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Original Research

Introduction of the 'Blue Card' Concussion Policy to Semi-Elite Australian Football: Medical Staff Experiences and Perceptions

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Background

The Western Australian Football League (WAFL) introduced a new umpire driven 'blue-card rule' for concussion, but its benefit to the sports medicine team is unknown.

Purpose

To determine the experiences and perceptions of medical staff within the 2022-2023 Men's and Women's WAFL competitions following the introduction of the 'blue-card rule'.

Study Design

Cross-sectional study.

Method

An online survey was delivered through Qualtrics to all WAFL medical staff (doctors, physiotherapists, head trainers). The survey contained four sections (demographics, concussion knowledge, concussion exposure and blue-card perceptions) with closed and multiple-answer questions. Standard methods for reporting descriptive data were applied, including mean ± standard deviation (SD) and proportions (%). Between-group differences were assessed using chi-square tests, and significance was accepted at $p < 0.05$.

Results

Response rate was 48% (n=7 doctors, n=12 physiotherapists, n=12 head trainers). Most staff (70%) did not agree that the 'blue-card rule' was a helpful concussion policy or should remain within the WAFL. Staff also felt umpires are not qualified to identify suspected concussions on-field (67%). Over two-thirds of medical staff feel the Football Commission needs to provide education about concussion policies before the commencement of each season. Only 33% of medical staff felt completely confident in delivering a sideline assessment, and 17% felt completely confident in their diagnostic capabilities. Relationships between medical and other staff were not substantially impacted by the 'blue-card rule'.

Conclusions

Medical staff within the WAFL reported the 'blue-card rule' as an ineffective concussion identification tool and did not support its continued use for future WAFL seasons. Staff

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suggested that the Football Commission needs to provide more education on concussion policies before the commencement of each season.

Level of Evidence

3

INTRODUCTION

Sports-related concussions are becoming a growing concern in contact sports globally.[1,2] However, while some data exist on concussion prevalence[3] the incidence rate in semi-elite Australian football is largely unknown. This includes both West Australian Football League Men's (WAFL-M) and WAFL Women's (WAFL-W).[4] However, almost half of WAFL (men's and women's) players included in a study on the prevalence of mental health complaints self-reported a concussion history.[4] This is far more than the number diagnosed clinically within the WAFL-M,[5] and no research has reported this for WAFL women (WAFL-W).

The 'blue-card rule' is a concussion identification program that aims to allow umpires to remove a player from the field of play for a medical review if they have sustained a suspected sports related concussion (SRC) from an on-field incident (WAFL Rules and Regulations, wafooty.com.au). Following this, medical staff perform their standard concussion assessment per WAFL guidelines.[6] The rationale for the blue card includes improving the identification of concussive events and increasing safety of the game.

A study in Rugy Union explored referees' perspectives on the 'blue-card rule' and found they were well prepared to be involved in on-field concussion recognition.[7] Sullivan et al. also recommended investigating other stakeholders (i.e., medical staff, players, families) and their experiences with the 'blue-card rule'.[7] A similarly designed, larger study across multiple youth sports reported similar findings to the existing knowledge base.[8] Thus, to improve implementation of the 'blue-card rule', in partnership with the WAFL, the authors sought to determine the perspectives of its introduction in match-day medical staff.

The purpose of this study was to report the experiences and perceptions of medical staff within the 2022-2023 Men's and Women's WAFL competitions following the introduction of the 'blue-card rule'.

METHOD

STUDY DESIGN

A cross-sectional cohort study was performed, via an online survey of match-day medical staff (doctors, physiotherapists, head trainers), in the WAFL-M and WAFL-W between the 4th of April 2023 to the 6th of June 2023. This timeframe was following the conclusion of the 2022 WAFL-M and WAFL-W seasons and during the 2023 'in-season'. The final survey was distributed via the WAFC to WAFL-M and WAFL-W staff using an email with a link to the online survey.

