Concussion Management in United States College Sports: Compliance With National Collegiate Athletic Association Concussion Policy and Areas for Improvement

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Concussion Management in United States College Sports

Compliance With National Collegiate Athletic Association Concussion Policy and Areas for Improvement

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Background: In 2010, the National Collegiate Athletic Association (NCAA) adopted its Concussion Policy and Legislation, which applies to more than 450,000 collegiate athletes annually. To date, there has been no examination of school-level compliance with the NCAA Concussion Policy.

Purpose: To examine whether stakeholders at NCAA schools report that their school has a concussion management plan and whether existing plans are consistent with the NCAA policy. Also examined were stakeholders' perceptions regarding concussion management at their institution and possible areas for improvement.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Surveys were sent by e-mail to coaches, sports medicine clinicians, and compliance administrators at all 1066 NCAA member institutions. Surveys asked population-specific questions about institutional concussion management. Individuals (N = 2880) from 907 unique schools participated in this survey.

Results: Most respondents (n = 2607; 92.7%) indicated their school had a concussion management plan. Most schools had all (82.1%) or some (15.2%) respondents indicate a concussion management plan was present. When asked to indicate all individuals who could have final responsibility for returning athletes to play after a concussion, 83.4% selected team doctor, 72.8% athletic trainer, 31.0% specialist physician, 6.8% coach, and 6.6% athlete. Most respondents (76.1%) indicated that their institution had a process for annual athlete concussion education; 91.2% required athletes to acknowledge their responsibility to report concussion symptoms. Nearly all respondents (98.8%) thought their school's concussion management plan protected athletes ''well'' or ''very well.'' Top categories suggested for improvement included better coach education (39.7%), increasing sports medicine staffing (37.2%), and better athlete education (35.2%).

Conclusion: Although a large majority of respondents indicated that their school has a concussion management plan, improvement is needed. Compliance with specified components (eg, annual athlete education) lags behind the presence of the plan itself, and stakeholders had suggestions for areas in which improvements are needed. Increasing scientific evidence supporting the seriousness of concussion underscores the need for the NCAA to use its regulatory capabilities to ensure that athletes' brains are safe.

Keywords: concussion; NCAA; health policy; college

The acute[4,9,14,25,26,30] and long-term[6,15-17,27,29,32] effects of concussion are increasingly well documented. Medically indicated management of the diagnosis and return-to-play (RTP) processes are central components of risk reduction efforts.[2,3,10,14] Recently, questions have been raised regarding the extent to which the National Collegiate Athletic Association (NCAA) is protecting the health and safety of collegiate athletes (eg, Fenno,[8] National Collegiate Athletic Association Student-Athlete Concussion Injury Litigation,[18] and Sanchez[26]). In April 2010, the NCAA Executive Committee adopted its Concussion Policy and Legislation.[21] The policy requires that each member school has a concussion management plan and that the plan minimally includes

> (a) An annual process that ensures student-athletes are educated about the signs and symptoms of concussions. Student-athletes must acknowledge that they have received information about . . . concussions

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> and that they have a responsibility to report concussion-related injuries and illnesses to a medical staff member; (b) A process that ensures a student-athlete who exhibits signs, symptoms or behaviors consistent with a concussion shall be removed from athletics activities . . . and evaluated by a medical staff member. . . ; (c) A policy that precludes a student-athlete diagnosed with a concussion from returning to athletic activity . . . at least the remainder of that calendar day; and (d) A policy that requires medical clearance for a student-athlete diagnosed with a concussion to return to athletics activity . . . as determined by a physician . . . or the physician's designee.[21(p64)]

The NCAA's Concussion Policy applies to all 1066 NCAA member schools[20] and affects more than 450,000 athletes annually.[19] Although the policy has been in place for 4 years, there has been no evaluation of how, whether, and to what extent NCAA member schools are in compliance with its requirements. A pilot evaluation of the implementation of concussion education under the NCAA Concussion Policy found substantial variation, suggesting that aspects of the policy may be divergently enacted.[12]

There is a growing body of literature examining the implementation of rules and best-practice guidelines in sports medicine.[5,7,11,13,24,28,31] Generally, it has been found that effective implementation lags significantly behind the creation of guidelines.[7] For example, an evaluation of the implementation of National Athletic Trainers' Association best practices for concussion management in California community colleges found implementation to be inconsistent across institutions.[5] In their review of implementation-related literature, Donaldson et al[7] suggested that using implementation science may improve the rates at which new best-practice guidelines are put into action. In this study, we aimed to build on this existing literature by examining the implementation of the NCAA Concussion Policy at member schools.

