urinary incontinence found with the UDI-6 and ICIQ-UI SF is similar to previous studies in high-impact sports.[3 5 7 10 14 21] Prevention and management of SUI should be prioritised within female rugby due to the increase in everyday urinary leakage and high occurrence while playing rugby.

General risk factors

Players who had a higher BMI and who experienced constipation were at an increased odds of having rugby-related SUI, according to previous research.[2 17 18 22 23] Conversely, the type of fluid intake (eg, carbonated or caffeinated drinks), pain during sex and age did not affect the odds of having rugby-related SUI. In contrast to our study, BMI was similar between female rugby players experiencing SUI and those who do not at an amateur level.[7] One possible explanation could be the higher mean BMI in our study compared with Sandwich and

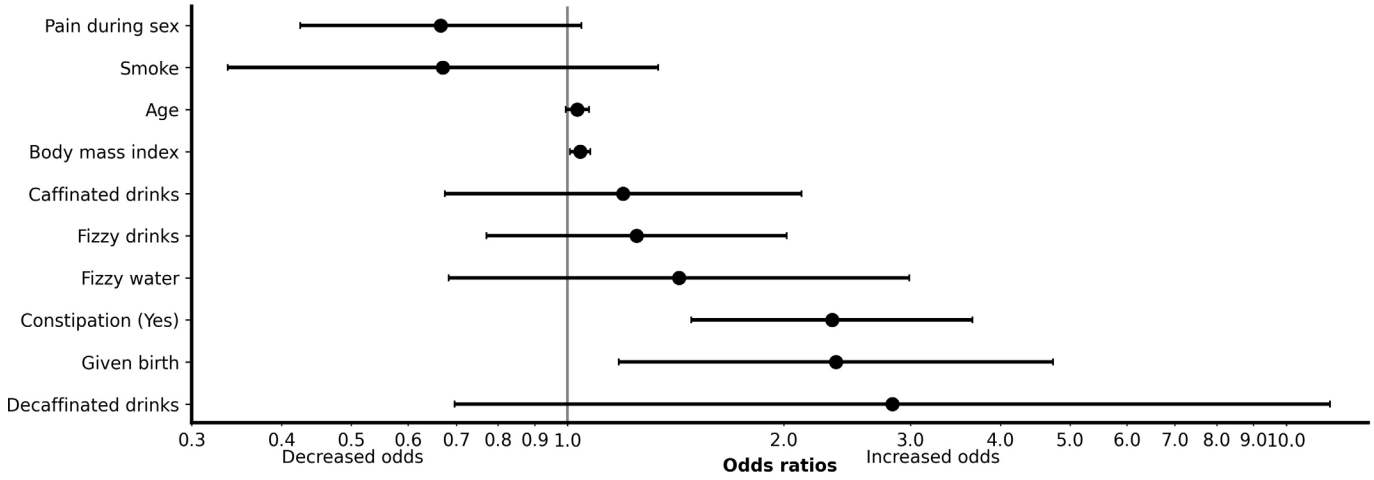

Figure 1 Odd ratios (95% CIs) for rugby-related stress urinary incontinence general risk factors. Data are presented on a log scale.

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Table 2 Rugby risk factors for rugby-related stress urinary incontinence in symptomatic and asymptomatic players (% (n); means±SD)

Risk factor	Level	Symptomatic	Asymptomatic
Playing position	Forward	69% (119)	53% (119)
	Back	31% (54)	47% (104)
Training duration per week	< 2 hours	82% (140)	78% (174)
	2–4 hours	15% (27)	18% (41)
	>4 hours	3% (5)	4% (9)
Playing level	Amateur	42% (72)	35% (78)
	Club	47% (81)	47% (105)
	National	11% (19)	18% (41)
Training sessions per week	Mean	3±1	2±1
Playing years	Mean	7±5	7±6

Robert[7] (28.5 vs 25.8 $kg.m^2$, respectively) and potential differences in body composition. Notably, 75% of players who leaked had a BMI>24.9 compared with 53% who did not. Both high BMI and experiencing constipation may increase the risk of SUI due to sustained increases in IAP. For incomplete bowel movements, the persistent straining may negatively impact PFM strain. The close anatomical proximity of the bowel and bladder organs may explain why dysfunction of one may influence the function of another.[24] Practitioners working with female rugby players should be aware of positional demands that may present certain physiological characteristics (eg, high BMI) and SUI risk, in addition to screening for different types of pelvic floor dysfunction.

Consistent with previous work in other populations and general SUI, having given birth increased the odds of experiencing rugby-related SUI.[4 16 25 26] Pregnancy-related changes (eg, stretching, tearing and loading the PFMs and the perineum) may explain the increased odds of SUI for postpartum players.[16 26 27] Postpartum return-to-rugby guidelines should include screening for SUI, advise on symptom management and recommend players are signposted to pelvic health physiotherapists.

