

# Concussion through my eyes: a qualitative study exploring concussion experiences and perceptions of male English blind footballers

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## ABSTRACT

**Objectives** Athletes with impairments play sports with a risk of sustaining head injuries and concussions. However, the scientific knowledge needed to improve care is lacking. This qualitative study explores English blind 5-a-side footballers' perceptions of concussion, concussion risks and prevention to improve para concussion care.

**Methods** Nine semi-structured interviews were conducted with male English blind footballers (six current and three retired). Data were analysed by thematic analysis using a six-stage approach.

**Results** Blind footballers were not sure about the number of concussions they had sustained. They lacked an understanding of what to experience when concussed, and they perceived the diagnosis and experience of a concussion to be different for a person without vision. Perceived concussion severity and previous concussion experiences were key concepts affecting their concussion reporting behaviours. Participants mentioned spatial orientation and sleep are important to function in daily life and were affected by concussions. However, these factors are not adequately included in current assessment tools or clinical guidance for sports-related concussions.

**Conclusion** Blind footballers suggested the quality and accuracy of reported concussions were impacted by lack of concussion experience, knowledge and concomitant impairment. A better understanding of concussion symptoms and injury mechanisms will improve concussion reporting for athletes with visual impairments. These athlete insights should guide future studies and para sports governing body initiatives to improve concussion reporting, diagnosis and management in para athletes.

## INTRODUCTION

*"Sometimes it is the people no one can imagine anything of who do the things no one can imagine."*  
Alan Turing (23 June 1912–7 June 1954)

Athletes with impairments play many sports with a risk of sustaining head injuries and concussions.<sup>1</sup> A para athlete is the international term for a sportsperson with an impairment who plays para sport.<sup>2</sup> Within this population, a Para athlete is a person who plays sports with an impairment recognised by the International Paralympic Committee.<sup>2</sup> Concussion carries the same important health and well-being consequences for

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Para athletes play sports and sustain concussions; however, scientific understanding of concussion in para sport is very limited.
- ⇒ On baseline Sport Concussion Assessment Tool testing, para and visually impaired athletes report more concussion symptoms than footballers without disability.
- ⇒ Guidelines exist for para concussion assessment and management, but their effectiveness is unknown.

## WHAT THIS STUDY ADDS

- ⇒ Blind footballers lack an understanding of what to experience when concussed and perceive concussion differently from a person with vision.
- ⇒ Postconcussion severity of symptoms and impact on daily life is more important to blind footballers than whether they sustained a concussion.
- ⇒ Blind footballers have impaired spatial orientation and sleep, which are important to function in daily life and are affected by concussions; however, these symptoms are not adequately included and recognised in current assessment tools or clinical guidelines for sports-related concussion.

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

- ⇒ Effective educational methods on concussion signs and symptoms are needed for blind footballers and their medical and support staff to improve para concussion care and diagnosis.
- ⇒ Different approaches may be required between footballers who have experienced concussions and those who have not, as these two groups report different perceptions, experiences and behaviours.
- ⇒ Symptoms and injury mechanism influence reporting behaviours, so a different approach may be needed to identify concussions that are perceived to be less concerning to blind footballers.

a para athlete as an athlete with no impairments. However, there are likely to be additional considerations and adverse consequences for the para athlete because of their impairment. For example, postconcussive symptoms affecting concentration



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in an athlete with visual impairment may make activities of daily living, the ability to rest and movement control more difficult.

However, a thorough scientific understanding of concussions in para sport and para football is lacking. A 3-year prospective injury surveillance study suggested that injuries to the head and face are common and account for 17% of injuries in both English international blind 5-a-side football and cerebral palsy 7-a-side football.<sup>3</sup> Injury surveillance data from the London 2012 and Rio 2016 Paralympic Games showed that blind football was the Para sport with the highest injury incidence per 1000 hours and at the London 2012 Paralympics, 13.6% of these injuries were to the head and face, also confirming blind footballers may be at risk for concussions.<sup>4,5</sup> While head injuries have been recorded in Summer Paralympic Games, no concussions have yet been reported in surveillance studies, despite witnessed head injuries with visible signs of concussion. This suggests that concussions may have occurred but are not being diagnosed, and this needs to be understood from the perspectives of para athletes and attending medical staff. Fitzpatrick *et al* measured kinematic forces, using head-mounted impact sensors, on seven members of a blind football team over 6 months and demonstrated 3.29 mean low magnitude impacts per player per 50 min match, confirming regular match head impacts and therefore concussion risk.<sup>6</sup> Lexell *et al* demonstrated that Swedish Para athletes with vision impairment reported a significantly higher incidence of sport-related concussion, with collisions being the most common injury mechanism.<sup>7</sup> In different contexts, these studies demonstrate that collisions involving head and neck impacts occur commonly to blind footballers and visually impaired Swedish Para athletes report higher rates of concussions than their Para athlete counterparts with normal vision, but the risk of concussion in para sports is not known.

Blind footballers, when well, on baseline testing using the earlier version of the Sports Concussion Assessment Tool 3 (SCAT3), experienced significantly more concussion symptoms than footballers without disabilities.<sup>8</sup> The more recent SCAT5 also includes an almost identical symptom severity score list, only differing slightly in order (and 'trouble falling asleep', present in both is noted only 'if applicable' in SCAT5). The presence of concussive symptoms when blind footballers are well, suggests that research is required to understand how this affects a blind footballer with concussion within the context of clinical practice and how a visually impaired footballer or their attending medical staff might know if they had sustained a concussion. Each phase of concussion assessment and management necessitates a concussed athlete to disclose, engage, follow clinical advice and behave as medically advised, regardless of disability or impairments.<sup>19</sup>

The first Concussion in Para Sport (CIPS) group position statement identified multiple knowledge gaps and called for research to better understand the intricacies of concussion care within para sport populations.<sup>1</sup> It is essential to understand para athlete concussion perspectives and perceptions, as the athlete's thoughts and behaviours impact the effectiveness and quality of medical care at each clinical stage (eg, disclosure, recognition, assessment, management and graduated return to play). Perhaps most importantly, para athletes are experts in their own injury context. A more effective clinical process will evolve through a thorough understanding of the injury context. It may lead to new insights into concussion care for para athletes (and possibly non-para athletes). This necessitates qualitative study designs among other study designs. To our knowledge, no qualitative studies have assessed the perceptions of para athletes on concussion.

This qualitative study explores current and retired male English blind 5-a-side footballers' perceptions of concussion, concussion risks and concussion prevention based on their experiences in para football, in order to improve clinical care.

## METHODS

### Design

This is an exploratory qualitative study using semi-structured interviews. Thematic analysis was used for this study, following the Consolidated Criteria for Reporting Qualitative Research (see online supplemental appendix 1).<sup>10</sup> Our study was pragmatic, and our methods acknowledge that people interpret reality differently. This creates a foundation for stakeholders to consider when treating para athletes, enabling future work around para concussion to be athlete-centred.<sup>11</sup>

### Ethical approval

The Amsterdam UMC Ethics Committee approved the study (2021.0319), and verbal consent was obtained from all participants after they had listened to an audio recording of the study participant information sheet.

### Participant selection

This study had a convenience sample of current international footballers from the men's England blind football team and recently retired male English international blind footballers still playing club football. All subjects were over 18 years of age. The principal author (RW) previously worked with several current and retired blind footballers in the national team and had personal contact with the team's backroom staff, through which the initial request for participation was communicated. Initial participants provided contact details for additional participants using a respondent-driven method. These additional participants were contacted by phone text messages and a follow-up phone call. All participants who were contacted agreed to participate in the study. The principal author (RW) explained the study background and purpose to the participants, after which they were sent an audio file of the participant information sheet.

