TCU CONCUSSION SAFETY PROTOCOL

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Concussion Management Plan:

This plan is based on the most current evidence on concussions available as well as the recommended best practices for concussion management distributed by the NCAA Committee on Competitive Safeguards in Sport. As such, modifications may follow as the science of concussion diagnosis, education, and treatment advances.

All incoming student-athletes, including transfer students and anyone new to the program, will be subject to this plan.

PRE-PRACTICE EDUCATION:

1) Student athletes will undergo a formal education program on concussion in sport. Topics covered will include mechanism of injury, recognition of signs and symptoms of concussion, and strategies to avoid injury/prevent further sequelae. The 'Concussion Fact Sheet for Student-Athletes' provided by the NCAA will also be distributed at this time. This will be completed before participating in the first official practice session and will be directed by a staff athletic trainer and/or team physician.

2) ALL coaches, athletic training staff, strength and conditioning staff, student support staff and other individuals associated and familiar with the student athlete on a regular basis shall undergo concussion education before the official start of the season. This will be conducted by a member of the TCU Sports Medicine staff and renewed annually. The Concussion Fact Sheet for Coaches supplied by the NCAA will be issued, and a synopsis of the return to play (RTP) guidelines as established by the 5th International Conference on Concussion in Sport will be reviewed and all will sign a statement stating such.

3) Team physicians will be provided with the NCAA Concussion Fact Sheet and any other applicable documents.

*In addition to pre-practice education all athletes will sign a statement in which they accept responsibility for reporting **all** injuries, including signs and symptoms of a concussion, to the appropriate healthcare personnel.*

PRE-PRACTICE SCREENING:

Athletes in all sports will undergo pre-participation baseline assessment before the first official practice session. Testing will be administered by certified staff or certified graduate assistant athletic trainers.

1) Student-Athletes will complete a concussion history assessment during their initial pre-participation screening which will be reviewed by and discussed with attending physician.

2) Student-athletes will submit a baseline computerized neurocognitive test utilizing the C 3 Logix program which includes a symptom evaluation, sideline concussion assessment tool, cognitive assessment and balance evaluation.

SIGNS OR SYMPTOMS OF CONCUSSION PRESENT:

- When a student-athlete exhibits any signs, symptoms or behaviors consistent with a concussion they will be removed from practice or competition by a member of the coaching staff, athletic training staff, team physician or his/her designee. They will be promptly evaluated by an athletics healthcare provider (certified athletic trainer, team physician or his/her designee).
- Evaluation will follow procedures based on the Evaluation and Management protocol.
- Without exception, a student-athlete *diagnosed* with a concussion shall be withheld from competition or practice and not return to activity for the remainder of the day.
- The student-athlete will receive serial monitoring for deterioration until discharge. Should worsening of signs or symptoms occur, the student-athlete may be taken to the nearest hospital emergency department per department emergency action plans.
- Upon discharge, the student-athlete will be provided a follow up time for the next day and will be released to a responsible party (roommate, significant other, family member, etc…) who will be provided a copy of the post-concussion discharge instructions. A copy of the discharge instructions will be retained by the healthcare provider and placed in the athlete's permanent medical file.
- If not already done, the athlete will be evaluated by the team physician or his/her designee as soon as able.
- Academic services will be notified by the team physician or his/her designee when an athlete is diagnosed with a concussion and will be advised of the recommendation to avoid class, papers, projects, presentations, and exams until further notice.

RETURN TO ACTIVITY

- No athlete shall return to competition, practice, strength training, or conditioning without being evaluated and cleared for participation by the team physician or his/her designee.
- All concussions, whether athletically related or not, will undergo a gradual return to activity as outlined in the 5th International Conference on Concussions in Sport, Berlin, 2016 (Berlin Guidelines).
- As outlined in the Berlin Guidelines, certain modifying factors may prolong or delay the return to activity including but not limited to: prolonged loss of consciousness, number and/or severity of symptoms, frequency and/or recency of concussions, co- and pre-morbidities, medication(s), behavior, and sport.
- No one form of assessment will determine an athlete's return to activity. In addition to the clinical exam, post-event symptom/severity scores will be monitored as well as C 3 Logix neurocognitive exams.
- Computerized neurocognitive examination will not typically occur until the patient is asymptomatic as determined by the team physician or his/her designee.
- The ultimate decision for an athlete's return to activity rests solely with the team physician or his/her designee.

IMAGING

- Routine imaging (X ray, CT, MRI/MRA, fMRI, PET) for concussions is not recommended.
- In the event an athlete deteriorates or requires transfer to an emergency department imaging will be at the discretion of the on call Sports Medicine physician or attending physician and this information will be communicated to a TCU team physician as needed.
- At any point in the athletes recovery outpatient imaging may be ordered by the team physician or his/her designee if deemed necessary.

POST CONCUSSIVE SYNDROME/PROLONGED SYMPTOMS

- If an athlete remains symptomatic for a prolonged period of time, the athlete may be referred to sub-specialists at the team physicians discretion for consultation to include, but not limited to: Neurologist, Neuropsychologist, Sports Psychologist, Psychologist, Psychiatrist, Vision Specialist, Physical Therapist trained in vestibular and oculomotor therapy etc…
- Imaging and/or formal neurocognitive testing may be pursued at the discretion of the team physician.
- At the discretion of the team physician or his/her designee, sub-specialty consultation may be sought at any time while an athlete has symptoms.

Inclusions:

- Concussion Fact Sheet for Student-Athletes and Concussion Education Statement
- Concussion Fact Sheet for Coaches/Staff; Concussion Education Statement; sample return to play protocol
- SCAT 5 Tool
- Student Athlete Post-Concussion Instructions
- Notification Letter to Academics

Appendix A:
Consensus statement on concussion in sport: the 5th International Conference on Concussion in Sport held in Berlin, October, 2016

Appendix B:
Inter-Association Consensus: Independent Medical Care for College Student-Athletes Guidelines

Appendix C
Independent Medical Care for College Student Athletes Best Practices

CONCUSSION

A fAct sheet for student-Athletes

What is a concussion?

A concussion is a brain injury that:

- Is caused by a blow to the head or body.
  - From contact with another player, hitting a hard surface such as the ground, ice or floor, or being hit by a piece of equipment such as a bat, lacrosse stick or field hockey ball.
- Can change the way your brain normally works.
- Can range from mild to severe.
- Presents itself differently for each athlete.
- Can occur during practice or competition in ANY sport.
- **Can happen even if you do not lose consciousness.**

hoW can i prevent a concussion?

Basic steps you can take to protect yourself from concussion:

- Do not initiate contact with your head or helmet. You can still get a concussion if you are wearing a helmet.
- Avoid striking an opponent in the head. Undercutting, flying elbows, stepping on a head, checking an unprotected opponent, and sticks to the head all cause concussions.
- Follow your athletics department's rules for safety and the rules of the sport.
- Practice good sportsmanship at all times.
- Practice and perfect the skills of the sport.

What are the symptoms of a concussion?

You can't see a concussion, but you might notice some of the symptoms right away. Other symptoms can show up hours or days after the injury. Concussion symptoms include:

- Amnesia.
- Confusion.
- Headache.
- Loss of consciousness.
- Balance problems or dizziness.
- Double or fuzzy vision.
- Sensitivity to light or noise.
- Nausea (feeling that you might vomit).
- Feeling sluggish, foggy or groggy.
- Feeling unusually irritable.
- Concentration or memory problems (forgetting game plays, facts, meeting times).
- Slowed reaction time.

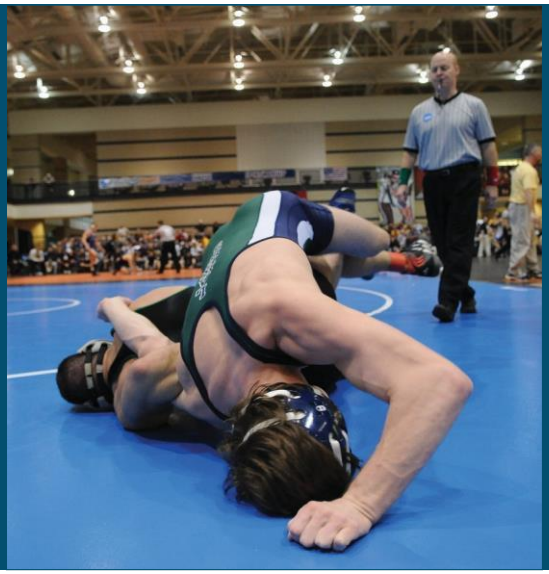
Exercise or activities that involve a lot of concentration, such as studying, working on the computer, or playing video games may cause concussion symptoms (such as headache or tiredness) to reappear or get worse.

Don't hide it. Tell your athletic trainer and coach. Never ignore a blow to the head. Also, tell your athletic trainer and coach if one of your teammates might have a concussion. Sports have injury timeouts and player substitutions so that you can get checked out.

Report it. Do not return to participation in a game, practice or other activity with symptoms. The sooner you get checked out, the sooner you may be able to return to play.

Get checked out. Your team physician, athletic trainer, or health care professional can tell you if you have had a concussion and when you are cleared to return to play. A concussion can affect your ability to perform everyday activities, your reaction time, balance, sleep and classroom performance.

Take time to recover. If you have had a concussion, your brain needs time to heal. While your brain is still healing, you are much more likely to have a repeat concussion. In rare cases, repeat concussions can cause permanent brain damage, and even death. Severe brain injury can change your whole life.



it's better to miss one game than the Whole season. When in doubt, get checked out.

For more information and resources, visit www.NCAA.org/health-safety and www.CDC.gov/Concussion.

Concussion Education Statement
Student Athletes

A concussion is an injury sustained to the brain as a result of a bump, hit, blow or jolt that causes the brain substance to be moved or shifted within the head. These injuries, if not diagnosed and managed properly, can lead to serious complications and improper brain functioning. ***Even though most concussions are mild, all concussions are potentially serious and may result in complications including, but not limited to, brain damage and death if not recognized and managed properly by a trained health care professional.***

As a TCU Student- Athlete, I attest that I have received verbal education and the FACT SHEET FOR STUDENT-ATHLETES, developed by the NCAA, from the TCU Athletic Training / Sports Medicine staff, or its designees, regarding recognition and reporting of a concussion.

Furthermore, I attest that I have been educated on the medical signs and symptoms of a concussion and I agree to report any clinical signs or symptoms of a suspected head injury to my/a Staff Athletic Trainer, Team Physician or designee immediately.

I understand that as a TCU Student- Athlete it is my responsibility to report all injuries/illnesses, regardless of perceived severity, to my/a Staff Athletic Trainer immediately, to include concussions.

I also hereby recognize and agree that my health and well-being is a shared responsibility between myself, the Coaching Staff, the Staff Athletic Trainer, Team Physicians and Sports Medicine team at TCU.

Student-Athletes Printed Name: _____

Student-Athletes Signature: _____

Student-Athletes I.D. Number: _____

Date: _____

CONCUSSION

A fAct sheet for coAches

The FacTs

- A concussion is a brain injury.
- All concussions are serious.
- Concussions can occur without loss of consciousness or other obvious signs.
- Concussions can occur from blows to the body as well as to the head.
- Concussions can occur in *any* sport.
- Recognition and proper response to concussions when they first occur can help prevent further injury or even death.
- Athletes may not report their symptoms for fear of losing playing time.
- Athletes can still get a concussion even if they are wearing a helmet.
- Data from the NCAA Injury Surveillance System suggests that concussions represent 5 to 18 percent of all reported injuries, depending on the sport.

WhaTis a concussion?

A concussion is a brain injury that may be caused by a blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head. Concussions can also result from hitting a hard surface such as the ground, ice or floor, from players colliding with each other or being hit by a piece of equipment such as a bat, lacrosse stick or field hockey ball.

Recognizing a possible concussion

To help recognize a concussion, watch for the following two events among your student-athletes during both games and practices:

1. A forceful blow to the head or body that results in rapid movement of the head;

-AND-

2. **Any change** in the student-athlete's behavior, thinking or physical functioning (see signs and symptoms).

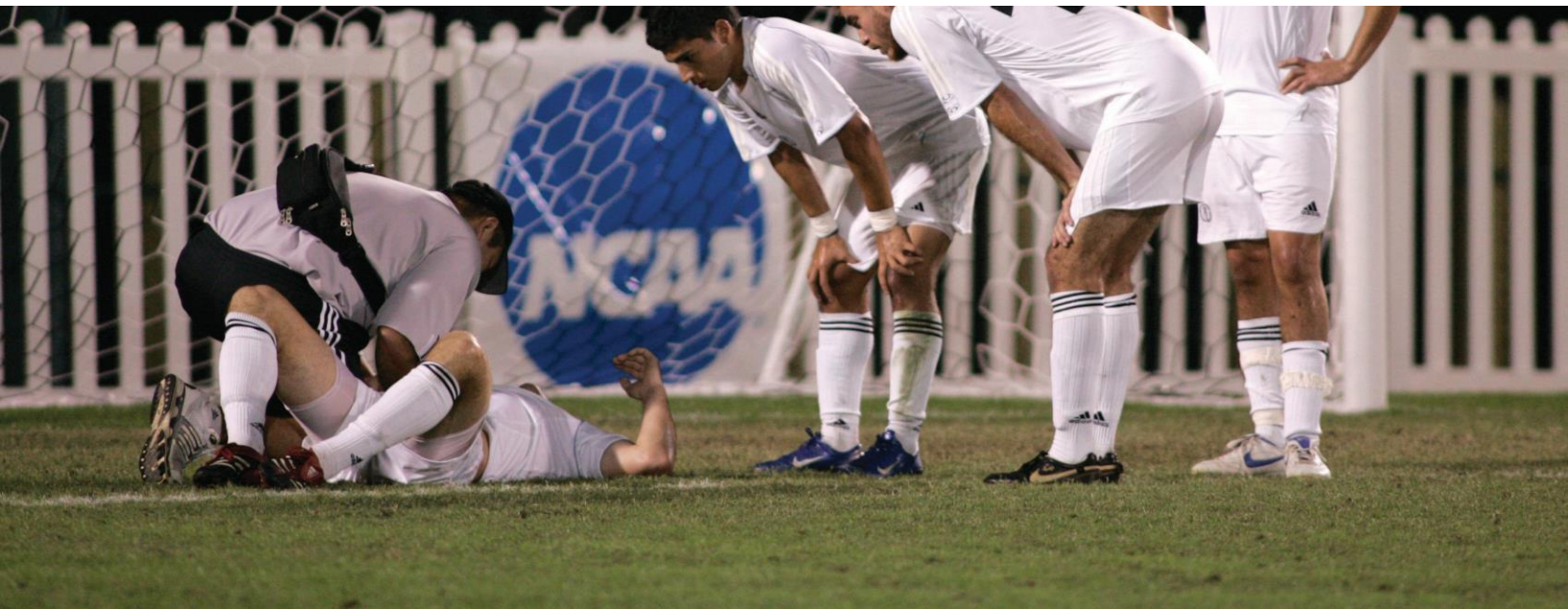
signs and sympToms

Signs Observed By Coaching Staff

- Appears dazed or stunned.
- Is confused about assignment or position.
- Forgets plays.
- Is unsure of game, score or opponent.
- Moves clumsily.
- Answers questions slowly.
- Loses consciousness (even briefly).
- Shows behavior or personality changes.
- Can't recall events before hit or fall.
- Can't recall events after hit or fall.

