Primary Care Considerations for the Baseball Athlete

Lauren Prisco 1 · Lauren A. Salesi 2 · Kathryn D. McElheny 2 · Doria Weiss 3 · Laura Diamond 4 · Tim Brennan 5

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Abstract

Purpose of Review To summarize current guidance and best practices surrounding non-orthopedic medical concerns in baseball.

Recent Findings Discussion of COVID19-related practice changes pertaining to the prevention and screening of communicable respiratory illness, concussion protocol updates, the enhanced role of a multi-disciplinary team of mental health professionals.

Summary Prevention, appropriate screening, and early identification remain cornerstones of effective primary care both within the general population as well as for the baseball athlete.

Keywords Baseball · Illness · Screening · Concussion · Cardiovascular · Mental health

Introduction

Medical care of the baseball athlete is complex and multi-faceted. It includes special considerations for the prevention of illness and injury in the setting of a rigorous training and travel schedule, concussion treatment and prevention, pre-participation screening, sleep optimization, and attention to mental health. We advocate for a multi-disciplinary team that works collaboratively using evidence-based practices to provide optimal care for our athletes.

Communicable Illnesses Within the Clubhouse

As the recent events of the COVID19 pandemic have highlighted, communicable illnesses threaten the health and well-being of elite athletes and can lead to interruption of training, withdrawal from the competition, and financial loss for professional athletes. Elite athletes are at an increased risk of contracting infectious illness due to intense training schedules, proximity to other athletes in both training and competition, and frequent travel. A retrospective analysis of all Major League Baseball (MLB) and Minor League Baseball (MiLB) athletes active between 2011 and 2016 found that 14.7% of all reported medical illness diagnoses (n=8,834) resulted in time lost from play, with an average of 4.6 days missed per diagnosis. The annual incidence of illness per season was 20.3 per 100 athletes, with the majority (88.7%) of illnesses occurring in MiLB players. The most common diagnoses were nonspecific viral illness (15.3%), gastroenteritis (13.6%), other gastrointestinal illness (8.3%), influenza (7.0%), and upper respiratory infection (URI) (6.2%).
Pitchers (42.6%) were the most common position to be diagnosed with an illness, followed by infielders (23.7%), outfielders (18.9%), and catchers (10.1%). The distribution of illnesses by position is proportional to the number of players per position on the roster [1].

Respiratory Illnesses

Diagnosis

It is important to distinguish between infectious and noninfectious causes of cough and congestion when considering treatment options [2–6]. Asthma, exercise-induced bronchoconstriction, upper respiratory infection (URI), upper airway cough syndrome, and environmental exposures are the most common causes of acute and chronic cough in the athlete. The common cold may present with a mild productive cough that worsens after 3 to 5 days of illness, though a reactive airway cough may last for up to three weeks after the resolution of all other symptoms. URIs, influenza, and nonspecific viral illness are most commonly diagnosed during Spring Training, which typically coincides with the end of cold and flu season. MLB and MiLB athletes also share training facilities, locker rooms, dining facilities, and housing in closer proximity during Spring Training, which may account for the increased spread of respiratory illnesses in athletes [1]. Finally, the training schedule may lead to different environmental exposures than the general population which can contribute to allergic sources of cough and rhinorrhea [2].

The recent COVID-19 pandemic is naturally the first etiology that comes to mind as it pertains to communicable respiratory illness. It exemplifies the utility of screening for the early detection, isolation, and symptomatic treatment of communicable illness in reducing time lost. Outbreaks among MLB teams provided evidence that a major mode of transmission of COVID-19 was by pre-symptomatic players, highlighting the importance of testing asymptomatic players [7]. Pathogen identification may provide useful information in directing early management of patients with respiratory ailments. Various testing tools, including rapid polymerase chain reaction (PCR) and rapid tests, are associated with decreased antibiotic use, reduced length of hospitalization courses, and increased detection rate. It should be noted that using certain testing modalities in an athletic facility requires laboratory designation status, a process that varies by state [8•].

Treatment

Given the paucity of data on optimal treatment of cough in athletes specifically, the CHEST guidelines recommend a similar treatment approach to cough in the general population, considering the specific training conditions, anti-doping regulations, and side effects that may interfere with performance [2].

