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# **Cognition, Lifestyle, and Gender: An Umbrella Review of Esport Performance, Participation, and Well-being**

## **Abstract**

**Background:** The recent exponential rise in esports participation has stimulated growing interest in the performance, participation, and well-being of esports players. This research has culminated in several systematic reviews that provide an initial biopsychosocial perspective of esports players. The aim of our umbrella review was to synthesise and quality appraise these systematic reviews to provide a coherent understanding of the biopsychosocial factors affecting esports players' performance and well-being.

**Methods:** An umbrella review was conducted on literature published from 2010 onwards from six online databases to identify and examine systematic reviews within esports literature related to mental health and performance. AMSTAR-2 was used to critically appraise systematic reviews.

**Results:** Fourteen systematic reviews were identified examining player performance (n=5), player mental health (n=4), and a combination of both factors (n=5). Four key themes were identified on esports player lifestyle, cognition, physical health, and gender-based concerns. Twelve of the 14 systematic reviews were rated low or critically low quality.

**Discussion:** The results highlight the biopsychosocial factors related to esports participation showing a positive impact on cognitive functioning, a mixed-to-negative impact on sleep outcomes and physical activity, and discrimination towards female players. The low-quality reviews show a need for more rigorous methodology in esports research.

## **Cognition, Lifestyle, and Gender: An Umbrella Review of Esport Performance, Participation, and Well-being**

Over the last decade, esports participation has seen a substantial growth with 32,265 active players in 2022 achieving earnings, up 642.47% from 5022 active players in 2012 (Esports Earnings, 2022a). Participation ranges from professional teams to amateur tournaments, playing in over 150 competitive games with Dota 2, Fortnite and Counter-Strike: Global Offensive contributing to some of the highest prize pools and player base. Alongside this sharp rise in activity, there appears to be a growing interest within esports research regarding esports participation, specifically in relation to player motivations, physical activity and health (e.g., Giakoni-Ramírez et al., 2022; Rudolf et al., 2020; Trotter et al., 2020). Additionally, factors underpinning esport performance have been investigated with esport specific competencies including player accuracy, analytical thinking, and teamwork; as well as the role of self-efficacy and anxiety experienced by players, believed to play a role on performance (e.g., Nagorsky & Weimeyer, 2020; Wang et al., 2022).

Currently, there appears to be a mixed opinion on the impact of esports participation on esports players. For example, evidence shows a positive relationship between improved cognitive functioning and esports performance in esports players (Valls-Serrano et al., 2022), as well as improved concentration and reaction times (Hagiwara et al., 2021) which are seen as key indicators of performance in esports (Nagorsky & Weimeyer, 2020). Additionally, esports participation may contribute to benefits with communication skills which also are necessary for esport performance (Wong et al., 2021). Conversely, there appears to be potentially significant personal costs. For example, a heightened cognitive load from extended participation may contribute to mental fatigue and burnout (Madden & Harteveld, 2021). Physical costs due to extended participation may also include upper body injuries such as Carpal Tunnel Syndrome and tendinopathies in the shoulder and wrists which may also

contribute to career breaks or even early retirement (Sant & Micallef Stafrace, 2021).

Researchers have requested a call to action to address these issues (Schary et al., 2022). One way to address these concerns is to provide a comprehensive overview of current literature in order to highlight any gaps in the research, consider any interactions between factors impacting player performance and participation, and ensuring current research is robust.

### ***Impact of Esports Participation on Esports Players***

Biological research has focused on the physical aspects of player health and performance that are often to the detriment of the player. For example, there are reports from interviews with amateur esports players that suggest they maintain sub-optimal lifestyles, including excessive consumption of energy drinks, limited physical activity and disturbed sleep patterns due to playing before bedtime (Baumann et al., 2022). Additionally, 44.2% of players in one article suffered from musculoskeletal pain as a result of training, showing excess sedentary time and repetitive strain due to competing in esports (Lindberg et al., 2020). Conversely, there appears to be cognitive improvements in spatial vision and selective attention as a result of higher playing levels and expertise in professional players contributing to better performance (Benoit et al., 2020). Despite the cognitive benefits to esports participation, the overall findings appear to show the esports lifestyle, including training and competition, may come at the detriment of player health and performance.

Sleep outcomes, namely offset, onset and deep sleep, have been found to be key predictors of player health and esports performance (Moen et al., 2022). Conversely, research in athletes suggests that poor sleep quality can impact neuroplasticity and executive functioning, consequently impairing skill development (Fullagar et al., 2015). Despite the links to positive sleep outcomes and esports performance, research on professional esports

players found that all players from a range of nations had significantly delayed sleep patterns, which in Korean players was correlated with higher depression scores than other nations (Lee et al., 2021). Baumann et al. (2022) also found that players were aware of the benefits of sleep and other factors on health and optimal game performance however lacked strategies to implement positive lifestyle changes to improve mental health and performance. Therefore, more research is required to develop key strategies to help improve player performance through sleep interventions which may also benefit mental health outcomes.

Mental health can be defined as ‘a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community.’ (World Health Organization, 2021, p. 1). Views on mental health have shifted from mental health being the absence of mental illness, to include the positive aspects of mental health (Schinke et al., 2018). The Dual Continuum Model (Keyes, 2002) further conceptualises mental health and mental illness as separate but interrelated dimensions in addition to the presence or absence of well-being (Keyes, 2014). For example, an individual with high mental health and low mental illness would be categorised as flourishing, whereas an individual with low mental health and high mental illness would be considered as languishing (Keyes et al., 2010; Keyes, 2002). Researchers have suggested not only a need to better understand mental health in sport contexts, but how researchers investigate it, and how sport organisations can best support athletes’ mental health (Henriksen et al., 2020).

To date, research into the mental health of esports players has primarily been conducted from a stress-based perspective. For example, researchers have found that burnout and esports-specific stressors such as in-game pressure and game-specific uncertainty were significant predictors of mental ill health among competitive student-level esports players

(Smith et al., 2022). Similarly, the issues with teammates, performance and work-life commitments were also key stressors experienced by esports players that were perceived as high intensity stressors (Poulus et al., 2022). Attempts by practitioners to manage these stressors faced by esports players include the use of breathing techniques, imagery, and pre-performance routines among others typically before competition (Leis et al., 2023). While more research into the efficacy of these stress management techniques is required, research shows that there are currently attempts to improve player well-being.

An issue with the literature however, is the limited research into the positive outcomes of esports participation on mental health. During unprecedented circumstances, such as the COVID-19 pandemic, esports participation highlighted improvements in resilience and social connectedness (Soares et al., 2022). Additionally, Trotter et al. (2022) examined if esports developmental programs played a role on positive youth development, physical activity, and self-regulation in high school students and found that while there was no difference or improvement in these factors, esports participation did not negatively impact student health. While these findings provide a foundation for understanding the positive impact esports participation may have on self-regulation, positive player development and overall health, further research is required to consider the role esports participation has on professional players.

