

Development of a Peer Education Program to Improve Concussion Knowledge and Reporting in Collegiate Athletes

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Context: A novel peer concussion-education program (PCEP) was developed to enhance concussion knowledge and reporting among collegiate student-athletes.

Objective: To describe the PCEP and its development and implementation.

Design: Program development consisting of a literature review, focus group, and pilot implementation.

Setting: Athletics department at a college participating at the National Collegiate Athletic Association Division II-sanctioned competition level.

Patients or Other Participants: Fifteen student-athletes from the women's soccer and men's lacrosse teams participated in the focus group. Four peer concussion educators (PCEs) were debriefed after the pilot implementation of the PCEP with the women's soccer and men's lacrosse teams.

Data Collection and Analysis: Focus-group data were analyzed qualitatively. The PCEs were debriefed, and responses were organized into recommendation types.

Results: The literature review contributed information that supported the development of the PCEP's conceptual model. Focus-group results provided information used to train the PCEs and refine the PCEP's education modules. The pilot implementation and PCE debriefing supplied information used to further revise the education modules, PCE training, and PCEP implementation procedure.

Conclusions: The PCEP was developed based on the Theory of Reasoned Action and Planned Behavior and uses a peer-mediated, cognitive-behavioral, and interdisciplinary model to enhance concussion knowledge of and reporting by collegiate student-athletes. After a focus-group discussion and pilot implementation, we revised the PCEP and its education modules and developed an online manual to facilitate broad dissemination.

Key Words: mild traumatic brain injuries, Theory of Reasoned Action and Planned Behavior, student-athletes

Key Points

- A novel peer concussion-education program (PCEP) was developed based on the Theory of Reasoned Action and Planned Behavior.
- The PCEP trains 2 peer concussion educators per team to provide education modules designed to enhance concussion knowledge and reporting.
- A worksheet activity based on cognitive-behavioral theory and intervention required student-athletes to list thoughts that inhibit concussion reporting and replace them with thoughts that facilitate reporting in both themselves and teammates.
- The PCEP development process consisted of a focus group, pilot implementation with 2 teams, and a debriefing session with the peer concussion educators who participated in the pilot implementation.
- An online manual was developed to facilitate broad dissemination of the PCEP.

An estimated 1.6 to 3.8 million concussions from sport- and recreation-related activities occur per year in the United States.¹ In addition, rates of concussion during athletic events, which include both competitions and practices, have increased for collegiate athletes from the late 1980s to the mid-2000s.² These rates vary by sport, with greater risks in sports such as football and wrestling for men and soccer and ice hockey for women.³ Rates of diagnosed concussions have also increased among high school athletes,⁴ and in a prospective 11-year study, researchers⁵ found increased concussion rates for male and female high school athletes in all 12 sports studied.

The increase in sport-related concussion rates is likely to be associated with several factors, including advances in

evaluation and management.⁶ In addition, the proliferation of online education programs for athletes, parents, coaches, and sports officials, such as “Heads Up to Youth Sports” from the Centers for Disease Control and Prevention,⁷ may have led to greater awareness. Legislation such as the Lystedt law, which requires youth athletes with suspected concussions to be removed from play and cleared by a health care professional before returning as well as concussion education for athletes, parents, and coaches, may also be responsible for increased concussion rates.⁸ For example, the number of documented concussions in 10 public high schools in Seattle, Washington, more than doubled the year after the Lystedt law was passed.⁸ Finally, similar legislation has been passed in all 50 states,⁸ which is likely to increase concussion identification rates nationwide.

Concussion identification is challenging and often relies in part on self-report.⁹ Facilitating prompt removal from play is crucial, as engaging in strenuous activities shortly after concussion adversely affected neurocognitive recovery¹⁰ and may increase the risk of repeat concussion.¹¹ Unfortunately, cultural aspects surrounding competitive athletics appear to create barriers to concussion reporting.¹² Collegiate student-athletes described pressure from multiple sources, including teammates, coaches, parents, and fans, to continue playing despite experiencing a head impact.¹³ These pressures, along with those internal to the athlete (eg, not wanting to lose playing time), are consistent with research findings^{13–15} indicating that approximately one-third to one-half of collegiate athletes continued to play while experiencing symptoms of a possible concussion. Moreover, high school athletes reported only 40% of recalled concussive events to a coach or medical professional.¹⁶ A reluctance to report concussion symptoms and continuing to play while symptomatic are behaviors that appear to begin before collegiate competition, which suggests that factors inhibiting concussion reporting may persist for years and become entrenched.