Symptoms Reported By Student-Athlete

- Headache or "pressure" in head.
- Nausea or vomiting.
- Balance problems or dizziness.
- Double or blurry vision.
- Sensitivity to light.
- Sensitivity to noise.
- Feeling sluggish, hazy, foggy or groggy.
- Concentration or memory problems.
- Confusion.
- Does not "feel right."



pReVenTion and pRepaRaTion

As a coach, you play a key role in preventing concussions and responding to them properly when they occur. Here are some steps you can take to ensure the best outcome for your student-athletes:

- Educate student-athletes and coaching staff about concussion. Explain your concerns about concussion and your expectations of safe play to student-athletes, athletics staff and assistant coaches. Create an environment that supports reporting, access to proper evaluation and conservative return-to-play.
  - Review and practice your emergency action plan for your facility.
  - Know when you will have sideline medical care and when you will not, both at home and away.
  - Emphasize that protective equipment should fit properly, be well maintained, and be worn consistently and correctly.
  - Review the Concussion Fact Sheet for Student-Athletes with your team to help them recognize the signs of a concussion.
  - Review with your athletics staff the NCAA Sports Medicine Handbook guideline: Concussion or Mild Traumatic Brain Injury (mTBI) in the Athlete.
- Insist that safety comes first.
  - Teach student-athletes safe-play techniques and encourage them to follow the rules of play.
  - Encourage student-athletes to practice good sportsmanship at all times.
  - Encourage student-athletes to immediately report symptoms of concussion.
- Prevent long-term problems. A repeat concussion that occurs before the brain recovers from the previous one (hours, days or weeks) can slow recovery or increase the likelihood of having long-term problems. In rare cases, repeat concussions can result in brain swelling, permanent brain damage and even death.

Take him/her out of play immediately and allow adequate time for evaluation by a health care professional experienced in evaluating for concussion.

An athlete who exhibits signs, symptoms or behaviors consistent with a concussion, either at rest or during exertion, should be **removed immediately from practice or competition** and should not return to play until cleared by an appropriate health care professional. Sports have injury timeouts and player substitutions so that student-athletes can get checked out.

iF a concussion is suspecTed:

1. **Remove the student-athlete from play.** Look for the signs and symptoms of concussion if your student-athlete has experienced a blow to the head. Do not allow the student-athlete to just "shake it off." Each individual athlete will respond to concussions differently.

2. **Ensure that the student-athlete is evaluated right away by an appropriate health care professional.** Do not try to judge the severity of the injury yourself. Immediatelyrefer the student-athlete to the appropriate athletics medical staff, such as a certified athletic trainer, team physician or health care professional experienced in concussion evaluation and management.

3. **Allow the student-athlete to return to play only with permission from a health care professional with experience in evaluating for concussion.** Allow athletics medical staff to rely on their clinical skills and protocols in evaluating the athlete to establish the appropriate time to return to play. A return-to-play progression should occur in an individualized, step-wise fashion with gradual increments in physical exertion and risk of contact.

4. **Develop a game plan.** Student-athletes should not return to play until all symptoms have resolved, both at rest and during exertion. Many times, that means they will be out for the remainder of that day. In fact, as concussion management continues to evolve with new science, the care is becoming more conservative and return-to-play time frames are getting longer. Coaches should have a game plan that accounts for this change.

iT's beTTeR They miss one game Than The Whole season. When in doubT, siT Them ouT.

For more information and resources, visit www.NCAA.org/health-safety and www.CDC.gov/Concussion.

Sample Return to Play Guideline
as Established by the International Conference on Concussion in Sport, Berlin, 2016

Sport related concussion is a traumatic brain injury induced by biomechanical forces.

Signs and Symptoms:

Loss of consciousness	Visual disturbances (blurry, double, photophobia)
Confusion	Disequilibrium(balance problems)
Disorientation	Feeling in a "fog" or "zoned out"
Delayed verbal and motor responses	Vacant stare
Inability to focus	Irritability or emotional changes
Headache	Dizziness
Nausea/vomiting	Slurred or incoherent speech
Excessivedrowsiness	Hearing problems or ringing in the ears
Antero grade amnesia	Retrograde amnesia

Symptomatic – reporting or finding of symptoms relative to a concussion
Asymptomatic – does not report any symptoms and no symptoms are found on clinical exam by physician or Athletic Trainer

Below are the current guidelines for return to activity as established by the Conference on Concussion in Sport:

- An athlete diagnosed with a concussion will not be allowed to return to play that same day
- Return to play will be sport specific given the demands of that particular sport

1. Symptom-limited activity: Daily activities that do no provoke symptoms. Goal: Gradual reintroduction of work/school activities.

2. Light aerobic exercise: Walking or stationary cycling at slow to medium pace. No resistance training . Goal: Increase heart rate.

3. Sport specific exercise: Running or skaing drills. No head impact activities. Goal: Add movement

4. Non-contact training drills: Harder training drills, eg, passing drills. May beging progressive resistance
   training. Goal: Exercise, coordination and increased thinking.

5. Full-contact practice: Following medical clearance, participate in normal training activities. Goal: Restore confidence and assess functional skills by coaching staff.

6. Return to sport: Normal game play.

It is important to note that returning an athlete to play too soon may actually put them at risk for additional concussions and more lost time. With each documented concussion the return to play time will likely lengthen and ultimately put the athlete's career in jeopardy.

In cases of more complex concussions, the rehabilitation and return to play process may be more prolonged for the protection of the athlete.

An athlete should never be advised to falsify answers to the clinical examiner, but rather encouraged to be honest regarding his/her symptoms so that their long-term health is never put at risk. If it is found the athlete has been advised to falsify the reporting of symptoms by any coach or staff member, that information will be documented and forwarded to the Athletic Director for review and appropriate disciplinary action.

The team physician, or team physician's designee, will report concussions to the academic office so the athletes professors can be apprised of the situation and the athlete will be allowed the opportunity to receive cognitive rest as well as physical rest.

The team physician or the designee of the team physician will make all decisions or recommendations regarding the evaluation, progress and return to activity for an athlete who has been diagnosed with a concussion.

I attest that I have undergone formal training and received written information specific to concussions, recognizing the signs and symptoms of a concussion, prevention of concussions and return to play guidelines as outlined by the International Conference on Concussions and TCU Athletic Training Sports Medicine and agree to abide by such guidelines.

Print Name_____ Position Held/Sport_____

Signature_____ Date_____

Concussion Education Statement Staff

A concussion is an injury sustained to the brain as a result of a bump, hit, blow or jolt that causes the brain substance to be moved or shifted within the head.
These injuries, if not diagnosed and managed properly, can lead to serious complications and improper brain functioning. ***Even though most concussions are mild, all concussions are potentially serious and may result in complications including, but not limited to, brain damage and death if not recognized and managed properly by a trained health care professional.***

As a TCU full time staff member, student support staff or other individual associated with or in direct contact with TCU student athletes I attest that I have received verbal education and the FACT SHEET FOR COACHES, developed by the NCAA, from the TCU Athletic Training / Sports Medicine staff, or its designees, regarding recognition and reporting of a concussion.

Furthermore, I attest that I have been educated on the medical signs and symptoms of a concussion and I agree to report any clinical signs or symptoms of a suspected head injury to a Staff Athletic Trainer, Team Physician or designee immediately.

I understand that as a TCU staff member, student support staff or individual directly associated with TCU student athletes, it is my responsibility to report all injuries/illnesses, regardless of perceived severity, to a Staff Athletic Trainer or physician immediately, to include concussions.

I also hereby recognize and agree that the health and well-being of the student athlete is a shared responsibility between myself, Staff Athletic Trainers, Team Physicians and Sports Medicine team at TCU.

Staff Member Printed Name: _____

Staff Member Sport: _____

Staff Member Signature: _____

BJSM Online First, published on April 26, 2017 as 10.1136/bjsports-2017-097506SCAT5
To download a clean version of the SCAT tools please visit the journal online (http://dx.doi.org/10.1136/bjsports-2017-097506SCAT5)

SCAT5©

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Patient details

Name: _____

DOB: _____

Address: _____

IDnumber: _____

Examiner: _

DateofInjury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals[1]. The SCAT5 cannot be performed correctly in less than 10 minutes.

Ifyouarenota physicianorlicensed healthcareprofessional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose. Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions foreachtestaregiveninitalics. The onlyequipmentrequired forthetesteris a watchortimer.

Recognise and Remove

Aheadimpactbyeithera directblowor indirecttransmission offorcecanbeassociatedwithaseriousandpotentiallyfatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment; however, these do not need to be done serially.

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

STEP 1: RED FLAGS

RED FLAGS:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/ burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless,

STEP 2: OBSERVABLE SIGNS

Witnessed ☐ Observed on Video ☐

Lying motionless on the playing surface	Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	Y	N
Disorientation or confusion, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N

STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS[2]

"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"

STEP 4: EXAMINATION GLASGOW COMA SCALE (GCS)[3]

Time of assessment			
Date of assessment			
Best eye response (E)			
No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4
Best verbal response (V)			
No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5
Best motor response (M)			
No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6
Glasgow Coma score (E + V + M)			

CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	Y	N
If there is NO neck pain at rest, does the athlete have a full range of ACTIVE pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.

Who scored last in this match?	Y	N
What team did you play last week / game?	Y	N
Did your team win the last game?	Y	N

Note: Appropriate sport-specific questions may be substituted.

OFFICE OR OFF-FIELD ASSESSMENT

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

STEP 1: ATHLETE BACKGROUND

Sport /team / school:

Date / time of injury:

Years of education completed:

Age:

Gender: M / F / Other

Dominant hand: left / neither / right

How many diagnosed concussions has the athlete had in the past?:

When was the most recent concussion?:

How long was the recovery (time to being cleared to play) from the most recent concussion?: (days)

Has the athlete ever been:

Hospitalized for a head injury?	Yes	No
Diagnosed / treated for headache disorder or migraines?	Yes	No
Diagnosed with a learning disability / dyslexia?	Yes	No
Diagnosed with ADD / ADHD?	Yes	No
Diagnosed with depression, anxiety or other psychiatric disorder?	Yes	No

Current medications? If yes, please list:

Name:

DOB:

Address:

ID number:

Examiner:

Date:

2

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: ☐ Baseline ☐ Post-Injury

Please hand the form to the athlete

	none	mild		moderate			severe
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6
Total number of symptoms:							of 22
Symptom severity score:							of 132
Do your symptoms get worse with physical activity?						Y	N
Do your symptoms get worse with mental activity?						Y	N
If 100% is feeling perfectly normal, what percent of normal do you feel?							

If not 100%, why?

Please hand form back to examiner

STEP 3: COGNITIVE SCREENING

Standardised Assessment of Concussion (SAC)[4]

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

ORIENTATION

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score		of 5

IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists					Score (of 5) Trial 1	Trial 2	Trial 3
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
					Immediate Memory Score			of 15
					Time that last trial was completed			

List	Alternate 10 word lists					Score (of 10) Trial 1	Trial 2	Trial 3
G	Finger Candle	Penny Paper	Blanket Sugar	Lemon Sandwich	Insect Wagon			
H	Baby Elbow	Monkey Apple	Perfume Carpet	Sunset Saddle	Iron Bubble			
I	Jacket Dollar	Arrow Honey	Pepper Mirror	Cotton Saddle	Movie Anchor			
					Immediate Memory Score			of 30
					Time that last trial was completed			

CONCENTRATION

DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)					
List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	List E	List F			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
		Digits Score:			of 4

MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0 1
Months Score	of 1
Concentration Total Score (Digits + Months)	of 5

4

STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?		of 10
Can the patient perform tandem gait normally?		of 10
Total errors		of 30

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing[5]

Which foot was tested (i.e. which is the non-dominant foot) ☐ Left ☐ Right

Testing surface (hard floor, field, etc.) _____

Footwear (shoes, barefoot, braces, tape, etc.) _____

Condition	Errors
Double leg stance	
Single leg stance (non-dominant foot)	
Tandem stance (non-dominant foot at the back)	

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

5

STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started _____

Please record each word correctly recalled. Total score equals number of words recalled.

_____

_____

_____

Total number of words recalled accurately: _____ of 5 or _____ of 10

6

STEP 6: DECISION

Domain	Date & time of assessment:		
Symptom number (of 22)			
Symptom severity score (of 132)			
Orientation (of 5)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: _____

If the athlete is known to you prior to their injury, are they different from their usual self?
☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**
(If different, describe why in the clinical notes section)

Concussion Diagnosed?
☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

If re-testing, has the athlete improved?
☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.

Signature: _____

Name: _____

Title: _____

Registration number (if applicable): _____

Date: _____

SCORING ON THE SCAT5 SHOULD NOT BE USED AS A STAND-ALONE METHOD TO DIAGNOSE CONCUSSION, MEASURE RECOVERY OR MAKE DECISIONS ABOUT AN ATHLETE'S READINESS TO RETURN TO COMPETITION AFTER CONCUSSION.

CLINICAL NOTES:

Name:

DOB:

Address:

ID number:

Examiner:

Date:

CONCUSSION INJURY ADVICE

(To be given to the person monitoring the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, worsening headache, double vision or excessive drowsiness, please telephone your doctor or the nearest hospital emergency department immediately.

Other important points:

Initial rest: Limit physical activity to routine daily activities (avoid exercise, training, sports) and limit activities such as school, work, and screen time to a level that does not worsen symptoms.

1) Avoid alcohol

2) Avoid prescription or non-prescription drugs without medical supervision. Specifically:

   a) Avoid sleeping tablets

   b) Do not use aspirin, anti-inflammatory medication or stronger pain medications such as narcotics

3) Do not drive until cleared by a healthcare professional.

4) Return to play/sport requires clearance by a healthcare professional.

Clinic phone number:

Patient's name:

Date /time of injury:

Date / time of medical review:

Healthcare Provider:

Contact details or stamp

INSTRUCTIONS

Words in *Italics* throughout the SCAT5 are the instructions given to the athlete bythe clinician

Symptom Scale

The time frame for symptoms should be based on the type of test being administered. At baseline it is advantageous to assess how an athlete "typically" feels whereas during the acute/post-acute stage it is best to ask how the athlete feels at the time of testing.

The symptom scale should be completed by the athlete, not by the examiner. In situations where the symptom scale is being completed after exercise, it should be done in a resting state, generally by approximating his/her resting heart rate.

For total number of symptoms, maximum possible is 22 except immediately post injury, if sleep item is omitted, which then creates a maximum of 21.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132, except immediately post injury if sleep item is omitted, which then creates

a maximum of 21x6=126.

