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Defining the Term "Overuse": An Evidence-Based Review of Sports Epidemiology Literature

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Clinical Question: What is the current context of the term *overuse* in the epidemiologic sports injury literature?

Data Sources: The authors performed a database search of PubMed and SPORTDiscus. The Boolean phrases *athletics* AND *injury* and *overuse* OR *epidemiology* were searched.

Study Selection: Studies were included in the review based on the following criteria: (1) epidemiologic in nature, (2) involved US high school or collegiate athletes, and (3) published in English between 1996 and 2012. In addition, a study was classified as epidemiologic in nature if appropriate exposure data were collected in order to calculate injury incidence rates. One reviewer initially read the titles or abstracts of the studies to determine their relevance for the systematic review. Studies were excluded if they (1) were biomechanical or anatomical in nature, (2) were clinical in nature, or (3) assessed the effectiveness of an intervention.

Data Extraction: The reviewer extracted statistics and definitions of the word and phrase *overuse* and *no contact*. The reviewer adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines as much as possible.

Main Results: A total of 5182 titles of articles were initially identified in the databases searched. Then 232 studies were read to determine if they included overuse statistics. A total of 35 articles were included in the final review. Two main surveillance programs were used in these studies, with the authors of 12 articles (n = 12/35, 34.3%) using data from the High School Reporting Information Online (RIO) and the authors of 13 articles (n = 13/35, 37.1%) using data from the National Collegiate Athletic Association's Injury Surveillance System (ISS). One group (n = 1/35, 2.9%) used both surveillance systems, whereas 9 groups (n = 9/35, 25.7%) used other surveillance systems. Articles were categorized as (1) high school or collegiate studies using neither ISS nor RIO data, (2) high school studies using RIO data, or (3) collegiate studies using ISS data. The authors of only 1 article of the 35 (2.9%) provided a comprehensive definition of the word *overuse*. Collectively, 14 groups classified *overuse* as a mechanism of injury, 7 classified it as a category of diagnosis, and 8 classified it as both a mechanism of injury and a category of diagnosis. Specifically, 12 of the 35 articles combined *overuse* with other terms such as *chronic*, *gradual onset*, and *repetitive stress*, whereas 4 of the 35 articles defined *overuse* in the context of *no-contact* injuries.

Conclusions: A great deal of inconsistency exists within the sports injury epidemiological literature regarding the term *overuse*. The authors of the systematic review recommended using the term *overuse* when referencing the mechanism of injury. A working definition of the term *overuse* should be used in injury surveillance such that injuries due to *overuse* are characterized by a mechanism of gradual onset and an underlying pathogenesis of repetitive microtrauma.

Key Words: injury prevention, mechanism of injury, documentation

COMMENTARY

Currently in the United States, 7.3 million secondary school students[1] and 460 000 college students[2] participate in competitive athletics. Sports participation in both secondary schools and collegiate programs has seen an increase in the number of athletes active in year-round competition, leading to increased participant exposures. The extended participation period reduces the opportunity for optimal rest time, which may lead to an increased incidence of overuse injury from repetitive microtrauma at submaximal loading.[3,4] Research supported this theoretical connection as investigators[5] have reported that increased sport participation and training-volume demands have resulted in more than 54% of total injuries reported being characterized as overuse in nature. Although clinicians have used the term *overuse* when referring to injuries, literature to support a working definition to guide medical documentation and injury surveillance is lacking.

