Journal of Athletic Training 2024;59(5):447–457
doi: 10.4085/1062-6050-0370.23

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Commentary

Applying the National Institute on Minority Health and Health Disparities Research Framework to Social Determinants of Health in the Context of Sport-Related Concussion: A Clinical Commentary

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Sport-related concussion (SRC) is a prevalent injury. Significant disparities in SRC outcomes exist across racial and ethnic groups. These disparities may be attributed to the unequal distribution of political power (or influence) and resource allocation in various communities, shaping individuals' social determinants of health (SDOH). However, the influence of SDOH on SRC outcomes remains understudied. In this clinical commentary, we use the National Institute on Minority Health and Health Disparities Research Framework and describe how its application can help address gaps in our understanding of SDOH and SRC. This framework provides a comprehensive approach to investigating and addressing health disparities by considering SDOH along multiple levels and domains of influence. Using this framework, athletic trainers can identify areas requiring intervention and better understand how SDOH influence SRC outcomes. This understanding can help athletic trainers develop tailored interventions to promote equitable care for patients with SRC.

Key Words: health equity

Key Points

- Disparities in sport-related concussion outcomes exist across racial and ethnic groups, suggesting that social determinants of health affect these outcomes.
- The National Institute on Minority Health and Health Disparities Research Framework provides a comprehensive approach to studying and addressing health disparities in sport-related concussion outcomes.
- Athletic trainers can use the National Institute on Minority Health and Health Disparities Research Framework to enhance the implementation of management strategies for sport-related concussion with consideration of social determinants of health.

Sport-related concussion (SRC) is a serious and burdensome mild traumatic brain injury. An estimated 1.1 to 1.9 million youth sport- or recreation-related concussions are reported annually in the United States.[1] Despite this high prevalence, a disparity exists in the disclosure of SRC to a trusted individual (eg, athletic trainer [AT], coach), with variations across racial and ethnic groups.[2–5] This disparity extends to different components of SRC, such as knowledge, attitudes, and health care access.[3–9]

The presence of racial inequalities and inequities has been identified in recent SRC literature.[4,6,8–10] Findings from this literature highlight disparities in health outcomes after SRC, with examples including variations in baseline cognitive functioning, psychological well-being, and return-to-play rates among different demographic groups.[3,9,11,12] While examining variations in SRC-related outcomes, researchers have focused on racial comparisons[3,4,6]; however, it is important to recognize that factors beyond race, encompassing various aspects of social determinants of health (SDOH), may be instrumental in influencing these observed differences. *Social determinants of health* are defined as the conditions in which people are born, grow, live, work, and age that can affect health outcomes.[13] The SDOH include social and economic factors such as access to health care services, education, employment opportunities, socioeconomic status (SES), neighborhood and physical environment, social support networks, and cultural norms and values, as well as systemic factors such as policies and legislation.[14,15] Social determinants of health affect both the upstream risk of sustaining an SRC as well as the downstream effects of reporting and recovery.[16]

Social determinants of health drive racial disparities in health outcomes after SRC and can include a lack of access to health care providers and low SES.[6] For example, authors have noted that Black high school students had less

SRC-related knowledge, and further investigation revealed that, among those Black students, most lacked reliable access to health care and attended low-income schools.[6] Similarly, studies of baseline vestibular and oculomotor function among racial groups demonstrated that these differences were likely influenced by SDOH (ie, access to health care, low SES) rather than being inherently linked to race.[8] Addressing SDOH in athletic training clinical practice is paramount to ensuring equitable care for all athletes with SRC, as SDOH play a significant role in determining health outcomes.

Despite researchers' focus on racial disparities in SRC, the larger influence of SDOH on SRC outcomes remains understudied, which has resulted in a significant gap in the current literature. These disparities may be due to social identities (eg, race) being used to structure policies and practices, creating inequities in access to housing, education, resources (eg, food, water), and health care. This lack of understanding hinders the ability to address and alleviate the disparities in SRC outcomes and further deepens the root cause of these disparities by viewing racial differences as inherent and not driven by SDOH. This misattributed cause of disparities based on race is well documented in adjacent allied health fields.[17,18] By investigating the effects of SDOH on SRC outcomes, we can gain valuable insights into the underlying factors contributing to these disparities, acknowledging the intricate interaction between race and the effects of SDOH on SRC.

