International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	UPPER LIMB INJURIES IN ESPORTS AND VIDEOGAMING – A NARRATIVE REVIEW OF PATHOLOGY, RISK FACTORS AND PREVENTION METHODS
ARTICLE INFO	Wiktor Chrzanowski, Lidia Mądrzak, Julia Kwiecińska, Katarzyna Krzyżanowska, Władysław Hryniuk, Marta Korchowiec, Jacek Sitkiewicz, Alicja Toczyłowska, Łukasz Bialic, Mateusz Muras. (2025) Upper Limb Injuries in Esports and Videogaming – A Narrative Review of Pathology, Risk Factors and Prevention Methods. *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3448
DOI	https://doi.org/10.31435/ijitss.3(47).2025.3448
RECEIVED	02 June 2025
ACCEPTED	11 July 2025
PUBLISHED	14 July 2025
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

UPPER LIMB INJURIES IN ESPORTS AND VIDEOGAMING – A NARRATIVE REVIEW OF PATHOLOGY, RISK FACTORS AND PREVENTION METHODS

Wiktor Chrzanowski *(Corresponding Author, Email: wiktor.chrzanowski2000@gmail.com)*
Medical University of Warsaw
ORCID ID: 0009-0008-0820-1452

Lidia Mądrzak
Medical University of Warsaw
ORCID ID: 0009-0005-9516-911X

Julia Kwiecińska
University Clinical Hospital in Opole
ORCID ID: 0009-0004-0924-6063

Katarzyna Krzyżanowska
Medical University of Warsaw
ORCID ID: 0009-0009-3306-0804

Władysław Hryniuk
University Clinical Hospital in Opole
ORCID ID: 0009-0009-8653-468X

Marta Korchowiec
Medical University of Warsaw
ORCID ID: 0009-0008-3365-4728

Jacek Sitkiewicz
Silesian Centre for Heart Diseases in Zabrze
ORCID ID: 0009-0006-0889-0652

Alicja Toczyłowska
University Clinical Hospital in Opole
ORCID ID: 0009-0007-3155-0573

Łukasz Bialic
Medical University of Warsaw
ORCID ID: 0000-0003-4837-5920

Mateusz Muras
University Clinical Hospital in Opole
ORCID ID: 0009-0003-4536-6006

ABSTRACT

Objective: The growth of esports and videogaming has led to increased upper limb musculoskeletal complaints. This narrative review synthesizes literature on injury types, prevalence, risk factors, and management to guide prevention and management.
Methods: We searched PubMed and Google Scholar for English-language studies on esports and videogaming up to May 2025. Epidemiological surveys, case reports, and reviews were included if they addressed upper limb injuries. Data on prevalence, injury types (e.g., neuropathies, tendinopathies), potential pathology and risk factors, were extracted.
Key findings: Up to 70% of competitive gamers report wrist and hand pain; wrist pain appears in 6%–36% and hand pain in 5%–30%. Among those gaming > 2 hours/day, 34.8% had musculoskeletal disorders. Common injuries include RSIs such as carpal tunnel and ulnar neuropathies, tendinopathies (e.g., "gamer's thumb"), and occasional fractures or lacerations. Risk factors include prolonged sessions (5–10 hours/day), high actions per minute (APMs) (500–600), non-ergonomic setups and obesity. Only 2% seek medical care and untreated injuries can limit performance, force time off or end careers.
Conclusions: Early detection and intervention are vital. Preventive measures include ergonomic optimization, regular breaks, ergonomic devices, and exercise. Educating players and involving sports medicine professionals can reduce injuries and improve gamer well-being.

KEYWORDS

Esports, Videogaming, Upper Limb Injury, Repetitive Strain Injury

CITATION

Wiktor Chrzanowski, Lidia Mądrzak, Julia Kwiecińska, Katarzyna Krzyżanowska, Władysław Hryniuk, Marta Korchowiec, Jacek Sitkiewicz, Alicja Toczyłowska, Łukasz Bialic, Mateusz Muras. (2025) Upper Limb Injuries in Esports and Videogaming – A Narrative Review of Pathology, Risk Factors and Prevention Methods. *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3448

Introduction.

