



Inter-association Recommendations: Best Practices in Strength and Conditioning

The primary purpose of strength and conditioning programs for athletes is to optimize performance while reducing injury risk during training, practice and competition. The evaluation of weightlifting technique(s), aerobic and anaerobic capacity, and fitness level, as they relate to sport-specific demands, should guide the creation of individualized training prescription. This requires implementing sound physiologic rationale and evidence-based practice. Additionally, careful planning of the training programs should prioritize the safety and well-being of the athlete. The safety of an athlete during training and competition is multi-factorial and inter-disciplinary, and as such all efforts should be made to consider the collection of variables that can facilitate or prohibit optimization of physical readiness during exertion.

Over the past several years, an increasing number of cases involving athletes suffering catastrophic injuries and deaths, during conditioning programs have been cited.^{12, 20, 22} The National Center for Catastrophic Sport Injury Research reports 85 college athletes have died from 2000 to 2016 from causes indirectly related to their sport; 40 percent of whom were football players.^{4, 11} The term “indirectly,” refers to the causes of death from exertional events that have triggered medical emergencies such as heat stroke, complications from sickle cell anemia, asthmatic episodes, and sudden cardiac arrest. In addition, there has been a significant increase in the number of cases of rhabdomyolysis, a rare exertional disorder associated with tissue breakdown that is acutely traumatic and potentially life-threatening.^{15, 16} In college sports, most exertional injuries and cases that resulted in death occurred after workouts or conditioning drills and could have been prevented through compliance with established standards and best-practice guidelines.^{20,22} Adhering to scientifically-established principles of physical conditioning, employing best-practices for training instruction, monitoring volumes and training response, and activating the emergency action plan with the attending medical staff, should significantly reduce risk of exertional injury and death.

A variety of contributing factors have led to the increases in exertional deaths in athletes, many of which are controllable. Undue influences from the sports coach(s), inadequate supervisory oversight, sub-optimal reporting lines and administrative support, insufficient higher education curricula coupled with limited applicable field experience(s), as well as a known culture of using physical training for punishment or “mental toughness,” have all contributed to the aforementioned risks associated with conditioning programs.^{2, 6} The professionals involved in the physical conditioning and medical oversight of athletes have the ability to mitigate undue safety and health risks by managing these known factors. Should these factors continue to be left unchecked, future needless harm to athletes will most likely continue and stain the landscape of sports.

Injuries and deaths have not been associated with sports participation (practices and games) and have rarely occurred in-season. More commonly, off-season and transitional periods are noted for having potentially dangerously high training volumes and intensities, posing greater risk⁷. These issues are well-documented and published best practice recommendations have existed for nearly a decade. In 2012, a coalition of experts from the foremost sports medicine and sports science organizations in the United States developed a best-practices document for mitigating the risk of sudden death during conditioning sessions⁶. This document specifically addressed these named risk areas: competency and credentialing standards for professionals, reporting structure to remove sport coach influence, implementation of proper acclimation periods, denouncing the use of conditioning as punishment, and developing and practicing emergency action plans with special attention to the primary exertional ailments. In 2019, a joint publication from two of the foremost accrediting bodies in the strength and conditioning profession outlined the guidelines for attenuating associated risk during transition periods.⁷

Despite an improvement of collaborative efforts by leadership in the medical and strength and conditioning fields, published evidence-based practice guidelines, and objective training parameters, athletes continue to be fatally injured during conditioning sessions.¹⁰ Currently a lack of a uniform policy related to the strength and conditioning profession's education and credentialing remains problematic.^{7, 10, 22} The lack of uniformity exists across all levels of regulated sport. Professional and amateur sports organizations have the means available, through recommendations and best practices, to institute policy(s) aimed at protecting athletes from the forenamed risks associated with conditioning sessions. However, for the above-mentioned policies to be successfully implemented, the requisite capabilities of those responsible for delivery and oversight must be aptly qualified. Herein lies the crux of the lack of uniformity within the profession, employment, and oversight of the strength and conditioning professional.