Treatment of respiratory infections depends on the etiology and severity of symptoms. The common cold is a benign, self-limited syndrome that is caused by a virus, most commonly rhinovirus, in over 90% of cases. Antibiotics are not recommended for the treatment of acute purulent or clear rhinitis [9]. Acute pharyngitis (or strep throat) is another common respiratory infection typically caused by respiratory viruses (25–45% of adult cases), though group A Streptococcus accounts for 5–15% of adult cases. Management of acute pharyngitis should be guided by the Modified Centor Criteria, which recommends antibiotics for culture-positive infections with a score of two/three or empiric antibiotics (typically 10 days of penicillin) and/or culture for infections with a score of four or greater [10]. Appropriate and timely treatment of acute pharyngitis is critical to reduce the risk of rheumatic fever, alleviate symptoms, and prevent transmission. Treatment of viral URIs should involve supportive care targeting the worst symptoms. Sore throat can be relieved with over-the-counter analgesics, saltwater gargles, throat lozenges and analgesic sprays, warm liquids, and decongestants. Studies assessing the effects of medications on respiratory symptoms in athletes found a modest effect on exercise-induced respiratory symptoms [2, 11–15]. Nasal congestion can be treated with nasal saline irrigation, oral or topical decongestant for a maximum of 3 days, and intranasal steroids. Intranasal steroids are also effective in relieving a cough caused by postnasal drip secondary to environmental allergic triggers, while albuterol may be used as needed for a cough caused by bronchospasm. In addition to supportive care, antivirals may reduce the duration of influenza symptoms specifically by 12–29 h if started within 48 h of symptom onset. However, there is not sufficient data to determine whether antivirals reduce influenza transmission, highlighting the importance of continued hand and respiratory hygiene. The overwhelming majority of respiratory infections among athletes are viral and should be treated with supportive care, including hydration and rest in addition to over the counter medications discussed above. Bacterial infections on the other hand should be treated with the appropriate antibiotics based on the presumed etiology and local antibiotic sensitivity patterns.

Return to Play

Acute respiratory illness in athletes may result in time lost from play. According to Snyders et al., 20% of acute respiratory illnesses in athletes result in time loss from training or competition. This systematic review and meta-analysis of 31,065 athletes found that the mean duration of acute respiratory illness symptoms in athletes was 7 days [16]. There is a lack of evidence to make firm recommendations on days until return to play after acute respiratory illness or infection.
Skin and Soft Tissue Infections

Skin and soft tissue infections (SSTIs) result in high morbidity among athletes, despite a lower prevalence than respiratory and gastrointestinal diseases. Conway et al. reported that dermatologic infections account for 11.5% of total days missed, but <5% of diagnoses among MLB and MiLB athletes [1]. The majority of SSTIs among athletes are methicillin-resistant *Staphylococcus aureus* (MRSA), followed by cutaneous beta-hemolytic streptococci. MRSA can cause severe, invasive, and potentially fatal infections, necessitating appropriate treatment to limit frequency and severity. Cleaning and monitoring of abrasions is important for the early detection of infection [1]. If an athlete presents with MRSA with purulent cellulitis, the recommended management is to obtain culture specimens and initiate antibiotics. For purulent lesions originating from cutaneous abscesses, prompt incision and drainage are recommended. Previously, a “no antibiotic needed” dogma for uncomplicated, drained *Staph aureus* abscesses was standard of care, but recent studies have shown a higher cure rate for patients with purulent abscess treated concurrently with trimethoprim-sulfamethoxazole [17].

Viral SSTIs affecting athletes include herpes simplex, herpes zoster, and verruca vulgaris (or human papillomavirus (HPV) warts). Herpes simplex virus (HSV) is transmitted via direct contacts with breaks in the skin, causing painful vesicles on an erythematous base and, in some cases, prodromal symptoms, such as fever and sore throat. Antivirals should be used to treat HSV and suppressive therapy may be considered for athletes with recurrent infections. Herpes zoster is caused by reactivation of dormant varicella zoster virus (VZV). Herpes zoster typically presents as a maculopapular rash that develops into clusters of vesicles, most commonly in one dermatome that does not cross the body’s midline. Similar to HSV, herpes zoster may present with prodromal symptoms and should be treated with antivirals. Athletic participation requires lesions to be surrounded by a firm crust without evidence of secondary bacterial infection. Lesions should always be covered around teammates. Verruca vulgaris (HPV warts) is caused by HPV and presents as rough, hyperkeratotic papules that interrupt skin lines. Treatment of HPV warts includes salicylic acid or surgical removal.