Concussion management in collegiate sports is a complex and multifaceted process involving a variety of stakeholders and interests. In recognition of this, 3 stakeholder populations were included in this examination of institutional compliance with the NCAA Concussion Policy. Sports medicine clinicians (primarily athletic trainers [ATs] and physicians) were selected as an important population for their high level of involvement in all levels of concussion management, from policy creation to implementation. Coaches were selected as an important population in recognition of their role as important authority figures for athletes and individuals who, even in the presence of an athletic trainer, are responsible for being able to identify concussion signs and symptoms.[3] Finally, compliance administrators were included in this survey. At NCAA member institutions, the compliance administrator is the primary person in charge of ensuring that the school is in compliance with NCAA policy; as this study was focused on institutional compliance with NCAA policy, these administrators were included in the sample.

The objectives of the present study were to assess institutional compliance with the NCAA Concussion Policy and to understand whether specific components of the concussion management plan were implemented at member schools. In addition, we examined how well nonathlete stakeholders felt their institutional concussion management plan protected the health of their school's athletes and areas in which they thought improvement was needed. Understanding the extent to which schools are adopting concussion management plans and implementing the required components is critical in evaluating the adequacy of the NCAA's present policy and enforcement strategy.

METHODS

Procedure

Survey questions were developed directly from the language of the NCAA's Concussion Policy. Questions were reviewed by experts and members of the target population for content and clarity, and were pilot tested in a small sample. Minor revisions were made as a result of this process. Subsequently, coaches, sports medicine clinicians, and compliance administrators at all 1066 NCAA member institutions were contacted by e-mail using a distribution service provided by the NCAA's Sport Science Institute. Within the e-mail was a description of the research and a link to a secure online survey hosted on the Qualtrics

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TABLE 1
NCAA Concussion Management Study Respondents and Schools Represented[a]

	All	Division I	Division II	Division III
NCAA Concussion Management Study individual respondents				
Total respondents[b]	2880	1403 (48.7)	515 (17.9)	960 (33.4)
Sports medicine[b,c]	908	478 (52.6)	163 (18.0)	266 (29.3)
Athletic trainer	789	394 (49.9)	146 (18.5)	249 (31.6)
Doctor[b]	111	78 (70.3)	16 (14.4)	16 (14.4)
Administrators	133	46 (34.6)	34 (25.6)	53 (39.8)
Coaches[b,d]	1839	879 (47.8)	318 (17.3)	641 (34.9)
Contact/collision[b]	1013	467 (46.1)	172 (17.0)	373 (36.8)
Noncontact/noncollision	437	229 (52.4)	78 (17.8)	130 (29.7)
NCAA Concussion Management Study school representation				
Total schools represented	907	329 (36.3)	224 (24.7)	354 (39.0)
Sports medicine	533	229 (43.0)	120 (22.5)	184 (34.5)
Athletic trainer	498	211 (42.4)	110 (22.1)	177 (35.5)
Doctor	85	61 (93.8)	12 (14.1)	12 (14.1)
Administrators	119	40 (33.6)	30 (25.2)	49 (41.2)
Coaches	755	291 (38.5)	175 (23.2)	289 (38.2)
Contact/collision	579	219 (37.8)	126 (21.8)	234 (40.4)
Noncontact/noncollision	313	152 (48.6)	63 (20.1)	98 (31.3)

[a]Data are reported as No. (%). NCAA, National Collegiate Athletic Association.
[b]Row sums (Division I + II + III) do not equal total because not all respondents provided an answer to the question asking their division of competition.
[c]Athletic trainer + doctor does not sum to total clinicians because 8 non–athletic trainer, nonphysician clinicians also responded to the study.
[d]Contact/collision + Noncontact/noncollision does not sum to total coaches because not all coaches provided information regarding the type of sport they coached.

survey platform. Participants provided informed consent online before completing survey questions. After the initial e-mail, 2 follow-up e-mails were sent at approximately 3-week intervals. Surveys were completed during September and October 2013. The study was approved by the institutional review boards at Boston University Medical Center and Harvard School of Public Health.

Participants

The initial e-mail was received by 32,150 individuals (28,183 coaches, 2935 clinicians, and 1032 administrators), 9699 recipients opened the e-mail (8207 coaches, 1187 clinicians, and 305 administrators), and 2880 individuals responded to the survey (1839 coaches, 908 clinicians, and 133 administrators). Conservative estimates of individual response rates are 9.0% overall, 6.5% for coaches, 30.9% for clinicians, and 12.9% for administrators. There were 1 or more respondents from 907 institutions, for an institution-level response rate of 85.1%. All 50 states and the District of Columbia were represented. Respondent and school characteristics can be found in Table 1.

