

Letters

RESEARCH LETTER

Assessment of Head Collision Events During the 2014 FIFA World Cup Tournament

The consensus statement from the 2012 and 2016 International Conference on Concussion in Sport, adopted by Federation Internationale de Football Association (FIFA), indicates that players showing any feature of concussion should be immediately withdrawn from play and assessed by sideline health care personnel.¹ Such recommendations and their enforcement may influence officiating, coaching, and play of millions of young players. The incidence, characteristics, and assessment of head collision events incurred during the 2014 FIFA World Cup were studied to evaluate compliance with the consensus statement.

Methods | Four trained reviewers identified head collisions through observation of video footage of all 64 matches of the 2014 FIFA World Cup with complete agreement. Video analysis has been shown to be reliable and valid for evaluating head injury in sport.^{2,3} Any event involving head contact in which a player did not continue playing immediately afterward was defined as a head collision event.

Details regarding whether and by whom the players were assessed and the outcome of the assessment were collected on standardized forms. Observable effects of the collision on the player (slow to get up, disoriented, obvious disequilibrium, unconsciousness, seizure-like movements, head clutching) were documented as potential signs of concussion.⁴

Although no accepted cutoff for the number of signs that might indicate a concussion exists, we analyzed players with 2 or more signs. St Michael's Hospital research ethics board waived the need for approval.

Results | During 64 games, 61 players had 81 head collisions in 72 separate events (1.13 per match, 32.54 per 1000 match-hours, and 9 involved a head collision event for both players). Of the 81 head collisions, 14 players (17%) showed 0 or 1 sign of concussion, 45 (56%) had 2 signs, and 22 (27%) had 3 or more signs (Table). Health care personnel assessed the player in 12 cases (15%); 45 players (56%) received assessment from another player, referee, or personnel on the field; and 21 players (26%) received no assessment.

Of the 67 occasions in which players manifested 2 or more signs of concussion, 11 (16%) received no assessment and returned to play immediately, 42 (63%) returned to play after on-field assessment by another player (15 cases), referee (12 cases), or health care personnel on the field (15 cases); 11 (16%) were assessed at the sideline by health care personnel and returned to play, and 3 (5%) were removed from the match or tournament (Table). Among players with 3 or more concussion signs, 86% (19 of 22) returned to play during the same game after a mean assessment duration of 84 seconds (Table).

Discussion | In the 2014 World Cup, concussion assessment protocols were not followed in 63% of events when players involved in head collisions were not assessed by sideline health care personnel.

The 81 head collision events identified in this analysis are more than the 19 injuries to the head reported by team physicians to FIFA⁵; however, the lack of formal assessments, identification of the players involved, and differences in methods preclude direct comparison between the studies. Team physicians may have only reported the most obvious and more severe events, and players may have underreported their symptoms to physicians to avoid losing playing time.⁶

Table. Signs of Concussion and Player Outcome

No. of Signs of Concussion	No. of Head Collisions (%)	Player Outcome					Mean Time Stopped for Assessment (Range), s
		No Assessment	Returned to Play After Assessment by		Removed From Play		
			Another Player, Referee, or Health Care Personnel on the Field ^a	Health Care Personnel at the Sideline ^b	For Remainder of Match	From Tournament	
0	3 (4)	2	1	0	0	0	30
1	11 (14)	8	2	1	0	0	62 (22-134)
2	45 (56)	10	30	5	0	0	56 (15-180)
3	20 (25)	1	12	4	2	1	79 (20-170)
4	1 (1)	0	0	1	0	0	130
5	1 (1)	0	0	1	0	0	92
6	0	0	0	0	0	0	0
Total (%)	81 (100)	21 (26)	45 (56)	12 (15)	2 (2)	1 (1)	

^a The mean time play was stopped for player assessment was 53 seconds (range, 15-118 seconds).

^b The mean time play was stopped for player assessment was 107 seconds (range, 64-180 seconds).

The estimate from this study could also be underestimated because video footage follows the play and some injuries could have been missed.

Observation of players' reactions to collision events does not necessarily mean injury or concussion occurred. Some may exaggerate or feign injury to draw a foul. However, 83% of observations noted players displaying more than 1 concussion sign.

Applying similar visible signs of concussion with support from video footage, the National Hockey League and the National Football League introduced trained spotters to identify potentially concussed athletes at games and remove players for assessment. Following the 2014 tournament, FIFA instituted a new rule that avoids disadvantaging teams with 1 less player during the assessment, which may improve the rate of appropriate assessments.⁵

Soccer players presenting signs of concussion following a head collision event deserve assessment from independent health care personnel to avoid delay of care or further injury. Assessment and management of soccer players suspected of concussion should be improved.

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COMMENT & RESPONSE

Maternal Obesity and Cerebral Palsy in Offspring

To the Editor Dr Villamor and colleagues¹ investigated the association between maternal body mass index (BMI) and incidence of cerebral palsy in offspring and found that overweight and obesity in early pregnancy was associated with an increased rate of cerebral palsy. Important confounding factors, including maternal diabetes and hypertension, were not considered in their statistical analyses.

In their unadjusted analyses, maternal diabetic disease and hypertensive disease were significantly associated with incidence of cerebral palsy. However, those confounders were not included as covariates in the multivariable analyses.

Maternal diabetes and hypertension also were not considered as mediators in their study. Diabetes and hypertension are comorbid with maternal overweight and obesity. Previous studies have reported that maternal diabetes and hypertension were associated with increased risk of cerebral palsy in children.^{2,3} As diabetic disease and hypertensive disease are known consequences of maternal obesity and are also possible causes of cerebral palsy, they should have been considered as mediators.

Villamor and colleagues suggested a mechanism that maternal obesity induces macrosomia and hyperinsulinemia, which subsequently may result in neonatal asphyxia and cerebral palsy. However, macrosomia⁴ and fetal hyperinsulinemia⁵ are also more likely in mothers with diabetes because of higher blood glucose levels.

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