


# Health conditions among retired elite rugby players: a scoping review

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## ABSTRACT

The aim of this scoping review was to present an overview of the existing epidemiological evidence in retired male and female elite rugby players regarding the prevalence rates of musculoskeletal, cardiovascular, neurocognitive, psychological and gynaecological health conditions. A systematic search was carried out across MEDLINE (via PubMed), SPORTDiscus (via EBSCOhost), PsycINFO (via EBSCOhost) and EMBASE for musculoskeletal (eg, osteoarthritis), cardiovascular (eg, hypertension), neurocognitive (eg, dementia) and psychological health (eg, disordered eating, alcohol misuse) conditions in retired elite male and female rugby players and gynaecological health conditions (menorrhagia) in retired female rugby players. Primary research studies describing the prevalence rates of health conditions in retired elite male and female rugby players written in English, Dutch or French and with full text available online were included. Five hundred and seventy-three citations were originally identified and 16 studies were ultimately included in our review. No studies on health conditions in retired elite female rugby players were found. Four individual studies showed there was a significant higher prevalence rate of osteoarthritis in retired elite male rugby players compared with control groups. Various neurocognitive health conditions were investigated and showed, among others, a prevalence rate of 57% for mild cognitive disorder. The prevalence of self-reported depression and hazardous alcohol use in retired elite male rugby players was significantly higher than in control groups matched for age and education. Our review found relatively high prevalence rates of musculoskeletal health conditions such as osteoarthritis and psychological health conditions such as depression and hazardous alcohol use in retired elite male rugby players. More research needs to be conducted to understand better the health conditions of retired elite rugby players, especially among retired elite female players.

## INTRODUCTION

Rugby is a popular high-speed collision sport played mainly in two variations worldwide: rugby union and rugby league (both referred to as rugby hereafter). As a result of the physical demands of professional rugby and the psychological demands of training and performing at an elite level for extended periods, rugby players experience various physical and psychological challenges during their playing days.<sup>1-7</sup>

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Rugby has one of the highest injury rates of all sports and elite rugby players are likely to sustain serious injuries.
- ⇒ The most-reported injury in professional rugby is concussion while active elite rugby players also experience various musculoskeletal and psychological health conditions.
- ⇒ Elite male rugby players experience various health challenges after ending their playing careers.

## WHAT THIS STUDY ADDS

- ⇒ There are no studies on the prevalence of health conditions in retired elite female rugby players.
- ⇒ Multiple studies show symptoms of psychological health conditions, such as self-reported depression and hazardous alcohol use, and osteoarthritis are prevalent in retired elite male rugby players.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ More research on the health conditions of retired elite rugby players needs to be conducted to provide a clearer picture and raise awareness of the health challenges former players are likely to face.
- ⇒ The findings from this scoping review could be of value to all stakeholders in rugby to ensure better care and assistance for retired rugby players.

Rugby has one of the highest injury rates of all sports,<sup>1</sup> and elite rugby players are more likely to sustain serious injuries that require hospitalisation and surgery than athletes from non-contact sports.<sup>2</sup> The most-reported injury in professional rugby is concussion, followed by upper/lower back and knee ligament injuries.<sup>3</sup> There have also been several reports of rugby players experiencing cardiovascular health problems (eg, cardiac arrest) during professional rugby matches.<sup>4-6</sup> At the same time, there is evidence that more than a quarter of professional rugby players will experience depression and anxiety symptoms over 12 months.<sup>7</sup>

A scoping review conducted in 2020 mapped the body of research on the relationship between rugby union (including elite rugby

union) and health.<sup>8</sup> Scientific research on the prevalence of health conditions in retired elite and amateur rugby players is less readily available than on current players. The existing evidence denotes that retired elite male rugby players experience various problems in the following areas: musculoskeletal, cardiovascular, neurocognitive and psychological.<sup>3 9–13</sup> In particular, the neurocognitive health of retired athletes has received increasing attention in recent years as a result of high-profile cases of retired athletes experiencing neurocognitive problems and as the advances in neuroscientific research have shed light on the long-term effects of repetitive head trauma.<sup>14 15</sup> Identifying the nature and extent of available research evidence on the prevalence of health conditions in retired elite male and female rugby players is essential in understanding their health challenges and needs related to postsport care and assistance.

This scoping review aims to present an overview of the existing epidemiological evidence in retired male and female elite rugby players regarding the prevalence rates of musculoskeletal, cardiovascular, neurocognitive, psychological and gynaecological health conditions. This scoping review constitutes the first step of a more extensive research project to enhance a transitioning health examination for retired elite male and female rugby players in South Africa. The identified gaps in knowledge can also guide future studies on the areas where more research needs to be conducted. The findings from this scoping review could be of value to all stakeholders in rugby to ensure better care and assistance for retired rugby players.