Unlike other practitioners in sport (i.e. athletic trainers, physical therapists, and physicians), strength and conditioning coaches are not bound to regulated governance, as in state licensing laws. Moreover, entry into the strength and conditioning field does not require a post-secondary degree in exercise science or related major. It is then of no surprise that most of the documented incidences whereby a death or catastrophic injury occurred, was under the supervision of individuals who would have failed to meet the above standard of an appropriate higher education degree. Furthermore, the vast majority of individuals whom these incidences occurred under, were not certified by a National Commission for Certifying Agencies (NCCA) accredited strength and conditioning credentialing program.¹²

At the end of 2017 the members of the NCAA Sports Science Institute contacted Coalition for Registration of Exercise Professionals (CREP) member organizations for further clarification on the role of NCCA accreditation for certification of strength and conditioning coaches; and how it could function to enhance student athlete safety during conditioning programs. In response, the Coalition for Registration of Exercise Professionals (CREP) and the National Athletic Trainers Association's Intercollegiate Council on Sports Medicine (ICSM) task force on student safety joined to create workgroups of subject matter experts to identify gaps in education and training, as well as influences that may increase student athlete risk. Four areas were identified as key elements to student athlete safety including:

Foundational Education, Training and Credentialing of Strength Coaches

Continued Professional Development in areas of Student Athlete Safety

Reporting Structures of Strength and Conditioning Programs

Scope of Professional Practice and Safety Responsibilities of Strength Coaches and Athletic Trainers

Subject matter experts were assigned to each work group to investigate current practices, identify potential areas of risk, and establish initial criteria for best practice recommendations to the larger group. The work groups generated two (2) surveys to evaluate data regarding experience, education and training, credentialing, and reporting of strength and conditioning coaches as well as curriculum preparations used at accredited post-secondary academic institutions for careers in strength and conditioning.

The first survey was generated to collect data on full time strength coaches specific to the areas of highest level of education, field of study, current certifications held, reporting hierarchy and resources. The study went out 2500 strength coaches including all D-1 institutions. Nearly 500 strength coaches qualified as valid to the data set, representing each conference and all NCAA regulated levels of play. The second survey went to more than 1000 academic programs in sports and exercise science to identify curricular components of education and training aimed at professions in strength and conditioning. The questionnaire's goals were to 1) identify qualifying criteria within academic programs preparation and alignment to NCCA accredited board certification exams, and 2) identify qualifying internship experiences meeting role specific preparation in practical training and professional development that promote the needed competencies in strength and conditioning. For the fourth group, experts in mapping and gap identification, engaged the role delineation studies of the three NCCA accredited strength and conditioning programs and the role delineation study of the NATA ATC program to identify alignment and gaps for better understanding of the interaction, overlap and areas to be addressed to optimize student athlete safety during participation in conditioning programs.

Several meetings served to aggregate the data for final analysis to support recommendations that provide actionable steps for institutions and organizations, related to the employment qualifications and oversight of strength and conditioning coaches. Of note, the employment qualifications and supervisory oversight differ across the conferences within the NCAA. The authors believe that implementation of the seven recommendations in the manuscript will help protect all college student-athletes and institutions from undue harm. As a result, the authors believe the rates of non-traumatic injury and death among collegiate student-athletes will decrease.²

The following recommendations are designed to serve several stakeholder groups and purposely not isolated to the benefit of any one group. Rather they serve to remedy multiple issues and function to benefit multiple stakeholders of the strength and conditioning profession. To ensure all groups were represented, the task force established stakeholder groups' goals as a basis of developing the recommendation. These goals include:

Student Athletes – create an environment for athletic development under optimal conditions for safe engagement in all activities and deliver best practices in monitoring and response to prevent negative outcomes.

Strength and Conditioning Coaches – create an environment of accountability with appropriate autonomy and freedom from undue influence including sports coaches. Enhance competency for safe and effective practices and emergency readiness to optimally protect student athletes and prevent any negative outcomes.

Athletic Trainers – provide avenues to enhance collaboration between medical staff and the strength and conditioning department to optimize student safety through collegial support and recognition of expertise, particularly during the implementation of an emergency action plan.

Athletic Departments – provide methods of best practices, across varied levels of resources, to ensure student athlete safety, interdepartmental alignment, appropriate reporting structures with defined accountability, and defensibility of departmental practices.

Academic Units – provide the curriculum recommendations based on role delineation alignment for preparatory coursework and training, including internships and experiences that serve tracks in strength and conditioning.

