

The Role of Social Support in Concussion Disclosure in United States Air Force Academy Cadets: A Mixed Methods Approach

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ABSTRACT

Introduction:

United States Air Force Academy (USAF) cadets are at risk for sustaining concussions; however, several factors inhibit disclosure. We aimed to better understand the role of social support in concussion disclosure.

Methods and Materials:

We used a mixed methods approach with an electronic survey and interviews. The survey used a 9-point Likert scale (1 = strongly disagree and 9 = strongly agree) to assess concussion disclosure. Survey items asked cadets whom they felt most comfortable disclosing a concussion or bell-ringer/ding to, how quickly they would seek medical attention for a suspected concussion or bell-ringer/ding, whether cadets would be generally supportive/unsupportive of another cadet disclosing a concussion to medical staff, and whether other cadets important to them would be generally supportive/unsupportive if they reported a concussion to medical staff. Two multivariate linear regressions, one for concussion and one for bell-ringers/dings, were calculated to determine whether cadet choice of the person they felt most comfortable disclosing a concussion or bell-ringer/ding to predicted whether they would immediately seek medical attention for either condition. Choice of person included Air Officer Commanding (AOC)/Academy Military Trainer (AMT), upper classmen, cadet who had recovered from a concussion, cadet, closest friend, teammate, and squadmate. Descriptive analyses assessed whether cadets felt supported or unsupported by other cadets and by those who were important to them concerning concussion reporting. Thirty-four semi-structured interviews were conducted with cadets to explore their views on concussion disclosure.

Results:

Increased comfort with disclosing a suspected concussion to an AOC/AMT had higher agreement seeking medical attention ($\beta = 0.28, P < .001$). For every 1-point increase in being comfortable disclosing a potential bell-ringer/ding to an AOC/AMT ($\beta = 0.272, P < .001$), squadmate ($\beta = 0.241, P = .002$), and teammate ($\beta = -0.182, P = .035$), agreement for seeking medical attention immediately increased 0.27, increased 0.24, and decreased 0.18, respectively. Interviews indicated cadets would often speak to a peer before seeking medical attention.

Conclusions:

Our results suggested that cadets felt comfortable reporting a suspected concussion or bell-ringer/ding to various peers and that those peers would be supportive of that choice, indicating social support. Future interventions should include educating cadets that peers may come to them, especially if they are AOCs/AMTs or squadmates.

INTRODUCTION

Nearly 85% of ~9,000 traumatic brain injuries experienced by U.S. military personnel during a single year were considered to be concussions, a subset of mild traumatic brain injury.^{1,2} The U.S. Air Force Academy (USAF) is a federal military service academy, and upon completion, cadets receive a Bachelor of Science degree on graduation. Approximately half of graduates commit at least 5 years of military service to the U.S. Air Force. The remaining graduates complete pilot training, which incurs a longer service commitment (over 10 years). At the USAFA, over 500 concussions occurred

the U.S. government as part of that person's official duties. The investigators have adhered to the policies for protection of human subjects as prescribed in AR 70-25.

doi:10.1093/milmed/usab102

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during a 3-year span.³ Since various signs and symptoms of concussion are not observable to anyone other than the individual experiencing them, some concussions are concealed. When treatments are delayed, concussions may lead to prolonged recovery^{4,5} or higher symptom burden.⁴ When USAFA cadets conceal a concussion for 72 h or more, the average recovery time for males is 28 days rather than approximately 20 days if immediately reported. When women conceal a concussion for more than 72 h, the average recovery time is 46 days rather than approximately 30 days if immediately reported.⁶ The decision to disclose or conceal a concussion is multifactorial, and previous studies have determined that individuals often conceal concussion because of perceived pressure from teammates^{7–10} and reputation costs.¹¹ Bell-ringers/dings are sometimes described as “brief, transient alteration in neurologic function” (p. 647) but no formal definitions exists, as the terms “bell-ringers/dings” are often used by nonmedical personnel to describe potential concussions. These terms are often used in a way that minimizes the perceived seriousness of concussions.^{12,13} Further, the perceived social support of cadets may influence the decision to seek medical attention or keep the injury concealed. Therefore, identifying the individual(s) that cadet would seek out when reporting a concussion would help inform bystander concussion educational interventions, so that they can be developed to reinforce concussion-reporting behavior in targeted groups.

A cadet’s social network is unique. Each cadet is assigned to a squadron with approximately 100 fellow cadet squadmates. A cadet’s roommate is a member of their squadron and military training is completed in squads, thus cadets live and work with their squadron for 4 years. Each squadron is assigned an Air Officer Commanding (AOC) who is a full-time military dorm residence assistant and an Academy Military Trainer (AMT) who oversees military training events (e.g., Basic Cadet Training). The AOC is an officer and the AMT is enlisted.

