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# The multidimensional profiling of youth male rugby union players: a systematic scoping review, nominal group technique and survey

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**ABSTRACT**

This three-part study aimed to 1) investigate the most common profiling practices in male rugby union; 2) identify factors profiled within youth players; and 3) assess the importance of these factors for player progression and their measurement feasibility. Part one employed a systematic scoping review. For part two, expert practitioners participated in a Nominal Group Technique session to identify factors to profile within youth male rugby union. Part three included practitioners from a Tier One rugby nation and researchers, who ranked their agreement for the importance of the identified factors, and their measurement feasibility. The review identified 107 studies profiling 50 factors across five themes: physical ($n = 67$ studies), demographic ($n = 25$), psychological ($n = 20$), technical ($n = 20$), and tactical ($n = 6$). Expert practitioners reported an additional 20 factors that should be profiled. Over 70% of the survey participants agreed that 40 factors were important for progression and 28 factors were feasible to measure. Only 15 factors reached 70% agreement for both importance and feasibility, including strength, power, and games played. Factors across all themes were considered important, re-emphasising the need for multidimensional profiling within youth male rugby union. Further research is required to enhance the feasibility of measuring these factors and create a multidimensional player profile.

**KEYWORDS**

Rugby union; youth sport; multidimensional profiling

## Introduction

Talent identification and development within sport is a complex task. Talent identification (ID) comprises of recognition and selection of individuals, whereas talent development (TD) refers to the nurturing and advancement of individuals within their sport (Cobley et al., 2011). National governing bodies in rugby union (RU) aim to identify, select, and develop young RU players through age-grade performance pathways. These pathways have become common place as a cost-effective method of talent development and often include an academy structure which allows teams to nurture players prior to a professional contract through fostering technical, tactical, psychological, and physical qualities that are associated with RU performance (Bennett et al., 2019; Cunningham et al., 2018; Ungureanu, Brustio, et al., 2019; Ungureanu, Condello, et al., 2019). One process used within these pathways is a player profiling system, whereby players are assessed via a battery of objective and subjective assessments on a range of factors and characteristics for talent ID and development purposes (F. Dimundo, Cole, Blagrove, et al., 2021). Factors and characteristics refer to the qualities, features, or traits of an individual (and for the purpose of this study, will be referred to only as factors).

Previous research has critiqued current profiling practices for the absence of multidimensional profiling within RU (F. Dimundo, Cole, Blagrove, et al., 2021). It is noted that coaches within youth RU pathways have a propensity to select players based primarily upon physical characteristics, despite the players being at an age where physical attributes are largely governed by maturation status (Helsen et al., 2000; Malina, 2014; Marceau et al., 2011). Developing a multidimensional player profile would help provide a broader range of information to inform selection and development decisions, whilst promoting consistency between coaches and stages of the player pathway for talent ID and development. In order to develop a multidimensional player profile, understanding the factors that support the development of youth players and are important for progression through performance pathways is critical.

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Dimundo and colleagues (F. Dimundo, Cole, Blagrove, et al., 2021) recently undertook a systematic review, using Davids (Davids et al., 2012) ecological dynamic framework, highlighting the multidisciplinary nature of talent ID and development research in RU. However, the study only reviewed studies that were explicitly related to talent ID, yet there is a range of research that profiles RU players outside of TD settings. As such, solely including TD papers may lead to the exclusion of key factors that are important to progression within RU. No review has summarised the factors included in both TD and non-TD research. Mapping the existing literature regarding player profiling within male RU will expose the gaps in the current evidence base of multidimensional player profiling. Through a systematic approach of mapping evidence to identify main concepts and knowledge gaps, a scoping review is a fitting methodology to reach these objectives (Tricco et al., 2018). The systematic scoping review aimed to summarise the factors that have been profiled in male RU, which allowed identification of factors that were most frequently measured in the existing literature. However, the previously conducted systematic review by Dimundo and colleagues demonstrated the lack of practitioner insights into the most effective profiling tools (F. Dimundo, Cole, Blagrove, et al., 2021). Recognising this gap emphasises the need for a methodological framework that fosters practitioner engagement. The nominal group technique (NGT) utilises discussions with experts in small groups to communicate ideas around a topic (McMillan et al., 2016). The inclusion of an NGT would present ideas that have not been identified in the existing research, making the NGT an appropriate methodology for the study objectives.

Following the identification of factors, establishing which are important in contributing to the progression of a player through a performance pathway will aid the development of a multidimensional player profile. In the identification and rating of these factors, it is important to understand how the profiling processes can be implemented in practice. As such, assessing the feasibility of measurement of the factors is essential. A survey round can be used to collate opinions from a large group of participants, making a survey an appropriate methodology to assess the importance and feasibility of the holistic factors (T. L. Jones et al., 2013). Gaining opinions of practitioners and researchers, through both the NGT and survey, would aid the translation of this research into practice (B. Jones et al., 2019). Combining these three methodologies ensures a comprehensive examination of profiling practices within male RU, drawing on existing research and the opinions of both researchers and practitioners. The scoping review and the NGT session allow identification of a wide range of multidimensional factors to be included in the survey, which will then allow the rating of factors that are vital for supporting and developing youth RU players through a performance pathway.

Based on the above, the overall aim of this study was to provide insight into the factors that should be profiled within an elite youth male RU player pathway to support the development and aid progression. The study comprised of three parts, which aimed to 1) establish the most common actors for profiling RU players through a systematic scoping review, 2) identify the factors to profile within male youth RU players through a NGT and 3) rate the importance and feasibility of profiling these factors for the progression of male youth RU players through a player pathway.

## Methods

### Design

The present study follows a three-part design. Part one included a systematic scoping review of profiling within male RU, which was performed in line with the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses Search Extension for Scoping Review (Tricco et al., 2018). Part two was a modified NGT session whereby a group of seven expert practitioners working within youth male RU participated. The NGT session was conducted following the steps reported by McMillan and colleagues (McMillan et al., 2016), except the final step which was replaced by part three. Part three was a survey whereby practitioners from a Tier One RU nation performance pathway and a global sample of researchers from talent development ranked their agreement with the importance of the factors, identified in part one and two, for the progression of a player through a performance pathway. The survey also asked participants to rank their agreement with the feasibility of measuring each factor given the appropriate resources. The study received approval by the Leeds Beckett University ethics board, reference 134,840.

### Part 1: Systematic-scoping review of profiling within male RU

#### Search strategy

A search of three databases (PubMed, SPORT Discuss, SCOPUS) was conducted for peer-reviewed papers published from January 1995 (when RU became professional) to March 2023. The search strategy was established using existing published sports science reviews as a guide (F. Dimundo, Cole, Blagrove, et al., 2021; C. Owen et al.,

2020). The primary search term was 'rugby union' and terms that would enable studies that profile male RU players to be identified were linked using Boolean terms; 'male', 'adolescents', 'youth', 'teenagers', 'student', 'junior', 'academy', 'young adult', 'Fitness testing', 'physical characteristics', 'physical qualities', 'physical performance', 'physical profile', 'anthropometric', 'body height', 'body weight', 'skinfold', 'body composition', 'body fat', 'power', 'countermovement jump', 'vertical jump', 'muscular strength', 'acceleration', 'speed', 'sprint', 'running', 'agility', 'change of direction', 'fitness', 'physical fitness', 'aerobic capacity', 'cardiorespiratory fitness', 'repeated-sprint ability', 'anaerobic', 'psych*', 'mental', 'psychological characteristic*', 'psychological skill*', 'mindset', 'environment*', 'socio*', 'social', 'relative age*', 'matur*', 'participation history', 'holistic', 'technical', 'pass*', 'tackl*', 'ruck', 'carry', 'lineout', 'kick*', 'maul', 'tactical'. Reference lists of identified papers were also searched for eligible papers.

### Study selection

Once duplicates were removed, two researchers (EK, CR) independently screened the titles and abstracts of the search results against the eligibility criteria. Conflicts (n = 7) were resolved through discussion or, if required, through a third researcher (KT). Studies were considered eligible if they were peer-reviewed original research in the English language that investigated or used player profiling within male RU. Where a study included both men's and women's rugby players, the study was included if data was reported for men and women separately. Similarly, if studies included other sports than RU, if the RU data was reported separately it was included. Conference proceedings, case studies or studies where the full text was unavailable were excluded.

### Data charting

Data charting aided the extraction of relevant information from any identified studies and was performed by the lead author (EK), and cross-checked by two other authors (CR, KT) (Tricco et al., 2018). The following headings guided the data extraction:

(1) Author and Year of Publication
(2) Country of Origin
(3) Study Cohort
(4) Theme(s)
(5) Study Aims
(6) Factors Assessed

Studies were categorised into evidence-based themes that were determined by the study's primary aims and outcome measures (Heyward et al., 2022). The data chart is provided in Supplementary Information 1.

### Data analysis

The frequency of study characteristics (e.g., playing level of study population) and the prevalence of different factors (e.g., number of studies assessing lower body power) were quantified using R Studio (V4.1.2, R Foundation for Statistical Computing, Vienna, Austria).