The rapid ascent of e-sports to a globally recognized competitive discipline for the past several years has increased the attention towards the health aspects of this phenomenon. With the estimated esport Polish market value at 12.6 million dollars in 2022 and hundreds of players involved in the esports arena, the market is growing every year since the start of the data collection (1). As the discussion about the definition of sports and athleticism persists, notable differences are to be seen between traditional sports and e-sports (2). Musculoskeletal complications and injuries arising from the physical exertion are commonly recognized, but health problems in e-sports can differ greatly as they are more associated with sedentary work and repetitive movements, possibly resembling office work (3). Esport players - often engaged in gaming for prolonged periods - are exhibiting a substantial prevalence of musculoskeletal complaints, particularly affecting the neck, back, shoulders, and upper extremities - hands especially (4). Many of these problems can be career ending conditions, exacerbating the need to manage those conditions as best as possible.

First described video game-related injuries date back nearly 40 years to the first report from 1987 describing two cases of joystick-use related trigger finger in children, named "Joystick digit" (5). Additional case reports were published in the early 1990's., when the term "Nintendinitis" was first used (6). However, the gaming systems have evolved since the initial reports and the nature of modern systems might leave players more vulnerable to injury. The emerging field of esports research has begun to document these concerns, yet the literature remains fragmented and lacks a unified framework for understanding the scope, risk factors, and preventive strategies specific to professional esports athletes. This narrative literature review aims to synthesize current research on the prevalence, types and factors contributing to upper limb musculoskeletal problems in esports players and seeks to identify knowledge gaps and support the development of sustainable health practices within the esports community.

Methodology

For this narrative review all data were collected from publicly available sources. Two bibliographic databases: PubMed and Google Scholar were screened in May 2025. The phrases for records extraction included “esports”, “videogaming” and “injury”. Only studies in English were retrieved. There were no time restrictions on the publication dates of research papers. The reference lists of identified studies were searched for additional articles.

Epidemiology

According to some studies wrist and hand pain reported by players can range from 6,25% to 36% in wrist pain and 5%-30% in hand pain (4).

Overall, up to 70% of esports players report hand and wrist pain (7). In one study, 34.8% of test subjects who play for more than 2 hours a day had some kind of musculoskeletal disorder in the upper limb (8).

Although largely lacking precise statistical data on prevalence of specific upper limb injuries, up to date literature mentions several of them. An USA-based study of National Electronic Injury Surveillance System (NEISS) concluded, that the majority of body parts reported as injured in gamers were fingers, hands and wrists, with surprisingly the most common injury

types being strains and sprains, followed by contusions and abrasions, possibly due to interactive nature of some of the modern gaming systems. The majority of upper limb injuries in esports mentioned in other literature are repetitive strain injuries (RSIs). This includes neuropathies like Carpal Tunnel Syndrome (CTS), cubital tunnel syndrome and distal ulnar neuropathy of the deep motor branch, also called „Videogame palsy“, that can result from compression at the level of Guyon’s canal associated with hypothenar callus formation from repetitive game-controller induced trauma (9). Another group frequently mentioned are tendinopathies and tendons-related inflammation, like lateral epicondylitis (Mouse’s elbow) or medial epicondylitis. Flexor pollicis longus (FPL) and extensor pollicis longus (EPL) injuries - both also being called „nintendinitis“ also belong to that group. Additionally, frequently mentioned is De Quervains tenosynovitis (Gamer’s thumb) (3,9–12) and similar to it so-called “intersection syndrome”, when friction between the first extensor tendon compartments (abductor pollicis longus and extensor pollicis brevis) and the second extensor tendon compartment (extensor carpi radialis longus and extensor carpi radialis brevis) leads to inflammation causing characteristic crepitus induced by painful wrist movements (3,9,10).

Other mentions include larger prevalence of first carpometacarpal osteoarthritis and so called „Playstation thumb“ formerly the “Atari-finger”, a condition involving skin blistering, numbness, and swelling caused by friction from fast pace repetitive button pressing (9). Another injury is microtrauma to the extensor carpi ulnaris (ECU), which possibly results from rapid wrist adduction, often from so-called “flick shots”, which include reaching more lateral keybinds with the ulnar-most fingers (3).

Worth mentioning is “Wii Shoulder,” also known as “Wiiitis”, which refers to pain in the upper arm and shoulder muscles. It is often accompanied by swelling, caused by extended play of motion-controlled video games. Activities such as simulated tennis or bowling, which mimic real-life sports movements, have been recognized as contributing factors to the onset of this condition due to repetitive, vigorous arm motions (9).

