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Developing an Interdisciplinary Community-Based Sports Concussion Management Program

Anthony LoGalbo[a, b] · Christine M. Salinas[b, c] · Michael Dougherty[b] · Mel Field[b, d]

[a]Medical Psychology Associates, Winter Park, Fla., and [b]Florida Hospital Sports Concussion Program, [c]Comprehensive Epilepsy Center, Florida Hospital for Children, and [d]Orlando Neurosurgery, Orlando, Fla., USA

Abstract

The increasing incidence and associated consequences of sport-related concussion have been at the forefront of public health concerns in recent years, prompting the need for safe and effective management guidelines and availability of appropriately trained healthcare providers. In this report we provide practical and user-friendly information regarding several important factors to consider when developing a sports concussion program, including how to select relevant team members, assess community needs and available resources, provide concussion education, secure and nurture partnerships with athletic programs, implement management strategies that align with current practice standards, and cater to athletes' unique needs in terms of program accessibility. It is hoped that the knowledge shared and proposed recommendations will be beneficial for guiding both newly developing and established concussion programs alike.

Over the past decade, there has been mounting evidence regarding the epidemiology and consequences of concussion to support that athletes of any age, gender, or sport may have equivalent or greater risk than the traditionally studied male football players [1–5]. Improved knowledge and awareness regarding the neurometabolic changes associated with concussion [6], and the effects of multiple injuries [7], along with highly publicized athlete retirements and cases that instill fear about potentially dangerous outcomes (including the controversial second impact syndrome and chronic traumatic encephalopathy) have placed concussion in the limelight as a public health issue. This has led to a series of international sports concussion consensus meetings [8, 9] and improved safety for the majority of athletes.

Prior to the mid-1990s, the cornerstone of concussion management included concussion grading scales. Although simple to use, they were not empirically validated

and have subsequently been found to have many flaws, placing some athletes at risk for further injury while others are withheld from play in spite of full recovery. It is well known that athletes frequently underreport symptoms in order to avoid removal from athletic competition; therefore, the mantra 'when in doubt, sit them out' reflects the recent shift toward a more conservative management approach [10]. The recognized need for an individualized approach with an emphasis on demographic variables, neuropsychological status, balance, extended rest, and graded exertional protocols [8, 9] has resulted in an increasing demand for the establishment of concussion management programs at all levels of sports around the country.

Increased vigilance has also led to improved protective sport equipment, state regulation regarding helmet use, and concussion legislation in all states except for Mississippi (incited by the Zackery Lystedt Law of 2009) in hopes of protecting student-athletes from returning to play too soon and requiring athletes to seek medical attention by healthcare personnel. Unfortunately, despite this positive momentum, few states have infrastructure for access, provide aide for development, or mandate that insurance plans (including those that are state-run) cover services required for comprehensive concussion care. As healthcare providers, the onus of responsibility has fallen on us to ensure the proper care of this population. Few resources detail how to implement a successful community-based concussion program that satisfies individual state mandates and ensures buy-in by local and regional schools, parents, coaches, and athletes. In this report we will review multiple factors that need to be considered when creating a sports-concussion program, and provide management strategies that align with current practice standards.

Key Components to Program Establishment

Select an 'A' Team

Starting a concussion program requires much time and effort, often beyond the realm of an individual's capacity. Therefore, establishing a team of individuals from multiple disciplines with a strong passion and competence in this area is paramount. Each contributes an important role in the process of diagnosis and management of concussion, and ultimately return-to-play decisions. Team members typically include neuropsychologists, neurologists, neurosurgeons, sports medicine specialists, athletic trainers, and physical therapists. At a minimum, a core triad of a physician, neuropsychologist, and athletic trainer is highly recommended. The program's setting (e.g. university-based, private hospital, or independent organization) will have an enormous influence on the roles each of these team members will play in developing and implementing the program, and available resources for the program in terms of financial and administrative support. In university- and hospital-based programs, strong physician and organizational leadership support can be influential in getting the program up and running: from providing financial support and a physical location to house the

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program, to allocating resources for marketing and community outreach efforts. Independent organizations, on the other hand, may depend on philanthropic support from local foundations, charities, or athletic associations.