## Part 2: Modified NGT session

Seven expert practitioners from three European Tier One RU nations were purposefully sampled and invited to participate in the NGT. Expert practitioners were defined as having ten or more years of experience as a practitioner within a performance pathway, which is the highest level of training and participation in a rugby nation for ages 16–20 years. Seven expert practitioners, with 19.5 ± 4.7 (mean ± SD) years experience, participated in the NGT session. The participants were asked to consider what factors need to be profiled to support the development of youth elite male RU players that were not identified through the systematic scoping review. The session included three steps: silent generation, where the group were given an opportunity to consider and write down their ideas based upon the presented findings and their own knowledge and experience; round robin, the experts reported back the factors they believed were missing from the scoping review; and clarification of ideas, which was an opportunity for the experts to discuss the ideas presented (McMillan et al., 2016).

## Part 3: Survey round

Forty-one practitioners from a European tier one RU nation were purposefully sampled as the total population of rugby coaches and support staff (i.e., athletic development, medical, performance analysis, team management) from one Tier One RU nation performance pathway that had a minimum of 3 years' experience working in a RU performance pathway. Participants were contacted directly by email. In addition, 34 expert researchers were purposefully sampled to participate in the survey round. They were identified through being the first, second, or last-named author on a paper within the scoping review and had to have published three or more studies in male youth rugby talent ID and development. Researchers that met these criteria were contacted through their email address found on publications, LinkedIn or Research Gate. Twenty practitioners and nine researchers completed the survey, a response rate of 38.7%. The practitioners had an average 11.7 ± 7.1 years of experience within a performance pathway as either rugby coaches, strength and

conditioning coaches, medical staff, team managers, or analysts.

### Survey

Through the online software Qualtrics (Qualtrics, Provo, USA), participants were provided with the list of factors that was collated following the scoping review and the NGT session. Participants were asked to rate their agreement with the importance of each factor in contributing to the progression of a male RU player through a performance pathway on a 3-point Likert scale (1 = disagree, 2 = neither agree nor disagree, 3 = agree). Participants were also asked to rank whether they agree that it is feasible to measure each factor as part of the profiling processes within a player performance pathway on a three-point Likert scale (1 = disagree, 2 = neither agree nor disagree, 3 = agree). To promote the completion of the survey, and due to the large number of items included in the survey, a 3-point scale was considered appropriate due to the perception of greater ease and speed of completion (Jacoby & Matell, 1971). The list of factors and definitions included in the survey is displayed in Supplementary Information 2.

### Data analysis

The percentage of participants that agreed with the importance and feasibility of each factor was calculated in R Studio (V4.1.2, R Foundation for Statistical Computing, Vienna, Austria). To establish which factors are considered the most important and feasible, a threshold of ≥70% of participants voted agree was set, based upon the agreement level used in previous studies (Heyward et al., 2022; Robertson et al., 2017; Scantlebury et al., 2022).

## Results

### Part 1: Systematic scoping review of profiling within male RU

### Search and selection of studies

The search identified 3198 articles. Following assessment for eligibility and the removal of duplicates, 107 studies were included in the scoping review. Figure 1 presents the details each step of this process.

***Date of studies.*** Of the 107 studies included in this systematic scoping review, 76 (71.0% of 107 studies) were published between 2013 and 2023 highlighting the recent growth in exploring profiling within male RU (Ashford et al., 2021; Atack et al., 2022; Barr, Newton, et al., 2014; Barr et al., 2014; Batista et al., 2018, 2019; Brown et al., 2015; Casserly et al., 2019; Chiwaridzo et al., 2019, 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015, 2016; Delahunt et al., 2013; den Hollander et al., 2019, 2021; DiCorrado et al., 2014; F. Dimundo, Cole, Blagrove, et al., 2021; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2018; Fontana et al., 2015, 2016; Fuller et al., 2013; Geeson-Brown et al., 2020; T. Grobler et al., 2016; T. D. Grobler et al., 2017; Hamilton & Gatherer, 2014; Hamlin et al., 2021; Heffernan et al., 2016; Hendricks et al., 2014, 2015; A. Hill et al., 2015; B. Jones et al., 2018; T. W. Jones et al., 2018; Kearney, 2017a, 2017b; Kelly, Jackson, et al., 2021; Kelly, Till, et al., 2021; Kobal et al., 2016; Krause et al., 2014; Lewis et al., 2015; Lombard et al., 2015; Martín et al., 2017; McAuliffe et al., 2022; McCarthy & Collins, 2014; McHugh et al., 2021; Morgan et al., 2020; C. Owen et al., 2020Nakamura et al., 2017, 2022; J. Owen et al., 2022; Parsonage et al., 2014; Posthumus et al., 2020; Rouquette et al., 2021; Rumbold et al., 2020; Runswick et al., 2020; Sherwood et al., 2019; Smart et al., 2013, 2014; Solis-Mencia et al., 2021; Stoop et al., 2018; Teece et al., 2021; Till et al., 2020; A. Ungureanu et al., 2022; Vachon et al., 2021; Vaz et al., 2014, 2015, 2019; Wang et al., 2016; Winn et al., 2016; Wood et al., 2018; Zemski et al., 2015). Twenty-six (24.3%) studies were published between 2003 and 2012 (Andrew et al., 2007; Argus et al., 2012; Correia et al., 2012; Durandt et al., 2006, 2011; Edwards & Edwards, 2012; Hamilton et al., 2012; Hansen et al., 2011; A. P. Hill & Appleton, 2011; Holland et al., 2010; Jarvis et al., 2009; R. Neil et al., 2006, 2012; Nicholls & Polman, 2007; Nicholls et al., 2006; Roberts & Fairclough, 2012; Sedeaud et al., 2012; Spamer, 2009a, 2009b; Spamer & De la Port, 2006; Van den Berg et al., 2012; Van Gent & Spamer, 2005; Vaz et al., 2012; Walsh et al., 2011; Wheeler & Sayers, 2009; Woodcock et al., 2011), and five (4.7%) published prior to 2003 (Pienaar & Spamer, 1998; Pienaar et al., 1998; Quarrie et al., 1995, 1996; Treasure et al., 2000).

***Geographical location of the studies.*** The studies were published in 16 different countries: Argentina, Australia, Brazil, England, France, Ireland, Italy, New Zealand, Portugal, Scotland, South Africa, Spain, Switzerland, USA, Wales, and Zimbabwe. England accounted for the highest proportion of published studies (n = 31, 29.0% of 107 studies) (Ashford et al., 2021; Atack et al., 2022; Darrall-Jones et al., 2015, 2016; F. Dimundo, Cole, Blagrove, et al., 2021; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Fuller et al., 2013; Geeson-Brown et al., 2020; Hansen et al., 2011; Heffernan et al., 2016; A. P. Hill & Appleton, 2011; A. Hill et al., 2015; Holland et al., 2010; B. Jones et al., 2018; T. W. Jones et al., 2018;