Immediate Memory

The Immediate Memory component can be completed using the traditional 5-word per trial list or, optionally, using 10-words per trial. The literature suggests that the Immediate Memory has a notable ceiling effect when a 5-word list is used. In settings where this ceiling is prominent, the examiner may wish to make the task more difficult by incorporating two 5-word groups for a total of 10 words per trial. In this case, the maximum score per trial is 10 with a total trial maximum of 30.

Choose one of the word lists (either 5 or 10). Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order." The words must be read at a rate of one word per second.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3:

"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

Concentration

Digits backward

Choose one column of digits from lists A, B, C, D, E or F and administer those digits as follows:

Say: *"I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

Begin with first 3 digit string.

If correct, circle "Y" for correct and go to next string length. If incorrect, circle "N" for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N's) in a string length. The digits should be read at the rate of one per second.

Months in reverse order

"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November … Go ahead"

1 pt. for entire sequence correct

Delayed Recall

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section.

"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."

Score 1 pt. for each correct response

Modified Balance Error Scoring System (mBESS)[5] testing

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A timing device is required for this testing.

Each of 20-second trial/stance is scored by counting the number of errors. The examiner will begin counting errors only after the athlete has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum number of errors for any single condition is 10. If the athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once the athlete is set. Athletes that are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

"I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

(a) Double leg stance:

"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

(b) Single leg stance:

"If you were to kick a ball, which foot would you use? [This will be the dominant foot] *Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:

"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

Finger to Nose

"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."

References

1. McCrory et al. Consensus Statement On Concussion In Sport – The 5th International Conference On Concussion In Sport Held In Berlin, October 2016. British Journal of Sports Medicine 2017 (available at www.bjsm.bmj.com)
2. Maddocks, DL; Dicker, GD; Saling, MM. The assessmentoforientation following concussion in athletes. Clinical Journal of Sport Medicine 1995; 5: 32-33
3. Jennett, B., Bond, M. Assessment of outcome after severe brain damage: a practical scale. Lancet 1975; i: 480-484
4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11:176-181
5. Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

CONCUSSION INFORMATION

Any athlete suspected of having a concussion should be removed from play and seek medical evaluation.

Signs towatchfor

Problems could arise over the first 24-48 hours. The athlete should not be left alone and must go to a hospital at once if they experience:

- Worsening headache
- Drowsiness or inability to be awakened
- Inability to recognize people or places
- Repeated vomiting
- Unusual behaviour or confusion or irritable
- Seizures (arms and legs jerk uncontrollably)
- Weakness or numbness in arms or legs
- Unsteadiness on their feet.
- Slurred speech

Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.

Rest & Rehabilitation

After a concussion, the athlete should have physical rest and relative cognitive rest for a few days to allow their symptoms to improve. In most cases, after no more than a few days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

When returning to play/sport, the athlete should follow a stepwise, **medically managed exercise progression, with increasing amounts of exercise.** For example:

Graduated Return to Sport Strategy

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functionalskills by coaching staff.
6. Return to play/sport	Normal game play.	

In this example, it would be typical to have 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest).

Written clearance should be provided by a healthcare professional before return to play/sport as directed by local laws and regulations.

Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The athlete may need to miss a few days of school after a concussion. When going back to school, some athletes may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms donot get worse.If a particular activity makes symptoms worse, then the athlete should stop that activity and rest until symptoms get better. To

make sure that the athlete can get back to school without problems, it is important that the healthcare provider, parents, caregivers and teachers talk to each other so that everyone knows what the plan is for the athlete to go back to school.

Note: If mental activity does not cause any symptoms, the athlete may be able to skip step 2 and return to school part-time before doing school activities at home first.

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the athlete continues to have symptoms with mental activity, some other accomodations that can help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- Moretime tofinish assignments/tests
- Quiet room to finish assignments/tests
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Taking lots of breaks during class, homework, tests
- No more than one exam/day
- Shorter assignments
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

The athlete should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.

Sport concussion assessment tool - 5th edition

Br J Sports Med published online April 26, 2017

Notes

TCU Sports Medicine
Mild Traumatic Brain Injury/Post-Concussion Instructions

Name:_____ Date:_____ Time: _____

By sustaining a sport related concussion, you need to be cautious with your activities and monitor your symptoms. There are various signs and symptoms which can show-up immediately or several hours after the initial injury:

- Loss of consciousness
- Headache
- Confusion
- Delayed verbal or motor responses
- Neck pain
- Nausea and/or Vomiting
- Loss of appetite
- Dizziness or loss of balance
- Excessive drowsiness/fatigue
- Inability to focus
- Visual disturbance
- Feeling in a "fog" or "zoned out"
- Unusual irritability/emotional changes
- Slurred or incoherent speech
- Hearing problems or ringing in the ears
- Memory problems pre or post injury

Please be aware of your symptoms and report them to the Athletic Training/Sports Medicine Staff

In addition, please follow these instructions:

It is OK to:

- Use the medicine given to you by the sports medicine staff
- Use ice (15 minutes) for neck pain
- Go to sleep at a decent hour
- Stay hydrated and eat foods that sound appetizing
- Rest – quiet, comfortable, dim room
- Call if symptoms worsen

It is NOT OK to:

- Take sleeping pills
- Drink alcohol or caffeine
- Do any physical/strenuous activity
- Drive a vehicle
- Stay up late
- Watch TV/play video games, sit at your computer or listen to loud music
- Be exposed to bright light

Please remember to report back to the TCU Sports Medicine Staff tomorrow at_____ for a follow-up evaluation. If your symptoms worsen, or if additional symptoms appear, report to the emergency room immediately and call the Athletic Trainer once the athlete is under appropriate medical care.

Emergency Phone Numbers:

On campus emergency- (817) 257-7777
Off campus emergency- 911
Harris ER Downtown- (817) 882-3333
Athletic Trainer-_____ Phone number- _____
Physician -_____Phone number-_____

_____has been released to_____Ph. #_____ with instructions on SRC/Concussion care and when to report back to the sports medicine staff.

Released to signature_____Date:_____

Athletic Trainer_____Date: _____

Athletic Academics
Campus Life
Professors

To Whom It May Concern:

A concussion is in fact a mild traumatic brain injury that may be caused by a blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head. Concussions can also result from hitting a hard surface such as the ground, ice or floor, from players colliding with each other or being hit by a piece of equipment such as a bat, stick or ball. Concussions can occur without loss of consciousness or other obvious signs or symptoms. All concussions should be taken seriously. Data taken from a recent NCAA Injury Surveillance System suggests that concussions represent between 5 to 18 percent of all reported injuries, depending on the sport.

Unfortunately, like most universities around the country, TCU athletes suffer from concussions related to sport within the range above. What is important to know is that our athletes are immediately evaluated by our well-qualified Athletic Training staff and then again by our team physicians. Recommendations are made based on the severity of the immediate symptoms, but in most cases the immediate recommendation is for complete physical and cognitive rest. Our athletes are instructed to avoid TV, video games, computers, listening to music, bright light, alcohol, caffeine, driving a vehicle or staying up late as well as any physical or strenuous activity. In most cases this will mean the athlete will not be in class for several days following diagnosis with a concussion. Recommendations also include eating a well-balanced diet, staying hydrated and getting plenty of sleep. Student athletes are re-evaluated regularly by our team physicians. Current science, although evolving regularly with the more knowledge we gain about concussions, tells us that complete physical and cognitive rest gives a person the best chance to recover more quickly from on-going symptoms. Unfortunately no two concussions or athletes are the same and there is no way to determine how long an athlete will be affected by concussion symptoms. We understand this sometimes puts a burden on the student in the classroom. However, we believe that exacerbating their symptoms by returning them to the classroom or sport to soon will only make it more difficult for them to recover physically and academically in the long run. Once they are cleared by a physician to resume limited activity they follow a strict return-to-play/return to class protocol recommended and followed closely by our Sports Medicine staff.

Please know that we do our very best to keep academics notified of any and all injuries we are aware of in a timely manner. We truly appreciate your patience and understanding as we deal with these sometime very difficult situations. We take all injuries and illnesses very seriously, particularly concussions, and in the end we all only want what is in the best interest of our student athlete.

If you ever have any questions or concerns, please do not hesitate to contact our Sports Medicine Department through our Athletic Academic Office. Again, thank you for your understanding.

Respectfully:

David Gable, MS, ATC, LAT Associate
Athletics Director – Sports Medicine
Head Athletic Trainer - Football

Michele Kirk, MD
Head Team Physician - TCU

TCU Concussion Protocol for Evaluation and Management

A. Preseason Evaluation

a. Baseline concussion history form for all sports
    i. Filled out and signed by SA or parent/guardian if under 18 years
b. Baseline C3 Logix for all sports
c. Team physician will determine final clearance on all athletes following pre-participation evaluation

B. In-Season Evaluation

a. If concern for signs, symptoms or behaviors consistent with concussion an athlete may be removed from practice or play by a:
    i. Coach, ATC staff or student, GA, physician, athlete himself or herself
b. Initial evaluation will include examination for cervical spine injury, skull fracture, potential brain bleed or any other serious bodily injury. If any of these are suspected the appropriate emergency action plan (EAP) for that venue will be initiated
c. Evaluation by the athletic training staff and/or physician will follow removal from activity
    i. Evaluation may include portions of one or more of the following: SCAT 5/C 3 (to be compared to baseline), physical, neurologic exams (serial), other exams deemed appropriate by medical staff
    ii. Athletes diagnosed with a concussion will NOT be returned to play the same day
    iii. Serial monitoring by the athletic training staff, team physician or team physician designee will be employed to monitor for deterioration of symptoms
        1. Should deterioration of symptoms or concerning symptoms present to include, but not limited to, prolonged loss of consciousness, focal neurological deficit, or spine injury, and it is deemed necessary by the medical staff, the athlete may be transported to the nearest emergency department (ED) per EAP for that venue.
        2. If it has not already occurred, evaluation by the team physician will happen as soon as available, but within a maximum of 24 – 48 hours, unless the injury happens while traveling. Then the injury will be discussed via phone between the team physician(s) and team ATC.

d. Athlete(s) Discharged
    i. Will be discharged with written instructions to include, but not limited to what activities to avoid, what meds can and can't be taken, and when to follow-up
        1. A copy of the above will be kept in the athlete's medical file
    ii. Will be discharged to a responsible party, to include:
        1. Roommate, family member, friend, or significant other
    iii. Academic services will be notified by the team physician(s) concerning the athlete's diagnosis and physician's recommendations as to academic activity every 1-2 days until full clearance

C. Return to Activity

a. Athletes will be seen regularly by the team physician(s) until symptom free
b. Once symptom free the C 3 Logix test will be administered and compared to baseline
c. If the C 3 Logix is within acceptable parameters of baseline (to be interpreted by physician), then the athlete will be cleared to start the return to play (RTP) protocol under the guidance of the team ATC and physician(s)
    i. RTP protocol used is established by the 5th International Conference on Concussions in Sport, Berlin, 2016 (Berlin Guidelines)

D. Referrals/testing

a. Imaging
    i. At the discretion of the treating physician
b. Specialty Referrals, i.e. Neurologist, Neuropsychologist, Sports Psychologist, Psychologist, Psychiatrist, Vision specialist, Physical Therapist trained in vestibular and oculomotor therapy, etc…
    i. At the discretion of the treating physician. Consider especially for student athletes with prolonged symptoms or pre-existing conditions that may complicate recovery or return from sport related concussion
    ii. Consider especially for student athletes with prolonged symptoms or pre-existing conditions that may complicate return from sport related concussion

Roles In Concussion Management

Medical personnel with training in the diagnosis, treatment and initial management of acute concussions must be *present* at all NCAA varsity competitions in the following contact/collision sports: basketball, equestrian, field hockey, football, ice hockey, lacrosse, pole vault, rugby, skiing, soccer, wrestling. These same individuals must be *available* at all NCAA varsity practices in the following contact/collision sports: basketball, field hockey, football, ice hockey, lacrosse, pole vault, rugby, skiing, soccer, wrestling.

A. ATCs may perform the following roles in concussion management:

- **a.** Evaluation
  - **i.** Remove any athlete exhibiting signs, symptoms, or behaviors consistent with a concussion from practice/play
  - **ii.** Perform an exam on athlete suspected of having a concussion
    - **1.** Exam to include, but not limited to: symptom check list, neurological exam, further exam pertaining to injury or deemed necessary by ATC
  - **iii.** Diagnose athlete(s) with concussion and remove from play for the remainder of the day
  - **iv.** Monitor (serial monitoring) athlete for deterioration of symptoms
  - **v.** Determine whether further treatment is needed at an emergency facility
- **b.** Management
  - **i.** Notify team physician(s) of athlete(s) with concussions as soon as able
  - **ii.** Direct athlete to see team physician when team physician available
  - **iii.** Provide athlete with written instructions for concussion management
  - **iv.** Discharge athlete to responsible party with follow-up care scheduled
  - **v.** Notify academic services of SA's diagnosis and restrictions every 1-2 days
- **c.** Return to Activity
  - **i.** Work with team physician(s) to monitor athlete for symptoms (number and severity) daily
  - **ii.** Create/direct return to play (RTP) protocol once athlete is cleared
  - **iii.** Notify team physician(s) if any symptoms develop/return during RTP protocol

B. Team Physician(s) may perform the following roles in concussion management:

- **a.** Evaluation
  - **i.** Remove any athlete exhibiting signs, symptoms, or behaviors consistent with a concussion from practice/play
  - **ii.** Perform an exam on athlete suspected of having a concussion
    - **1.** Exam to include, but not limited to: symptom check list, neurological exam, further exam pertaining to injury or as deemed necessary by physician
  - **iii.** Diagnose athlete(s) with concussion and remove from play for the remainder of the day
  - **iv.** Monitor (serial monitoring) athlete for deterioration of symptoms
  - **v.** Determine whether further treatment is needed at an emergency facility

b. Management

i. Evaluate athlete within 24-48 hours of injury, unless athlete is traveling. Then the physician(s) will coordinate care with the team ATC via phone until the athlete returns to campus for evaluation.

ii. Provide athlete with written instructions for concussion management when appropriate

iii. Discharge athlete(s) to a responsible party with follow-up care scheduled

iv. Notify Academic Services of athlete's diagnosis and activity/academic restrictions every 1-2 days

v. Prescribe appropriate medications as needed

vi. Refer to appropriate outside services/physician as needed and at any time, such as:

1. Imaging-CT, MRI, etc.

2. Neuropsychological Testing (formal) with licensed neuropsychologist

3. Neurologist

vii. Make final determination for return to play clearance in conjunction with supervising athletic trainer

c. Return to Activity

i. Monitor athlete for symptoms (number and severity) in conjunction with the team ATC

ii. Perform appropriate testing when athlete is symptom free to determine clearance to start RTP protocol

1. Testing may include, but is not limited to: symptom check list, C 3 Logix neurocognitive test, neurological exam, etc

iii. Follow/create RTP protocol in conjunction with ATC to monitor for return of concussive symptoms