Identify and Address Community Needs

Developing a vision, including the main purpose and goals, is vital during the initial stages of program development. Part of this process includes assessing community needs to establish your target athlete populations. For example, will the program focus on middle or high school athletes? Are there enough professional and/or collegiate athletic organizations in the community that have a need for such a program? Are youth recreational and club leagues accessible and interested in participating? Are there other sports or entertainment performers in the area which may be vulnerable to concussions (e.g. skiing/snowboarding and stunting/acrobatics)? Will the focus be on securing physician or professional referrals, such as from pediatricians or emergency room and urgent care visits? Do other concussion management programs already exist in the community? If so, how can the program be unique? Communities will have different needs, depending on various factors, such as whether the area is urban or rural, what the popular sports are in the area, and importantly, how invested athletic programs are in incorporating concussion management into their system. We recommend exploring the number of high schools with athletic programs and club and recreational leagues in the area. Developing relationships with local hospitals, universities, and sports medicine organizations (often orthopedic in nature) can be helpful to pool resources and facilitate referral sources. Newly developed concussion programs might initially consider selecting just a few schools or athletic organizations to ensure quality management practices.

Build a Local Network

To get athletic programs 'on board', it is vital to establish and maintain ongoing communication with school districts, school administrators, athletic directors, club organization officials, team physicians, athletic trainers, coaches, and even athletes and their families, especially when dealing with youth. Obtaining support from organizational leadership typically helps with program implementation and expansion. For example, making an arrangement to conduct baseline and postconcussive testing with an athletic trainer for specific team sports is a good step forward; however, having an athletic department mandate evaluation of all athletes is a huge leap. We encourage newly developed programs to create a template to guide schools in their institutional policies regarding concussion management. The most powerful method is to gain support from a local school district through development of concussion management policies. Notably, parents of established athletes are often the biggest advocates for the program and represent an important voice in the community. Parents frequently spread the message to other families or may be linked with a school's booster club, which can create positive momentum toward changing a concussion management policy. Their experience and passion may expand your local audience, help provide more resources, and ensure a school's policy is implemented.

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Raise Awareness in the Athletic Community

Concussion education that emphasizes signs and symptoms, common injury mechanisms, evaluation procedures, recovery expectations, and management protocols should be developed for coaches, parents, athletes, officials, and healthcare providers. Within the context of youth, the likelihood that a healthcare professional will be accessible and/or familiar with guidelines for identification, treatment, and management of concussions is low. Therefore, education should ideally begin with individuals that are on the first line of preventing or detecting a concussion (e.g. parents, coaches, athletic trainers, and athletes themselves). Providing knowledge of subtle signs dispels misconceptions, leading to accurate injury identification. Education regarding concussion prevalence and risk in various sports, including those less commonly recognized (such as girls' soccer, lacrosse, or cheerleading) is vital to ensuring all athletes' safety. Ask athletic programs to identify their approach to managing concussions and areas that could be improved upon in the future. Educate them about how your concussion program may help relieve excess burden, facilitate athletes' recovery, and ensure safe return to athletic play. Provide training to athletic trainers and coaches so that they can perform accurate sideline evaluations to assist with early injury detection and emphasize athlete removal from play when there is a doubt of injury and until the athlete can be evaluated by a healthcare professional competent in concussion management. Implementation of management guidelines is a high priority, both initially and throughout each sport season. Organizational leadership benefits from education about concussion so that they understand the risks and allocate funding toward acquiring qualified personnel to monitor athletic activities and implement management protocols. The 'Heads Up: Concussion' toolkits are free resources provided by the Centers for Disease Control and Prevention (CDC; http://www.cdc.gov/concussion/headsup/) that are useful in disseminating concussion-related information to parents, players, coaches, physicians, and schools.

Educate Healthcare Professionals

Create opportunities to meet with local physicians, nurses, urgent care facilities, and emergency departments to inform them of the current standards of care for diagnosis and management of concussion, and tell them about the comprehensive services your program can provide for athletes. Create a "lunch-n'-learn", set up a physician dinner with lectures, participate in medical department meetings, be visible at athletic games, and initiate conversation with team physicians on the sideline. Provide continuing education unit lectures and figure this into the program's budget. Costs may include money to become a continuing education unit provider for certified athletic trainers (ATCs) or other disciplines, postage, and media (or you can opt for electronic distribution and 'go green'). Choosing a targeted audience such as your local ATC partners, athletic directors, coaches, and team physicians can reduce costs and ensure optimal participation. With more resources, a program may be able to establish a statewide or national miniconference.