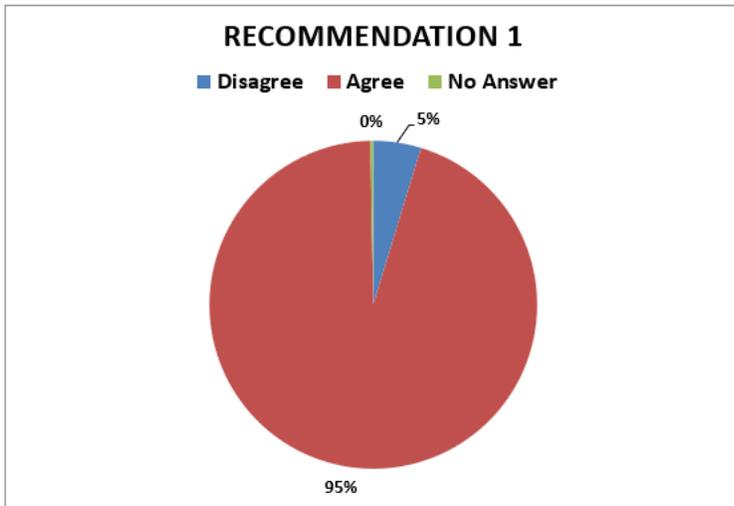
NCAA or other Oversight Body – offer a third-party best practice document of recommendations across all three divisions, that 1) provides evidence-based support for recommendations, 2) presents detailed methods for implementation at any resource level, 3) partially shift the burden of oversight to other regulatory bodies including the US register of Exercise professionals, 4) Publicly support the NCAA in the process.

The overall process to develop the following recommendations included research in the history of events and factors that have led to student athlete injury or death, a review of literature of previous recommendations and foundations for best practices, and surveys of professionals, academic institutions and related stakeholders to identify ideal preparatory paths to qualification of strength and conditioning professionals and reporting lines that provide proper oversight and prevent undue influences. Task force meetings of researchers and subject matter experts analyzed the facts and data sets provided by these exercises and formalize conclusions that support the seven (7) recommendations. Additionally, all recommendations have been reviewed by the respective constituent groups for which they apply. Each recommendation below is followed by the industry support of the recommendations based on a final survey.

Recommendation 1. All NCAA-regulated schools should be held to a common standard for hiring a strength and conditioning coach.

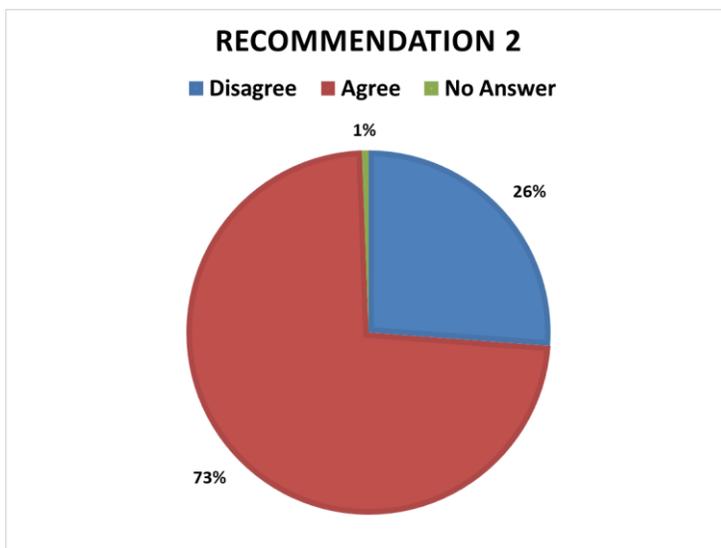
Student-athlete safety during training and conditioning sessions, and in the potential benefits of carry-over into practice and competition, is a central responsibility of a strength and conditioning coach. Irrespective of the institution's financial resources, student-athletes have the right to quality professional practice, competent supervision, and adequate safety measures at their institutions from strength coaches designing and overseeing physical training regimens. Fortunately, there exists an extensive supply of candidates available for hire, who meet the minimum criteria outlined in this document. The economic law of supply and demand, in this case where there is an ample supply of

qualified hires are favorable to the institutions across the NCAA divisions. As a result, there are no financial barriers to justify non-compliance.⁸