Moreover, limited research has been conducted to understand the social impact esports participation has on players. However, the research from general gaming shows concerns with harassment and gender-based discrimination towards female players resulting in withdrawal and disengagement with online gaming (Fox & Tang, 2017). Esport performance is also hampered within female players as they are unable to access meaningful

connections and communities to develop their skills due to this gender-based discrimination within the esports industry (Taylor, 2012). Despite evidence showing no significant differences in playing abilities between genders when given the same opportunities to practice and compete (Shen et al., 2016), there is still a gender disparity within the esports industry. This is reflected in the literature as most available research on women in esports pertains to their experiences of harassment and discrimination in esports (e.g., Rogstad et al., 2021), and not related to their skills or what factors may improve or hinder their performance and wellbeing. It is therefore important to consider to what extent these experiences of discrimination have on performance and well-being in female esports players, in addition to other mitigating factors which are currently unresearched in the literature. Similarly to the issue with female athletes in traditional sport research, the underrepresentation of professional and amateur female esports players in esports literature limits the ability to provide evidence-informed approaches specific to female players which may impede their performance potential (Emmonds, Heyward & Jones, 2019).

From the available literature, the impact of esports participation and performance ranges in perspectives across the biopsychosocial model. Primarily, these factors appear to trend towards the negative impact on player health and subsequent performance. To best address the range of factors involved in esports participation, the biopsychosocial theoretical framework will be used to organise relevant literature on esports performance and participation into biological, psychological, and social aspects (Engel, 1977). In adopting this framework, it is possible to explore the multifaceted nature of factors affecting player performance and well-being and allow for a greater understanding of what factors may have the greatest impact on performance as well as consider if there are any interactions between the factors in the current literature. While originally used in clinical research, the

biopsychosocial framework has also been applied in other settings such as sport injury and performance (e.g., Heinrich et al., 2021; McCormack et al., 2022; Moore et al., 2022). This framework is encouraged in sport science to better understand the range of demands impacting on athlete health and performance by providing a more holistic approach to research which encompasses factors from different disciplines (McGawley, 2024). As esports players have also been referred to as a form of athlete (Jenny et al., 2017), it is important that similar steps are taken to ensure all knowledge surrounding factors affecting esports players in terms of performance and well-being are encapsulated in the research.

### ***The Present Study***

The literature on biopsychosocial factors in esports itself requires further review to critically assess what research has already been undertaken, what study designs are frequently used and evaluate the reliability of their use in esports research, and then assess the overall quality of the research. Since 2015, the number of publications in esports has risen exponentially with successive growth across all fields up to 2018 (Reitman et al., 2020). This has resulted in systematic reviews being conducted to gather this growing research on particular topic areas within esports research. Despite efforts to improve the overall quality of systematic reviews using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses; Page, 2021) guidelines, there is still a risk by uncritically accepting the results of a single systematic review (Shea et al., 2017). To mitigate these concerns, the use of an umbrella review, known as a systematic review of systematic reviews, should also be considered for usage in a research area. The purpose of an umbrella review is to provide readers with a succinct overview and synthesis of available secondary research in a specific research area (Papatheodorou, 2019). Following this synthesis of literature, umbrella reviews are used to evaluate the quality of evidence available in a topic area to enhance reader



confidence in the rigor of current literature, as well as identify any gaps in the research (Aromataris et al., 2015).

Drawing on the above, the main aims of the umbrella review, were to (1) provide an encompassing overview of the biopsychosocial impact of esports on esports players and subsequent affects on esports performance that exist in the current reviews; (2) critically assess the methodological quality of the current systematic reviews; and (3) identify gaps, flaws, and limitations within the literature of biopsychosocial factors affecting esports players, and provide recommendations.

Understanding the breadth and overall study quality of factors within this topic area will help to inform sport and exercise psychologists and researchers to develop interventions and applied strategies to help esports player performance and wellbeing.

## **Methods**

The current umbrella review of systematic reviews was conducted following Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Page et al., 2021). Owing to there being no restriction on study design included within the systematic reviews and the difficulty with adopting PICO and PICOS (PICO/S = Population, Intervention, Comparison, Outcomes, and Study Design) frameworks where reviews include qualitative and mixed-methods research (Methley et al., 2014), the SPIDER tool (Sample, Phenomenon of Interest, Design, Evaluation, Research Type) was used:

Sample: Esports players from amateur to professional level. Male and female players were eligible from any competitive esports game. Players aged 12 and over were eligible for

inclusion as most competitive video games require individuals to be over the age of 12 years old.

Phenomenon of Interest: Biopsychosocial factors on esports performance and participation

Design: Peer-reviewed Systematic Reviews

Evaluation: Benefits and issues related to performance, participation and well-being of esports players.

Research Type: Systematic reviews including quantitative, qualitative and mixed-method data collection and analysis (e.g., cross-sectional, experimental, and observational studies)

### ***Search Strategy and Selection Criteria***

A comprehensive search of scientific literature was performed on the following databases up to June 2023: PsycInfo, PsycArticles, Medline, SportDiscus, Scopus, Cochrane Library. The following search terms were used: (esports OR e-sports OR "competitive gaming" OR "esports player" OR e-athlete) AND (emotion\* OR psycholog\* OR lifestyle OR wellbeing OR well-being OR health OR stress OR performance) AND ("systematic review" OR review OR "meta-analysis"). Review selection was restricted to the last 13 years (January 2010 – June 2023) to ensure the study assessment was up to date. This was also in line with research suggesting this period of time as the largest, consistent rise in publications within esports literature (Reitman et al., 2020). All papers were found to have been published in the last five years. Researchers then reviewed the articles to ensure the literature focused on amateur and professional esports players.

The inclusion criteria for the study were:

1. Research synthesis including systematic reviews and meta-analyses.

2. Studies that involve esports players at any competitive level from amateur to professional.
3. Quantitative synthesis of results and study designs.
4. Studies that examine the positive and negative impact of esports participation on players and esports performance.
5. Studies published in English and full texts in peer reviewed literature.

Many eligible systematic reviews that were retrieved by the search strategy encompassed multiple factors across the biopsychosocial framework that were related to esports performance and participation, for example, Lam et al. (2020) addressed issues related to sleep, physical activity, and mental demands of esports on players. While the search strategy was therefore believed to be effective in retrieving relevant systematic reviews focusing on elements of the biopsychosocial framework, forward and backward citation searching of included systematic reviews was undertaken to ensure as far as possible that all potentially relevant systematic reviews were included (cf. Gledhill, Forsdyke & Murray, 2018).

### ***Screening and Data Extraction***

The search results were collated into Mendeley Reference Manager where one reviewer screened the articles based on their titles and abstracts for eligibility and inclusion in the current review. Two additional reviewers independently assessed the full-text articles for relevancy to the current review (Belbasis et al., 2022).