Several concussion-education programs have been developed to enhance athlete safety. These programs typically consist of videos, fact sheets, or presentations by health care professionals.^{7,17,18} Current education programs increased concussion knowledge; however, little evidence indicates that increasing knowledge alone changes behaviors to produce a culture of safety.¹² For example, a qualitative focus-group study¹⁹ of male and female high school athletes showed that even though participants demonstrated a solid understanding of concussive symptoms and possible adverse outcomes (eg, long-term disability), many would not report concussive symptoms due to factors such as wanting to keep playing and to avoid letting the team down. Additionally, investigators²⁰ suggested that knowledge about concussion symptoms alone failed to fully predict concussion-reporting behavior and that other attitudes influenced reporting behavior. However, a program involving a variety of formats, including slide presentations, videos, and case studies delivered by medical or health care student volunteers, improved both symptom knowledge and appropriate postconcussion responses in youth athletes immediately after the program.¹⁸

These findings support the need for a cultural change to enhance concussion safety, which has been promoted by several major research, health care, and athletic organizations, including the Institute of Medicine,¹² Centers for Disease Control and Prevention,²¹ National Collegiate Athletic Association (NCAA), and U.S. Department of Defense.²² For this cultural change to occur, additional approaches to concussion education are needed that not only increase concussion knowledge and awareness but also facilitate a change in attitudes and behavior that increase reporting and collaboration with health care personnel regarding a safe return to play.

Our aim was to describe the development and implementation of a novel peer concussion-education program (PCEP) designed to enhance concussion knowledge and reporting, with the ultimate goal of changing team norms to be more conducive to concussion safety. The PCEP's conceptual model was informed by the Theory of Reasoned Action and Planned Behavior (TRA-TPB), which has

traditionally been applied to understanding attitudes and norms related to health behaviors.²³ The TRA-TPB posits that knowledge is a predictor of behavior only when group norms and other facilitating factors support the behavior.²³ The TRA-TPB has been used to explore the relationship among the intention to report concussion, an athlete's thoughts about how teammates perceive his or her behavior, and the effects of reporting on the team's performance.²⁴

The use of a peer-mediated approach to concussion education is further supported by studies demonstrating the effectiveness of peer-assisted learning and behavioral management in a range of populations, including school-aged children,²⁵ college students,²⁶ and Vietnam War veterans.²⁷ Moreover, in an anonymous survey,¹⁴ only 10% of collegiate athletes reported being unlikely or extremely unlikely to conceal symptoms of concussion from a teammate, leading the authors to suggest that including peers in concussion education might be valuable. Peer-mediated concussion education may also be beneficial for high school athletes. Among high school football players, most (76.7%) reported their concussions to a certified athletic trainer; however, a sizable minority (27.2%) disclosed the injury to a teammate.²⁸ The PCEP capitalizes on this tendency of student-athletes to be less likely to conceal a concussion from a teammate and perhaps more likely to entrust the information to a teammate. Given the PCEP's emphasis on changing team norms through a peer-mediated expectation that concussion reporting of self and teammates is a necessary and appropriate behavior, we anticipated that disclosure to teammates and possibly Peer Concussion Educators (PCEs) would, in turn, facilitate disclosure to health care professionals.

PROGRAM DESCRIPTION

Program Overview

The PCEP uses a peer-mediated model of education to create a culture in which student-athletes are stakeholders along with coaches, health care personnel, and administrators with respect to concussion education, assessment, reporting, and management. The PCEP is designed to reinforce and enhance an organization's existing concussion-education program, not replace it. Although a number of professionals with expertise in concussion can implement the program, athletic trainers are likely to be in the best position to do so given their close proximity to and relationships with student-athletes. A key feature of the PCEP is training 2 student-athletes per team to become PCEs to facilitate a change in group norms in order to transform the culture of concussion from within the team itself as opposed to relying exclusively on experts from outside the team.