Vibrating controllers have been occasionally associated with hand-vibration syndrome, where protracted vibrations exposure causes the hands to become pale and edematous in the cold, but red and painful when warmed (6,9).

Injuries caused by modern gaming systems go beyond just RSIs. Since gaming consoles are usually connected to a TV, players often play in areas where their movement can be restricted by low ceilings, nearby walls, furniture like coffee tables and couches, or ceiling fans, which can cause different injuries when struck. Secondary analysis in (9) revealed that in such cases, fractures, cuts, and bruises tend to affect the lower parts of the arms more often than the upper parts. This would be consistent with several published case studies, like a review of 39 self-reported injuries related to the Nintendo Wii that found hand lacerations were the most common, with nearly half of the injuries happening during Wii Tennis (13). One case involved a Rolando fracture after a player struck a coffee table while bowling on the Wii. Another report described a player who tore the extensor pollicis longus tendon after hitting a wall with a backhand motion during Wii Tennis (6).

Some of aforementioned RSIs are also seen in other occupations requiring repetitive hand movements, like office workers (10) or instrumentalists (14). Due to scarcity in studies about these subjects and similarities among these populations some specialists working in the field allow extrapolations from those populations onto esports (15).

With all mentioned injuries, it is important to diagnose and manage them early, as not only can these conditions worsen with time and lead to permanent changes in musculoskeletal apparatus, but also they can have significant negative influence on players quality of life, especially for professional esport players. In a single study, 6.3% of participants had pain limiting their ability to participate in esports (4). In another study, over 17% needed to take 1-8 weeks off due to injuries, which resulted in missing competitions (16). Several other studies mention the necessity to even prematurely end the career due to an upper limb injury, even at a young age (3,6,7,11). Such cases include but are not limited to players retiring due to CTS, wrist, arm and thumb pain or radial tunnel syndrome (3). A chronic wrist and thumb injury led to the retirement of a professional Call of Duty eSports athlete, who had accumulated nearly $400,000 in career earnings (6).

Pathology and risk factors

Currently tendinopathies, although not fully understood, are described as a progressive spectrum of tissue changes across three stages—beginning with reactive tendinopathy, advancing into tendon disrepair, and finally culminating in degenerative tendinopathy.

The state of tendon may improve or worsen through these phases depending on the workload placed on it (10). Neuropathies in context of this article are primarily the result of nerve compression (17–19).

Prevention knowledge

Due to lack of supportive environment, the majority of esport athletes are not aware of the significance of their injuries or their prevention. Some simulated sports games require similar movements to the sport being played, and the players being largely amateur, with poor mechanics and improper warm-up routine can be more susceptible to the soft tissue injury.

Additionally, among the players surveyed in a study, only 2% sought medical attention (3). With delayed treatment and continual overloading, the less potential there is to reverse the damage to tendons in tendinopathies (10).

Duration of computer use

Reports suggest that the average esport athlete spends between 5.5 to 10 hours a day preparing for competitions. 15% claim 3 or more sitting hours without any break (7).

According to studies, Esport athletes may be more prone to overuse injuries than casual gamers or office workers, as they can perform up to 500-600 actions per minute (APMs) compared to the average of 130-180 APMs range of office work. During these actions, repeated or sustained wrist bending, twisting or pushing motions and non-neutral wrist postures are observed (10). With these observations, a positive correlation between weekly gaming hours and pain in wrist and hands can be found. Additionally, positive correlation between the duration of gaming session and number of areas an individual experiences pain exists (20). Also CTS and cubital tunnel syndrome have been observed to correlate with prolonged videogaming play (9).

Lifestyle factors

Obesity is known to be relevant factor to elevated tendinopathy risk (21) and CTS risk (22). One study found, that while more esport athletes can be classified as normal weight than the general population, obesity classes 2 and 3 were more prevalent amongst them. This might be attributed to lower activity levels, however it is worth mentioning that top-ranked players are more physically active than their lower-ranked counterparts (23). Generally, it can be noted that the average esports participant BMI places them in the overweight bracket (24).

Smoking, while also a significant factor (22,25) is generally less present in esport athletes than in general population (23).

Depending on studies 11.3% to 40.0% surveyed esport players mention that they do not participate in any kind of physical activity (26).