## METHODS

### Design

This scoping review was based on the Johanna Briggs Institute (JBI) framework,<sup>16</sup> which is underpinned by the Arksey and O'Malley framework.<sup>17</sup> The scoping review was written with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews Checklist.<sup>18</sup>

### Databases

We selected the following databases for the search: MEDLINE (via PubMed), SPORTDiscus (via EBSCOhost), PsycINFO (via EBSCOhost) and EMBASE.

### Search strategy

A systematic search was carried out across the selected electronic databases. The keywords (and synonyms) used in all the databases were 'rugby', 'retired' and 'health conditions'. Where appropriate, the MeSH terms for the various keywords were used for MEDLINE. The Boolean command 'OR' was used to combine synonyms and was also used between different disorders in each health domain. The keywords (and synonyms) were combined using the Boolean command "AND." The search strategy was customised for each database and is outlined in online supplemental appendix S1A.

### Inclusion criteria

The following inclusion criteria were defined and applied:

- ▶ Retired elite male and female rugby players who participated at the highest or second highest national or professional levels.
- ▶ Studies describing the prevalence rates of health conditions such as musculoskeletal (eg, osteoarthritis, OA), cardiovascular (eg, AF), neurocognitive (eg, dementia), psychological (eg, nutritional behaviour, disordered eating, irritability, sleep, smoking, alcohol misuse) and gynaecological (eg, reproduction, menstruation, hormones).
- ▶ Primary prospective and retrospective research studies, cross-sectional studies and case-control studies.
- ▶ Studies written in English, Dutch, or French.
- ▶ Studies with full text available online.

### Source selection

Author JLR and coauthor FA conducted the search on 22 September 2022 (MEDLINE, SPORTDiscus, PsycINFO and EMBASE) and 15 January 2023 (MEDLINE). All articles were imported to Rayyan—Intelligent Systematic review. After duplicate articles were removed, the lead author (JLR) and coauthor (FA) independently screened the titles and abstracts identified by the search strategy against the inclusion criteria and excluded unsuitable articles (after discussion when appropriate). The full texts of the included titles and abstracts were then read and screened against the inclusion criteria. The articles that did not meet the inclusion criteria were excluded. Any disagreements on the inclusion of a study were solved by a third reviewer (VG). The selected study's reference lists were also screened to ensure that relevant articles were not omitted.

### Critical appraisal

For evaluation of the quality of the included articles as well as how the articles tried to address bias, the JBI Critical Appraisal Checklist for Studies Reporting Prevalence Data (online supplemental appendix S2B) was used.<sup>19</sup> The checklist contains nine questions to be answered with 'yes,' 'no,' 'unclear' or 'not relevant.'. The lead author (JLR) and coauthor (FA) independently appraised all included articles. The findings of this process were used to guide the interpretation of the study's results in the discussion section.

### Data charting

A data-charting form was created using Word to include the following information: article details (eg, author(s)), demographics of the study population (eg, age), demographics of the control group if included (eg, age), study design and aim, health domain explored in the study, assessment method of the health condition (eg, questionnaire), and prevalence of health condition in study population and control group. The extracted data were

informed by previous reviews<sup>8 20</sup> and discussions within the research team.

## RESULTS

### Search results

The study selection process is described in a PRISMA flow chart (online supplemental figure S1: PRISMA flow chart displaying the study selection process). Following the search, 573 citations were identified and after removing duplicates, 444 remained. After screening the remaining articles a further 391 were removed due to not meeting the inclusion criteria. The full text articles of the remaining 53 studies were assessed for eligibility. Subsequently, 37 articles were excluded due to having the incorrect outcome (6), incorrect population (10), incorrect study design (3), incorrect publication type (16) or the results were presented in another included study (2). Ultimately, 16 studies were included in the scoping review.<sup>2 3 9 13 21–32</sup>

All 16 included articles describe studies conducted only among male participants. Nine articles focused on retired rugby union players, five on retired rugby league players and two on retired players from both versions. The studies included participants from various countries: France (2), the UK (6), Australia (4) and New Zealand (1). Two studies included participants from multiple countries, and one did not specify which country the participants were from.

Six articles provided prevalence rates on musculoskeletal health conditions, 2 on cardiovascular health conditions, 10 on psychological health conditions and 6 on neurological health conditions. Several studies reported on combined health conditions while three reported on other health conditions that did not fall into the previously mentioned categories, namely asthma, diabetes, stroke and disabling headaches. No studies on gynaecological health were found.

### Critical appraisal

Two studies did not meet the appropriate sample frame of the research problem.<sup>23 25</sup> Gouttebauge *et al* focused only on retired elite rugby players who were younger than 51 years of age,<sup>25</sup> while Gallo *et al*<sup>23</sup> studied participants who were 50 years and older.<sup>23</sup> An appropriate statistical analysis was given in four studies.<sup>25 27–29</sup> In the other 12 studies, there was no 95% CI provided with the prevalence rates.<sup>3 9 13 21–26 30–33</sup> In 10 studies, the response rate was not described.<sup>2 3 13 21 24 26 27 30–32</sup> The full results of the critical appraisal are presented in online supplemental appendix S3C.

