Football is a national pastime, and for many, an obsession. It also is an entertainment industry tour de force with the National Football League (NFL) generating estimated revenues greater than $13 billion in 2016.1 The national culture of football perpetuated by the NFL trickles down to the state and local levels. Inspired by this culture, roughly 3.5 million youth in the United States play football and continue to play the game throughout high school.2 In fact, in cities and small towns across the United States, autumn ushers in the bright lights of Friday night high school football. Unfortunately, the excitement and thrill of the high school football season is not without consequence.

A growing number of studies3 have documented the adverse consequences of repeated concussions from high impact sports such as football. Whereas sports like football predominantly are played by boys, high school girls appear to be at greater risk for persistent sequelae from concussion than high school boys.4 In fact, soccer, in particular, poses a high risk for concussion among high school girls.5 Because of the inherent risks associated with contact sports, students, parents, legal guardians, coaches, and teachers must be aware of the potential risks of participation in such sports in order to provide informed assent and consent.

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Besides football and soccer, hockey, wrestling, rugby, and lacrosse pose a risk for “exposure to brain injury that ranges from asymptomatic subconcussive blows to symptomatic concussion to more moderate or severe traumatic brain injury (TBI). In addition, military service and many other activities, including, but not limited to, downhill skiing, martial arts, horse riding, parachuting, and other adventure sports have been associated with TBI.”6(pS460)

The US Centers for Disease Control and Prevention (CDC) has prioritized concussion, a medical condition that requires a medical diagnosis and management, as an important public health issue with its online training module, Heads Up.7 According to the CDC: “A concussion is a type of traumatic brain injury—or TBI—caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth. This sudden movement can cause the brain to bounce around or twist in the skull, stretching and damaging the brain cells and creating chemical changes in the brain.”8 Aside from second impact syndrome (ie, a condition whereby an athlete sustains a blow to the head after experiencing a concussion that has not fully healed; second impact syndrome can result in death or permanent disability),9 perhaps the most devastating consequence of repeated concussions is chronic traumatic encephalopathy (CTE).

CTE was discovered by Dr. Bennet Omalu whose research was the focus of the film Concussion.10 Dr. Omalu, a neuropathologist, conducted autopsies on the brain of a retired Pittsburgh Steelers player who had completed suicide and uncovered signs of a degenerative disease. CTE is marked by “memory loss, confusion, impaired judgment, impulse control problems, aggression, depression, and, eventually, progressive dementia.”11

For years, the NFL conducted its own studies regarding concussions and concluded that football players do not experience brain damage. Despite a conflict of interest, the research conducted by the NFL allowed the organization to deny that concussions were contributing factors to behavioral
and mood disorders and cognitive decline. The NFL’s approach to concussions was much like that of the tobacco industry, which bankrolled studies finding no connection between their product and cancer.12

According to Heffernan, both the NFL and the tobacco industry were guilty of willful blindness, a phenomenon whereby people could and should know about an issue, but refuse to acknowledge its existence.13 Fortunately, the connection between concussions and CTE became apparent when 5000 players filed suit against the NFL due to increased rates of dementia and other long-term neurocognitive degenerative diseases. The NFL settled the case and admitted in court that they expect one-third of players to develop behavioral and mood disorders, cognitive decline, and other brain injury related issues (eg, Alzheimer’s disease and other types of dementia, Parkinson’s disease, and Lou Gehrig’s disease—amyotrophic lateral sclerosis) at an earlier age than the rest of the non-football-playing population.14 Interestingly, researchers15 recently uncovered CTE in “110 of 111 former National Football League players (99%).”2(p360)

Despite all of the attention toward concussions in the NFL, Barra16 contends that “America’s most dangerous football is in the Pee-Wee leagues, not the NFL.” Influenced by parents and coaches, children increasingly are being exposed to contact sports like football at young ages in an effort to be competitive.17 Unfortunately, in accordance with Social Cognitive Theory,18 children tend to emulate the type of play they see in the NFL, thus increasing their risks for concussion.

The NFL recognizes that if children do not play football, the pipeline for future NFL players seriously will be compromised. It should be noted that the NFL is not alone in its quest for future players. In fact, some parents perceive scholarships for football and other high impact sports as the key to paying for college.19 Alternatively, some parents place greater emphasis on sports participation than academics as a means of attaining upward mobility.20

In addition to opportunities for financing higher education, football offers many youth a sense of camaraderie, an opportunity to engage in physical activity, and a means for building teamwork and leadership skills.21 Despite these benefits, the question remains—How well-informed are children, youth, parents, and legal guardians about the inherent risks of football? Moreover, can youth provide informed assent, and their parents and legal guardians informed consent, without being made fully aware of the potentially devastating sequelae associated with the sport?