SETTING

The WAFL is a semi-elite Australian Football League comprising of the WAFL-M and WAFL-W competitions.[9] The WAFL-M competition has nine clubs with three divisions (League, Reserves, Colts), while the WAFL-W competition has seven clubs with two divisions (League, Rogers). Each club within the WAFL-M and WAFL-W competition must have a qualified medical team (doctor, physiotherapist, and/or head trainer) to diagnose, assess and treat concussions on game day. The 'blue-card rule' allows umpires to remove a player from the field if the umpires believe that a player has a suspected SRC from an incident. That player is then sent to the medical team for a minimum 15-minute review, where a member of the match-day medical team assesses the player. This review involves completion of the SCAT (it was the SCAT 5 at the time of this study),[6] and a judgement on whether the player is or is not concussed. At the same time, the offending player is also sidelined for 15 minutes before returning to the field of play.

In the WAFL-W, each club has a physiotherapist and/or doctor, and one head trainer. Some clubs have the same one or two staff for both divisions, while other clubs may have an independent physiotherapist and/or head trainer for their Rogers team. In the WAFL-M competition, the league and reserves divisions require one doctor, physiotherapist, and head trainer. The Colts division has a minimum of a physiotherapist and/or head trainer. Some clubs have the same three medical staff for all three divisions, or clubs may have an independent physiotherapist and head trainer for their Colts team.

PARTICIPANTS

Key medical staff (doctors, physiotherapists, and head trainers) from the WAFL-M and WAFL-W competitions in the 2022 and 2023 seasons were invited to participate. Participants contact details were obtained via emails, phone calls, and text messages through the research team and an industry partner (TK) from the Western Australian Football Commission (WAFC).

VARIABLES

An online Qualtrics survey (Qualtrics, Provo, UT) was used to collect data and the survey was piloted with the final survey provided in Appendix A. Medical staff self-reported all answers in the survey, which consisted of four key sections addressing: demographics, concussion knowledge, concussion exposure and blue-card perceptions. Participants provided electronic consent via the online Qualtrics survey and participants were able to complete the survey in less than 30 minutes.

Key independent variables collated from the survey included age (years), gender (man, women, non-binary), competition (WAFL-M or WAFL-W or both), level of competition (Seniors or Colts/Rogers), and respondent's experience in their respective role within the WAFL (years). Concussion exposure was self-reported using the following variables: concussions witnessed at training (n), and concussions witnessed in a game (n). Concussion knowledge was assessed on a five-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) and included the capacity to perform a concussion assessment, referral of a potential concussion, and management of a concussion. The number of blue-cards witnessed per respondent was recorded (n). The opinions of the medical staff regarding the 'blue-card rule' were recorded with a five-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree). The 'blue-card rule' impact on the medical staff's relationships with football personnel was assessed on a four-point scale (Positive effect, no effect, negative effect, prefer not to say).

SURVEY DEVELOPMENT AND PILOTING

The initial draft of survey questions was developed by a panel consisting of two concussion researchers (SAH and GC),[10-12] an expert in survey development and validation (MCM),[13,14] a representative from the WAFC (TK), and a WAFL player (JRM). These experts also represent a former WAFL doctor, physiotherapist and sports trainer who are the target healthcare professions in the study.

Once the panel developed the survey items, content and face validity of the items were assessed through a pilot survey that was distributed and reviewed by a small number of WAFL-M and WAFL-W medical team members (n=3) who worked as either a physiotherapist, head trainer or doctor within the WAFL for at least three seasons. This feedback was used to refine the survey's relevance, comprehensiveness, and comprehensibility (as judged by medical team members and the research team, using a similar approach to the authors' previous research).[14]

The process of ensuring the survey had adequate content validity (consisting of relevance, comprehensiveness, and comprehensibility), is the most important step in the validation of any self-reported data and improves accuracy.