The PCEs provide an education module designed to enhance concussion knowledge (Module 1) and reporting (Module 2). Module 1 includes information on (1) the pathophysiology of concussion, (2) symptoms, (3) recovery from concussion, (4) the return-to-play protocol (RTP) and its rationale, and (5) concussion prevention. Module 2 begins with the PCEs giving an overview of the cognitive-behavioral model of change to facilitate an appreciation of the role that modifying cognitions plays in facilitating

behavior change. Module 2 concludes with the PCEs leading teammates in a concussion-reporting worksheet activity that requires the athletes to list thoughts that inhibit reporting and replace them with those that facilitate reporting in both themselves and their teammates. Module 2 is consistent with the TRA-TPB, which asserts that for behavior change to occur, changes in group norms, attitudes, and knowledge are all necessary.²³

Unlike most educational programs that consist of a discrete experience, the PCEs continue to be involved throughout the season and off-season, which allows them to serve as liaisons among their teammates, health care staff, and coaching staff. Moreover, the PCEs are available to provide ongoing information, leadership, and support regarding concussion safety to their teammates, which may afford additional opportunities to change team norms.

Program Model and Rationale

The PCEP's conceptual model incorporates 3 components. The first component uses a peer-mediated approach to directly engage the primary constituents, student-athletes, in the change process. Most approaches to concussion education include educational videos and fact sheets that are essentially "top-down" approaches in which information is disseminated from an expert authority to student-athletes. Although these programs are portable and can be completed relatively quickly, changing the culture of concussion to one that supports reporting and safety is likely to require a multipronged approach. Therefore, concussion education is likely to be more effective when "top-down" approaches are combined with "bottom-up" or grassroots approaches such as peer education. The advantages of using a peer-mediated approach to concussion education are summarized in Table 1.

The second component of the program uses a cognitive-behavioral model of change to identify thoughts that inhibit reporting concussions in oneself and teammates and to replace them with thoughts that facilitate reporting. Cognitive-behavioral therapy refers to psychological interventions developed by Albert Ellis²⁹ and Aaron Beck³⁰ with the basic premise that identifying and modifying cognitions leads to changes in behavior and a concomitant reduction in emotional distress. Researchers³¹ of behavioral change suggested that cognitively identifying barriers is a primary strategy for approaching behavioral change. An example of a cognition that inhibits self-reporting is "If I report my concussion, I will lose my spot." An example of a replacement cognition that may increase reporting is "I can recover and be 100% and then play and have a better chance of keeping my spot than if I risk losing it with a concussion." An example of a cognition that inhibits reporting a teammate is "My friend wants to keep playing, and he will be mad," which can be replaced by "I am protecting him and he will be better when he comes back." Consistent with the TRA-TPB, authors³² of a review of cognitive-behavioral theories and adherence to health-related behaviors found that changing the knowledge about a health condition alone was insufficient for altering behavior but changing cognitions associated with a specific health behavior was a key factor in improving healthy behaviors.

Finally, the third PCEP component uses an interdisciplinary approach to facilitate cultural change. Attempting to

Table 1. Advantages of a Peer-Mediated Approach to Concussion Education

Peer educators are likely to be aware of individual differences in their fellow teammates as well as team dynamics that may enhance or impede concussion reporting and management.
Peer educators can act as liaisons with coaches and health care professionals to enhance safety cognitions and behaviors and mitigate counterproductive cognitions and behaviors.
Peer educators can serve as role models with respect to concussion safety.
Peer educators are likely to interact with fellow teammates outside of practice and competition, which may permit them to reinforce cognitive and behavioral changes with respect to concussion safety.

change the culture of concussion is a complex and challenging endeavor, as factors operating at multiple socioecological levels (eg, intrapersonal, interpersonal, and environmental) have the potential to undermine concussion safety.³³ Consequently, expertise shared by multiple professionals and resources from different departments across the college or university are likely to bring about the broadest and most significant change. Moreover, Knapp et al³⁴ asserted that interdisciplinary work can provide insights into complex problems, such as a culture that creates barriers to concussion safety. The PCEP uses an interdisciplinary team that can consist of faculty and staff from many departments, including athletics, academic affairs, and student life, to identify and support the PCEs and supervise the implementation of the program.