Game and controller type

Esport involves many different types of videogames, which might differ significantly in the character of upper limb movements (27). This might result in different prevalence of certain upper limb conditions debated upon. For example, mobile phone gaming is especially correlated with incidence of De Quervains's tenosynovitis (28,29). In a survey study in 2023 (20) the level of competitiveness was found to positively

correlate with pain in the left wrist and right hand, although negative correlations were also found with pain in the left elbow, left shoulder and left forearm.

Excessive vibration, present in most console controllers and mobile phones has been linked to hand-vibration syndrome and carpal tunnel syndrome (9).

Lateral epicondylitis is generally attributed to repeated wrist extension and forearm pronation, movements that are extremely common among gamers. Additionally, repeated motions performed while using computers are linked to a poor long-term prognosis for individuals with lateral epicondylitis (11).

When it comes to shoulder area, Wiitis is thought to be associated with abnormal arm deceleration forces, that act on a player while aggressively playing simulated sports with motion controllers weighing often less than 200 grams (9).

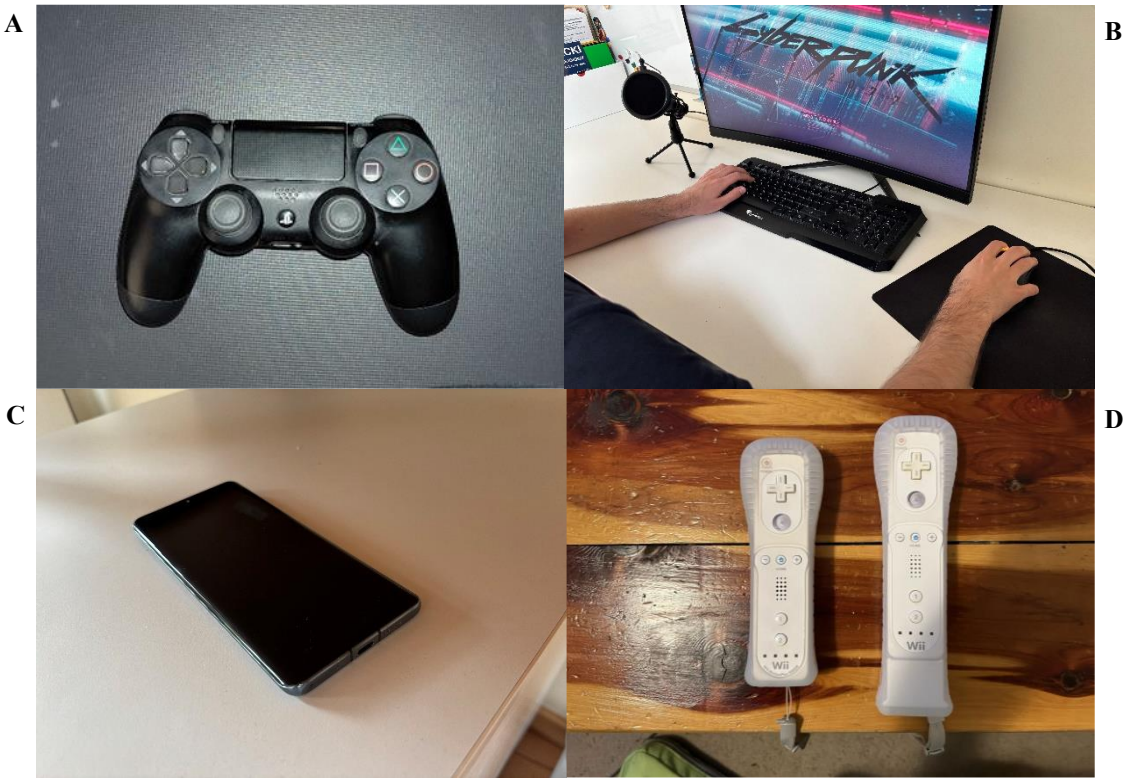

Fig. 1. *Controllers most often used in esports. (A) Pad controller, typical for console games. (B) Mouse and keyboard, used for PC (personal computer) gaming (C) Smartphone for mobile gaming (D) Motion controllers, often used in simulated sports games.*

Age and sex

Survey studies (20,30) reveal that esport arena tends to be male-dominated, with an average age of respondents being 20.8 or 23.8 depending on the study. With that in mind, the majority of injuries in the field also tend to be in young males (6), while generally, musculoskeletal disorders are more frequently seen in females and increase with age (31).