SAMPLE SIZE ESTIMATE

Based on the WAFL-M and WAFL-W structure, in direct collaboration with the WAFC, it was assumed that each of the nine WAFL-M clubs had four key medical staff (doctor, physiotherapist, head trainer, and an additional physiotherapist/head trainer for Colts) (n=36) and each of the seven WAFL-W clubs had two key medical staff (head trainer, doctor and/or physiotherapist) (n= 14). Therefore, using a conservative estimate, the maximum sample was estimated to be 50 participants in the 2022 season, with an additional 14 staff (based off WAFC data) in the 2023 season due to turnover (e.g., a total sample of 66 medical staff). Finally, this study aimed for a >44% response rate, which is reported as the average response rate in online surveys, to ensure diversity of the sample.[15]

STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS version 29.0 software (SPSS Inc., Chicago, IL, USA). Standard methods for reporting descriptive data were used, as appropriate. Between-group comparisons of medical team opinions (responses collapsed into agree OR did not agree) on the 'blue-card rule' were assessed using chi-square tests for three sub-groups of interest: Respondent profession (doctor, physiotherapist, trainer); competition (WAFL-M, WAFL-W); competition level [Seniors and Under 19's (WAFL-M Colts/WAFL-W Rogers)]. Statistical assumptions of chi-square test were met with a minimum of five responses per tabulation possible.[16] Significance was set at $p < 0.05$.

ETHICAL CONSIDERATIONS

Ethical approval for this study was provided by the University of Notre Dame Australia Human Research Ethics Committee (Approval number: 2023-007F) and the WAFC. Participants were provided electronic consent, and all data were recorded in a de-identified format.

RESULTS

RECRUITMENT

Sixty-four WAFL-M and WAFL-W medical team staff were sent the survey, and 40 commenced the survey (commencement rate 63%). A total of 31 (48%) completed the survey to the end (Figure 1), which exceeded the aim for an overall 44% response rate of all WAFL-M and WAFL-W medical team members.

PARTICIPANT CHARACTERISTICS

Head trainers made up 38.7% of respondents (n=12), physiotherapists made up 38.7% of respondents (n=12), and doctors made up 22.6% (n=7). An equal split of men and women was observed, and a single participant reported being non-binary. 'Australian' was the most reported ethnicity (n=24, 80.0%), and participants were a mean (SD) of 36.7 (16.2) years old. About three-fourths (n=23, 79.3%) had tertiary qualifications. The majority of participants (n=22, 73.3%) reported having a history of playing contact sport, with 45.2% (n=14) of respondents reporting having had a concussion from contact sport. Ten (33.3%) participants reported being in their current role at their respective club for over five years. Complete participant characteristics can be found in Table 1.

CONCUSSION KNOWLEDGE

The self-reported confidence of the medical team to assess, refer, and manage concussions varied substantially (Appendix B), with specific breakdowns by role presented in Table 2. Furthermore, most respondents (n=23, 74.2%) reported

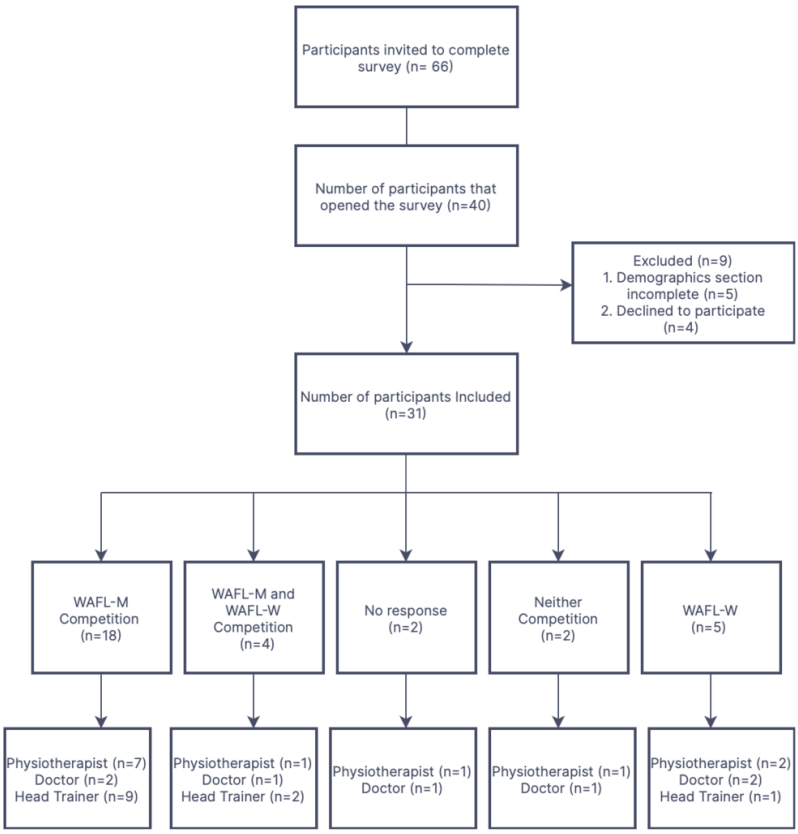

Figure 1. Strengthening the reporting of observational studies in epidemiology Flow Chart

the need for the WAFL to provide specific concussion education.