PROGRAM IMPLEMENTATION PROCEDURE

The PCEP is implemented using a 4-step procedure delineated in the online manual (<https://www.chc.edu/peer-concussion-education/peer-concussion-education-program-manual>) and summarized in Table 2. (An optional fifth step consists of a detailed process for assessing the program.) In the first step, an interdisciplinary team is formed to implement the PCEP. Ideally, an implementation team spanning multiple departments and consisting of professionals with varied areas of expertise is recommended; however, not all colleges or organizations may have access to a broad range of professionals with expertise in concussion or there may be logistical or organizational barriers (eg, a lack of collaborative relationships across departments) to involving professionals from different departments. At a minimum, the program-implementation team should consist of an athletic trainer, a coach from each participating team, and the director of athletics or an administrative designee.

Next, 2 PCEs are selected from each team by a committee including a coach, athletic trainer, and administrator from the department of athletics. The candidates must be respected by most of the team. Individuals on the periphery with respect to social involvement or athletic prowess typically should not be selected. Also, a candidate should not be the coach's "favorite" unless the team also holds that individual in high regard. Additional criteria include leadership (both on and off the field), diplomacy, strong interpersonal skills and academic ability, and positive attitudes and behaviors toward health in general and dealing with concussion in particular. One PCE should be either a senior or junior and the other a sophomore or freshman to provide continuity after the graduation of the

Table 2. Steps of Peer Concussion-Education Program Implementation

Step	Task	Personnel	Time to Complete
1	Form interdisciplinary team to implement the program	Athletic trainer, coach, and administrator from the department of athletics	15 min
2	Select PCEs	Athletic trainer, coach, and administrator from the department of athletics	10–15 min
3	Train PCEs	Professional with expertise in sport-related concussion (eg, athletic trainer or clinical neuropsychologist)	45–60 min
4	PCEs present education modules to their teammates	PCEs and professional with expertise in sport-related concussion supervise Module 1	45–60 min
5	Debrief and assess the program (optional)	Professional with expertise in program evaluation	Depends on extent of assessment

Abbreviation: PCE, peer concussion educator.

more senior student. The presence of 2 PCEs per team also allows for mutual support and allows team members to approach more than 1 PCE with concerns.

After being selected, the PCEs are trained by appropriate faculty or staff to provide Module 1 (“Enhancing Concussion Knowledge”) and then Module 2 (“Enhancing Concussion Reporting”). After completing the training, the PCEs meet with their respective teams and deliver Education Modules 1 and 2 to their teammates. Each module takes 20 to 30 minutes, and they are presented successively with a brief break in between. Because the information presented in Education Module 1 is at times technical and complex, an athletic trainer or other qualified faculty or staff member needs to be present. Conversely, faculty or staff are not present during Education Module 2 to emphasize the peer-mediated nature of the program, increasing the likelihood that the PCEs and their teammates will take ownership of the program and the candor of the responses.

Each team participates in the program annually. It is recommended that the program be implemented during preseason or after the student-athletes’ return from summer break; however, each organization and team can determine the optimal time for implementation. More detailed information on the implementation procedure along with all of the materials needed to implement the PCEP is available in the online manual.

PROGRAM-DEVELOPMENT PROCESS

The preliminary concept and model for the PCEP came from the athletic and professional experiences of the authors, a consultation with an athletic trainer, and a review of the concussion-knowledge and -reporting literature. These sources of information were integrated, and the following conclusions were drawn. First, concussion knowledge alone, which is almost always obtained from sources outside the team, does not always translate into reporting.¹⁹ Therefore, an approach that consists of information presented by individuals from within the team that directly engages student-athletes in the educational process might increase the likelihood of translating concussion knowledge into reporting behavior. Next, student-athletes need more in-depth information on concussion, including the pathophysiological changes that occur in the brain, to appreciate its seriousness and the importance of allowing the brain to return to preinjury functioning before they return to play. Also, lesser known symptoms, such as sleep disturbance and affective

changes,³⁵ should be emphasized to improve concussion identification. Including information on the RTP was also deemed important; we reasoned that if athletes had a greater understanding of the purpose of the RTP, they would be more likely to report their symptoms and collaborate with health care professionals. Finally, barriers to concussion reporting and strategies for mitigating those barriers needed to be identified by the student-athletes themselves to increase the relevance of concussion education. These conclusions informed the development of the program’s educational modules.