We propose using the National Institute on Minority Health and Health Disparities (NIMHD) Research Framework to organize and summarize the influence of SDOH on SRC outcomes.[19] The NIMHD Research Framework is a hybrid of the National Institute on Aging (NIA) Health Disparities Research Framework and the socioecological framework.[20–22] The NIA Health Disparities Research Framework provides an approach to understanding health disparities by considering multiple domains, including biological, behavioral, sociocultural, physical or built environments, and the health care system.[20,21] The socioecological model allows for the exploration of health and well-being by considering the interconnectedness of individual, interpersonal, community, and societal levels.[22] This NIMHD Research Framework as a hybrid framework takes a novel approach by considering SDOH within the domains of influence derived from the NIA Health Disparities Research Framework within each level of the socioecological model, offering a comprehensive understanding of health disparities and their effect on diverse populations (Table 1).[20]

To date, few authors have applied the NIMHD Research Framework to sports medicine. This framework is unique, as it includes several key domains of consideration, such as biological factors, behavioral factors, the physical or built environment, the sociocultural environment, and the health care system across key levels of effect.[20] At the highest level, the framework emphasizes the effect of societal and policy factors on health disparities.[20] At the community level, it highlights the importance of organizational and social environments in shaping health outcomes.[20] At the interpersonal level, the framework acknowledges the significance of relationships and social influences on individual health, whereas the individual level focuses on individual experiences and behaviors.[20] By using this framework, ATs can identify areas requiring intervention and develop a deeper understanding of how various SDOH

Table 1. Social Determinants of Health in the National Institute on Minority Health and Health Disparities Research Framework[20]

	Level of Influence			
Domain of Influence[19]	Individual	Interpersonal	Community	Societal
Biological	Biological vulnerability and mechanisms	Caregiver-child interaction, family microbiome	Community illness exposure, herd immunity	Sanitation, immunization, pathogen exposure
Behavioral	Health behaviors, coping strategies	Family functioning, school or work functioning	Community functioning	Policies and laws
Physical or built environment	Personal environment	Household environment, school or work environment	Community environment, community resources	Societal structure
Sociocultural environment	Sociodemographics, limited English, cultural identity, response to discrimination	Social networks, family or peer norms, interpersonal discrimination	Community norms, local structural discrimination	Societal norms, societal structural discrimination
Health care system	Insurance coverage, health literacy, treatment preferences	Patient-clinician relationship, medical decision-making	Availability of health services, safety net services	Quality of care, health care policies
Health outcomes	Individual health	Family or organizational health	Community health	Population health

Table 2. Examples of Factors Associated With Sport-Related Concussion (SRC) in the Biological Domain of the National Institute on Minority Health and Health Disparities Research Framework[a]

	Level of Influence		
	Individual	Interpersonal	Community
Authors	Giza et al[23]	Kroshus et al[24]	Register-Mihalik et al[25]
Year	2014	2018	2020
Sample		236 parents of youth club soccer parents	972 first-year service academy cadets
SRC-related outcomes		SRC knowledge, perceived likelihood of SRC, perceived harm of SRC, parental support pressure, parent-child communication	SRC-related knowledge, attitudes, perceived social norms, and behavioral intention
Key finding	A unique physiological response to concussion and the recovery process exists	Child-parent relationships affect SRC disclosure	Direct contact with and exposure to SRC education are associated with higher intention to disclose SRC symptoms

[a] Limited literature available for the societal level of influence.

interact with demographic factors (ie, race, gender) implicated in SRC outcomes. Therefore, the objective of this clinical commentary was to demonstrate how ATs can use the NIMHD Research Framework to enhance the implementation of management strategies for SRC with consideration of SDOH. Although our clinical commentary focuses on SRC, it is important to recognize that the NIMHD Research Framework has broader applicability to all sport-related injuries. By embracing this framework, ATs can gain a comprehensive understanding of the multifaceted factors contributing to SRC and develop effective strategies to mitigate the potential negative effects of SDOH. Importantly, this clinical commentary serves as an illustrative exploration, aiming to highlight research studies as exemplars rather than providing an exhaustive review of all available research in each domain.

Biological Domain

Within the NIMHD Research Framework, the biological domain considers the unique vulnerabilities, mechanisms, and biological variations among individuals to understand the complex web of disparities in SRC incidence, recovery, and long-term outcomes (Table 2). For instance, biologically, variations have been found between how different sexes (ie, males, females) express symptoms and recover after an SRC.[20]

Biological Domain: Individual Level. The *individual level* of the NIMHD Research Framework refers to the athlete and the factors that influence the person's health behaviors and outcomes, often SDOH.[20] Biological variables at this level include biological vulnerability and mechanisms.[20] Biological athlete factors within the context of SRC encompass various aspects, including genetic predispositions, neurobiological traits, and individual susceptibility to SRC-related effects.[26] Understanding these nuanced biological factors allows health care professionals, including ATs, to comprehensively assess and address the intricate interplay between biology, psychology, and SDOH in the management and recovery process after an SRC. The biological vulnerability of SRC lies in the intricate interplay between the brain's susceptibility to injury and the unique physiological response to trauma experienced by individuals.[23]