CONCUSSION EXPOSURE

The majority of respondents reported having witnessed a concussion during games (n=25, 83.3%) and/ or during training (n=17, 57%) (while the blue-card was in effect), with complete details per Appendix C. Seventeen participants (54.8%) reported being present when a 'blue-card rule' was enforced, 12 (38.7%) reported not having seen the 'blue-card rule' enforced, with two participants not responding. Of those participants who witnessed a 'blue-card rule' being enforced, 15 (86.7%) reported their player was the one with a suspected concussion, whereas eight (46.7%) reported their player was the offending player (respondents could select both options). For players who were assessed with suspected concussion via the 'blue-card rule', the majority were diagnosed with concussion either on the day or during the following two days (n=13, 75%). However, 69% (n=12) returned to play during the game [44% (n=5/12) of these were removed from play again during the same game].

BLUE CARD PERCEPTIONS

VALUE OF THE 'BLUE-CARD RULE'

There was some diversity in opinions of medical staff about the 'blue-card rule' (Table 3). However, the majority of medical staff: did not agree that the 'blue-card rule' helps identify players with concussions (n=19/27, 70.4%); did not agree that the 'blue-card rule' assists medical staff in making a concussion diagnosis (n=19/27, 70.4%); did not agree that the 'blue-card rule' makes diagnosing a concussion easier (n=18/25, 72.0%); did not agree that the 'blue-card rule' should be for all concussions, not just reportable offenses (n=15/26, 57.6%); did not agree that the 'blue-card rule' is useful as it allows umpires (in addition to club staff) to identify concussions (n=18/27, 66.7%); and did not agree that the 'blue-card rule' should remain with the WAFL (n=19/27, 70.4%).

EFFECT OF THE 'BLUE-CARD RULE' ON FOOTBALL DEPARTMENT RELATIONSHIPS

For those respondents who reported having witnessed the 'blue-card rule', there were mixed views on the effect of the rule on the relationship the respondent had with the player, medical team, coach, football manager, and umpire. However, less than 20% of medical staff reported any perceived negative effects concerning the player, coach or umpire, with no respondents reporting negative effects with

Table 1. Participant Characteristics

Characteristic (n=31)	Distribution	Number (n)	Proportion (%)
Gender	Man	15	48.4
	Woman	15	48.4
	Non-Binary	1	3.2
Ethnicity	Australian	24	77.4
	Asian	2	6.5
	European	1	3.2
	New Zealander	2	6.5
	North American	1	3.2
	Missing	1	3.2
Education	Completed Year 11 or 12	3	9.7
	Graduate Certificate	3	9.7
	Undergraduate Degree	7	22.6
	Post-graduate Degree	3	9.7
	Higher Degree (Master's or Doctorate)	13	41.9
	Missing	2	6.5
History playing contact sport	Yes	22	71.0
	No	8	25.8
	Missing	1	3.2
History of concussion	No	17	54.8
	One to three concussions	10	32.3
	More than three concussions	4	12.9
Seasons working within the WAFL Club	1 year	7	22.6
	2-5 years	11	35.5
	6-10 years	6	19.4
	>10 years	4	12.9
	Not reported	2	6.5
	Missing	1	3.2

the medical team members or the football manager (Appendix D).

DIVERSITY OF RESPONSES TO THE VALUE OF THE 'BLUE-CARD RULE' BASED ON PROFESSION

No significant between-group differences were detected for Medical Team Opinions on the 'blue-card rule' based on the respondent's role for all items in Table 4. There was a trend that physiotherapists and doctors were in agreement, with differences usually due to head trainer responses, however this trend was not significant. A breakdown of medical staff responses to each item concerning their role can be found in Appendix E.