C. Neurologist

a. None on TCU Staff or Campus

b. Outside Referral

c. To be involved when referral is deemed necessary by TCU team physician

d. Role: To act in normal capacity as a consultant

D. Neuropsychologist (one with experience in sport concussion is preferable)

a. None on TCU Staff or Campus

b. Outside Referral

c. To be involved when referral is deemed necessary by TCU team physician

d. Role: To act in normal capacity as a consultant

E. Health and Wellness Committee

- **a.** This committee meets once a month (or more if needed) to discuss potential issues facing TCU student athletes
- **b.** Athletes with ongoing concussion symptoms lasting longer than 2 weeks and/or causing any academic or other stress will be discussed to ensure everyone is educated on the situation
- **c.** This committee will be comprised of staff members representing:
  Athletic Department Administration
  Sports Medicine (Athletic Trainer and/or Team Physician)
  Athletic Academics
  Nutrition
  Compliance
  Strength and Conditioning
- **d.** Information will be disseminated to Campus Life, professors, coaches and any other TCU staff member who plays a role in ensuring the overall health, well-being and success of the student athlete as indicated during the meeting

Return to Learn Protocol

A. Physical Rest
    a. Athletes are placed on both physical and cognitive rest upon diagnosis of a concussion, length of time to be determined by physician.
B. Cognitive Rest
    a. Athletes are placed on both physical and cognitive rest upon diagnosis of a concussion, length of time to be determined by physician.
    b. Cognitive rest can include, but are not limited to the following:
        i. No attendance of classes
        ii. No studying
        iii. No electronics (TV, phone, computer, video games)
C. Athletes are seen and evaluated by a team physician on a regular basis. Evaluation may include, but is not limited to the following:
    a. Number of symptoms
    b. Severity of symptoms
    c. Physical exam
D. Return to Learn decisions are based on the following:
    a. **INDIVIDUALIZED** to each athlete
    b. Number and severity of symptoms
    c. Physical exam and general health/well-being
E. Return to learn options may include any or all of the following and are always **INDIVIDUALIZED**:
    a. Partial return to classes (example: 4 classes in one day but athlete only attends 2)
        i. May modify classes as needed such as: no computer work, no watching of videos, use of sunglasses and/or earplugs, etc…
        ii. Athlete is instructed to leave class upon increase of symptoms or return of symptoms
    b. Full return to classes
        i. May modify classes as needed such as: no computer work, no watching of videos, use of sunglasses and/or earplugs, etc…
        ii. Athlete is instructed to leave class upon increase of symptoms or return of symptoms
    c. Studying in small increments with frequent breaks (example: 20-30 minutes of studying followed by a 10-15 min break),
        i. Studying may continue as long as symptoms do not return or worsen
F. Progression of return to learn
    a. **INDIVIDUALIZED** to each athlete
    b. Dependent upon same criteria as D
    c. May include any of the options listed in E or others deemed necessary by a physician
    d. Athlete will be re-evaluated by the team physician if symptoms worsen or return with academic challenges
G. Academics
    a. Academic advisor (for each sport) to be ***point person*** for return to learn
    b. Notified of all athletes with a concussion
    c. Updated on a regular basis on their status of return to learn
H. Prolonged Return to Learn
    a. **INDIVIDUALIZED** plan for each athlete
    b. Multidisciplinary approach with referrals to specialists as needed
        i. Specialists may include but are not limited to neurologist, neuropsychologist, psychiatrist, visual specialist, PT/OT with training in vestibular and oculomotor therapies

c. Health and Wellness Committee to become involved as needed to help manage complex cases (see page previous page for members of this committee)

d. Return to learn and prolonged return to learn will comply with ADAAA and all other campus policies and resources to include our academic learning specialists and the Office of Disability Services

Prevention of Concussion in Sport

A. Education of athletes

- **a.** Athletes receive education yearly (see Pre-Practice Education in TCU Sports Medicine Concussion Management Plan)
- **b.** Education is provided to each sport by their respective athletic trainer
- **c.** Education includes, but is not limited to, how to recognize signs and symptoms of concussions, importance of reporting symptoms or suspected concussion to appropriate staff on themselves or a teammate, who they can report symptoms to, and procedures in place to help prevent concussions and treat athletes with concussions
- **d.** Athletes are required to sign a Concussion Education Form to document their concussion education
- **e.** Athletes are provided with a fact sheet on concussions from the CDC and NCAA to retain for their review

B. Education of Coaching Staff

- **a.** All head coaches, assistant coaches, strength and conditioning staff, and other staff members involved with student athletes receive yearly education
- **b.** Education is provided by David Gable, Associate Director of Sports Medicine and Head Football Athletic Trainer
- **c.** Education includes, but is not limited to, how to recognize signs and symptoms of concussions, importance of reporting athletes with suspected concussions to the medical staff, and procedures in place to help prevent concussions and treat athletes with concussions
- **d.** All staff listed above must sign a sheet indicating they have been educated on and understand the importance of concussion safety protocols

C. Baseline Testing

- **a.** See TCU Concussion Protocol for Evaluation and Management

D. Equipment

- **a.** Properly fitting and appropriately maintained equipment is provided to all student athletes
  - **i.** Primarily important for football athletes in the prevention of concussion
  - **ii.** Well-fitting helmets **may** reduce the risk of concussion

E. Practice Guidelines

- **a.** Best practice guidelines are followed as issued by the Big 12 Conference, effective 2014
- **b.** Independent medical care for college student athletes best practices

F. Concussion Action Plan

- **a.** See TCU Concussion Protocol for Evaluation and Management
- **b.** See Roles in Concussion Management

G. Injury Management System

- **a.** All injuries, including concussions, are uploaded using EMR (electronic medical records)

APPENDIX

A

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Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016

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PREAMBLE

The 2017 Concussion in Sport Group (CISG) consensus statement is designed to build on the principles outlined in the previous statements[1–4] and to develop further conceptual understanding of sport-related concussion (SRC) using an expert consensus-based approach. This document is developed for physicians and healthcare providers who are involved in athlete care, whether at a recreational, elite or professional level. While agreement exists on the principal messages conveyed by this document, the authors acknowledge that the science of SRC is evolving and therefore individual management and return-to-play decisions remain in the realm of clinical judgement.

This consensus document reflects the current state of knowledge and will need to be modified as new knowledge develops. It provides an overview of issues that may be of importance to healthcare providers involved in the management of SRC. This paper should be read in conjunction with the systematic reviews and methodology paper that accompany it. First and foremost, this document is intended to guide clinical practice; however, the authors feel that it can also help form the agenda for future research relevant to SRC by identifying knowledge gaps.

A series of specific clinical questions were developed as part of the consensus process for the Berlin 2016 meeting. Each consensus question was the subject of a specific formal systematic review, which is published concurrently with this summary statement. Readers are directed to these background papers in conjunction with this summary statement as they provide the context for the issues and include the scope of published research, search strategy and citations reviewed for each question. This 2017 consensus statement also summarises each topic and recommendations in the context of all five CISG meetings (that is, 2001, 2004, 2008, 2012 as well as 2016). Approximately 60 000 published articles were screened by the expert panels for the Berlin meeting. The details of the search strategies and findings are included in each of the systematic reviews.

The details of the conference organisation, methodology of the consensus process, question development and selection on expert panellists and observers is covered in detail in an accompanying paper in this issue.[5] A full list of scientific committee members, expert panellists, authors, observers and those who were invited but could not attend are detailed is at the end of the summary document. The International Committee of Medical Journal Editors conflict of interest declaration for all authors is provided in Appendix 1.

Medical legal considerations

The consensus statement is not intended as a clinical practice guideline or legal standard of care, and should not be interpreted as such. This document is only a guide, and is of a general nature, consistent with the reasonable practice of a healthcare professional. Individual treatment will depend on the facts and circumstances specific to each individual case. It is intended that this document will be formally reviewed and updated before 31 December 2020.

SRC AND ITS MANAGEMENT

The paper is laid out following the CISG's 11 'R's of SRC management to provide a logical flow of

clinical concussion management. *The new material recommendations determined at the Berlin 2016 meeting are italicised*, and any background material or unchanged recommendations from previous meetings are in normal text.

The sections are: Recognise; Remove; Re-evaluate; Rest; Rehabilitation; Refer; Recover; Return to sport; Reconsider; Residual effects and sequelae; Risk reduction.

Recognise

What is the definition of SRC?

In the broadest clinical sense, SRC is often defined as representing the immediate and transient symptoms of traumatic brain injury (TBI). Such operational definitions, however, do not give any insights into the underlying processes through which the brain is impaired, nor do they distinguish different grades of severity, nor reflect newer insights into the persistence of symptoms and/ or abnormalities on specific investigational modalities. This issue is clouded not only by the lack of data, but also by confusion in definition and terminology. Often the term mild traumatic brain injury (mTBI) is used interchangeably with concussion; however, this term is similarly vague and not based on validated criteria in this context.

One key unresolved issue is whether concussion is part of a TBI spectrum associated with lesser degrees of diffuse structural change than are seen in severe TBI, or whether the concussive injury is the result of reversible physiological changes. The term concussion, while useful, is imprecise, and because disparate author groups define the term differently, comparison between studies is problematic. In spite of these problems, the CISG has provided a consistent definition of SRC since 2000.[1]

The Berlin expert panel modified the previous CISG definition as follows:

Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury include:

- *SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.*
- *SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.*
- *SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.*
- *SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.*

The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (eg, psychological factors or coexisting medical conditions).

Do the published biomechanical studies inform us about the definition of SRC?

Many studies have reported head-impact-exposure patterns for specific sports—for example, American football, ice hockey and Australian football. Those studies report head-impact characteristics including frequency, head kinematics, head-impact location, and injury outcome. In these studies, the use of instrumented helmets has provided information on head-im- pact exposures, although there remains some debate about the accuracy and precision of the head kinematic measurements. To quantify head impacts, studies have used helmet-based systems, mouthguard/headband/skin sensors and videometric studies; however, reported mean peak linear and rotational acceleration values in concussed players vary considerably.

Although current helmet-based measurement devices may provide useful information for collision sports, these systems do not yet provide data for other (non-collision) sports, limiting the value of this approach. Furthermore, accelerations detected by a sensor or video-based systems do not necessarily reflect the impact to the brain itself, and values identified vary considerably between studies. The use of helmet-based or other sensor systems to clinically diagnose or assess SRC cannot be supported at this time.

Sideline evaluation

It is important to note that SRC is an evolving injury in the acute phase, with rapidly changing clinical signs and symptoms, which may reflect the underlying physiological injury in the brain. SRC is considered to be among the most complex injuries in sports medicine to diagnose, assess and manage. The majority of SRCs occur without loss of consciousness or frank neurological signs. At present, there is no perfect diagnostic test or marker that clinicians can rely on for an immediate diagnosis of SRC in the sporting environment. Because of this evolving process, it is not possible to rule out SRC when an injury event occurs associated with a transient neurological symptom. In all suspected cases of concussion, the individual should be removed from the playing field and assessed by a physician or licensed healthcare provider as discussed below.

Sideline evaluation of cognitive function is an essential component in the assessment of this injury. Brief neuropsychological (NP) test batteries that assess attention and memory function have been shown to be practical and effective. Such tests include the SCAT5, which incorporates the Maddocks' questions[6 7] and the Standardised Assessment of Concussion (SAC).[8–10] It is worth noting that standard orientation questions (eg, time, place, person) are unreliable in the sporting situation when compared with memory assessment.[7 11] It is recognised, however, that abbreviated testing paradigms are designed for rapid SRC screening on the sidelines and are not meant to replace a comprehensive neurological evaluation; nor should they be used as a standalone tool for the ongoing management of SRC.

A key concept in sideline assessment is the rapid screening for a suspected SRC, rather than the definitive diagnosis of head injury. Players manifesting clear on-field signs of SRC (eg, loss of consciousness, tonic posturing, balance disturbance) should immediately be removed from sporting participation. Players with a suspected SRC following a significant head impact or with symptoms can proceed to sideline screening using appropriate assessment tools—for example, SCAT5. Both groups can then proceed to a more thorough diagnostic evaluation, which should be performed in a distraction-free environment (eg, locker room, medical room) rather than on the sideline.

In cases where the physician may have been concerned about a possible concussion, but after the sideline assessment (including additional information from the athlete, the assess- ment itself and/or inspection of videotape of the incident) concussion is no longer suspected, then the physician can

Table 1 Graduated return-to-sport (RTS) strategy

Stage	Aim	Activity	Goal of each step
1	Symptom-limited activity	Daily activities that do not provoke symptoms	Gradual reintroduction of work/school activities
2	Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training	Increase heart rate
3	Sport-specific exercise	Running or skating drills. No head impact activities	Add movement
4	Non-contact training drills	Harder training drills, eg, passing drills. May start progressive resistance training	Exercise, coordination and increased thinking
5	Full contact practice	Following medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play	

NOTE: An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression. There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step. Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are persistent (eg, more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is an expert in the management of concussion.

determine the disposition and timing of return to play for that athlete.

We acknowledge that many contact sports are played at a fast pace in a disorganised environment, where the view of on-field incidents is often obscured and the symptoms of SRC are diverse, all of which adds to the challenge of the medical assessment of suspected SRC. Furthermore, evolving and delayed-onset symptoms of SRC are well documented and highlight the need to consider follow-up serial evaluation after a suspected SRC regardless of a negative sideline screening test or normal early evaluation.

The recognition of suspected SRC is therefore best approached using multidimensional testing guided via expert consensus. The SCAT5 currently represents the most well-established and rigorously developed instrument available for sideline assessment. There is published support for using the SCAT and Child SCAT in the evaluation of SRC. The SCAT is useful immediately after injury in differentiating concussed from non-concussed athletes, but its utility appears to decrease significantly 3–5 days after injury. The symptom checklist, however, does demonstrate clin- ical utility in tracking recovery. Baseline testing may be useful, but is not necessary for interpreting post-injury scores. If used, clinicians must strive to replicate baseline testing conditions. Additional domains that may add to the clinical utility of the SCAT tool include clinical reaction time, gait/balance assessment, video-observable signs and oculomotor screening.

The addition of sideline video review offers a promising approach to improving identification and evaluation of significant head-impact events, and a serial SRC evaluation process appears to be important to detect delayed-onset SRC. Other tools show promise as sideline screening tests but require adequately powered diagnostic accuracy studies that enrol a representative sample of athletes with suspected SRC. Collaboration between sporting codes to rationalise multimodal diagnostic sideline protocols may help facilitate more efficient application and monitoring. Current evidence does not support the use of impact sensor systems for real-time SRC screening.

Symptoms and signs of acute SRC

Recognising and evaluating SRC in the adult athlete on the field is a challenging responsibility for the healthcare provider. Performing this task often involves a rapid assessment in the midst of competition with a time constraint and the athlete eager to play. A standardised objective assessment of injury that excludes more serious injury is critical in determining disposi- tion decisions for the athlete. The sideline evaluation is based on recognition of injury, assessment of symptoms, cognitive and cranial nerve function, and balance. Serial assessments are often necessary. Because SRC is often an evolving injury, and signs and symptoms may be delayed, erring on the side of caution (ie, keeping an athlete out of participation when there is any suspi- cion of injury) is important.