Blind 5-a-side football is played on a futsal pitch with an audible ball and sideboards to avoid throw-ins. Goalkeepers are sighted and confined to a small area in front of the goal, and four outfield players are classified as completely blind. Blind footballers wear blindfolds to ensure fairness because some can have partial vision (eg, they may see light and dark, which could provide a sporting advantage). Players must shout the word 'voy' (in Spanish, this means "I am going") when going in for a tackle to alert other players of their presence regarding a tackle to avoid collisions and resultant injuries. Voy infringements should be penalised by the referee, and if a player makes five voy fouls in a game, this player is disqualified from that game.<sup>12</sup>

### Data collection

RW conducted all the one-to-one semi-structured interviews by phone between October and December 2021. Each interview was audio recorded. Face-to-face interviews were avoided during the COVID-19 pandemic, and given that all participants had significant visual impairment, the impact of visual cues was not considered essential to the integrity or quality of data collected. A semi-structured interview guide composed of open questions was applied to understand participants' perceptions regarding their concussion experiences. RW developed the interview questions, which were refined through several meetings and discussions with CB, EV and OHA until agreement on the final

wording of the questions was reached. Before main data collection, a pilot interview was conducted by RW with a colleague without impairment who plays amateur sport to ensure the suitability and practicality of the study methods. Once data saturation appeared to have been reached,<sup>13</sup> one further interview was performed, from which no new concepts or ideas emerged. Data collection was subsequently stopped. The mean interview length was 27.3 min (SD 5.0), ranging from 18 to 32 min.

### Data analysis

Each audio-recorded interview was transcribed verbatim by a professional medical typist who was not part of the research team. A six-stage approach to thematic analysis, described by Braun *et al.*,<sup>14</sup> was used to analyse the data. This approach allows for differences in qualitative research experience between researchers and enables the capture of in-depth accounts of the personal experiences and perceptions of the participants.<sup>13</sup> The first stage involved RW familiarising himself with the transcripts through repeated reading. The second stage involved coding with basic themes. Third, these basic themes were shared and discussed with CB, enabling the development of themes and subcodes, allowing RW to refine the themes and subthemes further to reflect the footballers' stories. The fourth stage involved sharing this data with the research team (CB, EV and OHA) to provide further feedback on the arrangement and coding. In the fifth stage, the research team developed connections between themes and subthemes and the naming of codes to be amended and agreed on by the research team. The sixth phase, which encompasses all other phases, involved writing up the data and analysis.

## RESULTS

### Demographics

Our sample consisted of nine male English blind footballers (six current and three retired blind England football team players). The three retired international blind footballers confirmed they were still playing club or cup blind football. The mean age of the players was 32 years (SD 9.9), and their mean duration of playing blind football was 12.8 years (SD 10.3). Closed questions were used to understand athletes' backgrounds, and these questions followed those in step 1 of the office or off-field assessment of the SCAT5.<sup>15</sup> The highest academic qualifications ranged from five participants at secondary school examinations level (one at age 16 and four at secondary school leaving exams), one participant with an undergraduate degree (BSc) and three participants with postgraduate degrees (two Masters and one PhD). Selected background information of the participants relevant to the study is shown in table 1, with all potential individual participant identifiers excluded.

The main themes and subthemes are presented in conjunction with a short description of our findings. More detailed information and representative quotes are presented in tables 2–4 and a graphic representation of our results is presented in figure 1.

### Theme 1: "Do I have a concussion?"

#### "Did I have a concussion?"

No footballers could report with certainty the number of concussions they had sustained in their football careers. Several footballers perceived that it could be difficult to know if their feelings after a head injury were due to the head injury itself or to the adrenaline and fatigue felt when playing their sport. When recalling their experiences of concussion symptoms, the

**Table 1** Background demographics of the study sample related to Athlete Background section of Sport Concussion Assessment Tool 5, with all potential identifiers removed

Participant	LD/dyslexia/ADHD/ADD or short-term/long-term memory issues	Number of concussions	Hospitalised with a head injury
1	No	I'd say twice	No
2	No	The honest answer is I don't know	No
3	No	Two or three, I think	No (but during the interview reported to have gone to the hospital on one occasion)
4	No	I would say two	No
5	No	I haven't had any. I've taken a few knocks, but I haven't had any concussions	No
6	No	I don't think I've had any	I had a tooth knocked out, which was obviously all sorted and put back in
7	No	To my knowledge, I've never had any concussions	No
8	No	I haven't had any diagnosed concussions in my career, but I think there's a chance I've had a few mild ones	Yes
9	No	One to my knowledge	No

.ADD, attention deficit disorder; ADHD, attention deficit hyperactivity disorder; LD, learning disability.

connection was not made with whether they may have sustained a concussion.

#### What is a concussion?

Footballers defined concussion based on the injury mechanism and the related symptoms. Participants were generally uncertain what a concussion is, highlighted by a wide variety of postconcussion symptoms that they mentioned to have experienced or perceived as 'could be experienced' following a head injury. Footballers' perceptions of concussion varied regarding the severity of symptoms, with each participant noting only a few symptoms at best.

#### Would I report a concussion?

Several footballers reported an innate urge to continue playing the sport after a head injury, accepting the risks to themselves of not disclosing a suspected concussion. Several participants also recognised that as a blind footballer with a concussion, one's performance will be adversely affected if disorientated.

#### Factors influencing diagnosis?

Several participants expressed that their medical teams (explicitly mentioned were physiotherapists and doctors) must decide if they have a concussion. Several participants also perceived their medical team would benefit from knowing how each footballer moves and behaves when 'normal' to spot if they are 'different'

Table 2 Subthemes, codes and exemplary quotes on the theme "Do I have a concussion?"