Eligible full-text articles were then extracted into a Microsoft Excel spreadsheet by one reviewer and included the following information: bibliometric data such as author, year and language; sample characteristics, and description of study outcomes. Following this, two reviewers independently verified the accuracy of the extraction, with disagreements

facilitated by a third researcher and resolved by consensus. The articles were then categorised into following the biopsychosocial framework into their three areas: biological, psychological, and social factors.

### ***Quality Assessment***

To assess the methodological quality and risk of bias, the reviews were assessed using ‘A MeaSurement Tool to Assess Systematic Reviews (AMSTAR-2; Shea et al., 2017). AMSTAR-2 is a validated 16-item critical appraisal tool for systematic reviews which uses four ratings to assess the quality of the reviews (high, moderate, low, and critically low). The 16 items used to assess systematic reviews include: (i) components of PICO; (ii) use of a review protocol; (iii) explanation for study design inclusion; (iv) use of comprehensive literature search strategy; (v) study selection in duplicate; (vi) data extraction in duplicate; (vii) list of excluded studies with justification; (viii) study characteristics; (ix) assessment of risk of bias; (x) reported sources of funding for included studies; (xi) appropriate methods used in meta-analysis; (xii) assess potential impact of risk of bias on the results; (xiii) consider risk of bias when interpreting/discussing the results; (xiv) satisfactory explanation about heterogeneity observed in the results; (xv) conduct an adequate investigation into publication bias; (xvi) report potential sources of conflict of interest (Shea et al., 2017). Two reviewers independently completed the AMSTAR-2 assessments of systematic reviews, with disagreements discussed and, where necessary, facilitated by a third researcher where a consensus was reached.

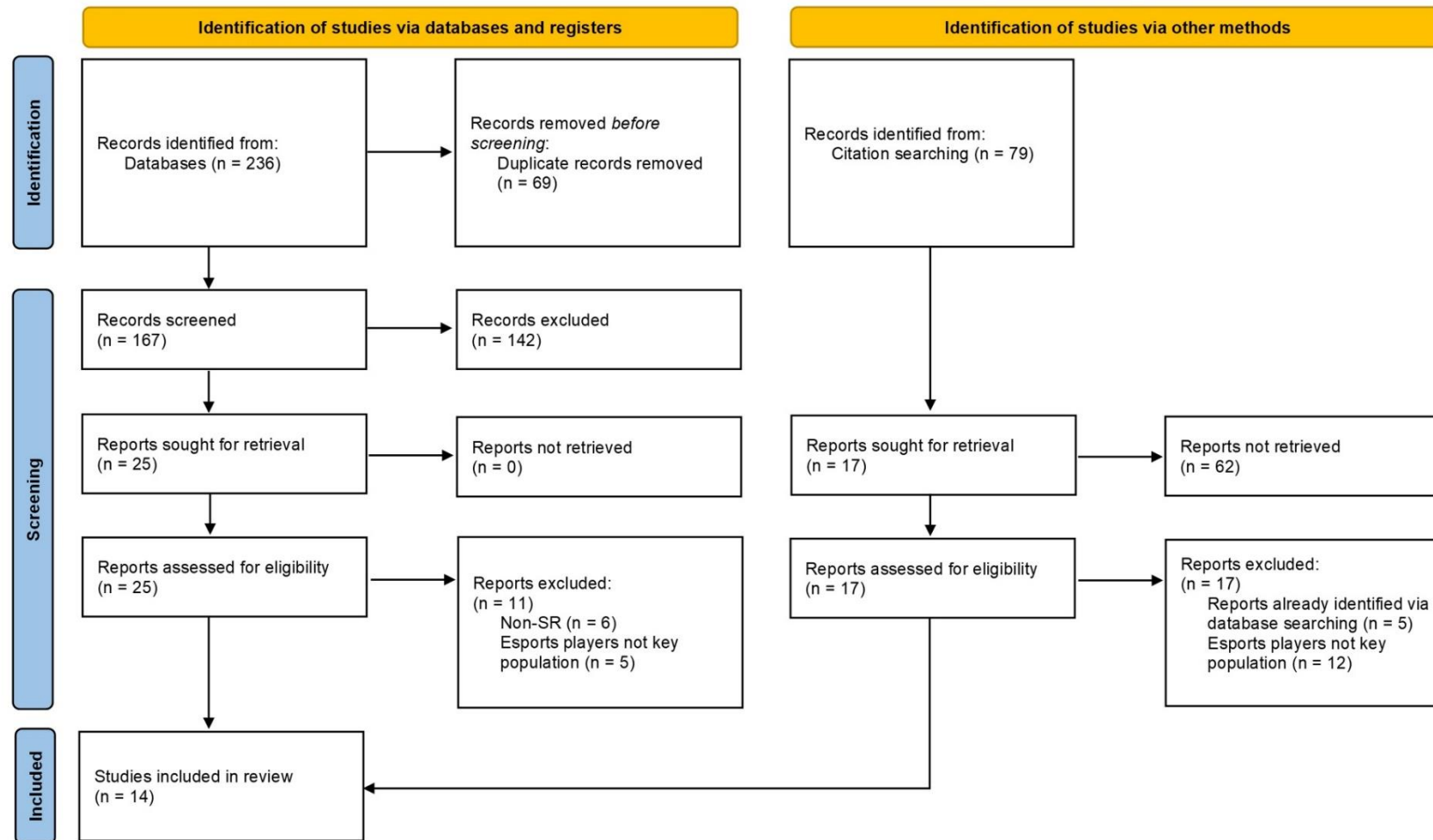
### ***Data Analysis and Presentation of Results***

The characteristics of each of the systematic reviews analysed were descriptively summarised (see Tables 1 & 2). An overview of the systematic review findings was

synthesised using qualitative synthesis. This data was aggregated and summarised using key themes to discuss the overall findings of each review (Seers, 2012). The themes were initially mapped using the biopsychosocial framework before being developed into overarching themes that provide a clearer understanding of the multifaced nature of the factors involved in esports participation. The lead researcher established the initial themes, which were then developed further and agreed upon by all researchers. Additionally, the methodological quality of the systematic reviews was assessed using AMSTAR-2 and categorised into ‘high’ to ‘critically low’ ratings of overall confidence. It is important to state that while a confidence rating is provided, the AMSTAR-2 is not meant to generate an overall score of the review and simply to address key domains that may influence the confidence in the results of the reviews (Shea et al., 2017).

## **Results**

From the selected search terms, 233 publications from six databases were identified, 167 of which remained after the removal of duplicate records. The titles and abstracts of the remaining studies were analysed, and 25 articles were selected for full-text reading. Finally, 14 systematic reviews were included in the final review. Seventy-nine articles were also identified through forward and backward citation searching of included systematic reviews, and 17 articles were eligible for full-text reading, however none of these studies were eligible to be included in the final review. The PRISMA flow diagram presenting the process of identification, screening and inclusion for the articles is presented in Figure 1.