The diagnosis of acute SRC involves the assessment of a range of domains including clinical symptoms, physical signs, cognitive impairment, neurobehavioral features and sleep/wake disturbance. Furthermore, a detailed concussion history is an important part of the evaluation both in the injured athlete and when conducting a pre-participation examination.

The suspected diagnosis of SRC can include one or more of the following clinical domains:

a. Symptoms: somatic (eg, headache), cognitive (eg, feeling like in a fog) and/or emotional symptoms (eg, lability)
b. Physical signs (eg, loss of consciousness, amnesia, neurological deficit)
c. Balance impairment (eg, gait unsteadiness)
d. Behavioural changes (eg, irritability)
e. Cognitive impairment (eg, slowed reaction times)
f. Sleep/wake disturbance (eg, somnolence, drowsiness)

If symptoms or signs in any one or more of the clinical domains are present, an SRC should be suspected and the appropriate management strategy instituted. It is important to note, however, that these symptoms and signs also happen to be non-specific to concussion, so their presence simply prompts the inclusion of concussion in a differential diagnosis for further evaluation, but the symptom is not itself diagnostic of concus- sion.

Remove

When a player shows any symptoms or signs of an SRC:

a. The player should be evaluated by a physician or other licensed healthcare provider on site using standard emergency management principles, and particular attention should be given to excluding a cervical spine injury.
b. The appropriate disposition of the player must be determined by the treating healthcare provider in a timely manner. If no healthcare provider is available, the player should be safely removed from practice or play and urgent referral to a physician arranged.
c. Once the first aid issues are addressed, an assessment of the concussive injury should be made using the SCAT5 or other sideline assessment tools.
d. The player should not be left alone after the injury, and serial monitoring for deterioration is essential over the initial few hours after injury.
e. A player with diagnosed SRC should not be allowed to return to play on the day of injury.

McCrory P, *et al. Br J Sports Med* 2017;**0**:1–10. doi:10.1136/bjsports-2017-097699

Table 2 Graduated return-to-school strategy

Stage	Aim	Activity	Goal of each step
1	Daily activities at home that do not give the child symptoms	Typical activities of the child during the day as long as they do not increase symptoms (eg, reading, texting, screen time). Start with 5–15 min at a time and gradually build up	Gradual return to typical activities
2	School activities	Homework, reading or other cognitive activities outside of the classroom	Increase tolerance to cognitive work
3	Return to school part-time	Gradual introduction of schoolwork. May need to start with a partial school day or with increased breaks during the day	Increase academic activities
4	Return to school full time	Gradually progress school activities until a full day can be tolerated	Return to full academic activities and catch up on missed work

When a concussion is suspected, the athlete should be removed from the sporting environment and a multimodal assessment should be conducted in a standardised fashion (eg, the SCAT5). Sporting bodies should allow adequate time to conduct this evaluation. For example, completing the SCAT alone typically takes 10 min. Adequate facilities should be provided for the appro- priate medical assessment both on and off the field for all injured athletes. In some sports, this may require rule changes to allow an appropriate off-field medical assessment to occur without affecting the flow of the game or unduly penalising the injured player's team. The final determination regarding SRC diagnosis and/or fitness to play is a medical decision based on clinical judgement.

Re-evaluate

An athlete with SRC may be evaluated in the emergency room or doctor's office as a point of first contact after injury or may have been referred from another care provider. In addition to the points outlined above, the key features of follow-up exam- ination should encompass:

a. A medical assessment including a comprehensive history and detailed neurological examination including a thorough assessment of mental status, cognitive functioning, sleep/wake disturbance, ocular function, vestibular function, gait and balance.
b. Determination of the clinical status of the patient, including whether there has been improvement or deterioration since the time of injury. This may involve seeking additional information from parents, coaches, teammates and eyewitnesses to the injury.
c. Determination of the need for emergent neuroimaging to exclude a more severe brain injury (eg, structural abnormality).

Neuropsychological assessment

Neuropsychological assessment (NP) has been previously described by the CISG as a 'cornerstone' of SRC management. Neuropsychologists are uniquely qualified to interpret NP tests and can play an important role within the context of a multifaceted—multimodal and multidisciplinary approach to managing SRC. SRC management programmes that use NP assessment to assist in clinical decision-making have been instituted in professional sports, colleges and high schools.

The application of NP testing in SRC has clinical value and contributes significant information in SRC evaluation.[12–17] Although in most cases, cognitive recovery largely overlaps with the time course of symptom recovery, cognitive recovery may occasionally precede or lag behind clinical symptom resolution, suggesting that the assessment of cognitive function should be an important component in the overall assessment of SRC and, in particular, any return-to-play protocol.[18 19] It must be emphasised, however, that NP assessment should not be the sole basis of management decisions. Rather, it provides an aid to the clinical decision-making process in conjunction with a range of assessments of different clinical domains and investigational results.

It is recommended that all athletes should have a clinical neurological assessment (including evaluation of mental status/cognition, oculomotor function, gross sensorimotor, coordination, gait, vestibular function and balance) as part of their overall management. This will normally be performed by the treating physician, often in conjunction with computerised NP screening tools.

Brief computerised cognitive evaluation tools are a commonly utilised component of these assessments worldwide given the logistical limitation in accessing trained neuropsychologists. However, it should be noted that these are not substitutes for complete NP assessment.

Baseline or pre-season NP testing was considered by the panel and was not felt to be required as a mandatory aspect of every assessment; however, it may be helpful or add useful information to the overall interpretation of these tests. It also provides an additional educative opportunity for the healthcare provider to discuss the significance of this injury with the athlete.

Post-injury NP testing is not required for all athletes. However, when this is considered necessary, the assessment should optimally be performed by a trained and accredited neuropsychologist. Although neuropsychologists are in the best position to interpret NP tests by virtue of their background and training, the ultimate return-to-play decision should remain a medical one in which a multidisciplinary approach, when possible, has been taken. In the absence of NP and other testing, a more conservative return-to-play approach may be appropriate.

Post-injury NP testing may be used to assist return-to-play decisions and is typically performed when an athlete is clinically asymptomatic. However, NP assessment may add important information in the early stages after injury.[20 21] There may be particular situations where testing is performed early to assist in determining aspects of management—for example, return to school in a paediatric athlete. This will normally be best determined in consultation with a trained neuropsychologist.[22 23]

Concussion investigations

Over the past decade, we have observed major progress in clinical methods for evaluation of SRC and in determining the natural history of clinical recovery after injury. Critical questions remain, however, about the acute neurobiological effects of SRC on brain structure and function, and the eventual time course of physiological recovery after injury. Studies using advanced neuroimaging techniques have demonstrated that SRC is associated with changes in brain structure and function, which

correlate with post-concussive symptoms and performance in neurocognitive testing during the acute post-injury phase.

The assessment of novel and selective fluid (eg, blood, saliva and cerebrospinal fluid) biomarkers and genetic testing for TBI has rapidly expanded in parallel with imaging advances, but this currently has limited application to the clinical management of SRC. Extending from the broader TBI literature, there is also increasing interest in the role of genetics in predicting risk of (i) initial injury, (ii) prolonged recovery and long-term neurological health problems associated with SRC, and (iii) repetitive head-impact exposure in athletes.

Clinically, there is a need for diagnostic biomarkers as a more objective means to assess the presence/severity of SRC in athletes. Beyond the potential diagnostic utility, there is also keen interest in the development of prognostic biomarkers of recovery after SRC. Imaging and fluid biomarkers that reliably reflect the extent of neuronal, axonal and glial damage and/or microscopic pathology could conceivably diagnose and predict clinical recovery outcome and/or determine risk of potential cumulative impairments after SRC.

Advanced neuroimaging, fluid biomarkers and genetic testing are important research tools, but require further validation to determine their ultimate clinical utility in evaluation of SRC.

Rest

Most consensus and agreement statements for managing SRC recommend that athletes rest until they become symptom-free. Accordingly, prescribed rest is one of the most widely used interventions in this population. The basis for recommending physical and cognitive rest is that rest may ease discomfort during the acute recovery period by mitigating post-concussion symptoms and/or that rest may promote recovery by minimising brain energy demands following concussion.

There is currently insufficient evidence that prescribing complete rest achieves these objectives. After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active while staying below their cognitive and physical symptom-ex- acerbation thresholds (ie, activity level should not bring on or worsen their symptoms). It is reasonable for athletes to avoid vigorous exertion while they are recovering. The exact amount and duration of rest is not yet well defined in the literature and requires further study.

Rehabilitation

This summary statement regarding the potential for concussion rehabilitation must be read in conjunction with the systematic review paper, which details the background, search strategy, citations and reasoning for this statement. As 'Rehabilitation' did not exist as a separate section in the previous Consensus State- ments, this section is all in italics.

SRCs can result in diverse symptoms and problems, and can be associated with concurrent injury to the cervical spine and peripheral vestibular system. The literature has not evaluated early interventions, as most individuals recover in 10–14 days. A variety of treatments may be required for ongoing or persistent symptoms and impairments following injury. The data support interventions including psychological, cervical and vestibular rehabilitation.

In addition, closely monitored active rehabilitation programmes involving controlled sub-symptom-threshold, submaximal exercise have been shown to be safe and may be of benefit in facilitating recovery. A collaborative approach to treatment, including controlled cognitive stress, pharmacological treatment, and school accommodations, may be beneficial.

Further research evaluating rest and active treatments should be performed using high-quality designs that account for potential confounding factors, and have matched controls and effect modifiers to best inform clinical practice and facilitate recovery after SRC.

Refer

Persistent symptoms

A standard definition for persistent post-concussive symptoms is needed to ensure consistency in clinical management and research outcomes. The Berlin expert consensus is that use of the term 'persistent symptoms' following SRC should reflect failure of normal clinical recovery—that is, symptoms that persist beyond expected time frames (ie, >10–14 days in adults and >4 weeks in children).

'Persistent symptoms' does not reflect a single pathophysiological entity, but describes a constellation of non-specific post-traumatic symptoms that may be linked to coexisting and/ or confounding factors, which do not necessarily reflect ongoing physiological injury to the brain. A detailed multimodal clinical assessment is required to identify specific primary and secondary pathologies that may be contributing to persisting post-trau- matic symptoms. At a minimum, the assessment should include a comprehensive history, focused physical examination, and special tests where indicated (eg, graded aerobic exercise test). Currently, while there is insufficient evidence for investigations, such as EEG, advanced neuroimaging techniques, genetic testing and biomarkers, to recommend a role in the clinical setting, their use in the research setting is encouraged.

Treatment should be individualised and target-specific medical, physical and psychosocial factors identified on assessment. There is preliminary evidence supporting the use of:

a. *an individualised symptom-limited aerobic exercise programme in patients with persistent post-concussive symptoms associated with autonomic instability or physical deconditioning, and*
b. *a targeted physical therapy programme in patients with cervical spine or vestibular dysfunction, and*
c. *a collaborative approach including cognitive behavioural therapy to deal with any persistent mood or behavioural issues.*

Currently, there is limited evidence to support the use of pharmacotherapy. If pharmacotherapy is used, then an important consideration in return to sport is that concussed athletes should not only be free from concussion-related symptoms, but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of SRC. Where pharma- cological therapy may be begun during the management of an SRC, the decision to return to play while still on such medication must be considered carefully by the treating clinician.

Overall, these are difficult cases that should be managed in a multidisciplinary collaborative setting, by healthcare providers with experience in SRC.

Recovery

There is tremendous interest in identifying factors that might influence or modify outcome from SRC. Clinical recovery is defined functionally as a return to normal activities, including school, work and sport, after injury. Operationally, it encompasses

a resolution of post-concussion-related symptoms and a return to clinically normal balance and cognitive functioning.

It is well established that SRCs can have large adverse effects on cognitive functioning and balance in the first 24–72 hours after injury. Injured athletes report diverse physical, cognitive and emotional symptoms during the initial days after injury, and a greater number and severity of symptoms after an SRC predict a slower recovery in some studies.

For most injured athletes, cognitive deficits, balance and symptoms improve rapidly during the first 2 weeks after injury. Many past studies, particularly those published before 2005, concluded that most athletes recover from SRC and return to sport within 10 days. This is generally true, but that conclusion should be tempered by the fact that many studies reported group-level findings only, not clinical outcomes from individual athletes, and group statistical analyses can obscure subgroup results and individual differences. There is also historical evidence that some athletes returned to play while still symptomatic, well before they were clinically recovered. Moreover, during the past 10 years, there has been a steadily accumulating literature that a sizeable minority of youth, high-school and collegiate athletes take much longer than 10 days to clinically recover and return to sport.

Some authors have suggested that the longer recovery times reported in more recent studies partially reflects changes in the medical management of SRC, with adoption of the gradual return-to-play recommendations from the CISG statements. This seems likely because these return-to-play recommendations include no same-day return to play and a sequential progres- sion through a series of steps before medical clearance for return to sport. Longer recovery times reported by some studies are also significantly influenced by ascertainment bias—that is, studies that rely, or report data, on clinical samples have a major selection bias and will report longer recovery times than those reported from truly incident cohort studies that provide a more accurate estimate of recovery time.

At present, it is reasonable to conclude that the large majority of injured athletes recover, *from a clinical perspective*, within the first month of injury. Neurobiological recovery might extend beyond clinical recovery in some athletes. Clinicians know that some student athletes report persistent symptoms for many months after injury, that there can be multiple causes for those symptoms, and that those individuals are more likely to be included in studies conducted at specialty clinics. There is a growing body of literature indicating that psychological factors play a significant role in symptom recovery and contribute to risk of persistent symptoms in some cases.

Researchers have investigated whether pre-injury individual differences, initial injury severity indicators, acute clinical effects, or subacute clinical effects or comorbidities influence outcome after SRC. Numerous studies have examined whether genetics, sex differences, younger age, neurodevelopmental factors such as attention deficit hyperactivity disorder or learning disability, personal or family history of migraine, or a personal or family history of mental health problems are predictors or effect modifiers of clinical recovery from SRC. Having a past SRC is a risk factor for having a future SRC, and having multiple past SRCs is associated with having more physical, cognitive and emotional symptoms before participation in a sporting season. Therefore, it is not surprising that researchers have studied whether having prior SRCs is associated with slower recovery from an athlete's next SRC. There have been inconsistent findings regarding whether specific *injury severity characteristics*, such as loss of consciousness, retrograde amnesia, or post-traumatic amnesia, are associated with greater acute effects or prolonged recovery. Numerous *post-injury clinical factors*, such as the initial severity of cognitive deficits, the development of post-traumatic headaches or migraines, experiencing dizziness, difficulties with oculomotor functioning, and experiencing symptoms of depression have all been associated with worse outcomes in some studies.

