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Public Health Concerns for Video Game Players: A Literature Review

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Abstract

According to a report by the Entertainment Software Association, 64% of U.S. adults and 70% of those under 18 regularly play video games. The group of individuals who play video games is a population. A systematic literature search was conducted using PubMed and Web of Science in June 2023. After reviewing 79 articles, authors ranked health concerns related to video game players based on the number of references. This study identified 46 research articles that targeted gaming disorders, which included risk factors, prevalence, symptoms, diagnostics, disorder mechanisms, and treatments of gaming disorders. Another top health concern for video game players is "sleep." There is a lack of research on specific health concerns, such as mental health, vision, hearing, and nutrition. This study's findings will increase the awareness of population-based healthcare management among people who play video games, the public, health providers, and parents. The authors also discussed key issues for different audiences, such as the public, health care providers (such as Pediatrics), and parents.

Keywords: Video games, Public Health, Gaming Disorder, Sleep

1. Introduction

According to a report by the Entertainment Software Association, 64% of U.S. adults and 70% of those under 18 regularly play video games (Entertainment-Software-Association, 2023)**.** A group of individuals who play video games is a population. The American Psychiatric Association (APA) published the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in 2013. In DSM-5 Section III, Internet Gaming Disorder was identified as "*a condition warranting more clinical research and experience before it might be considered for inclusion in the main book as a formal disorder."* World Health Organization (WHO) released the 11th revision of the International Classification of Diseases (ICD-11) in 2018. Gaming disorder was defined in ICD-11 as "*a pattern of gaming behavior ("digital-gaming" or "video-gaming") characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences*"(Bean et al., 2017). The researchers commented that including gaming disorder in ICD has more advantages than disadvantages (Király & Demetrovics, 2017).

In the past ten years, there have been research studies about health risk factors related to playing video games. A comprehensive literature review has been conducted, and the study's purpose was to understand the health and disease patterns of this population who play video games. The study's findings can increase the awareness of the population-based healthcare management of people who play video games and promote the health and prevention of diseases in this population.

The first stage of change for video game players is the "knowledge stage": a video game player gains some understanding of how video games can lead to possible health concerns. Secondly, the "persuasion stage" occurs when the video game player forms "a favorable or unfavorable attitude toward playing video games." This paper discusses

Vol. 2025 (3) 176 – 186
ISSN 2688-3651 [online]

health concerns regarding video game addiction and is primarily focused on the first stage of behavior change. Hopefully future research of the authors will focus on finding actionable public health intervention. For example, recommendations for specific, practical steps to monitor gaming habits, making the findings more applicable to real-world scenarios.

2. Method

A systematic literature search was conducted using PubMed and Web of Science from inception to 21 June 2023. The research terms were searched in the fields of title and abstracts of the publications. The searches were limited between 2013 and 2023. Only research studies from the past ten years were evaluated. These search terms included 'video game,' 'computer game,' 'health,' 'medical,' 'disease,' 'public health,' 'mental health,' 'epidemiology,' 'sleep,' 'hand,' 'eye,' 'vision' and 'physical activity.' The inclusion criteria were articles discussing the health concerns of playing a computer video game. Two independent reviewers screened the titles and abstracts of the articles to determine inclusion. Articles included experimental studies, observational studies, and reviews. Two independent reviewers further assessed the retrieved articles based on the previously mentioned eligibility criteria.

The PRISMA flow diagram mapped the identification of studies (Figure 1). The searches of PubMed and Web of Science resulted in the identification of 3488 records. After removing duplicates, 2845 studies with unique titles were obtained to screen titles and abstracts. A total of 2698 studies were removed after screening titles and abstracts. After excluding 16 records that did not have full-text access, 131 full-text articles were retrieved. After conducting assessments based on the inclusion criteria, 52 articles failed to meet the inclusion criteria. Thus, this review included 79 articles.

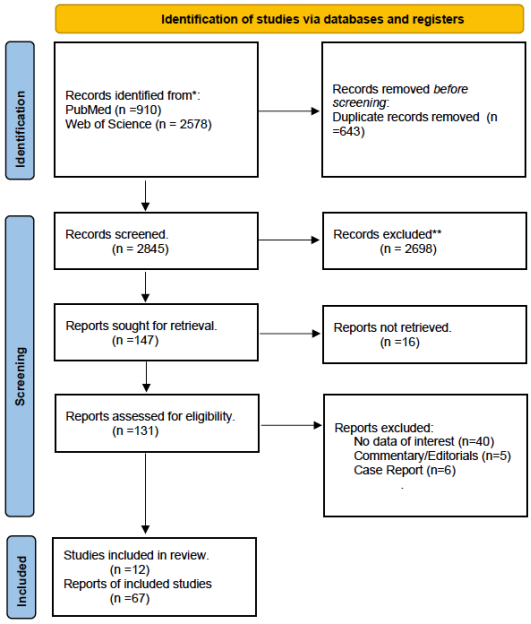

Figure 1. PRISMA flow diagram

3. Results

Research studies about health concerns for video game players are preliminary classified based on main research targets: game addiction/disorder, sleep, mental health/depression, diet/nutrition, vision, hearing, and death (See Table 1). Conceptually, there may be overlap present; for example, "Game addiction/disorder" is a disease that is a severe form of mental health issue. "Mental health" is a broader concept of which there can be severe or less severe cases. Many people may have mental health issues, but few could have game addiction/disorder.