Measures

The 3 stakeholder groups were asked questions in 3 overarching categories: individual- and school-level demographic characteristics, concussion management policy and implementation, and individual perceptions of concussion management.

Individual and School-Level Demographic Characteristics. Participants selected the state in which their school is located, their school name, and the NCAA division (DI, DII, or DIII) in which the majority of their school's teams compete. Coaches and clinicians indicated their sex and years of experience, as well as the sport and sex of the team(s) they coach or provide care for, respectively. Contact and collision sports were classified using the definition given in the NCAA handbook.[21]

Concussion Management Policy and Implementation. All participants were asked whether their institution has a concussion management plan; response options were yes, no, and unsure.

Individual Perceptions of Concussion Management. All respondents who indicated that their school has a concussion management plan were asked, "In your opinion, how well does your school's concussion management plan protect the health of student-athletes?" with responses on a 4-point scale ranging from *not at all* to *very well*. Coaches and clinicians were also asked, "What changes could improve your concussion management plan?" and were provided with a list of 13 options and space to write in other suggested improvements.

Implementation of Concussion Management Plan. To understand how RTP decisions are made at NCAA member schools, participants were asked, "Who makes the final decision about an athlete's return to play?" They could select all that applied from the following: AT, team doctor, specialist physician, athlete, and/or coach. To understand whether athletes were provided with educational information about

concussions, clinicians and administrators were asked whether there was an annual process for educating athletes about concussions; response options were yes or no. Those who indicated that there was an educational process were subsequently asked who received concussion education. Response choices were all athletes, athletes in contact/collision sports only, or unsure. To understand whether athletes were required to provide acknowledgment that they are responsible for reporting concussion symptoms, clinicians and administrators were asked, "At your school, are athletes required to sign a statement in which they accept responsibility for reporting their injuries and illnesses to the institutional medical staff, including signs and symptoms of concussions?" Response options were *yes*, *no*, or *unsure*.

Analysis

Analyses were conducted using SPSS statistical package version 20 (SPSS Inc) and a standard α of 0.05. Where school-level analyses are reported, they represent the aggregate answers from all respondents from that school for the given question. Chi-square tests of independence were used to examine respondent group-level and division-level categorical differences across questions. Differences between categories were assessed post hoc with z scores reported for significant differences after Bonferroni correction for multiple comparisons. Independent sample t tests were used to examine the effect of concussion management plan presence on specific implementation outcomes, with the Levene test to identify unequal variances for all binary categorical variables.

RESULTS

Presence of Concussion Management Plan

The presence of an institutional concussion management plan was reported by 92.7% of all respondents (n = 2607). A small minority reported that their school did not have a plan (1.1%; n = 30) or that they were unsure whether their school had a plan (6.2%; n = 175). All respondents who were unsure about the presence of an institutional concussion management plan were coaches, representing a significant difference in plan awareness compared with other stakeholders ($\chi^2(4) = 106.65$, $P < .001$). Clinicians more frequently indicated that a concussion management plan was present than did coaches or administrators ($\chi^2(4) = 106.65$, $P < .001$). Division II respondents reported that their school did not have a concussion management plan significantly more frequently than did respondents from other divisions ($\chi^2(4) = 24.99$, $P < .001$). Among coaches who specified what sport they coached (n = 1449), coaches of noncontact/noncollision sports reported that they were unsure whether their school had a concussion management plan significantly more often than did coaches of contact/collision sports ($\chi^2(2) = 19.35$, $P < .001$).

To understand how many schools had concussion management plans and to attempt to reduce the possibility of multiple individuals from the same school inappropriately skewing results, we combined responses of all individuals at a given institution and looked at the information in aggregate at the institutional level. Most schools (82.1%; n = 743) had all respondents indicate that their institution had a concussion management plan, 0.6% of schools (n = 5) had all respondents indicate that their school did not have a concussion management plan, 2.1% of schools (n = 19) had all respondents unsure about the presence of a concussion management plan, and 15.2% of schools (n = 138) had respondents with conflicting answers. Responses regarding concussion management plan presence are presented in Table 2.

Concussion Management Perceptions and Suggested Improvements

Most respondents answered that their concussion plan protected athletes "well" (32.3%; n = 776) or "very well" (66.4%; n = 1594). A small minority indicated that their plan protected athletes "not very well" (1.1%; n = 27) or "not at all" (0.1%; n = 2). Those who answered "not very well" or "not at all" were predominantly coaches (n = 26) of contact and/or collision sports (n = 21) and represented 26 schools (17 DI).