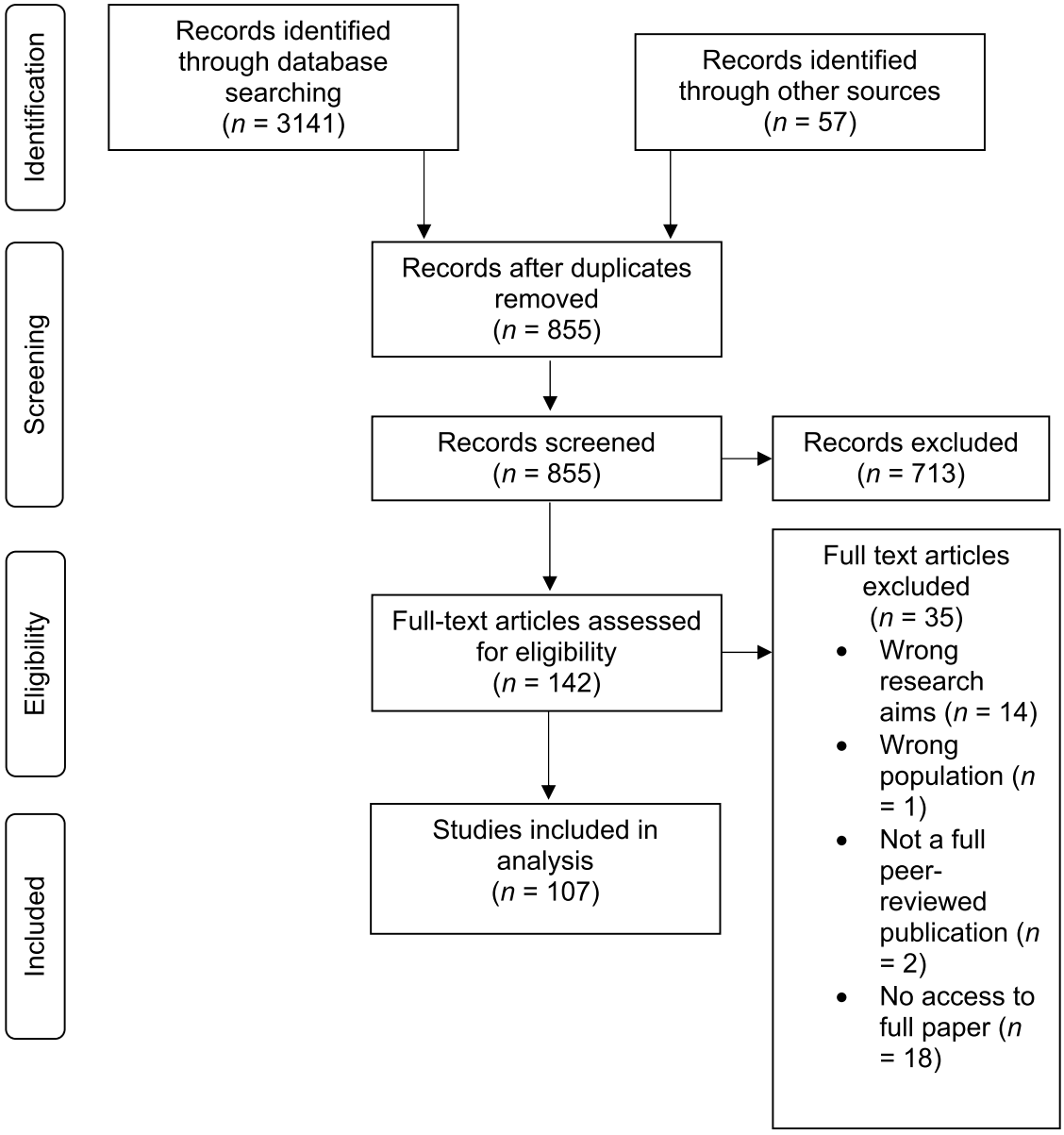


**Figure 1.** Flow chart of studies from identification to inclusion (Page et al., 2021).

Kelly, Jackson, et al., 2021; Kelly, Till, et al., 2021; McCarthy & Collins, 2014; Nicholls & Polman, 2007; Nicholls et al., 2006; C. Owen et al., 2020, 2022; Roberts & Fairclough, 2012; Rouquette et al., 2021; Rumbold et al., 2020; Runswick et al., 2020; Till et al., 2020; Treasure et al., 2000; Woodcock et al., 2011), followed by South Africa (n = 19, 17.8%) (Andrew et al., 2007; den Hollander et al., 2019, 2021; Durandt et al., 2006, 2011, 2018; Edwards & Edwards, 2012; T. Grobler et al., 2016; T. D. Grobler et al., 2017; Hendricks et al., 2014, 2015; Lombard et al., 2015; Pienaar & Spamer, 1998; Pienaar et al., 1998; Spamer, 2009a, 2009b; Spamer & De la Port, 2006; Van den Berg et al., 2012; Van Gent & Spamer, 2005), and New Zealand (n = 10, 9.3%) (Argus et al., 2012; Brown et al., 2015; Hamlin et al., 2021; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Sherwood et al., 2019; Smart et al., 2013, 2014; Teece et al., 2021).

***Playing level of study population.*** Fourteen different playing levels were included across the 107 studies: professional, semi-professional, academy, senior international, junior international, national, provincial, regional, university, school, club, amateur, and novice. Professional was the most common playing level (n = 30, 28.0%) (Argus et al., 2012; Ashford et al., 2021; Atack et al., 2022; Correia et al., 2012; den Hollander et al., 2021; DiCorrado et al., 2014; Fontana et al., 2015; Fuller et al., 2013; Geeson-Brown et al., 2020; Hamilton & Gatherer, 2014; Hansen et al., 2011; Heffernan et al.,

2016; Hendricks et al., 2015; A. P. Hill & Appleton, 2011; T. W. Jones et al., 2018; Kearney, 2017a, 2017b; McHugh et al., 2021; R. Neil et al., 2006, 2012; Nicholls et al., 2006; Posthumus et al., 2020; Runswick et al., 2020; Sherwood et al., 2019; Smart et al., 2013, 2014; Stoop et al., 2018; Teece et al., 2021; Treasure et al., 2000; Wheeler & Sayers, 2009), followed by academy (n = 25, 23.4%) (Argus et al., 2012; Brown et al., 2015; Casserly et al., 2019; Darrall-Jones et al., 2015, 2016; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Hansen et al., 2011; A. Hill et al., 2015; Holland et al., 2010; B. Jones et al., 2018; Kelly, Till, et al., 2021; Kobal et al., 2016; McAuliffe et al., 2022; McCarthy & Collins, 2014; C. Owen et al., 2020, 2022; Parsonage et al., 2014; Rouquette et al., 2021; Rumbold et al., 2020; Till et al., 2020; Vaz et al., 2015, 2019; Woodcock et al., 2011), and school (n = 17, 15.9%) (Chiwaridzo et al., 2019, 2019a, 2019b, 2020; Delahunt et al., 2013; Edwards & Edwards, 2012; T. Grobler et al., 2016; T. D. Grobler et al., 2017; Hamilton et al., 2012; B. Jones et al., 2018; C. Owen et al., 2020; Pienaar & Spamer, 1998; Pienaar et al., 1998; Quarrie et al., 1995; Spamer, 2009a; Van den Berg et al., 2012; Walsh et al., 2011).

### Higher order themes

The 107 of included studies were categorised into five higher-order themes, these are presented in Table 1.

The physical theme relates to measures of physical performance qualities (e.g., lower body power) and were the most common, reported in 67 studies. The demographic theme included 25 studies and referred to population-based factors (e.g., socioeconomic status). Twenty studies were encompassed by the psychological theme and measured factors related to a player's mental state or mental performance (e.g., focus). The 20 studies assessing factors related to rugby-specific skills (e.g., passing) were included in the technical theme. The least prevalent theme was tactical, which covered only six of 107 studies. The tactical theme referred to studies that evaluated strategy-based factors. Twenty-three studies investigated factors from more than one theme. Seventeen studies covered two themes (Atack et al., 2022; Chiwaridzo et al., 2019a, 2019b, 2020; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021; Durandt et al., 2018; Fuller et al., 2013; T. D. Grobler et al., 2017; Krause et al., 2014; Pienaar & Spamer, 1998; Pienaar et al., 1998; Sedeaud et al., 2012; Spamer, 2009a; Spamer & De la Port, 2006; Van den Berg et al., 2012; Van Gent & Spamer, 2005), four studies covered three themes (Chiwaridzo et al., 2019; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021; J. Owen et al., 2022; Till et al., 2020), one study covered four themes (Dimundo et al., 2022), and one study covered five themes (F. Dimundo, Cole, Blagrove, et al., 2021).

***Physical.*** Table 2 presents the factors assessed in the 67 studies in the physical theme and the studies which assessed each factor. Sixteen different physical factors were reported, with body mass as the most reported factor, used in 51 studies.

***Demographic.*** Eleven factors were measured in the 25 demographic studies. These factors are displayed in

**Table 1.** Number of studies included in each higher-order theme.

| Higher Order Theme | Number of Studies | References |
|---|---|---|
| Physical | 67 | (Argus et al., 2012; Atack et al., 2022; Barr, Newton, et al., 2014; Barr et al., 2014; Brown et al., 2015; Casserly et al., 2019; Chiwaridzo et al., 2019, 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015, 2016; Delahunt et al., 2013; F. Dimundo, Cole, Blagrove, et al., 2021; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2006, 2018; Fontana et al., 2015, 2016; Fuller et al., 2013; Geeson-Brown et al., 2020; T. D. Grobler et al., 2017; Hamilton & Gatherer, 2014; Hamilton et al., 2012; Hamlin et al., 2021; Hansen et al., 2011; Jarvis et al., 2009; B. Jones et al., 2018; T. W. Jones et al., 2018Nakamura et al., 2017, Kobal et al., 2016; Krause et al., 2014; Lombard et al., 2015; McHugh et al., 2021; C. Owen et al., 2020, 2022; J. Owen et al., 2022; Parsonage et al., 2014; Pienaar & Spamer, 1998; Pienaar et al., 1998; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Sedeaud et al., 2012; Smart et al., 2013, 2014; Solis-Mencia et al., 2021; Spamer, 2009a, 2009b; Spamer & De la Port, 2006; Stoop et al., 2018; Teece et al., 2021; Till et al., 2020; A. Ungureanu et al., 2022; Vachon et al., 2021; Van Gent & Spamer, 2005; Vaz et al., 2014, 2015, 2019; Walsh et al., 2011; Wang et al., 2016; Wood et al., 2018; Zemski et al., 2015) |
| Demographic | 25 | (Andrew et al., 2007; Chiwaridzo et al., 2019b, 2020; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2011, 2018; Fontana et al., 2016; T. Grobler et al., 2016; T. D. Grobler et al., 2017; Heffernan et al., 2016; Kearney, 2017a, 2017b; Kelly, Jackson, et al., 2021; Kelly, Till, et al., 2021; Krause et al., 2014; Lewis et al., 2015; McCarthy & Collins, 2014; C. Owen et al., 2022; J. Owen et al., 2022; Roberts & Fairclough, 2012; Sedeaud et al., 2012; Van den Berg et al., 2012; Winn et al., 2016) |
| Psychological | 20 | (Andrew et al., 2007; Batista et al., 2018, 2019; DiCorrado et al., 2014; Dimundo et al., 2022; Edwards & Edwards, 2012; A. P. Hill & Appleton, 2011; A. Hill et al., 2015; Holland et al., 2010; McAuliffe et al., 2022; R. Neil et al., 2006, 2012; Nicholls & Polman, 2007; Nicholls et al., 2006; J. Owen et al., 2022; Rouquette et al., 2021; Rumbold et al., 2020; Treasure et al., 2000; Van den Berg et al., 2012; Woodcock et al., 2011) |
| Technical | 20 | (Atack et al., 2022; Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; den Hollander et al., 2019, 2021; Hendricks et al., 2014, 2015; Martín et al., 2017; Pienaar & Spamer, 1998; Pienaar et al., 1998; Runswick et al., 2020; Spamer, 2009a; Spamer & De la Port, 2006; Van Gent & Spamer, 2005; Vaz et al., 2012; Wheeler & Sayers, 2009) |
| Tactical | 6 | (Ashford et al., 2021; Correia et al., 2012; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021; Dimundo et al., 2022; Morgan et al., 2020; Sherwood et al., 2019) |