Lastly, occlusive clothing and helmets worn by baseball players provide a warm, moist environment for the development of fungal infections. Diagnosis of fungal infections is generally made by the appearance and location of the lesion and treatment of the athlete does not differ from that of the general population [18]. *Tinea pedis* (athlete’s foot) should be treated with oral and topical antifungals and can be prevented with good hygiene and dry socks. *Tinea cruris* (jock itch) is a fungal infection of the groin that typically results from spread from another body part. Rashes caused by *Tinea cruris* appear slightly elevated and erythematos with a sharply demarcated border. Ringworm is a fungal skin infection of the trunk/extremities, most commonly caused by *Tinea rubrum*, that presents as a pruritic, circular/oval, erythematous, scaling patch that spreads centrifugally, followed by central clearing and a persistently raised border. Treatment of *Tinea cruris* and *Tinea rubrum* involves topical antifungals and, in widespread or resistant cases, systemic antifungal treatment (in particular when nails are involved) [19]. Depending on the choice and duration of antifungals, monitoring bloodwork and liver function tests may be necessary.

If an athlete suffers from recurrent SSTIs despite appropriate treatment, referrals to an infectious-disease specialist should be considered along with concomitant skin and nasal decolonization [17]. Guidelines from the Center of Disease Control (CDC), Infectious Disease Society of America (IDSA), National Collegiate Athletic Association (NCAA), and NATA have outlined steps to prevent bacterial and fungal infection in locker rooms, gymnasiums, and fitness centers, specifically emphasizing the importance of properly covered wounds and appropriate hygiene to minimizing spread. [17]

Gastrointestinal Illnesses

Gastrointestinal illnesses are a significant cause of morbidity among athletes, comprising over 20% of total medical diagnoses among MLB and MiLB athletes. Noroviruses are the most important cause of epidemic, non-bacterial gastroenteritis worldwide. They account for 58% of all foodborne gastroenteritis in the US and are transmitted by the fecal–oral route [20, 21]. Various factors accentuate norovirus transmission among sports teams in consistent close contact with one another, including the small inoculum required to produce infection (<100 viral particles), prolonged viral shedding, and the virus’s ability to survive in the environment [22]. Based on the results of 20 observational studies and three experimental studies, the median incubation period for norovirus was estimated to be 1.2 days [20]. Knowledge of incubation period is of clinical utility in determining the source of infection and implementing evidence-based interventions to prevent transmission. Other common causative organisms of foodborne illnesses in the US include nontyphoidal *Salmonella* spp. (11%), *C. perfringens* (10%), *Campylobacter* spp. (9%), and *Staphylococcus aureus* (3%) [21]. Clinical symptoms of gastroenteritis broadly include abdominal cramps, nausea, vomiting, and diarrhea. A thorough history and physical is paramount to ensure proper diagnosis as well as to rule-out other causes of GI distress including gastric ulcers, NSAID-induced gastritis, or other causes of a surgical abdomen such as appendicitis. Treatment for foodborne illness is generally supportive care, primarily to reverse dehydration and electrolyte abnormalities. Antiemetics may provide benefit for some patients with significant nausea; anti-motility agents may be used in certain situations with significant dehydration, but are typically avoided in infectious diarrheal illness [22].
Bacterial gastroenteritis should be treated with the appropriate antibiotics when indicated. Definitive diagnosis can be made only through stool culture or more advanced laboratory testing. Finally, the peak incidence of gastroenteritis and other gastrointestinal illness in MLB and MiLB players was during the first 2 months of the regular season (April and May), highlighting the need to maintain rigorous prevention efforts, including hand hygiene and flu vaccination, beyond Spring Training [1].

**Sexually Transmitted Infections**

Medical care of athletes may also include the screening and treatment of sexually transmitted infections (STI). Complaints of dysuria, urethral discharge, or hematuria should include appropriate STI screenings, especially chlamydia and gonorrhea. The United States Preventative Services Task Force (USPSTF) can be a useful resource for age-appropriate screenings and counseling. The Center for Disease Control (CDC) has up-to-date antibiotic and antiviral regimens when indicated.