The purpose of this study was to better understand the role of social support in concussion disclosure. Specifically, we aimed to determine if the choice of individual(s) that cadets preferred to report a concussion or bell-ringer/ding to predicted willingness to immediately report these conditions. This objective sought to describe how cadets perceived the support of people in their social and leadership network after concussion disclosure and to explore the factors that lead cadets to report or conceal concussion. By understanding this unique social network, researchers and clinicians may then be able to better understand the role of social support from fellow cadets and how it influences concussion disclosure, which may lead to educational interventions that promote social support in a positive manner.

METHODS

The current study used a mixed methods approach inclusive of an electronic survey and qualitative interview data for triangulation and convergence.¹⁴ Specifically, this study employed

a convergent parallel design, which uses two methods in order to gain insight into a deeper and more comprehensive phenomenon description.¹⁴ Convergent parallel design also includes separate data collection and analysis, and then the results are combined in order to achieve triangulation with multiple methods.^{14,15} The survey portion of the study was approved and considered exempt by the USAFA Institutional Review Board (IRB). Participants consented to survey participation by checking a box at the beginning of the survey indicating consent. All interview procedures were approved by the USAFA IRB. To ensure anonymity during interviews, participants checked a box if they consented to be interviewed. No active duty service members were involved in the consent process or interviewing process.

Participants

The entire USAFA student body is composed of approximately 4,000 cadets with near 75% male and 25% female. Surveys were administered during Designated Survey and Assessment Time (DSAT), a set-aside period for cadets to complete surveys for course credits or similar compensation. Of those who volunteered during the DSAT, 413 were invited at random to participate in this study, with 408 respondents included in the survey portion of the study (males = 224 [54.5%], females = 166 [40.7%], and missing = 18 [4.4%]). Interviews were collected from 34 participants (males = 23 [67.6%] and females = 11 [32.4%]).¹¹ The inclusion criteria for the survey and interviews included USAFA cadets who speak English. Exclusion criteria include those who are not USAFA cadets.

Survey Content and Distribution

Participants completed the online survey during DSAT. Cadets were e-mailed a link to the survey, which was available for completion from April 5, 2019 to April 9, 2019. The survey could be completed at their convenience during the 1-week participation window, and participation was completely voluntary.

The electronic survey was created specifically by Foster et al.;¹⁶ however, we utilized the survey for the current study to determine whether the choice of individual cadets preferred to report a concussion or a bell-ringer/ding to predicted their willingness to immediately report these conditions and to describe how cadets perceived the support of fellow cadets after disclosure of concussion. Participants responded using a 9-point Likert scale (1 = strongly disagree and 9 = strongly agree). The survey was created using SurveyMonkey (San Mateo, CA) and took 20–25 min to complete.

The survey began with instructions for completion and specified that participants would not be asked to provide identifying information to encourage them to respond honestly. Two items asked participants to identify which individual they felt most comfortable disclosing a concussion and bell-ringer/ding to. Seven options were provided for each question:

AOC/AMT, upper classmen, cadet who had recovered from a concussion, cadet, closest friend, teammate, or squadmate. Two items asked participants whether they would immediately seek medical attention if they thought they had a (i) concussion or (ii) bell-ringer/ding. We included assessment of concussion and bell-ringer/ding in the current study because of misconceptions regarding the reporting of these conditions.¹⁷

Four items assessed how cadets perceived the support of fellow cadets after disclosure of concussion. Specifically, items asked participants whether they thought cadets would be generally supportive or unsupportive of a cadet self-reporting a concussion to medical staff and whether they thought cadets who were important to them would be generally supportive or unsupportive if they self-reported a concussion to medical staff.

Semi-Structured Interview

The interview portion of the current study was part of a previous study described in Weber Rawlins et al.¹¹ Cadets were recruited through a required behavioral science course during their first and third years at USAFA. Participants could receive course extra credit for interview participation, and we informed participants that they could stop the interview at any time without penalty. To protect cadet identity, we did not collect name or other identifiable data.

A demographic form and two semi-structured interview scripts (one for those with concussion/bell-ringer/ding history and one for those without concussion/bell-ringer/ding history) were developed by three concussion researchers, of which two were qualitative research experts.¹¹ Two interview scripts were developed, however previous findings suggested similar findings between both scripts.¹¹ Interview scripts were adapted for the cadet population using a hermeneutic phenomenological approach. To assess the interview scripts, pilot or test interviews took place in March 2018 with additional interviews conducted in April and May 2018.¹¹ After the pilot interviews, no changes to the demographic form or scripts were made.

