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ORIGINAL ARTICLE

Injury Incidence and Injury Period Prevalence in Underwater Hockey: A Retrospective Study

Vikki Adams[1] · Ashley Jones[1] · Hannah Partner[1] · Richard Partner[1,2]

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Abstract

Purpose Underwater Hockey (UWH) is an upcoming sport involving limited contact between players. To date there are no published estimates of injuries in UWH. The aim of this study was to provide estimate on overall injury incidence and injury period prevalence in a sample of UWH players.

Methods A cross-sectional study design with a convenience sample of UWH players recorded injuries sustained over the previous 12-month period. A total of 441 UWH players completed the study online questionnaire. Descriptive statistics with confidence intervals, alongside a one variable Chi squared test (χ^2) or independent sample *t*-test.

Results The overall injury incidence was 2.33/1000 h. Wrist, hand, and finger injuries combined (31.8%) were the most frequently injured regions followed by isolated shoulder injuries (16.8%). Contact with another player was the most frequent injury mechanism (43.5%) attributed, whilst the most common injury duration was between 8 and 28 days (35.9%).

Conclusion This is the first study to report injury data in a sample of UWH players. Incidence rates were similar to other water-based sports such as endurance swimming. The high prevalence of wrist, hand and finger and shoulder injuries suggest that future injury prevention programmes should look to include upper limb-focussed risk reduction strategies.

Keywords Underwater Hockey · Epidemiology · Athletic Injury · Aquatic Sports

Introduction

Previously, injury surveillance studies amongst athletic populations have used injury incidence and injury period prevalence to quantify injury rates. Injury incidence is commonly expressed as injuries per 1000 exposed hours [17] whilst injury period prevalence is recorded using tally counts [2]. Knowledge around the injury incidence, as well as more in-depth knowledge about more common injuries is crucial for injury prevention programming and resource management amongst medical, science and coaching staff. Additionally, injury surveillance studies have been used by governing bodies to alter rules in sport to increase safety in play [9].

Governed by the world underwater federation [Confédération Mondiale des Activitiés Subaquatiques (CMAS)], Underwater Hockey (UWH) is a physically demanding sport which requires players to repeatedly submerge to the bottom of a swimming pool to out-manoeuvre the opposition and score a goal whilst holding their breath [15]. A game lasts 30 min and involves periods of high intensity sprint swims with short recovery periods, and often one-on-one contests for the puck [4]. Strength, speed, agility, power, coordination, apnoeic ability and anaerobic and aerobic fitness are important components of an UWH game [15]. A weakness in these areas, especially when compared to an opponent, may increase a player's injury risk [1, 14].

Whilst UWH is an internationally recognised sport, there is currently an absence of injury surveillance data available, with UWH literature limited to physiological adaptations and lung physiology (Davis et al. [6]; Coetsee and Terblanche [5]) [1, 15]. Competitive swimming, water polo and underwater rugby have similar physical demands to UWH; all are swimming pool based and all have varying levels of apnoea. UWH is classified as a non-contact sport [4], much like competitive swimming where injury

✉ Richard Partner
r.partner@leedsbeckett.ac.uk

[1] Musculoskeletal Health Research Group, School of Health, Leeds Beckett University, CL604, City Campus, Leeds LS1 3HE, UK

[2] Carnegie Applied Rugby Research (CARR) Centre, Carnegie School of Sport, Leeds Beckett University, Leeds, UK

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rates range from 0.02 to 3.04 injuries per 1000 exposure hours [3, 16]. Conversely, underwater rugby allows contact between competitors, and a recent injury incidence rate of 37.7/1000 playing hours in a sample of 198 participants was retrospectively reported [21]. Furthermore, a study by Mountjoy, et al. (2019) estimated water polo (contact sport) time-loss injury rates to be 14.7/1000 h at the International Swimming Federation World Championships (2009, 2013, 2015, 2017) and Olympic Games (2004, 2008, 2012, 2016).

Defining the injury problem in any given sport is the starting point that proceeds any injury prevention strategy [10, 20]. Although UWH has been around for over 60 years, to the author's knowledge there is currently no published studies which estimate injury incidence and injury period prevalence. Therefore, the primary aim for this study is to estimate the injury incidence and injury period prevalence in a sample of UWH players. The secondary aim for this study was to report the characteristics of the injuries obtained by UWH players.

