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Dolna 17, Warsaw,
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+48 226 0 227 03
editorial_office@rsglobal.pl

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HEALTH IMPLICATIONS OF COMPETITIVE ESPORTS: A SYSTEMATIC REVIEW OF PHYSICAL, MENTAL AND SOCIOBEHAVIORAL OUTCOMES

Kamil Turlej *(Corresponding Author, Email: kturlej99@gmail.com)*
University Clinical Center of the Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0008-2919-284X

Anastazja Orłowa
University Clinical Center of the Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0005-5125-3686

Aleksandra Oparcik
Medical Center HCP, Poznań, Poland
ORCID ID: 0009-0008-0438-3797

Kinga Szyszka
J. Gromkowski Provincial Specialist Hospital in Wrocław, Wrocław, Poland
ORCID ID: 0009-0001-3467-4121

Klaudia Martyna Patrzykąt
109th Military Hospital with Policlinic in Szczecin, Szczecin, Poland
ORCID ID: 0009-0000-9440-5444

Marta Cieślak
University Clinical Hospital in Poznań, Poznań, Poland
ORCID ID: 0009-0004-5522-3786

Anita Pakuła
Medical University of Katowice, Katowice, Poland
ORCID ID: 0009-0002-7866-2939

Anna Baranowska
University Clinical Hospital No. 2, Pomeranian Medical University in Szczecin, Szczecin, Poland
ORCID ID: 0009-0006-1762-2414

Laura Kurczoba
Józef Struś Multi-Specialist Municipal Hospital, Poznań, Poland
ORCID ID: 0009-0004-1330-991X

Julia Pawłowska
St. Barbara Provincial Specialist Hospital No. 5 in Sosnowiec, Sosnowiec, Poland
ORCID ID: 0009-0004-4309-0226

ABSTRACT

Background: Competitive electronic sports (esports) represent a rapidly expanding global discipline with distinctive training loads and lifestyle patterns. While esports provide opportunities for performance development and social connectedness, they also raise concerns regarding musculoskeletal strain, sleep disruption, sedentary cardiometabolic risk, mental-health burden, and the use of cognitive enhancers.
Objective: To systematically synthesize evidence from last decade on physical, psychological, and sociobehavioral health outcomes associated with competitive esports participation, and to evaluate implications for clinical practice, athlete welfare, and public-health policy.
Methods: We will search PubMed/PMC, Scopus, Embase and Web of Science. Eligible studies include observational research, randomized trials, systematic reviews, and position statements assessing health outcomes in competitive gamers or comparing esports athletes with controls. Outcomes include musculoskeletal symptoms, sleep and circadian patterns, mental health (depression, anxiety, stress, problematic gaming), cardiometabolic markers and sedentary behavior, visual strain, and stimulant/nootropic use. A meta-analysis or narrative synthesis will be performed where appropriate, with subgroup analyses by age, competitive level, and game genre.
Results: Evidence consistently shows high rates of musculoskeletal complaints, sleep irregularities, and sedentary behavior among professional eAthletes. Studies also report mixed cardiometabolic findings, mental-health vulnerabilities, and emerging concerns regarding performance-enhancing stimulant or nootropic use. Heterogeneity in study methods and definitions limits data pooling but identifies priority areas for prevention.
Conclusions: Overall, competitive esports are associated with a multifaceted health profile encompassing physical, psychological, and lifestyle domains. Standardized methodologies, longitudinal monitoring, and structured pre-participation screening are needed to inform evidence-based guidelines and improve athlete safety across clinical, public-health, and governance settings.

KEYWORDS

Esports, Competitive Esports, Musculoskeletal Complaints, Sleep Irregularities

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Introduction

Esports—defined as organized and competitive video gaming—has undergone a remarkable transformation over the past decade, progressing from a niche pastime into a globally recognized performance domain. Its contemporary structure increasingly mirrors that of traditional elite sports, supported by professional teams, formal training systems, international tournament circuits, and advanced technological infrastructure [1,2]. In this environment, modern esports competitors operate as high-performance athletes. They are required to sustain rapid cognitive processing, precise visuomotor execution, and efficient decision-making while simultaneously managing psychological pressure, public exposure, and scrutiny from broadcasting platforms and social media [3,4].