DIVERSITY OF RESPONSES TO THE VALUE OF THE 'BLUE-CARD RULE' BASED ON COMPETITION TYPE

Significant between-group differences were detected for Medical Team Opinions on the 'blue-card rule' based on the 'blue-card rule' assists medical staff in making a concussion diagnosis (p=0.029), with WAFL-M staff feeling it to be less helpful than WAFL-W staff. Otherwise, no significant between-group differences were detected for competition type in all other items (Table 5). A breakdown of medical staff responses to each item concerning the competition they provide coverage at can be found in Appendix F.

DIVERSITY OF RESPONSES TO THE VALUE OF THE 'BLUE-CARD RULE' BASED ON COMPETITION LEVEL

No significant between-group differences were detected for Medical Team Opinions on the 'blue-card rule' based on the respondent's competition type for all items in Table 6. There was a trend that Colts/ Rogers respondents were more supportive of the 'blue-card rule', however this trend was not significant. A breakdown of medical staff responses to each item concerning their role can be found in Appendix G.

Table 2. Confidence in Concussion Assessment, Referral and Management by role.

Confidence Item		Role		
		Doctor (n, %)	Head Trainer (n, %)	Physiotherapist (n, %)
Sideline Assessment	Sometimes	0 (0)	0 (0)	1 (5)
	About half the time	0 (0)	0 (0)	1 (5)
	Most of the time	2 (11)	6 (32)	3 (16)
	Always	2 (11)	1 (5)	3 (16)
Diagnosis	Never	0 (0)	1 (5)	0 (0)
	Sometimes	0 (0)	0 (0)	1 (5)
	About half the time	0 (0)	1 (5)	2 (11)
	Most of the time	3 (16)	4 (21)	4 (21)
	Always	1 (5)	1 (5)	1 (5)
Ruling a Player Out	Never	0 (0)	1 (5)	0 (0)
	About half the time	0 (0)	0 (0)	1 (5)
	Most of the time	3 (16)	3 (16)	6 (32)
	Always	1 (5)	3 (16)	1 (5)
Referring a Potential Concussion for Assessment	Most of the time	1 (5)	2 (11)	4 (21)
	Always	3 (16)	5 (26)	4 (21)
Prescribing Treatment	About half the time	0 (0)	1 (5)	1 (5)
	Most of the time	0 (0)	2 (11)	6 (32)
	Always	4 (21)	4 (21)	1 (5)
Providing a Return to Play Clearance	Never	0 (0)	4 (21)	1 (5)
	About half the time	0 (0)	0 (0)	1 (5)
	Most of the time	1 (5)	2 (11)	5 (26)
	Always	3 (16)	1 (5)	1 (5)
Providing Return to Play Advice	Never	0 (0)	3 (16)	0 (0)
	Most of the time	1 (5)	1 (5)	4 (21)
	Always	3 (16)	3 (16)	4 (21)
Managing Player with Concussion History	Never	0 (0)	1 (5)	0 (0)
	Sometimes	0 (0)	1 (5)	0 (0)
	About half the time	0 (0)	1 (5)	1 (5)
	Most of the time	1 (5)	1 (5)	3 (16)
	Always	3 (16)	3 (16)	4 (21)
Diagnosing a concussion in players with medical comorbidities (e.g., depression)	Sometimes	0 (0)	1 (5)	1 (5)
	About half the time	0 (0)	2 (11)	2 (11)
	Most of the	2 (11)	1 (5)	5 (21)

	time			
	Always	2 (11)	3 (16)	0 (0)
Diagnosing Concussion Less Than 16 years old	Never	0 (0)	1 (5)	1 (5)
	Sometimes	0 (0)	0 (0)	2 (11)
	About half the time	0 (0)	3 (16)	1 (5)
	Most of the time	3 (16)	3 (16)	4 (21)
	Always	1 (5)	0 (0)	0 (0)