Subtheme	Code	Exemplary quotes
"Did I have a concussion?"	I don't know	<p>"Obviously, I don't necessarily know if I definitely had a concussion. It was just, oh, hurt my head, and just kept on going, but I could tell, bloody hell, it was a big old hit that one, something is not right."</p> <p>"I suppose I don't...I didn't necessarily know what I'd be looking for to know whether I did or didn't have it."</p> <p>"I wouldn't be surprised if I had a couple more concussions...more sort of minor ones."</p> <p>"I think some people don't even know if they've got it, do they? That's the thing, isn't it? My perception of it is like you can obviously mess up with your memory a little bit for a short period of time or maybe confusion."</p>
	Maybe I did	<p>"I think there's a fringe, isn't there, where it could be a concussion, or it could be the adrenaline of the situation has overridden what's happened and sometimes it's hard to recall what's happened at the time or straight after the event."</p> <p>"At the time, I had quite a lot of blood loss, and I had to go to the hospital. It was at the time a potential concussion, but it wasn't a full-blown diagnosis of a concussion. Concussion protocol was taken, but I'd say it was on the fringe. It was a grey area, whether it was or if it was just adrenaline at the time."</p> <p>"I suppose you get tired during games which causes you to lose concentration, so I guess you don't know whether you attribute sometimes lapses in concentration to just fatigue or whether there are other elements. You know whether there's been a knock that kind of contributed to that as well. So it can be difficult to decide whether that's specifically due to age, a knock on the head or whether it's just general fatigue."</p> <p>"I think I can remember, you know, times after training where I've had a really bad knock and you kind of feel a bit all over the place for the rest of the day, and you know you just want to kind sit down and not do very much."</p>
	I know, as I already had one	<p>"For the second one, I knew I was a little bit in trouble, and I got the doctor involved, and then he did the protocols actually when I got home after the tournament."</p> <p>"I can go back to my last concussion as an example, really. I got a severe head knock, I got very, very disorientated, but I was only able to almost get through that head knock and reorientate myself because I understood where our bench was and orientate myself from our guide and our goalkeeper in order to play. If I'd had that headlock when I first started playing, I wouldn't have been able to orientate...reorientate myself again, and I would have just been just, you know, just nowhere, that sort of thing."</p> <p>"The first one was during a training camp... it was literally just a head knock in the training game, and from my recollection, it wasn't even that big an incident or big collision, but it just left me feeling quite dizzy and just sort of unsteady on my feet for maybe sort of a day afterwards."</p> <p>"I believe I stayed on the pitch for a few minutes afterwards, which maybe wasn't the best thing until they actually realised that I probably was concussed. And I've got no recollection of anything after the game."</p>
What is a concussion?	Based on mechanism	<p>"A bang to the head which causes a fall or equipment to be lost. That bang to the head is usually from the side rather than front on. The bang to the head causes a bit of a blank or a bang or a shockwave."</p> <p>"A significant head injury that's...I suppose changes in cognitive function and/or some kind of emotional change."</p> <p>"Getting knocked out, being out cold. And then, at a lower type of stage, I'd probably say dizziness, not being able to walk properly straight after the incident. Maybe not being able to see, but, in our case, obviously, we wouldn't have that. Things like nosebleeds and things like that I'd say is a concussion."</p> <p>"A kind of...a temporary of...not sort of brain...almost like a brain...a short term brain injury almost...that seems like a very strong word to use but...yeah...and one that kind of affects your memory and your ability to...your ability to function and do kind of everyday things for a short period of time."</p>
	Based on symptoms	<p>"I suppose the main kind of things I remember was, yes, huge clashes and kind of the pain of that, but I also remember headaches."</p> <p>"Some of the lads have come in. They've talked about feeling a bit cloudy thinking."</p> <p>"I think confusion's a big one... memory and probably the balance."</p> <p>"I think it's mild headaches. Really, I would say that's the sort of the symptoms that I'd say that I have had."</p> <p>"It's loss of memory, unable to walk straight, unable to recall certain things, whether it's from the long-term memory or short-term memory."</p> <p>"I was definitely confused, dazed, hyper-emotional for quite a number of days afterwards and during the game and just really drowsy, groggy for three/four days afterwards as well."</p>
	Based on delayed symptoms	<p>"We had two nights left after that tournament ended, and I pretty much spent the whole of those two days sleeping. I didn't go to the functions, didn't do anything, so I just knew that I just had to sleep and just stay horizontal because my head was pounding. I was dizzy as hell, and there wasn't much more I could do for myself really other than that."</p> <p>"I can remember kind of not feeling so great the next day or two, kind of having a bit of a quite large headache and struggling to kind of walk in a straight line and things like that. And yeah, I improved kind of pretty quickly. I'd say within a few days, four or five days. I was feeling more normal again. But even so, I remember...yeah, even kind of a week or so, maybe even two weeks afterwards, I was...I still felt a bit kind of dinged, if that's a word, and I was quite tired and yeah, just needed to rest, really."</p> <p>"I struggled with sleep for the first few nights afterwards."</p>
Would I report a concussion?	I want to play	<p>"I think, like many sports people, you're fundamental drive and desire is to get back on the pitch."</p> <p>"In major competitions, I would probably be a little bit loose with the truth... I would play down reporting to ensure that I could play."</p> <p>"In the long run, you should tell someone about a head injury or concussion, but then in the heat of the moment, then you don't want to be subbed off or go, or there could be a million and one reasons."</p> <p>"I think definitely during a game. You just think that it's nothing, especially the clash of heads or something, and you don't realise that something has happened, and you just get on with it."</p> <p>"I know the medical staff in place would carry out protocols if they knew the truth. So I'm comfortable with that, and I'm comfortable with the choices that I make, and I know the sacrifices."</p>
	Fear of long-term sequelae	<p>"My view over the last couple of years definitely changed to more of those concerns than before. I was just getting on with it, and I didn't really know what my view was, but it was more the fact that I didn't really mind. I didn't really have an idea of it, but now I'm a bit more concerned."</p> <p>"Concussion is a big thing, and you might think about, you know, concealing it now but in later life or whatever that could come back to haunt you, so for me, you know, it's a big thing now in every football, so for me, I wouldn't conceal it, but I could see how some people might try and cover it up."</p> <p>"Say you were concussed or whatever and lied about it or didn't realise, or you go back on and get another one. We all know what can happen like so and I've got a wife and kids at home."</p> <p>"I think across all sports, I think we're a lot more aware of kind of the risks of concussion now and what repeated concussion can do to people, kind of the effect it can have on them in later life even as well."</p>

Continued

Table 2 Continued

Subtheme	Code	Exemplary quotes
	Impact on performance	<p>"From a football point of view of it is, you might be the best player in the world, but if you can't... think straight here, you're no good to the team anyway."</p> <p>"If you don't think that you've got a concussion and you get put on the pitch, for one, it could worsen it, and also, two, you're not in that mindset. You might think you are, but then you're not. You might not think straight and things, so it obviously affects your performance but then also the team's performance."</p>
Factors influencing diagnosis?	The medical staff need to tell me I have a concussion	<p>"We have a physio, and he's been excellent at visibly seeing when something is not right, or something has happened, and he's like, okay, I saw that I saw exactly what happened, and he knows, he'll call out head injury and then all of a sudden you'll get checked."</p> <p>"Obviously, we can't see the physio looking at us because we can't see, but I'm certain he'll be looking to see how are they walking, how are they moving, and he'll check in to see you're okay."</p> <p>"I think you've got to kind of trust in what that medical person's judgment is."</p> <p>"Someone's health has to come first, so if that medical person who doesn't know the person that they're working with makes that judgment, I think it's got to be gone with because you've got to, I think you've always got to be better safe than sorry."</p> <p>"I think the way I'd know I had a concussion is for someone else to tell me. I think the thing I've learnt is that having witnessed people, including my own son, with a concussion, is that I'm not sure I'd know. So I think it needs to be taken out of the athlete's hands completely."</p>
	The concussion assessor needs to know me	<p>"I think that knowing you as a person is a big thing because someone like me, I'm very good at hiding things like fatigue."</p> <p>"So, someone that you know will be able to know that he seems like the kind of individual who is good at hiding things, so you need to make sure that we keep an eye on him because he ain't going to voluntarily come off. Whereas some lads, you'll be able to physically see straight away they're not right, or they'll say they're not right. I think it's a responsibility on both people, both parties; physios and us as players."</p> <p>"I think it's a difficult one. If it's somebody who knows you well, a physio or medical staff who have worked with you, who know you as a person and know your sort of movements, I don't really see there being a problem because I would imagine that they would judge you based on this isn't how you normally move or act. However, I suppose if it's somebody who doesn't know you... It's a difficult one because I suppose, for instance, if someone said to you can you go over there and sit on the chair to your left and you missed it looking for it, that might just be because you didn't see that it was there or, you know, you might move in a different way."</p> <p>"Whether or not the player is going, to be honest, or if you've got like a baseline, the SCAT test... if you don't have a base knowledge of how well they can perform outside of playing, I think that can be a hindrance to the tests."</p> <p>"I definitely am working on balance. Yeah, definitely a concern of if someone has got bad balance, then you can't really 100% go off that. I know obviously, during the test, there are other things, but that's definitely one of the things that you can't really go off for whether you've got a concussion or not because some people might not be able to balance."</p>
	Concussion assessments are visually bias	<p>"The lack of visual feedback for the medical staff to identify whether it is a concussion."</p> <p>"I think definitely with a concussion and being blind is a lot harder because, with not having that sight, you're only going off a feeling."</p> <p>"You'd have to change the measuring points, I think, and try and get it to be not visual dominant. I suppose you haven't got those visual cues where, you know, you've got those different tests, the cognitive tests that you do with somebody who is sighted so, you know, just a simple test on walking in a straight line you couldn't have... you could still not have a concussion and still not be able to walk in a straight line."</p> <p>"I suppose one of the obvious ones is things like double vision, but when you haven't really got any vision to start with, then that's quite a difficult one. I remember being in a hospital because of a mild head injury that wasn't necessarily a concussion, but they said to me... one of the first things they said is if you have any double vision, you know, that was one of the first things they said as like a sign to look out for. I said I barely have light and dark protection, so I don't think that I would even know if I was seeing double anyway."</p> <p>"It was kind of balance and fix points, even the standing on one leg those tests, that's quite hard for a blind person because you haven't got that point to focus on. But the actual mechanism of it, I'm not quite sure how they would present differently, but I know it would be harder to explain the symptoms for a blind person compared to a sighted one."</p>
	Additional challenges relating to visual impairment	<p>"I would start off potentially with how visually impaired people manage under mental fatigue or daily tasks and that stressed situation. As simple as it may sound, it could be travelling unaided with a mobility aid such as a guide dog or a cane, travelling just through the centre of town where there are lots of different obstacles and things like that or situations that might arise and uncertainty, I think that would be a good indicator of how they're coping."</p> <p>"It's worth noting how challenging their tasks can be and how mentally draining they are actually for a long period of time. The hardest thing for a blind or visually impaired athlete isn't necessarily the physical training. It's the mental exertion because of how they work to keep their orientation around the pitch and their awareness around the situation or changes."</p>
	Consider removing the blindfold worn during the game for assessment	<p>"If somebody comes off the pitch and they've still got a blindfold and an eye patch, that's your first barrier to understand... to know if people are focussing where they should be or if they're not, sort of not presenting... not actually facing you... you know talking to you as they should be and then when you take those eye patches off you know you could be presented with a blind player that has two prosthetic eyes... so you won't be seeing if there's any kind of issues going on there, focus issues, that sort of thing and then you've got all the different conditions, you know, weird and wonderful all the way in between where people could have eyes will be wobbling about quite naturally all the time."</p> <p>"So it would give a true chance to reflect on the situation for the blind person. You can be startled sometimes from a knock or a collision. It's not necessarily a concussion. It's just where you've had the wind knocked out of you, and it's knocked your senses slightly. So being able to recalibrate by taking off your blindfold and your patches will give you a chance to show if it's a long-term effect or not."</p> <p>"In my football life, a portion of your face when you play is covered by a blindfold. Quite often, people, because of the visual impairment, won't actually display much kind of eye contact, this is my interpretation anyway, but display much eye kind of movement and so on and often won't make a kind of or is unable to make eye contact with somebody in day-to-day life anyway so you've really, really got the bottom part of the face to look at until you actually take someone's blindfold off and then... yeah even then I can imagine the expression might be a less reliable indicator."</p>