Biological Domain: Interpersonal Level. Due to the often invisible nature of SRCs, disclosure remains imperative in order for individuals to receive care in a timely manner.[27] The decision to disclose an SRC is deeply intertwined with interpersonal relationships and established social norms, often influenced by SES, race, and cultural factors.[27] At the interpersonal level, the biological domain encompasses the caregiver-child interaction and the effect of the family microbiome. Quality of the caregiver-child interaction is a crucial component of the biological domain, in which biological and genetic factors intersect with social and environmental influences. In the context of SRC, the quality of the caregiver-child interaction plays a vital role in the management and recovery process, as it influences support, communication, and adherence to medical recommendations, shaping the athlete's overall well-being and safe return to sport.[24] The consideration of parent-child interactions can help ATs gain insights into the intricate connections between biological and social factors, such as the availability of family members and guardians in the home, family dynamics, and parenting styles. Expanding beyond the parent-child interaction, family functioning for older individuals may contribute to SRC outcomes. After SRC, families may not be prepared for the biological, psychological, or social changes that accompany the injury, potentially leading to disrupted family dynamics.[28]

Although caregiver-child interaction has traditionally been emphasized, recent authors have suggested that the family microbiome also contributes to the intricate web of factors influencing SRC outcomes.[29] Children, in particular, exhibited more interpersonal variation in microbiome composition, with pronounced differences based on the geographic location and cultural background of the child and those they interacted with.[29] The family microbiome may be crucial for understanding the underlying importance of the gut-brain axis for overall health after SRC and other brain injuries.

Biological Domain: Community Level. *Community* refers to the structured environment an athlete belongs to that can directly affect health.[30] This can be conceptualized as a school, team, or organization.[30] At the community

Table 3. Examples of Factors Associated With Sport-Related Concussion (SRC) in the Behavioral Domain of the National Institute on Minority Health and Health Disparities Research Framework

	Level of Influence			
	Individual	Interpersonal	Community	Societal
Authors	Register-Mihalik et al[31]	Karmali et al[32]	Clement et al[33]	McGowan Lowrey[34]
Year	2013	2022	2011	2015
Sample	167 high school athletes	31 adults with concussion, 16 health care professionals	49 injured college student-athletes	
SRC-related outcomes	SRC reporting, SRC-related attitudes and knowledge	The recovery process after concussion and barriers to and facilitators of returning to the workplace after concussion	Social support	
Key finding	SRC knowledge and attitudes affect SRC reporting	Family and work functioning affect concussion recovery trajectory	Athletic trainers serve as a great source of social support during injury recovery	Each state mandates a concussion policy; however, compliance varies

level, the biological domain encompasses community illness, exposure, and herd immunity.[20] Sport-related concussion educational programs implemented in communities have the potential to enhance knowledge, raise awareness, and promote safer practices related to SRC.[26,30] By incorporating targeted education initiatives, such as unique training for ATs, coaches, parents, and the athletes themselves, we can empower community members with the necessary tools to identify, respond to, and appropriately manage SRC incidents.

Biological Domain: Societal Level. The *societal level* refers to the broader social, economic, and political factors that shape health disparities.[20] The biological domain at this level includes sanitation, immunization, and pathogen exposure. However, research exploring these factors, specifically in the context of SRC, is limited.

Behavioral Domain

The behavioral domain provides valuable insight into the intricate interplay between individuals' health behaviors and the disparities in SRC outcomes observed in diverse populations (Table 3). Through examining the behavioral determinants that influence health outcomes, the behavioral domain highlights modifiable factors that can drive equitable SRC health outcomes. By elucidating the complex dynamic of individuals' behaviors and their social context, we can contribute to the growing body of knowledge and promote evidence-based strategies that foster equitable SRC outcomes for all athletes.

Behavioral Domain: Individual Level. Behavioral factors contributing to health outcomes at the individual level include health behaviors, such as symptom disclosure and coping strategies. Understanding the intricate interplay between these behavioral factors and SRC outcomes is crucial for ATs and investigators aiming to promote optimal recovery and mitigate disparities. Behavioral factors on the individual level can significantly affect the trajectory of recovery and long-term outcomes after SRC.[31,35] The decision to disclose symptoms is influenced by psychosocial factors such as stigma, perceived social support, and cultural norms. These factors can have profound implications for timely and appropriate SRC management.[36,37] Furthermore, coping strategies adopted by individuals, such as active problem solving, seeking social support, or engaging in maladaptive behaviors, can influence their resilience, symptom management, and overall well-being throughout the recovery process.[38,39]