**Table 2.** The factors identified from the scoping review, grouped by theme, and the prevalence of their occurrence within each theme.

| Theme | Factor | Prevalence | References |
|---|---|---|---|
| Physical | Body Mass | 51 | (Atack et al., 2022; Barr, Newton, et al., 2014; Casserly et al., 2019; Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015, 2016; Delahunt et al., 2013; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2006, 2018; Fontana et al., 2015, 2016; Fuller et al., 2013; T. D. Grobler et al., 2017; Hamilton & Gatherer, 2014; Hamilton et al., 2012; Hamlin et al., 2021; Jarvis et al., 2009; B. Jones et al., 2018; T. W. Jones et al., 2018; Kobal et al., 2016; Krause et al., 2014; Lombard et al., 2015; McHugh et al., 2021; C. Owen et al., 2022; J. Owen et al., 2022; Pienaar & Spamer, 1998; Pienaar et al., 1998; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Sedeaud et al., 2012; Smart et al., 2013, 2014; Solis-Mencia et al., 2021; Spamer, 2009a; Spamer & De la Port, 2006; Teece et al., 2021; A. Ungureanu et al., 2022; Van Gent & Spamer, 2005; Vaz et al., 2014, 2015, 2019; Walsh et al., 2011; Wood et al., 2018; Zemski et al., 2015) |
| | Height | 46 | (Atack et al., 2022; Barr, Newton, et al., 2014; Casserly et al., 2019; Chiwaridzo et al., 2019a, 2019b, 2020; Darrall-Jones et al., 2015, 2016; Delahunt et al., 2013; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2006, 2018; Fontana et al., 2015, 2016; Fuller et al., 2013; T. D. Grobler et al., 2017; Hamilton & Gatherer, 2014; Hamilton et al., 2012; Hamlin et al., 2021; Jarvis et al., 2009; B. Jones et al., 2018; T. W. Jones et al., 2018; Kobal et al., 2016; Krause et al., 2014; Lombard et al., 2015; C. Owen et al., 2022; J. Owen et al., 2022; Pienaar & Spamer, 1998; Pienaar et al., 1998; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Sedeaud et al., 2012; Solis-Mencia et al., 2021; Spamer, 2009a; Spamer & De la Port, 2006; A. Ungureanu et al., 2022; Van Gent & Spamer, 2005; Vaz et al., 2014, 2015, 2019; Walsh et al., 2011; Wood et al., 2018; Zemski et al., 2015) |
| | Sprint Ability | 42 | (Barr et al., 2014; Casserly et al., 2019; Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015, 2016; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2006; Fontana et al., 2016; T. D. Grobler et al., 2017; Hamlin et al., 2021; Hansen et al., 2011; Jarvis et al., 2009; T. W. Jones et al., 2018Nakamura et al., 2017, Kobal et al., 2016; Krause et al., 2014; Lombard et al., 2015; C. Owen et al., 2022; J. Owen et al., 2022; Parsonage et al., 2014; Pienaar & Spamer, 1998; Pienaar et al., 1998; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Smart et al., 2013, 2014; Spamer, 2009a; Spamer & De la Port, 2006; Teece et al., 2021; A. Ungureanu et al., 2022; Vachon et al., 2021; Van Gent & Spamer, 2005; Vaz et al., 2014, 2015, 2019; Wang et al., 2016) |
| | Lower Body Power | 35 | (Argus et al., 2012; Atack et al., 2022; Casserly et al., 2019; Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Fontana et al., 2016; Hansen et al., 2011; T. W. Jones et al., 2018Nakamura et al., 2017, Kobal et al., 2016; Krause et al., 2014; C. Owen et al., 2022; J. Owen et al., 2022; Parsonage et al., 2014; Pienaar et al., 1998; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Smart et al., 2013, 2014; Spamer, 2009a; Spamer & De la Port, 2006; A. Ungureanu et al., 2022; Vachon et al., 2021; Van Gent & Spamer, 2005; Vaz et al., 2015, 2019; Wang et al., 2016; Wood et al., 2018) |
| | Body Fat | 34 | (Barr, Newton, et al., 2014; Chiwaridzo et al., 2019a, 2019b, 2020; Darrall-Jones et al., 2015, 2016; Delahunt et al., 2013; Durandt et al., 2006, 2018; Fontana et al., 2015, 2016; Geeson-Brown et al., 2020; T. D. Grobler et al., 2017; Hamlin et al., 2021; Jarvis et al., 2009; T. W. Jones et al., 2018; McHugh et al., 2021; J. Owen et al., 2022; Pienaar & Spamer, 1998; Pienaar et al., 1998; Posthumus et al., 2020; Sedeaud et al., 2012; Smart et al., 2013, 2014; Solis-Mencia et al., 2021; Spamer, 2009a; Spamer & De la Port, 2006; Teece et al., 2021; Vachon et al., 2021; Van Gent & Spamer, 2005; Vaz et al., 2014, 2015; Walsh et al., 2011; Zemski et al., 2015) |
| | Upper Body Strength | 32 | (Argus et al., 2012; Chiwaridzo et al., 2019a, 2019b, 2020; Darrall-Jones et al., 2015; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2006; T. D. Grobler et al., 2017; Hamilton & Gatherer, 2014; Hamilton et al., 2012; Hamlin et al., 2021; B. Jones et al., 2018; Lombard et al., 2015; J. Owen et al., 2022; Pienaar & Spamer, 1998; Pienaar et al., 1998; Posthumus et al., 2020; Quarrie et al., 1995, 1996; Smart et al., 2013, 2014; Spamer, 2009b; Spamer & De la Port, 2006; Teece et al., 2021; A. Ungureanu et al., 2022; Vachon et al., 2021; Van Gent & Spamer, 2005; Vaz et al., 2014, 2015, 2019) |
| | Aerobic Capacity | 31 | (Casserly et al., 2019; Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015, 2016; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Durandt et al., 2006; Fontana et al., 2016; Hamlin et al., 2021; Jarvis et al., 2009; B. Jones et al., 2018Nakamura et al., 2017, Kobal et al., 2016; Lombard et al., 2015; Teece et al., 2021) |
| | Lower Body Strength | 21 | (Argus et al., 2012; Brown et al., 2015; Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Darrall-Jones et al., 2015; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; Hamlin et al., 2021; C. Owen et al., 2022; Posthumus et al., 2020; Smart et al., 2013, 2014; Teece et al., 2021; A. Ungureanu et al., 2022; Vachon et al., 2021; Vaz et al., 2014, 2015, 2019; Wang et al., 2016) |
| | Agility | 16 | (Chiwaridzo et al., 2019a, 2019b, 2020; Darrall-Jones et al., 2015; Durandt et al., 2006; Jarvis et al., 2009; Kobal et al., 2016; Pienaar & Spamer, 1998; Pienaar et al., 1998; Quarrie et al., 1995, 1996; Spamer, 2009a; Spamer & De la Port, 2006; Vaz et al., 2015, 2019; Wang et al., 2016) |
| | Strength Endurance | 12 | (Chiwaridzo et al., 2019a, 2019b, 2020; Durandt et al., 2006; T. D. Grobler et al., 2017; Pienaar & Spamer, 1998; Pienaar et al., 1998; Spamer, 2009a; Spamer & De la Port, 2006; Van Gent & Spamer, 2005; Vaz et al., 2015, 2019) |
| | Repeated Sprint Ability | 11 | (Chiwaridzo et al., 2019a, 2019b, 2020; Pienaar & Spamer, 1998; Pienaar et al., 1998; Quarrie et al., 1995, 1996; Smart et al., 2013, 2014; Spamer, 2009a; Vachon et al., 2021; Van Gent & Spamer, 2005) |
| | Lean Mass | 5 | (Delahunt et al., 2013; McHugh et al., 2021; Solis-Mencia et al., 2021; Spamer, 2009a; Zemski et al., 2015) |
| | Upper Body Power | 4 | (Argus et al., 2012; Chiwaridzo et al., 2019a, 2019b, 2020) |
| | Movement Competency | 1 | (Parsonage et al., 2014) |
| | Diet | 1 | (Walsh et al., 2011) |
| | Sleep | 1 | (Teece et al., 2021) |