Continued

Table 2 Continued

Subtheme	Code	Exemplary quotes
Consider orientation during the assessment		<p>"I've obviously never had a concussion from a sighted point of view, so I have no point of reference, but I guess you've obviously already got one less centre to orientate yourself with and certainly when you're playing blind football, you are very reliant on using your hearing and your spatial awareness to orientate yourself and I guess it's just kind of maybe that difference that you're missing is amplified when you're concussed."</p> <p>"For me, I would add the orientation like do they actually know where their left, right, forward and back is...and can they tell you where basic things like can they tell you where the goal they're defending is and where the opposition goal is, like can you point roughly speaking in that direction."</p> <p>"Your spatial awareness is a really important thing in blind football, and I think, you know, a head injury can really, really mess with that and again, like with this...if you use sighted football as the kind of stark example, you don't have those troubles really, do you, you don't have to reorientate yourself if you are suffering with a head injury, you just carry on playing, that's why so many players carry on playing, and nobody really realises for a while afterwards."</p>

SCAT, Sport Concussion Assessment Tool.

Table 3 Subthemes, codes and exemplary quotes on the theme "Why am I concussed?"

Subtheme	Code	Exemplary quotes
The game	It is a contact sport	<p>"I think head injuries are more common in blind football than in sighted football because there's a lot more battling and a lot more close contact."</p> <p>"I'm not going to lie. Blind football is contact."</p> <p>"I guess just the way the game is played. You've got a relatively small pitch, and the kind of number of players per square metre on that pitch is higher compared to eleven-a-side football, so I think because of, you know, there's a lot of close contacts, and obviously, the vision impairment doesn't help in that regard, but I think yeah, just, in general, you've got a lot of close contact facing your opposition. So those kinds of head-to-head injuries are more likely just because of that."</p> <p>"Possibly a bit more so in our sport, hard to know, but you would think that the incidents of head collisions are probably higher kind of per minute played or trained than there would be in sighted footballers who had a really bad like head-to-head collisions you...I would expect it to be a bit higher."</p>
No high force or aerial challenges		<p>"However, on the flip side of that, we don't go up for headers, you know, we don't challenge for the ball in the air, and you see a lot of collisions in sighted football which are as a result of people challenging for crosses. So I think it probably evens itself out."</p> <p>"I think at the very top level. I think concussions are probably less...they are probably less likely than in sighted eleven-a-side football because you don't have players competing for the ball in the air, and generally, when you get to the highest level, you...most players on that pitch are very, very spatially aware, and they're well coached and well guided."</p> <p>"We don't head the ball. I think it's a big perception to think that we probably run into each other a lot, but you look at an average Premier League every week and look how many get hit in the face. People that commit to going to 50/50 balls going for headers and things like that, how many people do get caught on a weekly basis like across the country in even sighted football. So...and we wear the extra protection."</p> <p>"If you have two people collide (in sighted football) in that nature or collide with a goalkeeper's elbow or something like that, then I would imagine that the ferocity of that is probably going to be higher than what we come across."</p>
Visual impairment		<p>"If they're standing still and someone runs into them as a standing target, they're probably going to get the brunt of it rather than the person who is running."</p> <p>"I think set pieces, and obviously, I do set pieces which are corners and free kicks, and now in the game, there are runners. You get runners and runners, which will run from a standing start. It sounds crazy because in normal life, would you ever let a blind person tell them to go and run as hard as they can at another blind person. Whereas in our sport, a runner off a wall, a runner off a corner is second nature to us, and I think if that person doesn't stop, you're literally stood there and going to get run into at full throttle from about 5 metres out."</p> <p>"I would just say obviously it's visual impairment, not seeing where each other is, the lack of communication, and then the next thing you know, you've run into someone, or someone has run into you."</p> <p>"Blind people are probably going to run into each other more because they can't see. Blind people tend to play football with their head down because they're listening to the ball, but, you know, it doesn't necessarily need to be that way."</p>
Environment		<p>"I think just communication as a whole. When you're playing in windy conditions particularly, to be honest, like if it's torrential rain, you'd rather play in that than you would like the heavy wind because that's a real challenge then because it just obscures a lot of the communication."</p> <p>"Collisions are more likely to happen on a windy day because they can't hear what's happening around them."</p> <p>"Another instance of the ball is it's having the sight of people being able to watch the people not on the ball as well. Definitely, from one instance I can remember that happened about a month ago was we're playing a league game, and one of the lads was sprinting to get back and no one, not the goalkeeper because they were, she, was guiding, and he ran straight into the post. Or you've got instances where I've known other people, or I've heard about other people running into the fences and into walls whenever it was played inside or whatever. I think they need to be watched on as well because they're more at risk as well."</p>
Experience dependent		<p>"The issues when you come further down the pyramid there is experience of coaches, the experience of volunteers and the experience level of that player and, again, understanding of the game and their body. So, again, I wouldn't say it's the actual impairment that would be more likely but probably the experience of the environment around them."</p> <p>"I think when you get to that top level, then everyone and each of us can sustain levels, so you don't really get surprised by, you know, a loose ball or a player dribbling particularly fast at you or a quick change of direction."</p> <p>"Sometimes I've found with younger players coming through and stuff that it's a faster-paced game than maybe what they're expecting, and they can't get it in in time, so that's when you have collisions."</p> <p>"I've definitely seen more head injuries occur in the lower levels of blind football or lower standard competitions of blind football than I've seen happen at the international level."</p> <p>"The more inexperienced you are playing the game and the least confident you are with your movement, the more high risk you are. Because even if you have a collision when you are an experienced, confident player, it's generally whilst you are moving, and you're in a little bit more control of your movements that you tend to get less hurt than, say, if you're somebody who is standing still and maybe they're confused, they don't know necessarily where they are on the pitch."</p>

**Table 4** Subthemes, codes and exemplary quotes on the theme 'Concussion prevention and improving concussion management?'