The strongest and most consistent predictor of slower recovery from SRC is the severity of a person's initial symptoms in the first day, or initial few days, after injury. Conversely, and impor- tantly, having a low level of symptoms in the first day after injury is a favourable prognostic indicator. The development of subacute problems with migraine headaches or depression are likely risk factors for persistent symptoms lasting more than a month. Children, adolescents and young adults with a pre-in- jury history of mental health problems or migraine headaches appear to be at somewhat greater risk of having symptoms for more than 1 month. Those with attention deficit hyperactivity disorder or learning disabilities might require more careful plan- ning and intervention regarding returning to school, but they do not appear to be at substantially greater risk of persistent symp- toms beyond a month. Very little research to date has been carried out on children under the age of 13. There is some evidence that the teenage years, particularly the high-school years, might be the most vulnerable time period for having persistent symptoms— with greater risk for girls than boys.

Establishing time of recovery for SRC

Establishing the time of recovery after an SRC is a difficult task for healthcare providers. These determinations have been limited by lack of a gold standard as well as subjective symptom scores and imperfect clinical and NP testing. In addition, patients frequently experience more persistent symptoms, including, but not limited to, chronic migraines, anxiety, post-traumatic stress disorder (PTSD), attention problems and sleep dysfunction. Clinicians must determine whether these are premorbid mala- dies, downstream effects of SRC, or unrelated challenges while being mindful of the potential for repeat injuries when returning patients to sport too early. Providers are often left in a quandary with limited data to make decisions. Moreover, recent literature suggests that the physiological time of recovery may outlast the time for clinical recovery. The consequence of this is as yet unknown, but one possibility is that athletes may be exposed to additional risk by returning to play while there is ongoing brain dysfunction.

In a research context, modalities that measure physiological change after SRC can be categorised into the following:

- *functional MRI (fMRI)*
- *diffusion tensor imaging (DTI)*
- *magnetic resonance spectroscopy (MRS)*
- *cerebral blood flow (CBF)*
- *electrophysiology*
- *heart rate*
- *measure of exercise performance*
- *fluid biomarkers*
- *transcranial magnetic stimulation (TMS).*

Owing to differences in modalities, time course, study design and outcomes, it is not possible to define a single 'physiolog- ical time window' for SRC recovery. Multiple studies suggest that physiological dysfunction may outlast current clinical measures of recovery, supporting a 'buffer zone' of gradually increasing activity before full contact risk. Future studies need to use generalisable populations, longitudinal designs following

to physiological and clinical recovery, and careful correlation of neurobiological modalities with clinical measures. At this stage, these modalities, while useful as research tools, are not ready for clinical management.

Return to sport

Graduated return to sport

The process of recovery and then return to sport participation after an SRC follows a graduated stepwise rehabilitation strategy, an example of which is outlined in table 1. This table has been modified from previous versions to improve clarity.

After a brief period of initial rest (24–48 hours), symptom-limited activity can be begun while staying below a cognitive and physical exacerbation threshold (stage 1). Once concussion-related symptoms have resolved, the athlete should continue to proceed to the next level if he/she meets all the criteria (eg, activity, heart rate, duration of exercise, etc) without a recurrence of concussion-related symptoms. Generally, each step should take 24 hours, so that athletes would take a minimum of 1 week to proceed through the full rehabilitation protocol once they are asymptomatic at rest. However, the time frame for RTS may vary with player age, history, level of sport, etc, and management must be individualised.

In athletes who experience prolonged symptoms and resultant inactivity, each step may take longer than 24 hours simply because of limitations in physical conditioning and recovery strategies outlined above. This specific issue of the role of symptom-limited exercise prescription in the setting of prolonged recovery is discussed in an accompanying systematic review.[24] If any concussion-related symptoms occur during the stepwise approach, the athlete should drop back to the previous asymptomatic level and attempt to progress again after being free of concussion-related symptoms for a further 24 hour period at the lower level.

Reconsider

The CISG also considered whether special populations should be managed differently and made recommendations for elite and young athletes.

Elite and non-elite athletes

All athletes, regardless of level of participation, should be managed using the same management principles noted above.

The child and adolescent athlete

The management of SRC in children requires special paradigms suitable for the developing child. The paucity of studies that are specific to children, especially younger children, needs to be addressed as a priority, with the expectation that future CISG consensus meetings will have sufficient studies to review that are age-specific, of high quality, and with a low risk of bias.

We recommend that child and adolescent guidelines refer to individuals 18 years or less. Child-specific paradigms for SRC should apply to children aged 5–12 years, and adolescent-specific paradigms should apply to those aged 13–18 years. The literature does not adequately address the question of age groups in which children with SRC should be managed differently from adults. No studies have addressed whether SRC signs and symptoms differ from adults. The expected duration of symptoms in children with SRC is up to 4 weeks, and further research is required to identify predictors of prolonged recovery. It is recommended that age-specific validated symptom-rating scales be used in SRC assessment, and further research is required to establish the role and utility of computerised NP testing in this age group. Similar to adults, a brief period of physical and cognitive rest is advised after SRC followed by symptom-limited resumption of activity.

Schools are encouraged to have an SRC policy that includes education on SRC prevention and management for teachers, staff, students and parents, and should offer appropriate academic accommodation and support to students recovering from SRC. Students should have regular medical follow-up after an SRC to monitor recovery and help with return to school, and students may require temporary absence from school after injury.

Children and adolescents should not return to sport until they have successfully returned to school. However, early introduction of symptom-limited physical activity is appropriate.

An example of the return-to-school progression is in table 2.

Residual effects and sequelae

This summary statement regarding the potential for long-term sequelae following recurrent head trauma must be read in conjunction with the systematic review paper, which details the background, search strategy, citations and reasoning for this statement.[25]

The literature on neurobehavioral sequelae and long-term consequences of exposure to recurrent head trauma is inconsistent. Clinicians need to be mindful of the potential for long-term problems such as cognitive impairment, depression, etc in the management of all athletes. However, there is much more to learn about the potential cause-and-effect relationships of repetitive head-impact exposure and concussions. The potential for developing chronic traumatic encephalopathy (CTE) must be a consideration, as this condition appears to represent a distinct tauopathy with an unknown incidence in athletic populations. A cause-and-effect relationship has not yet been demonstrated between CTE and SRCs or exposure to contact sports. As such, the notion that repeated concussion or subconcussive impacts cause CTE remains unknown.

The new US National Institutes of Neurological Disease and Stroke (NINDS) and National Institute of Biomedical Imaging and Bioengineering (NIBIB) consensus criteria provide a standardised approach for describing the neuropathology of CTE. More research on CTE is needed to better understand the incidence and prevalence, the extent to which the NP findings cause specific clinical symptoms, the extent to which the neuropathology is progressive, the clinical diagnostic criteria, and other risk or protective factors. Ideally, well-designed case–control or cohort studies can begin to answer these important questions.

Risk reduction

Role of pre-participation SRC evaluation

Acknowledging the importance of an SRC history, and appreciating the fact that many athletes will not recognise all the SRCs they may have suffered in the past, a detailed SRC history is of value.[26–29] Such a history may identify athletes who fit into a high-risk category and provides an opportunity for the health-care provider to educate the athlete as to the significance of concussive injury.

A structured SRC history should include specific questions as to previous symptoms of an SRC and length of recovery, not just the perceived number of past SRCs. Note that dependence on the recall of concussive injuries by teammates or coaches is unreliable.[26] The clinical history should also include information about all previous head, face or cervical spine injuries, as these may also have clinical relevance. In the setting of maxillofacial and cervical spine injuries, coexistent concussive injuries

may be missed unless specifically assessed. Questions pertaining to disproportionate impact versus symptom-severity matching may alert the clinician to a progressively increasing vulnerability to injury. As part of the clinical history, the health practitioner should seek details regarding protective equipment used at the time of injury for both recent and remote injuries.

There is an additional and often unrecognised benefit of the pre-participation physical examination insofar as the evaluation provides an educative opportunity with the player concerned, as well as consideration of modification of playing behaviour if required.

Prevention

While it is impossible to eliminate all concussion in sport, concussion-prevention strategies can reduce the number and severity of concussions in many sports. Until the past decade, there has been a relative paucity of scientifically rigorous evaluation studies examining the effectiveness of concussion-prevention strategies in sport.

The evidence examining the protective effect of helmets in reducing the risk of SRC is limited in many sports because of the nature of mandatory helmet regulations. There is sufficient evidence in terms of reduction of overall head injury in skiing/snowboarding to support strong recommendations and policy to mandate helmet use in skiing/snowboarding. The evidence for mouthguard use in preventing SRC is mixed, but meta-analysis suggests a non-significant trend towards a protective effect in collision sports, and rigorous case–control designs are required to further evaluate this finding.

The strongest and most consistent evidence evaluating policy is related to body checking in youth ice hockey (ie, disallowing body checking under age 13), which demonstrates a consistent protective effect in reducing the risk of SRC. This evidence has informed policy change in older age groups in non-elite levels, which requires further investigation.

There is minimal evidence to support individual injury-prevention strategies addressing intrinsic risk factors for SRC in sport. However, there is some promise that vision training in collegiate American football players may reduce SRC. Limiting contact in youth football practices has demonstrated some promising results in reducing the frequency of head contact, but there is no evidence to support the translation of these findings to a reduction in SRC. Evaluation of fair play rules in youth ice hockey, tackle training without helmets and shoulder pads in youth American football, and tackle technique training in professional rugby do not lead to a reduction in SRC risk. A recommendation for stricter rule enforcement of red cards for high elbows in heading duels in professional soccer is based on evidence supporting a reduced risk of head contacts and concussion with such enforcement.

Despite a myriad of studies examining SRC-prevention interventions across several sports, some findings remain inconclusive because of conflicting evidence, lack of rigorous study design, and inherent study biases. A clear understanding of potentially modifiable risk factors is required to design, implement and evaluate appropriate prevention interventions to reduce the risk of SRC. In addition, risk factors should be considered as potential confounders or effect modifiers in any evaluation. Biomechanical research (eg, video-analysis) to better understand injury risk behaviour and mechanisms of injury associated with rules will better inform practice and policy decisions. In addition, psychological and sociocultural factors in sport play a significant role in the uptake of any injury-prevention strategy and require consideration.

Knowledge translation

The value of knowledge translation (KT) as part of SRC education is increasingly becoming recognised. Target audiences benefit from specific learning strategies. SRC tools exist, but their effectiveness and impact require further evaluation. The media is valuable in drawing attention to SRC, but efforts need to ensure that the public is aware of the right information, including uncertainties about long-term risks of adverse outcomes. Social media is becoming more prominent as an SRC education tool. Implementation of KT models is one approach organisations can use to assess knowledge gaps, identify, develop and evaluate education strategies, and use the outcomes to facilitate decision-making. Implementing KT strategies requires a defined plan. Identifying the needs, learning styles and preferred learning strategies of target audiences, coupled with evaluation, should be a piece of the overall SRC education puzzle to have an impact on enhancing knowledge and awareness.

As the ability to treat or reduce the effects of concussive injury after the event is an evolving science, education of athletes, colleagues and the general public is a mainstay of progress in this field. Athletes, referees, administrators, parents, coaches and healthcare providers must be educated regarding the detection of SRC, its clinical features, assessment techniques and principles of safe return to play. Methods to improve education, including web-based resources, educational videos and international outreach programmes, are important in delivering the message. Fair play and respect for opponents are ethical values that should be encouraged in all sports and sporting associations. Similarly, coaches, parents and managers play an important part in ensuring these values are implemented on the field of play.[30–43]

In addition, the support and endorsement of sporting bodies such as the International Ice Hockey Federation, Fédération Internationale de Football Association (FIFA) and the International Olympic Committee who initiated this endeavour, as well as organisations that have subsequently supported the CISG meetings, including World Rugby, the International Equestrian Federation and the International Paralympic Committee, should be commended.

CONCLUSION

Since the 1970s, clinicians and scientists have begun to distinguish SRC from other causes of concussion and mTBI, such as motor vehicle crashes. While this seems like an arbitrary separation from other forms of TBI, which account for 80% of such injuries,[44 45] it is largely driven by sporting bodies that see the need to have clear and practical guidelines to determine recovery and safe return to play for athletes with an SRC.

In addition, sports participation provides unique opportunities to study SRC and mTBI, given the detailed SRC phenotype data that are typically available in many sports.[46] Having said that, it is critical to understand that the lessons derived from non-sporting mTBI research informs the understanding of SRC (and vice versa), and this arbitrary separation of sporting versus non-sporting TBI should not be viewed as a dichotomous or exclusive view of TBI. One of the standout features of the Berlin CISG meeting was the engagement by experts from the TBI, dementia, imaging and biomarker world in the process and as coauthors of the systematic reviews, which are published in issue 10 of the *British Journal of Sports Medicine* (Volume 51, 2017).

This consensus document reflects the current state of knowledge and will need to be modified according to the development of new knowledge. It should be read in conjunction with the systematic reviews and methodology papers that accompany this document (*British Journal of Sports Medicine*, issues 9 and 10, 2017). This document is first and foremost intended to inform clinical practice; however, it must be remembered that, while agreement exists on the principal messages conveyed by this document, the authors acknowledge that the science of concussion is incomplete and therefore management and return-to-play decisions lie largely in the realm of clinical judgement on an individualised basis.

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Jennie Ponsford
Alain Ptito
Laura Purcell
Tad Seifert
Gary Solomon
John Sullivan
Tamara Valovich-McLeod
Keith Yates

Consensus statement on concussion in sport ––the 5th international conference on concussion in sport held in Berlin, October 2016

Paul McCrory, Willem Meeuwisse, Jirí Dvorak, Mark Aubry, Julian Bailes, Steven Broglio, Robert C Cantu, David Cassidy, Ruben J Echemendia, Rudy J Castellani, Gavin A Davis, Richard Ellenbogen, Carolyn Emery, Lars Engebretsen, Nina Feddermann-Demont, Christopher C Giza, Kevin M Guskiewicz, Stanley Herring, Grant L Iverson, Karen M Johnston, James Kissick, Jeffrey Kutcher, John J Leddy, David Maddocks, Michael Makdissi, Geoff Manley, Michael McCrea, William P Meehan, Sinji Nagahiro, Jon Patricios, Margot Putukian, Kathryn J Schneider, Allen Sills, Charles H Tator, Michael Turner and Pieter E Vos

Br J Sports Med published online April 26, 2017

APPENDIX

B

Inter-Association Consensus:
Independent Medical Care for College Student-Athletes Guidelines

Purpose:
The *Safety in College Football Summit* (see appendix) resulted in inter-association consensus guidelines for three paramount safety issues in collegiate athletics:

1. Independent medical care in the collegiate setting;
2. Concussion diagnosis and management; and
3. Football practice contact.

This document addresses independent medical care for college student-athletes in *all* sports.

