

Opinion

# Linking Esports to health risks and benefits: Current knowledge and future research needs

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## 1. Introduction

Electronic sports (Esports), viewed as competitive and organized video gaming,<sup>1</sup> are becoming accepted as a form of sports.<sup>2–4</sup> Many digital video games associated with Esports are played through various platforms (e.g., computers, consoles, mobile, streaming, or virtual reality)<sup>5</sup> and involve either simulating competitive sports (motion-based) or combative (action-based) activities.<sup>2</sup> Esports have been around for more than 20 years<sup>1</sup> and continue to thrive economically as a highly profitable gaming industry.<sup>2,6</sup> Thanks to the advances in digital media and online game-streaming or cloud gaming technologies, there has been a rapid increase, on a global scale, in the popularity of Esports worldwide,<sup>6</sup> evidenced by the exponential growth in participation, media coverage, viewership, sponsorship, and commercialization.<sup>7–10</sup> The latest statistics on global Esports showed more than USD1 billion in market revenue in 2019, with a predicted market growth reaching USD1.79 billion by 2022.<sup>11</sup>

Not all video games related to Esports are competitive by design (e.g., exergaming<sup>12</sup>). Those that are (e.g., action-based games), however, have been at the center of scholarly debates with respect to the true athletic nature of sports, cultural values, and the moral ethics of Esports play.<sup>3,13,14</sup> These issues have an impact on mainstream sports and sporting communities in general. In health promotion, interactive exercise video games, known as exergaming, combine exercise with game play and have been widely studied, with evidence of health benefits and increased levels of physical activity.<sup>12,15–18</sup> In competitive sports, however, the recognition of Esports as a contested event remains unclear. The International Olympics Committee has taken a stance on what sorts of competitive games it will consider to be acceptable in the Olympic Games.

While it will not have specific Esports events as part of the Games, it does aim to promote Esports within the spirit and shared values of the Olympics, with a focus on promoting gaming that simulates sports movement and improves the health and well-being of gamers or competitors at all levels.<sup>19</sup> Likewise, Esports will not be included in the upcoming 19th Asian Games in Hangzhou, China.<sup>20</sup> On the other hand, Esports were included among the competitions that took place in the 2019 Southeast Asian Games, shaping it into a history-making event.<sup>21</sup>

Globally, Esports have been increasingly recognized as a competitive sport activity in various contexts, as evidenced by establishment of Esports Europe (including 23 national Esports organizations).<sup>22</sup> Recognition by the National Basketball Association<sup>23</sup> and the formation of the National Association of Collegiate Esports,<sup>24</sup> as well as the addition of Esports in intercollegiate athletic competitions<sup>10</sup> and sanctioning by the National Federation of State High School Associations,<sup>25</sup> are additional evidence of this growth. Esports, especially some virtual sports and action-based video games (e.g., platformer, shooter, fighting), share some common physical and mental demands with non-digital sports<sup>2,4,26</sup> in that Esports also require motor skills, mental agility, processing speed, executive function, motivation, and, to a lesser extent, physical exertion.<sup>27</sup> Some limited research indicates that action videogames, whether played cooperatively or competitively, are beneficial in building skills related to cognitive ability,<sup>28–30</sup> reading ability,<sup>31,32</sup> reaction time,<sup>33</sup> and sensorimotor skills.<sup>34</sup>

The popularity of professional Esports continues to soar, with players predominantly being younger individuals, including school-aged children and adolescents,<sup>5,35</sup> as well as college athletes.<sup>10,36,37</sup> Given the speed at which many games associated with Esports are played and the psychological intensity of the competition, contenders or athletes undertake extensive training to establish proficiency in the use of control devices

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(e.g., keyboards, mice, or console controllers). They must also hone the essential neurological skills, including effective hand-eye coordination, development of fast reaction times, and rapid decision making in a virtual competitive environment, that are critical for winning and success in Esports games.<sup>13,38,39</sup> The intensity of training required for competitive Esports games paradoxically necessitates sitting in the same position for hours at a time in front of a computer or television screen, enduring high levels of stress, visual attention, blue light (from light-emitting diodes), and repetitive small-muscle movements, which together equate to a sedentary and, consequently, unhealthy lifestyle.<sup>40–42</sup>

## 2. Current knowledge

The digital gaming characteristics of Esports make it easy to identify potential adverse health effects that may result from the sustained and stressful training and fierce competition encountered by high-level Esports game players.<sup>43–45</sup> This finding is especially evident when considering the fact that most participants are young school-aged children and adolescents<sup>5</sup> who compete in a physically and mentally demanding environment, exposing them to negative risks with harmful outcomes.<sup>46</sup>

Some commonly identified negative health outcomes documented to date include stress,<sup>47</sup> sleep disturbances,<sup>48</sup> vision problems,<sup>49</sup> musculoskeletal pain,<sup>50</sup> overuse injuries,<sup>51,52</sup> metabolic disorders<sup>53</sup> or weight gain,<sup>54</sup> and other behavioral problems (i.e., addiction, violence, aggression).<sup>55–57</sup> For example, a recent survey showed that college students who spent a significant amount of daily time (from 5.5 h to 10.0 h) in front of screens playing Esports suffered from eye fatigue as well as neck, back, wrist, and hand pains.<sup>51</sup>