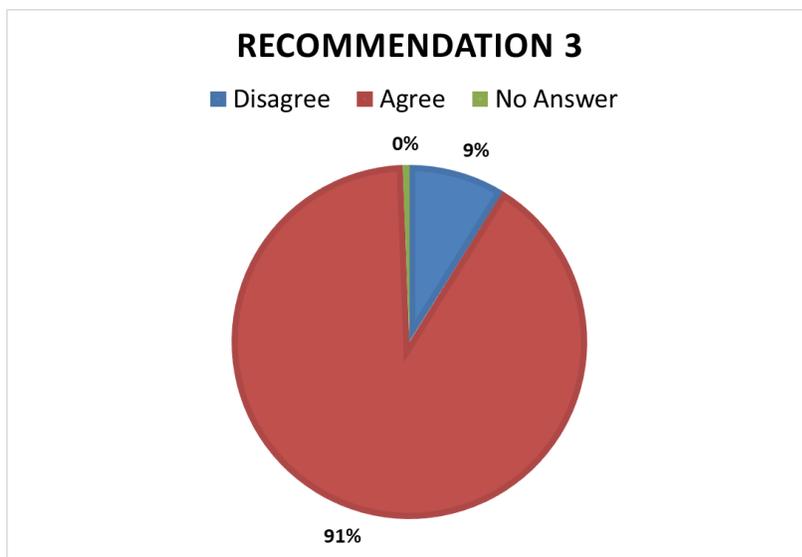
Recommendation 2. The minimum degree requirement for a position as a strength and conditioning coach should be a bachelor’s degree in exercise science or a related field.

Key components to providing safe and effective physical training regimen are to reduce injury incidence, create beneficial physical adaptations for sport, and providing the foundational competencies for understanding physical exertional stress. To date, the documented cases of non-traumatic exertional injuries and death are associated with negligence to the constructs (acclimation, recovery, and transition times) and misconduct of a physical conditioning sessions.²² The authors believe that a four-year, higher education degree generally provides adequate time to develop the knowledge and skills of an entry-level strength and conditioning professional, with the capabilities to deliver safe and effective programs. The appropriate college major(s) should also align with the mandatory pre-requisite coursework for the preeminent certification bodies in the strength and conditioning profession⁹. While the number of degree programs available are diverse with varied titles, degrees that would normally be able to meet this criterion include: Kinesiology, Exercise Physiology, Applied Movement Physiology, Movement Science and Biomechanics.⁵



Recommendation 3. The qualifying degree must cover content related to the medical safety and health concerns that aligns with the job task analysis for NCCA- or ISO 17024-accredited certification programs for strength and conditioning. The content alluded to should include, but not be limited to, the following: common medical risk factors and conditions (i.e., rhabdomyolysis, environment illness, concussion, spinal injury, sickle cell trait, dehydration, cardiovascular, metabolic, and respiratory conditions), training instruction and spotting techniques, programming, transitional periods, and emergency action planning. When considering this content, it is important to note scopes of practice and the hierarchy of care in the event of a health concern.