**Figure 1** PRISMA flowchart for records screened from databases, registers, and other sources included in the umbrella review. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Non-SR = not a systematic review.

## ***Overview of the Systematic Reviews***

The included 14 systematic reviews represented a total number of 313 publications. Of these systematic reviews, five assessed esport performance, four considered the impact of esports participation on players, and the remaining five examined a combination of both factors. Overall, most reviews considered psychological outcomes of esports players ( $n = 11$ ), primarily focusing on sleep ( $n = 9$ ) and mental health ( $n = 9$ ). Physical health of esports players was also examined in over half of the systematic reviews ( $n = 8$ ), with the focus on physical activity and BMI ( $n = 7$ ); and injuries ( $n = 5$ ). Finally, social outcomes of esports players were assessed ( $n = 4$ ) with emphasis on gender issues and discrimination ( $n = 2$ ). There is limited information on the esports genres assessed as many systematic reviews did not provide thorough details. Tables 1 and 2 provide a summary of the systematic review characteristics.

**Table 1**

*Study characteristics and results for systematic reviews assessing the impact of esports participation*

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
Bányai et al. (2019)	8	Cross-sectional  Observations  Interviews	N = 2057  [2011-2017]	NS	NS	Pro, Am, Other	Player motivations  Player characteristics (knowledge and strategy – individual skill; coping mechanisms, communication skills, work-life balance)  Spectator motivations	Motivation of players related to mastery, improvement, self-concept  Enjoyment related to skill specialisation leading to esports identity  Mental skills and techniques needed for optimal performance e.g., adaptability, goal setting, decision making  Barriers include confidence issues, harassment, poor coping techniques  Some perceptions as esports/gaming as escapism – may lead to problematic/addictive gaming.
Leis and Lautenbach (2020)	17	RCT  NRCT  Crossover design	Non-competitive: N = 766  Competitive: N=195	Y and Ad M and F	Shooter, Fighting, Sport, MOBA	Pro, Am	Psychological stress (anxiety)  Physiological stress (blood pressure,	Mixed findings on psychological stress in non-competitive settings Higher levels of anxiety in competitive settings



Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
							cortisol, heart rate, testosterone, heart rate variability, respiration rate)	Mixed to no change in systolic blood pressure in non-competitive (only one competitive raised both systolic and diastolic BP)  Sig. increase in cardiac output in competitive settings  No cortisol change in non-comp  No difference in testosterone.  Mixed increase in heart rate in comp and non-comp
Lam et al. (2020)	6	Cross-sectional Interviews	N = 2523 <i>[1996-2020]</i> <i>[2010-2020]</i>	Ad M and F	NS	Pro, Am	Physical activity – sedentary behaviour  Injuries  Diet  Sleep	Most esports players met or exceeded WHO PA guidelines  Player motivations for PA to improve health which improved performance  Positive correlation between PA and mental toughness 35% training included PA  No techniques for injury prevention  High levels of sedentary behaviour – 15% of players spend 3 hours or more game time without a break

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
								<p>Eye, wrist and back pain make up 56% of esport injuries</p> <p>No sig. difference between video game and health behaviours – more active, less sleep (compared to general population).</p>
Palanichamy et al. (2020)	7	Cross-sectional	N = 7818 <i>[2017-2020]</i>	Y and Ad M and F	NS	Pro, Am, Other	<p>Physical issues in players (eye fatigue, body pain, poor vascular health)</p> <p>Psychological issues (depression, addiction, aggression, social phobias, poor sleep, apathy)</p>	<p><b>Physical issues:</b> Issues with eye fatigue with increased play time</p> <p>General musculoskeletal issues</p> <p>Increased grey matter volume in anterior cingulate gyrus – related to addiction regulation</p> <p><b>Psychological issues:</b> Rise in depression and aggression with play</p> <p>Issues with communication and audience effects during competition</p> <p>Excessive gaming related to social issues and poorer academic performance</p>

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
								Gender differences in addiction, aggression, and sleep
								Violent video games related to short term aggression.
Kemp et al. (2021)	12	RCT  Descriptive Observational study  Prospective cohort	N = 5429  [2000-2020]	Ad M and F	MOBA, Mobile	Pro, Am, Other	Sleep outcomes  Addiction  Physical health – BMI and sedentary behaviour	Weak sig. relationship in gaming duration, sleep quality and insomnia (compared to controls)  No link between gaming behaviour and sleep quality in esports  Positive correlation between sleep quality and emotional distress  No link between physical health and sleep quality  Half esports population normal weight – no differences in BMI across all levels  Higher game time linked with increased BMI  Lower PA related to higher game time

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
								Most esports players engaged in moderate to vigorous PA 2.5hr/week.
Schulze et al. (2021)	21	Not stated	N = DNS <i>[2011-2021]</i>	NS	Shooter	Pro, Am, Other	<p>Biological issues (nutrition – caffeine supplements, poor sleep outcomes, physiological arousal, pain and injury)</p> <p>Psychological issues (stress, coping, cognitive fatigue, addiction, mental ill-health)</p> <p>Social issues (harassment – gender, doxing, bullying, racism)</p>	<p><b>Biological issues:</b> Cultural differences in BMI, physical activity in esports players</p> <p>Poor nutrition</p> <p>Game type determined differences in heart rate and blood pressure</p> <p>Physical issues and pain common</p> <p>Poor sleep quality</p> <p><b>Psychological issues:</b> Parallel demands to traditional sports e.g., concentration, communication, emotional regulation</p> <p>Stress impacts on wellbeing, but may improve performance</p> <p>Poor esport-life balance</p> <p>Cognitive fatigue after comp</p> <p>Adaptive and maladaptive coping strategies among players</p>

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
								Addictive behaviours and risk of depression and anxiety
								<b>Social issues:</b> Harassment and racism exacerbated by anonymity
								Women experience greater level of sexism and harassment.
Chan et al. (2022)	36	Cross-sectional Case control Cohort	N = 54950  [2011-2019]	Y and Ad M and F	MMORPG, Shooter	Pro, Am, Other	BMI  Sleep related outcomes  Eye strain and body pain  Diet  Sedentary	Higher esport involvement related to unhealthy lifestyle outcomes  Gaming addiction related to less sleep  High levels of physical strain in esports and 40% inactive  Mixed findings for metabolic-related outcomes – low PA and problematic gaming  Increased gaming correlated with higher consumption of sugared beverages  Mixed findings between gaming and smoking and drinking  Mixed findings on sleep outcomes.