### Musculoskeletal health conditions

Six articles described outcomes relating to the musculoskeletal health of retired elite rugby players.<sup>3 9 21 27–29</sup> Four studies provided prevalence rates for OA (including hand OA, wrist OA and ankle OA),<sup>3 9 27 29</sup> three for pain (including neck, back, joint and hand pain),<sup>3 21 27</sup> one article described prevalence rates for joint replacement

(including hip and knee replacement)<sup>9</sup> and one provided prevalence rates for chronic orthopaedic problems as well as osteoporosis. The essential information from the six studies is summarised in online supplemental appendix table S1—musculoskeletal health conditions in retired elite rugby players.

The presence of general OA was measured through self-report questionnaires that required participants to indicate if they had been diagnosed with this health condition, and the prevalence range was 51%–60%.<sup>3 9</sup> Hind *et al*<sup>3</sup> reported a significant difference in the prevalence of OA in elite retired rugby players (51%) compared with non-contact retired sportsmen (22%) ( $p < 0.05$ ).<sup>3</sup> There was no significant difference in the prevalence of hand OA (4%) and wrist OA (2%) compared with former professional cricket players (hand OA: 2%, wrist OA: 2%).<sup>27</sup> There was also no significant difference in the prevalence of ankle OA (5%) compared with retired professional football players (9%).<sup>29</sup>

Pain was assessed using self-report questionnaires and standardised instruments.<sup>3 21 27</sup> Neck pain, assessed with the Neck Disability Index, was significantly more prevalent in retired rugby players (51%) compared with matched controls from the general population (32%) ( $p = 0.01$ ).<sup>21</sup> The prevalence of disabling neck pain was also higher in retired rugby players (3%) compared with the general population (1%).<sup>21</sup> The prevalence of hand pain, assessed with the National Health and Nutrition Examination Survey (NHANES) criteria, was significantly higher in retired elite cricket players (20%) compared with retired elite rugby players (10%).<sup>27</sup> Back pain and severe and regular joint pain, assessed through self-report questions, were more prevalent in retired professional rugby players (80%–64%) than in retired amateur rugby players (75%–53%) and retired non-contact athletes (69%–47%). However, no significant difference was indicated.<sup>3</sup>

Joint, knee and hip replacement were measured through self-reported questions that required participants to indicate if they had been diagnosed with this health condition.<sup>9</sup> The prevalence rate of joint replacement was 24%, hip replacement was 15%, knee replacement was 9% and no control group was used in this study.<sup>9</sup>

The prevalence of osteoporosis was assessed by asking if this health condition had been diagnosed by a physician.<sup>9</sup> The prevalence of osteoporosis was 4%, and there was no control group in the study.<sup>9</sup>

Chronic orthopaedic problems (no specific definition provided) were examined through a self-report inventory, revealing a higher prevalence rate in retired rugby players (14%) compared with the matched control group (3%); however, no significance value for this difference was provided.<sup>28</sup>

### Cardiovascular health conditions

Three articles described the prevalence of cardiovascular health conditions in retired elite male rugby union players.<sup>9 23 28</sup> Heart conditions were measured through

self-report questionnaires, and prevalence rates for heart problems, cardiovascular disorder and hypertension were provided. The essential information from the three studies is summarised in online supplemental appendix table S2—cardiovascular health conditions in retired elite rugby players.

The prevalence rate for heart problems in former elite male rugby players was 18% and hypertension had a prevalence range of 28%–32%.<sup>9,23</sup> There were no control groups in these studies.<sup>9</sup> Retired elite male rugby players had a prevalence rate of 2% for cardiovascular disorder, while the control group matched for age and social deprivation had a prevalence rate of 21%.<sup>28</sup>

### Neurocognitive health conditions

Six articles described the prevalence of the following neurocognitive health conditions: neurological abnormalities, dementia, neurological disease, mild cognitive disorder, cognitive decline, the presence of abnormal cavum septum pellucidum (CSP) and Parkinson's disease.<sup>9,21,22,28,30,31</sup> The studies used questionnaires, standardised assessment tools and MRI scans to obtain information. The essential information from the six studies is included in online supplemental appendix table S3: neurocognitive health conditions in retired elite rugby players.

### Neurological

Neurological abnormalities were assessed using Japanese Orthopaedic Association scores (JOA scores).<sup>21</sup> A JOA score of 15/17 was the limit value of neurological abnormality. In the study, 1 of the 101 participants had a neurological abnormality, giving a prevalence rate of 1%. The prevalence rate in the control group was not provided.

A prevalence rate of 3% was reported for neurological disease in retired elite rugby players, which was less than the prevalence rate in retired elite sportsmen from other sports (4%).<sup>22</sup> However, the difference was not statistically significant ( $p=0.763$ ).