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Support School Partners

An athletic trainer and athletic program solidify schools as referral sources when concussions occur; therefore, a close working relationship with both is key to a program's success. Provide support in many ways from increasing manpower to proctoring baseline testing and assisting with sideline evaluations. This approach ensures that testing is done properly with adequate oversight, minimizing the frequency of invalid testing. Your staff will often serve as a liaison between the athletic trainer, coach, and/or parent. It is helpful to check daily if testing has been performed at a school as routine practice. Tracking concussed athletes relieves excessive burden on school personnel since they may support 10 or more contact sports annually. Educate staff regarding the necessary course of action when a concussion occurs. Advise school athletic staff if an appointment is necessary, whom would be best to schedule, and make sure information pertaining to injury characteristics, symptomatology, associated consequences (including cognitive changes that may impact academic functions), risk factors for prolonged recovery, and compliance with recommendations is gathered. Inform ATCs if a concussed athlete has not followed up to avoid premature return to athletic play.

Market Your Program

Develop a program logo, professional brochure, field cards (fig. 1), a banner, and a program website. Free promotion can be conducted through social media and blogs, patient testimonials, and word of mouth. Investing in the educational aspects of the program, partnering with local schools and teams, and providing excellent patient experience can be more influential to the program's success than paying for expensive radio spots, television ads, or a billboard. Conducting internal research regarding concussion incidence and recovery can be powerful data to share with your local community and helps raise awareness about particularly vulnerable groups. Tracking trends can help anticipate patient volume for planning costs and expenditures, time and resource allocation, and potential growth.

Developing and Implementing Management Practices for Concussed Athletes

A successful program should be equipped to support athletic programs as well as evaluate and manage sport-related concussion in accordance with the consensus of the scientific community [8, 9]. The typical protocol includes preseason baseline computerized neurocognitive assessments for all athletes, sideline assessment when a suspected concussion has occurred and determination of appropriateness for immediate urgent care, postinjury neurocognitive assessment, reassessment of symptoms and cognitive functions as necessary throughout the recovery process, and facilitation of a safe return to play. Supplemental balance, vestibular, ocular-motor, and visual assessments may be included. The general consensus regarding determination of an athlete's recovery is based on at least three factors: resolution of postconcussive symptoms while at

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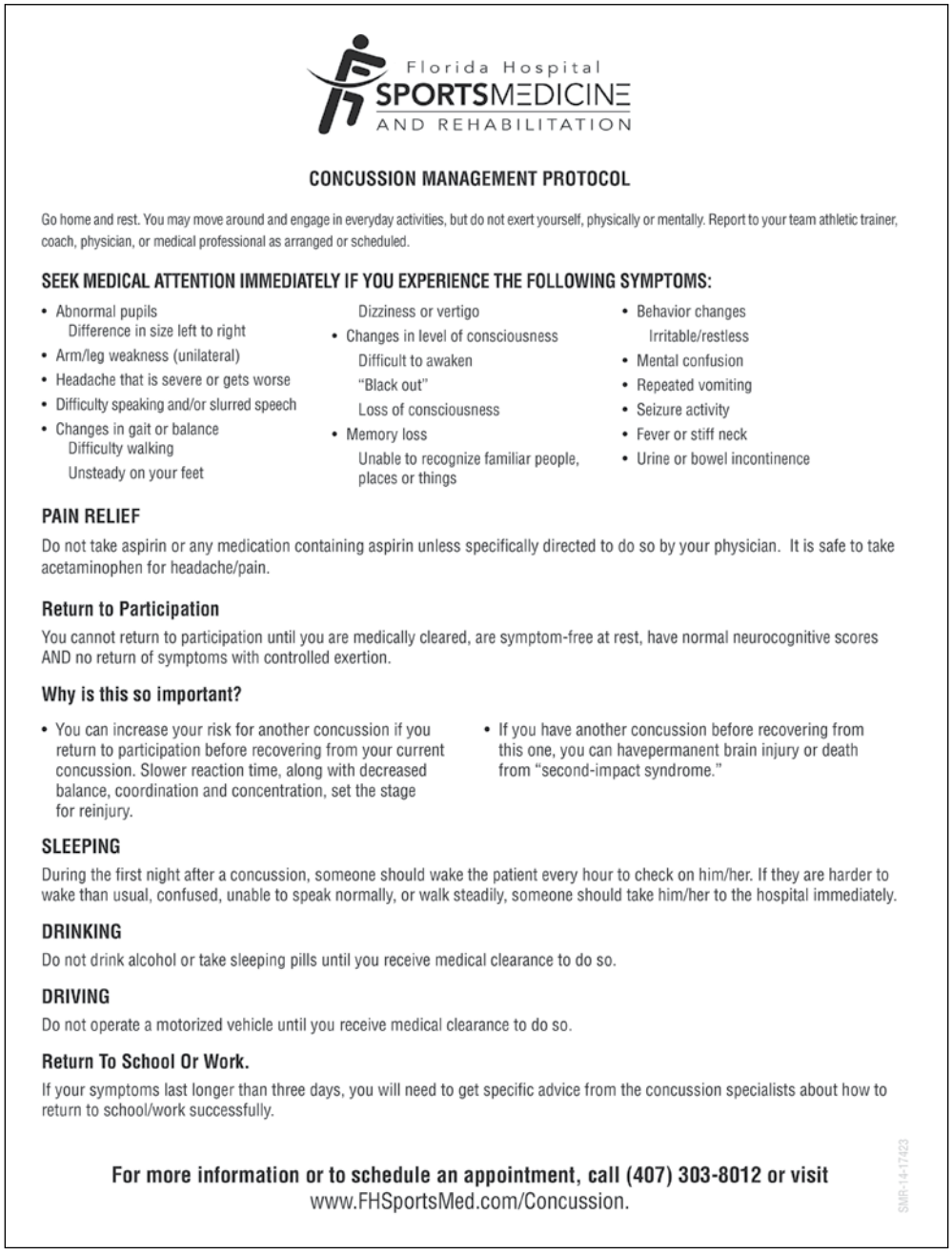