Interviews lasted approximately 10–35 min and were led by two researchers (M.W.R and C.J.D.). The lead researcher (M.W.R) primarily conducted the interview and the co-researcher asked questions as needed. Audio of the interview was recorded with the cadet's permission. After the interview, audio files were sent to a professional transcription company (Rev.com, San Francisco, CA). The lead researcher then listened to audio recordings while reading transcripts to ensure accuracy. All identifying information, such as names, places, or other items deemed applicable, were redacted. Researchers determined that data saturation occurred, and prolonged engagement was completed after 16 interviews of participants without concussion history and 18 interviews of those with prior concussion history.

Data Analysis

Participant demographics were summarized using descriptive statistics (frequencies and percentages). Cadet responses to the 9-point Likert scale survey questions were summarized using mean, standard deviation (SD), 95% confidence interval, median, and interquartile range. Two multivariate linear regressions, one for concussion and one for bell-ringer/ding, were used to determine whether the individual (AOC/AMT, upper classman, cadet who had recovered from a concussion, cadet, closest friend, teammate, or squadmate) cadets felt most comfortable disclosing a concussion or bell-ringer/ding to predicted whether they would immediately seek medical treatment if they thought they had either condition. All seven predictor variables (individual cadets felt most comfortable disclosing a concussion or bell-ringer/ding to) were included in each model initially but were removed in subsequent models if the variance inflation factor (VIF) was greater than 5.¹⁸ The α level was set at 0.05 and analysis was conducted using SPSS 23 (IBM Corp, Armonk, NY).

Data analysis of the interviews is described in Weber Rawlins et al.¹¹ Overall, a five-cycle process was used as described by Anderson¹⁹ and Wertz et al.²⁰ Cycles one and two are completed by creating an introduction as above and literature review. Cycle three includes data collection, identifying meaningful units, and summarizing findings.^{19,20} The lead researcher read all transcripts and assigned five randomly selected transcripts to four team members.¹¹ After reading each transcript, the team met to discuss the identified meaningful units and create a codebook with themes and sub-themes. Once the codebook was created, the lead researcher examined all transcripts to identify themes and subthemes as outlined by the research team and codebook. To ensure data trustworthiness, data credibility was assessed through prolonged engagement, and data dependability and confirmability were determined by two external reviewers.^{11,21} The external reviewers read all transcripts and ensured our codebook matched their idea of data representation. This process was completed during the third cycle of data analysis. Cycles four and five include relating current findings to the literature and making final data interpretations, which are included in the discussion.¹⁹

RESULTS

Demographic characteristics of survey participants are presented in [Table I](#). Of 413 possible participants, 408 (98.8%) consented to participate in the survey portion of the study. Survey responses are summarized in [Table II](#). For disclosure of bell-ringers/dings, feeling comfortable disclosing to an upper-class cadet had a VIF (variance inflation factor) of >5.0 ($VIF = 5.13$) and, therefore, was removed from analysis. Full participant demographics were previously reported for interview participants.¹¹

TABLE I. Demographic Results for Survey Data Collection

Variable	N	Percentage (%)
Consent rate	408/413, 98.8%	
Gender	N	Percentage (%)
Males	224	54.9
Females	166	40.7
Missing	18	4.4
Class year	N	Percentage (%)
First year (graduate in 2022)	83	20.3
Second year (graduate in 2021)	147	36.0
Third year (graduate in 2020)	95	23.3
Fourth year (graduate in 2019)	67	16.4
Missing	16	3.9

Individual Cadet Preference regarding Target of Disclosure

Ninety-two percentage of cadets completed all items related to this study ($n = 378/408, 92.6\%$). Overall, the choice of individual predicted agreement with seeking medical treatment if they thought they had a concussion ($F_{7,370} = 16.69, P < .001, R^2 = 0.24; \text{Table III}$). Specifically, for every 1-point increase

on the 9-point Likert scale in feeling comfortable disclosing to an AOC/AMT increased agreement with immediately seeking medical attention by 0.28 ($\beta = 0.28, P < .001$).