The variability in application of the term *overuse* may have implications for injury-surveillance research. The National Athletic Trainers' Association[6] released a position statement in 2011 regarding the prevention of pediatric overuse injuries. This position statement indicated that approximately 50% of pediatric sport-related injuries were due to an overuse mechanism. The position statement increased awareness of overuse injuries in the adolescent population, but the lack of a clear working definition of the term in clinical practice may have influenced reporting behaviors regarding the pathogenesis of the injury. Additionally, current injury-surveillance systems may not be accurately capturing patients' suffering from an injury due to an overuse mechanism because of the time loss associated with the injury. Injuries caused by overuse require substantial

Table. Working Definitions Related to Injury Surveillance

Term	Working Definition
Injury[8-10]	Any physical complaint sustained by a player that results from a practice or competition, irrespective of the need for medical attention or time loss from activity
Overuse[3]	Mechanism of gradual onset with an underlying pathogenesis of repetitive microtrauma
Recurrent injury[8-10]	Injury of the same type and at the same site as an index (initial) injury which occurs after a player's return to full participation
Injury severity[8-10]	The number of days that have elapsed from the date of injury to the date of the player's return to full participation in training and availability for competition selection: • Slight: 0–1 d • Minimal: 2–3 d • Mild: 4–7 d • Moderate: 8–28 d • Severe: more than 28 d • Career ending • Nonfatal catastrophic • Catastrophic

medical resources that result in a significant burden on the health care system.

Different definitions of *overuse* have created limitations that separate epidemiologic research and clinical practice. As described in the systematic review by Roos and Marshall,[3] clinicians reported the term *overuse* as a mechanism of injury, a category for diagnosis, or both a mechanism of injury and a category for diagnosis in injury surveillance. The authors recommended that clinicians and researchers use the term *overuse* only when referring to a "mechanism of gradual onset with an underlying pathogenesis of repetitive microtrauma."[3] When referencing a diagnosis of injury as *overuse*, clinicians may overlook the underlying pathologic condition or misrepresent the nature of the injury. We propose that clinicians use standard diagnostic terms for musculoskeletal injuries rather than referencing the symptoms by the mechanism of injury. For example, in clinical practice, rotator cuff tears can be caused by either an acute mechanism, from falling on an outstretched hand, or an overuse mechanism, such as repetitive throwing.[4,7] The mechanism of injury is vital to understanding the root of the pathologic complaint, which could be confusing to clinicians if all rotator cuff cases were documented as *overuse* rather than by the true mechanism. The lack of a working definition has potentially skewed the results of injury-surveillance systems.[3]

To bridge the gap between epidemiologic research and clinical practice, clinicians should use the accepted working definitions (Table)[3,8–10] to describe their patients' current health status. In addition, the accepted working surveillance definitions should align with the classification and coding system of the International Statistical Classification of Diseases and Related Health Problems.[11] The use of a clear working definition of *overuse* will aid in the process of identifying modifiable risk factors and causal mechanisms that researchers and clinicians can target to implement interventions to prevent injuries due to *overuse*. This will help researchers and clinicians as we begin to examine and attempt to understand how pediatric sport participation affects the long-term health-related quality of life of these individuals. This shift requires clinicians to appropriately identify and differentiate mechanisms of injury and injury classifications. Collectively, it promotes improved medical documentation by the clinician and permits researchers, through injury-surveillance programs, to accurately determine the risk of sport participation. Currently, several injury-surveillance systems are specifically based on the level of sport participation (eg, secondary schools and colleges) to track prevalence and incidence rates for participants. In the systematic review,[3] study authors mainly reported the use of 2 platforms: the High School Reporting Information Online (RIO) and the National Collegiate Athletic Association's Injury Surveillance System (ISS). Although both injury-surveillance systems have been used extensively for epidemiologic studies in high school and collegiate athlete populations, we suggest that these systems review their operational definitions of how injuries caused by an *overuse* mechanism are categorized and tracked.[10]

Athletic training, including research and clinical practice, can benefit from adopting the working definition of *overuse* as a mechanism of gradual onset with an underlying pathogenesis of repetitive microtrauma, as described in the systematic review.[3] As we athletic trainers continue to educate ourselves regarding working definitions used in epidemiologic research and injury surveillance, such as injuries due to overuse, we will likely see a shift in prevalence and incidence rates of injuries related to sport participation. This information will provide a clearer picture of injury prevalence and incidence rates in athletes. In addition, we believe these data may also provide more information about athletic trainers' workloads and the time allotted for preventing and managing injuries that resulted from an overuse mechanism.

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