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CONCUSSION MANAGEMENT PROTOCOL

Go home and rest. You may move around and engage in everyday activities, but do not exert yourself, physically or mentally. Report to your team athletic trainer, coach, physician, or medical professional as arranged or scheduled.

SEEK MEDICAL ATTENTION IMMEDIATELY IF YOU EXPERIENCE THE FOLLOWING SYMPTOMS:

- Abnormal pupils
  Difference in size left to right
- Arm/leg weakness (unilateral)
- Headache that is severe or gets worse
- Difficulty speaking and/or slurred speech
- Changes in gait or balance
  Difficulty walking
  Unsteady on your feet
  Dizziness or vertigo
- Changes in level of consciousness
  Difficult to awaken
  "Black out"
  Loss of consciousness
- Memory loss
  Unable to recognize familiar people, places or things
- Behavior changes
  Irritable/restless
- Mental confusion
- Repeated vomiting
- Seizure activity
- Fever or stiff neck
- Urine or bowel incontinence

PAIN RELIEF

Do not take aspirin or any medication containing aspirin unless specifically directed to do so by your physician. It is safe to take acetaminophen for headache/pain.

Return to Participation

You cannot return to participation until you are medically cleared, are symptom-free at rest, have normal neurocognitive scores AND no return of symptoms with controlled exertion.

Why is this so important?

- You can increase your risk for another concussion if you return to participation before recovering from your current concussion. Slower reaction time, along with decreased balance, coordination and concentration, set the stage for reinjury.
- If you have another concussion before recovering from this one, you can havepermanent brain injury or death from "second-impact syndrome."

SLEEPING

During the first night after a concussion, someone should wake the patient every hour to check on him/her. If they are harder to wake than usual, confused, unable to speak normally, or walk steadily, someone should take him/her to the hospital immediately.

DRINKING

Do not drink alcohol or take sleeping pills until you receive medical clearance to do so.

DRIVING

Do not operate a motorized vehicle until you receive medical clearance to do so.

Return To School Or Work.

If your symptoms last longer than three days, you will need to get specific advice from the concussion specialists about how to return to school/work successfully.

For more information or to schedule an appointment, call (407) 303-8012 or visit
www.FHSportsMed.com/Concussion.

SMR-14-17423

Fig. 1. An example of a Concussion Guide Field Card given to all athletic trainers and team physicians.