Less than one-quarter of responding individuals (21.9%) felt that their concussion management plan needed no improvement. Of the 78.1% of respondents who indicated improvements to the concussion management plan were needed, a mean (SD) of 2.44 (1.59) changes were suggested. Better coach education (39.7%; n = 853), more staffing in the sports medicine department (37.2%; n = 799), and better athlete education (35.2%; n = 757) were most frequently cited. There were different responses regarding warranted concussion plan improvements between respondent groups. For example, coaches said more frequently than clinicians or administrators that no changes to the concussion plan were needed. Generally, clinicians more frequently cited areas for improvement. For example, clinicians indicated more frequently than other respondent groups that better preseason baseline testing, more medical resources, and better concussion management plan enforcement were warranted. Additional details are provided in Table 3.

Implementation: Return to Play

Most respondents indicated that team physicians (83.4%) and/or ATs (72.8%) had final responsibility for RTP decisions. A sizable minority (31.0%) indicated that specialist physicians had this responsibility. Some respondents selected coaches (6.8%) and/or athletes (6.6%) as final RTP decision makers. After examining both individual responses and aggregate school-level responses, we found that it was most frequent for a physician or an AT to have the ability to make final RTP decisions (61.0% of individual respondents, 87.3% of schools). Additional details are provided in Table 4.

There were significantly different answers by respondent group. Clinicians reported that team doctors were

TABLE 2
Existence of Institutional Concussion Management Plans at NCAA Member Schools[a]

	Existence of Concussion Management Plans at NCAA Member Schools, by Respondent				
	All	Plan	No Plan	Not Sure	*P* Value
Total respondents	2812	2607 (92.7)	30 (1.1)	175 (6.2)	
Clinicians	886	878 (99.1)[b]	8 (0.9)	0	
Administrators	121	118 (97.5)	3 (2.5)	0	<.001[c]
Coaches	1805	1611 (89.3)	19 (1.1)	175 (9.7)[b]	
Contact/collision	1012	932 (92.1)	10 (1.0)	70 (6.9)	
Noncontact/noncollision	437	376 (86.0)	1 (0.2)	60 (13.7)[b]	<.001[d]
Division I respondents	1373	1266 (92.2)	9 (0.7)	98 (7.1)	
Division II respondents	502	460 (89.3)	15 (3.0)[b]	27 (5.4)	<.001[e]
Division III respondents	936	880 (94.0)	6 (0.6)	50 (5.3)	

	Existence of Concussion Management Plans at NCAA Member Schools, by School				
	Schools	Yes Only	Unsure Only	No Only	Mixed[f]
Total school responses	905	743 (82.1)	19 (2.1)	5 (0.6)	138 (15.2)
Division I schools	329	250 (76.0)	4 (1.2)	1 (0.3)	74 (22.5)
Division II schools	222	185 (83.3)	8 (3.6)	3 (1.4)	26 (11.7)
Division III schools	354	308 (87.0)	7 (2.0)	1 (0.3)	38 (10.7)

[a]Data are reported as No. (%). NCAA, National Collegiate Athletic Association.
[b]Indicates that this group responded significantly more frequently to the given answer choice regarding concussion management plan presence (yes, no, or unsure) than did other groups ($z \geq 1.96$).
[c]Reflects differences in responses about the presence of a concussion management plan between major respondent groups (clinicians, administrators, and coaches).
[d]Reflects differences in responses about the presence of a concussion management plan between contact/collision coaches and noncontact/noncollision coaches.
[e]Reflects differences in responses about the presence of concussion management plan respondents from NCAA Divisions I, II, and III.
[f]Indicates that there were divergent responses among individual respondents at the given institution.

TABLE 3
Suggested Improvements to Schools' Concussion Management Plans[a]