Subtheme	Code	Exemplary quotes
Prevention ideas	Education	<p>"Athlete education: I think it's making players aware that they are not doing themselves or the team a disservice by admitting it...admitting that they have a head injury, and they are struggling cognitively."</p> <p>"Coach education: Coaches of any level really...really understanding how to help players to protect themselves and coach them away from potential dangers, that is, the guy behind the goal not letting a player run smack into a goal post or, you know, help basically to create safe environments for those players."</p> <p>"Coach education: With the coaching issue, I think we can just get over that just by having maybe better modules in blind coaching courses around safety, head protection, head injury, concussion."</p> <p>"Athlete, coach and medical staff education: I think it's just reaffirming those things across players, coaches, and medical staff that if you have a problem, you do have to say, you do have to put your hand up. You know, you would if you had a broken leg, so why not with a concussion."</p> <p>"Referee education: It could even just be where the referee has some type of training or medical or something just to come over to see you, check whether you're alright quickly at any head injury or facial injury."</p>
	Spotters	"One option could be even just having a sighted person on the touchline that are open because you've got people on the sides, so even someone talking, it could just be a volunteer, and just someone stood there."
	Equipment	"You don't want to pad up the goalposts because, for one, it makes it less like a goal and, two, it just gives it padding, and it could be the difference between a goal and not because obviously, it could take the pace out of the ball or anything."
	Rule changes	"I definitely remember, even just in training sometimes or something, where you're in a match or something, and someone gets a knock, and you sit up, and you're like, okay, I'm alright, and the referee says, are you alright, and you just go, yeah, and you just get up, and that's it. It could even just be in blind football or in any football. If the medical team come on, then you have to go off."
	Importance of voy rule	<p>"Regarding perceptions on Voy rule: I think it's fairly consistent. Any referees can make a mistake. If you're involved in football, how many challenges...how many challenges do people get away with in any...in any form of football. So I think there are probably mistakes now and again with the voy and that, but no, I think it's fairly consistent. It's a big rule in blind football."</p> <p>"Voy is obviously part of the game to make your game flow and make it attractive, but yeah, also primarily, I guess, is a safety measure."</p>
Referee standards and consistency		<p>"I would say actually the standard of refereeing because generally what happens is the referees aren't always under control with fouls and things like that, and using the voy rule... that's when the risk of getting seriously injured increases."</p> <p>"I think they vary it. I don't know why or anything. I played a couple of weeks ago, and I had hold of the ball, and I was basically through on goal, and there was someone literally just stood there, and I ran straight into them, and they never said voy, but the referee never gave it. But then you've got things like battling on the ball, but yet they'll give no voy on things, and you're right next to each other. So I think they should definitely be a lot more harsh on the fact if there's no contact, then you don't know where that person is. They should definitely have a look at every challenge of no voys and see how serious it is because if there's no voy there and you don't know where they are, then it's going to be a lot more fatal than if you're on the boards and you know where they are than battling but yet they're still not saying voy, at least there's more control over it."</p> <p>"I think that's where there's some responsibility on the referees to referee out properly because I think too often it's...putting it the other way is its late voys and late voys can...it's frustrating because they...they found a, from a footballing point of view it can result in a kind of unfair turnover of possession but also probably, more importantly, that is where you quite often have a large number of head collisions is the if the voy you felt is way too late because you just don't have time to react and kind of take evasive action."</p>
		<p>"I remember particularly one season where we basically had new referees coming in practically every league fixture, and I felt at times it got quite dangerous because they were just so new to the game. It's different internationally because the sport has moved on a lot and the referees internationally are highly experienced now, so they know what to look for, they know the nuances of the game, and that makes a big difference."</p> <p>"Referees, again, at the international level and below, being really, really strict on the voy rule for whoever it is, you've got a tendency with referees maybe to give some leeway to people who are novices or intermediates are not saying voy or not saying voy early enough, and it's always been a bugbear of mine that because yes you may be penalising them in the short term but in the long term you're making them safe and everybody else around them safer."</p> <p>"I think it's very important for it to be refereed more stringently, and I know when I play in the league sometimes, and we sometimes have new referees to the sport if they are not refereeing that rule correctly...I often come back from the league I kind of have more bumps and bruises than I would have done in an international even though the pace of the game isn't as fast, and it's just because of how much of that is let go."</p>
Voy rule is player experience dependent	<p>"I think when you get to that top level, then everyone and each of us can sustain levels, so you don't really get surprised by, you know, a loose ball or a player dribbling particularly fast at you or a quick change of direction, so the voy rule is consistently managed and done well amongst the players. I think the troubles you come into with the voy rule is again when you come down to the national, regional level when you've got international players playing against intermediate, intermediates playing against novices that people can get surprised and they don't voy early enough, or they don't voy at all."</p> <p>"I think when you're new to the game. Obviously, you're told about the voy rule, but when you're new to the game, it's kind of hard to get it in time."</p>	
Player responsibility	<p>"Players can easily have a role to play, wearing headguards and saying the voy, bringing that rule in and making sure it's nice and loud and clear."</p> <p>"I think definitely you have to be a lot more harsh on the voy rule of the person who is saying voy coming into that person, because if you're running with the ball and someone is stood still, and you run into them, then I think you have maybe more control of that."</p>	
Voy rule enforcement	<p>"I think if you've got someone who has literally said voy as they're running into you, obviously it's been given as a freekick, but it definitely has to be something where you have personal fouls, and you have so many to get to until you get a red card. But it has to be given as the fact that if you have, for example, two late voys on someone, then you get a yellow card or something in that sense because, like I say, if someone is running at you, they don't have as much control over the situation..."</p> <p>"I think if referees were stricter on voys then that could...that would help the number of collisions, and I feel that's grown in importance over time as the game has got a lot quicker."</p> <p>"I think referees need to be more aware of is what we call the second man Voy, which sometimes can kind of go under the radar. So, for instance, the first man of the defence says Voy, you go past that player. However, because he said Voy, he's actually screamed at the person who is defending behind him or her, who then doesn't say it, and the referees sometimes don't pick up on it because it's so quick and because of the person in front... you know, there's quite a lot of noise going on, and sometimes they don't necessarily pick up on the second one."</p>	

Continued

Table 4 Continued

Subtheme	Code	Exemplary quotes
Temporary concussion substitutes	Sufficient time to assess	<p>"If you don't, after ten minutes, know whether someone's concussed or not, then you shouldn't probably be bringing them back on the pitch."</p> <p>"I think sometimes you can have a head collision, and it's uncertain whether it's a concussion or not...I think possibly from a blind point of view, you would never know unless you took time, so it would show whether it was more long-term, lasting effects or if it was just adrenaline from the situation."</p> <p>"I was well aware of an incident that happened in a game only a few years ago where one of our players actually got a really bad concussion wearing a head guard, and there were all kinds of bother between the physio and the head coach whether he should be treated on the pitch or not and again with this...with the protocol that sort of stuff wouldn't happen, it shouldn't have happened anyway, but it wouldn't happen now."</p> <p>"I think definitely that's a good thing because it gives them time to actually fully assess whether you've got a concussion or not."</p>
	Resource dependent	<p>"So I think ten minutes is a good period of time, and the question then moves to how many teams have the ability to diagnose, so how many, you know, if you look at the sort of national scale, for example, or even at a local team level, how many, is the skill going to be there, you know, to be able to diagnose, that's the question and what resources are available to enable people to do that."</p> <p>"There's a more practical reason in blind football why a third party may be more appropriate, which is that not every nation has...brings a doctor with them. Having a third party available to adjudicate on this could actually be quite useful in terms of providing that resource to nations that can't afford it."</p> <p>I'm not sure that in some cultures, a team...a team doctor is the right person to be making that call necessarily."</p>
Responsibility removed from the athlete		<p>"Within our game, you might need those extra few minutes to assess that player because obviously, when you're in the thick of the game and you're just being quickly tested, your thing is to get back in the game as quickly as possible, you might not want to come off."</p> <p>"I have seen one player that I believe had a concussion at the time, just kept saying I'm fine, I'm fine and carried on playing, and I believe now he still has a bit of like a lapse of what had happened during that game, but I think with these temporary concussion subs you just take that away from the player, that's what needs to happen because the player isn't going to want to come off with anything really."</p> <p>"I think this is great because I don't think you know yourself."</p>
		<p>"The only other alternative is for it to be a permanent substitution and for that player to go off regardless if they've had a head collision, but, you know, I think we all know that that's...that's not necessarily the right thing to do because, you know, not every head...not every head injury is a concussion, so I think it's a good thing."</p> <p>"I think if they can bring that (TCS) on, I think that would be fantastic. It would definitely help the team. I think as well because you're not necessarily forced to use one of your actual substitutions."</p> <p>"This is a great thing because it means...because they're still limited to having the amount of subs you can have in each half, aren't they now? So at least coaches, even if they were disinclined to use up one of those subs, they wouldn't be now because that's there."</p> <p>"I think you're allowed to make six subs per half anyway so you already have plenty of scope to make substitutions so it will be rare, very rare, I think, that anybody could bend the system to their advantage."</p>
Equipment	Padded headguards and blindfolds	<p>"We have these headguards that we wear now to protect us a bit, like a rubbery foamy headguard thing that we wear, and I've noticed more teams around Europe and stuff have started to introduce them, so they are helping, so it's not full skull on skull contact, there is a bit of padding."</p> <p>"Technology has changed considerably since I've been playing, and there is more padding around the eye socket area, and initially, I think that was because there was so much cutting going on, and so when people crashed heads before those padded blindfolds got more padded, there was a lot of cuts around the eyebrow, cheekbone, that sort of area. I couldn't say if I think it limits concussions or not because that whole area, like around the face, you know, I'm not too sure how many concussions happen around there."</p> <p>"I think the padding that we use now has become the norm. In my view, it's definitely made a difference. For example, on a few occasions where I've had someone actually break the back of me and not only is it safer for them because they're not smashing their teeth or their faces right into the back of my head, they're hitting the headguard which is softer. But also, I've had somebody's tooth actually go into my head before now."</p> <p>"It gives me a bit more confidence when playing. I do take a hit on the head, it's going to absorb some of the impacts, and if you do take a particularly bad knock to the head, you would hope that it would reduce the risk of actually becoming concussed. When I was concussed, it was a full-on kind of knee to the temple, and, you know, we will never know, but maybe if I'd been wearing something like that day, it would have reduced the force that actually went through my head."</p>
	May have issues	<p>"The head protection, I think it leads people into trying to win balls they wouldn't necessarily win or maybe not protecting their body with their arm as they could or should do."</p> <p>"Some of that head protection is really kind of bulky and a bit unwieldy. It's not necessarily the most attractive to play in."</p> <p>"Internationally people are more kitted up with headgear and suchlike because it's been provided for them."</p>