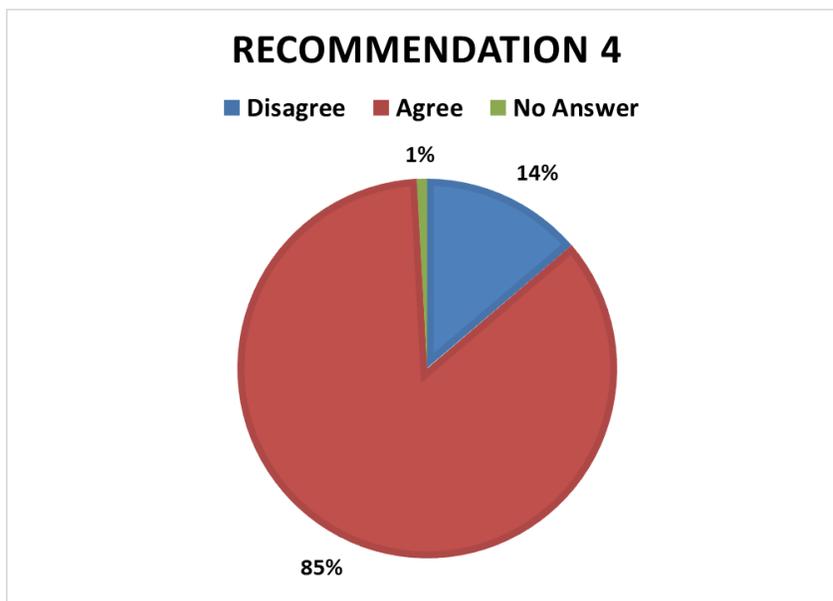
Exertional injuries are arguably the most preventable injuries that occur to athletes. Exertional stress, combined with environmental stress, hydration and/or nutrient insufficiency, and inadequate acclimation to sustained exertional stress dramatically increases preventable risk. It is well documented that non sport-specific conditioning performed at intense levels with inadequate rest increases injury potential, particularly among those at elevated risk. ^{2, 3, 4, 11} All strength and conditioning professionals should have foundational education, training, and practice in constructing and conducting appropriate training sessions which includes proper rest to work ratios for athletes with adequate acclimation to the training intensity and volume. Academic preparations for careers in strength and conditioning must include content in programming, training instruction and management that teaches students how to mitigate risk for these types of injuries and exactly what to do if they occur.



Recommendation 4. All developing and emerging strength and conditioning coaches must complete at a minimum, a one (1) semester equivalent of internship experience(s) in relevant strength and conditioning settings with a qualified supervisor(s) that allow for the development of critical competencies (e.g., safety, training instruction, spotting techniques, and performance-based program design).

Current internship and practice standards amongst the strength and conditioning education programs are highly variable and lack benchmark criterion. Evidence indicates that supervisors and interns must adhere to defined guidelines that clearly state and delineate responsibilities to maximize the value of the experiential learning opportunity. ²¹ The authors suggest accredited education programs for strength and conditioning begin the process of realizing a standardized assessment tool for internship experiences, with relevant and mutually agreed upon benchmark metrics. There is precedent for this model, which is consistent within the health sciences and other licensed professions, including athletic training, dietetics, and physical therapy. ¹ The authors believe that strength and conditioning professionals must also be held to this commonly accepted standard of practice.

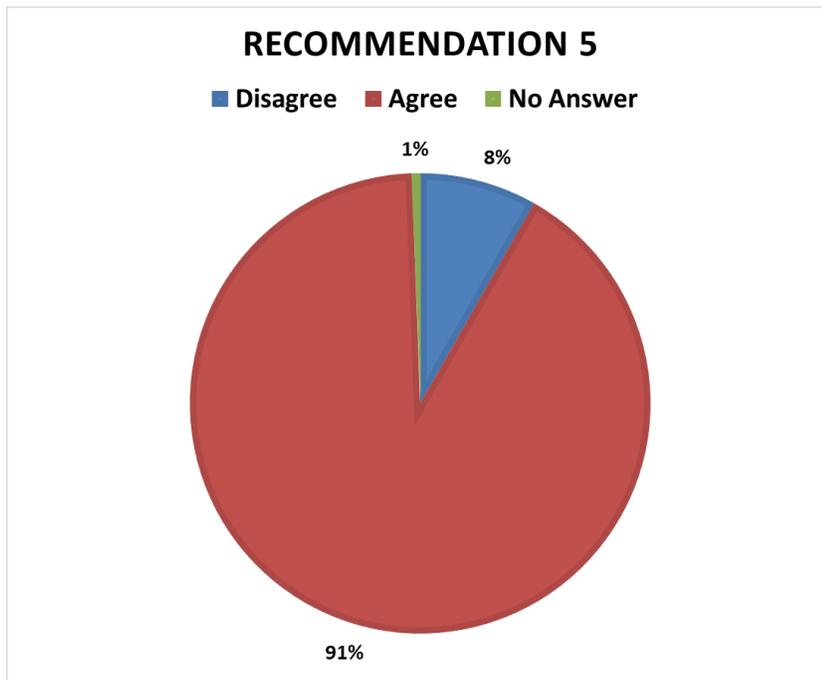
Emerging professionals often participate in formalized field experiences under the supervision of a qualified practitioner. In some cases, the supervising professional has also undergone additional continuing education courses geared towards clinical instruction. The role of clinical supervisor is based on defined competencies, which contain a clear focus on professional development and role modeling for entry level professionals in-line with effective clinical supervision of allied health professions. 17 This clinical instruction includes oversight, mentoring, and grading of interns against a common set of standards with learning outcomes objectively reflecting the entry-level competency requirements identified in the role delineation studies of the profession. 5 As such the authors suggest a means of training certified coaches to be field instructors through validated post-professional continuing education coursework or training with outcomes measured against a common standard. This standard clarifies the duties and authority of instructors when conducting practice-based training and outlines the competencies necessary for scientific knowledge as well as professional, ethical, and pedagogical adequacy.