Materials and Methods

A self-reported, retrospective study design was used. Ethical approval was granted from the School of Health at Leeds Beckett University. A convenience sample of participants with varied levels of experience in UWH were recruited via coaches who acted as gatekeepers for the study. Additionally, social media posts were created to advertise the study. To fulfil the inclusion criteria, a player must have played in a competitive UWH game or been involved in UWH training in the last 12 months at a regional or international standard. Also, all participants had to be older than 18 years of age to partake in the study for full consent to be obtained without the need of a parent or carer's assent.

Procedure

An online questionnaire (Qualtrics, XM 2020, USA) was used to obtain information on the injuries sustained in UWH in this retrospective cohort study. A link to the questionnaire was sent out on social media using the British Octopush Association social media accounts allowing sharing internationally. Additionally, individual clubs were contacted by the lead researcher and invited to share the questionnaire with their own players. The online questionnaire was open for a total of 2 months at the start of 2020 (23/3/20–23/5/20).

Consent was gained by completing the consent form included at the beginning of the questionnaire. All participants were advised that participation was voluntary, and that they could withdraw at any time up to the point of data analysis. Participants remained anonymous, with the only personal information obtained being age, gender, and country of residence. The questionnaire could be completed on a laptop, mobile phone, or tablet, and was originally written in English and a copy later translated to the Mandarin language to make it more accessible to potential worldwide participants. The online questionnaire asked the player to recall injuries sustained over the past 12 months, specifically, the number of time-loss injuries sustained, the anatomical area and the duration of each time-loss injury. Anthropometric data was also collected along with UWH participation information. The questions were mainly quantitative with some questions allowing for expansion on answers if the participant's answer did not appear in the multiple choices.

Definitions and Categorisation

The definition of a sports injury in this questionnaire was *'tissue damage or other derangement of normal physical function due to participation in underwater hockey, resulting from rapid or repetitive transfer of kinetic energy'* adapted from the definition by the International Olympic Committee Consensus 2020 [2]. The participants were asked if they had suffered a time-loss injury in the past 12 months in order to calculate the time-loss injury incidence rate as recommended by the International Olympic Committee Consensus 2020 [2], and defined as *'any physical complaint sustained by yourself that resulted from an Underwater Hockey game or training session that led to you being unable to take part in future Underwater Hockey games or training sessions'* adapted from the International Olympic Committee Consensus 2020 [2]. Those who had experienced a time-loss injury were directed to further questions about each individual time-loss injury, including anatomical location, severity of injury, and mechanisms of the injury.

Anatomical location was categorised in accordance with the Orchard Sports Injury and Illness Classification System (OSIICS) version 13 [24]. The 'Thoracic Spine' and 'Lumbosacral' areas stated in OSIICS were changed to 'Back' and 'Buttocks' to improve participant understanding. The severity of injury was categorised by the number of days lost: *'0 days', '1–7 day(s)', '8–28 days' and 'more than 28 days'* in accordance with the definitions proposed by the International Olympic Committee Consensus 2020 [2].

The mechanisms of injury were categorised specifically for UWH. Pool based injury categories were '*contact with another player*''*contact with a moving object, e.g., the puck*' '*contact with immobile object, e.g., the wall*' and '*swimming action'.* Although UWH is a non-contact sport, players can be hit by the other player's fins, snorkel, bat, or a body part, whether intentional or accidental. The puck is usually flicked across the bottom of the pool and can often be flicked off the bottom of the pool, possibly coming into contact with a player. Players may also contact the pool walls or the buzzer system, resulting in injury. '*Land based training'* was also a category to encompass the training taking place outside of the pool. If this category was chosen, the following question asked them about the type of land-based training that caused the injury; categorised into '*cardiovascular training e.g., running, cycling, rowing ergometer*' '*body weight exercise*' '*resisted exercise e.g., weights, resistance bands*' and '*other*'. The players were also provided with the options '*other*' and '*don't know*' for the mechanism of injury.

The highest level a player had competed at in the last 12 months were categorised and ordered by ranking, the highest being '*played on an elite team at an international event*' and the lowest being '*not played in a tournament or game*'. To be eligible for an elite team, a player must be older than 18 years old. To be eligible to compete for the masters, the criteria is currently 35 years or older for men and 32 years or older for women [4].

A single weekly estimate of athletic exposure was recorded under three categories; combined UWH activity (matches and training), land based and traditional swimming sessions [18, 21]

Statistical Analysis

The completed questionnaires were collated on QualtricsXM and later exported to an Excel (Microsoft 2021, USA) document. The raw data was numerically coded to be analysed in SPSS Statistics (IBM version 29.0, USA). Normality was tested using the Kolmogorov–Smirnov test and by inspecting the z-skewness and z-kurtosis of the data. Data were considered normally distributed if the P value ≥ 0.05 and if figures were between ± 1.96.