Behavioral Domain: Interpersonal Level. At the interpersonal level, the behavioral domain includes factors such as family and school or work functioning. *Family functioning* refers to the dynamics, relationships, and communication patterns within a family unit that can affect an individual's SRC experience.[20] A supportive family environment can foster a sense of emotional well-being and provide appropriate care and guidance.[24,40] Similarly, school or work functioning encompasses the systems where individuals attend school or work and how they influence their academic or occupational performance.[20] Adapting to the demands of school or work while recovering from an SRC can be challenging, as symptoms such as difficulties with concentration, memory, or fatigue may affect the athlete's ability to engage fully.[32,41] Adequate support from educators, employers, and peers as well as appropriate accommodations can significantly affect an athlete's successful return to school or work.[32,41]

In addition to family and school or work functioning, the role of coaches, teammates, and parents is pivotal in the management and recovery process after an SRC. Coaches, as influential figures in an athlete's life, can provide guidance, implement appropriate training techniques, and create a safe sporting environment that promotes injury prevention and effective SRC management.[42] Moreover, teammates can contribute to the overall well-being of the injured athlete by offering emotional support, fostering a positive team culture, and understanding the importance of adhering to medical recommendations.[43] Parents, too, play a critical role in the athlete's SRC journey by providing support, advocating for necessary accommodations, and facilitating open communication with health care professionals and school or work personnel.[44]

Behavioral Domain: Community Level. The behavioral domain in the community level includes community functioning, which extends beyond the general community to include the specific athletic community, fans, and the medical community. This broader perspective recognizes the influence of the athletic environment and the interconnectedness of various engaged parties involved in the athlete's well-being. Community functioning in this context

Table 4. Examples of Factors Associated With Sport-Related Concussion (SRC) in the Physical or Built Environment Domain of the National Institute on Minority Health and Health Disparities Research Framework[a]

	Level of Influence		
	Individual	Interpersonal	Community
Authors	Greenhill et al[47]	Pei et al[41]	Eliason et al[48]
Year	2016	2023	2023
Sample	4580 high school students with SRCs		38 studies examining policy and rule changes
SRC-related outcomes	Symptoms, SRC duration, and helmet parameters	Postconcussion school attendance, academic performance, perceptions of academic difficulty, and accommodations for students	
Key finding	An improperly fitting helmet is a risk factor for SRC, with more symptoms of longer duration	Creating a culture of SRC awareness, promoting open communication, and implementing appropriate adjustments can contribute to the athlete's successful return to learning and academic progress	Policy and rule modification may help prevent SRC

[a] Limited literature available for the societal level of influence.

encompasses social support, the perception and reality of being cared for, receiving assistance from others, and being connected to a supportive social network.[33] For athletes, ATs serve as a great source of social support.[33] Because ATs are often with athletes from their initial injury to full return to play, their proximity to the athlete allows them to serve in various roles. These roles enable ATs to develop a unique relationship with the athlete because of the time spent together. This relationship leads to athletes being more satisfied with the type and availability of social support available from ATs.[33] Also, the team culture, which is a fundamental aspect of the athletic community, influences social support dynamics and shapes the overall well-being of athletes.[43] The availability of ATs not only plays a crucial role in community functioning but also significantly influences behaviors related to SRC recognition and reporting. Authors have previously supported the argument that access to ATs can positively affect athletes' ability to recognize and take action after an SRC.[45]

Behavioral Domain: Societal Level. At the societal level, the behavioral domain includes key characteristics such as policies, regulations, and practices implemented by organizations and systems that directly or indirectly affect health disparities.[20] These institutions can include health care systems, educational institutions, government agencies, and community-based organizations. One example of policies that affect health disparities is residential segregation; creating such differences between White and minoritized communities results in structural differences that shape health outcomes such as access to health care, the built environment, and education.[46] Specific to SRC, each state mandates a concussion policy; however, compliance with policies varies.[34]

Physical or Built Environment Domain

The physical or built environment domain within the NIMHD Research Framework explores the profound effect of societal structures and environmental factors on health disparities. This domain recognizes that the places where people live, work, and play significantly shape their health outcomes. The physical or built environment encompasses various elements, such as housing, transportation, community infrastructure, and access to recreational spaces (Table 4). By examining how these factors interact with SDOH, we can gain a deeper understanding of the structural inequities that contribute to disparities in health outcomes. Exploring the physical or built environment domain allows us to identify and address the environmental factors that perpetuate health disparities, paving the way for interventions and policies that create healthier and more equitable communities.