Prevention

Rest

According to one qualitative study of esports players some of them stated that actively stretching wrists and "moving around" between games could help minimize some of aforementioned problems (30). Musculoskeletal issues in the upper extremity—such as pain in the wrist or hand—often improve with rest, which usually includes brief immobilization for 1 to 2 weeks. If symptoms persist despite rest and regular stretching, nonsteroidal anti-inflammatory drugs (NSAIDs) can be considered as a treatment option (17).

Taking breaks from the keyboard—sometimes called "keyboard holidays"—by stepping away from the gaming setup for extended periods can help reduce pain. However, to avoid hand overuse injuries in the first place, it's important for esports athletes to undergo an ergonomic assessment of their gaming environment. Additionally, coaches and program staff should be informed and actively participate in injury prevention efforts. Lastly, players should have regular access to physical and occupational therapy as part of a comprehensive, team-based approach to care (3).

Gaming setup ergonomics

Radial wrist discomfort in De Quervain's tenosynovitis often intensifies during gripping or rotational movements involving the thumb, such as when operating a game controller's analog stick. Switching to a shorter analog stick can help minimize thumb abduction and extension, which in turn reduces strain on the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) tendons and their surrounding sheath (3).

A thorough assessment of the gaming setup's height and wrist positioning should be conducted and adjusted as needed to help treat and prevent intersection syndrome (3).

To prevent RSIs affecting the wrist it is advised to adjust the armrests so that they do not cause scapular elevation, which pushed the humerus upwards. Finding a comfortable alignment of forearms and hands relative to peripherals like keyboard and mouse can be crucial in preventing RSIs affecting the wrist.

Adjusting the height of the desk is important when dealing with compressive forces acting on upper limbs when they're pressed on table's edges. Such modification can help in prevention of mouse elbow, CTS or cubital tunnel syndrome.

Proper equipment plays a role too - gaming mice often come with ergonomic designs to reduce hand fatigue, enabling athletes to maintain performance for extended periods.

Occupational therapists are needed to help with optimization of gaming setups in order to prevent RSIs by modifying or adapting the environment to better suit the individuals (32).

Sports medicine and healthcare professionals should play an increasingly important role in evaluating, treating, managing, and advising esports athletes on their performance and health goals. As such, it will be important for the physician to understand the various contributory factors and considerations unique to the esports athlete, and create a collaborative, working relationship on a path for esports athletes to have a successful career and be free of its potential negative health consequences in life.

Table 1. PC-setup ergonomics in relation to body positioning and movements associated with elevated injury risk (10).

Setup ergonomics	Related body positioning/movements
Keyboard and mouse positioning	wrist ulnar/radial deviation
Keyboard key resistance	repetitive movement against resistance
Most commonly-used keys	wrist position in multiple planes, repetitive finger movement
Mouse size	wrist extension angle
Mouse grip type	forearm/wrist/hand muscle contraction, sustained wrist positioning in multiple planes
Lack of arm support	postural, shoulder, forearm, and wrist muscle contraction
Infrequent whole-body movement	postural muscle contraction, sustained loading of passive structures (joints, ligaments)

Discussion

This review tries to consolidate the growing amount of literature on upper limb musculoskeletal injuries in esports and video gaming. While traditional sports-related injuries are well-documented, musculoskeletal disorders in esports remain an underexplored area despite the rising number of professional players and recreational gamers globally. The evidence suggests a high prevalence of wrist and hand pain among esports athletes, primarily attributed to repetitive strain injuries (RSIs), neuropathies, and tendinopathies. Notably, the gaming environment and training load, often involving extended hours and high-frequency movements, appear to significantly contribute to these disorders.

Several case reports and cross-sectional studies emphasize the importance of early recognition and intervention. However, the quality and consistency of current studies are limited. Most available data are observational or anecdotal, with few longitudinal studies or controlled trials assessing risk mitigation strategies. Extrapolations from similar, repetitive motion-requiring occupations, such as office work offer some insights, but esports presents unique challenges in ergonomics, intensity, and performance pressures.