For survey items related to which individual the cadet felt most comfortable reporting a bell-ringer/ding to and whether they would immediately seek medical attention if they thought they had a bell-ringer/ding, 382/408 (93.6%) cadets completed all items, and choice of individual predicted agreement with seeking medical treatment ($F_{6,375} = 16.49, P < .001, R^2 = 0.21; \text{Table III}$). Every 1-point increase in agreement to report to an AOC/AMT ($\beta = 0.27, P < .001$) and squadmate ($\beta = 0.24, P = .002$) increased agreement for immediately seeking medical attention by 0.27 and 0.24, respectively. For every 1-point increase on the 9-point Likert scale for feeling most comfortable telling a teammate, there was decreased agreement with immediately seeking medical attention by 0.18 ($\beta = -0.18, P = .035$).

Perceived Support from Fellow Cadets After Concussion Disclosure

Overall, survey participants believed other cadets in general and those who were important to them would be supportive

TABLE II. Descriptive Findings for Survey Items

Variable	N	Mean ± Standard deviation	95% Confidence interval	Median	Interquartile range
<i>Predictor or Independent Variables</i>					
If I thought I had a concussion but wasn't sure, I would feel most comfortable telling....					
...Air Officer Commanding (AOC)/Academy Military Trainer (AMT)	387	5.56 ± 2.70	5.29–5.83	6.00	4
...upper-class cadet	388	4.93 ± 2.63	4.67–5.20	5.00	4
...a cadet who had recovered from a concussion	390	5.69 ± 2.60	5.43–5.95	6.00	4
...a cadet	389	5.10 ± 2.61	4.84–5.36	5.00	4
...my closest friend	389	7.22 ± 2.05	7.02–7.43	8.00	3
.....a teammate	389	6.58 ± 2.36	6.35–6.82	7.00	4
...a squadmate	388	5.68 ± 2.62	5.42–5.94	6.00	4
If I thought I had a bell-ringer/ding but wasn't sure, I would feel most comfortable telling....					
...AOC/AMT	386	5.38 ± 2.70	5.11–5.65	5.50	5
...upper-class cadet	386	4.81 ± 2.58	4.55–5.07	5.00	4
...a cadet who had recovered from a concussion	386	5.43 ± 2.59	5.17–5.69	6.00	4
...a cadet	385	5.00 ± 2.54	4.75–5.26	5.00	4
...my closest friend	385	6.82 ± 2.33	6.58–7.05	7.00	4
.....a teammate	386	6.33 ± 2.48	6.08–6.57	7.00	4
...a squadmate	385	5.57 ± 2.66	5.30–5.84	6.00	5
Cadets would be generally supportive of a cadet self-disclosing a concussion to medical staff	394	6.52 ± 2.01	6.32–6.72	7.00	2
Cadet would be generally unsupportive of a cadet self-disclosing a concussion to medical staff	393	3.15 ± 2.03	2.94–3.35	3.00	2
Cadets who are important to me would be generally supportive if I self-report a concussion to medical staff	395	7.54 ± 1.50	7.39–7.69	8.00	2
Cadets who are important to me would be generally unsupportive if I self-reported a concussion to medical staff	395	2.24 ± 1.55	2.08–2.39	2.00	2
<i>Criterion Variables</i>					
If I thought I had a concussion, I would immediately seek medical attention	390	6.72 ± 2.06	6.52–6.93	7.00	2
If I thought I had a bell-ringer/ding, I would immediately seek medical attention	391	5.56 ± 2.28	5.34–5.79	6.00	3

TABLE III. Aim One Multivariate Regression Analyses

Criterion variables	Predictor variables	Estimates	Standard error	Variance inflation factor	P-Value
If I thought I had a “concussion,” I would immediately seek medical attention. ($n = 378$; $F_{7,370} = 16.691$, $P < .001$, $R^2 = 0.240$)					
	Constant	4.008	0.364		<.001
	Air Officer Commanding (AOC)/Academy Military Trainer (AMT)	0.283	0.042	1.451	<.001*
	Upper-class cadet	0.042	0.071	3.978	.558
	A cadet who had recovered from a concussion	0.025	0.057	2.480	.664
	A cadet	0.012	0.068	3.549	.865
	My closest friend	0.067	0.067	2.174	.315
	A teammate	−0.021	0.069	3.112	.766
	A squadmate	0.066	0.066	3.420	.322
If I thought I had a “bell-ringer/ding,” I would immediately seek medical attention. ($n = 382$; $F_{6,375} = 16.486$, $P < .001$, $R^2 = 0.209$)					
	Constant	3.240	0.354		.000
	AOC/AMT	0.272	0.047	1.444	.000*
	A cadet who had recovered from a concussion	0.037	0.070	3.007	.594
	A cadet	−0.042	0.075	3.276	.577
	My closest friend	0.094	0.078	2.966	.226
	A teammate	−0.182	0.086	4.131	.035*
	A squadmate	0.241	0.078	3.876	.002*

*Significance at the 0.05 level.

of self-report of a suspected concussion to medical staff (median = 7.00 and 8.00; Table II). Respondents mostly disagreed that cadets in general and those important to them would be unsupportive of self-report of a suspected concussion to medical staff (median = 2.00 and 3.00).