Physical or Built Environment Domain: Individual Level. The individual level of the physical or built environment domain of influence includes the personal environment, the immediate physical surroundings, and the social context in which individuals live, work, and interact. The personal environment is closely intertwined with other SDOH. For example, the personal environment may include the physical condition of one's home, neighborhood safety, access to recreational facilities, and availability of healthy food options. These factors can significantly affect an individual's health and well-being, as they shape opportunities for physical activity, exposure to environmental hazards, and access to nutritious food. Additionally, the social context in the personal environment, such as social support networks, community cohesion, and exposure to social stressors, also plays a crucial role in shaping health outcomes. For instance, individuals who live in close-knit communities with strong social support systems may experience better mental and emotional well-being than those in socially isolated or high-stress environments.

Physical or Built Environment Domain: Interpersonal Level. At the interpersonal level, the physical or built environment domain includes an individual's household environment and school or work environment.[20] Though earlier authors may not have extensively covered the physical location of resources within a school or work environment, the importance of dedicated spaces for SRC management should be acknowledged. These physical spaces could include areas for rest and progressive return, such as an athletic training facility outfitted with the necessary equipment. The availability

Table 5. Examples of Factors Associated With Sport-Related Concussion (SRC) in the Sociocultural Environment Domain of the National Institute on Minority Health and Health Disparities Research Framework

	Level of Influence			
	Individual	Interpersonal	Community	Societal
Authors	Anderson et al[51]	Sanderson et al[37]	Kerr et al[52]	Register-Mihalik et al[53]
Year	2021	2019	2018	2021
Sample	741 collegiate student-athletes	58 blog posts		391 first-year student-athletes
SRC-related outcomes	Personal demographics, SRC history, concussion knowledge	Social support		SRC knowledge, attitudes, perceived social norms, and behavioral intention
Key finding	Personal demographics are associated with concussion nondisclosure in collegiate athletes	Social networks and peer norms exert significant influence on athletes' concussion reporting behaviors, treatment-seeking decisions, and adherence to return-to-play protocols	Popular opinion-leader interventions may reshape community norms toward greater adoption of SRC-prevention policies	More favorable perceived social norms are associated with a higher prevalence to disclose SRC symptoms

and accessibility of these physical resources may play a crucial role in supporting an athlete's recovery trajectory. Future researchers in this domain could further explore the significance of physical aspects within the school or work environment, examining factors such as the ease of access to dedicated areas for rest, rehabilitation, and the overall influence of the built environment on the successful return to learning, work, or play post-SRC.

The *environment* also refers to the availability of a reliable support network and the social dynamics, structures, and interactions that can contribute to the athlete's overall recovery trajectory.[20] This encompasses factors such as the presence of dedicated SRC protocols and guidelines, the availability of trained staff who can recognize and respond to SRC, and the provision of appropriate accommodations to support individuals during their recovery process. By creating a culture of SRC awareness, promoting open communication, and implementing appropriate adjustments, the home and school or work environment can contribute to the athlete's successful return to learning and academic progress.

Furthermore, environmental factors, including screen time, may influence SRC recovery.[49] Investigating the effect of screen time, lighting, and other environmental elements within the school or work setting on SRC outcomes adds a valuable dimension to our understanding of the effect of the physical environment on SRC recovery.

Physical or Built Environment Domain: Community Level. At the community level, the physical or built environment domain encompasses the community environment and community resources contributing to health outcomes.[20] The community environment is the context and places where people spend their lives.[15] It is characterized by housing, transportation, access to health systems and services, and other SDOH.[14] Considering individuals' environment is essential to ensure that their space is safe and promotes positive health behaviors. Facilities and playing surfaces that adhere to safety standards and provide appropriate equipment significantly reduce the risk of SRCs.[50] In addition, protective measures, such as proper headgear and padding, can minimize the effect and severity of head injuries.[50] Creating an environment that prioritizes athlete safety and follows evidence-based guidelines for SRC prevention can significantly reduce the occurrence and effect of SRC in the community.

Physical or Built Environment Domain: Societal Level. The physical or built environment domain, at the societal level, highlights the role of societal structure in shaping health outcomes. Societal structure emphasizes the significant influence of social, economic, and political systems on shaping the physical environment of a society.[20] This domain recognizes that health outcomes are shaped by various factors, including SDOH, that are deeply embedded in the organization and functioning of society.[20] These factors include access to quality health care services, exposure to environmental hazards, social cohesion, and community resources.[20]

Sociocultural Environment Domain

The sociocultural environment domain delves into the interplay between societal norms, cultural values, interpersonal relationships, and discrimination that collectively shape health outcomes among diverse populations. Understanding the sociocultural context surrounding SRC is crucial for unraveling the complex web of factors that contribute to unequal health outcomes and identifying targeted interventions that can promote health equity (Table 5). By examining the sociocultural environment, researchers and practitioners gain valuable insights into how social networks, family and peer norms, and experiences of discrimination affect health behaviors, access to care, and overall well-being. This domain provides a lens through which to analyze and address the sociocultural components of disparities in SRC outcomes, ultimately leading to more inclusive and effective strategies for improving health outcomes for all individuals.