	Overall	Coaches	Clinicians	*P* Value[b]
Total respondents	2148	1427	721	
None needed	626 (21.9)	479 (26.0)$^+$	147 (16.2)$^-$	<.001
Better coach education	853 (39.7)	414 (29.0)$^-$	439 (60.9)$^+$	<.001
Better athlete education	757 (35.2)	453 (31.7)$^-$	304 (42.2)$^+$	<.001
Better athletic trainer education	112 (5.2)	78 (5.5)	34 (4.7)	.460
More uniform diagnostic standards	209 (9.7)	130 (9.1)	79 (11.0)	.173
More standards for RTP	235 (10.9)	158 (11.1)	77 (10.7)	.783
Better preseason testing	276 (12.8)	168 (11.8)	108 (15.0)	.036
More medical resources	290 (13.5)	151 (10.6)$^-$	139 (19.3)$^+$	<.001
More staffing in sports medicine department	799 (37.2)	417 (29.4)$^-$	382 (53.0)$^+$	<.001
More frequent review of CMP	228 (10.6)	134 (9.4)	94 (13.0)$^+$	.010
Better CMP enforcement	84 (2.9)	32 (2.2)$^-$	52 (7.2)$^+$	<.001
More/different people reviewing CMP	167 (7.8)	90 (6.3)$^-$	77 (10.7)$^+$	<.001
Multiple clinicians per concussion case	139 (6.5)	92 (6.4)	47 (6.5)	.949
Other[c]	113 (5.3)	75 (5.3)	38 (5.3)	.989

[a]Data are reported as No. (%). CMP, concussion management plan; RTP, return to play. +, this group responded significantly more frequently to the suggested improvement than did other groups ($z \geq 1.96$); –, this group responded significantly less frequently to the suggested improvement than did other groups ($z \leq -1.96$).
[b]*P* values reflect differences in the frequency of responses to the given suggested improvement between respondent groups.
[c]Other write-in responses include: improved communication (22), be less cautious (15), better equipment and assessments (14), staff (6), better RTP (5), unsure (4), more research (3), sport-specific concussion management plans (3), and rule changes (2).

TABLE 4
Final Responsibility for Return-to-Play Decisions After Concussion[a]

	Final Responsibility for Return to Play by Respondent								
	No. of Respondents	AT	Team Physician	Specialist Physician	Athlete	Coach	AT Only[b]	Physician Only[c]	AT and Physician[d]
Overall	2603	1895 (72.8)	2171 (83.4)	808 (31.0)	171 (6.6)	177 (6.8)	307 (11.8)	707 (27.2)	1588 (61.0)
Clinicians	844	421 (49.9)	774 (91.7)	238 (28.2)	21 (2.5)	8 (0.9)	23 (2.7)	423 (50.1)	398 (47.2)
Coaches	1696	1436 (84.7)	1344 (79.2)	555 (41.3)	149 (8.8)	168 (9.9)	276 (16.3)	259 (15.3)	1160 (68.4)
Administrators	63	38 (60.3)	53 (84.1)	15 (23.8)	1 (1.6)	1 (1.6)	8 (12.7)	25 (39.7)	30 (47.6)
	Final Responsibility for Return to Play by School								
	No. of Schools	AT	Team Physician	Specialist Physician	Athlete	Coach	AT Only[b]	Physician Only[c]	AT and Physician[d]
Total	889	820 (92.2)	809 (91.0)	506 (56.9)	143 (16.1)	156 (17.5)	44 (4.9)	68 (7.6)	776 (87.3)
Division I schools	324	294 (90.7)	315 (97.2)	218 (67.3)	71 (21.9)	78 (24.1)	4 (1.2)	30 (9.3)	290 (89.5)
Division II schools	216	198 (91.7)	193 (89.4)	103 (47.7)	22 (10.2)	22 (10.2)	13 (6.0)	18 (8.3)	185 (85.6)
Division III schools	349	328 (94.0)	301 (86.2)	185 (53.0)	50 (14.3)	56 (16.0)	27 (7.7)	20 (5.7)	301 (86.2)

[a]Data are reported as No. (%). AT, athletic trainer.
[b]Indicates that the AT was selected as having final responsibility for return-to-play (RTP) decisions but neither team physician nor specialist physician was selected.
[c]Indicates that team physician and/or specialist physician was selected as having final responsibility for RTP decisions but AT was not selected.
[d]Indicates that AT and at least 1 team physician and/or specialist physician were selected as having final responsibility for RTP decisions.

final RTP decision makers significantly more frequently than did coaches ($\chi^2(2) = 57.12$, $P < .001$; 90.8% vs 78.9%, respectively). Compared with coaches, clinicians less frequently reported that the following groups made final RTP decisions: ATs ($\chi^2(2) = 349.03$, $P < .001$; 49.4% vs 84.3%, respectively), athletes ($\chi^2(2) = 39.33$, $P < .001$; 2.5% vs 8.7%, respectively), and coaches ($\chi^2(2) = 74.53$, $P < .001$; 0.9% vs 9.9%, respectively).