Interviews

Analysis of the interviews resulted in eight themes; however, the current study focuses on the single theme of cadet peer advocacy and encouragement. Cadets often stated they would report a possible concussion or bell-ringer/ding to someone they trusted before they sought medical care. For instance, one cadet stated, “I think I would first try to speak to my AOC because she really takes good care of us. So I would try to first speak with her because I trust her. She would be like, ‘hey this guy has a concussion,’ and try to make sure the symptoms I’m seeing really decide there really is a concussion. And maybe she could give me great advice.”

Other participants said they would seek help from an upper classman. One cadet stated, “[I] would seek help from my upper classmen who’s supposed to be well-versed in making, who’s well versed in what the symptoms are. And then following through with a checkup or an appointment at the cadet clinic.” Participants also stated that there was value in talking to someone who had previously had a concussion. In one interview, the cadet relayed the conversation and advice of someone who had had a concussion:

I told her, “I don’t feel well.” And she said, “I think you should report that to the clinic. Go tell someone because you probably have a concussion.” And she said herself, she went through a concussion her freshman year and didn’t report it, and it was

miserable. So, she said, “Report it. Nothing bad will happen. If anything, you’ll just be put on bedrest and you’ll be fine.”

Cadets also indicated that encouragement from a friend was helpful even when they were not convinced they had a concussion. As one cadet stated, “I honestly thought I felt fine. You can ask all of my friends, they’d be like, ‘No, he was concussed.’ But I would tell you that, ‘No, I’m fine. Just want to continue with my life. I just got here. I just want to start it.’”

Conversely, some cadets expressed that they thought fellow cadets may dissuade them from disclosing concussion. As one cadet stated, “I know there are definitely some people that would encourage, and some people would be like, ‘Aw, you shouldn’t do that. It’ll hurt your chances.’ I would probably say majority would go with they would encourage. But it depends on the community.” Another cadet stated, “Honestly, I feel like if you were to go to some of the cadets, they might say, ‘Naw, you’re fine. Don’t worry about it. It’s probably not as bad as you think.’ Other cadets might say, ‘Yeah, you need to get it checked out.’ But it just kind of depends on who you talk to.”

DISCUSSION

The purpose of the current study was to better understand the role of social support in concussion disclosure. Results from survey responses and the interviews suggest USAFA cadets perceived they had support to report a concussion. Cadets indicated other cadets in general and those important to them would support their decision to self-report a suspected concussion to medical staff. Military environments are often perceived as antithetical to mental health support, so it is notable that cadets felt support to advocate for their own brain health.

Further, cadets who felt most comfortable disclosing a potential concussion or bell-ringer/ding to their AOC/AMT or squadmate had stronger agreement that they would immediately seek medical attention if they thought they had either of these conditions. Our results also indicated that cadets who were more comfortable disclosing a bell-ringer/ding to a teammate had decreased agreement that they would immediately seek medical attention. This result may indicate that those who are skeptical of disclosing a concussion to superiors are more likely to lean on peer support—especially within athletics. Although our models predicted a small amount of variance and often-low beta weights, the results of this study collectively highlight interesting areas in which concussion education could be supplemented or targeted to improve concussion care seeking. For instance, when framed in a pro-health direction, pre-emptively encouraging peer support for concussion disclosure may more effectively reach those who are most concerned about the negative outcomes of concussion disclosure.

Previous research has investigated the socio-ecological framework to better understand the dynamics that play a role in concussion disclosure.^{22,23} According to this framework, concussion disclosure is influenced by factors associated with intrapersonal (i.e., individual's concussion knowledge and attitudes), interpersonal (i.e., coach, teammates, and parent), community, and society and policy levels.²³ Our findings expand research in this area and highlight the direct influence of specific peers in concussion disclosure for USAFA cadets at the interpersonal level. This finding is particularly important since concussions influence more than student athletes. At the peer level, previous studies have found that the perceived norms of the team influence concussion disclosure.^{24,25} In a study by Kroshus et al.,²⁶ student athletes indicated their teammates pressured them to continue to play with symptoms of concussion. The findings from Kroshus et al.²⁶ and our findings show that teammates can have a negative or positive effect on concussion disclosure. Therefore, student athletes should complete concussion disclosure education regarding the signs and symptoms of concussion, and peers should be educated that fellow cadets may ask for advice about what they should do for various symptoms they may be experiencing, which has shown effectiveness in civilian athletes.^{27,28} Fellow cadets should be taught to persuade peers asking for advice to seek medical attention to determine whether their symptoms are from a concussion or another health condition, as these individuals are healthcare providers trained in concussion recognition. Further, all cadets (student athletes, peers, and fellow cadets) should be informed that classmates may have a diminished capacity to recognize their own concussion.