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
Bihari and Pattanaik (2023)	32	Interviews	N = DNS <i>[2011-2022]</i>	NS M and F	NS	Pro, Am, Other	Socio-cultural role of players	Professional players seen as peddlers of national soft power (but still stigma for gamers)
		Cross-sectional					Gender issues	Backlash and misogyny faced by female players
		Experimental					Career identity	Mixed pathways to professionalism
		Ethnography					Sleep	Neurological differences in pro players compared to addicted gamers
		Longitudinal observation					Cognitive functioning	Poor sleep outcomes
							Physical health	Almost all players physically active
							Mental health	Exposure to stress increased by amount of game time.
Shen and Cicchella (2023)	8	Experimental	N = 131 <i>[2004-2021]</i>	Y and Ad M and F	Fighting	Pro, SP	Physical health	Physical stressors contributors to fatalities
		Cross-sectional					Injuries	Lower limb thrombosis common in players, seizures
		Case study					Death and fatalities	Overuse of caffeine
								Sig. HRV during competition

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
								Disrupted sleep cycles associated with mood swings and depression in some players.
<i>Note.</i> Y = Youth; AD = Adult; M = Male; F = Female; Pro = Professional Player; SP = Semi-Professional; Am = Amateur; NS = Not specified; Other = Non-gamers/controls, spectators etc.								

**Table 2**

*Study characteristics and results for systematic reviews assessing the impact on esports performance*

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
Pedraza-Ramirez et al. (2020)	52	Cross-sectional	Cognitive Performance: N = 31,612	NS	Shooter, Fighting, MOBA, Sport, RTS	Pro, SP, Other	Cognitive performance (working memory, inhibitory control, cognitive flexibility and high order functions)	<b>Cognitive performance:</b> Mixed findings on esports training and working memory (compared to amateurs)
		Quasi-experimental	Game Performance: N = 3,300,821					Greater inhibitory control – reaction times – with esports training
		Experimental						Mixed cognitive flexibility
		Longitudinal	[1992-2019]				Game performance (expertise differences, effects of participation/training)	Mixed higher order functions
								<b>Game performance:</b> Experts better under pressure
								Mixed findings for age and practice on expertise
								Successful teams communicate better
								Player attitudes to game outcomes and passion type effects on affect and performance
								Gender and performance predictors of enjoyment



Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
								Mixed findings for audience effects.
Toth et al. (2020)	70	RCT  Pre-post design	Intervention Studies: N=798  Group Studies: N=3740  [1999-2019]	Y and Ad M and F	Shooter	NS, Other	Cognitive ability - intervention and performance (attention, memory, information processing, task switching)  Effects of exercise on cognitive abilities	Action video games improved attention, information processing and task-switching in non-gamers  No sig. difference for memory Exercise improved attention e.g., reaction times, visuospatial attention  Mixed findings on memory and information processing  Weak effects of exercise on improving task-switching.

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
Choi et al. (2021)	18	Experimental	N=855 <i>[2012-2019]</i>	Y and Ad M and F	NS	Pro, Am, Other	Brain imaging (enhanced cognitive functioning – cognitive control and visual working memory. Cognitive flexibility)	<p>Changes in brain structure in pro gamers compared to amateurs and individuals with gaming disorders – related to decision making and intelligence</p> <p>Greater integration of working memory in professional players</p> <p>Increased volume in striatum in gaming disorders – related to APD</p> <p>Decreased grey matter in some regions for gaming disorder</p> <p>Pros maintain better attention, processing and cognitive flexibility.</p>
Voisin et al. (2022)	18	Cross-sectional  Cohort  Interviews	N = 7442 <i>[2016-2022]</i>	Y and Ad M and F	Sport and MOBA	Pro, Am	Physical activity	<p>Mixed findings on PA but majority reached WHO guidelines</p> <p>Pros more likely to exceed WHO guidelines</p> <p>Potentially game dependent – virtual footballers more physically active.</p>

Author	No. Studies Included	Study Designs	No. Participants	Age Group (Y, Ad) And Gender (M, F)	Esport/Genre	Level of Participation (Pro, SP, Am, Other)	Factors Examined	Study Results
Akan et al. (2022)	8	Observational	N = 1685 <i>[2019-2021]</i>	Y and Ad NS	Shooter	Pro, Am	Sleep outcomes	Generally poor sleep quality for esports players  Delays in sleep patterns  Better performance related to higher sleep duration.

*Note.* Y = Youth; AD = Adult; M = Male; F = Female; Pro = Professional Player; SP = Semi-Professional; Am = Amateur; NS = Not specified; Other = Non-gamers/controls, spectators etc.

## *Qualitative Synthesis of Systematic Reviews*

### **Player Lifestyle Behaviours Negatively Impact on Physical and Mental Health**

The first overarching theme identified from the systematic reviews relates to how the lifestyle of esports players may be detrimental to their overall health and subsequent esports performance. Nine reviews cited that sleep-related outcomes were a key factor affecting player health. The reviews assessed typically professional players, but also included university level and amateurs. Participants were predominantly male esports players. Despite mixed findings across the literature, there appears to be a trend towards the amount of time players spend gaming and the negative effects on sleep including insomnia, sleep time and rise time compared to controls (Kemp et al., 2021). Additionally, poor sleep outcomes are associated with mental ill health such as depression, psychological distress, and other mood disorders (Shen & Cicchella, 2023). Despite the negative sleep-related outcomes impacting esports players, greater durations of sleep appear to contribute to improved esports performance (Akan et al., 2022).

The role of physical activity was also commonly cited as a concern to player health in seven systematic reviews. Professional players were typically assessed but some systematic reviews included primary studies that used non-gamer controls in relation to physical activity. All but one systematic review assessed primary studies that predominantly focused on male participants (Toth et al., 2020 – 44% female participants). Research typically suggests that as players increase their involvement in esports, the healthier their player lifestyle becomes, with around 40% of players found to be inactive (Chan et al., 2022). This is reflected in additional results showing players have a generally higher BMI than the general population (Shulze et al., 2021). There is however contrary evidence which suggests that almost all players attain the WHO physical activity guidelines and that professional players are more

likely to exceed these guidelines (Bihari & Pattanaik, 2023). Certain esports games may also improve physical activity, for example individuals competing football games appear to be more physically active (Voisin et al., 2022). Despite the suggestions that physical activity is increasing among esports players, they still show high levels of sedentary behaviour overall which can contribute to other concerns.

Some concerns that appear to be affecting players as cited within the systematic reviews are pain and injuries (n=5). The sample included professional and amateur esports players and predominantly male participants. The main injuries hampering players are related to the wrist, neck, back and eyes (Lam, 2020). These injuries make up 56% of all esports-related injuries with eye fatigue or 'computer vision syndrome' found to worsen as play time increases (Palanichamy et al. 2021). Even more concerning, one review found that esports participation across excessive periods of time may contribute to physical complications, such as thrombosis, and in some cases death (Shen & Cicchella, 2023). Despite the range of concerns to health from musculoskeletal injuries, that have resulted in early retirement of some players, the literature shows there is no clear strategy in place for injury prevention of esports players (Palanichamy et al., 2021).