Sociocultural Environment Domain: Individual Level. The sociocultural environment at the individual level encompasses an individual's sociodemographics, language proficiency, cultural identity, and response to discrimination. For example, sociodemographics such as race, ethnicity, SES, and educational background can significantly

affect access to resources and health care utilization. For instance, individuals from lower socioeconomic backgrounds may face financial barriers that limit their access to specialized SRC care or delay their seeking medical attention.[54] Language proficiency is another important aspect, as individuals with a limited ability to speak, write, and understand the dominant language in a particular area may encounter challenges in communicating their symptoms or understanding medical instructions, potentially affecting their recovery outcomes.[55] Additionally, cultural identity and response to discrimination play a role in shaping an individual's experience with SRC. Cultural beliefs, values, and practices related to health and healing may influence the acceptance of SRC diagnoses, adherence to treatment recommendations, and engagement in follow-up care.[56] These sociodemographic factors are important considerations in understanding the effect of SRC, as they can influence an individual's access to resources, health care utilization, and recovery outcomes.[30]

Sociocultural Environment Domain: Interpersonal Level. At the interpersonal level, the sociocultural environment includes social networks, family or peer norms, and interpersonal discrimination.[20] Social networks play a crucial role in the sociocultural environment surrounding SRC. Individuals' connections and relationships within their social network can influence their SRC-related experiences and outcomes.[44] Having a supportive network of friends, teammates, coaches, and ATs who understand and prioritize SRC management can contribute to the athlete's adherence to recommended protocols and promote a safe return to play.[37] The concept of an individual's connections and relationships demonstrates significant overlap with the behavioral domain. These networks exert a profound effect on an individual's SRC-related experiences and outcomes, as they can provide valuable support, guidance, and resources through the recovery process.

Family and peer norms in the sociocultural environment also shape the athlete's experience of SRC. Norms within the athlete's immediate family and peer group, such as beliefs about playing through an SRC or downplaying the severity of SRC, can affect the athlete's willingness to report symptoms and seek timely medical attention.[51] Addressing and shifting these norms toward a culture of SRC awareness and prioritizing athlete safety are essential in supporting optimal SRC management and reducing health disparities.

Interpersonal discrimination in the sociocultural environment is another important aspect to consider in the context of SRC. Athletes from marginalized communities may face additional barriers and challenges regarding accessing appropriate care, receiving fair treatment, and navigating the SRC management process.[9,10] Discrimination based on factors such as race, ethnicity, SES, or gender can exacerbate existing health disparities and contribute to inequities in SRC diagnosis, treatment, and support.

Sociocultural Environment Domain: Community Level. The sociocultural environment domain at the community level includes community norms and local structural discrimination. Community norms can reflect the prevailing beliefs, attitudes, and practices related to SRC within a specific community.[52] For example, in some communities, norms may prioritize winning and downplay the significance of SRC, leading to a culture of playing through injuries and inadequate reporting.[51] *Local structural discrimination* refers to policies of governing institutions and the behaviors and actions of the individuals who control these institutions.[57] Many states have no laws or policies that protect against discrimination based on sexual or gender identity.[58] Local structural discrimination may contribute to disparities in education, housing, and access to health care.[57] For health care providers, recognizing and addressing these experiences of discrimination is crucial for promoting equity, ensuring fair treatment, and improving health outcomes for all individuals affected by SRC.

Sociocultural Environment Domain: Societal Level. At the societal level, the sociocultural environment encompasses not only the societal norms that shape the perception and management of SRC but also the broader societal structural discrimination that may contribute to disparities in SRC recognition, diagnosis, and access to appropriate care.[20] Societal norms surrounding SRC can influence how athletes, coaches, parents, and health care professionals perceive and respond to SRC, affecting disclosure and treatment-seeking behaviors.[52,53] Furthermore, societal structural discrimination, such as racial or socioeconomic disparities, can exacerbate existing inequalities in SRC outcomes, including access to concussion education, medical resources, and supportive services.

Health Care System Domain

The health care system domain encompasses a broad range of influences including but not limited to an individual's insurance coverage, health literacy, and treatment preferences within the larger context of the health care system.[19] This domain recognizes that access to quality care and the ability to navigate the complex health care landscape are influenced not only by individual characteristics but also by broader societal structures, policies, and norms (see Table 6).