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rest, neurocognitive testing performance returning to an established baseline or otherwise within expectation, and completion of a stepwise physical exertional testing protocol while remaining asymptomatic. Legislative and organizational policies may specify whether additional steps are required and who is capable of providing medical clearance (e.g. any 'healthcare provider with experience and training in concussion management', or a physician MD/DO only); therefore, it is imperative to be knowledgeable about policies in your state to ensure your program satisfies these criteria and implements strategies that support a successful reentry to sports, school, or work.

Baseline Testing

A program member (frequently an ATC) should go to the school or athletic organization to assist with baseline testing, and this should be done before a sport season begins. Parental consent may be needed for performing such testing with youth, and this can be incorporated into documentation parents complete to allow their child's athletic participation. Selecting 1–2 days per sport during preseason workouts and conditioning often works best for administration of baseline assessments. School computer labs can be used to streamline the process and test multiple athletes simultaneously, although caution needs to be exercised to ensure an optimal test-taking environment and valid test results. Computerized neurocognitive measures have embedded validity indicators; however, we recommend that a neuropsychologist review tests that have been flagged as 'invalid' to deem whether repeat testing is appropriate.

Sideline Evaluation

When a concussion is suspected, it is important to perform a brief yet multifaceted sideline assessment as soon as possible (e.g. SCAT3). This will typically be performed by an ATC, if available; however, other athletic staff could also be trained to perform this assessment. A predetermined set of critical signs and symptoms (e.g. decreased consciousness or arousal, emesis, increasing symptom severity, focal neurological deficits, behavioral changes), if observed, should trigger an immediate referral to the emergency department. Otherwise, the athlete should be closely monitored for acute symptom onset and a parent should be informed of the injury if the athlete is a minor. Detailed information regarding concussive injuries should be provided to caregivers including warning signs that may indicate a worsening condition, along with recommendations for an acute follow-up plan, including removal from play until being evaluated by an appropriate healthcare professional (fig. 2).

Postconcussive Neuropsychological Evaluation

Athletes typically undergo an initial postinjury neurocognitive assessment that may include both computerized and traditional paper and pencil measures within 24–72 h. Face-to-face neuropsychological consultation to review test results in the context of the athlete's medical and psychosocial history and to generate treatment recommendations (e.g. including extended cognitive and physical rest) for symptom manage-

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Fig. 2. An example of a fold-up pocket-sized Concussion Care Card given to concussed athletes and their caregivers at the time a concussion occurs.

ment is helpful during the acute phase of recovery. Providing detailed recommendations regarding classroom or work accommodations can inform others about the injury and specific guidelines to facilitate recovery, which may help minimize an adverse impact on the athlete's academic or work performance. Implementation of a 504 or Individualized Education Plan may be needed for youth. The Acute Concussion Evaluation (ACE) care plan is a freely accessible resource on the CDC website: www.cdc.gov/concussion/HeadsUp/physicians_tool_kit.html [11].

Monitoring and Managing the Injured Athlete

Frequent communication between the concussion program and athletic staff (as well as parents) regarding an athlete's status is imperative during the recovery process, as

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symptoms may fluctuate and may be highly dependent on compliance with activity restrictions (i.e. he/she may have a hard time resisting social media, computers, videogames, and physical exercise). Adjustments to recovery guidelines and accommodations are needed as the athlete gradually recovers or in the event of a prolonged course. Repeat computerized neurocognitive assessment is performed once the athlete is asymptomatic at rest, commonly at least 2 consecutive days. Caution is advised in administering serial assessments within a short time span, especially while the athlete remains symptomatic as this may exacerbate symptoms and lead to practice effects, skewing conclusions which may be drawn from the data. Reassessments may be performed at various locations with neuropsychologists solely providing test interpretation. Notably, many factors need to be considered when comparing baseline and postinjury data, including but not limited to an athlete's prior history of concussion or other neurological conditions (e.g. seizures, migraine syndromes), learning disability, and attention-deficit/hyperactivity disorder. Because of neuropsychologists' expertise in understanding brain-behavior relationships and competence with standardized neuropsychological assessment, they are in the 'best position' to analyze baseline and postinjury testing data [9], especially in the context of these comorbid conditions. Some athletes also experience a protracted recovery that lasts beyond several weeks. In these cases, comprehensive neuropsychological evaluations are warranted to better understand the athlete's cognitive and psychological status, along with other demographic, situational, and familial factors that may be contributory. Referrals to neurologists, physiatrists, physical therapists, psychiatrists, and psychologists may be necessary.