A crucial concern highlighted in this review is the gap in medical engagement - only a small fraction of gamers seek medical care, often due to lack of awareness or support structures. This delay in seeking care can exacerbate injuries, leading to chronic impairment or premature career termination. Despite these risks, injury prevention remains poorly integrated into esports training.

There is also a lack of standardized ergonomic guidelines for gaming setups, despite strong associations between workstation configuration and injury risk. Similarly, although lifestyle factors like obesity and physical inactivity are increasingly recognized as risk modifiers, few interventions target these elements in esports populations. As esports continues to professionalize, a more comprehensive and multidisciplinary approach involving physicians, physiotherapists, and occupational health specialists is needed.

Future research should aim to address methodological limitations, including small sample sizes and heterogeneity in game types. Standardized diagnostic criteria, larger prospective studies, and randomized interventions could provide stronger evidence to guide policy and practice.

Conclusions

Upper limb injuries are common among esports players and are often the result of a prolonged, repetitive, and high-intensity gameplay. Despite their frequency, these injuries remain underreported and inadequately managed. This narrative review underscores the need for early identification, ergonomic optimization, and increased player education on injury prevention. Incorporating healthcare professionals into esports programs and promoting cross-disciplinary collaboration can mitigate long-term disability and enhance player longevity. Further high-quality research is essential to establish evidence-based guidelines for injury prevention, diagnosis, and rehabilitation in this growing population.

Disclosures

Author's contribution:

Conceptualization: Wiktor Chrzanowski

Methodology: Łukasz Bialic, Lidia Mądrzak

Software: Wiktor Chrzanowski, Lidia Mądrzak

Check: Julia Kwiecińska, Łukasz Bialic

Formal analysis: Marta Korchowiec, Jacek Sitkiewicz,

Investigation: Wiktor Chrzanowski, Julia Kwiecińska, Katarzyna Krzyżanowska, Władysław Hryniuk

Resources: Wiktor Chrzanowski

Data curation: Wiktor Chrzanowski

Writing-rough preparation: Wiktor Chrzanowski, Julia Kwiecińska, Katarzyna Krzyżanowska, Władysław Hryniuk, Marta Korchowiec, Jacek Sitkiewicz, Alicja Toczyłowska, Łukasz Bialic, Mateusz Muras

Writing review and editing: Wiktor Chrzanowski, Alicja Toczyłowska, Łukasz Bialic, Mateusz Muras

Project administration: Wiktor Chrzanowski

All authors have read and agreed with the published version of the manuscript.

Funding Statement:

The study did not receive special funding.

Institutional Review Board Statement:
Not applicable.

Informed Consent Statement:
Not applicable.

Data Availability Statement:
Not applicable.

Acknowledgments:
The image D of Figure 1 was provided by Wikipedia https://en.wikipedia.org/wiki/Motion_controller#/media/File:Wii_Remote_Plus_and_Wii_MotionPlus_comparison.jpg
All other images belong to the authors.

Conflict Of Interest:
The authors declare no conflict of interest.