Growing professionalization has also intensified interest in the potential health implications associated with competitive esports participation. Evidence indicates that the physiological and behavioural demands placed on esports athletes differ substantially from those observed in both recreational gamers and traditional athletes. One of the most consistently reported concerns involves musculoskeletal strain arising from repetitive fine-motor movements, constrained postures, and prolonged periods of immobility. Pain and discomfort typically affect the wrists, hands, neck, and thoracic spine, and their prevalence increases in proportion to daily training duration [5–8,18].

Sleep disturbances represent another prominent component of the esports health profile. Many professional players engage in late-evening or nighttime training, compete in online scrimmages across

multiple time zones, or travel internationally for tournaments. As a result, numerous studies have documented shortened sleep duration, delayed sleep timing, and reduced sleep efficiency among esports athletes—factors associated with impaired reaction speed, diminished emotional regulation, and poorer cognitive functioning [9,10,32].

Psychological load constitutes an equally important challenge. Competitive players routinely face stressors related to ranking systems, unstable contracts, social-media engagement, and ongoing public visibility. These pressures may contribute to heightened anxiety, burnout-like symptoms, and mood instability [11–13]. Moreover, the design characteristics of esports titles—characterized by rapid reinforcement loops and high-frequency reward cycles—can make balancing intense training schedules with adequate recovery particularly difficult.

From a broader health perspective, the sedentary nature of esports training is also noteworthy. Professional players commonly spend 8–12 hours per day seated, a pattern associated with metabolic and autonomic dysregulation even in individuals with normal body weight [14–16,22,28,37]. Competitive match play additionally elicits strong autonomic responses, including sharp increases in heart rate and blood pressure that, at peak intensity, may resemble physiological reactions seen in traditional high-stress sports environments [17].

Ocular symptoms represent a further area of concern. Extended screen exposure, high luminance, reduced blink frequency, and prolonged visual concentration can lead to eye dryness, headaches, and decrements in visual clarity—factors that can directly affect performance [18].

Increasing attention has also been directed toward the use of stimulants and nootropics. Many players consume caffeine and energy drinks, and some report the use of psychostimulants or over-the-counter cognitive enhancers to sustain alertness or endurance during prolonged practice sessions [23–25]. The absence of unified anti-doping regulations across esports organizations complicates monitoring and regulation in this area.

Despite these risks, existing literature also highlights potential advantages of structured esports involvement, such as improvements in cognitive skills, teamwork, and executive functions [20]. Nevertheless, the rapid global expansion of esports, its significant influence on younger populations, and the lack of standardized health guidelines underscore the need for comprehensive evaluation and targeted preventive frameworks [21,22].

This review aims to integrate research from the past decade concerning the physical, psychological, and behavioural health of esports athletes, identify key patterns of risk, and highlight areas requiring further clinical, scientific, and policy-oriented attention.

Methods

This review was conducted in accordance with the PRISMA 2020 guidelines. A comprehensive literature search was carried out across four major databases—PubMed/PMC, Scopus, Embase and Web of Science—to identify studies published between January 2015 and January 2025 that examined health-related outcomes in competitive esports participants. Only articles written in English were considered. The search strategy combined terms related to esports (e.g., esports, e-athletes, competitive gaming) with keywords reflecting physical, psychological and behavioural health domains.

Because notable heterogeneity was expected across study designs, outcome definitions and measurement tools, most findings were synthesized narratively. Meta-analysis was planned only for outcomes reported in at least three comparable studies. When possible, subgroup patterns were explored according to age group, competitive level (professional vs. amateur) and game genre. Certainty of evidence for each outcome domain was appraised following GRADE recommendations.

Musculoskeletal Outcomes

Musculoskeletal strain emerged as one of the most consistently documented concerns among esports athletes, with studies reporting substantial symptom prevalence and dose–response patterns linked to daily training volume. Across multiple cohorts, neck pain affected approximately 40–55% of players, upper thoracic discomfort was noted by 30–40%, and wrist and hand pain was reported by 35–50% of competitors [5–8]. Professional players, who frequently train for 6–10 hours per day, exhibited the highest symptom burden [18]. Pain involving the shoulders and lumbar region was also common, though reported somewhat less frequently.

Biomechanical analyses provided insight into underlying mechanisms. High-level players execute hundreds of precise hand and finger movements per minute, often amounting to tens of thousands of repetitive actions during a single training day—exposure patterns similar to those associated with overuse injuries in

other computer-intensive occupations [6]. Electromyography studies demonstrated elevated trapezius activation, abnormal wrist-extension torque patterns, faster onset of muscle fatigue and reduced grip endurance over prolonged sessions. Some athletes displayed signs suggestive of developing tendinopathies such as De Quervain's tenosynovitis, lateral epicondylitis and early median nerve compression, although formal diagnostic data remained limited.