**Travel Illness Considerations**

Given the significant MLB recruitment and development leagues in Latin American and the Caribbean, the baseball clinician may also encounter infectious illness endemic outside the US. This may include mosquito-borne illnesses such as Chikungunya, dengue fever, Zika, and malaria, and a travel history may warrant a broader differential when encountering an athlete with febrile illness. Schistosomiasis, which is a parasitic illness contracted from infested water, may present as abdominal pain, diarrhea, hematuria, and fever. Hepatitis A may present as abdominal pain, nausea, vomiting, dark urine, and jaundice. Prior to travel, we recommend a review of CDC travel guidelines which will have up-to-date vaccination recommendations. Prompt referral to an infectious disease specialist should be considered in cases of suspected tropical illness.

**Illness Prevention**

**Infection Control Measures Amidst a Pandemic**

The COVID-19 pandemic forced professional sports organizations to implement preventative measures to mitigate the transmission of the virus, which brought to light the prior paucity of infection control guidelines. Several prevention practices geared towards elite sports settings have been proposed. Personal hygiene (both hand and respiratory), common area surface cleaning, and equipment sanitation are the first steps that should be taken. Redesigning shared spaces and strategic locker placement and seating assignments during travel have also been found to reduce the spread.

In addition to infection control strategies, vaccination plays a pivotal role in preventing infectious diseases, yet there is no established vaccination or immune screening protocol in major league baseball. In fact, one study found that 33.5% of MLB and 33.3% of NBA athletes were not immune to at least one of the viruses tested, which included measles, mumps, rubella, and varicella [23].

Vaccination serves as a safe and effective method of infection prophylaxis [24•]. Similar to the general population, elite athletes are reluctant to receive vaccinations due to perceived side effects and potential future repercussions as it pertains to new vaccine administrations. Side effects may be of higher relevance to athletes, as even mild symptoms may impact athletic performance making administration timing challenging amidst the busy training and competition schedule in baseball. Interestingly, a randomized prospective intervention study assessed the appropriate timing for an influenza vaccine after previous training, specifically evaluating the presence of side effects when vaccination was 2 h versus 24–26 h after previous training. Results found no difference between the two groups indicating that training constraints are not needed [24•].

**Cardiovascular**

**Incidence of Sudden Cardiac Death**

Sudden cardiac death while playing sports is the leading cause of mortality in athletes and comprises 75% of all sports-related deaths [25••]. The incidence is between 1 in 80,000 and 1 in 200,000 athletes per year [26, 27]. As a leading cause of athlete mortality, screening measures have been implemented in an effort to better identify athletes potentially at risk. Unfortunately, the screening techniques currently utilized, while helpful, remain imperfect. One retrospective study found that of the sixteen sudden cardiac deaths that occurred during competitive sports in a 6-year period, systemic preparticipation screening may have identified only three of those who were at risk for cardiac arrest [28]. Previous studies have suggested that hypertrophic cardiomyopathy (HCM) is the leading cause of sudden death among athletes [29]. HCM is more likely to be detected by electrocardiography than other causes of sudden cardiac arrest, and as such, is more likely to be picked up during pre-participation screening [28].

**Cardiac Screening**

Cardiac pre-participation screening has been implemented among professional sports organizations for identification of athletes at risk for cardiac disorders to prevent sudden cardiac events. NATA and the American Heart Association (AHA)
have recommended a complete history and physical exam, with an emphasis on family history, as 80% of individuals who experience sudden cardiac death are asymptomatic themselves prior to the event [30]. Electrocardiograms (EKG) are also completed as part of entrance physicals league wide; however, the use of EKG is controversial at other levels of sport. The NATA only recommends EKG be selectively used in those athletes who are at high-risk for cardiac disorders [30, 31]. EKG can be a useful tool for detecting cardiac abnormalities associated with sudden cardiac death in specific settings [25]. The routine use of EKGs as a screening modality among elite athletes highlights the need for physician education on interpreting EKG results to distinguish between normal physiological adaptations in athletes from abnormal cardiac pathology [25].

During 2020–2021 amidst the COVID-19 pandemic, professional sports leagues began to implement more extensive cardiac screening processes due to the association of COVID-19 infection with myocardial injury, even in asymptomatic or mildly symptomatic cases. Interestingly, when all cardiac screening conducted within MLB, Major League Soccer (MLS), National Football League (NFL), and National Hockey League (NHL) was evaluated over a 6-month period, cardiac imaging through RTP screening identified inflammatory heart disease in 0.6% (5 of 789) of professional athletes with prior COVID-19 infection, which resulted in restriction from play in accordance with ACC guidelines [32]. They also found that EKG results had low specificity for detecting subclinical inflammatory heart disease, suggesting that EKG alone for RTP screening is ineffective for athletes with prior non-severe COVID-19 illness [32]. Echocardiograms on the other hand were found to be more useful in the detection of inflammatory heart disease [32].