Health Care System Domain: Individual Level. At the individual level, an individual athlete's relevant knowledge and attitude toward factors associated with SRC contribute to his or her health literacy.[61] This includes the understanding of risk factors, preventive measures, and their behaviors and decision-making related to SRC.[61] Athletes need to be aware of various factors that aid in recognizing and responding to SRC, such as identifying signs and symptoms, knowing the necessary steps to take after an injury, and understanding the potential consequences.[27] Based on several studies,[2,6,31,62,63] it seems that athletes possess a moderate level of knowledge, but gaps persist, particularly concerning the signs and symptoms of SRC. Lack of knowledge about SRC is 1 of the primary drivers of nondisclosure among athletes.[27] This lack of awareness can stem from various factors, such as insufficient education and awareness campaigns targeted specifically at athletes, coaches, and parents.[64] Bridging these knowledge gaps and improving SRC literacy among athletes is a critical component to ensuring timely recognition, appropriate management, and optimal outcomes for SRC. By enhancing athletes' knowledge and understanding of SRC, we can empower them to make informed decisions regarding their health and well-being, promote early reporting of symptoms, and facilitate timely access to appropriate medical care.

Table 6. Examples of Factors Associated With Sport-Related Concussion (SRC) in the Health Care System Domain of the National Institute on Minority Health and Health Disparities Research Framework

	Level of Influence			
	Individual	Interpersonal	Community	Societal
Authors	Wallace et al[10]	Sanderson et al[37]	Wallace et al[59]	Gibson et al[60]
Year	2021	2019	2022	2015
Sample	1263 child visits to the emergency department for concussion	58 blog posts	582 adolescent athletes	Commercially insured children aged 12–18 y from all 50 states and the District of Columbia, January 1, 2006–June 30, 2009
SRC-related outcomes	Diagnosis, mechanism of injury	Social support	Location of first health system contact, time from injury to first health system contact, time to in-person SRC clinic visit, presence of established care	Emergency department and related health care utilization rates for concussion
Key finding	Sociodemographic differences exist in emergency department diagnosis of concussion	The athlete-clinician relationship plays a crucial role in injury management, influencing athletes' compliance with treatment plans and their disclosure of symptoms	An established health clinic, within a community or school system, focusing on the care and treatment of SRC may be helpful in promoting equitable health care access across diverse patient demographics	Concussion legislation has had a positive effect on health care utilization for children with concussion

Moreover, health literacy extends beyond recognizing symptoms to encompass an individual's choice of health care systems and health care providers, which can influence recovery.[65] Exploring factors influencing athletes' health care decisions, including provider selection, adds a valuable dimension to the understanding of SRC recovery outcomes. Addressing these aspects can further encourage athletes to make informed decisions, ensuring timely recognition, appropriate management, and optimal outcomes for SRC. Comprehensive educational efforts should involve not only athletes but also coaches, parents, and other engaged parties involved in their care and support network to foster a collective understanding and promote a culture of SRC awareness and safety.[66]

Health Care System Domain: Interpersonal Level. The health care system domain, at the interpersonal level, includes the athlete-clinician relationship and medical decision-making. Specific to SRC, individuals from a lower SES are more likely to face barriers in accessing timely and adequate health care, which can affect their decision to disclose an SRC due to concerns about potential financial burdens or limited access to appropriate medical resources.[2,4] Additionally, cultural beliefs and stigmas surrounding SRC may further contribute to the decision-making process.[38] When authors described factors influencing National Collegiate Athletic Association athletes' decision to disclose SRC, stigma was cited as a barrier. Several athletes described being perceived as weak or faking their injury as factors that made self-disclosure more difficult.[45] This stigma, rooted in relationships with other sports constituents, may influence interpersonal dynamics within the health care system, contributing to athletes' relationships with health care providers. The fear of judgment or disbelief may strain the athlete-provider relationship, potentially hindering effective communication and timely disclosure of SRCs. In addition to cultural beliefs, non-White populations have historically faced discrimination and maltreatment within the medical community, leading to mistrust and skepticism toward health care providers.[67,68] This prevailing mistrust, combined with ongoing disparities in health care access, further emphasizes the importance of interpersonal factors related to SDOH in shaping athlete trust and adherence to SRC management practices. Mistrust in the health care system can lead to underreporting and underdiagnosis. Addressing SDOH and building trust between marginalized communities and ATs are crucial in ensuring that all individuals receive appropriate care for SRC. This trust can be built by increasing community engagement and diversifying the workforce to gain insight into the social dynamics and cultural health beliefs of different marginalized communities.