Weekly UWH exposure hours were multiplied by 52 (weeks) to represent the estimated exposure for a full year [13]. The total number of time-loss injuries was divided by the estimated yearly training (exposure) hours to provide the injury incidence. Injury incidence was presented per 1000 UWH hours (h) with 95% confidence intervals (95% CI) as adapted from Lundberg Zachrisson et al. [18] and Meyer et al. [21].

$$\text{Injury Incidence} = \frac{\text{Total Number of Time Loss Injuries}}{(\text{Total Weekly UWH Exposure Hours} \times 52)}$$

One variable chi squared tests (χ^2) were used to ascertain if expected values were significantly different from overserved values in anatomical location, injury mechanisms, injury severity variables. The level of significance was set at $P < 0.05$. Anatomical location, injury mechanisms and injury severity data were presented with mean values with 95% CI. Independent samples *t*-tests were used to analyse differences between parametric variables.

Results

An initial number of 470 players took part in this study. However, a total of 29 of the players did not fully complete the questionnaire and therefore had their results omitted from the study. This led to a final participation number of 441 which included 269 males and 172 females (Table 1). For the purpose of analysis all data were considered normally distributed.

Participation was worldwide covering all open age elite world championship winning nations since its inception in 1980 (Table 2). Of the 441 responses, 374 were obtained from the English language questionnaire, and 67 from the Mandarin language questionnaire.

Injury Incidence

A total of 393 time-loss injuries were recorded in the 12-month retrospective online questionnaire. In total, 50.6% of UWH players (223/441, 95% CI 45.7%–55.3%) sustained at least 1 time-loss injury over a 12-month period, with 49.3% (110/223, 95% CI 42.5%–56.0%) sustaining more than 1 time-loss injury (Table 3). The average number of UWH exposure hours per week was 7.36 ± 4.8 with a sum of 3245.76 h for the whole sample, resulting in an overall injury incidence rate of 2.33/1000 h (95% CI 0.23 to 2.55).

$$\frac{393}{(52 \times 3245.76)} \times 1000 = 2.33$$

UWH exposure was sub categorised into UWH training and matches (Injury incidence = 4.02/1000h), land-based training (Injury incidence = 0.41/1000 h) and swim training (Injury incidence = 1.35/1000h). Females sustained more time-loss injuries than males (54.0% vs. 48.3%) and had a higher Injury incidence (2.53 ± 0.5 vs. 2.20 ± 0.3), although upon analysis, this was not significant [t (439) = – 0.076, $P = 0.935$].

Table 1 Anthropometric characteristics of the participants

Variable	Male ($n = 269$) Mean ± SD	Female ($n = 172$) Mean ± SD	Overall ($n = 441$) Mean ± SD
Age (years)	35 ± 13	29 ± 10	33 ± 12
Height (cm)	179.6 ± 7.7	166.1 ± 6.9	174.3 ± 9.9
Weight (kg)	84.8 ± 20.8	69.0 ± 15.8	78.7 ± 20.5
BMI (kg/m^2)	26.2 ± 6.2	25.0 ± 5.7	25.7 ± 6.1

SD standard deviation

Table 2 Respondents by country/area of origin

Country/area of origin (World Championships wins)	Total responses (%)
Angola	1 (0.2)
Australia (21)	22 (5.0)
Belgium	4 (0.9)
Canada (1)	26 (5.9)
China	69 (15.6)
Czech Republic	2 (0.5)
France (3)	17 (3.9)
Germany	3 (0.7)
Hong Kong, China	3 (0.7)
Indonesia	4 (0.9)
Ireland	13 (2.9)
Israel	3 (0.7)
Malaysia	3 (0.7)
New Zealand (7)	36 (8.2)
Philippines	10 (2.3)
Poland	2 (0.5)
Portugal	1 (0.2)
Serbia	1 (0.2)
Singapore	1 (0.2)
South Africa (5)	5 (1.1)
South Korea	1 (0.2)
Spain	7 (1.6)
Switzerland	1 (0.2)
The Netherlands (2)	5 (1.1)
Turkey	2 (0.5)
United Kingdom (2)	184 (41.7)
United States of America	15 (3.4)

Injury Period Prevalence

Anatomical Location

The highest number of time-loss injuries were reported at the wrist/hand/finger (31.8%, 125/393, 95% CI 27.2%–36.6%), with 39.2% (49/125, 95% CI 9.3%–16.1%) of injuries taking longer than 28 days to return to UWH. The second and third most frequent anatomical locations were the shoulder (16.8%, 66/393, 95%, CI 13.2%–20.8%) and head (12.0%, 47/393, 95% CI 8.9%–15.5%), respectively. A one-variable chi squared test found a significant difference between expected and observed values in anatomical location [$\chi^2(14) = 583.90$, $P \leq 0.001$] Table 4 details the number of injuries in each of the anatomical location categories.