In regard to energy expenditure, there is some evidence that active games (e.g., exergaming) tend to increase energy expenditure or physical activity levels,<sup>58–60</sup> suggesting that active video games focusing on fitness or exercise can contribute to health-enhancing physical activity and fitness. However, relatively little is known about the energy levels expended among athletes engaging in high-level gaming competitions. In fact, one study showed that 40% of collegiate varsity Esport players reported not participating in any other form of physical activity.<sup>51</sup>

Given the rapidly expanding popularity of Esports video games (e.g., Dota 2, Fortnite, League of Legends) and accelerating growth in the Esports industry, scientific research addressing the public health implications of the Esports phenomenon is significantly lacking.<sup>40,41,61</sup> There is also a lack of knowledge about the potential health benefits of Esports, along with the behavioral risks it carries with it, including addiction,<sup>46,62</sup> overuse injuries,<sup>50–52</sup> overweight/obesity,<sup>53,54</sup> and doping behaviors,<sup>63</sup> all of which can result from the highly competitive nature and lucrative rewards system inherent in Esports.

## 3. Gaps in knowledge and research needs

The lack of knowledge about Esports stems from the dearth of substantial health research into this phenomenon.<sup>64,65</sup> More

information and research is needed on the following aspects of Esports:

- Health issues related to participation in competitive action-based Esports video gaming in more advanced virtual and augmented reality Esports environments
- Psychosocial, physical, and cognitive effects of Esports competition among players of various ages
- Mental health issues resulting from competitive video gaming, including gaming addiction, burnout, cyber bullying, intimidation, and discrimination
- Whether participation in the Esports genre of sports simulation or motion-based video gaming leads to increased motivation to engage in traditional sports or physical activity
- Acute or chronic adverse health risks associated with excessive and prolonged Esports training and playing
- Levels of physical fitness and oxidative stress that occur among competitive Esports athletes
- Mechanisms underlying overuse injuries in Esports
- Potential gender gaps and differences regarding Esports training and competition
- Impact of physical inactivity or prolonged sitting during digital game play, including overweight, obesity, and cardiovascular risk
- Associations between levels of energy expenditure during Esports gaming and health consequences
- Long-term health consequences of video game playing
- The extent to which active games can serve as a healthier alternative to sedentary screen time

These research and knowledge gaps create significant barriers to addressing this emerging public health need and determining how to safely promote Esports for either competition or leisure. To narrow these gaps, a strategic research agenda should be developed to better understand the benefits of Esports (its ability to promote health, well-being, and physical activity) and identify strategic and preventive solutions to ameliorate its adverse health impacts among various levels of professional athletes and amateur players alike.<sup>64</sup>

The following list describes some of the epidemiological and experimental research that is needed to advance the field of scholarship in Esports. Knowledge gained from this line of research can help to create guidelines and strategies that promote healthy participation in Esports and the well-being of its players.

- Epidemiologic research that tracks the prevalence of health risk factors associated with the sedentary nature of Esports performed on various platforms (computers, consoles, or virtual reality environments)
- Studies that identify the determinants of psychological and physiological factors that either facilitate or impede healthy behaviors resulting from game playing, with a distinction made between serious play (i.e., for winning) and leisure/fitness<sup>61</sup>
- Comparative studies between traditional sports and Esports in regard to factors that influence performance

- Development of exergaming-based physical activity interventions aimed at reducing sedentary behavior among Esports players
- Development of training strategies that promote mutual respect and fair play and reduce cyber bullying among Esports players
- Mechanistic studies that seek to determine the mechanism(s) of injuries associated with repetitive joint movements or sustained sedentary time during gaming
- Development of preventive and therapeutic interventions that help rehabilitate players and athletes with chronic musculoskeletal pain or overuse injuries<sup>51</sup>
- Development of exercise-based relaxation techniques that reduce stress, burnout, and anxiety; improve the mental health, sleep quality, and well-being of Esports players; and optimize their competitive performance
- Development and evaluation of safety interventions or workstation modifications that address computer- or console-related injuries, including the negative effects of blue light that causes symptoms of digital eyestrain due to extended exposure from the play screen, carpal tunnel syndrome, repetitive strain injury, and back pain
- Policies and initiatives that promote consensus around the promotion of healthy electronic gaming in Esports
- Development of interventions that help increase motivation to transfer gaming activities or movement skills related to Esports into participation in real-world sports activities

#### 4. Conclusion

Playing and competing in Esports games have significant ramifications for the players' health. With the popularity of Esports continuing to grow rapidly worldwide, research that focuses on understanding the health risks and benefits associated with Esports competition and participation has lagged. Insufficient attention has been given to the development and evaluation of preventive interventions that address the harms that video games associated with Esports may entail. Similarly, gaps exist in our knowledge of ways to promote safe and healthy digital gaming among an ever-growing population of younger Esports athletes. These gaps need to be filled through systematic scientific research so that evidence-based guidelines and intervention strategies, involving healthy diet, regular exercise, and sleep hygiene, can be developed. It is a public health approach that moves toward better integration of Esports gaming and Esports fitness.

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#### Authors' contributions

All authors have contributed significantly to this article; YL was responsible for the overall content of the article; KY

drafted the manuscript. All authors were involved in the literature search, data interpretation, and writing, editing, and critical revision of multiple versions of the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of the presentation of the authors.

#### Competing interests

The authors declare that they have no competing interest.

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