Background:
Diagnosis, management, and return to play determinations for the college student-athlete are the responsibility of the institution's athletic trainer (working under the supervision of a physician) and the team physician. Even though some have cited a potential tension between health and safety in athletics,[1,2] collegiate athletics endeavor to conduct programs in a manner designed to address the physical well-being of college student-athletes (i.e., to balance health and performance).[3,4] In the interest of the health and welfare of collegiate student-athletes, a student- athlete's health care providers must have clear authority for student-athlete care. The foundational approach for independent medical care is to assume an "athlete-centered care" approach, which is similar to the more general "patient-centered care," which refers to the delivery of health care services that are focused only on the individual patient's needs and concerns.[5] The following 10 guiding principles, listed in the *Inter-Association Consensus Statement on Best Practices for Sports Medicine Management for Secondary Schools and Colleges*,[5] are paraphrased below to provide an example of policies that can be adopted that help to assure independent, objective medical care for college student-athletes:

1. The physical and psychosocial welfare of the individual student-athlete should always be the highest priority of the athletic trainer and the team physician.
2. Any program that delivers athletic training services to student-athletes should always have a designated medical director.
3. Sports medicine physicians and athletic trainers should always practice in a manner that integrates the best current research evidence within the preferences and values of each student-athlete.
4. The clinical responsibilities of an athletic trainer should always be performed in a manner that is consistent with the written or verbal instructions of a physician or standing orders and clinical management protocols that have been approved by a program's designated medical director.
5. Decisions that affect the current or future health status of a student-athlete who has an injury or illness should only be made by a properly credentialed health professional (e.g., a physician or an athletic trainer who has a physician's authorization to make the decision).

6. In every case that a physician has granted an athletic trainer the discretion to make decisions relating to an individual student-athlete's injury management or sports participation status, all aspects of the care process and changes in the student-athlete's disposition should be thoroughly documented.
7. Coaches must not be allowed to impose demands that are inconsistent with guidelines and recommendations established by sports medicine and athletic training professional organizations.
8. An athletic trainer's role delineation and employment status should be determined through a formal administrative role for a physician who provides medical direction.
9. An athletic trainer's professional qualifications and performance evaluations must not be primarily judged by administrative personnel who lack health care expertise, particularly in the context of hiring, promotion, and termination decisions.
10. Member institutions should adopt an administrative structure for delivery of integrated sports medicine and athletic training services to minimize the potential for any conflicts of interest that could adversely affect the health and well-being of student-athletes.

Team physician authority becomes the linchpin for independent medical care of student-athletes. Six preeminent sports physicians associations agree with respect to "… athletic trainers and other members of the athletic care network report to the team physician on medical issues."[6] Consensus aside, a medical-legal authority is a matter of law in 48 states that require athletic trainers to report to a physician in their medical practice. The NCAA Sports Medicine Handbook's Guideline 1B opens with a charge to athletics and institutional leadership to "create an administrative system where athletics health care professionals – team physicians and athletic trainers – are able to make medical decisions with only the best interests of student-athletes at the forefront."[7] Multiple models exist for collegiate sports medicine. Athletic health care professionals commonly work for the athletics department, student health services, private medical practice, or a combination thereof. Irrespective of model, the answer for the college student-athlete is established independence for appointed athletics health care providers.[8]

Guidelines:

Institutional medical line of authority should be established independently of a coach, and in the sole interest of student-athlete health and welfare. Medical line of authority should be transparent and evident in athletics departments, and organizational structure should establish collaborative interactions with the medical director and primary athletics health care providers (defined as all institutional team physicians and athletic trainers) so that the safety, excellence and wellness of student-athletes are evident in all aspects of athletics and are student-athlete centered.

Institutions should, at a minimum, designate a licensed physician (M.D. or D.O.) to serve as medical director, and that medical director should oversee the medical tasks of all primary athletics health care providers. Institutions should consider a board certified physician, if available. The medical director may also serve as team physician. All athletic trainers should be directed and supervised for medical tasks by a team physician and/or the medical director. The medical director and primary athletics health care providers should be empowered with

unchallengeable autonomous authority to determine medical management and return-to-play decisions of student-athletes.

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3. NCAA Bylaw 3.2.4.17 (Div. I and Div. II; 3.2.4.16 (Div. III).
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5. Courson R et al. Inter-association consensus statement on best practices for sports medicine management for secondary schools and colleges. *J Athletic Training* 2014;49:128-137.
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This Consensus Best Practice, Independent Medical Care for College Student-Athletes, has been endorsed by:

American Academy of Neurology
American College of Sports Medicine
American Association of Neurological Surgeons
American Medical Society for Sports Medicine
American Orthopaedic Society for Sports Medicine
American Osteopathic Academy for Sports Medicine
College Athletic Trainers' Society
Congress of Neurological Surgeons
National Athletic Trainers' Association
NCAA Concussion Task Force
Sports Neuropsychological Society

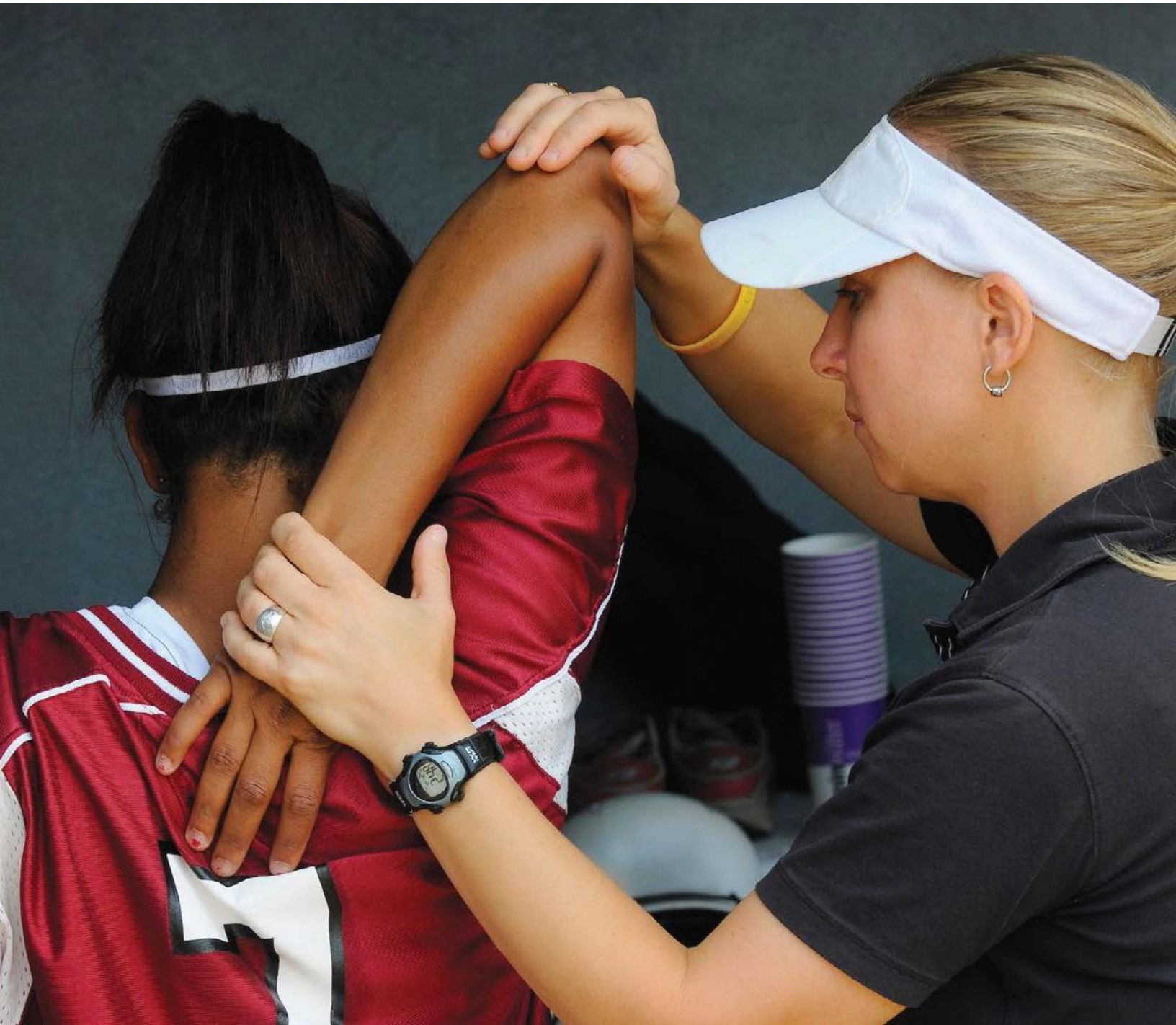
APPENDIX

C

SPORT SCIENCE INSTITUTE™

INTERASSOCIATION CONSENSUS:

INDEPENDENT MEDICAL CARE FOR COLLEGE STUDENT-ATHLETES BEST PRACTICES



PURPOSE

The Second Safety in College Football Summit resulted in interassociation consensus recommendations and best practices for four paramount safety issues in collegiate athletics:

1. Independent medical care for college student-athletes.
2. Diagnosis and management of sport-related concussion.
3. Year-round football practice contact for college student-athletes.
4. Preventing catastrophic injury in college student-athletes.

This document addresses independent medical care for college student-athletes for all sports. Following a presentation[1] that delineated how "Interassociation Consensus: Independent Medical Care for College Student-Athletes Guidelines"[2] became the foundation for NCAA Autonomy legislation on independent medical care, the endorsing organization representatives agreed that the updated consensus on Interassociation Consensus: Independent Medical Care for College Student-Athletes Best Practices should be consistent with the Autonomy legislation.

This document is divided into the following sections:

BACKGROUND

This section provides an overview of the challenges of providing independent medical care for all college student-athletes.

INDEPENDENT MEDICAL CARE FOR COLLEGE STUDENT-ATHLETES BEST PRACTICES

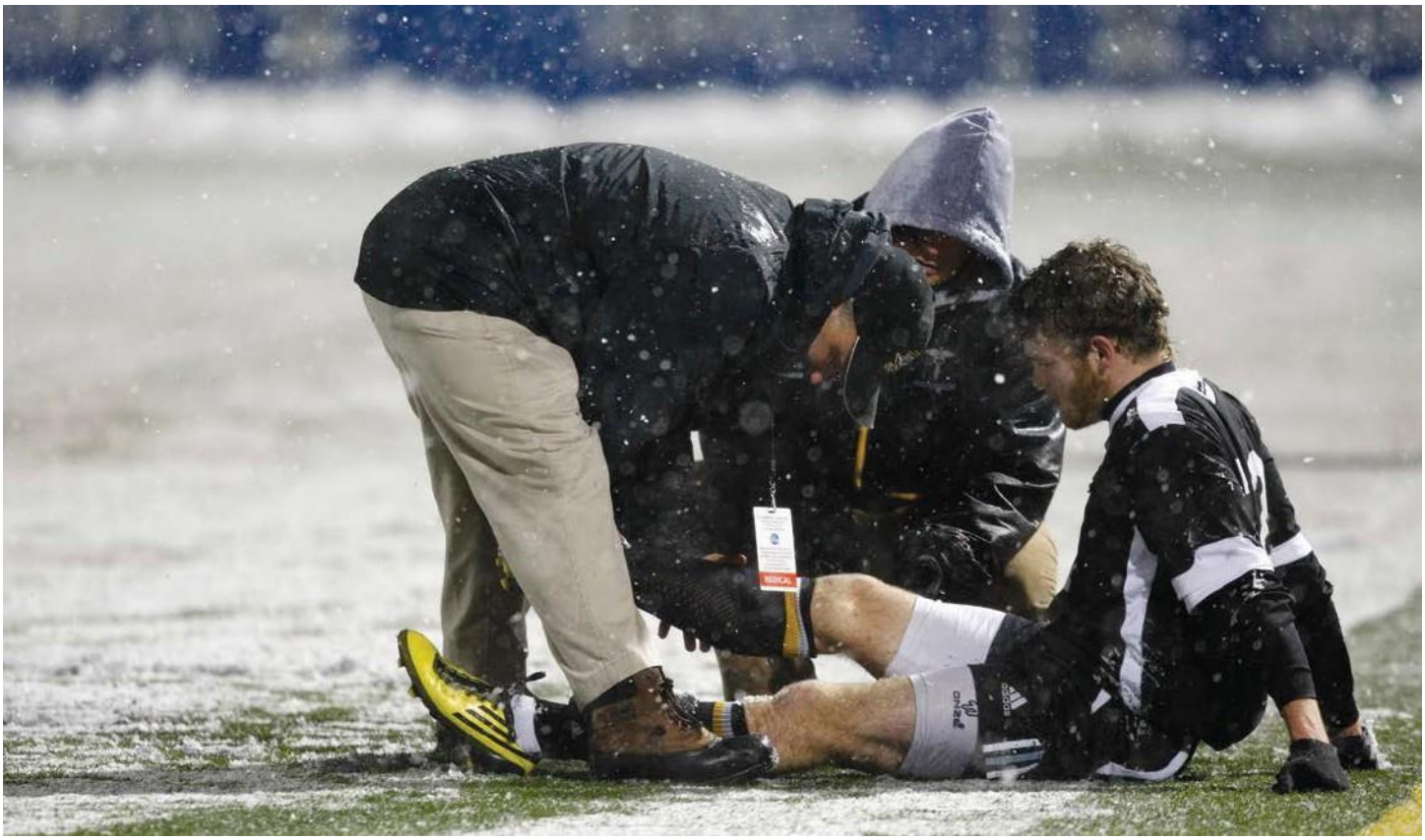
This section provides the fi endorsed recommendations of the medical organizations for revised independent medical care for college student-athlete best practices.

REFERENCES

This section provides the relevant references for this document.

APPENDICES

This section lists the agenda, summit attendees and medical organizations that endorsed this document.