Injury Severity

The most frequent time lost period following injury was 8–28 days (35.9%, 141/393, 95% CI 31.1%–40.8%) which was closely followed by injuries that took > 28 days (33.3%, 131/393, 95% CI 28.6%–38.2%). Injuries resulting in 1–7 day(s) time loss accounted for 30.8% (121/393, 95% CI 26.2%–35.6%). A one-variable chi squared test found no differences between expected and observed values in injury severity [$\chi^2(2) = 1.52$, $P = 0.46$]. Table 4 shows the spread of injury severity proportions across each of the anatomical locations.

Injury Mechanism

A total of 69.7% (274/393, 95% CI 64.9%–74.2%) time-loss injuries were caused by a contact mechanism (another player, moving object or immobile object) whilst non-contact mechanisms of injury contributed to 18.6% (73/393, 95% CI 14.8%–22.7%). Injury mechanisms not listed as part of the questionnaire accounted for 7.9% (31/393, 95% CI 5.4%–11.9%) of time-loss injuries, whilst 3.8% (15/393, 95% CI 2.1%–5.2%) had an unknown cause. Contact with another UWH player was the most common mechanism of a time-loss injury in UWH with 43.5% (171/393, 95% CI 38.5%–48.4%) of injuries occurring from the contact. Contact with a moving object was the second highest occurring cause of time-loss injury with 17.8% (70/393, 95% CI 14.1%–21.9%), followed by swimming action with 11.7% (46/393, 95% CI 8.6%–15.3%). Land-based training accounted for 6.0% (27/393, 95% CI 4.5%–9.8%) of all injuries and was further sub-categorised as either cardiovascular training, body weight training or resisted training. Of these sub-categories, cardiovascular training accounted for almost half (44.4%, 12/27, 95% CI 25.4%–64.6%) of

Table 3 Comparison of time-loss injuries and injury incidence between male and female UWH players

Sex UWH exposure (Mean ± SD)	No T-L injuries (%)	1 T-L injury	More than 1 T-L injury	Total number of T-L injuries (%), II ± SD
Male 7.39 ± 4.9	139 (51.6)	64	66	227 (48.3), 2.20 ± 0.5
Female 7.33 ± 4.5	79 (45.9)	49	44	166 (54.0), 2.53 ± 0.3
Total	218	113	110	393

T-L time-loss, *II* injury incidence per 1000 h, *SD* standard deviation

Table 4 Number of time-loss injuries and duration of time-loss injuries according to anatomical location and severity in UWH

Anatomical location	Number of T-L injuries (%)	Severity of injury (Days)		
		1–7 Day(s)	8–28 Days	> 28 Days
Wrist/Hand/Finger(s)	125 (31.8)	28	48	49
Shoulder	66 (16.8)	23	17	26
Head	47 (12.0)	19	18	10
Ankle/Foot/Toe(s)	41 (10.4)	14	13	14
Elbow	26 (6.6)	7	12	7
Back	17 (4.3)	6	6	5
Chest	14 (3.6)	5	6	3
Knee	14 (3.6)	2	6	6
Neck	13 (3.3)	7	4	2
Upper Arm	9 (2.3)	1	4	4
Hip/Groin	7 (1.8)	2	3	2
Lower Leg	7 (1.8)	3	3	1
Forearm	3 (0.8)	1	1	1
Upper Leg	3 (0.8)	2	0	1
Abdomen	1 (0.3)	1	0	0
Buttocks	0 (0.0)	0	0	0
Total	393	121	141	131

T-L time-loss

the injury mechanisms, followed by resistance training (29.6%, 8/27, 95% CI 13.7%–50.1%) and body weight training (22.2%, 6/27, 95% CI 8.6%–42.2%). One time-loss injury did not fall into the above-mentioned land-based training categories. A one-variable chi squared test found a significant difference between expected and observed values in mechanisms of injury [$\chi^2(6) = 306.30$, $P \leq 0.001$]. Table 5 highlights the mechanisms of injury recorded for the whole sample.