Recommendation 5. All collegiate strength and conditioning coaches must have an NCCA/ISO 17024-accredited certification, specifically in strength and conditioning, at the time of hire, and maintain said certification in good-standing while serving as a strength and conditioning coach.

The strength and conditioning profession is unregulated at the state and federal levels but has significant resource contribution through industry-regulation from select credentialing bodies. These credentialing bodies have met NCCA or ANSI ISO 17024 accreditation standards, demonstrating to a third-party that they defensibly acknowledge minimum competency to perform the job as defined by the supporting role delineation study or job task analysis. ¹⁴ In the United States, the credentials in strength and conditioning that meet this minimum requirement have been mapped for content alignment which has additionally been validated by a third-party and is acknowledged internationally. All the currently available credentials can be centrally verified by the United States Register of Exercise Professionals (USREPs).¹⁸ Non-certified strength coaches consistently fail to meet the competency level needed to properly protect student-athletes from harm associated with conditioning programs. ¹² Additionally, those strength coaches participating in certification programs that do not meet the third-party standards present similar risks. While no credential independently can replace proper education and training,

constructive experience, and prudent decision-making, a consistent theme among most of the individuals supervising practices where a student-athlete experienced a non-traumatic catastrophic injury or death was a lack of proper credentialing. ¹³



Recommendation 6. All strength coaches shall complete continuing professional development coursework/workshops in managing student-athlete safety to include emergency action plans (annual), environmental safety management, and program safety (transition periods, load volume).

It is an occupational obligation to remain competent and current in a health and safety profession. Completing continued professional development in specific areas of study or practice that provide the requisite knowledge and ability to improve student-athlete safety should be a condition of continual employment as a strength and conditioning coach. Given that most student-athlete injuries and deaths are preventable, it is reasonable to expect a strength and conditioning professional to have proficiency in identifying and mitigating those risks and successfully managing outcomes. Research has indicated that strength coaches, in general, are not adequately trained or prepared to prevent or manage exertional emergencies. ¹⁹ The authors believe the following professional competencies should be addressed in continued professional development courses:

Emergency Action Plans

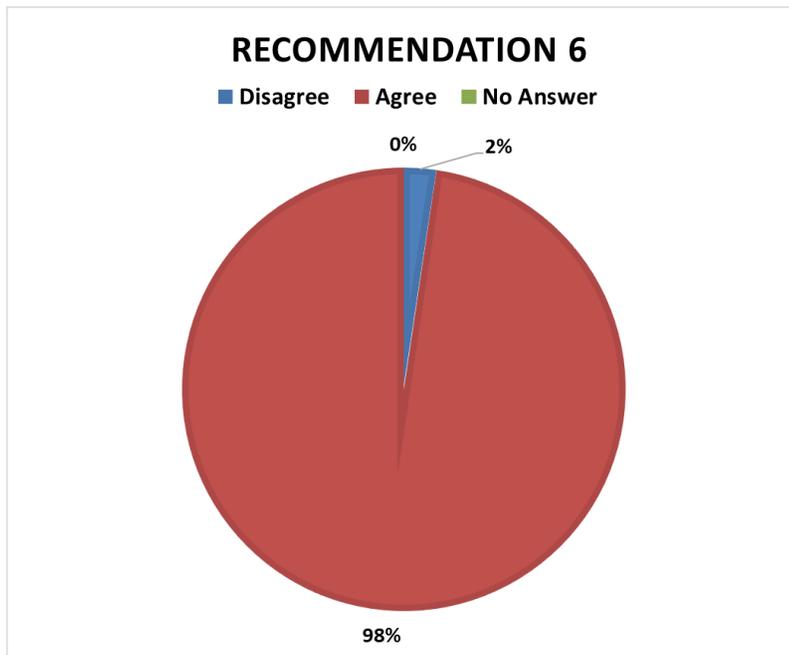
1. Head and neck injury
2. Cardiac arrest
3. Heat illness and stroke
4. Exertional rhabdomyolysis
5. Exertional collapse associated with sickle cell trait
6. Exertional/non-exertional collapse
7. Diabetic emergency
8. Mental health emergency