Rugby-related risk factors

To our knowledge, this is the first study to observe the impact of playing position on SUI. Playing as a forward increased the odds of SUI. This could be due to the higher contact demands for forwards, exposing them to a greater frequency of repetitive rapid (tackle event) and sustained (rucks and mauls) increases in IAP compared with backs. Additionally, forwards play a dominant role in tackles,[28] which have the highest SUI prevalence and typically have higher BMIs.[29 30] These positional physical characteristics and playing demands may hypothetically have additive effects, with players experiencing greater stress on their PFMs. Furthermore, a higher playing level (national) decreased the odds of experiencing rugby-related SUI compared with amateur level. National players may be able to tolerate loads placed on the PFMs during rugby due to better sport-specific conditioning and training exposure. Prevention strategies for rugby-related SUI should be targeted at forwards and amateur-level rugby players, focusing on sport-specific conditioning (eg, training exposure). Further, BMI should be considered within a player's SUI risk profile, and individualised PFM training programmes should be implemented as required.

Impact of rugby-related SUI on participation

Similar to previous research, being tackled had the highest SUI prevalence,[7] followed by running and jumping/landing. All these activities occur frequently in matches and can be characterised by rapid transient increases in force, with tackling also having an element of unpredictability.[28] This may overload the PFMs due to increases in IAP occurring with no warning,[31] as normal pelvic floor function would respond despite no warning. Weight lifting was identified as a risk factor for SUI in powerlifters[10 32 33] but had a lower prevalence than

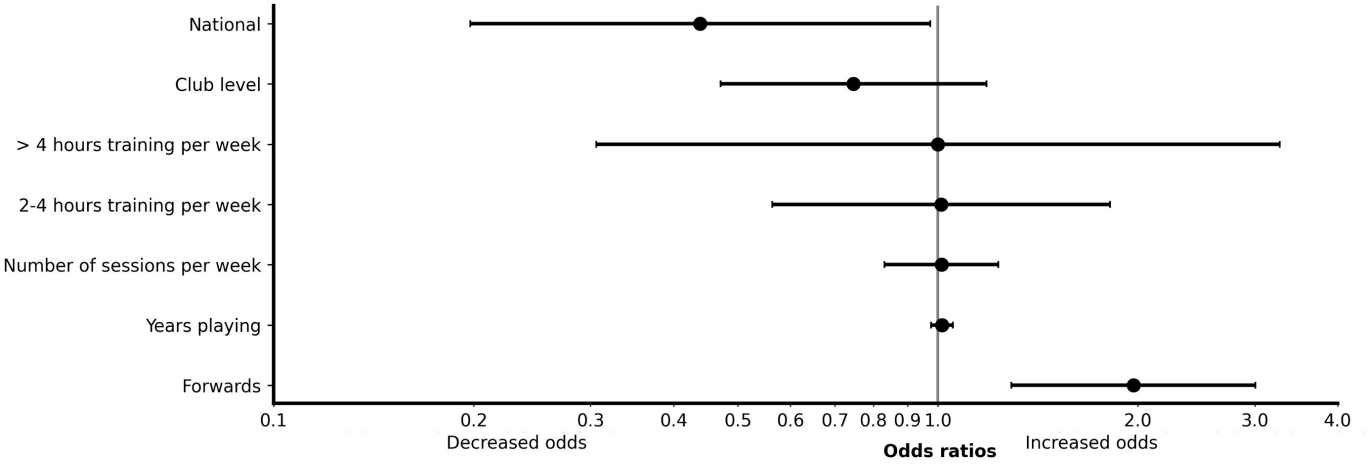

Figure 2 Odds ratios (95% CIs) for rugby-related stress urinary incontinence rugby risk factors. Data are presented on a log scale. SUI, stress urinary incontinence.