As Bob Costas pointed out in the documentary, Head Games,22 it is incumbent upon coaches, parents, legal guardians, and others to consider the question—“What is the level of acceptable risk and the level of reasonable reform?” Pro football players have come to recognize that whereas the financial rewards are great, the costs in terms of CTE and dementia are not worth the risks. Although not every concussion results in CTE and a causal link has not yet been established,4 an awareness of risks posed by high impact sports is imperative. The international consensus statement on concussion in sports held in Berlin in 2016 notes: “…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.”4(p844)

Increased recognition of CTE has sparked a national interest in protecting youth from football-related concussions. To that end, many improvements have been made in rules of play, equipment, and recognition of concussions and subsequent care.23 For example, the National Federation of State High School Associations has issued rules against illegal helmet contact (eg, spearing)24 and all 50 states have instituted concussion laws, some of which require baseline cognitive testing.25

In addition to the aforementioned efforts, the 2017 Concussion in Sport Group Consensus Statement provides a number of tools (eg, the Concussion Recognition Tool version 5, the Sports Concussion Assessment Tool version 5 [SCATS], and the Child SCATS) and guidelines (eg, 6-step graduated return-to-sports strategy as well as a 4-step graduated return-to-school strategy) for dealing with sports-related concussions.4

**IMPLICATIONS FOR SCHOOL HEALTH**

With the growing body of evidence linking repeated concussions to CTE, health educators have an ethical responsibility to assist parents, legal guardians, and students with making informed decisions about participating in high impact sports such as football. Specifically, a call to action is needed for health educators within the realms of education, research, and advocacy. To that end, we offer the following recommendations for health educators.

**Education**

- Develop programs to assure that students, parents, legal guardians, teachers, and coaches recognize that: (1) concussion is a medical condition and requires a medical diagnosis and management;4 (2) concussions may occur without loss of consciousness;26 (3) repeated head injuries, even those that are
Conduct more rigorous studies and evaluations such as impaired long-term memory and learning, impaired concentration, second impact syndrome, and increased risks for depression, dementia, CTE, as well as suicide.\textsuperscript{11,27,28}

- Create a social marketing plan for parents, legal guardians, and athletes to recognize sports that pose the greatest risks for concussion. It should be noted that girls and young women are not immune to concussions. In fact, girls’ soccer is notorious for posing increased risks for concussion.\textsuperscript{26}

As such, health educators should advocate for increased attention toward concussions among male and female athletes alike.

- Assist parents, legal guardians, and athletes with identifying the challenges posed by concussion. For example, according to Scorza, Raleigh, and O’Connor,\textsuperscript{28} there are no objective diagnostic measures for concussion and no “well-documented,” effective treatments for concussion; there also is no universal definition for concussion. Moreover, there are “limited empiric prospective data to guide return-to-play decisions.”\textsuperscript{[p123]}

- Develop strategies within the school district (eg, discussion forums) for parents, legal guardians, and athletes to weigh the pros and cons of participation in high impact sports such as football and to make informed decisions.

- Serve as a resource person for parents, legal guardians, and athletes by helping them to locate information, both pro and con, to support their decision to engage in sports with the potential for concussion.

- Incorporate concussion education into school health curricula as part of injury prevention units. Such education especially is needed in urban schools where knowledge of concussion is lacking.\textsuperscript{29}

- Work with school boards and administrators to make concussion training required for all entities involved in sports including, but not limited to, players, parents, legal guardians, coaches, teachers, and team medical providers.\textsuperscript{30}

Research

- Partner with health care practitioners to: (1) work toward establishing a universal definition of concussion; (2) gather data to better inform return-to-play guidelines; and (3) investigate the burden of concussion and CTE on the public’s health.

- Conduct more rigorous studies and evaluations to establish effectiveness of large-scale educational interventions in support of developing best practices. These interventions and research studies should be inclusive of a diverse spectrum of participants.\textsuperscript{31}

Advocacy

- Collaborate with schools to create and enforce concussion protocols where they are lacking. For example, health educators need to assist schools with developing return-to-learn policies to support student-athletes with their post-concussion learning needs. Health educators also need to facilitate training opportunities for parents, faculty, staff, and administrators to better support student-athletes as they transition back to school after sustaining a concussion.\textsuperscript{28,32}

- Advocate for evidence-based diagnosis and treatment methods for concussion.

- Advocate for the presence of athletic trainers, especially in urban schools where a disparity exists.\textsuperscript{29}

- Apprise lawmakers of ongoing needs for regulatory intervention.\textsuperscript{30}

- Work with parents, legal guardians, athletes, and coaches to create a culture of safety surrounding sports participation.\textsuperscript{33}

- Advocate to change the manner in which games like football are played. For example, eliminating tackle football among those younger than 16 and advocating for continued modifications to the game and equipment would be helpful in reducing the incidence of concussion.\textsuperscript{34}

In conclusion, concussions occur in all contact sports. The decision to engage in high impact sports should be an informed one for children, youth, high school students, parents, and college students alike. That said, health educators have an ethical responsibility to create concussion awareness among student athletes and their parents necessary for informed assent and consent regarding sports participation.

REFERENCES