Focus Group

The next step in the development of the PCEP was a focus group consisting of 15 collegiate student-athletes from the women’s soccer and men’s lacrosse teams at a liberal arts college competing in NCAA Division II.³⁶ The purpose of the focus group was to better understand the culture surrounding concussion reporting, barriers to reporting, and factors that might facilitate reporting. We chose a focus-group format so that participants could interact with one another and discuss concussion reporting in a manner relatively similar to the athletic context (ie, with teammates).³⁷ The questions were developed based on the Moustakas³⁸ recommendation that questions center on experiences with the phenomena and the context and situations that influence those experiences. Thus, the following core questions were asked:

What are your thoughts about reporting concussion symptoms?
 What are those things that keep you from reporting either your own symptoms or someone else’s?
 What is your team culture surrounding the reporting of symptoms?
 What would you need to know or understand to feel safe reporting symptoms?

Follow-up questions were asked during the discussion as needed to clarify participants’ responses and obtain more detailed information pertaining to the core questions. Information from the focus group was analyzed using procedures recommended for phenomenologic, qualitative data by using an inductive approach.^{39,40}

The focus group provided contextualized information associated with the challenges athletes experience in self-identifying concussion symptoms. For example, uncertainty

Table 3. Exemplar Cognitions: Reporting Self

Thoughts That Inhibit Self-Reporting of Concussion	Replacement Thoughts That Facilitate Reporting
"If I report my concussion, I may be out for an extended period of time."	"If I report my concussion, I will have a better chance of healing faster."
"If I report my concussion, I will lose my spot."	"If I report my concussion, I will come back stronger and retain my spot."
"If I report, I'll disappoint my team."	"If I report, I'll be able to play my best and help my team more."
"If I report my concussion, my teammates and friends will think I'm weak."	"By reporting my concussion, I'm only helping my recovery and myself heal; this doesn't mean I'm weak."
"If I report my concussion, I will not be able to go to school and will fall behind on class work."	"If I report my concussion, I will be giving my brain a break so I can return to class at 100%."

about symptoms emerged as a barrier to reporting (eg, is a headache due to a concussion or just a headache?). Also, several participants indicated that symptom severity was a factor associated with reporting, the implication being that they would not report unless or until symptoms worsened.³⁶ We incorporated these findings into the PCE training session by emphasizing the importance of encouraging teammates to report all possible symptoms of concussion so that health care professionals could evaluate them. Moreover, these results supported the decision to provide in-depth information on concussion symptoms, the rationale for the RTP, and the consequences of playing while symptomatic in Module 1.

Additional barriers identified during the focus group included concerns about being removed from play, situational factors that inhibit reporting (eg, playing in a championship game), and the expectation that all teammates push through injury, including concussion, and play regardless of the consequences.³⁶ This information was used to elaborate on the barriers to reporting that athletes experience when training the PCEs to provide Module 2.

During the focus group, participants also indicated that having someone else, such as an athletic trainer, determine whether a concussion has occurred would help facilitate reporting.³⁶ This finding was incorporated into the PCE training by explaining that the role of the PCE is not to diagnose concussion or to remove a teammate from play but simply to work with teammates to report any possible concussion symptoms to the athletic trainer, who can determine whether a concussion occurred and if the athlete should be removed from play. It is important to note that the focus-group results were obtained from members of 2 teams at a single college. Consequently, the results may not be representative of all student-athletes. Additional focus-group research may yield results requiring revision of the PCEP.

Pilot Implementation and PCE Debriefing

After the modules were completed, we pilot tested the PCEP with the men's lacrosse and women's soccer teams.