REFERENCES

1. Marszałkowski J, Biedermann S, Rutkowski E. The Game Industry of Poland – Report 2023. 2023 [cited 2025 May 19]; Available from: https://en.parp.gov.pl/publications/publication/the-game-industry-of-poland-report-2023
2. Bubna K, Trotter MG, Polman R, Poulus DR. Terminology matters: defining the esports athlete. Front Sports Act Living. 2023 Aug 25;5:1232028. doi: 10.3389/fspor.2023.1232028. PMID: 37691641; PMCID: PMC10485553.
3. Law A, Ho G, Moore M. Care of the Esports Athlete. Curr Sports Med Rep. 2023 Jun 1;22(6):224-229. doi: 10.1249/JSR.0000000000001077. PMID: 37294198.
4. Lindberg L, Nielsen SB, Damgaard M, Sloth OR, Rathleff MS, Straszek CL. Musculoskeletal pain is common in competitive gaming: a cross-sectional study among Danish esports athletes. BMJ Open Sport Exerc Med. 2020 Aug 28;6(1):000799. doi: 10.1136/bmjsem-2020-000799. PMID: 33585039; PMCID: PMC7876625.
5. Osterman AL, Weinberg P, Miller G. Joystick Digit. *JAMA.* 1987;257(6):782. doi:10.1001/jama.1987.03390060072023.
6. DalCortivo, Robert & Ahn, David & Amer, Kamil & Vosbikian, Michael & Ahmed, Irfan. (2025). Incidence of Vido Game-Related Upper Extremity Injuries in the United States. SurgiColl. 3. 10.58616/001c.126711.
7. DiFrancisco-Donoghue J, Balentine J, Schmidt G, Zwibel H. Managing the health of the eSport athlete: an integrated health management model. BMJ Open Sport Exerc Med. 2019 Jan 10;5(1):e000467. doi: 10.1136/bmjsem-2018-000467. PMID: 30792883; PMCID: PMC6350739.
8. Kang JW, Kim H, Cho SH, Lee MK, Kim YD, Nan HM, Lee CH. The association of subjective stress, urinary catecholamine concentrations and PC game room use and musculoskeletal disorders of the upper limbs in young male Koreans. J Korean Med Sci. 2003 Jun;18(3):419-24. doi: 10.3346/jkms.2003.18.3.419. PMID: 12808332; PMCID: PMC3055053.
9. Belyea CM, Rummel G, Lanham N, Krul KP. Upper Extremity and Musculoskeletal Injuries Related to Videogame and Augmented Reality Game Usage: A Narrative Review Article. Curr Rev Musculoskelet Med. 2025 May;18(5):201-206. doi: 10.1007/s12178-025-09956-9. Epub 2025 Feb 13. PMID: 39946075; PMCID: PMC12014968.
10. McGee C, Ho K. Tendinopathies in Video Gaming and Esports. Front Sports Act Living. 2021 May 28;3:689371. doi: 10.3389/fspor.2021.689371. PMID: 34124663; PMCID: PMC8195326.
11. Sant, K., & Micallef Stafrace, K. (2021). Upper Limb Injuries secondary to Overuse in the Esports community. Is this a rising epidemic?. *International Journal of Esports*, 1(1). Retrieved from https://www.ijesports.org/article/39/html
12. Zapata AL, Moraes AJ, Leone C, Doria-Filho U, Silva CA. Pain and musculoskeletal pain syndromes related to computer and video game use in adolescents. Eur J Pediatr. 2006 Jun;165(6):408-14. doi: 10.1007/s00431-005-0018-7. Epub 2006 Mar 22. PMID: 16552547.
13. Sparks D, Chase D, Coughlin L. Wii have a problem: a review of self-reported Wii related injuries. Inform Prim Care. 2009;17(1):55-7. doi: 10.14236/jhi.v17i1.715. PMID: 19490774.
14. Geoghegan L, Wormald JCR. Sport-related hand injury: a new perspective of e-sports. J Hand Surg Eur Vol. 2019 Feb;44(2):219-220. doi: 10.1177/1753193418799607. Epub 2018 Sep 20. PMID: 30236028.