Respondents from 889 schools completed RTP questions. Examined at the school level, there were significant differences by division. Detailed responses can be found in Table 4. Division I schools had specialist physicians as final RTP decision makers significantly more often than other divisions ($\chi^2(2) = 23.88$, $P < .001$). Athletes ($\chi^2(2) = 14.52$, $P = .001$), and coaches ($\chi^2(2) = 18.18$, $P < .001$) were reported as final RTP decision makers at DI schools more often than other divisions ($\chi^2(2) = 14.52$, $P = .001$). ATs but not physicians were final RTP decision makers at DIII schools significantly more often than other divisions ($\chi^2(2) = 15.79$, $P < .001$); in contrast, ATs but not physicians were final RTP decision makers significantly less often at DI schools ($\chi^2(2) = 15.79$, $P < .001$). Respondents who indicated their school had a concussion management plan indicated significantly less frequently that ATs were final RTP decision makers ($P = .008$) and more frequently that "physicians only" were final RTP decision makers ($P = .01$).

Implementation: Athlete Education and Acknowledgment

Table 5 presents detailed responses regarding annual athlete concussion education and acknowledgment of their responsibility to report symptoms of a concussion. Respondents from 519 schools (n = 803) provided information about athlete concussion education. Three-quarters (76.1%) of respondents (n = 611), representing 70.8% of schools, indicated that their institution had an annual process for educating athletes about concussions. Of those who indicated concussion information was provided, 81.5% of respondents (n = 498) provided it to all athletes and 15.6% (n = 92) provided it to only contact and/or collision sport athletes. Respondents who indicated their school did not have a concussion management plan reported significantly more frequently that their school did not provide athletes with concussion education ($P = .001$).

Most respondents (91.2%; n = 736) and the majority of represented schools (89.7% yes only; 94.4% including mixed responses) indicated that athletes were required to acknowledge their responsibility to report signs and symptoms of concussion. The association between institutions having a process for educating athletes about concussions and requiring that athletes provide acknowledgment was not significant ($\chi^2(2) = 3.69$, $P = .158$).

DISCUSSION

Compliance with the NCAA Concussion Policy is high but incomplete. More specifically, most NCAA member schools have a concussion management plan (82.1% had all respondents indicate a concussion management plan was present, and an additional 15.2% of schools had some respondents indicate a concussion management plan was present). However, compliance with specific facets of the

TABLE 5
Institutional Requirement of Athlete Concussion Education and Athlete Acknowledgment of Responsibility to Report Concussion Symptoms[a]

	Annual Process for Educating Athletes About Concussions by Respondent		
	No. of Respondents	Yes Education	No Education
Total	803	611	192
Clinicians	750	573 (76.4)	177 (23.6)
Administrators	53	38 (71.7)	15 (28.3)
Division I respondents	407	321 (78.9)	86 (21.1)
Division II respondents	156	108 (69.2)	48 (30.8)
Division III respondents	240	182 (75.8)	58 (24.2)

	Annual Process for Educating Athletes About Concussions by School			
	No. of Schools	Yes Education	No Education	Mixed[b]
Total	518	367 (70.8)	102 (19.7)	49 (9.5)
Division I schools	221	158 (71.5)	32 (14.5)	31 (14.0)
Division II schools	119	82 (68.9)	28 (23.5)	9 (7.6)
Division III schools	178	127 (71.3)	42 (23.6)	9 (5.1)

	Athlete Acknowledgment by Respondent			
	No. of Respondents	Yes Acknowledge	No Acknowledge	Unsure
Total	807	736 (91.2)	40 (5.0)	31 (3.8)
Clinicians	737	676 (91.7)	30 (4.1)	31 (4.2)
Administrators	70	60 (85.7)	10 (14.3)	0
Division I respondents	401 (49.7)	369 (92.0)	17 (4.2)	15 (3.7)
Division II respondents	164 (20.3)	144 (87.8)	13 (7.9)	7 (4.3)
Division III respondents	242 (30.0)	223 (92.1)	10 (4.1)	9 (3.7)

	Athlete Acknowledgment by School				
	No. of Schools	Yes Only	No Only	Unsure Only	Mixed[b]
Total	486	436 (89.7)	14 (2.9)	13 (2.7)	23 (4.7)
Division I respondents	217	193 (88.9)	5 (2.3)	2 (0.9)	17 (7.8)
Division II respondents	110	100 (90.9)	3 (2.7)	5 (4.5)	2 (1.8)
Division III respondents	159	143 (89.9)	6 (3.8)	6 (3.8)	4 (2.5)

[a]Data are reported as No. (%).
[b]Indicates that there were divergent responses among individual respondents at the given institution.

policy (eg, annual athlete concussion education) lagged behind the presence of the plan itself. Understanding the extent to which member institutions adhere to the NCAA's Concussion Policy is a necessary step in determining whether the current policy and enforcement strategy are adequately protecting the health of collegiate athletes. This study adds critical information to this necessary and timely discussion as the first examination of compliance in a large sample of NCAA member schools across all divisions of competition. Furthermore, the findings of this study reinforce previous literature,[7] suggesting the need for implementation strategies to complement the adoption of new rules or best-practice guidelines.