after a head injury. Footballers perceived concussions for sighted and blind people to be different experiences, suggesting that concussion assessments are designed for people with sight. Several participants felt that impaired spatial orientation may be a sensitive and important sign worth assessing after a head injury. The mental exertion and concentration required to play blind football and live as a blind person were also highlighted as challenging and were suggested as worthy of being considered by clinicians when assessing for concussion.

## Theme 2: "Why am I concussed?"

### Game-related factors

Most participants in this study perceived that blind football is a sport involving close contact and a risk of head collisions. They suggested that this is related to the nature of the game played on a small pitch, requiring close contact and 'battling' for ball possession.

In contrast, several footballers perceived that because there are no aerial headers or airborne challenges in blind football, the frequency of higher force collisions is likely to be reduced compared with 'sighted football'.

### Visual impairment

Visual impairment was recognised as a key reason for collisions by participants.

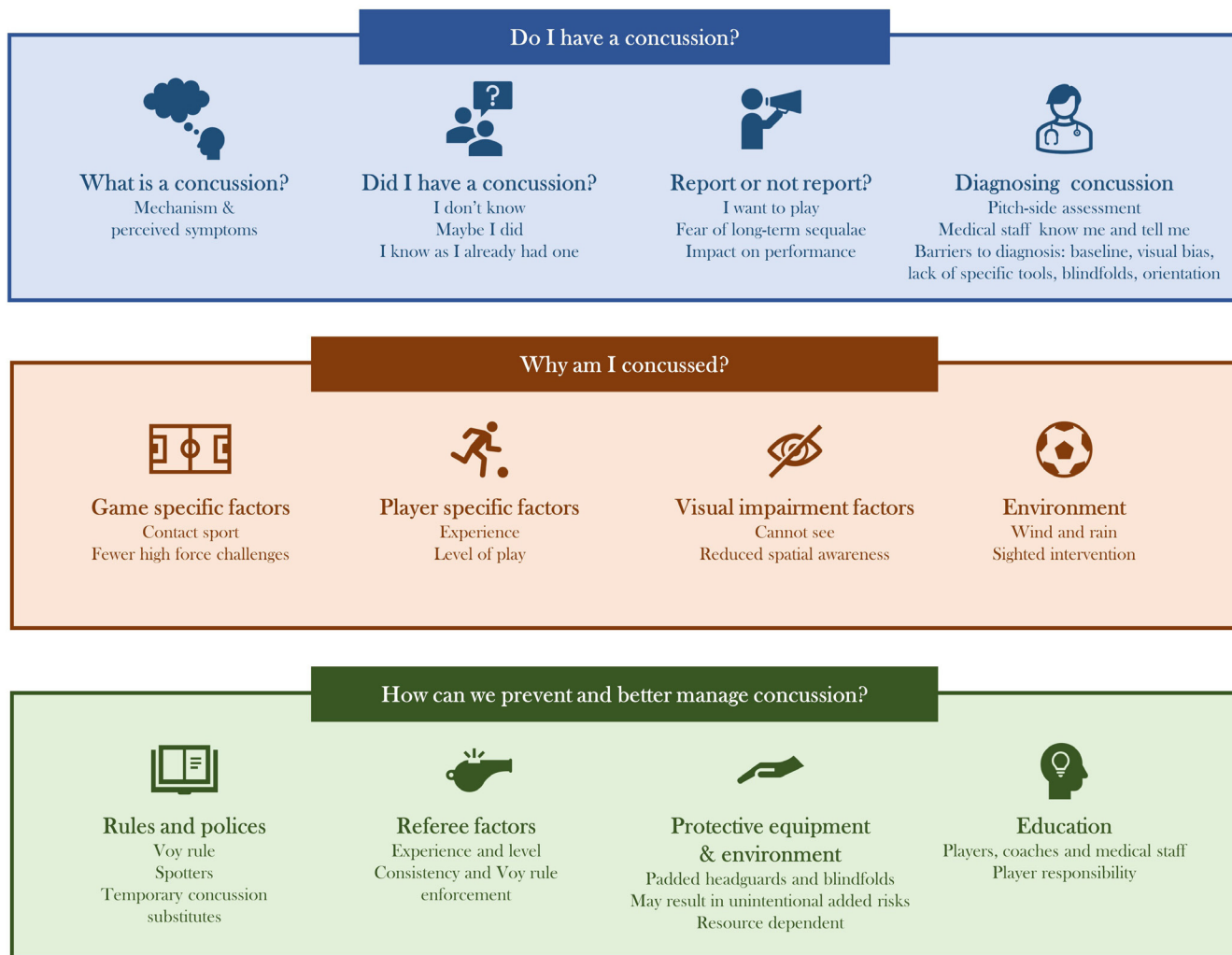
### Environment

Two footballers mentioned that communication between footballers is important to avoid collisions, recalling the example of collisions experienced when unable to hear in windy conditions. One footballer mentioned the importance of communication between them and their support team/sighted goalkeepers, citing an example when a player running back to defend ran into





## CONCUSSION EXPERIENCES AND PERCEPTIONS THROUGH THE EYES OF ENGLISH BLIND FOOTBALLERS



**Figure 1** Concussion experiences and perceptions through the eyes of English blind footballers.

a post and examples of players running into walls and fences. These participants suggested that such collisions are avoidable if witnessed by someone sighted who communicates these movements with the footballers.

### Player-related factors: experience and level

Several blind footballers stated that they had experienced more head injuries at the lower and less experienced game levels. Some participants suggested that as footballers become more experienced (as they move better and play in more experienced environments), they are less likely to have collisions and sustain fewer concussions. One footballer reflected that at the highest level, *“most players on that pitch are very, very spatially aware, and they’re well coached and well guided.”*

### Theme 3: Concussion prevention and improving concussion management

Most participants mentioned education as important in concussion management, and education for players, coaches and medical staff were separately mentioned. Concussion ‘spotters’ (someone who witnesses head injury events live or via live video analysis, relaying their observations to side-line medical staff),

equipment changes and rule changes (eg, consistency of referee ‘voy’ rule enforcement and mandatory head injury assessments by medical staff) to the game were also suggested as potential ideas for concussion prevention.

Perceptions relating to the recent introduction of 10 min temporary concussion substitutions were varied, and several blind footballers felt that 10 min was sufficient time to allow medical assessment. They acknowledged that this provision would be dependent on team resources.

Participants had mixed perceptions on enforcement of the ‘voy’ rule, suggesting that the rule is both important for safety reasons and helps the game flow. Some blind footballers perceived that the referee’s enforcement of the voy rule improves with refereeing experience. Participants also perceived that their observance of the voy rule improved with their experience.