BACKGROUND

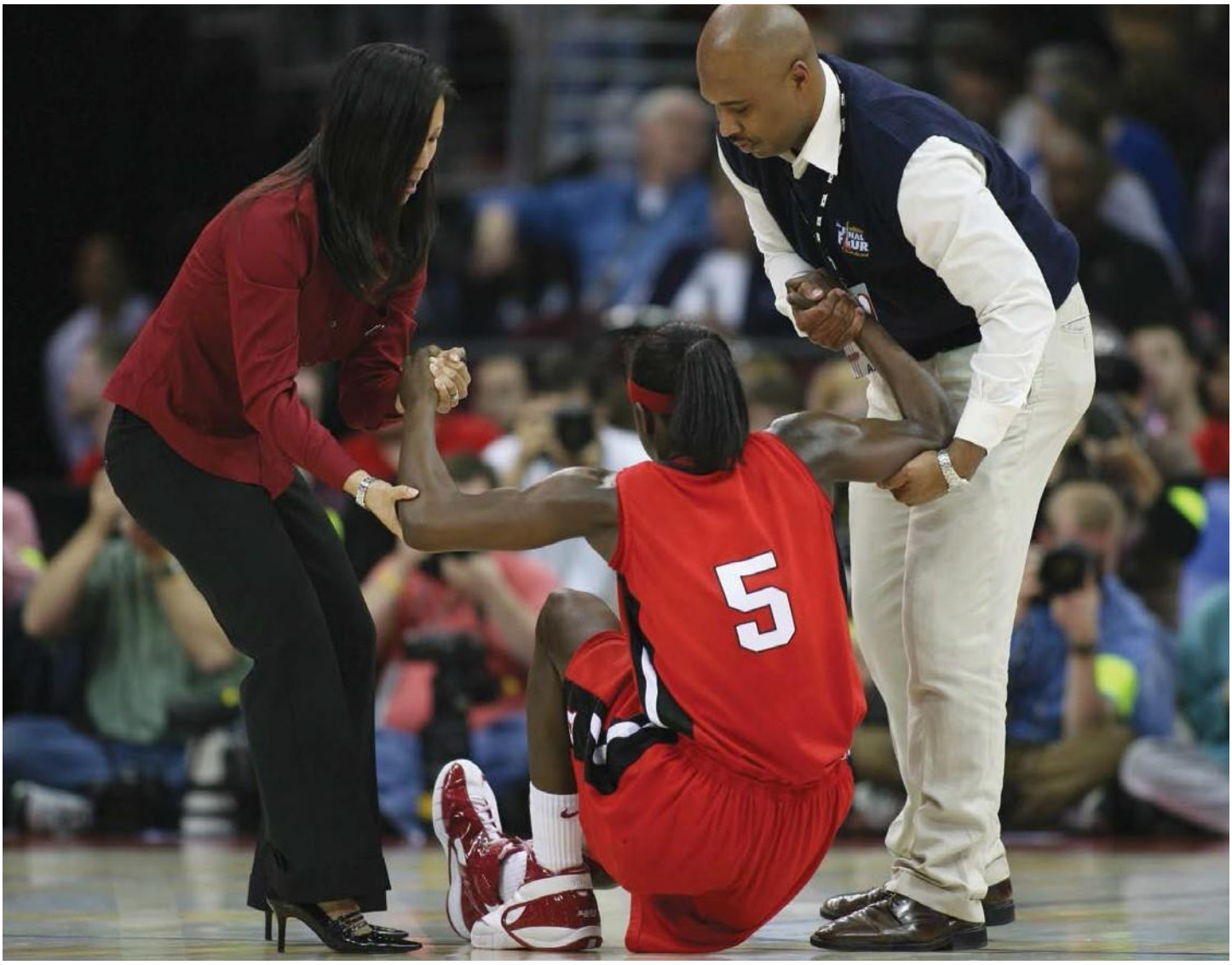
Diagnosis, management and return-to-play determinations for the college student-athlete are the responsibility of the institution's primary athletics healthcare providers (team physicians and athletic trainers).[3] Even though some have cited a potential tension between health and safety in athletics,[4-5] collegiate athletics endeavor to conduct programs in a manner designed to address the physical well-being of college student-athletes (i.e., to balance health and performance).[6-9] In the interest of the health and welfare of collegiate student-athletes, a student-athlete's healthcare providers must have clear authority for student-athlete care. The foundational approach for independent medical care is to assume an "athlete-centered care" approach, which is similar to the more general "patient-centered care," which refers to the delivery of health care services that are focused only on the individual patient's needs and concerns.[10-14] The following 10 guiding principles, listed in the "Interassociation Consensus Statement on Best Practices for Sports Medicine Management for Secondary Schools and Colleges,"[14] are paraphrased below to provide an example of policies that can be adopted that help to assure independent, objective medical care for college student-athletes:

1. The physical and psychosocial welfare of the individual student-athlete should always be the highest priority of the athletic trainer and the team physician.
2. Any program that delivers athletic training services to student-athletes should always have a designated medical director.
3. Sports medicine physicians and athletic trainers should always practice in a manner that integrates the best current research evidence within the preferences and values of each student-athlete.
4. The clinical responsibilities of an athletic trainer should always be performed in a manner that is consistent with the written or verbal instructions of a physician or standing orders and clinical management protocols that have been approved by a program's designated medical director.

5. Decisions that affect the current or future health status of a student-athlete who has an injury or illness should only be made by a properly credentialed health professional (e.g., a physician or an athletic trainer who has a physician's authorization to make the decision).
6. In every case that a physician has granted an athletic trainer the discretion to make decisions relating to an individual student-athlete's injury management or sports participation status, all aspects of the care process and changes in the student-athlete's disposition should be thoroughly documented.
7. Coaches must not be allowed to impose demands that are inconsistent with guidelines and recommendations established by sports medicine and athletic training professional organizations.
8. An athletic trainer's role delineation and employment status should be determined through a formal administrative role for a physician who provides medical direction.
9. An athletic trainer's professional qualifications and performance evaluations must not be primarily judged by administrative personnel who lack health care expertise, particularly in the context of hiring, promotion and termination decisions.
10. Member institutions should adopt an administrative structure for delivery of integrated sports medicine and athletic training services to minimize the potential for any conflicts of interest that could adversely affect the health and well-being of student-athletes.

The unchallengeable, autonomous authority of primary athletics healthcare providers to determine medical management and return-to-play decisions becomes the linchpin for independent medical care of student-athletes. Importantly, this linchpin in college sports is the team eff of both physicians and athletic trainers, with ultimate medical reporting authority being the team physician.[15] The NCAA Sports Medicine Handbook's Guideline 1B opens with a charge to athletics and institutional leadership to "create an administrative system where athletics healthcare professionals—team physicians and athletic trainers—are able to make medical decisions with only the best interests of student-athletes at the forefront."[3] Multiple models exist for collegiate sports medicine. Primary athletics healthcare providers may report to the athletics department, student health services, the institution's medical school, a private medical practice or a combination thereof. Irrespective of model, the answer for the college student-athlete is established medical decision-making independence for appointed primary athletics healthcare providers.[13]

Athletics healthcare administration is one of the strategic priorities of the NCAA Sport Science Institute.[16] Athletics healthcare administration refers to the manner in which healthcare services are delivered within the athletics department of a member institution. Even if there is an extraordinary medical team in place, medical healthcare delivery will suff if such care does not have an effi and well-rehearsed delivery system. To help provide oversight in effi and well-rehearsed delivery of medical care, member schools should designate a director of medical services. This individual will be generally responsible with administrative oversight of the delivery of student-athlete health care and will ensure an administrative structure that provides independent medical care to student-athletes. This individual should be familiar with healthcare administration but does not need to be a licensed physician. This administrative role may include assuring that schools are compliant with all pertinent NCAA health and safety legislation and with interassociation consensus statements that impact student-athlete health and safety. Because this position is administrative in nature, it does not refl the normal medical-legal hierarchy of healthcare practitioners. Healthcare practitioners can have dual roles. For example, athletic trainers deliver healthcare under the direction of a licensed physician; however, an athletic trainer could concomitantly serve as the director of medical services in a purely administrative role.



INDEPENDENT MEDICAL CARE FOR COLLEGE STUDENT-ATHLETES BEST PRACTICES

Institutional line of medical authority should be established in the sole interest of student-athlete health and safety. An active member institution should establish an administrative structure that provides independent medical care and affi the unchallengeable autonomous authority of primary athletics health care providers (team physicians and athletic trainers) to determine medical management and return-to-play decisions related to student-athletes.

In addition to an administrative structure that assures such authority of primary athletics health care providers, an active institution should designate a director of medical services to oversee the institution's athletic health care administration and delivery.

Note: *Upon the suggestion of the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports, the term "Director of Medical Services" has been changed to "Athletics Health Care Administrator" in the legislative language. This intent of this proposed terminology is to stress the administrative nature of this position, with no change otherwise in the function of this position.*

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16. NCAA Sport Science Institute: Strategic Priorities. http://www.ncaa.org/health-and-safety/sport-science-institute. Accessed January 2, 2017.

APPENDIX A

AGENDA

National Collegiate Athletic Association

Safety in College Football Summit

Orlando, Florida February 10-11, 2016

DAY 1

1. Welcome and summit overview. (Scott Anderson and Brian Hainline)

2. Topic 1: Sensor and clinical data regarding football practice and head exposure.

a. Campus research. (Stefan Duma, Thomas Druzgal, Jacob Marucci, Jason Mihalik)

b. Big 12 research. (Scott Anderson, Allen Hardin)

c. Roundtable discussion and report out.

d. Referendum: Year-round football practice contact.

3. Topic 2: Catastrophic injury in football.

a. Traumatic. (Kevin Guskiewicz)

b. Non-traumatic. (Scott Anderson, Doug Casa)

c. Roundtable discussion and report out.

d. Referendum: Action plan for mitigating catastrophic injury in football.

4. Topic 3: Diagnosis and management of sport-related concussion guidelines.

a. Guidelines overview. (Brian Hainline, Scott Anderson).

b. Concussion diagnosis and management update: New data from CARE Consortium. (Steven Broglio, Thomas McAllister, Michael McCrea)

c. Re-examining concussion treatment: Agreements from the TEAM meeting? (Anthony Kontos)

d. Roundtable discussion and report out.

e. Referendum: Diagnosis and management of sport-related concussion.

DAY 2

1. Opening remarks. (Scott Anderson and Brian Hainline)

2. Topic 4: Independent medical care. (Scott Anderson and Brian Hainline)

a. Roundtable discussion and report out.

b. Referendum: Independent medical care.

3. Topic 5: Interassociation consensus statements.

a. Year-round football practice contact.

b. Catastrophic injury in football.

c. Diagnosis and management of sport-related concussion.

d. Independent medical care.

4. Closing remarks.

APPENDIX B

SAFETY IN COLLEGE FOOTBALL SUMMIT PARTICIPANTS

Jeff Allen, Head Athletic Trainer, University of Alabama (attending on behalf of Nick Saban)

Scott Anderson, College Athletics Trainers Society, University of Oklahoma

Doug Aukerman, Pacifi 12 Conference

Julian Bailes, MD, Congress of Neurological Surgeons, American Association of Neurological Surgeons

Stevie Baker-Watson, Director of Athletics, DePauw University

Brad Bankston, Commissioner, Old Dominion Athletic Conference

Karl Benson, Commissioner, Sun Belt Conference

Bob Boerigter, Commissioner, Mid-America Intercollegiate Athletics Association

Bob Bowlsby, Commissioner, Big 12, Chair, Football Oversight Committee

Matthew Breiding, Centers for Disease Control and Prevention

Steve Broglio, MD, Principal Investigator CARE Consortium, University of Michigan

William Bynum, President, Mississippi Valley State University

Jeff Bytomski, DO, American Osteopathic Academy of Sports Medicine

Carolyn Campbell-McGovern, Ivy League

Doug Casa, Ph.D., Consortium Director, Division on Exertional Injury, National Center for Catastrophic Sport Injury; Chief Executive Offi Korey Stringer Institute; Director, Athletic Training Education, University of Connecticut

Bob Casmus, CSMAS, Catawba College

Scott Caulfi , National Strength & Conditioning Association

Randy Cohen, National Athletic Trainers' Association

Bob Colgate, National Federation of State High School Associations

Dawn Comstock, Associate Professor, University of Colorado, Denver

Julie Cromer Peoples, Senior Woman Administrator, University of Arkansas Fayetteville

Kevin Crutchfi , MD, American Academy of Neurology

Ty Dennis, Division II Student-Athlete Advisory Committee, Minnesota State University, Mankato

Jon Divine, MD, President, American Medical Society for Sports Medicine

Tom Dompier, Ph.D., President, Datalys

Jason Druzgal, MD, Neuroradiologist, University of Virginia

Stefan Duma, Ph.D., Director, School of Biomedical Engineering and Sciences, Virginia Polytechnic University

Ruben Echemendia, Ph.D., President, Sports Neuropsychology Society

Brent Feland, MD, Collegiate Strength & Conditioning Coaches' Association

Scott Gines, Director of Athletics, Texas A&M University-Kingsville

Kevin Guskiewicz, Ph.D., University of North Carolina, Chapel Hill

Allen Hardin, Senior Associate Athletics Director, University of Texas

Steven Hatchell, President, National Football Foundation

Bill Heinz, Chair, Sports Medicine Advisory Committee, NFHS

Jamie Hixson, Associate Commissioner, Mountain West Conference

Peter Indelicato, American Orthopaedic Society for Sports Medicine

Nick Inzerello, Senior Director, Football Development, USA Football

Jay Jacobs, SVPC, Auburn University

Chris Jones, Division I Football Oversight Committee (proxy), University of Richmond

Kerry Kenny, Assistant Commissioner, Public Aff Big Ten Conference

Zachary Kerr, Director, Datalys

Anthony Kontos, Ph.D., Assistant Research Director, Sports Medicine Concussion Program, University of Pittsburgh Medical Center

William Lawler, Southeastern Conference

Josephine Lee, Board Member, College Athletics Trainers Society

Donald Lowe, Board Member, College Athletics Trainers Society

Jack Marucci, Louisiana State University

Thomas McAllister, MD, Principal Investigator, CARE Consortium

Michael McCrea, Ph.D., Principal Investigator, CARE Consortium

William Meehan, MD, American Academy of Pediatrics

Jason Mihalik, Ph.D., University of North Carolina, Chapel Hill

Bob Murphy, Board Member, College Athletics Trainers Society

Bob Nielson, Chair, NCAA Rules Committee

Scott Oliaro, Board Member, College Athletics Trainers Society

Kene Orjioke, Division I Student-Athlete Advisory Committee (SAAC), University of California, Los Angeles

Steve Pachman, JD, Montgomery McCracken

Sourav Poddar, MD, American College of Sports Medicine

Kayla Porter, Division III Student-Athlete Advisory Committee, Frostburg State University

Rogers Redding, Secretary Rules Editor, NCAA Football Rules Committee

Yvette Rooks, Board Member, College Athletics Trainers Society

Eric Rozen, Board Member, College Athletics Trainers Society

Scott Sailor, President, National Athletic Trainers' Association

Jon Steinbrecher, Commissioner, Mid-American Conference

Ken Stephens, National Operating Committee on Standards for Athletic Equipment

Edward Stewart, Senior Associate Commissioner, Big 12 Conference

Michael Strickland, Senior Associate Commissioner, Atlantic Coast Conference

Grant Teaff, Executive Director, American Football Coaches Association

Buddy Teevens, Coach, Dartmouth University

James Tucker, MD, Board Member, College Athletics Trainers Society

Steve Walz, Associate Director of Athletics, University of South Florida

Alfred White, Senior Associate Commissioner, Conference USA

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Brian Hainline, Chief Medical Offi NCAA

Kathleen McNeely, Chief Financial Offi NCAA

Terrie Meyer, Executive Assistant, Sport Science Institute

John Parsons, Director, Sport Science Institute

Chris Radford, Associate Director, Public & Media Relations

Stephanie Quigg, Director, Academic & Membership Aff

APPENDIX C

ENDORSING MEDICAL ORGANIZATIONS

American Association of Neurological Surgeons
American College of Sports Medicine
American Medical Society for Sports Medicine
American Orthopaedic Society for Sports Medicine
American Osteopathic Academy of Sports Medicine
College Athletic Trainers' Society
Collegiate Strength and Conditioning Coaches Association
Competitive Safeguards and Medical Aspects of Sports
Congress of Neurological Surgeons
Korey Stringer Institute
National Athletic Trainers' Association
National Operating Committee on Standards for Athletic Equipment
National Strength and Conditioning Association
Sports Neuropsychology Society