Based on this low incidence of clinically meaningful cardiac pathology associated with COVID19 infections within professional sports, most teams now take a symptom based algorithmic approach as it pertains to additional testing (insert the correct study here with the symptom based algorithms [33, 34]. Supplementary testing, including echocardiograms, cardiac specific troponins, EKGS, and cardiac MRI (CMR) are reserved for more severe cases as a “down-stream test” rather than widespread screening tools [33].

**Management of Chronic and Exercise-Induced Arrhythmias**

Intense exercise can cause arrhythmias in certain athletes and specific considerations must be taken into account for clinical management. Sinus bradycardia and delayed atrioventricular conduction are considered normal in an athlete’s heart, which have been attributed to a variety of possible causes such as primary electrical remodeling and parasympathetic tone enhancement [33]. Only severe forms of bradycardia (<30 bpm or PR intervals > 300 msec) require medical assessment. Avoiding or reducing physical activity may improve symptoms in these athletes.

Exercise-induced atrial fibrillation is most frequently seen in middle-aged men who have endurance-trained for greater than ten years. Causes of AF may include atrial dilatation, parasympathetic enhancement, and atrial fibrosis [33]. Although studies have shown that exercise plays a role in 40% of individuals with atrial fibrillation and no other cardiovascular conditions, we currently lack effective methods to identify high-risk athletes who would benefit from primary prevention strategies [33]. Moreover, the most effective therapeutic approach to treat exercise-induced AF is unknown. Studies have found that individuals who stopped training had improved symptoms; however, this is not an appealing option for professional athletes who are not ready to retire nor willing to lose compensation [33]. For athletes with exercise-induced atrial fibrillation who wish to remain active, the first line for management is cardiac ablation.

Management of right ventricular arrhythmia is more complex and involves genetic and physical factors that may cause ventricular dilation and subsequent myocardial fibrosis [33]. For athletes with ventricular arrhythmias, established guidelines prohibit participation in competitive sports and discourage high-intensity activities [34]. Identification and management must remain a priority to prevent sudden cardiac events in athletes.

**Emergency Action Plan (EAP)**

Recognition of a sudden cardiac arrest, early cardiopulmonary resuscitation, and immediate access to an automated external defibrillator (AED) are critical for an athlete’s survival thus highlighting the importance of implementing a comprehensive, written emergency action plan (EAP) [35]. Sudden cardiac arrest should be suspected in any athlete that suddenly collapses and is unresponsive [36]. According to ACC Guidelines, initial evaluation of the athlete includes assessing for responsiveness and pulse, along with an examination of the chest for abnormal respiration [37]. If none are present, the established EAP should be followed including initiation of CPR and retrieval of an AED, which must be easily accessible to deliver a shock within 3 min. As part of the emergency action plan, a map should be created identifying all AED locations throughout the sports facility [37]. An EAP coordinator should be designated to oversee proper compliance and it should be rehearsed at least once per year to ensure efficiency and immediate action if sudden cardiac arrest were to occur, which would increase the athlete’s chance of survival.

**Concussion**

In addition to short- and long-term health complications, concussions pose performance and time loss concerns for
professional athletes. A cohort study of 4,186 MLB players found that those who sustained concussions had lower batting averages and on-base percentages on return to play when compared to matched athletes who had taken a non-medical leave. However, there was no significant effect of concussions on career longevity. This suggests that concussions in baseball tend to have more short-term impacts on athletes without enduring consequences on career trajectory—possibly due to the limited-contact nature of the sport resulting in fewer repetitive sub-concussive blows [38].

**Screening**

Common neurological tests used for concussion diagnosis include the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) and the Sport Concussion Assessment Tool, version 5 (SCAT5). In 2011, the MLB introduced a standard concussion protocol requiring (1) pre-season neurocognitive baseline testing (SCAT5), (2) use of SCAT5 as a standardized concussion screening tool during play, (3) mandatory 7-day disabled list (DL) for concussed players, (4) return to baseline neurocognitive function before return to play, and (5) prohibition of same-day return to play [38, 39]. The incidence of reported concussions significantly increased after implementation of the new protocol in alignment with the improved awareness of concussion presentation and symptoms throughout sports medicine. The increased reporting incidence may also be partially attributed to shortening the mandatory DL from 15 to 7 days, thus mitigating fear of losing a spot on the roster and encouraging players to disclose symptoms [39, 40].