(*Continued*)

**Table 2.** (Continued).

| Theme | Factor | Prevalence | References |
|---|---|---|---|
| Demographic | Relative Age | 14 | (F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Dimundo et al., 2022; T. Grobler et al., 2016; T. D. Grobler et al., 2017; Kearney, 2017a, 2017b; Kelly, Jackson, et al., 2021; Kelly, Till, et al., 2021; Lewis et al., 2015; McCarthy & Collins, 2014; C. Owen et al., 2022; J. Owen et al., 2022; Roberts & Fairclough, 2012) |
| | Participation History | 10 | (Andrew et al., 2007; Chiwaridzo et al., 2019b, 2020; Dimundo et al., 2022; Durandt et al., 2011; Fontana et al., 2016; Krause et al., 2014; J. Owen et al., 2022; Sedeaud et al., 2012; Winn et al., 2016) |
| | Age at Peak Height Velocity | 5 | (Chiwaridzo et al., 2019b, 2020; C. Owen et al., 2022; J. Owen et al., 2022) |
| | Injury History | 2 | (Krause et al., 2014; J. Owen et al., 2022) |
| | Maturation Status | 2 | (Chiwaridzo et al., 2019b; Van den Berg et al., 2012) |
| | Socioeconomic Status | 2 | (Dimundo et al., 2022; Winn et al., 2016) |
| | Cultural Heritage | 1 | (Krause et al., 2014) |
| | Ethnicity | 1 | (Durandt et al., 2018) |
| | Genetic Variation | 1 | (Heffernan et al., 2016) |
| Psychological | Self-Confidence | 8 | (Andrew et al., 2007; Batista et al., 2018, 2019; Di Corrado et al., 2014; Edwards & Edwards, 2012; R. Neil et al., 2006, 2012; J. Owen et al., 2022) |
| | Anxiety | 8 | Batista et al., (2018), Di Corrado et al., (2014); J. Owen et al., 2022; Rouquette et al., 2021; Andrew et al., 2007; Edwards & Edwards, 2012; R. Neil et al., 2006; R. Neil et al., (2012) |
| | Emotional Control | 8 | Batista et al., 2018; Di Corrado et al., 2014; J. Owen et al., 2022;Rumbold et al., 2020; Andrew et al., 2007; Nicholls et al., 2006; ;Nicholls & Polman, 2007; Van den Berg et al., 2012 |
| | Performance Routines | 6 | (Andrew et al., 2007; Batista et al., 2018, 2019; Edwards & Edwards, 2012; J. Owen et al., 2022; Van den Berg et al., 2012) |
| | Relaxation | 5 | (Andrew et al., 2007; Batista et al., 2018; Edwards & Edwards, 2012; R. Neil et al., 2006; Van den Berg et al., 2012) |
| | Focus | 5 | (Batista et al., 2018, 2019; DiCorrado et al., 2014; Edwards & Edwards, 2012; J. Owen et al., 2022) |
| | Goal Setting | 5 | (Andrew et al., 2007; Batista et al., 2019; DiCorrado et al., 2014; J. Owen et al., 2022; Van den Berg et al., 2012) |
| | Self-Talk | 5 | (Andrew et al., 2007; Batista et al., 2019; DiCorrado et al., 2014; R. Neil et al., 2006; Van den Berg et al., 2012) |
| | Motivation | 4 | (Dimundo et al., 2022; Edwards & Edwards, 2012; J. Owen et al., 2022; Treasure et al., 2000) |
| | Imagery | 4 | (Batista et al., 2019; Dimundo et al., 2022; Edwards & Edwards, 2012; R. Neil et al., 2006) |
| | Interpersonal Competencies | 3 | (Andrew et al., 2007; J. Owen et al., 2022; Van den Berg et al., 2012) |
| | Social Support Seeking | 3 | (Dimundo et al., 2022; Rouquette et al., 2021; Rumbold et al., 2020) |
| | Conscientiousness | 2 | (A. P. Hill & Appleton, 2011; J. Owen et al., 2022) |
| | Independence | 2 | (Batista et al., 2018; Dimundo et al., 2022) |
| | Resilience | 2 | (Dimundo et al., 2022; J. Owen et al., 2022) |
| | Realistic Self-Evaluation | 1 | (A. Hill et al., 2015) |
| Technical | Passing | 11 | (Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Hendricks et al., 2015; Pienaar & Spamer, 1998; Pienaar et al., 1998; Spamer, 2009a; Spamer & De la Port, 2006; Van Gent & Spamer, 2005; Vaz et al., 2012) |
| | Contact Skills | 9 | (Cunningham et al., 2018; den Hollander et al., 2019, 2021; Hendricks et al., 2014, 2015; Spamer, 2009a; Spamer & De la Port, 2006; Van Gent & Spamer, 2005; Wheeler & Sayers, 2009) |
| | Tackling | 9 | (Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; den Hollander et al., 2019, 2021; Hendricks et al., 2014, 2015; Vaz et al., 2012) |
| | Position Specific Skills | 8 | (Atack et al., 2022; Hendricks et al., 2015; Pienaar & Spamer, 1998; Pienaar et al., 1998; Runswick et al., 2020; Spamer, 2009a; Spamer & De la Port, 2006; Van Gent & Spamer, 2005) |
| | Catching | 7 | (Chiwaridzo et al., 2019a, 2019b, 2020; Cunningham et al., 2018; Hendricks et al., 2015; Spamer & De la Port, 2006; Van Gent & Spamer, 2005) |
| Tactical | Sport Intelligence | 6 | (Ashford et al., 2021; Correia et al., 2012; F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021, 2021; Morgan et al., 2020; Sherwood et al., 2019) |
| | Pattern Recall | 1 | (Sherwood et al., 2019) |

Table 2 alongside the studies that reported each factor. Relative age was the most prevalent factor, included in 14 of the 25 studies.

***Psychological.*** Table 2 displays the 16 factors reported in the 20 studies that explored psychological factors. Self-confidence, anxiety, and emotional control were all assessed in eight studies, whilst independence, resilience, and conscientiousness were assessed in only two.

***Technical.*** Five technical factors were evaluated in the 20 technical studies, presented in Table 2. Over half the technical studies (n = 11) assessed passing ability, making it the most prevalent technical factor. Seven studies reported catching, the least prevalent technical factor.

***Tactical.*** Table 2 displays the two factors reported in the six studies that assessed tactical factors. All six studies evaluated sport intelligence, but only one study evaluated pattern recall.

### Part 2: Modified NGT session

Twenty additional characteristics were identified in the session that were not highlighted by the systematic scoping review (Table 3). The factors have been grouped by the themes identified in part one. Eleven factors (55.0%) aligned with the demographic theme, six factors (30.0%) were included in the psychological theme, three (15.0%) characteristics in the physical theme. None of the characteristics identified during the NGT session were categorised into technical or tactical.

### Part three: Establishing importance and feasibility

Table 4 displays the percentage agreement of importance and feasibility for each factor, grouped by theme. Technical factors achieved the highest level of agreement for importance (86.9%), but physical factors achieved the highest level of agreement of feasibility (80.4%). Demographic factors were considered the least important (46.6% agreement), and psychological factors the least feasible (37.3% agreement).

The level of agreement for the importance and feasibility for each individual factor is displayed in Figure 2.

Four factors achieved 100% agreement on importance: upper body strength, position-specific skills, lower body strength, and lower body power. No factors achieved 100% agreement for feasibility of measurement, with 96.6% the highest agreement rating achieved for upper body strength, lower body strength, lower body power, baseline medical health, coaching hours, games played, and height. Previous match results and hometown population reached the lowest agreement for importance (6.9%), whereas followership had the lowest agreement for feasibility (13.8%). Forty factors reached ≥ 70% agreement for importance, 28 factors reached ≥70% agreement for feasibility, and 15 factors reached ≥70% agreement for both importance and feasibility.