Dementia was reported with a prevalence rate of 1% in former rugby players, while the prevalence rate for the control group was not provided.<sup>9</sup> One of 52 participants reported they had been diagnosed with Parkinson's disease (prevalence of 2%), and the prevalence rate in the control group of 29 was 0%.<sup>28</sup>

### Cognitive

Mild cognitive disorder was assessed with the French Telephone Interview for Cognitive Status, with a score below or equal to 30 considered a mild cognitive disorder. The prevalence of mild cognitive disorder in rugby participants (57%) was significantly higher compared with other retired sportsmen (40%) ( $p=0.005$ ).<sup>22</sup>

Cognitive decline was assessed with the Informant Questionnaire Cognitive Decline in the Elderly.<sup>31</sup> Cut-off scores indicating likely dementia vary from 3.3 to 3.6 and above.<sup>34</sup> The prevalence of cognitive decline with a

cut-off point of 3.88 was 8%, and the prevalence of cognitive decline with a cut-off point of 3.38 was 29%. There was no control group.

An abnormal CSP was measured with an MRI scan, which two raters assessed.<sup>30</sup> A non-significant difference was reported for abnormal CSP in former rugby players (61%), compared with the controls (42%) ( $p=0.08$ ).

### Psychological health conditions

Ten studies describe the following mental health conditions in retired elite rugby players: depression, anxiety, stress, distress, sleep disturbance, alcohol misuse, nutrition behaviour, irritability, smoking behaviour and drug use.<sup>2,9,13,22,24–26,28,31,32</sup> The essential information from the 10 studies is included in online supplemental appendix table S4: psychological health conditions in retired elite rugby players.

### Depression and anxiety

Seven studies described depression in retired professional rugby players,<sup>2,9,13,22,26,28,31</sup> four described the prevalence of anxiety,<sup>2,9,13,26</sup> while one study described the prevalence rate of depression or anxiety.<sup>25</sup>

The prevalence of depression or anxiety was 28% and was measured with the 12-Item General Health Questionnaire (GHQ-12).<sup>25</sup> There were no control groups in the studies. The depression prevalence range in the other studies was 6%–49%.<sup>2,9,13,22,26,28,31</sup> One study used the GHQ-12,<sup>13</sup> two used the Depression Anxiety Stress Scales (DASS),<sup>26,31</sup> one used the Patient Health Questionnaire-9<sup>22</sup> and three used self-report questionnaires.<sup>2,9,28</sup> One study showed a significant difference in self-reported depression prevalence between professional ex-rugby players (49%) and retired non-contact athletes (21%) ( $p=0.001$ ).<sup>13</sup> In another study, there was a non-significant difference in depression prevalence between professional ex-rugby players (11%) and amateur rugby players (10%) as well as non-contact players (9.5%) (elite rugby vs community rugby, relative percentage 1.1 (95% CI 0.6 to 2.0)) (elite rugby vs non-contact players, relative percentage 0.9 (0.4–1.9)).<sup>2</sup> Two studies described the prevalence of depression in multiple stages. The prevalence of moderate depression was 10%–11% and severe depression was 4%–5%.<sup>26,31</sup>

The prevalence of anxiety among retired professional rugby players varied between 5% and 42%.<sup>2,9,13,26</sup> A significantly higher prevalence of self-reported anxiety among retired elite rugby players (42%) compared with amateur rugby players (23%) was reported ( $p=0.009$ ).<sup>13</sup> One study reported a non-significant difference between retired elite rugby players (5%) and community rugby players (8%) (elite rugby vs community rugby, relative percentage 0.6 (95% CI 0.3 to 1.5)), and retired elite rugby players and non-contact sportsmen (7%) (elite rugby vs non-contact sports, relative percentage 0.7 (95% CI 0.2 to 2.2)).<sup>2</sup> One study also reported the prevalence of multiple anxiety stages.<sup>26</sup> This study reported an 8%

prevalence of mild anxiety, 6% moderate anxiety and 5% severe anxiety.

### Stress

The prevalence of stress was described in one study using the DASS-21.<sup>26</sup> The prevalence rate of retired rugby players with moderate stress was 9%, and severe stress was 6%. Distress was described in one study that used the four-dimensional symptom questionnaire and reported a prevalence rate of 25%.<sup>25</sup>

### Sleep disturbance

One study assessed sleep disturbance using the Patient-Reported Outcome Measurement Information System, where a score of 1 or more indicated a sleeping disturbance.<sup>25</sup> The prevalence rate in retired rugby players was 28%.

### Irritability

Irritability was assessed using the Spielberger Anger Expression Scale.<sup>13</sup> There was a significant difference in the prevalence of irritability in retired elite rugby players (52%) compared with retired amateur rugby players (42%) ( $p < 0.001$ ). No  $p$  value was mentioned for the difference between the prevalence in retired elite rugby players and non-contact athletes (18%).