Postural analysis revealed that forward-head positioning, often exceeding 20–30 degrees of cervical flexion, substantially increased mechanical load across the cervical spine. Prolonged static positioning, especially when combined with inadequate ergonomic support (non-adjustable chairs, inappropriate desk height, or poor monitor placement), significantly amplified discomfort intensity [7,8]. Observational data from tournaments indicated a progressive increase in musculoskeletal pain during multi-day events, likely reflecting cumulative tissue stress without sufficient recovery opportunities.

Functional consequences were notable. Several studies reported that players experiencing musculoskeletal pain also demonstrated measurable reductions in performance metrics, including slower reaction time, diminished precision in fine-motor tasks and increased variability in aim consistency during matches [18]. Despite these findings, only a minority of teams appeared to implement routine physiotherapy, ergonomic assessments or preventative conditioning programs, despite recommendations from clinical and sports-medicine experts [3,4].

Sleep and Circadian Health

Sleep disturbances were a recurrent finding across studies. Reported nightly sleep durations among esports athletes frequently ranged between 5.5 and 6.5 hours—well below the 7–9 hours recommended for adults—and often decreased further during competitive periods [9]. Circadian misalignment was common: 40–55% of players reported sleeping after 02:00, influenced by late-night training blocks, online scrimmages scheduled across time zones and the stimulating effects of prolonged screen exposure [10].

Objective measures from actigraphy and sleep-tracking devices indicated reduced sleep efficiency, prolonged sleep-onset latency and increased nighttime awakenings. Sleep efficiency values under 85% were typical in high-stress training phases, whereas elite athletic norms usually exceed 90% [9,32]. Sleep restriction was associated with slower visuomotor reactions, impaired cognitive flexibility and performance instability during longer matches. Fatigue-related decrements included reaction-time delays of 15–22 ms and reductions in short-term working-memory accuracy of 8–12% [32]. These impairments were particularly evident during multitasking situations, such as high-intensity team fights or rapid tactical decision-making moments.

An important finding across studies was the bidirectional relationship between sleep quality and psychological strain. Increased stress and performance anxiety predicted delayed sleep onset and poorer sleep efficiency, while insufficient sleep in turn exacerbated irritability, emotional lability and subjective stress levels [9–11]. Despite the clear importance of sleep health for cognitive performance and recovery, the literature revealed a lack of interventional trials targeting sleep optimization in esports.

Psychological and Mental-Health Outcomes

Psychological health was a prominent theme, with consistent evidence indicating that esports competitors face considerable mental-load demands. Rates of stress, anxiety and burnout-related symptoms were elevated relative to age-matched non-esports populations [11]. Across studies, 18–32% of players reported anxiety symptoms within clinically meaningful ranges, while depressive symptoms affected 12–23% of respondents. Burnout-like profiles were observed in roughly one-quarter to one-third of players, commonly characterized by emotional exhaustion and reduced sense of accomplishment [12].

Physiological indicators of stress supported these findings. Elevated resting heart rate, reduced heart rate variability and increased cortisol levels were documented during periods of intensive training or competition, though cortisol data were available from only a limited number of studies [11,12]. Performance anxiety was prevalent among elite players, often driven by concerns about ranking fluctuations, team selection, sponsorship obligations and public criticism in online forums.

Social media was identified as a unique stressor in esports. Unlike traditional athletes, esports competitors often interact directly with fan communities through streaming platforms and social networks, exposing them to unfiltered feedback, online harassment and constant performance scrutiny [12]. These factors contributed to emotional volatility and pressure to maintain a consistent public persona.

A subset of studies examined the relationship between competitive gaming and problematic gaming behaviours. Although few professional players met criteria for gaming disorder, some exhibited maladaptive

engagement patterns, including training despite fatigue, difficulty disengaging from practice sessions and prioritizing gaming over basic self-care [13,30]. These patterns were more common among younger players navigating high training loads without structured recovery strategies.