Although public health researchers have primarily used the socio-ecological framework, a psychology-based interdependence-based social dilemma model has also been applied to understanding concussion disclosure.¹⁶ This social dilemma perspective considers the perceived benefits and

costs from outcomes for concussion disclosure such as direct (e.g., being removed from athletic participation), self-concept (e.g., disclosure does not align with their athletic identity), and social status (e.g., others may think they are weak). These three outcomes are theorized to influence a given situation in addition to “relationship-specific motivations”—such as how a teammate might feel—and ethical considerations, which ultimately influence a person's decision to either report or conceal a concussion.¹⁶ For example, a participant noted to first seek advice from their social network and that that peer said to seek medical care for the injury and that nothing bad would happen; the social dilemma model views peer knowledge and support as doubly critical for relational and peer-specific knowledge. This view highlights the usefulness of the social dilemma and the socio-ecological models in concussion disclosure. Recent concussion education recommendations highlight the need to address this dilemma individuals face when determining if they should seek care for a concussion and the importance of team-level and unit-level education.²⁹ In team-level or unit-level education, authors recommend the need for athletes/service members to be educated on their role in encouraging their peers to seek care for a suspected concussion.²⁹ If cadets view their fellow cadets as supportive, that they will not be viewed negatively, one has an ethical responsibility to disclose a potential concussion, and that there is benefit to seeking care for a suspected concussion, disclosure for this unpleasant injury may increase.

Concussion disclosure is often studied in the athlete population, which has similar social dynamics and concerns as military populations. A primary reason student athletes conceal their injury is fear of letting teammates down.^{8,9,30–32} In one study, as many as 42% of concussions were unreported because of this reason.⁸ A study by Chrisman et al.³¹ found participants had a strong sense of “team,” did not want to let the team down, and felt symptoms in the given scenarios were not enough to leave the playing field. Cadets in the current study who felt comfortable disclosing their bell-ringer/ding to teammates had less agreement that they would immediately disclose the injury. Our results and those of Chrisman et al.³¹ highlight the need for continued investigation of the factors that influence concussion disclosure within a team or athletic perspective. Further, educational interventions are necessary that are specific to the individual athlete while incorporating the team culture or atmosphere.

Bystander intervention for concussion disclosure may also have implications in this population. In one study of athletes, 85% of participants indicated they would encourage another student athlete to report a suspected concussion.³³ Our results and those of others highlight the need for “prosocial bystander intervention.”³³ Here, USAFA cadets indicated they would often ask for help from a peer before seeking medical attention for a suspected concussion. Further, they felt other cadets were supportive of concussion disclosure and they indicated that reporting a possible concussion to an AOC/AMT or squadmate positively influenced their decision. Cadets should

be taught that fellow cadets may seek help from peers for a suspected concussion and that peer cadets should encourage their fellow cadets to seek medical treatment.

Other research in the USAFA population has shown that the perceived costliness of concussion disclosure was the greatest factor in willingness to report among cadets, including athletes.³⁴ The perceived high cost of disclosure presents potential reporters with a dilemma because they believe reporting negative outcomes could affect their athletic or military career but they realize they cannot get care without disclosure.³⁴ This perceived high cost of concussion disclosure among cadets may be based in part on misinformation about clinical outcomes and medical policies, so fostering a greater knowledge of concussion outcomes in the cadet student body may address this misinformation. In one study, other cadets reported that fears to reputation and social stigma influenced the decision to report or conceal a concussion.¹¹ In a study of the British military, Limbert³⁵ found that military personnel who perceived greater social support also had better psychological well-being. Therefore, improving the overall social culture as it relates to concussion disclosure may encourage those with a suspected concussion to actually seek medical attention. Ultimately, this issue should be addressed by military medical personnel.

Future research should continue to investigate what leads USAFA cadets to disclose or conceal suspected concussion. Researchers should also examine the influence of other socio-ecological framework levels and how they relate to social dilemmas, including targeted educational interventions for the social support team, to determine the efficacy of these programs. Future studies should also look at the differences between AOC/AMT, upper classmen, cadet who had recovered from a concussion, cadet, closest friend, teammate, or squadmates, as there may be overlaps in these individuals. There are limitations to our findings, including that our semi-structured interview sample only included first- and third-year USAFA cadets. Additionally, our sample included a higher percentage of female responses than representative of the USAFA population. Given this, and our qualitative findings, our findings may have limited generalizability.