Collectively, the institutions without a concussion management plan are responsible for the well-being of thousands of collegiate athletes each year.[19] Thus, ensuring that all institutions are fully compliant with the existing mandate is extremely important. Thirty respondents at 27 schools reported their school did not have a concussion management plan, 175 respondents from 140 schools were unsure whether their school had a concussion management plan, and 135 schools had conflicting responses about whether the school had a concussion management plan. Sports medicine clinicians most frequently reported that their institution has a concussion management plan; this may reflect their increased involvement in creating and implementing the concussion management plan compared with other stakeholder groups. For stakeholders to follow an institution's concussion management plan—or to have confidence that other stakeholders are following the plan—they must first know that it exists. At minimum, improved distribution of, and communication about, concussion management plans between stakeholders at NCAA member schools is advised.

The NCAA Concussion Policy states that a "physician or physician's designee" is responsible for the final decision

about an athlete's RTP after a concussion. Most respondents indicated that team physicians (83.4%) and/or ATs (72.8%) were final RTP decision makers. It was most commonly indicated that either an AT or a physician could make the RTP decision (61.0% of respondents, 87.3% of schools); in some cases, only a physician (27.2% of respondents, 7.6% of schools) or only an AT (11.8% of respondents, 4.9% of schools) was an RTP decision maker. Notably, a minority of respondents believed that coaches (6.8%) or athletes (6.6%) could also make final RTP decisions. It may be that ATs and physicians feel pressure from athletes and coaches to prematurely return athletes to play after a concussion. Alternatively, coaches and athletes may be seen as RTP decision makers in that, despite medical clearance, they may elect not to play or allow their athlete to play out of an abundance of caution. The NCAA policy should more clearly delineate that only licensed health care professionals and not athletes or coaches should be considered an appropriate "physician's designee" for returning an athlete to play after a concussion.

Adherence to the NCAA's athlete concussion education mandate was reported at 70.8% of schools. Concerns have previously been raised about the effectiveness of the education provided to collegiate athletes, even when institutions are in compliance with the education component of the NCAA Concussion Policy.[12] The policy provides little guidance on content or delivery of the education, which can have the result of substantial heterogeneity across institutions.[12] Although providing athletes with any information about concussions is a positive step, it is concerning that even minimal levels of information provision are not reported at all institutions. It is recommended that the NCAA Concussion Policy be modified to require provision of information in specific content areas, including the possible short- and long-term consequences of concussions, and that easily accessible evidence-based educational materials be recommended for use by all member institutions.

The NCAA Concussion Policy requires that athletes acknowledge receipt of information about concussions and their responsibility to report concussion signs and symptoms to medical staff. Symptom reporting requires knowing what symptoms to report, something the information provision component of the mandate is ostensibly designed to address. It is concerning that significantly more respondents indicated that athletes were required to acknowledge their role in reporting (91.2% of individuals, 89.7% of schools) than indicated that athletes received concussion education (76.1% of individuals, 70.8% of schools) and that there was not a significant relationship between implementation of the athlete education and the athlete acknowledgment components of the NCAA policy. Athlete acknowledgment may function as a means through which member schools aim to limit their institutional liability or as a strategy to encourage positive athlete concussion reporting behaviors.[1] Insofar as increasing symptom reporting behaviors is an intended outcome, acknowledgment should be paired with appropriate education.

Respondents provided a variety of suggestions for improving concussion management at their institution. On average, clinicians provided significantly more areas of improvement than did coaches. This may reflect an increased involvement on the part of the clinicians in concussion management and thus a more informed perspective on the range of areas in which improvement is needed. Concussion education for athletes and coaches was frequently referenced as needing improvement. This is not surprising: existing evidence indicates that the education provided to athletes sometimes consists only of a 1-page handout.[12] The NCAA recommends but does not require that institutions provide coaches with concussion education; it is unlikely that all institutions are complying voluntarily with this recommendation. Increased staffing in the sports medicine department was also frequently noted as an area for improvement. Medical resources generally (13.5%), as well as resources for preseason testing (12.8%) and having multiple clinicians per concussion case (6.5%), were selected by some respondents as areas that could improve concussion management. Improvement to standards, including those for RTP (10.9%) and concussion diagnosis (9.7%), were selected less frequently. Some respondents indicated that the concussion management plan should be reviewed more often (10.6%), by more or different people (7.8%), or be enforced better (2.9%). It is notable that 22 respondents wrote in that better communication is needed regarding concussion management. Communication about institutional concussion management policies generally and about specific athletes' concussion management is critical for the overall efficacy of concussion care given the multiple stakeholders involved in concussion management on college campuses. Institutions that are examining their concussion management practices should specifically consider the areas of improvement flagged by respondents to this survey. These areas should also be reviewed closely by the NCAA, as they may reflect opportunities to provide additional guidance to institutions.