## Discussion

This three-part study aimed to establish factors currently profiled, identify factors that should be profiled, and evaluate the importance and feasibility of profiling these factors within a male youth RU performance pathway. The systematic scoping review found an imbalance in the volume of research profiling the identified higher-order themes (e.g., 62.3% physical vs 23.6% demographic). In total, 50 factors were reported in the existing literature. Following the NGT session, an additional 20 factors were identified as important. When grouped by theme, the survey revealed technical factors achieved the highest level of agreement for importance, whereas demographic was the lowest. Forty of the 70 individual factors reached ≥70% agreement for their importance, and 28 reached ≥70% agreement for the feasibility of measurement. However, only 15 of the 70 individual factors achieved ≥70% agreement for both importance and feasibility: games played, coach hours, baseline medical health, upper body strength, lower body strength, lower body power, upper body power, sprint ability, strength endurance, repeated sprint ability, maturation status, aerobic capacity, injury history, lean mass, and movement competence.

These findings suggest the need for multidisciplinary player profiling within male youth RU, highlighted by the diverse range of factors that were considered important. Additionally, the disparity in the volume of research between themes, identified by the systematic scoping review, may help to guide the direction of future research, whilst providing considerations for multi-dimensional player profiling processes.

### Physical factors

Only five (out of the 18) physical factors did not reach the 70% agreement for importance in their contribution to player progression through a male RU pathway. The high level of agreement for the importance of physical factors mirrors the depth of the physical research in the

**Table 3.** The factors identified during the NGT session, grouped by theme.

| Physical | Demographic | Psychological | Technical | Tactical |
|---|---|---|---|---|
| Predicted height | Previous Competition Exposure | Competitiveness | | |
| Baseline Medical Information | Distance From Home to Training Venue | Mental Health and Wellbeing | | |
| Skeletal age | Sibling Birth Order | Followership | | |
| | Education | Hard Work Ethic | | |
| | Match Results History | Neurodiversity | | |
| | Parental Sporting History | Maintaining a Sense of Balance | | |
| | Sibling Involvement in the Sport | | | |
| | Coach Hours | | | |
| | Number of Games Played Per Season | | | |
| | Parental Support | | | |
| | Coaches Ability | | | |

**Table 4.** Percentage agreement for importance and feasibility of each factor, grouped by theme.

| Theme | Factor | Percentage of Participants Agreeing with Importance | Percentage of Participants Agreeing with Feasibility |
|---|---|---|---|
| Physical | Aerobic Capacity | 89.7% | 86.2% |
| | Agility | 89.7% | 69.0% |
| | Baseline Medical Health | 93.1% | 89.7% |
| | Body Fat | 62.1% | 65.5% |
| | Body Mass | 65.5% | 93.1% |
| | Diet | 89.7% | 51.7% |
| | Genetic Variation | 27.6% | 34.5% |
| | Height | 51.7% | 96.6% |
| | Lean Mass | 75.9% | 75.9% |
| | Lower Body Power | 100.0% | 96.6% |
| | Lower Body Strength | 100.0% | 96.6% |
| | Movement Competency | 86.2% | 72.4% |
| | Predicted Adult Height | 58.6% | 76.0% |
| | Repeated Sprint Ability | 89.7% | 86.2% |
| | Skeletal Age | 62.1% | 65.5% |
| | Sleep | 79.3% | 65.5% |
| | Sprint Ability | 89.7% | 89.7% |
| | Strength Endurance | 79.3% | 86.2% |
| | Upper Body Power | 93.1% | 89.7% |
| | Upper Body Strength | 100.0% | 96.6% |
| Demographic | Age at PHV | 58.6% | 72.4% |
| | Coach Hours | 75.9% | 96.6% |
| | Coaches Ability | 79.3% | 55.2% |
| | Competition Exposure | 69.0% | 79.3% |
| | Cultural Heritage | 24.1% | 41.4% |
| | Distance from Home to Training Venue | 44.8% | 89.7% |
| | Education | 31.0% | 86.2% |
| | Ethnicity | 20.7% | 58.6% |
| | Games Played Per Season | 72.4% | 96.6% |
| | Hometown Population | 6.9% | 65.5% |
| | Injury History | 93.1% | 79.3% |
| | Maturation Status | 72.4% | 86.2% |
| | Parental Sporting History | 20.7% | 65.5% |
| | Parental Support | 79.3% | 48.3% |
| | Participation History | 41.4% | 79.3% |
| | Participation in Other Sports | 55.2% | 69.0% |
| | Previous Match Results | 6.9% | 69.0% |
| | Relative Age | 58.6% | 89.7% |
| | Sibling Birth Order | 10.4% | 86.2% |
| | Sibling Involvement in the Sport | 31.0% | 79.3% |
| | Socioeconomic Status | 27.6% | 44.8% |
| Psychological | Anxiety | 58.6% | 41.4% |
| | Competitiveness | 75.9% | 37.9% |
| | Confidence | 82.8% | 37.9% |
| | Conscientiousness | 72.4% | 27.6% |
| | Emotional Control | 89.7% | 41.4% |
| | Focus | 72.4% | 34.5% |
| | Followership | 55.2% | 13.8% |
| | Goal Setting | 93.1% | 44.8% |
| | Hard Work Ethic | 93.1% | 44.8% |
| | Imagery | 62.1% | 34.5% |
| | Independence | 75.9% | 37.9% |
| | Interpersonal Competencies | 86.2% | 34.5% |
| | Maintain a Sense of Balance | 65.5% | 24.1% |
| | Mental Health | 51.7% | 41.4% |
| | Motivation | 89.7% | 51.7% |
| | Neurodiversity | 31.0% | 27.6% |
| | Performance Routine | 51.7% | 44.8% |
| | Relaxation | 58.6% | 27.6% |
| | Resilience | 93.1% | 44.8% |
| | Self-Evaluation | 93.1% | 51.7% |
| | Self-Talk | 71.7% | 27.6% |
| | Social Support Seeking | 82.8% | 27.6% |
| Technical | Catching | 75.9% | 58.6% |
| | Contact Skills | 89.7% | 65.5% |
| | Passing | 82.8% | 58.6% |
| | Position-Specific Skills | 100% | 69.0% |
| | Tackling | 86.2% | 65.5% |
| Tactical | Pattern Recall | 75.9% | 44.8% |
| | Sport Intelligence | 86.2% | 37.9% |

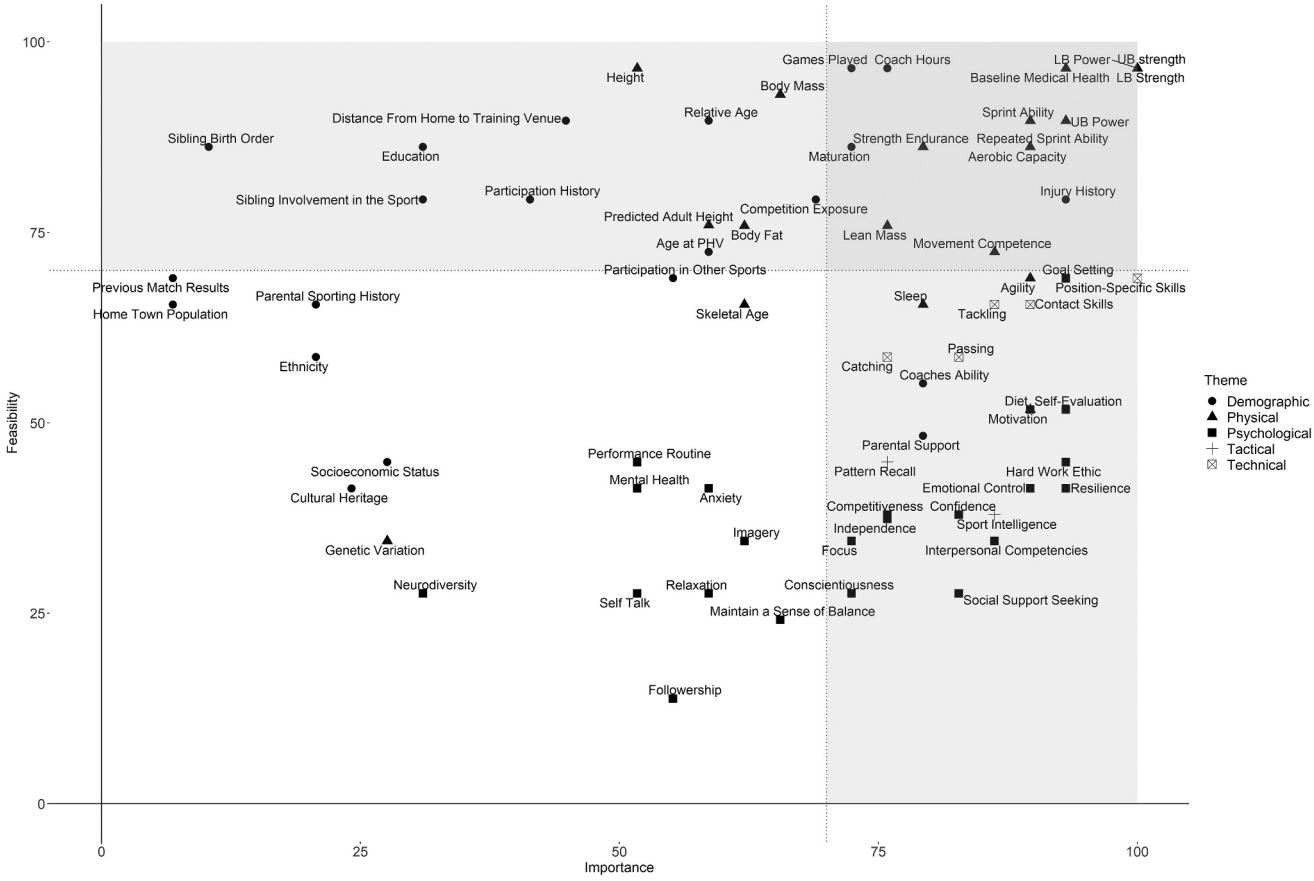


**Figure 2.** The percentage of participants that agreed with the importance and feasibility of each factor, grouped by theme.