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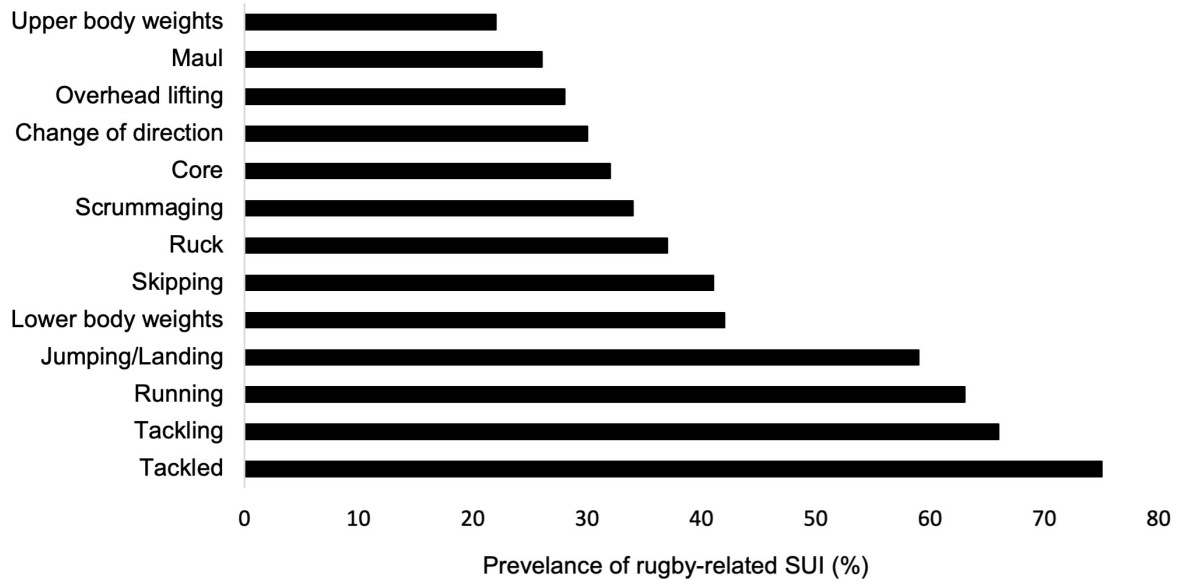

Figure 3 Prevalence (%) of rugby-related stress urinary incontinence (SUI) per rugby inciting event.

rugby-specific movements and those with rapid transient increases in force in our study.

Most players who report rugby-related SUI make no modifications to how they participate in rugby-related activities. With the high injury rates in rugby,[34] players may view leaking as insignificant or normal as it does not typically result in time lost to training or matches. Those who do make modifications report altering non-contact activities, even though contact activities resulted in a greater prevalence of SUI, as well as using incontinence products. We hypothesise that this suggests players are prioritising field performance indicators, as rather than changing tackle technique, they look to modify other activities or use external modifications. However, most of those modifying their activities felt rugby-related SUI negatively affected their performance. Exploring the perceived performance impact in more detail is required.

A large cohort of female rugby players across four nations and different levels were recruited through various mediums (eg, social media governing bodies). Therefore, no specific response rate could be calculated. Additionally, respondents may have been more interested in completing the survey if they have SUI. While a multidisciplinary approach was used to design the questionnaire and gather self-report data, physical

Table 3 Modifications players with rugby-related SUI make to their rugby activities (% (n))

Type	Activities	Prevalence
Contact-related activities	Changing my body position	41% (7)
	Reducing the amount	59% (10)
	The total of those who modify	37% (17)
Non-contact-related activities	Changing my technique	22% (4)
	Reducing the amount	28% (5)
	Reducing the speed and/or height	44% (8)
	Other	6% (1)
	The total of those who modify	38% (18)
Weight training	Reducing the amount	100% (1)
	The total of those who modify	2% (1)
Other	Wearing a pad	40% (4)
	Going to the toilet more often	40% (4)
	Dressing differently	20% (2)
	The total of those who modify	23% (10)

SUI, stress urinary incontinence.

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assessments (eg, a pad test) would objectively measure the occurrence and magnitude of leakage volume.

In summary, 43% of players report rugby-related SUI, compared with 63 to 88% who reported SUI in general day-to-day activities. Factors that increased the odds of having rugby-related SUI were having a higher BMI, experiencing incomplete bowel movements, being postpartum and being a forward. Conversely, a higher playing level (national compared with amateur) decreased the odds of having rugby-related SUI. The tackle had the highest prevalence of rugby-related SUI. Most players do not modify their rugby activities, while those who do tend to modify non-contact-related activities and perceive rugby-related SUI to affect their performance negatively. Prevention and management of SUI should be prioritised within female rugby due to the increase in everyday urinary leakage and high occurrence while playing rugby. Postpartum return-to-rugby guidelines should include SUI symptoms and management information due to being postpartum being identified as a risk factor for rugby-related SUI. In addition, player welfare strategies focused on SUI education (eg, risk factors and management strategies) and sport-specific PFM conditioning are needed.

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Contributors ISM and JP conceived the study idea. MM-R, JP, GMD, YC, KL, ML, KB, PO'H and ISM designed the study. MM-R, JP, GMD, YC, KL, ML, PO'H and ISM disseminated the survey. MM-R and ISM analysed the data. MM-R, JP and ISM interpreted the data. MM-R and ISM prepared the first draft of the manuscript. All authors made substantial contributions to the revision of the manuscript prior to submission. ISM is the guarantor for the paper.

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Competing interests JP is Head of Women's Medical for the Welsh Rugby Union. YC is a Medical Manager in the Irish Rugby Football Union. ML is employed by the Irish Rugby Football.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Cardiff Metropolitan University Ethics committee Sta-5972. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Deidentified participant data coded for analysis are available from the author ISM (imoore@cardiffmet.ac.uk). Data are available for further analysis based on the agreement of all coauthors.

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