Finally, some other lifestyle issues highlighted from the systematic reviews pertains to the diet and nutrition of esports players (n=4). The reviews showed that as time spent gaming increased, so did the likelihood of players consuming sugary and savoury snacks (Chan et al., 2022). There were also reports of overconsumption of caffeine while playing amongst esports players (Shen & Cicchella, 2023). While snacks and caffeine may help with alertness during gaming, it has been found to contribute to weight gain and other health concerns including increased blood pressure, diabetes, and cardiovascular diseases (Arsenault et al., 2017). None

of the reviews appear to show interventions or nutrition plans in place for players to improve their lifestyle choices.

**Cognitive Functioning of Players.** The second theme identified from the systematic reviews is how the role of cognition may affect esports players regarding performance (n=4). While most primary studies focused on professional and amateur players, individuals with gaming disorder were included in one systematic review (Choi et al., 2020). The reviews focused almost exclusively on male players. The reviews suggests that expertise in esports contributes to changes in brain structure when compared to amateurs included improvements in decision-making skills, motor control and intelligence (Choi et al., 2021). These changes may also go to explain why experts tend to make quicker and more accurate decisions during high pressure situations such as competition (Pedraza-Ramirez et al., 2020). In addition to individual expertise contributing to cognitive functioning, other reviews have found that the role of exercise provides a moderate improvement in attentional focus in esports players compared to non-gamers (Toth et al., 2020). Furthermore, specific esports training shows mixed results on the working memory players including greater inhibitory control, developing reaction times and decision-making skills, which are key for optimal performance in esports (Pedraza-Ramirez et al., 2020). In summary, participation in esports to the point of skill mastery, can contribute to cognitive development and neuroplasticity in addition to interventions such as cognitive training and exercise that may also further build on this improved cognitive functioning.

These changes in brain structure are not unique to esports players, but may also present in individuals with gaming addiction (Bihari & Pattanaik, 2023). One review showed that addicted individuals have decreased grey matter which contributes to a greater need for rewards, impairment in cognitive control and executive dysfunction (Choi et al., 2021). While

these individuals may be general gamers and should be made distinct from esports players, it is important consideration for the wellbeing of players is addressed to ensure they are not playing to excess and resulting in gaming addiction.

Finally, one review considered how cognitive health, namely stress can influence performance during competitive and non-competitive settings (Leis & Lautenbach, 2020). Non-competition, such as training sessions appear to have mixed to no changes in psychological and physiological stress on players. However, there is evidence of higher levels of anxiety during competitive settings that while it may impact on wellbeing, in small amounts it can contribute to overall esports performance (Leis & Lautenbach, 2020; Shulze et al., 2021). Given the limited number of reviews on psychological stress of players, more research should be considered into the role of competition on cognition.

**Player Characteristics and Performance.** Player characteristics were also found to affect overall player performance (n=3). The reviews focused on professional and amateur players, but also included primary studies focusing on esports spectators and general gamers. Two of the systematic reviews did not include information on gender with the remaining review focused mostly on male players. Some of the systematic reviews discussed how a well-integrated player identity, such as strong team dynamics and a sense of accomplishment, can contribute to positive motivations within esports players (Bányai et al., 2019). These motivations were also related to enjoyment and skill mastery which consequently led to skill expertise (Bányai et al., 2019). Conversely, the reviews also found that poor team communications, and maladaptive coping mechanisms contributed to a detriment in mental health and consequently overall player performance (Palanichamy et al., 2021; Pedraza-Ramirez et al., 2020). Other factors that may affect this is concerns over talent pathway for esports with some papers positing the chaotic journey to professionalism (Meng-Lewis et al.,

2022). The unpredictable nature for team selection and short careers of players may negatively impact on performance of players and their overall mental health.

**Gender-specific Considerations.** Another theme found to potentially impact on esports participation and performance concerned gender and discrimination in esports (n = 2). Despite discussing gender issues, the two reviews did not provide any demographic information in terms of gender split on the primary studies used nor the level of participation. While some barriers to participation are due to general harassment issues across all populations (Bányai et al., 2019), the reviews state that women experience greater levels of sexism, racism, and harassment in esports than men (Shulze et al., 2021). An example of this shows that women being more likely to be sexually harassed and objectified online compared to men (Ruvalcaba et al., 2018). The male-dominated, hyper-masculine nature of the esports industry makes it difficult for professional female players to build their online identities as they have to negotiate their identity as women in esports (Zeolides, 2015). For example, interviews with male and female players suggested that women often use strategies to hide their gender online in order to avoid stigma or harassment such as using voice changers or gender-neutral gaming names, which in some cases further perpetuates gender stereotypes and limits women's success in esports (Madden et al., 2021). Despite these overarching concerns female players face in esports, it is suggested that strong levels of social support is contributing to more women pursuing careers within the industry (Yusoff et al., 2021).

### ***Assessment of Methodological Quality***

The results of the AMSTAR-2 analysis used to critically assess the methodological quality of the systematic reviews is shown in Table 3. The assessment was conducted independently by two researchers to provide an inter-rater reliability score and found a



substantial level of agreement ( $\kappa = 0.80$ ). Discussions surrounding differing options on the results were facilitated by a third researcher and a consensus was reached.

Using this criterion, of the 14 systematic reviews critically assessed, 11 reviews were rated as ‘critically low’ in overall confidence, one review was rated as ‘low’, and the final two received a rating of ‘moderate.’ None of the systematic reviews achieved a rating of ‘high.’ There was little statistical analysis across the reviews with only one conducted a meta-analysis, and two others providing a discussion on effect sizes.

Most of the reviews failed to address many of the critical domains within the AMSTAR-2, which significantly diminish the confidence in the results of the reviews (Shea et al., 2017). The critical domains systematic reviews rated poorest on was ‘failing to provide explicit a priori statements surrounding written protocols’ (Item 2) with only two reviews mentioning preregistration. However, these were still only able to attain a rating of ‘partial yes.’ Item 9 and Item 13, which refer to the use of satisfactory risk of bias assessments for individual studies, and accounting for the risk of bias when interpreting the results of the review respectively, was where systematic reviews also performed particularly poorly. Five reviews critically appraised the risk of bias in the individual studies, whereas three of those reviews addressed biases within the individual studies by using high quality studies or discussing how these studies may implicate on the overall findings.

Systematic reviews also performed poorly on the following non-critical weaknesses:

- Item 10 – no reports of the sources of funding used in the individual studies (100%).
- Item 14 – no discussion of heterogeneity (93%).