Table 3. Medical Team Opinions on the Blue-card Rule

Variable	Strongly Agree (n, %)	Agree (n, %)	Neither Agree nor Disagree (n, %)	Disagree (n, %)	Strongly Disagree (n, %)
The blue-card rule helps identify players with concussion	3 (11)	5 (19)	8 (30)	7 (26)	4 (15)
The blue-card rule assists medical staff in making a concussion diagnosis	1 (4)	7 (26)	12 (44)	5 (19)	2 (7)
The blue-card rule makes the decision to diagnose a concussion easier	1 (4)	6 (24)	7 (28)	6 (24)	5 (20)
The blue-card rule should be for all concussions, not just reportable offences	3 (12)	8 (31)	6 (23)	7 (27)	2 (8)
The blue-card rule is useful as it allows umpires (in addition to club staff) to identify concussion	3 (11)	6 (22)	7 (26)	10 (37)	1 (4)
The blue-card rule should remain within the WAFL	2 (7)	6 (22)	12 (44)	4 (15)	3 (11)

Table 4. Between-group comparisons for Medical Team Opinions on the Blue-card Rule based on the respondent role (doctor, physiotherapist, or head trainer)

Variable	Pearson Chi-Square	Significance (p-value)
The blue-card rule helps identify players with concussion	2.25	0.325
The blue-card rule assists medical staff in making a concussion diagnosis	1.89	0.389
The blue-card rule makes the decision to diagnose a concussion easier	0.98	0.371
The blue-card rule should be for all concussions, not just reportable offences	3.40	0.180
The blue-card rule is useful as it allows umpires (in addition to club staff) to identify concussion	1.93	0.380
The blue-card rule should remain within the WAFL	0.72	0.696

DISCUSSION

This cross-sectional cohort study represents the first evaluation of 'the blue-card rule' in Australian Football. Moreover, it is the first study to distinctly quantify the medical staff's viewpoint concerning the 'blue-card rule' in any sporting code to which it has been applied.^7 8^ This study reveals three primary findings: firstly, medical staff did not support that the 'blue-card rule' helped with concussion identification on gameday during the 2022-2023 WAFL season; secondly, there was not a substantial number of negative consequences for the relationships between the medical team and football department staff due to the 'blue-card rule', and; lastly, the WAFC should provide more education to medical staff on concussion education (including the 'blue-card rule') in the pre-season.

In the context of rugby, two previous studies explored concussion knowledge, and the experiences of referees tasked with enforcing the 'blue card rule'. Van Vuuren et al. (2020) evaluated a cohort of rugby stakeholders including medical staff and referees who participated in an online survey assessing their concussion knowledge.[17] It was reported that referees attained a concussion knowledge score of 78%, comparable to the medical staff's score of 79%, contrasting the perspectives of WAFL medical staff concern-

Table 5. Between-group comparisons for Medical Team Opinions on the Blue-card Rule based on the respondent's league (WAFL-M or WAFL-W)

Variable	Pearson Chi-Square	Significance (p)
The blue-card rule helps identify players with concussion	2.10	0.147
The blue-card rule assists medical staff in making a concussion diagnosis	4.74	0.029*
The blue-card rule makes the decision to diagnose a concussion easier	0.09	0.763
The blue-card rule should be for all concussions, not just reportable offences	0.05	0.822
The blue-card rule is useful as it allows umpires (in addition to club staff) to identify concussion	0.131	0.717
The blue-card rule should remain within the WAFL	0.13	0.717

*Significant result with $p<0.05$

Table 6. Between-group Comparisons for Medical Team Opinions on the Blue-card Rule Based on the Respondent's Competition Level (Seniors or Colts/Rogers)

Variable	Pearson Chi-Square	Significance (p)
The blue-card rule helps identify players with concussion	0.46	0.794
The blue-card rule assists medical staff in making a concussion diagnosis	0.03	0.983
The blue-card rule makes the decision to diagnose a concussion easier	0.66	0.720
The blue-card rule should be for all concussions, not just reportable offences	0.41	0.817
The blue-card rule is useful as it allows umpires (in addition to club staff) to identify concussion	0.27	0.874
The blue-card rule should remain within the WAFL	1.1	0.576

ing concussion knowledge among WAFL umpires. However, the results need to be interpreted with caution due to the divergence in sporting codes the data were collected from and differing prior concussion education protocols. Additionally, Sullivan et al. (2017) explored referee's experiences with implementing the 'blue card rule' within a New Zealand rugby union league.[7] Two-thirds of the respondents felt the additional responsibility of the 'blue card rule' had no impact on their role performance. As differences in concussion management protocols between codes exist, and differences in the professional level exist (e.g., semi-elite versus elite Australia Football) the value of the 'blue card rule' is likely dependent on other concussion policies and procedures.