### Nutrition behaviour

Nutrition behaviour was assessed with questions about the participants' eating habits.<sup>25</sup> Adverse nutrition behaviour was reported when individuals consumed healthy meals less than 5 days (per week, had irregular eating patterns on less than 3 days per week, had breakfast before 10:30 less than 3 days per week, and had a final meal before 20:30 less than 3 days per week).<sup>25</sup> The prevalence of adverse nutrition behaviour was 24%.<sup>25</sup>

### Alcohol use

All the studies that described alcohol misuse in retired professional rugby players used the Alcohol Use Disorder Identification Test.<sup>2 13 24–26 31 32</sup> The two studies that used a value of 5 or above to indicate adverse alcohol behaviour reported 24%–59% prevalence rates.<sup>13 25</sup> One study used a value of 8 or above to indicate hazardous drinking and reported a prevalence of 38% in retired elite rugby players.<sup>2</sup> This was slightly lower than the prevalence rate in retired community rugby players (40%) (elite rugby vs community rugby, relative percentage 1.0 (95% CI 0.7 to 1.2)), but was significantly higher compared with retired non-contact sport players (25%) (non-contact players vs elite rugby, relative percentage 1.5 (95% CI 1.0 to 2.4)). The two studies that provided multiple breakdown limit values reported prevalence ranges of 46%–54% for hazardous alcohol use, 8%–9% for harmful levels and 9%–15% for high-risk levels.<sup>24 32</sup> In both studies, there were significant differences compared with the control groups matched for age and education ( $p < 0.01$ ). Two studies reported the prevalence of multiple levels of alcohol use.<sup>26 31</sup> The prevalence of a risky or hazardous

level was 36%–37%, a harmful level was 5%, and a high risk was 2%.<sup>26</sup>

### Smoking, cannabis and drug use

Adverse smoking behaviour and cannabis and drug use in retired professional rugby players were assessed using a questionnaire.<sup>25 26 31</sup> A prevalence rate of 15% was indicated for adverse smoking behaviour.<sup>25</sup> The prevalence range for cannabis use in the past 6 months was 2%–5%, and the prevalence of illicit drug use in the past 6 months was 5%–13%.<sup>26 31</sup> No control groups were used in the studies.

### Other health conditions

Three studies described health conditions that did not fit into the above-mentioned categories using questionnaires: asthma, diabetes, stroke and disabling headaches.<sup>9 22 23</sup> The essential information from the three studies is included in online supplemental appendix table S5: other health conditions in retired elite rugby players.

Asthma was present in 10% of the retired elite male rugby players,<sup>9</sup> diabetes had a prevalence range of 2%–4%.<sup>9 23</sup> and one study provided the prevalence rate of stroke as 3%.<sup>9</sup>

The prevalence of disabling headaches among retired rugby players was assessed using the Head Impact Test-6 (HIT-6).<sup>22</sup> A headache was considered disabling, with a HIT-6 score of 50. The prevalence rate of 16% in the rugby participants was not significantly different compared with that of participants who played another sport (13%) ( $p = 0.503$ ).<sup>22</sup>

## DISCUSSION

This scoping review aimed to present the prevalence of health conditions in retired elite male and female rugby players. No studies on health conditions in retired elite female rugby players were found. There was a higher prevalence rate of OA (51%–60%) in retired elite male rugby players compared with non-contact retired male athletes and former community male rugby players.<sup>3 9</sup> The prevalence of cardiovascular disorders in retired elite male rugby players was lower (2%) than the control group matched for age and social deprivation (21%),<sup>28</sup> while the prevalence rate for hypertension in retired elite male rugby players was 28%–32%.<sup>9 23</sup> Various neurocognitive health conditions in retired elite male rugby players were investigated and showed, among others, a prevalence rate of 57% for mild cognitive disorders.<sup>22</sup> The prevalence of self-reported depression in retired elite male rugby players was up to 49% and one study showed the prevalence rate was significantly higher than in retired community male rugby players or retired male athletes from non-contact sports.<sup>13</sup> Retired elite male rugby players had a prevalence rate of 5%–49% for anxiety symptoms<sup>2 9 13 26</sup> and 46%–54% for hazardous alcohol use.<sup>24 32</sup>

## Perspective of the findings

Our scoping review showed a significantly higher prevalence of OA in retired elite male rugby players (51%) compared with retired non-contact elite athletes (22%). In other literature, this prevalence rate also appears to be much higher compared with the general population.<sup>35 36</sup> Depending on various factors such as its definition and diagnosis, age, sex and study region, the prevalence of OA ranges from 12% to 22% in the general population.<sup>35 36</sup> However, hand OA, wrist OA and ankle OA prevalence rates were similar or lower in retired elite male rugby players compared with retired elite cricket and football players. Further research on hip, knee and shoulder OA in retired elite rugby players is required as repeated joint load in rugby likely increases the risk of developing OA.<sup>37</sup> It will be essential for this research to include retired elite female rugby players as this health condition is more prevalent in females than in males.<sup>38</sup>