**Diagnosis and Management**

Concussion remains a clinical diagnosis without a definitive effective single screening tool to make the determination. The MLB concussion management protocol mandates that the diagnosis be made by a certified athletic trainer or physician with the use of the SCAT5 and best clinical judgment [39]. The team physician and/or athletic trainer’s longitudinal relationship and an athlete and insight into their baseline behavior and personality can be instrumental when making the clinical diagnosis of a concussion. Conversely, diagnosis of concussion may be more challenging when evaluating a visiting player or umpire with whom the clinician is less familiar and may not have a baseline assessment.

According to the American Medical Society of Sports Medicine (AMSSM) position statement on concussion management, diagnosis should be guided by a symptom checklist, cognitive evaluation (including orientation, past and immediate memory, new learning, and concentration), balance tests, and further neurological and physical examination. Standardized sideline tests should be used in conjunction with a baseline test and results should be interpreted with caution, as their sensitivity, specificity, validity, and reliability are unknown. Balance testing is highly specific but not sensitive for concussions, and differences in sideline versus baseline conditions should be taken into account when performing sideline balance tests. Moreover, imaging should only be performed for athletes suspected to have intracerebral bleeding [41].

Concussion management and diagnosis involves continued monitoring for symptom evolution. Before returning to play (RTP), players must spend 7 days on the DL and return to baseline neurocognitive function. A cohort study of 114 MLB players found that the average time missed due to concussion decreased from 33.7 to 18.9 days with no significant difference in player performance after introduction of the 7-day DL [39]. RTP should involve a gradual, stepwise increase in physical demands, sports-specific activities, and exposure with risk for contact. If symptoms occur with activity, the RTP progression should be halted and restarted at the preceding symptom-free step per MLB protocol. Premature RTP poses risk to the athlete. Altered reaction time can contribute to additional head trauma or other injury and prolongation of symptoms [41]. Obtaining reaction time in addition to assessing for convergence and vestibular ocular motor screening may provide supplementary information for baseline neurocognitive testing.

Post-concussive examinations and treatment may also involve clinical psychologists and psychiatrists as current evidence suggests a link between sports-related concussion and depression symptoms in elite athletes [42]. Other conditions such as attention deficit and hyperactivity disorder (ADHD) may also affect both screening and post-concussive assessment and clinicians should be aware of pertinent mental health history.

**Prevention**

The most common mechanism of concussion in MLB is fielding injury, including colliding with other players, hitting the ground, running into walls, and diving, followed by getting hit by a pitch (HBP) [39]. Concussion rates are highest among catchers (38.2%) compared to other positions. In 2014, the MLB implemented a home plate blocking rule (known as the “Buster Posey Rule”) in an effort to reduce collisions at home plate, thereby preventing concussions. The incidence of concussions among catchers due to home plate collisions significantly decreased after the introduction of the new rule [39, 43]. The use of face masks is also valuable in preventing concussions among catchers. Hockey-style masks have a better safety performance than conventional-style masks. Other optimal face mask options include the Force3 Defender mask, which has springs to absorb the impact of foul balls. Moreover, padded outfield walls may help prevent concussions in outfielders [39].
The use of protective equipment for batters, specifically helmets, has been mandated since the 1950s to prevent catastrophic head injuries in batters HBP, but concussion prevention continues to be an area of interest. Increased pitch velocity and the pitch location are also important factors associated with increased risk of concussion and more days missed for batters HBP [42, 44]. The injury rate for batters HBP in the head/neck is over 10 times greater than the overall injury rate for HBP in any other body region. Furthermore, batters are 29 times more likely to miss time from play when hit in head/face compared to other body regions (excluding distal upper extremity) [42]. Moreover, batters HBP in a helmet missed an average of 7.3 days compared to 12.7 days for those HBP without a helmet [42]. Players who do not wear helmets, such as pitchers, spend more time out of play due to concussion compared to other positions.

Education and surveillance are additional tools for preventing and effectively treating concussions. Clinicians can educate players and coaches about the importance of early reporting. This has been proven to be effective in other sports such as soccer where concussion-educated players are more likely to report symptoms than uneducated players, reducing their risk for future injury. Additionally, surveillance is necessary to assess concussion incidence and outcomes so that we can continue to adjust our protocols, and potentially game rules, based on the latest evidence-based guidance [45].