Health Care System Domain: Community Level. At the community level, the health care system includes characteristics related to the availability of services and safety net services. Access to an AT in the community is vital in promoting positive health outcomes after SRC.[4,51] Having a dedicated AT accessible onsite ensures immediate and appropriate management of SRCs. Athletic trainers can provide education on SRC prevention, recognition, and proper return-to-play protocols and establish a trusted relationship with athletes, facilitating open communication about SRC symptoms and concerns. By having an AT present, athletes are more likely to receive timely care, reducing the potential risk associated with unreported or mismanaged SRC.[15]

Health Care System Domain: Societal Level. The health care system domain, at the societal level, involves the quality of care provided to athletes with SRC and the complex web of health care policies that shape SRC management. *Quality of care* involves the competence and expertise of health care professionals in diagnosing and treating SRC, the availability of specialized providers, and the use of evidence-based practices in SRC management; the use of evidence-based practices in SRC management, in particular, is crucial for optimizing outcomes. Alongside the quality of

care, health care policies significantly shape the landscape of SRC management. Legislative measures, return-to-play guidelines, and educational initiatives aimed at increasing awareness and prevention all contribute to creating a comprehensive system that supports the health and well-being of athletes.[20,50] It is worth noting that the effect of these policies can be observed through empirical evidence. For instance, immediately after the implementation of SRC laws, significantly increased trends of reported new and recurrent concussions were observed.[69] However, a notable finding was a subsequent decline in recurrent concussion rates approximately 2 years after the laws went into effect.[69] These findings highlight the ongoing evolution of health care policies and their potential influence on SRC outcomes, emphasizing the need for continuous monitoring, evaluation, and refinement of these policies to ensure the highest standard of care for athletes.[17,39]

Future Research Directions

Understanding the influence of SDOH on SRC disclosure, knowledge, attitudes, and health care access is crucial for addressing disparities across various demographic groups. Although prior authors have offered valuable insights, they have often fallen short of thoroughly examining the diverse domains that contribute to these disparities. To move beyond the limitations of a narrow focus—in which race and ethnicity have been used as a proxy for SDOH—future investigators should employ a combination of ethnographic, community-engaged, qualitative, and quantitative approaches. Involving members of minoritized communities in research and committing to explore solutions for upstream SDOH underlying health disparities is one of the ways we can decrease the societal disparities driving inequity. This approach acknowledges that disparities in SRC recovery are not solely determined by demographic factors (ie, race) but are influenced by the intricate interplay of the individual, interpersonal, community, and societal levels of various domains. By embracing the NIMHD Research Framework, we can revolutionize our understanding of the factors affecting SRC and advance equitable clinical care for individuals affected by SRC.

Clinical Application

Athletic trainers have a duty to identify and meet the needs of their athletes to optimize health outcomes after SRC. They play a critical role in comprehending the systemic structures, legislation, and policies that affect access to health care for SRC. It is essential for ATs to recognize SDOH and provide treatment that aligns with current practice standards and meets the individual needs of athletes. By measuring SDOH and incorporating this information into education and management strategies, ATs can assess the practices and policies concerning each domain of influence at the individual, interpersonal, community, and society levels that perpetuate the negative effects of SDOH. Equipped with the understanding of the NIMHD Research Framework and evidence-based approaches, ATs can effectively advocate for policy changes and systemic improvements, addressing health disparities and promoting equitable access to care for all individuals affected by SRC. Furthermore, as ATs hold a prominent position in the health care system domain, it is crucial for ATs to engage in diversity, equity, inclusion, and accessibility continuing education to enhance their understanding of the diverse experiences and needs of athletes. By seeking out educational resources that specifically address these aspects, ATs can develop the necessary skills and knowledge to navigate the interpersonal factors influenced by SDOH in their clinical practice. Addressing these factors could include creating inclusive environments, being culturally sensitive to the nuances that may affect SRC disclosure and management, and addressing barriers related to SDOH that can affect athletes' access to care. Prioritizing diversity, equity, inclusion, and accessibility in continuing education enables ATs to provide comprehensive and patient-centered care, ultimately improving SRC outcomes for athletes from all backgrounds.

CONCLUSIONS

The analysis of the societal, behavioral, physical or built environment, sociocultural, and health care system domains unveils the intricate network of factors influencing disparities in SRC outcomes. Understanding these complexities across individual, interpersonal, community, and societal levels is vital for advancing research, clinical care, and policy initiatives. The NIMHD Research Framework offers a valuable lens for researchers, practitioners, and ATs to contextualize SRC within the broader spectrum of SDOH. The application of the NIMHD Research Framework enables ATs to contribute to the enhancement of patient-centered care, ultimately promoting equitable SRC outcomes for athletes from diverse backgrounds.

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