Our review also found that the prevalence of self-reported depression was as high as 49% in retired elite male rugby players, being significantly higher compared with retired community male rugby players and retired male non-contact sport athletes. In general, depression affects approximately 4% of people, with this rate growing to 5% in adults and 6% in persons over 60 years.<sup>39</sup> In active elite athletes (Olympic or professional), a meta-analysis found a prevalence rate of 34% for anxiety/depression, and among former elite athletes who competed at varsity, professional, national or international level, the prevalence of depression ranged from 5% to 29%.<sup>40 41</sup> This scoping review also found a similar prevalence rate for anxiety/depression in retired elite male rugby players (28%–29%) compared with active elite rugby players (28%) and retired elite football players (26%–39%).<sup>20 42</sup>

The findings of this scoping review showed retired elite male rugby players present with a higher prevalence rate for hazardous alcohol use (46%–54%) compared with other former elite athletes (eg, 32% in former elite football players, 19% in former elite athletes from a variety of sports).<sup>20 40</sup>

The limited data on the prevalence rates of neurocognitive and cardiovascular health conditions in retired elite male rugby players makes it difficult to compare these findings to other studies.

## Limitations of the review

This is the first scoping review that presented an overview of the prevalence of health conditions in retired elite male and female rugby players. All 16 included studies focused only on retired elite male rugby players. As there is a difference in the incidence of injuries between male and female rugby players, the results of this review do not apply to retired elite female rugby players.<sup>43 44</sup> Male college rugby players have a 30% higher incidence of injuries than female college rugby players.<sup>43</sup> The types of injuries also differ between the two groups.

All the studies used questionnaires or interviews to determine the health conditions, which could have

affected the accuracy of the prevalence rates. Self-reporting measures could lead to under-reporting certain health conditions or behaviours, such as depression or alcohol use. A systematic review of the prevalence of psychological distress in retired elite athletes found that studies that used a postcareer clinical diagnosis had a higher prevalence rate for depression than studies that relied on self-report measures.<sup>41</sup> As a result, there could be under-reporting of certain health conditions in the studies included in our review.

Selected studies in this scoping review made use of self-reported physician-diagnosed outcomes. As certain diagnoses differ depending on the physician or contexts, different diagnostic criteria or methods may have been used to make certain diagnoses. This could have impacted the prevalence rates for some of the health conditions.

The studies that examined the prevalence of neurocognitive health conditions investigated different health problems, which meant it was impossible to compare these studies' outcomes. Also, due to the difference in limit values for depression, irritability and alcohol misuse, some results were not comparable.

Assessing the quality of included studies is optional in scoping reviews, however, all included studies were critically appraised using the JBI checklist for prevalence studies. The checklist was created through collaboration between JBI, who are considered leaders in the field of scoping reviews due to their extensive contribution to the advancement of scoping reviews, and other experts.<sup>19</sup> This tool is open to interpretation and does not summarise the quality appraisal into a numeric score, however, all papers were rigorously appraised by two authors and significant methodological issues were highlighted.

## Implications for research

No studies providing prevalence rates of health conditions in retired elite female rugby players were found. Therefore, this area requires further research, including studying gynaecological health conditions in retired elite female rugby players. The number of female rugby players increased by 27% between 2017 and 2019 and is expected to continue growing due to the accelerating the global development of women in rugby 2017–2025 programme.<sup>45</sup> As a result, an increasing number of elite female rugby players will retire in the upcoming years, which should facilitate further research into this population.

A better understanding of the health challenges of retired elite male and female rugby players is also required, especially during the early years of retirement. Newly retired elite athletes may be more likely to experience, for example, mental health difficulties.<sup>46</sup> Exploring the difference between the health conditions in retired elite male and female rugby players and the ages at which certain health conditions likely start to develop could also lead to better care for former elite rugby players.

## Implications for practice

This scoping review found that elite male rugby players may experience a wide range of health conditions during retirement which could impact their quality of life.<sup>8,47</sup> As a result, former elite rugby players require unique and thorough support during their retirement years. One of the support measures which was developed to improve the quality of life and long-term health of former professional male and female rugby players is the After Rugby Career Consultation (ARCC).<sup>48</sup> The ARCC was developed based on scientific evidence and according to the needs of active and retired players, to be implemented as a transitioning health examination for retired elite rugby players. A similar approach has been implemented globally in professional football. A number of key stakeholders in South African rugby, including the South African Rugby Union, MyPlayers and the South African Rugby Legends Association, have allied to trial the ARCC within the context of South African rugby.<sup>48</sup>

## CONCLUSION

This was the first scoping review to present the prevalence of health conditions in retired elite rugby players. No studies on health conditions in elite female retired rugby players were found. Our review found relatively high prevalence rates of musculoskeletal health conditions such as OA and psychological health conditions such as depression and hazardous alcohol use in retired elite male rugby players. More research needs to be conducted to understand better the health conditions of retired elite rugby players, especially among retired female players. More support should also be made available to this population, in particular during their early years of retirement as they transition out of elite rugby

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**Contributors** All coauthors contributed to the development of the search strategy. JLR and FA conducted the search strategy, study selection process, critical appraisal and data charting, with the other authors responsible for the control of these steps. JLR, DCJvR and VG wrote the initial draft of the manuscript, with FA and GK contributing to subsequent iterations. The final manuscript was agreed and approved by all authors prior to submission.