### DISCUSSION

This qualitative study is the first to explore para athlete perceptions and experiences of concussion. This study found that blind footballers were not confident self-reporting the number of concussions they had sustained. This might be a function of their perceived lack of understanding of what to experience

when concussed until the point that they may have experienced concussive symptoms that they recognise. They perceived the diagnosis and experience of a concussion to be different for a person without vision.

### DIAGNOSTIC CHALLENGES

Under-reporting of concussions is common in non-para athletes.<sup>16</sup> However, for blind footballers, also seems to be related to their visual impairment and a lack of knowledge rather than neglectful behaviours or choices where they do not report their own suspected concussions. Risk-taking and under-reporting of subsequent concussions may be apparent if an individual perceives previous concussions as 'mild' (regardless of visual impairment). A survey of 328 American college athletes suggested that athletes who had learnt experiences of concussions were more likely to continue playing, even while experiencing concussion symptoms.<sup>17</sup> In our study, it seemed that blind footballers who had experienced concussions were then better able to recognise concussion symptoms, which may affect reporting, but still, these athletes were uncertain about the total number of concussions they may have experienced. These previously concussed participants also expressed a greater propensity to report future concussions due to acknowledged symptom severity and experiencing unpleasant and more severe symptoms, impacting their lives during recovery.

The participants in our study cited spatial orientation, concentration and sleep as important to blind footballers and affected when concussed. Spatial orientation is a skill that enables a person to determine their position and destination relative to objects in the environment.<sup>18</sup> People with visual impairment know distances and directions that are observed and memorised, with an ability to commit these spatial relationships to memory when they change.<sup>19</sup> Impaired spatial orientation from a concussion may lead to impaired football performance and impaired function in daily life activities. While many other sports injuries have definitions and classification systems based on a spectrum of findings, concussion diagnosis has evolved from a severity spectrum to a binary state (ie, you have, or you do not have a concussion).<sup>20</sup> Despite this binary approach, blind footballers reported that symptom severity is important to them. They also recognised that spatial orientation and sleep are already impaired in people with severe visual impairment, so regular periodic baseline preparticipation examinations by medical staff may be needed to appreciate the presence and severity of these symptoms when blind footballers are well.<sup>1 21 22</sup> One should conclude that it is clinically relevant that spatial orientation is not included in the current SCAT5 guidance for sports concussion.<sup>1 10</sup>

Our study also suggested that blind footballers are not confident in using balance tests to assess for concussion, as they perceived their balance to be generally impaired at baseline. Balance can also be improved with training and therefore balance tests may need cautious clinical interpretation in this population during suspected concussion assessments. However, Weiler *et al* found that blind footballers' balance test scores on earlier SCAT3 baseline testing of blind footballers were not significantly different from sighted footballers.<sup>8</sup> Still, low participant numbers and one testing time point limit the interpretation of this finding.

More widely, para sport clinicians should be aware that athletes with visual impairment may perceive visual bias within existing concussion assessment tools. This may affect their engagement with medical care and trust in clinical decisions, which could lead to underdiagnosis of concussions in blind footballers and

poor concordance with medical treatment advice if they perceive clinical assessments (and care) not to be relevant to themselves.

van Mechelen *et al* reported six relevant key criteria when determining the severity of a sports injury; the duration and nature of treatment; sporting time lost; working time lost; permanent damage and cost.<sup>23</sup> Perceived severity and previous concussion experiences are additional key criteria that are contextually important to blind footballers, which may change their concussion reporting behaviours. Aside from improving individual medical care, without improved concussion diagnosis recognising para athlete perceptions, scientific understanding of all aspects of concussion will remain non-existent because concussions will remain undiagnosed. These undiagnosed concussions will not be recorded within future injury surveillance studies preventing the injury prevention cycle from starting as the scale of the para concussion problem will remain unknown.

### REPORTING CONCUSSION VERSUS RISK-TAKING

Several participants in this study suggested that medical staff are responsible for diagnosing their concussion, as they will struggle to self-diagnose. However, none of these blind footballers made a connection that concussion diagnosis by medical staff requires them to declare their concussion symptom suspicions and seek medical advice. The exception is those blind footballers who want to continue playing when they suspect a concussion and try to conceal their symptoms, a phenomenon common in many other sports and contexts.<sup>19</sup> Concussion assessment and subsequent diagnosis (and sports injury assessment in general) requires an honest declaration of symptoms, an interpretation of symptoms and identification of signs through clinical assessment. It is possible that blind footballers would better understand concussion if it were defined as a spectrum of severity because they can self-relate to the severity of symptoms.

Kissick and Webborn have recognised specific examples of athletes who perceived concussion not to be a 'big problem', comparing a brain injury with experienced major trauma or cancer as a comparator and athletes potentially being 'risk takers'.<sup>24</sup> Participants in our study expressed that they considered blind football a contact sport; therefore, their continued participation suggests an acceptance of perceived injury risks. Athletes who do not accept these perceived risks may choose not to participate or play perceived less risky sports. This supports the notion that some blind footballers are 'risk takers'. Participants generally perceived differences in concussion risk between blind football and mainstream football. Some footballers perceived this concussion risk higher because blind football is a close contact sport. However, other footballers perceived that without high-speed aerial collisions seen in contested headers in mainstream football, concussion risk could be lower in blind football.

In wheelchair basketball athletes, Wessels *et al* reported in a study on 263 subjects that 6.1% reported a concussion in the current season, and 44% did not report their concussion.<sup>25</sup> A further 67% of all wheelchair basketballers said they did not want to be removed from physical activity because of concussion, while 50% thought concussion was not serious and 50% did not know it was a concussion. In the only other qualitative study of general para sports injuries, Fagher *et al* reported that Swedish Para athletes (with 25 participants, of whom 8 had visual impairments) who were aware of their sports-related injuries often chose to continue training, despite considering elite sport to be risky.<sup>26</sup> Within the context of these two studies in para sport, the behaviours reported by some blind footballers related

to concealing a suspected concussion, accepting the long-term risks, and choosing to continue to play are not unique. Fagher *et al* have also shown that Swedish Para athletes with visual impairment perceived their injuries as mainly related to collisions and falls, which all carry a risk of head injury and concussion. This finding was mirrored in our study on the general perceptions of concussion among blind footballers.

### CLINICAL ASSESSMENT AND VISUAL BIAS

We found blind footballers relied on others (including attending medical staff) to witness and confirm their concussions. They also perceived that assessments and tests for concussions are ‘visually biased’ (ie, they implied assessments include tests they cannot do because of visual impairment), and medical staff may not always be present to witness the mechanism or know the athletes. These factors present challenges to the diagnosis of concussion, and this perceived lack of confidence in ‘visually biased’ assessments may also drive under-reporting of concussions in this cohort. The CIPS group position statement<sup>1</sup> recognised specific limitations in SCAT5 assessment tools for concussion-related visual signs and symptoms, which medical staff must consider when attending to visually impaired athletes.

Blind footballers rely on their attending medical staff being present and able to tell them if they have a concussion. While no studies have been undertaken on the knowledge of clinicians working in blind football, a survey of clinicians working with teams participating in the 2015 Cerebral Palsy Football World Championships showed that 29% had received no general concussion education. Only 28.6% used an assessment tool to support concussion diagnosis, and 50% used a cognitive assessment.<sup>27</sup> These apparent gaps in concussion knowledge at a recent para football World Championships suggests blind footballers’ reliance on their attending medical staff to tell them if they have a concussion may be misguided. The ability and reliability of attending para sport medical staff undertaking concussion assessment and management are likely to depend on both resources (ie, medical staff present) and the training, experience and knowledge of these clinicians. These factors will be variable in different countries and at different levels of blind football, thus highlighting the broad need for improved clinician para concussion education and awareness.

### PREVENTION AND IMPROVED MANAGEMENT OPPORTUNITIES

The footballers in our study expressed that they neither know the risk of concussion in their sport, nor the risk compared with mainstream football, meaning that issues with quantifying risk will remain if recognition and diagnosis remain challenging. Suppose athletes cannot recognise, or choose not to reveal a suspected concussion, and clinicians are neither present nor trained to make a diagnosis or struggle to apply visually biased assessment tools. In that case, concussion rates will remain under-reported. These clinical challenges confirm that complexity and context matter for the injury prevention being considered, as described by Bolling *et al*.<sup>28</sup> Therefore, even when context and complexity are recognised and considered, the concussion injury prevention cycle cannot be commenced as the true extent of the problem will remain unknown.