Medical staff in the current study disclosed that the WAFC needs to provide concussion education to medical staff in the pre-season. Previous literature has established the efficacy of this approach in referees. Notably, 95% of referees in Sullivan et al. reported having received education from their respective commissions for their expanded role.[7] Moreover, King and Coughlan reported that referees with prior concussion education attained higher average scores in a general concussion knowledge survey in comparison to referees without education.[8] Thus, reinforcing the potential effectiveness of the WAFC delivering concussion education to WAFL stakeholders.

Most of the blue cards issued were subsequently diagnosed with concussions, either on the day or within the following two days. Of specific concern, many players returned to the field during the same game. Plausible explanations for this include: The likelihood that players may have experienced a delayed onset of symptoms[18] or acute diagnostic and management skills of medical staff within the WAFL were inadequate compared to team physicians at higher levels of the sport.[19] This is not necessarily surprising as this study was performed prior to the introduction of the SCAT 6,[20] and the diagnostic accuracy of existing test batteries are known to be suboptimal.[11,21]

Considering this, Thomas et al. found that whilst doctors in their study were confident in making a diagnosis, they were not confident in concussion management.[22] Similarly, in the current study only a small proportion of medical staff expressed that they 'always' felt confident in conducting a sideline assessment and believed in their diagnostic abilities, respectively. It's important to note that the current dynamic nature of concussion protocols may be causing this uncertainty for medical staff. This is of substantial concern when one of the primary roles of medical doctors on match day is to recognize and remove athletes from play when they have a concussion.

This study holds implications for the WAFL's 'blue-card rule': 1) Based on the findings, the authors recommend that the WAFC provides concussion education to medical staff before the commencement of each season for the continued safeguarding of players. The authors recommend medical staff are consulted about what education is required to ensure it is appropriate for the league and addresses the concerns of medical staff, 2) The WAFC needs to con-

sider further research investigating umpire and player's experiences with the 'blue-card rule' (e.g., do umpires even want responsibility for concussion) and, on top of that, reassess whether its continuation within the WAFL is beneficial when balanced against other potential positives of the blue-card rule (e.g., deterrent from rough conduct), and 3) Future amendments to concussion guidelines by the WAFC should be co-designed with medical staff to improve implementation.

FUTURE RESEARCH

To determine the effectiveness of the 'blue card rule' future research should evaluate how many concussive episodes are missed by medical team staff in semi-elite football, which would be picked up by 'blue card rule'. Further, the sensitivity and specificity of the 'blue card rule' with actual concussions could be determined prospectively.

LIMITATIONS

This study had a low number of WAFL-W medical staff participants compared to WAFL-M. The key reason for this is that there were two fewer teams in the 2022 WAFL-W season and one less level within the competition compared to the WAFL-M. Consequently, achieving a balanced representation of participants from both competitions was out of the authors' control leading to sample size dissimilarity. Furthermore, it was not anticipated that medical staff would be providing coverage across both competitions and multiple levels within the competition, potentially leading to participants witnessing and reporting the same concussions within the survey. Another limitation was the potential for recall bias,[23] because participants had to retrospectively report their past experiences with the 'blue card rule' from the previous year.

CONCLUSION

Over two-thirds of medical staff did not support the continuation of the 'blue-card rule' into future WAFL seasons. It is recommended that the WAFC provide further education on concussion (including the 'blue-card rule') before the commencement of each season. These findings provide the WAFC additional information to assist with continued prioritisation of player well-being when implementing strategies to minimise concussion within the WAFL.

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SUPPLEMENTARY MATERIALS

Appendix A

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