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## REFERENCES

- Williams S, Trewartha G, Kemp S, et al. A meta-analysis of injuries in senior men's professional Rugby Union. *Sports Med* 2013;43:1043–55.
- Hume PA, Quarrie KL, Lewis GN, et al. NZ-RugbyHealth study: self-reported injury experience and current health of former rugby Union and non-contact sport players. *Sports Medicine* 2022;52:1701–13.
- Hind K, Konerth N, Entwistle I, et al. Cumulative sport-related injuries and longer term impact in retired male Elite- and Amateur-Level rugby code athletes and non-contact athletes: a retrospective study. *Sports Medicine* 2020;50:2051–61.
- Fisher S. WP Rugby Player recovers after heart attack. 2015. Available: <https://ewn.co.za/2015/09/08/20-year-old-rugby-play-recovering-after-heart-attack>
- News24. Heart attack 'shows need for medics. 2012. Available: <https://www.news24.com/witness/Archive/Heart-attack-shows-need-for-medics-20150430>
- Weekes J. Rugby Player fights back after heart attack during game. 2016. Available: <https://www.stuff.co.nz/sport/rugby/82233180/rugby-player-fights-back-after-heart-attack-during-game>
- Goutteborge V, Goedhart E, Kerkhoffs G. Empowering the health of retired professional Footballers: the systematic development of an after career consultation and its feasibility. *BMJ Open Sport Exerc Med* 2018;4:e000466.
- Griffin SA, Panagodage Perera NK, Murray A, et al. The relationships between Rugby Union, and health and well-being: a Scoping review. *Br J Sports Med* 2021;55:319–26.
- Davies MAM, D Judge A, Delmestri A, et al. Health amongst former Rugby Union players: A cross-sectional study of morbidity and health-related quality of life. *Sci Rep* 2017;7:11786.
- Curtis GL, Chughtai M, Khlopas A, et al. Impact of physical activity in cardiovascular and musculoskeletal health: can motion be medicine? *J Clin Med Res* 2017;9:375–81.
- Morissette MP, Prior HJ, Tate RB, et al. Associations between concussion and risk of diagnosis of psychological and neurological disorders: a retrospective population-based cohort study. *Fam Med Community Health* 2020;8:e000390.
- Hume PA, Theadom A, Lewis GN, et al. A comparison of cognitive function in former Rugby Union players compared with former non-contact-sport players and the impact of concussion history. *Sports Med* 2017;47:1209–20.
- Hind K, Konerth N, Entwistle I, et al. Mental health and wellbeing of retired elite and amateur Rugby players and non-contact athletes and associations with sports-related concussion: the UK Rugby health project. *Sports Med* 2022;52:1419–31.
- Cunningham J, Broglio S, Wilson F. Influence of playing rugby on long-term brain health following retirement: a systematic review and narrative synthesis. *BMJ Open Sport Exerc Med* 2018;4:e000356.
- Manley G, Gardner AJ, Schneider KJ, et al. A systematic review of potential long-term effects of sport-related concussion. *Br J Sports Med* 2017;51:12:969–77..
- Aromataris A, Munn Z. JBI manual for evidence synthesis. Adelaide: Joanna Briggs Institute, 2020.
- Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 2005;8:32:19–32.
- Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for Scoping reviews (PRISMA-SCR): checklist and explanation. *Ann Intern Med* 2018;169:467–73.
- Munn Z, Moola S, Lisy K, et al. Methodological guidance for systematic reviews of observational Epidemiological studies reporting prevalence and incidence data. *Int J Evid Based Healthc* 2015;13:147–53.
- Carmody S, Anemaat K, Massey A, et al. Health conditions among retired professional Footballers: a Scoping review. *BMJ Open Sport Exerc Med* 2022;8:e001196.