Cardiometabolic Health and Sedentary Behaviour

Sedentary exposure constituted another major domain. Competitive esports players routinely engaged in 8–12 hours of sitting per day, often with minimal breaks—levels comparable to high-risk sedentary occupations associated with metabolic dysregulation [14–16,37]. Although most players maintained normal BMI values, cardiometabolic markers suggested early physiological shifts. Studies described elevated resting heart rate (often 80–90 bpm), persistent sympathetic activation and borderline fasting glucose values (typically 5.4–5.8 mmol/L) in small athlete cohorts [22,28].

Laboratory findings also indicated increased triglycerides, modest reductions in HDL cholesterol and elevated inflammatory markers such as CRP in populations exposed to prolonged sitting [14]. While direct longitudinal evidence in esports athletes was limited, these patterns raise concern for long-term cardiometabolic risk even in populations that appear otherwise healthy.

The few interventional studies available demonstrated that incorporating brief activity breaks—such as a 6-minute walk performed hourly—significantly improved lower-limb circulation, subjective fatigue, postural alignment and perceived cognitive sharpness during gameplay [19]. These results suggest that even minimal movement may counteract some detrimental effects of prolonged sedentary behaviour, though adoption of such strategies in professional settings remains limited.

Esports-specific cardiovascular responses during high-pressure matches were striking. Heart rate elevations of 30–50 bpm above resting values and systolic blood pressure increases of 15–25 mmHg were observed during intense competitive moments [17]. Some players experienced palpitations, tremor or presyncopal sensations, particularly during elimination rounds or high-stakes scenarios. These findings indicate that esports elicit substantial autonomic arousal comparable to traditional competitive sports despite limited gross physical activity.

Ocular and Visual Outcomes

Visual strain was frequently reported among esports athletes. Across studies, 30–55% of players reported symptoms consistent with digital eye-strain syndrome, including dryness, burning sensations, blurred vision and headaches [18]. Blink rate during gameplay decreased dramatically—from natural rates of 15–20 blinks per minute to as few as 5–7 blinks—resulting in tear-film instability and ocular-surface irritation.

Prolonged attention to high-refresh-rate monitors, small visual targets and fast-moving stimuli contributed to faster fatigue onset and decreased visual acuity during long sessions. Performance consequences included slower target acquisition, increased reaction-time variability and reduced accuracy in tracking tasks. Symptom severity exhibited a dose-dependent relationship with daily play duration: players training more than 6 hours per day showed the highest rates of complaints [18].

Stimulant, Energy-Drink and Nootropic Use

The use of stimulants and cognitive enhancers was an emerging but increasingly documented issue. Reported caffeine intake was nearly universal among competitive players, and 40–60% consumed energy drinks daily or several times per week [23]. A smaller proportion disclosed the use of prescription stimulants (e.g., methylphenidate, modafinil) or commercially marketed nootropic compounds intended to improve focus and delay fatigue [24].

Motivations for substance use related primarily to maintaining alertness during extended practice sessions, countering insufficient sleep, and enhancing perceived performance consistency during tournaments. The lack of standardized anti-doping policies across esports organizations contributed to variable monitoring practices, raising concerns that young amateur players might emulate these behaviours [25].

Training Load, Cognitive Demands and Performance Factors

Training practices increasingly resembled structured regimens seen in traditional sports, incorporating mechanical skills training, tactical sessions, VOD analysis and cognitive drills [26]. However, health-protective components such as physical conditioning, mobility work, rest scheduling and psychological skills training were inconsistently integrated. Many players described a pervasive “grind culture,” wherein long

hours of practice were perceived as essential for competitive success, even when contributing to physical or mental fatigue.

Expert commentaries noted a lack of interdisciplinary support within most organizations and recommended broader involvement of sports-medicine clinicians, physiotherapists, psychologists, nutrition specialists and sleep consultants [3,21,22].

Discussion

The findings of this review show that competitive esports expose players to a constellation of physical and psychological demands that are distinct from both recreational gaming and traditional athletic competition. Across the literature, musculoskeletal strain emerged as one of the clearest and most consistent challenges. The combination of repetitive fine-motor activity, static posture and prolonged uninterrupted sitting creates a risk profile similar to that observed in high-intensity computer-based occupations. Despite the magnitude of this problem, formal preventive strategies—including ergonomics education, workstation modification and physiotherapy support—remain largely absent in most esports environments. This gap reflects the rapid expansion of the industry, in which performance development has outpaced the establishment of structured health-protection frameworks.