Blind footballers in our study perceived that padded blindfolds worn during play might offer some protection during collisions. Conversely, it was also suggested that these padded blindfolds might present a visual barrier to full clinical assessment by clinicians as they prevent the clinician from seeing and assessing

clinical concussion signs on the face of a footballer. Several participants perceived that temporary concussion substitutions reduce the time pressure on clinicians allowing them more time to remove blindfolds or head protection for a complete assessment. This was generally perceived to be a beneficial step.

Blind footballers stated the rules of blind football to be important, with the ‘voy’ rule being especially important to prevent collisions and allow the game to flow. Opinions varied regarding whether the voy rule is enforced appropriately, and several participants suggested that collisions (and subsequently concussions) increase when referees and athletes are less experienced. The inference was, therefore, that concussions are less likely in elite-level or international-level blind football compared with the lower levels of the sport. One blind footballer in this study highlighted that coaches could help to train athlete movement to reduce the risk of collisions, which presents a further education opportunity.

Asked, the footballers expressed perceptions and ideas on initiatives they think could be considered for injury prevention. Blind footballers in our study perceived that concussion education would raise awareness and recognition, and would improve reporting and clinical assessment. They suggest this education should be for athletes, coaches, referees and medical staff. Medical staff perceptions need to be studied to understand clinical perceptions and diagnostic issues. Future research would need to determine the purpose, content, delivery and effectiveness of such education programmes within the blind football community.

### PRACTICAL IMPLICATIONS

Our study found a perceived lack of understanding of what to experience when concussed, because visually impaired footballers also experience a high number of concussive symptoms when well. This suggests that effective education methods are needed to provide more concussion information to blind footballers, and perhaps to their medical and support staff, on how they can be aware of the signs and symptoms of concussion to improve concussion reporting. Given the reported different perceptions and beliefs observed in our study in footballers who thought they had been concussed and those who had not, different approaches may be required between these two groups as they report different perceptions, experiences and behaviours. Blind footballers perceived concussion symptom severity and mechanism of injury to be of greater relevance to them than whether they sustained a concussion, so we may require different approaches that acknowledge these perceptions to help identify less symptomatic concussions.

### METHODOLOGICAL CONSIDERATIONS

The study findings are limited to the unique environment of English blind 5-a-side football and, as such, may not be transferrable to other para sport impairment groups. To better understand clinical implications, the voices of para athlete medical staff and other support staff are needed as our study was limited to blind footballers. Our approach allowed us to sample participants of various ages and experiences who play blind football at amateur and elite levels. RW had a previous professional relationship with five participants, which could have impacted how the participants responded during these interviews.

### CONCLUSION

Participants stated that the quality and accuracy of concussion diagnosis is impacted by lack of concussion experience,

knowledge and concomitant impairment. The study suggests that blind footballers' experiences and perceptions must be considered by clinicians and researchers as they provide insights to help tailor clinical approaches and to determine whether blind footballers have sustained a concussion. This study highlights many contextual factors influencing concussion diagnosis, symptom reporting and prevention within blind football that should be considered clinically by governing bodies.

Future studies should listen to para athletes' concussion experiences and perceptions from other countries and levels, and explore contextual differences across sports and impairments. To improve clinical concussion care, the perceptions of medical staff also need to be determined. This will support improvements in concussion reporting by para athletes and their subsequent assessment.

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## Appendix 1 Consolidated criteria for reporting qualitative studies (COREQ)

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research

(COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

No. Item	Guide questions/description	Explanation	Reported on Page #
<b>Domain 1: Research team</b>			
<b>Personal characteristics</b>			
1. Interviewer	Which author/s conducted the interview or focus group?	All individual semi-structured interviews were conducted by Richard Weiler (RW)	
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Richard Weiler, MBChB, MSc Caroline Bolling, PhD Willem van Mechelen, MD, PhD Osman Hassan Ahmed (OHA), PhD Evert Verhagen PhD	
3. Occupation	What was their occupation at the time of the study?	Richard Weiler, Medical doctor Caroline Bolling, Sports physiotherapist and researcher Willem van Mechelen, Professor Osman Hassan Ahmed, Sports physiotherapist and researcher Evert Verhagen, Professor	
4. Gender	Was the researcher male or female?	The interviewer is male, Caroline Bolling is female and the other authors are male.	
5. Experience and training	What experience or training did the researcher have?	RW is a General Practitioner and Specialist in Sport & Exercise Medicine, with a masters in sport & exercise medicine and has basic experience with qualitative research. He was trained in qualitative research by experienced qualitative researchers in preparation for the study. Caroline Bolling has a masters degree in	

		<p>physiotherapy, a medical PhD, and is an experienced qualitative researcher.</p> <p>Willem van Mechelen is a medical doctor/human movement scientist/epidemiologist and experienced researcher with experience of qualitative research.</p> <p>Osman Hassan Ahmed has a postgraduate diploma in sports physiotherapy, a medical PhD, and is an experienced qualitative researcher.</p> <p>Evert Verhagen has a masters degree in epidemiology, a medical PhD and is a trained qualitative researcher.</p>	
Relationship with participants			
6. Relationship established	Was a relationship established prior to study commencement?	<p>The principal author (RW) already had contact with several current and retired blind footballers in the team and personal contact with the team's backroom staff, through which an initial request for participation was communicated.</p> <p>OHA worked as team physiotherapist for the England Blind Football Team in 2013-2014 but was/is not aware which athletes participated in this study.</p>	
7. Participant knowledge of the interviewer	What did the participants know about the researcher? E.g. personal goals, reasons for doing the research	Participants were informed of the background and aims of the study before the interview and were all sent an audio recording of the participant information sheet. They were explained the medical background of RW and provenance for the study.	
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g.	RW explained he has a strong interest in the research area and this	

	Bias, assumptions, reasons and interests in the research topic	study was a part of a PhD. RW was team doctor with the GB Blind Football Team at the 2012 Paralympics and was a team doctor for several years prior to this for the English Blind Football Team. He is a doctor, general practitioner and specialist in sport & exercise medicine with basic experience in qualitative research. RW was Chief Medical Officer (part-time) for England Para Football at The Football Association from 2018 to 2020.	
<b>Domain 2: Study design</b>			
Theoretical framework			
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	A pragmatist paradigm underpins this study.	
Participant selection			
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	A respondent driven sampling method was used.	
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Two of the researchers (RW and OHA) had personal contacts with the backroom staff of the team through which our request for participation was communicated.	
12. Sample size	How many participants were in the study?	In total 9 participants	
13. Non-participation	How many people refused to participate or dropped out? Reasons?	No one refused to participate in the study.	
Setting			
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	All data was collected by phone call.	
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	All interviews were conducted without anyone else present.	
16. Description of sample	What are the important characteristics of the	These are described in Table 1 and the Results section.	

	sample? e.g. demographic data, date		
<b>Data collection</b>			
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	This is outlined in the Methods.	
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	No	
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	All interviews were audio recorded	
20. Field notes	Were field notes made during and/or after the interview or focus group?	Yes, notes were made during data collection.	
21. Duration	What was the duration of the interviews or focus group?	The mean interview length was 27.3 minutes (SD 5.0), ranging from 18 to 32 minutes.	
22. Data saturation	Was data saturation discussed?	Data saturation was reached after 8 interviews and confirmed by an additional interview.	
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No	
<b>Domain 3: Analysis and findings</b>			
<b>Data analysis</b>			
24. Number of data coders	How many data coders coded the data?	One coder independently coded all interviews and then discussed the data with another coder to develop sub-themes.	
25. Description of the coding tree	Did authors provide a description of the coding tree?	No- but this is available upon request	
26. Derivation of themes	Were themes identified in advance or derived from the data?	Themes and sub-themes emerged from the data.	
27. Software	What software, if applicable, was used to manage the data?	N/A- data was organized in an Excel file	
28. Participant checking	Did participants provide feedback on the findings?	Participants did not provide feedback but the published paper will be sent to all participants.	
<b>Reporting</b>			
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Yes, within the Tables of the Results section	
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes	



31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes, in Tables and text	
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Yes, primary codes are also described	