**Table 3***Assessment of systematic reviews using AMSTAR-2*

Study	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Item 15	Item 16	Rating
Bányai et al. (2019)	N	N	N	N	N	N	Y	N	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Lam et al. (2020)	N	N	N	N	Y	Y	Y	Y	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Pedraza-Ramirez et al. (2020)	Y	N	N	Y	N	N	Y	Y	PY	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Leis & Lautenbach (2020)	Y	PY	Y	Y	Y	Y	Y	Y	Y	N	NO MA	NO MA	N	N	NO MA	Y	MODERATE
Toth et al. (2020)	Y	N	Y	N	N	N	N	Y	Y	N	NO MA	NO MA	Y	N	NO MA	Y	CRITICALLY LOW
Shulze et al. (2021)	N	N	N	Y	N	N	N	N	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Palanichamy et al. (2021)	N	N	N	N	N	N	Y	Y	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Kemp et al. (2021)	Y	N	Y	N	Y	N	Y	Y	N	N	NO MA	NO MA	N	Y	NO MA	N	CRITICALLY LOW
Choi et al. (2021)	Y	N	N	PY	N	N	Y	Y	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Voisin et al. (2022)	Y	N	N	PY	N	N	Y	Y	Y	N	NO MA	NO MA	Y	N	NO MA	N	LOW
Chan et al. (2022)	N	N	Y	Y	Y	Y	PY	Y	Y	N	Y	N	Y	N	Y	Y	MODERATE

Study	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Item 15	Item 16	Rating
Akan et al. (2022)	N	N	N	N	Y	N	Y	N	N	N	NO MA	NO MA	N	N	NO MA	N	CRITICALLY LOW
Shen & Cicchella (2023)	N	PY	Y	Y	N	N	N	N	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW
Bihari & Pattanaik (2023)	Y	N	N	N	N	N	Y	N	N	N	NO MA	NO MA	N	N	NO MA	Y	CRITICALLY LOW

## **Discussion**

### ***Summary of Evidence***

The current umbrella review was carried out on 14 systematic reviews to provide an overview of the biopsychosocial impact of esports participation on esports players as well as the subsequent outcomes on esports performance. It also aimed to critically appraise the methodological quality of the existing systematic reviews within this topic area, as well as identify any gaps or limitations of the available literature surrounding the biopsychosocial impact of esports participation and provide recommendations.

Overall, empirical evidence suggests general esports participation has a mixed to negative impact on esports players. The most common and detrimental implication esports participation appears to have on esports players is sleep-based outcomes. Poor sleep quality and habits was often cited within the systematic reviews with players struggling with sleep onset, rise time, and insomnia because of esports participation (Kemp et al., 2021). It was also frequently associated as the catalyst for greater concerns with psychological and physical health including symptoms of depression, fatigue, and cardiovascular issues (Shen & Cicchella, 2023; Shulze et al., 2021). The structure of esports and gaming lends itself to these negative outcomes such as stressors including teammate interactions, in-game pressures, and personal concerns contributing to mental ill health in players (Smith et al., 2022); exposure to blue light emitting devices before bedtime, and excessive caffeine usage (Bonnar et al., 2019). Despite research which suggests that sleep can have benefits to cognitive functioning, which is key for optimal performance, interventions have so far struggled to implement sleep interventions that change the sleep habits of esports players and improve their wellbeing and performance (Bonnar et al., 2022).

With consideration for how frequently the factor of sleep occurred within the systematic reviews, researchers should focus on developing longitudinal studies and interventions that support lifestyle change of esports players, but also consider other possible explanations for the irregular sleeping habits of esports players. For example, while delayed sleep phase syndrome is associated with problematic gaming habits (Kristensen et al., 2021), it is also prevalent in individuals with Attention Deficit Hyperactivity Disorder (ADHD; Snitselaar et al., 2018). Currently, there is a lack of literature on adult gamers and esports players in relation to being diagnosed with ADHD and the subsequent link to poor sleep outcomes, however, research on adolescents suggests ADHD is associated with excessive use of video games and irregular sleep patterns compared to adolescents without ADHD (Salerno, Becheri & Pallanti, 2022). Therefore, while esports, and gaming, participation may not be the root cause of poor sleep outcomes, it may exacerbate them.

Another prominent finding from the systematic reviews was the negative impact of esports participation on physical activity and diet of esports players. Generally, esports players appear to engage in limited physical activity – as a result of esports participation - thus showing more sedentary behaviour compared to the general population (Bihari & Shen, 2023; Chan et al., 2022; Lam et al., 2020; Palanichamy et al., 2020). This lack of physical activity is also related to significantly less lean body mass, higher percentages of body fat, and lower bone density compared to controls (DiFrancisco-Donoghue et al., 2022), showing detrimental outcomes on the physical health of esports players. Despite the potential physical consequences of esports participation on the general esports population, there is evidence that shows the top 10% ranked players in a study were significantly more likely to engage in physical activity and exceed WHO physical activity guidelines showing the perceived benefits of exercise on elite performance and well-being (Trotter et al., 2020). There are also cross-cultural differences that are evident with esports players showing varying levels of

fitness and health outcomes (Shulze et al., 2021). For example, American esports players were healthier than the general population of the USA but were still obese when compared globally (Trotter et al., 2020). Future research should therefore consider the cultural norms and risk factors related to player health, and despite some mixed findings, esports participation is predominantly sedentary and so more exercise-related interventions should be considered as part of esports training.

A key factor that shows a potentially positive impact of esports participation on players is the role of cognitive functioning. Professional esports players showed changes in brain structure associated with attentional and motor control, decision making skills, and overall improved executive functioning compared to amateur players (Choi et al., 2021; Pedraza-Ramirez et al., 2020). As seen in elite traditional sports, improved cognitive functioning is beneficial for decision making, attention and adapting to change (Hernández-Mendo et al., 2019), which are skills key for optimal performance. Furthermore, just as improved cognitive functioning can give athletes a competitive edge in sports that require attentional control on salient stimuli (Memmert, 2019), esports also could benefit from this advantage. While their visual search is limited to a computer screen, sustained attentional and focus on key stimuli could be the difference between winning and losing a game. Despite the differences in esports and traditional sports, it appears the cognitive needs are similar and the influence of training and expertise can cause changes in brain structure to benefit performance at the top level (Choi et al., 2021). Just as there is a call for more cognitive training within traditional sports (Walton et al., 2018), it may be beneficial for esports players to receive some task-specific cognitive training to ensure peak performance and the cognitive development needed for elite esports as shown by the results of the systematic reviews (Choi et al., 2021; Toth et al., 2020).

A final key finding that may contribute to a negative impact on esports players as a result of esports participation is discrimination and harassment in the esports industry. Despite only being mentioned in two systematic reviews, gender-based harassment appears to be one the biggest deterrents to esports participant for female esports players (Bányai et al., 2019; Shulze et al., 2021). Further research supports this claim that the male-dominated nature of esports is limiting opportunities for elite participation, and preventing women from engaging with the esports community due to fear of harassment (Darvin et al., 2021; Rogstad, 2021). This is also evident in that only two professional female players are within the top 1000 players by earnings and no higher than the top 400 (Esports Earnings, 2022b). Arguably, more women are now pursuing roles in esports, however the industry needs to promote safer and more inclusive environments for women to grow in esports with fewer challenges. This is even more pivotal as the virtual nature of esports lends itself to promoting inclusion as power imbalances and physical dynamics that exist in traditional sports and industries can be better mitigated (Hayday & Collison, 2020). While there is anecdotal evidence of the harassment and discrimination faced by female players, the current systematic reviews and the wider esports literature shows little empirical research has been conducted to address these issues and the implications they may have on female esports players. Indeed, Di Nicola and colleagues (2024) found that there was an overrepresentation of cisgendered men in esports research, making up 81.27% of all participants compared to cisgendered women (16.22%), and transgender participants (0.11%). Further research is therefore warranted in this area to better understand the experiences of female esports players and to investigate the extent to which harassment and discrimination is detrimental to women in esports.