existing evidence base. It is likely this is influenced by the higher feasibility of measurement of physical factors. Despite this, anthropometric measures (i.e., body mass, height, body fat) did not reach the agreement threshold for importance, contrasting to a wide body of research demonstrating that these factors are highly important to success within RU (Duthie et al., 2003; Fontana et al., 2016; Peeters et al., 2023; Smart et al., 2014). The difference in findings may be attributed to the acknowledgement by the participants that physical characteristics are largely determined by maturation status at the age at which players are in a performance pathway, therefore may not be as important as those that are not influenced by maturation (Helsen et al., 2000; Malina, 2014; Marceau et al., 2011). Despite the influence of maturation on physical factors, low body fat percentage was a predictor of future playing level within a group of 15-year-olds, though this study did not differentiate between positional groups (Fontana et al., 2016). A study that considered positional groups reported that body mass was not a common feature of selection in regional age grade RU (J. Owen et al., 2022). It has previously been noted that coaches consider physical characteristics play a key role in selection decisions, and talent development processes (Dimundo et al., 2023; Lewis et al., 2015). The inclusion of researchers and other practitioners outside of coaching in this study could be related to the contrast in findings, compared to those that solely report the opinions of coaches.

Although body fat did not reach agreement for importance, lean mass did surpass the 70% agreement threshold. Furthermore, upper body and lower body strength both reached 100% agreement. The positive relationship between lean mass and strength could indicate why lean mass is considered more important than body fat (de almeida-Neto et al., 2020). The two strength factors, alongside lower body power, reaching 100% agreement aligns with previous research reporting lower body strength and power, and match-derived key performance indicators to be positively related (Cunningham et al., 2018). Both upper body and lower body strength are reported to be higher in international age-grade players than non-international players (Cunningham et al., 2018; Peeters et al., 2023). Baseline medical health was not identified in the systematic

scoping review. However, it was considered by the expert panel in the NGT session and reached the 70% threshold of agreement for the importance. As such, future studies should seek to explore if a link exists between the baseline medical health of a male RU player and their progression through a performance pathway.

Sleep and diet both reached agreement for importance. Only one study explored nutrition-related factors in male RU players, looking at the nutritional knowledge, attitudes, and behaviours of senior schoolboy rugby players (Walsh et al., 2011), therefore exploring the importance of diet in the progression through a performance pathway may be a considered as an area for future research. Similarly, only one study reported the difference in sleep behaviours between playing levels (Teece et al., 2021). As links between sleep and performance have been noted, gaining insight into the sleep behaviours as part of the profiling process may be useful and guide future research directions (Cunha et al., 2023). However, both sleep and diet did not reach 70% agreement for the feasibility of their measurement. Sleep and diet are commonly assessed through self-reported measures such as questionnaires or diaries, both of which expose the risk of response bias, and often fail to align to gold standard methods of polysomnography and doubly labelled water (Capling et al., 2017; P. W. Neil et al., 2021). Such gold standard methods are expensive and largely inaccessible, therefore understanding how to measure and monitor sleep and diet as part of profiling processes requires further exploration.

### *Demographic factors*

The mean level of agreement for the importance of demographic factors was the lowest across the six themes, despite accounting for the 45% of the factors identified by the expert practitioners during the NGT session. Only three out of the 20 identified demographic factors had a mean level of agreement above 70% for their importance: the number of games played per season, maturation status, and injury history. The agreement for the importance of the number of games played per season partially mirrors the finding by Dimundo and colleagues whereby both a player and coach focus group reported game exposure as helpful for talent progression (Dimundo et al., 2023). However, participation history, competition exposure, and participation in other sports did not reach the agreement threshold for importance, contradicting existing literature (Dimundo et al., 2022, 2023). Although coach and player focus groups have noted the importance of participation in other sports, a study in RL found both early and delayed entry to the sport led to professional attainment. The findings in the current study could suggest that the number of games played in the current or recent season may be considered more influential in the development of a player, than the number of games an individual has played in total.

Over 70% of survey participants agreed that injury history contributed to the progression through a performance pathway. However, there lacks a body of research investigating the influence of injury history on talent progression in RU, presenting a focus area for future research. It was agreed by 72% of survey participants that maturation status is important. Early, and on-time, developers tend to have physical and functional advantages (i.e., strength and power) during adolescence (Howard et al., 2016; Malina, 2014). Therefore, maturation being considered important reflects the importance of physical factors found in the present study. Although over 70% of participants agree maturation was important, less than 70% of survey participants agreed that relative age and age at peak height velocity were important, despite the conceptual overlap. The contradiction in findings is possibly a result of the higher proportion of practitioners in the survey cohort, who may have a misunderstanding of key concepts in this domain (Till et al., 2022). Socioeconomic status (SES) was considered important by just 27% of participants. A previous study revealed that the higher ranked academy RU players were from more deprived areas, whilst in football, players who were considered to have greater potential were from lower social classifications (Dimundo et al., 2022; Kelly et al., 2023). However, Winn and colleagues reported no differences in the developmental milestones between deprivation groups (Winn et al., 2016). The absence of agreement for SES may partially be influenced by the apprehension to 'over-monitor' players for factors that are unmodifiable (Collins et al., 2015; Williams & Manley, 2016).

Over 70% of survey participants agreed that coaching hours and parental support were important in the contribution to progression through a performance pathway. Previous research has posited that coaches have ascendancy over both player and team development, impacting on the behaviours, cognitions, and affective responses of players (Cushion et al., 2012). Similarly, parents play a key role in talent development affecting motivation, behaviours, and psychological growth in sporting settings (Lauer et al., 2010; Luo & Kiewra, 2020; Witte et al., 2015). Understanding how exposure to greater coached hours, and the level of support players receive from their parents, affects the development of a player may be a beneficial direction for future research. It was agreed by over 70% of survey

participants that measuring coached hours was feasible, but there was a lack of agreement on the feasibility of measuring parental support. Parental support has been previously defined as an athlete's perception of their parents' behaviour to be a facilitator of sport participation and performance and has been linked to favourable sporting outcomes (Furusa et al., 2021; Holt et al., 2008; Leff & Hoyle, 1995; Marcen et al., 2013). The Parents Involvement in Activities Scale (PIAS) has been commonly utilised within sport parenting research to examine athletes' perceptions of how their parents enable sporting participation and provide choice (Anderson et al., 2003). However, parental support is considered multi-dimensional, providing instrumental, information, emotional, and autonomy support (Burke et al., 2023b). The PAIS does not consider the perceptions of informational and emotional support, and concerns have been reported regarding the inconsistent reliability of the measure (Burke et al., 2023a, 2023c). The Youth Sport Parental Support Questionnaire (YSPS-Q) has been recently developed and validated as a theory-grounded measure of parental support in youth sport (Burke et al., 2023a). Further investigation is warranted to examine the predictive and criterion validity, and test–retest reliability, to allow for assessment of parental support across time-points but may provide useful in the examination of parental support for profiling purposes (Burke et al., 2023a).

### *Psychological factors*

Fifteen psychological factors were identified following the systematic scoping review, and a further eight factors were identified during the NGT session. Over 70% of the survey participants agreed 12 of these factors were important for player progression. However, none of these reached over 70% agreement for the feasibility of measurement. The contrast in agreement between importance and feasibility demonstrates the importance of psychological factors in talent development settings, whilst highlighting the issues in utilising them as part of the profiling process. Despite the body of research exploring psychological factors, and their measurement, the low agreement of the feasibility of measuring psychological factors suggests there is a perception that psychological factors are difficult to measure (Dohme et al., 2019; Larsen et al., 2012). As such, understanding how to bridge this gap may prove a useful direction for further research. Furthermore, due to the importance of psychological factors, developing effective interventions to foster these may also prove beneficial (Dohme et al., 2019; Larsen et al., 2012). The disparity between research and practice is well highlighted by the absence of study participants who specialise in the psychology domain.