15. McGee C, Hwu M, Nicholson LL, Ho KKN. More Than a Game: Musculoskeletal Injuries and a Key Role for the Physical Therapist in Esports. J Orthop Sports Phys Ther. 2021 Sep;51(9):415-417. doi: 10.2519/jospt.2021.0109. PMID: 34465141.
16. Clements AJ, Paul RW, Lencer AJ, Seigerman DA, Erickson BJ, Bishop ME. Analysis of Musculoskeletal Injuries Among Collegiate Varsity Electronic Sports Athletes. Cureus. 2022 Nov 14;14(11):e31487. doi: 10.7759/cureus.31487. PMID: 36523696; PMCID: PMC9749791.
17. Emara AK, Ng MK, Cruickshank JA, Kampert MW, Piuzzi NS, Schaffer JL, King D. Gamer's Health Guide: Optimizing Performance, Recognizing Hazards, and Promoting Wellness in Esports. Curr Sports Med Rep. 2020 Dec;19(12):537-545. doi: 10.1249/JSR.0000000000000787. PMID: 33306517.
18. Basuodan RM, Aljebreen AW, Sobih HA, Majrashi KA, Almutairi NH, Alhaqbani SS, Alanazy MH. The impact of electronic gaming on upper-limb neuropathies among esports athletes. Med Pr. 2023 Nov 14;74(4):279-287. doi: 10.13075/mp.5893.01421. Epub 2023 Oct 24. PMID: 37966384.
19. Tiric-Campara M, Krupic F, Biscevic M, Spahic E, Maglajlija K, Masic Z, Zunic L, Masic I. Occupational overuse syndrome (technological diseases): carpal tunnel syndrome, a mouse shoulder, cervical pain syndrome. Acta Inform Med. 2014 Oct;22(5):333-40. doi: 10.5455/aim.2014.22.333-340. Epub 2014 Oct 29. PMID: 25568584; PMCID: PMC4272839.
20. Forman GN, Holmes MWR. Upper-Body Pain in Gamers: An Analysis of Demographics and Gaming Habits on Gaming-Related Pain and Discomfort. Journal of Electronic Gaming and Esports. 2023 Feb 13;1(1). DOI: https://doi.org/10.1123/jege.2022-0018
21. Macchi M, Spezia M, Elli S, Schiaffini G, Chisari E. Obesity Increases the Risk of Tendinopathy, Tendon Tear and Rupture, and Postoperative Complications: A Systematic Review of Clinical Studies. Clin Orthop Relat Res. 2020 Aug;478(8):1839-1847. doi: 10.1097/CORR.0000000000001261. PMID: 32732565; PMCID: PMC7371074.
22. Geoghegan JM, Clark DI, Bainbridge LC, Smith C, Hubbard R. Risk factors in carpal tunnel syndrome. J Hand Surg Br. 2004 Aug;29(4):315-20. doi: 10.1016/j.jhsb.2004.02.009. PMID: 15234492.
23. Trotter MG, Coulter TJ, Davis PA, Poulus DR, Polman R. The Association between Esports Participation, Health and Physical Activity Behaviour. Int J Environ Res Public Health. 2020 Oct 8;17(19):7329. doi: 10.3390/ijerph17197329. PMID: 33049914; PMCID: PMC7579013.
24. Bayrakdar A, Yıldız Y, Bayraktar I. Do e-athletes move? A study on physical activity level and body composition in elite e-sports. Physical education of students. 2020 Oct 30;24(5):259–64.
25. Shiri R, Viikari-Juntura E, Varonen H, Heliövaara M. Prevalence and determinants of lateral and medial epicondylitis: a population study. Am J Epidemiol. 2006 Dec 1;164(11):1065-74. doi: 10.1093/aje/kwj325. Epub 2006 Sep 12. PMID: 16968862.
26. Monteiro Pereira A, Costa JA, Verhagen E, Figueiredo P, Brito J. Associations Between Esports Participation and Health: A Scoping Review. Sports Med. 2022 Sep;52(9):2039-2060. doi: 10.1007/s40279-022-01684-1. Epub 2022 Apr 29. PMID: 35486374.
27. Dupuy, A., Campbell, M.J. & Toth, A.J. Differentiating right upper limb movements of esports players who play different game genres. *Sci Rep* **15**, 6498 (2025). https://doi.org/10.1038/s41598-025-90949-6
28. Morgan SD, Sivakumar BS, An VG, Sevao J, Graham DJ. A Review of De Quervain's Stenosing Tenovaginitis in the Context of Smartphone Use. J Hand Surg Asian Pac Vol. 2020 Jun;25(2):133-136. doi: 10.1142/S2424835520300029. PMID: 32312208.
29. Ma T, Song L, Ning S, Wang H, Zhang G, Wu Z. Relationship between the incidence of de Quervain's disease among teenagers and mobile gaming. Int Orthop. 2019 Nov;43(11):2587-2592. doi: 10.1007/s00264-019-04389-9. Epub 2019 Aug 28. PMID: 31463625.
30. Kari, Tuomas & Siutila, Miia & Karhulahti, Veli-Matti. (2018). An Extended Study on Training and Physical Exercise in Esports. DOI:10.4018/978-1-5225-7461-3.ch010
31. Nordander C, Ohlsson K, Akesson I, Arvidsson I, Balogh I, Hansson GA, Strömberg U, Rittner R, Skerfving S. Risk of musculoskeletal disorders among females and males in repetitive/constrained work. Ergonomics. 2009 Oct;52(10):1226-39. doi: 10.1080/00140130903056071. PMID: 19787502.
32. Pierides Jr., Nicholas Nalic, "An Ergonomic Approach for Esport Athletes: The Potential for Less Injury and Increased Occupational Performance" (2023). *UNLV Theses, Dissertations, Professional Papers, and Capstones*. 4760. http://dx.doi.org/10.34917/36114785