Environmental Safety

1. CPR and AED training
2. Evaluating environmental safety
3. Conditions that increase risks associated with hot cold environments
4. Environment management, coach to athlete ratios and observational visibility/proximity

Program Safety

1. Physical readiness evaluation
2. Acclimation and Transition period practice and timelines
3. Markers of physical competency
4. Training volumes and recovery
5. Assessment of overreaching
6. Indications of nonfunctional overreaching and overtraining syndrome

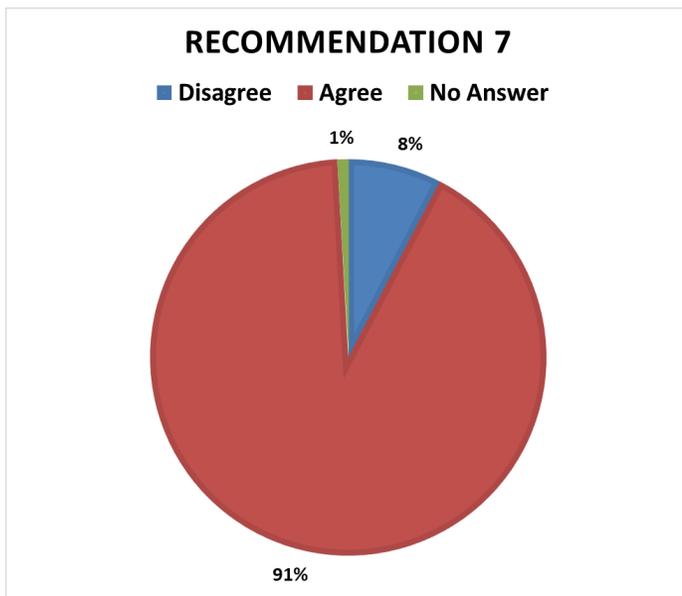


Recommendation 7. Strength and conditioning coaches must have autonomy to practice their craft void of influence from sports coaches and other individuals who are not certified as a strength and conditioning professional. Reporting of the strength and conditioning department should be to a director-level position that has the authority to provide supervision and oversight to ensure student-athlete safety and wellness, department activity transparency, and individual accountability.

It is inappropriate for a sports coach to have influence over any aspect of physical training as defined by the role of the strength and conditioning coach. Likewise, it is the obligation of the institution to afford appropriate oversight to the strength and conditioning department that provides for autonomy within the domain of professional competencies elucidated by specific job roles and scope of practice. Optimally, the authority over student health and safety presides with a Senior Athletic Director or Senior Medical Director who is not directly responsible for designing and instructing strength and conditioning programs but is qualified in understanding sports physiology. Medical units should work closely with the strength and conditioning departments to ensure student-athlete safety, particularly during return-

to-play scenarios and transitional periods between seasons. A support system should be established to monitor student-athletes during these periods, with an emphasis on incoming and at-risk individuals.²⁰

Specific failures have been identified as contributing to the risk of injury and death among student-athletes. The seven (7) recommendations by the authors are intended to mitigate these primary contributing factors by controlling for undue influences, improving practitioner qualities, providing appropriate supervisory oversight, and removing the toxic culture of using physical training for punishment^{2, 6}. Compliance with these recommendations requires limited additional resources and will allow conditioning programs to benefit student-athletes by halting the trends of exertion-related injury. It is the obligation of institutions to provide a safe environment during the promotion of athletic development; therefore, adopting these recommendations will send a united message to all stakeholders that the health and well-being of all student-athletes is central to the athletic program.



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