Sleep, ADHD, and Mental Health Considerations in the Baseball Athlete

Disordered Sleep

Like most professional sports, professional baseball involves extensive travel for 8–9 consecutive months resulting in constant interruptions in circadian cycles. It is not uncommon for baseball players to be competing until 11pm in one particular time zone and then fly later that night to another time zone, arriving as late as 3–4am with the expectation to be ready to play by 7pm (and sometimes as early as 1pm) that day. There is a paucity of data regarding the incidence of impaired sleep on performance and injury among professional baseball players, though Winter et al. examined 24,121 games played in MLB over a 10-year period and found that the team with the “circadian advantage” won 52% of the games. Notably, the winning percentage increased to 60% when the teams had a 3-h time zone advantage [46]. With recent advances in wearable technology devices, data regarding sleep health has never been more accessible or consumer friendly. It remains to be seen whether teams will utilize this data to their advantage by investing in sleep hygiene improvement initiatives. Sleep concerns and history of snoring should be screened for as part of the basic entrance physical. Furthermore, many teams are now utilizing separate sleep medicine consultants who can provide individual clinical assessments in addition to education as it pertains to sleep hygiene, strategic napping, circadian rhythm considerations. Sleep medicine clinicians also offer diagnostic expertise for treatable sleep disorders such as obstructive sleep apnea.

Attention Deficit Hyperactivity Syndrome

While all sports require fine motor coordination, baseball is perhaps uniquely demanding because of the nature of the sport. Players must stand almost completely still in the batter’s box in order to focus on seeing the incoming pitch, and yet they must also be ready to create explosive power in order to make contact with the ball. Not surprisingly, prescription stimulants that improve concentration are thought to convey an unfair advantage in baseball if they are taken without a valid pre-baseball diagnosis of ADHD [47]. Discerning a legitimate diagnosis of ADHD from someone who perhaps simply wants a prescription for a stimulant requires a nuanced assessment from an experienced clinician.

TUE Process in MLB for ADHD Medications

A so-called therapeutic use exemption (TUE) process exists to allow players to receive advanced approval from MLB for certain substances if they can obtain a valid prescription for a certified medical condition. The most common type of TUE is for prescription stimulants for ADHD. Based on the 2022 MLB Collective Bargaining Agreement, the TUE process for stimulant medication involves a stepwise approach including detailed documentation of clinical symptoms that meet DSM-5 criteria and associated clinical significance resulting in impairment both playing baseball and outside of baseball. While formalized neuropsychological testing may not be necessary at the outset, it may be required to elucidate a player’s status. Evaluation should also include a Barkley Functional Impairment Scale (BFIS), an interview with a player, as well additional informants for independent verification of player’s symptoms. Relevant family members, childhood clinicians, or experts may be interviewed, and pertinent laboratory and psychological testing may also be reviewed. Prior unsuccessful medications should be evaluated and an FDA-approved non-stimulant medication should have previously been considered. The clinician must include a detailed treatment plan that includes the medication for which a TUE is being requested, the dose, the route of administration, and the frequency of the use of the medication, as well as planned follow-up. If the player has been on the medication prior to the TUE request, the clinician must provide an evaluation of the efficacy of the medication used (including dosing and dosing regimen). Any observations and consequences when the medication is not taken for a brief period of time should be reported.
All of this information must be sent to MLB’s Independent Program Administrator for review. If approved, the prescribing clinician must be trained and practicing in psychiatry.

**Addiction Medicine**

Unfortunately, baseball is unique among professional sports in that players frequently consume intoxicants while they play in the form of various tobacco products. Enforcement of anti-tobacco policies is variable throughout baseball, and despite efforts at tobacco cessation and overall decline in usage, there remains a culture of tobacco utilization among a sizeable contingent of players [48]. Clinicians should be mindful of screening for tobacco use disorder among all baseball players and recommend cessation strategies for those interested in quitting. Under the current 2022 bargaining agreement between MLB and the MLB Players Association, all players are “prohibited from using, possessing, distributing or selling any drugs of abuse, stimulants or performance enhancing substance.” The policy extends to positive tests that occur as a result of a nutritional or dietary supplement, even if the player was not aware that the product contained the banned substance. The only supplements that the player can use without risk of a positive test are those that have been certified by the NSF Certified for Sport Program. A full list of products is available at www.NSFsport.com.