CONCLUSIONS

In the current study, cadets indicated they would ask for advice from a fellow cadet before seeking medical attention for a suspected concussion or bell-ringer/ding. Cadets also felt concussion disclosure was supported by their peers. In addition, USAFA cadets who were most comfortable disclosing their suspected concussion or bell-ringer/ding to an AOC/AMT or squadmate were most likely to agree with seeking medical attention immediately after injury. However, being comfortable disclosing to a teammate decreased their agreement that medical attention would be sought immediately. Overall, our results indicated that cadets may contact peers for a suspected concussion and that concussion

education interventions should consider a prosocial bystander approach, specifically for peers. In the future, prosocial bystander interventions should include education at the intrapersonal level. It would also be beneficial to use targeted messages, especially to AOCs, AMTs, teammates, and squadmates, that fellow USAFA cadets may approach them for guidance and that those peers should be encouraged to report their possible concussion or bell-ringer/ding to a medical professional.

ACKNOWLEDGMENTS

The authors would like to acknowledge Dr Cailee Welch Bacon for her involvement in interview script development.

FUNDING

Michelle Weber Rawlins and Julianne Schmidt received funds from the National Collegiate Athletic Association-Department of Defense Research Grand Challenge: Changing Attitudes about Concussions in Young and Emerging Adults Grant and the U.S. Air Force Summer Faculty Fellowship Program for a stipend and travel. Johna Register-Mihalik, Julianne Schmidt, Brian R. Johnson, Craig Foster, and Christopher D'Lauro were principal investigators or investigators for the grant from the National Collegiate Athletic Association-Department of Defense Research Grand Challenge and received travel funds. Emily Jones' salary was funded through the National Collegiate Athletic Association-Department of Defense Research Grand Challenge. Karin DeAngelis has no competing interests to declare.

CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. Defence and Veterans Brain Injury Center: DoD worldwide numbers for TBI. Available at <http://dvbic.dcoe.mil/dod-worldwide-numbers-tbi>; accessed November 2, 2017.
2. Harmon K, Drezner J, Gammons M, et al: American medical society for sports medicine position statement: concussion in sport. *Br J Sports Med* 2013; 47(1): 15–26.
3. D'Lauro C, Johnson BR, McGinty G, et al: Reconsidering return-to-play times: a broader perspective on concussion recovery. *Orthop J Sports Med* 2018; 6(3): 2325967118760854.
4. Terwilliger VK, Pratson L, Vaughan CG, et al: Additional post-concussion impact exposure may affect recovery in adolescent athletes. *J Neurotrauma* 2016; 33(8): 761–5.
5. Asken BM, Bauer RM, Guskiewicz KM, et al: Immediate removal from activity after sport-related concussion is associated with shorter clinical recovery and less severe symptoms in collegiate student-athletes. *Am J Sports Med* 2018; 46(6): 1465–74.
6. Robb J, McGinty G, Cambell M, et al: Late report of concussion is related to prolonged recovery. *Military Health System Research Symposium*. Kissimmee, FL, August 27–30, 2017.
7. Register-Mihalik J, Guskiewicz KM, Valovich McLeod TC, et al: Knowledge, attitude, and concussion-reporting behaviors among high school athletes: a preliminary study. *J Athl Train* 2013; 48(5): 645–53.
8. Llewellyn T, Burdette GT, Joyner AB, et al: Concussion reporting rates at the conclusion of an intercollegiate athletic career. *Clin J Sport Med* 2014; 24(1): 76–9.
9. Davies SC, Bird BM: Motivations for underreporting suspected concussion in college athletics. *J Clin Sport Psychol* 2015; 9(2): 101–15.
10. McCrea M, Hammeke T, Olsen G, et al: Unreported concussion in high school football players: implications for prevention. *Clin J Sport Med* 2004; 14(1): 13–7.