Institution-level adherence to specific components of the plan was reported at a much lower rate than adherence to simply having a concussion management plan. Ensuring that member institutions adhere to all components of the NCAA Concussion Policy is an important but difficult proposition, a full discussion of which is beyond the scope of this article. The present enforcement structure relies on institutional disclosure of noncompliance.[16,17] Enforcement through self-report is inherently problematic as incentive structures currently favor institutional nonreport. The recently released NCAA concussion guidelines,[22] a voluntary set of best practices, encourages institutions to make their concussion management plans publicly available. This element of the new NCAA concussion guidelines is an important step in a positive direction: making information public has been previously suggested as a mechanism for increasing transparency and uniformity of enforcement in other areas of concussion management.[23] Nonetheless, it bears evaluating whether all schools will comply with this guideline or whether NCAA policy should be revised to make public posting of the concussion management plan mandatory for all institutions.

It should be noted that schools that have not implemented their plans, or portions of their plans, are not technically in noncompliance with NCAA policy. As written, the NCAA Concussion Policy only requires the presence of a plan and not that the plan is actually implemented.[8]

Perhaps the most important next step is for the NCAA to revise the language of its concussion policy to reflect the necessity of plan implementation.

Limitations

This is the first and largest study to examine institutional compliance with the NCAA Concussion Policy; however, there are limits to the generalizability of the findings. It is possible that individuals who completed the survey are different from noncompleters. For example, they may be more knowledgeable about concussions, and this knowledge may be systematically related to their concussion management practices. Alternatively, they may be using this survey to report perceived institutional concussion mismanagement. Although more than 85% of schools had at least 1 stakeholder respond to the survey, it cannot be assumed that all stakeholders have similar knowledge of concussion management protocol at their institution. Specifically, coaches of noncontact sports may be less aware of concussion-related issues such as their school's policies. Furthermore, this study does not include athletes, a critical stakeholder population. Although the response rates were not different across divisions of competition, the absolute number of individuals who responded was significantly higher in Division I than in Division II or III; schools with a large number of respondents may be represented differently than those with only one or two. There are inherent limitations to self-report survey research; most centrally for this survey is the possibility of social desirability bias. It is possible that respondents did not feel adequately protected by investigator assurances of individual and school confidentiality and did not report the true concussion management practices of their institution. The result of these possible biases is that we may be overstating true compliance in the population of interest. It should be noted that not having a concussion management plan or not abiding by particular facets of the NCAA policy is not necessarily indicative of poor clinical care.

CONCLUSION

As scientific evidence supporting the seriousness of both the short- and long-term effects of concussion grows, so too does the need to ensure that athletes' brains are protected. The present findings indicate that not all NCAA member schools are in compliance with the existing NCAA Concussion Policy or recommendations, both with regard to the existence of an institutional concussion management plan and the implementation of its components. Even when respondents reported their school to be in compliance, there were numerous suggestions for improvement. This study reinforces previous findings[12] regarding the need for specific, implementable, and enforced guidelines at NCAA member schools. Implementation strategies, including those previously suggested[7] for improving the adoption of best-practice guidelines may prove useful here. We suggest that the NCAA Concussion Policy be revised to include more specific guidance about content and delivery of concussion education for athletes and coaches, as well as provide more specific guidance about who an appropriate physician's designee could be for RTP decisions. We also recommend that the NCAA's policy be modified to explicitly require that member institutions implement their concussion management plans and require institutional officials to actively report institutional compliance with the NCAA's policy rather than relying on institutional report of noncompliance. The NCAA's recently released guidelines[22] are a positive step toward this end, and it is hoped that schools comply with the voluntary best-practice guideline of making their concussion management plan publicly available. Improvement to and enforcement of the NCAA Concussion Policy is critical for protecting the health and safety of all collegiate athletes. The NCAA, an organization founded to protect the health and well-being of athletes, is strongly encouraged to make the changes outlined as an important step toward achieving this goal.

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