Table 5 Mechanisms of time-loss injuries in UWH

Mechanism of injury	Number of T-L injuries (%)
Contact with another player	171 (43.5)
Contact with moving object	70 (17.8)
Contact with immobile object	33 (8.4)
Swimming action	46 (11.7)
Land-based training	27 (6.9)
Other	31 (7.9)
Do not Know	15 (3.8)

T-L time-loss

Participation Level

When split into groups according to the highest playing level in the last 12 months (Table 6), those playing at national club level had the highest recorded time-loss injuries with 94 (23.9%), followed by elite level players with 80 (20.3%) time-loss injuries. Those who had not played an UWH game or at a tournament in the last 12 months and masters players had the least recorded time-loss injuries [15 (3.8%) and 11 (2.8%) respectively].

Discussion

This is the first study to estimate injury incidence and injury period prevalence figures in a sample of UWH players. Most respondents were from the UK (41.7%) and were male (61%) who played at a national club level (23.9%). Overall time-loss injury incidence was estimated at 2.33/1000 h. The upper extremities accounted for a higher proportion of all injuries, specifically in the hand/wrist/fingers (31.8%), the shoulder (16.8%) and head (12.0%). Contact with either another player (43.5%), a moving object (17.8) or immobile object (8.4) collectively accounted for most injury mechanisms (69.7%). In total, 69.2% of the recorded time loss injuries required at least a week before a return to UWH training and match activities took place (8–28 days: 35.9%, > 28 days: 33.3%).

Injury Incidence

The present study estimated the overall injury incidence for UWH players in the present study is 2.33/1000 h which is comparable to previous data from a collegiate swimming population (3.04/1000 h) [3] yet higher than those reported amongst sprint swimmers (0.02/1000 h) [16]. When comparing our results to other underwater-based contact team sports

Table 6 Time-loss injuries according to the highest playing level in UWH

Highest playing level	Number of T-L injuries (%)
Elite	80 (20.36)
Age groups	60 (15.27)
Masters	11 (2.80)
International club	48 (12.21)
Top tier national club	54 (13.74)
National club	94 (23.92)
Regional club	31 (7.89)
Not played	15 (3.82)

T-L time-loss

such as underwater rugby (37.7/1000 h) [21] and water polo (14.7/1000 h) [23], injury rates are much lower. This finding is perhaps unsurprising, as land-based rugby and handball, the most closely aligned land-based activities, both have a higher overall incidence rate (rugby 30.9/1000 h, handball 6.5/1000 h [22, 27] than field hockey (3.7/1000 h) [11] in sub-elite populations. The difference in injury rates between these sports may be partially attributed to the nature and degree of opponent contact allowed across the different sports (both on land and in water).

Sub analysis of injury incidence by those identifying as male (2.20/1000 h) or female (2.53/1000 h) in this cohort showed a non-significant difference. However, given the uneven split of males ($n = 269$) and females ($n = 172$), this trend towards females having a higher incidence of time loss injuries may show significance in a more equal cohort. Underwater rugby (UWR) may be the most comparable aquatic sport from a physiological and playing perspective. Meyer et al. [21] reported a higher frequency of female injuries in an evenly distributed sample of males and females without substantive reasoning, whereas specific gender injury analysis was not reported in a more recent study on German UWR players [19]. Gender specific epidemiological data will help in the overall injury evaluation and should be considered in future methodological designs.

We report that 50.6% of UWH players sustained 1 or more time-loss injuries over a 12-month period which is similar to previous study findings which included competitive swimmers (56.0%–56.3%) [7, 8]. However, the number of injuries has shown to be 31.6% higher than those collected in a sample of water polo players during the 2016 Olympic Games [25]. This may be in part due to the short timeframe of a tournament compared to the 12-month period used in our study and the differences in injury reporting. Therefore, to create a more closely aligned comparison, a future study could consider collecting injury rates using consistent methods and timeframes.