11. Weber Rawlins ML, Johnson BR, Register-Mihalik JK, et al: United States Air Force Academy cadets' perceived costs of concussion disclosure. *Mil Med* 2019; 185(1-2): e269–e275.
12. McLeod TCV, Bay RC, Heil J, et al: Identification of sport and recreational activity concussion history through the preparticipation screening and a symptom survey in young athletes. *Clin J Sport Med* 2008; 18(3): 235–40.
13. Weber Rawlins ML, Johnson BR, Register-Mihalik JK, et al: United States Air Force Academy cadets' unprompted concussion knowledge: perceived differences and similarities in concussions and bell-ringers/dings. *J Athl Train In review*.
14. Greene J: *Mixed Methods in Social Inquiry*. John Wiley & Sons; 2007.
15. Creswell JW, Plano Clark VL: *Designing and Conducting Mixed Methods Research*. 2nd ed. Sage Publications, Inc; 2010.
16. Foster CA, D'Lauro C, Johnson BR: A social dilemma model of information of self-disclosure, applied to the concussion domain. *J Concussion* 2019; 3: 1–11.
17. Weber Rawlins M, Suggs D, Bierema L, et al: Examination of collegiate student-athlete concussion reporting intentions and behavior. *J Clin Transl Res* 2020; 5(4): 186–196.
18. Sheather SJ: *A Modern Approach to Regression with R*. Springer Science & Business Media; 2009.
19. Anderson R: Intuitive inquiry: exploring the mirroring discourse of disease. In: Wertz F, Charmaz K, McMullen L, Josselson R, Anderson R, McSpadden E, eds. *Five Ways of Doing Qualitative Analysis: Phenomenological Psychology, Grounded Theory, Discourse Analysis, Narrative Research, and Intuitive Inquiry*. Guilford Press; 2011: 66–9.
20. Wertz FJ, Charmaz K, McMullen LM, et al: *Five Ways of Doing Qualitative Analysis: Phenomenological Psychology, Grounded Theory, Discourse Analysis, Narrative Research, and Intuitive Inquiry*. Guilford Press; 2011.
21. Lincoln YS, Guba EG: But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New Directions Program Eval* 1986; 1986(30): 73–84.
22. Kerr ZY, Register-Mihalik JK, Marshall SW, et al: Disclosure and non-disclosure of concussion and concussion symptoms in athletes: review and application of the socio-ecological framework. *Brain Inj* 2014; 28(8): 1009–21.
23. Register-Mihalik J, Baugh C, Kroshus E, et al: A multifactorial approach to sport-related concussion prevention and education: application of the socioecological framework. *J Athl Train* 2017; 52(3): 195–205.
24. Kroshus E, Kubzansky LD, Goldman RE, et al: Norms, athletic identity, and concussion symptom under-reporting among male collegiate ice hockey players: a prospective cohort study. *Ann Behav Med* 2015; 49(1): 95–103.
25. Kroshus E, Garnett BR, Baugh CM, et al: Social norms theory and concussion education. *Health Educ Res* 2015; 30(6): 1004–13.
26. Kroshus E, Garnett B, Hawrilenko M, et al: Concussion under-reporting and pressure from coaches, teammates, fans, and parents. *Soc Sci Med* 2015; 134: 66–75.
27. Kneavel ME, Ernst W, McCarthy KS: Randomized controlled trial of a novel peer concussion-education program for collegiate athletes. *J Athl Train* 2020; 55(5): 456–68.
28. Ernst W, Kneavel ME: Development of a peer education program to improve concussion knowledge and reporting in collegiate athletes. *J Athl Train* 2020; 55(5): 448–55.
29. Kroshus E, Cameron KL, Coatsworth JD, et al: Improving concussion education: consensus from the NCAA-Department of Defense Mind Matters Research & Education Grand Challenge. *Br J Sports Med* 2020; 54: 1314–1320.
30. Kerr ZY, Register-Mihalik JK, Kroshus E, et al: Motivations associated with nondisclosure of self-reported concussions in former collegiate athletes. *Am J Sports Med* 2016; 44(1): 220–5.
31. Chrisman SP, Quitiquit C, Rivara FP: Qualitative study of barriers to concussive symptom reporting in high school athletics. *J Adolesc Health* 2013; 52(330–335): e333.
32. Wallace J, Covassin T, Nogle S, et al: Knowledge of concussion and reporting behaviors in high school athletes with or without access to an athletic trainer. *J Athl Train* 2017; 52(3): 228–35.
33. Kroshus E, Garnett BR, Baugh CM, et al: Engaging teammates in the promotion of concussion help seeking. *Health Educ Behav* 2016; 43(4): 442–51.
34. Foster CA, D'Lauro C, Johnson BR: Pilots and athletes: different concerns, similar concussion non-disclosure. *PLoS One* 2019; 14(5): e0215030.
35. Limbert C: Psychological well-being and job satisfaction amongst military personnel on unaccompanied tours: the impact of perceived social support and coping strategies. *Mil Psychol* 2004; 16(1): 37–51.