Realistic self-evaluation, motivation, resilience, emotional control, focus, and independence were six of the 12 factors that were exceeded 70% agreement for importance, mirroring previous research which reported these factors as having a positive effect on talent development (A. Hill et al., 2015). The same study reported mental health issues as having a negative effect on talent development, which can be partially explained by the use of avoidance-based coping strategies (Dm et al., 2013; A. Hill et al., 2015). Yet only 59% of the survey participants agreed that mental health was important. Similarly, imagery, self-talk, and pre-performance routines were not considered important despite evidence between higher levels of performance and the use of such psychological skills (Barraclough et al., 2024). The contradiction in previous research to the current findings may reflect the lack of rugby-specific psychological research in talent development environments, further emphasising the need for greater utilisation of psychological tools within profiling settings (McAuliffe et al., 2022). Additionally, the inconsistency in the importance of such psychological factors could be attributed to the absence of psychology practitioners involved in the present study, reflecting the limited knowledge and underutilisation of psychology within talent development settings. The number of psychological factors that are considered important in the current study, despite the lack of agreement to feasibility measure them, underlines the value of the psychological domain. Research across different sports confirms the significance of psychological factors in development environments, affirming the requirement for greater utilisation of these in profiling processes within RU (Dohme et al., 2019).

### *Technical factors*

Five technical factors were identified following the systematic scoping review; however, no additional technical factors were identified following the NGT session. The technical factors listed from the scoping review were broad in nature (i.e., position-specific skills) and grouped together due to the difference in relevance of the specific skills depending on the individual player position. For example, the importance of kicking would be greater for backs than forwards. As such, there are relatively few technical factors included in this study compared to other themes,

There was a high level of agreement for the importance of the five technical factors, with all of them reaching ≥ 70% agreement. Yet, none of them exceeded the 70% agreement for measurement feasibility, perhaps

reflecting the current limited use of specific technical assessments in profiling test batteries. However, research exists detailing methods of assessment and measurement criteria for tackles, ball carrying, passing, and catching (Chiwaridzo et al., 2019a, 2019b, 2020; den Hollander et al., 2019; Hendricks et al., 2015; Pearce et al., 2019; Spamer, 2009a; Spamer & De la Port, 2006). Such methods are for use within training scenarios, which fail to account for the complex nature of a RU game, and therefore hold limited ecological validity (Hendricks et al., 2015). For example, Spamer and colleagues assess passing, kicking, ground skills, and sidestep ability which, although a simple and easy to use on a large scale, were conducted in a closed environment with minimal task constraints and pressure (Hendricks et al., 2015; Spamer, 2009a; Spamer & De la Port, 2006). To minimise the degree of subjectivity, it is important the assessments are accompanied by a clear and explicit measurement criterion and hold an acceptable level of construct validity and reliability (Hendricks et al., 2015). Gabbett and colleagues have provided such assessments for tackle technique, draw and pass assessment, and reactive agility for Rugby League (Gabbett & Ryan, 2009; Gabbett et al., 2008; Gabbett, Jenkins, et al., 2011; Gabbett, Wake, et al., 2011). Due to the similar skill demands of Rugby League and RU, the use of these assessments may be appropriate for use in RU profiling settings. Further investigation is warranted to improve the translation of the existing research into the technical profiling practices within youth male RU.

### Tactical factors

Although only two factors, sport intelligence and pattern recall, were identified within the tactical theme, both were considered important. Sport intelligence is the mental ability to understand the sport, make the correct decisions at the appropriate time, have awareness of the space around them, anticipate and analyse, learn quickly, implement new information, and be innovative (Dohme et al., 2019). Due to the multi-faceted nature of sport intelligence, it is unsurprising that it did not surpass 70% agreement for the feasibility of measurement. A fundamental aspect of sport intelligence is related to in-game behaviours, and therefore attempting to develop a method of assessment for use in a testing battery appears futile. Instead, it may be useful for future research, and practitioners, to consider a descriptive criterion for each segment of sport intelligence, that acknowledges the nuance in subjective assessments. Similarly, the feasibility of measurement did not reach $>70\%$ agreement for pattern recall. Pattern recall is a major component of decision making, and an essential skill for RU players (Hendricks, 2012; Sherwood et al., 2019). One study attempted to assess pattern recall using still images of players in position on a pitch and participants were required to recall where the players were stood (Sherwood et al., 2019). Although the assessment was able to discriminate between players with differing levels of experience, the results did not align with the coaches' perceptions of players on pitch decisions. A key area for future development is the assessment of tactical factors within youth male RU players, due to their importance in the contribution to progression through a performance pathway.

### Feasibility

The 25 factors that achieved agreement for importance, but did not reach agreement for feasibility of measurement, is a key area for future research. Practitioners designing testing batteries as a part of their profiling processes are encouraged to utilise the existing research regarding testing methodologies. For example, a review by Hendricks and colleagues (2015) details the challenges associated with technical skill assessment within RU, whilst providing example assessments that can be utilised within TD settings (Hendricks et al., 2015). Furthermore, over half of these 25 factors are psychological, yet measures such as the Psychological Characteristics of Developing Excellence Questionnaire have been specifically designed for TD settings (Macnamara & Collins, 2011). The lack of feasibility for psychological factors may be attributed to the absence of psychologists within the survey participants, however it highlights the need to further the understanding of practitioners within talent pathways and bridging the gap between researchers and practitioners. The development of an RU multidimensional testing battery that can be utilised within a performance pathway, would help to increase the perceived feasibility of factors. Dimundo and colleagues provided an example of such a testing battery, including factors that were not perceived to be feasible to measure, but it did not include any technical assessments (F. Dimundo, M. Cole, R. C. Blagrove, et al., 2021; Dimundo et al., 2022). It is important that the factors that are considered important, but did not reach feasibility agreement are not excluded from testing batteries, and is a key area for both researchers and practitioners to explore.

### Limitations

The current study reports a broad overview of profiling within male RU through the systematic scoping review and NGT session with expert practitioners, identifying

the imbalances and gaps within the current evidence base. However, the limitations of the review must be acknowledged. The literature search preceded the NGT session and survey, resulting in a gap between search and submission for publication. As such, it is likely recent publications will be missing from the current review. Despite this gap, due to the volume of studies included (n = 107), it is unlikely that recent studies would significantly alter the findings of the review. The expert participants involved in the NGT session only represented three European Tier One RU nations, which is an important limitation of the study that must be acknowledged. The survey findings offered indication of the opinions of researchers and practitioners into which factors are considered important for progression through a male RU performance player pathway, alongside the feasibility of measuring these as part of profiling processes. Whilst the broad, multi-dimensional nature of this study provides directions for further developments across a range of disciplines, it limits the depths of the findings. Furthermore, only 29 researchers and practitioners out of the 75 invited completed the survey, eliciting a response rate of only 38.7%. The low response rate led to an imbalance in the proportion of responses from practitioners compared to researchers, with just nine researchers completing the survey. The disparity in professional backgrounds may lead to a bias towards the opinions of practitioners based on their domain-specific knowledge. However, the practitioners that provided a response had high levels of experience (mean time within a RU performance pathway 11.7 years). The study did not distinguish between stages of the performance pathway (e.g., by age groups), the importance of a factor may differ across stages and future work could explore these potential distinctions. A 3-point Likert scale was employed for the perception of ease and speed of completion to encourage participation; however, it must be acknowledged that a 3-point Likert scales hold lower reliability than 5-point Likert scales (Krosnick & Presser, 2009). The practitioners who participated in the survey are from the same Tier One RU nation, which is an important limitation as the findings are not representative of all RU populations, but instead reflective of the sampled population. It is important to consider this when interpreting the findings of this study. Further work in this area is encouraged to broaden the generalisability of these findings.

## Conclusions

This three-part multi-dimensional study provides a summary of the existing research into player profiling within male RU, multi-disciplinary factors that should be profiled, and the importance and feasibility of these factors for use within profiling settings. A notable disparity between themes exists in the evidence base, with 62% of studies exploring physical factors compared to only 23% of studies under the demographic theme, for example. Whilst physical factors were most common in the existing literature, largely demographic and psychological factors were presented by expert practitioners to be profiled to support the development of youth male RU players. Forty factors across all six themes were perceived to be important by over 70% of survey participants re-emphasising the need for greater multidimensional profiling within RU. These factors should be considered for use within a multidimensional profiling tool, future research should work to establish effective ways to develop and implement this. There existed a particular lack of agreement in the feasibility of measuring factors from the psychological and technical areas, providing direction for further investigation. Whilst the cross-national nature of this study is a strength of the research, the contextual boundaries of the inclusion of only three European Tier One countries in the NGT session, and one European Tier One nation for the survey should be considered when interpreting the results.

## Disclosure statement

EK is the sport scientist for the male Scotland U20 rugby union team and CR is the sport scientist for the male Scotland rugby union team.

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## Authors' contributions

EK, KT and CR conceptualised the study and drafted the article. EK and CR undertook the systematic scoping review. EK collected and analysed all other data. AB and RS critically reviewed and edited the manuscript prior to submission. All authors read and approved the final version of the manuscript.

## Data availability statement

Selected data are available upon reasonable request from the corresponding author.

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