Injury Period Prevalence

The combined area of wrist/hand/finger(s) was the most frequently injured body location in this study at 31.8% with shoulder injuries the second most prevalent at 16.8%. Collectively, this suggests UWH players sustain injuries to the upper extremities most often and practitioners need to focus on injury reduction strategies in these regions. The upper limb bias may be indicative of the demands of the sport when players use their upper limb during contact with opponents and to also control the puck on the bottom of the pool. The specific demands of the sport make it difficult to directly compare injuries by locations. However, previous studies investigating injury prevalence in water-based contact sports have found injuries to the head to be the most prevalent location in water polo (25.6%) [23] and underwater rugby [21]. When interpreting self-reported data, it may be useful to combine categories where cross over of symptoms or interventions may exist. Reported prevalence of combined head and neck [60 (15.2%) Table 4] may highlight the need to review protective equipment around the head and neck to mitigate the risk of injuries, although further studies are required to provide a stronger rationale for this theory.

In the present study, the most common mechanism of injury was direct contact, which accounted for 69.7% of all time-loss injuries, specifically 43.5% of these were as a result of contact with another player. This finding was surprising and may begin to challenge the World Underwater Federation [4] definition of UWH as a non-contact sport [4]. The injury mechanisms seen in the present study are comparable with water polo (57%) [23] which may be because of the similarities in the nature of the activities. Contact with a moving object (e.g., the puck) was the second highest cause of injury (17.8%), followed by swimming action (11.7%). Conversely, injury data collected on endurance swimming participant groups have shown overuse injuries accounting for almost 60% of injury mechanisms [3, 12]. This large difference may be because unlike an endurance swimmer, UWH utilises a varied set of actions which may reduce the risk of sustaining an overuse injury from a single swimming action.

The most frequent time-loss injury category in the current study was 8–28 days (35.9%), although it should be noted that there was little difference between all 3 categories [1–7 day(s)—30.8% and > 28 days—33.3%]. Previously, Chase, et al.(2013) found that 58.1% of time-loss injuries in collegiate endurance swimmers were 1–7 day(s) which suggests that injury severities in endurance swimmers tend to not cause much time loss [3]. However, the consistency across the different severity timeframes reported in the present study initially suggests the need to consider injuries on a case-by-case basis as there is an equal chance of injuries causing significant time loss as there is an injury being resolved within a week of occurrence.

Limitations

Due to the retrospective nature of the study, all injury and exposure data relied upon participants memory recall from the previous 12-months. Therefore, all findings from this study should be interpreted cognisant of this. Additionally, the self-reported nature of the study design meant that specific injury types may not be accurately reported. Medical provision of minority sports such as UWH, often precludes time sensitive medical reporting of injury data. Whilst this is accepted as a limitation, the novelty of the study still provides initial estimates of frequently injured regions in UWH players from regional and international participation levels.

A future study, with a medically reported methodology, is now needed in a medically supported cohort, to confirm common injury types in this population and see if there are differences between injury period prevalence and incidence for athletes undertaking UWH skills training vs. match play. Highest participation level was categorised, but given the international participation in this study, interpretation of playing categories used could be variable, as categorising level of participation is a difficult concept to standardise dependant on country of origin [26]. This study started data collection at the start of the COVID-19 pandemic requesting a 12-month retrospective recall of injuries. Given the global variability in commencement of Covid-19 containment plans from early 2020, there is the possibility that participants completing the online survey in their country may have had their participation impacted by lockdowns, travel restrictions and alterations in training and competition.

Conclusion

The current study is the first to estimate injury incidence and injury period prevalence rates in a sample of regional and international underwater hockey players. The injury incidence in UWH is 2.33/1000 UWH hours. The main injured anatomical locations were in the upper extremities. This information provides initial insights for medical and coaching staff when considering injury risk reduction strategies in this sport.

Further in-depth research around injury incidence in UWH players is needed, with multi-season, medically reported prospective studies recommended. Injury epidemiology and risk factors in UWH should be explored so specific injury prevention programs can be produced to reduce the injury incidence in UWH for both the male and female games. Despite being currently classified as a non-contact sport, over two thirds of time-loss injuries recorded were caused by contact, with 43.5% caused by contact with another player. Although there is compulsory protective equipment in place to reduce the risk of injury, there could be consideration of further equipment for additional protection, especially of that to the head, neck, shoulder, wrist, hand and fingers. These recommendations could assist in reducing the risk of injury in future UWH games and training.

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Data Availability Raw anonymous tabulated data from this study can be made available by contacting the corresponding author in accordance with ethical statement on data management for this study.

Declarations

Conflict of Interest The authors have no relevant financial or non-financial interests to disclose.

Ethics Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Leeds Beckett University 23/3/2020 ID 33473155.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent to Publish The authors affirm that human research participants provided informed consent for publication of the findings of this study.

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