The results of the AMSTAR-2 assessment revealed that the methodological rigour of systematic reviews in this area of esports research is weak with more than 78% of the reviews

analysed being rated as ‘critically low.’ A potential reason for this outcome could be the apparent floor effect caused by the lack of leniency and high standards of the AMSTAR-2 (De Santis et al., 2023) making it difficult for systematic reviews of this nature to attain a high overall confidence score. One key concern with the systematic reviews that may reduce the confidence in the results include the fact only five of the 14 reviews provided a satisfactory assessment for risk of bias in individual studies. While the reviews may have reported their results appropriately, it is also difficult to assess whether the literature is subject to bias as limited quality assessments have been undertaken. Additionally, only three reviews that assessed risk of bias omitted low quality studies from their research synthesis which may bring into question the reliability of the primary studies included in the broader research area. While the AMSTAR-2 is seen as a guide and not to provide an overall quality rating for systematic reviews (Shea et al., 2017), the critically low ratings suggest a need to improve methodological standards in esports research, particularly within systematic reviews. As such the presented findings of the systematic reviews should be interpreted with caution and tentatively due to the lack of high-quality evidence and potential for biases.

This umbrella review may help develop a better understanding of the stringent criteria required for a systematic review within esports literature and improve the methodological quality of future reviews, with a focus on accounting for risk of bias from individual studies and a priori statements for written protocols for to ensure rigour. Furthermore, conducting an umbrella review has allowed for systematic reviews within esports literature to be compare and contrasted and provide a broad understanding of the impact of esports participation on esports players.

### ***Methodological Limitations and Recommendations***



As well as the concerns highlighted from the results of the AMSTAR-2, several other issues within the systematic reviews have been identified that may have contributed to the poor methodological quality seen in the reviews. For example, most of the articles used across the systematic reviews were cross-sectional studies with an overreliance on self-reports and observational studies. While there are benefits to using cross-sectional research in esports given the niche population and access to participants, it is often susceptible to biases as well as being unable to make causal inferences (Wang & Cheng, 2020), diminishing the overall validity of the research. This is particularly so when compiled as part of a systematic review where the purpose of synthesising primary data on a topic area is to limit bias and random error (Cook et al., 1997).

Regarding bias, there appears to be a possibility of selection bias within the systematic reviews. Lam and colleagues (2020) commented on the lack of age, gender and ethnicity differences with their samples being predominantly young, male, and from western cultures. Furthermore, Choi et al. (2021) noted that six of the 18 studies did not even include female participants. While this may not be intentional bias, the samples are not representative of the esports population where there is a growing appeal in esports amongst women who now make up 37% of the esports audience in Europe (Gough, 2023) and could lead to a rise in players within the youth programmes (Valentine, 2018). Therefore, more research must ensure there is a focus on not just female esports players, but women and other marginalised genders within the esports industry overall.

Another issue with the systematic reviews was the lack of intervention or experimental studies. This may be due to the lack of such research in esports literature, as indicated by the calls for more epidemiological and experimental designs to better understand health in esports (Yin et al., 2020). Due to the methodological heterogeneity across the

systematic reviews, the generation of statistical analysis of results has not been possible in this umbrella review. This is a limitation of the current review as a consequence of the systematic reviews included. However, this is the first comprehensive analysis of evidence on biopsychosocial factors affecting performance and wellbeing of esports players and as such may help highlight the future research that is required in this area.

In relation to the results of the AMSTAR-2 analysis, there are several suggested recommendations to researchers who plan to conduct a systematic review within esports research in the future. Researchers should ensure better justifications for study designs, including statements about the lack of RCT studies in esports research and how that may contribute to the use of NSRI studies. It is also important to address the variance, or lack of in the systematic reviews, and how they may implicate on findings. For example, many reviews commented on the limited number of female participants but did not discuss the homogenous nature of sampling in esports. Moreover, a priori protocols should also be encouraged to ensure transparent reporting of results and minimise the researcher biases due to knowledge from preliminary results. By considering these recommendations, it may help improve the rigour and standard of systematic reviews within esports research.

### ***Implications and Future Directions***

The umbrella review offers practical implications by providing practitioners with an encompassing overview of the factors related to esports player needs and barriers which may help in supporting player development, performance and health. Sport and exercise psychologists in particular can help players with skill development through deliberate practice and optimisation of practice. Additionally, they can help players cope with the psychological demands of esports and provide them with key strategies (Smith et al., 2019). Interdisciplinary teams should also be promoted that provide players with well-rounded

support including nutrition, physical activity and ensuring a healthy work-life balance. Frameworks are also required to ensure practice and play within esports is positive and improves the physical and mental health of players. This responsibility should be held and promoted by professional governing bodies and stakeholders (Hong, 2022; Kelly et al., 2022) which will provide players with the stability and support they need within esports.

Factors related to the impact of esports participation should also be evaluated using more rigorous methods such as experimental designs. This would allow us to fully understand the causal effects and build on the foundations for more experimental and epidemiological research on health in esports (Yin et al., 2020). To best address the broad range of factors identified within the umbrella review, it may be beneficial to future esports research to propose a biopsychosocial impact of esports participation model to provide an encompassing overview of the factors involved in esports participation, and their subsequent positive, negative, or mixed impact on esports players. Esports research could also benefit from more qualitative studies that examine the mental health and pressures players experience as well as a greater understanding of the general experience of players from marginalised groups which are overlooked in this review. Additionally, more emphasis should be placed on the role of gender and social issues within esports. As the least considered within the systematic reviews and yet the most discussed anecdotally, the role of harassment and discrimination against women in esports on their health, wellbeing and performance should be examined in greater depth.

## **Conclusions**

In summary, the systematic reviews show a breadth of factors both positively and negatively affecting esports players from participating in esports. The results show players should benefit from interventions related to increased physical activity and sleep outcomes to

improve overall esports performance and mental health outcomes. Players would also benefit from the development of positive coping strategies to help alleviate the stressors related to participating in esports. There are also concerns with women facing harassment and discrimination within the esports industry that limits their engagement with esports that must be addressed, as well as an underrepresentation of women in esports research. The umbrella review also assessed the methodological quality of systematic reviews within esports research. Overall, the study demonstrates a critically low confidence in the results of many of the systematic reviews regarding biopsychosocial factors that affect wellbeing and performance of esports players. Future research must therefore improve the quality of their reviews by providing clear assessments for risk of bias within studies as well as establishment of written protocols prior to conducting studies.

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