The concussion-reporting worksheets from Module 2 were collected, and sample cognitions were extracted and placed in separate tables for oneself and one's teammates (see Tables 3 and 4 for abbreviated lists). The tables were developed for use during the PCE training session to prepare the PCEs for the types of cognitions they might encounter when delivering Module 2 to their teammates. In addition, the tables were designed to allow the PCEs to compare cognitions generated by their teammates with those of a larger group during the presentation of Module 2 to facilitate awareness and discussion. Finally, the information in the tables provides the PCEs with a contingency in the event their teammates are reluctant or have difficulty discussing cognitions that inhibit or facilitate reporting.

After the pilot implementation, the 4 PCEs participated in a group debriefing and were asked to (1) describe their experiences serving as a PCE, (2) explain how the PCEP differed from traditional concussion-education programs, (3) discuss the characteristics of an effective PCE, and (4) provide recommendations for improving the PCEP (Tables 5 and 6). We read the transcript from the PCE debriefing multiple times, based on the recommendation of Creswell and Poth,³⁹ to develop an overall understanding of the phenomena before extracting meaning statements and themes. Recommendations from PCEs that we both deemed to be salient and feasible were selected. Those recommendations included implementing the program during the preseason or off-season and emphasizing interpersonal skills during the PCE selection process and were incorporated into the online manual. Simplifying and clarifying the terminology in Module 1 was also advised. We reviewed the Module 1 slide presentation with the PCEs and identified the changes to be implemented (eg, adding the term *chemical messengers* to explain *neurotransmitters*). Moreover, the slide presentation was shortened by condensing or omitting material (eg, abbreviating the slide describing the RTP and removing a slide of a magnetic resonance imaging scan depicting grey and white matter). The PCE debriefing was based on only 4 individuals.

Table 4. Exemplar Cognitions: Reporting Teammates

Thoughts That Prevent Reporting of Teammates With Suspected Concussion	Replacement Thoughts That Facilitate Reporting
"We need him on the field to win."	"A concussion won't let him be at his full strength and if further injury occurs, then we may lose him forever."
"My teammate will be mad at me."	"It is protecting their health and looking out for the team's performance."
"I might lose my teammate as a friend."	"My friend will, down the road, thank me for protecting him."
"If they aren't reporting it themselves, then it's not that bad."	"They may be in trouble and need help."
"I do not truly know how my teammate feels."	"It is smart to just play it safe."

Table 5. Peer Concussion Educators' Perceptions of the Peer Concussion-Education Program: Debriefing Statements

- "Yeah, I think it helped, working with your team and teammates so, it, we all know each other, like, personally, both on and off the field, but I think, like educating them, being, like, teammates kinda, maybe, opens up their mind more than just, like, watching a video, like an instructor teaching them."
- "... it's about peer education, so you are not, like, just learning from a professor, or learning from a coach or from like, one of the parents that is teaching you, you are actually learning from one of your teammates. So, it actually makes you pay more attention, and I feel like the guys definitely got more out of it learning it from us than if they would have learned it from someone else."
- "... it is also more, I think, comforting for our teammates in the sense that, even if we don't have the answer, we certainly have access to you guys so that we can answer them that way, and that's definitely, I think more constructive..."
- "... I think this went more in-depth with everything, so instead of just a video giving a brief overview of everything, I think... they did activities, and everyone gets more involved in it than just watching a video."
- "... it's not just something that when you have the workshop, you are going to go home and forget about it, the sense that when you are with your teammates all the time on and off the field there is always that sort of presence and as far as I've had so far in my collegiate career, there is more a lot of talk about concussions off the field, like in your dorm room or with your friends when you are hanging out and like PCE #3 said, if someone is just kind of like, I feel a little weird, but I am not really sure, and as long as there is someone there who can say, oh well let's talk about this, and kind of direct the conversation to see if in fact the person does have a concussion, like you can encourage them, oh go to the [athletic] trainer, do this, and kind of take it easy or something, but now that we have that peer educator sort of environment and relationship with your teammates, I think that will definitely help in the future, not only on the field, but certainly off the field as well."
- "... since the guys knew that me and PCE #3 had a background on it, they came to us real quickly during the game or during practice like, hey, I think we are feeling it, and to make sure that they go see our [athletic] trainer and to make sure that they get checked out, go through the whole process to make sure that nothing serious is going on."
- "Yeah it is good to recognize if there is a play on the field and someone gets hit really hard, and it is possible they have a concussion, they come off the field, it is nice to have someone on the sideline, not just a coach or [athletic] trainer, just your teammate that you are able to talk to and kind of put your mind at ease through the whole process."