Exertional Testing

After an athlete's postinjury test results are considered to be within expectation, the athlete then undergoes physical exertional testing, which is usually performed under the supervision of an athletic trainer or coach. While initial steps can be employed through the concussion program (e.g. engaging the athlete in gradually more intense aerobic activities), subsequent steps may be effectively completed with the athletic program (e.g. participating first in noncontact drills and then participating in contact practices before competing in a game).

Concussion Program Accessibility: Catering to Athletes' Unique Needs

The concussion management practice model is unique in that athletic events occur daily and present a risk for injury, requiring acute evaluation and education regarding symptom management. To make matters more complex, there can be high stakes involved; therefore, athletes themselves, coaches, and even parents may want him/her to return to play as soon as possible. Hence, prompt availability of clinicians to perform assessments and make recommendations is vital to a concussion management

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program's effectiveness. The following are some suggestions to improve flexibility and efficiency in this setting.

We recommend blocking specific time in clinicians' schedules for concussion patients, perhaps on a weekly or biweekly basis depending on the anticipated need. Patient volume can be difficult to predict across the school year and from one sport season to the next, even in already established concussion programs. While making appointments in advance is preferred in most clinical settings, with respect to concussions, there is often a need to adopt an urgent care-like model allowing for 'walk-ins'. The majority of concussed athletes will seek an evaluation as soon as possible. They are often directed to the program by an athletic trainer for an initial assessment after sustaining an injury the night before, or upon presenting to school, urgent care, or their primary care provider with postconcussive symptoms the morning after an injury occurred. Clinician availability within a day or two following an injury or initial point of contact with the athlete is crucial for all the aforementioned reasons in this report. It is ideal to allocate specific time earlier in the week for injuries that occurred over the weekend and later in the week for events that occurred midweek (i.e. our program has successfully implemented a Tuesday and Thursday walk-in morning clinic with additional flexibility set aside during the week).

Another unique aspect to a concussion clinic model, especially for neuropsychologists, is the need to see multiple patients in a relatively shorter period of time. For example, the initial sports concussion consultation may last 30 min. Having a multidisciplinary team in place is beneficial to facilitating clinic flow. An athletic trainer or other team member can check in newly arriving athletes and set them up with computerized testing, while the neuropsychologist and physician meet with athletes who have completed testing. A neuropsychology trainee may also assist with traditional neuropsychological testing. A mechanism needs to be in place for communicating results back to referral sources. The program's athletic trainers can communicate with the athletic program directly by phone or email, and progress notes along with recommendations can be sent to referring physicians. It is important for the concussion program to delegate responsibilities among team members to ensure follow-through and efficiency.

There are many additional key concepts regarding program accessibility to consider. The physical and geographic location of the concussion clinic should ideally be easily accessible and within reasonable proximity to the athletic organizations which it is supporting. The space should be large enough to accommodate all program team members and also allow for anticipated patient volume during clinic hours. Financial considerations regarding how to manage athletes who are underinsured or who have insurance that is not typically accepted by the providers is critical. Providing occasional pro bono services can accommodate an individual athlete's needs and often facilitates establishing and maintaining consistent participation with specific schools, school districts, and nonacademic athletic organizations. However, informing athletic staff that the program only serves athletes with certain insurance requirements

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may lead to a drop off in commitment to the program and referrals. Grant funding, philanthropic support, and/or sliding fee scales are helpful to ensure sustainability.

In summary, the large accumulation of evidence pertaining to sport-related concussion and its associated consequences has led to the establishment of legislative, athletic organization, and international guidelines to appropriately diagnose and manage injured athletes. Athletic participation has reached an all-time high in younger ages, often resulting in concussions sustained during play and, with increased vigilance and monitoring, better injury detection. All of these factors in combination have created an unprecedented demand for healthcare professionals that are qualified to provide competent services to concussed athletes. The development of interdisciplinary and multimodal concussion management programs, particularly at the high school level, may help address this public health concern. Interdisciplinary management programs also lend themselves well to research, which can lead to improvements regarding empirically validated approaches to the diagnosis and treatment of athletes in the future, particularly youth, who still represent relatively new uncharted territory.

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Anthony LoGalbo, PhD
Medical Psychology Associates
1685 Lee Road, Suite 200
Winter Park, FL 32789 (USA)
E-Mail anthony.logalbo@flhosp.org

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