Sleep and circadian disruption represent another critical issue for esports athletes. Irregular schedules, late-night training blocks and cross-continental online competition patterns interfere with sleep duration and quality, leading to cognitive slowing, mood instability and impaired emotional regulation. As performance in esports depends heavily on rapid decision-making and fine visuomotor precision, even modest reductions in sleep quality may have meaningful competitive consequences. Yet, despite the importance of sleep for sustaining high-level cognitive performance, targeted sleep interventions have been largely unexplored in professional esports settings.

Psychological stress also plays a central role in shaping the health profile of esports athletes. The combination of public visibility, ranking pressure, financial instability and online audience interaction creates a unique mental-health landscape. Emotional exhaustion, anxiety and burnout-like symptoms were recurring findings across multiple studies, illustrating the need for structured psychological support, resilience training and access to qualified mental-health professionals. Unlike traditional athletes, esports competitors often lack institutional frameworks that monitor psychological wellness, leaving many players without the resources necessary to manage chronic stressors inherent to the esports environment.

The sedentary nature of competitive gaming adds another layer of health risk. Although most players maintain a normal body weight, physiological markers suggest early signs of metabolic imbalance, including elevated resting heart rate, reduced autonomic flexibility and borderline abnormalities in glucose or lipid parameters. These findings highlight that cardiometabolic strain may occur independently of overweight status. Interventional evidence suggests that even brief bouts of physical activity may alleviate some of the negative effects of extended sitting, but widespread adoption of such strategies remains limited within esports culture.

Autonomic responses recorded during competitions further emphasise the physiological intensity of esports. Rapid increases in heart rate and blood pressure during high-stakes play mirror stress reactions seen in traditional competitive sports. While such responses are not inherently harmful, repeated exposure without adequate recovery could contribute to long-term autonomic dysregulation. These observations support the concept that esports should be treated as a form of high-pressure cognitive athletics requiring structured recovery strategies.

Visual strain was also commonly reported, driven by long hours of screen exposure, reduced blink rate and high visual-processing demands. These symptoms have direct implications for in-game performance, underscoring the need for ocular-health guidelines, visual-ergonomic education and regular screening.

Another emerging issue concerns the widespread use of stimulants, energy drinks and, in some cases, nootropics. While many players rely on caffeine as part of normal practice routines, reports of more potent substances raise concerns regarding regulation, health risks and potential normalization of pharmacological enhancement within the esports community. The absence of unified anti-doping standards across leagues creates uncertainty and may increase the likelihood of misuse, particularly among younger players aspiring to reach professional levels.

Collectively, the evidence demonstrates that esports athletes operate within a demanding context in which multiple risk factors converge. Physical strain, psychological pressure, sleep disruption, sedentary exposure and stimulant use interact in ways that may amplify health vulnerabilities. At the same time, the

organizational structures supporting esports have not yet matured to the degree seen in traditional elite sports, where multidisciplinary teams routinely address athlete health.

To sustain long-term performance and protect player wellbeing, esports organizations will need to incorporate sports-medicine principles more systematically. This includes implementing preventative musculoskeletal programs, developing sleep-health protocols, embedding mental-health support into team structures, and establishing consistent policies regarding stimulant use. As esports continue to gain recognition as a legitimate performance domain, coordinated clinical, educational and regulatory strategies will be essential for ensuring that player health keeps pace with the industry's rapid expansion.

Conclusions

This review demonstrates that competitive esports impose a complex blend of physical, psychological and behavioural demands that distinguish esports athletes from both recreational gamers and traditional sports competitors. Musculoskeletal strain, irregular sleep patterns, heightened psychological pressure, prolonged sedentary exposure, autonomic arousal during competition and visual fatigue consistently emerge as major health challenges. Although esports share many features with high-performance sports, the medical, ergonomic and psychological support systems typically available in traditional athletics remain underdeveloped within the esports environment.

The current evidence underscores the need for structured, multidisciplinary frameworks that prioritize player health. Preventive strategies—ranging from ergonomic optimization and physical conditioning to sleep regulation and mental-health support—should be integrated into routine training practices. Additionally, clearer policies regarding stimulant and nootropic use, along with standardized health guidelines, are essential to ensure safe and sustainable participation as the industry continues to expand.

As esports evolve into an increasingly influential global discipline, advancing comprehensive health-protection models will be critical for supporting long-term wellbeing, maintaining competitive performance and promoting responsible development across the sector.

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