Abbreviation: PCE, peer concussion educator.

Consequently, information from a greater number of PCEs may result in further revisions to the PCEP.

The program-development process culminated in the completion of the online manual to allow broad dissemination of the PCEP. The online manual contains all of the necessary procedures and materials for implementing the PCEP, including a program overview, a description of the program's model and rationale, and a detailed 5-step process for implementing and assessing the PCEP. In addition, video excerpts from the faculty, staff, and student-athletes who participated in the pilot implementation are featured in the manual.

DISCUSSION

Sport-related concussions occur frequently,¹ and their rates are increasing among collegiate² and high school^{4,5} athletes. These increased rates appear to be associated with advances in clinical assessment and management,⁶ greater

availability of educational programs,⁷ and legislation mandating concussion management and education for youth athletes.⁸ Identification of concussion often depends in part on self-reports⁹; however, reporting has several barriers^{12,13} operating at multiple socioecological levels, including intrapersonal, interpersonal, and environmental levels.³³ These barriers are likely to be associated with substantial rates of underreporting among collegiate^{13–15} and high school¹⁶ athletes. Although several concussion-education programs are available and seem to increase knowledge, knowledge alone does not always increase reporting.¹⁹ In this article, we described the development of a novel PCEP designed to enhance concussion knowledge and reporting with the ultimate goal of changing team norms to be more conducive to concussion safety.

After a review of the literature, which provided preliminary information for the PCEP's conceptual model and content for its education modules, we conducted a focus group to better understand the culture surrounding concussion reporting, barriers to reporting, and factors that might facilitate reporting.³⁶ Barriers to reporting included uncertainty about symptoms and being less likely to report symptoms considered less severe. These knowledge-based barriers operate at the intrapersonal level³³ and supported the decision to provide comprehensive and in-depth information during Module 1 to augment the routine concussion education offered at an athlete's institution. In addition, these findings were incorporated into the PCE training by emphasizing that the PCEs should encourage teammates to report all suspected symptoms.

Barriers to reporting also included concerns about being removed from play, situational factors (eg, playoff game), and the expectation that both oneself and one's teammates should "push through" concussion and other injuries and play, regardless of the consequences. Pressure from teammates to continue playing after a head impact at the collegiate level has also been reported by previous authors.¹³ These barriers operate at both the intra- and interpersonal levels³³ and reinforced the decision to include a second education module focused on reporting by oneself and one's teammates. Moreover, when training the PCEs to deliver Module 2, we used the focus-group findings to provide contextualized examples of cognitions that inhibit reporting. The intra- and interpersonal barriers to concussion reporting identified by the focus-group participants and prior researchers also supported the rationale for developing and including the concussion-reporting worksheet activities, which are a key component of Module 2. These activities have the added advantage of directly engaging student-athletes in the education process. Moreover, the worksheet activities provide content for reflection throughout the season germane to student-athletes' intra- and interpersonal reporting barriers and modified cognitions to mitigate those barriers.

The pilot implementation allowed us to collect exemplar cognitions that inhibit and facilitate reporting. The exemplars were placed in tables that were used to train the PCEs to deliver Module 2. The PCE debriefing provided additional information used to refine Module 1, such as shortening its length and decreasing jargon. Finally, the PCE debriefing resulted in recommendations that included implementing the program during the preseason or off-season and emphasizing interpersonal skills during PCE selection.