**Depression and Anxiety**

For decades in competitive American sports, mental health has been an afterthought. It was well known that professional athletes frequently suffered from a lack of emotional fulfillment in retirement, but voicing mental health concerns during one’s career was essentially taboo. Fortunately, that is no longer the case. Notable athletes like Simone Biles, Naomi Osaka, Michael Phelps, DeMar DeRozan, Kevin Love, and others have spoken up about their own mental health struggles and created a watershed moment in sports for mental health.

While participating in athletics has many proven benefits for mental wellness, the pressure to perform at an elite level can intensify pre-existing symptoms of anxiety and/or depression as well as elicit new symptoms.

Standardized scales and assessments such as The Patient Health Questionnaire-9 (PHQ-9), Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), Depression, Anxiety and Stress Scale (DASS) and The Generalized Anxiety Disorder-7 (GAD-7), for example, are key components of diagnosis and treatment of elite athletes. The Columbia-Suicide Severity Rating Scale (C-SSRS) is another essential tool applied to assess safety and track suicidal ideation and behavior. It can be difficult for athletes who are taught to redirect or compartmentalize emotions to verbalize how they are feeling. The utilization of these screening tools supports the data driven climate of baseball and is a consistent way to track progress and identify baselines for patients and providers.

Luckily, both anxiety and depression are treatable, as long as the athletes are willing to be treated. A combination of psychotherapy and psychopharmacology is often used in tandem for the best results [49]. It is important for clinicians to be empathic listeners, provide safe emotional spaces for each athlete, and to take cultural considerations into account. These components help to create individualized treatment plans to ensure that all needs are met and that the athlete’s vulnerability is positively reinforced.

Many modalities are used for the treatment of anxiety and depression, including but not limited to CBT, MET, psychodynamic therapy, and mindfulness. When indicated, SSRIs are commonly used for the treatment of anxiety and depression, and prescribers for athletes tend to utilize medications that are more activating and less prone to producing drowsiness, tremors, weight gain and cardiac issues [50].

Regardless of whether an athlete voices emotional distress, seeks assistance or shows signs or symptoms of anxiety or depression, situational stressors are inevitable and can push an individual into crisis mode at any given moment. We see an importance in strengthening each player’s baseline so that they have the tools to adapt and self-sooth if they are under distress due to a stressor related to baseball or stressors in their overall lives.

It is imperative for the culture of baseball to normalize self-care for mental health and provide readily available baseball-specific resources for athletes. Crisis management education for all staff is crucial. Providing psychoeducation and basic training to all staff members can save lives and also helps to perpetuate the conversation of mental wellness. In addition, creating an emergency action plan for mental health with trigger points so that every staff member knows exactly what to do and who to call at the first sign of player distress provides the athletes with seamless warm hand offs and assistance in the exact moments they need it most.

These athletes have mastered the art of physical performance and can apply similar skills to ensure that their minds and emotions are given the same amount of space and attention. If the athletes are given the right tools, they are set up for success.

**Future Directions of Mental Health**

While statistics play a major role in all sports, baseball is perhaps unique in the sheer volume of data that is collected about each player, and much of this data is not only available to players, coaches and agents, but also to fans and bettors, to analyze as they wish. One wonders whether baseball teams will seek to collect additional information on sleep cycles, attention span, emotional stress tolerance, resilience skills,
and other mental health data points in order to improve performance in addition to individual well-being.

Conclusions

We hope to have illustrated the multi-dimensional and multi-disciplinary nature of non-orthopedic medical considerations in the sport of baseball. Early identification, screening, education, and implementation of prevention strategies driven from evidence-based best practices remain cornerstones of optimal medical care for our athletes. There appears to be recent momentum in the field of mental health which we hope will only improve as de-stigmatization continues. Recent rule changes surrounding concussion have led to clinically meaningful improvements in time lost and incidence. Finally, the COVID-19 global pandemic has illustrated the importance of early detection as well as basic respiratory and hand hygiene in the prevention of spread of communicable disease, which has historically been a perhaps undervalued culprit of time missed from professional baseball.

Declarations

Lauren Prisco, Doria White, Laura Diamond, Tim Brennan, Kathryn D. McElheny, and Lauren A. Salesi all declare that they have no financial conflicts of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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• Of importance
• Of major importance

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