- 21 Brauge D, Delpierre C, Adam P, *et al.* Clinical and radiological Cervical spine evaluation in retired professional Rugby players. *J Neurosurg Spine* 2015;23:551–7.
- 22 Decq P, Gault N, Blandeau M, *et al.* Long-Term consequences of recurrent sports concussion. *Acta Neurochir* 2016;158:289–300.
- 23 Gallo V, McElvenny DM, Seghezzi G, *et al.* Concussion and long-term cognitive function among Rugby players-the BRAIN study. *Alzheimers Dement* 2022;18:1164–76.
- 24 Gardner AJ, Iverson GL, Wojtowicz M, *et al.* Mr spectroscopy findings in retired professional rugby League players. *Int J Sports Med* 2017;38:241–52.
- 25 Gouttebauge V, Kerkhoffs G, Lambert M. Prevalence and determinants of symptoms of common mental disorders in retired professional rugby union players. *Eur J Sport Sci* 2016;16:595–602.
- 26 Iverson GL, Van Patten R, Terry DP, *et al.* Predictors and correlates of depression in retired elite level Rugby League players. *Front Neurol* 2021;12:655746.
- 27 Jones ME, Davies MAM, Shah K, *et al.* The prevalence of hand and wrist osteoarthritis in elite former cricket and Rugby Union players. *J Sci Med Sport* 2019;22:871–5.
- 28 McMillan TM, McSkimming P, Wainman-Lefley J, *et al.* Long-term health outcomes after exposure to repeated concussion in elite level: Rugby Union players. *J Neurol Neurosurg Psychiatry* 2017;88:505–11.
- 29 Paget LDA, Aoki H, Kemp S, *et al.* Ankle osteoarthritis and its association with severe ankle injuries, ankle surgeries and health-related quality of life in recently retired professional male football and Rugby players: a cross-sectional observational study. *BMJ Open* 2020;10:e036775.
- 30 Stanwell P, Iverson GL, Van Patten R, *et al.* Examining for cavum septum pellucidum and ventricular enlargement in retired elite-level rugby League players. *Front Neurol* 2022;13:817709.
- 31 Van Patten R, Iverson GL, Terry DP, *et al.* Predictors and correlates of perceived cognitive decline in retired professional Rugby League players. *Front Neurol* 2021;12:676762.
- 32 Wright DK, Gardner AJ, Wojtowicz M, *et al.* White matter abnormalities in retired professional Rugby League players with a history of concussion. *J Neurotrauma* 2021;38:983–8.
- 33 Brown JC, Kerkhoffs G, Lambert M, *et al.* Forced retirement from professional Rugby Union is associated with symptoms of distress. *Int J Sports Med* 2017;38:582–7.
- 34 Ding Y, Niu J, Zhang Y, *et al.* Informant questionnaire on cognitive decline in the elderly (IQCODE) for assessing the severity of dementia in patients with Alzheimer's disease. *BMC Geriatr* 2018;18:146.
- 35 Litwic A, Edwards MH, Dennison EM, *et al.* Epidemiology and burden of osteoarthritis. *Br Med Bull* 2013;105:185–99.
- 36 Palazzo C, Nguyen C, Lefevre-Colau M-M, *et al.* Risk factors and burden of osteoarthritis. *Ann Phys Rehabil Med* 2016;59:134–8.
- 37 Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clin Geriatr Med* 2010;26:355–69.
- 38 Safiri S, Kolahi A-A, Smith E, *et al.* Global, regional and national burden of osteoarthritis 1990-2017: a systematic analysis of the global burden of disease study 2017. *Ann Rheum Dis* 2020;79:819–28.
- 39 World Health organization. Depression. 2021. Available: <https://www.who.int/news-room/fact-sheets/detail/depression>
- 40 Gouttebauge V, Castaldelli-Maia JM, Gorczynski P, *et al.* Occurrence of mental health symptoms and disorders in current and former elite athletes: a systematic review and meta-analysis. *Br J Sports Med* 2019;53:700–6.
- 41 Mannes ZL, Waxenberg LB, Cottler LB, *et al.* Prevalence and correlates of psychological distress among retired elite athletes: a systematic review. *Int Rev Sport Exerc Psychol* 2019;12:265–94.
- 42 Gouttebauge V, Hopley P, Kerkhoffs G, *et al.* A 12-month prospective cohort study of symptoms of common mental disorders among professional rugby players. *Eur J Sport Sci* 2018;18:1004–12.
- 43 Peck KY, Johnston DA, Owens BD, *et al.* The incidence of injury among male and female intercollegiate rugby players. *Sports Health* 2013;5:327–33.
- 44 Toohey LA, Drew MK, Finch CF, *et al.* A 2-year prospective study of injury epidemiology in elite Australian rugby Sevens: exploration of incidence rates, severity, injury type, and subsequent injury in men and women. *Am J Sports Med* 2019;47:1302–11.
- 45 World Rugby. World Rugby launches global campaign to revolutionise women's Rugby. 2019. Available: <https://www.world.rugby/news/422288>
- 46 Gouttebauge V, Aoki H, Verhagen E, *et al.* Are level of education and employment related to symptoms of common mental disorders in current and retired professional Footballers *Asian J Sports Med* 2016;7:e28447.
- 47 Filbay S, Pandya T, Thomas B, *et al.* Quality of life and life satisfaction in former athletes: A systematic review and meta-analysis. *Sports Med* 2019;49:1723–38.
- 48 Gouttebauge V, Janse van Rensburg C, Kerkhoffs G. No time to waste: necessary health support for retired professional rugby players. *S Afr J Sports Med* 2021;33:1–3.