Table 6. Recommendations from Peer Concussion Educators (PCEs) for Improving the Program and Its Education Modules

Recommendation Type	Related PCE Debriefing Statement
Scheduling	"I think right before the actual season starts would be a perfect time because you are not going to be busy because you don't have sports and the semester just started so you are not going to be that loaded up with homework and everyone's got free time at the beginning of the semester." "...I think it was a benefit for us to be doing this program during our off-season. I personally know that once I am in season, I'm really only thinking about soccer, bed, homework, trying to find some food to eat, and that's about it. So I think it's definitely a benefit to do it when it's sort of a slow time and everyone has free time in their schedule."
PCE Selection	"... a strength of the program could really be the coaches being involved in the picking of who the peer educators are... I honestly can't see them [teammates] in the role that me and PCE #1 are in, in the sense that I don't think they might understand exactly, so they wouldn't be able to turn around and relay it... the coaches are involved in picking out who it is, and knowing each individual player's personality and who might be able to step up to the plate and who might not be." "...I think just like players who will take this seriously, not just... there are some teammates that just mess around but don't know when to take things seriously and this is important. Someone who is like ready to sit down and will be there for the teammates if they have any questions." "Someone who sort of has an approachable personality obviously, someone who, not necessarily someone science geared, because even though me and PCE #1 are, I don't think you guys (referring to the other two PCE's) are really into the science, but someone who is able to understand all of the information they are going to get trained on and someone who is able to communicate appropriately with their teammates."
Module I content	"...cleaning up some of the bigger words, I'm not a science major, I'm a business major, like some of the things that are being talked about. So simplifying it. I think if we continue to simplify it even, it will really help." "Or like incorporate the big words that some of my teammates won't understand and give an explanation for that big word and use smaller terms."

Although coaches have been identified as a potential interpersonal barrier to concussion reporting,¹³ high school football players disclosed their concussions to coaches at a relatively high rate (38.8%).²⁸ These findings, along with the crucial role coaches play in establishing and maintaining team culture, warrant the inclusion of coaches in the concussion-education process. Although coaches do not receive or deliver either of the PCEP's education modules, they are still a key part of the program through their involvement in the PCE selection committee. Consequently, coaches are made aware of the program's objectives and, as a result, are in a position to strengthen the PCEP's goal of facilitating normative changes around concussion reporting and safety.

The environmental level of the socioecological framework is another important level of potential influence that may impede or facilitate concussion reporting.³³ The presence of athletic trainers and other health care professionals during practice and competition contributes to an environment that promotes safety. However, coverage at levels of competition below Division I is likely to be more variable, with a trend toward less coverage in Divisions II and III as well as in high school and club sports.³³ Although the PCEs have less knowledge than health care professionals, the information they acquire through the PCEP, along with the fact that they are embedded within their team throughout the year, places them in a position to be adjuncts to health care professionals with respect to facilitating safety changes at the environmental level.

CONCLUSIONS

The PCEP was developed based on the Theory of Reasoned Action and Planned Behavior and uses a peer-mediated, cognitive-behavioral, and interdisciplinary model to enhance concussion knowledge and reporting in collegiate student-athletes. The PCEP and its education modules were developed in a 3-step process. The first step involved integrating information from a literature review, consultation with an athletic trainer, and our own athletic

experiences. The second and third steps consisted of a focus group and pilot implementation, respectively, which provided information for further refining the PCEP and its education modules. The development process culminated with an online manual designed to facilitate broad dissemination of the PCEP. The PCEP represents a unique contribution to concussion education in that 2 student-athletes per team are trained as PCEs to deliver the educational material directly to their teammates. Moreover, the PCEs lead their teammates in a concussion-reporting worksheet exercise in which cognitions that inhibit reporting are replaced with those that facilitate reporting for both oneself and one's teammates. This approach to concussion education attempts to change team norms associated with concussion reporting by directly engaging student-athletes in the education process and leveraging relationships among teammates to facilitate a change in the culture of concussion safety. Finally, unlike most concussion-education programs that are provided once per year, the PCEs are available to demonstrate safe behaviors and collaborate with their teammates and athletic trainers to reinforce the PCEP objectives throughout the year. The effectiveness of the PCEP was investigated during a national randomized controlled trial, and the results are reported in "Randomized Controlled Trial of a Novel Peer Concussion Education Program in Collegiate Athletes."⁴¹

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