In this study, the authors ranked health concerns related to video game players based on the number of references. The top two health concerns are "gaming disorder" and "sleep," which already have significant research studies. At the same time, there are few research studies (less than five articles) about other health concerns, such as "mental health," "nutrition," "vision" and "hearing." There is a need for more research studies on those health concerns for the video game player population in the future.

3.1 Video Game Addiction/Disorder

This study identified 46 research articles between 2013 and 2023 that targeted gaming disorders (see Table 2 and Figure 2). Those research articles included seven general reviews, seven articles about risk factors such as gender, two articles about prevalence, two articles about symptoms, two articles about diagnostics, eleven articles about disorder mechanisms, such as "happiness," distress, depression, and loneliness, six articles about treatments, such as cognitive behavior therapy and medication, and seven articles for others.

Vol. 2025 (3) 176 – 186
ISSN 2688-3651 [online]

Table 1. Health concerns for video game players.

Health Concerns	References	Number of References
Game Addiction /Disorder	General /Review (7) (Aziz et al., 2021; Bean et al., 2017; González-Bueso et al., 2018; Hawi et al., 2018; Mohammad et al., 2023; Raouf et al., 2022; Stockdale & Coyne, 2018) Risk factors (7) (Andre et al., 2022; Esposito et al., 2020; González-Bueso et al., 2020; Kornhuber et al., 2013; Nogueira et al., 2019; Rehbein et al., 2021; Saini & Hodgins, 2023) Prevalence (2)(Alghamdi & Alghamdi, 2023; Wittek et al., 2016) Symptoms (2)(Mylona et al., 2020; Zhang et al., 2022) Diagnostics (2)(Finserås et al., 2019; Müller et al., 2014) Mechanism (11)(De Pasquale et al., 2020; Durak et al., 2023; Gros et al., 2019; Han et al., 2017; King & Delfabbro, 2014; Krossbakken, Pallesen, et al., 2018; Labana et al., 2020; Madran & Cakilci, 2014; Müller et al., 2018; Phan et al., 2019; Saquib et al., 2017; Walia et al., 2022) Treatment (6)(Loton et al., 2016; Moge & Romano, 2020; Sakuma et al., 2017; Torres-Rodríguez et al., 2018; Wölfling et al., 2019; Zajac et al., 2020) Others (7)(Cudo et al., 2020; Ferguson & Colwell, 2020; Khorsandi & Li, 2022; Küçükturan et al., 2022; Lieberoth & Fiskaali, 2020; Machimbarrena et al., 2022; Triberti et al., 2018; Ustinavičienė et al., 2016)	46
Sleep	Sleep(Akçay & Akçay, 2020; Alqaderi et al., 2018; Altintas et al., 2019; Exelmans & Van den Bulck, 2015; Gradisar et al., 2013; Hartmann et al., 2019; King et al., 2013)	7
Mental Health	Mental Health(García-Gil et al., 2022; H. H. Kim & Ahn, 2016; L. Li et al., 2022; Sussman et al., 2018)	4
Diet/ Nutrition	Nutrition(Cemelli et al., 2016; Khan et al., 2019; Soffner et al., 2023)	3
Vision	Vison(D. J. Kim et al., 2017)	1
Noise exposure/ hearing	Hearing(Iannace et al., 2019a)	1
Death	Death(Kuperczko et al., 2022)	1

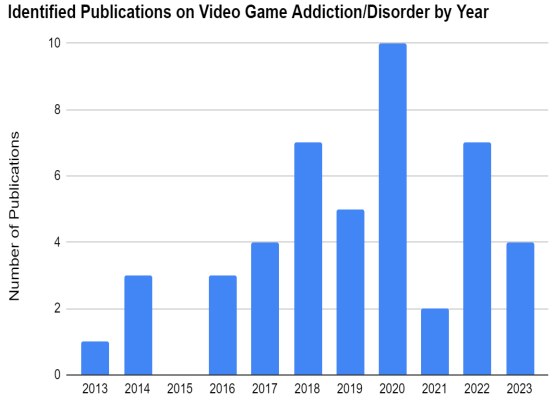

Figure 2. Identified research publications on “game addiction/disorders” by year.

Numerous studies have been done to find the prevalence rate of gaming disorders. A questionnaire was administered to a group of Norwegian gamers. The "results showed 1.4% addicted gamers" out of the sample of 3389 gamers (Wittek et al., 2016). In another part of the world, the Middle East, a questionnaire was done on Saudi Arabian high schoolers in Saudi Arabia (n=391). The results concluded that "the prevalence of IGD was found to be 3.5%" (Alghamdi & Al.ghamdi, 2023). Treatments of IGD includes medication or cognitive behavioral therapy (CBT), however, there are lack of strong conclusions about the efficacy of any treatment for IGD in the last literature reviews (Zajac et al., 2020).

3.2 Sleep

There is a widespread notion that using screen devices before bed will lead to lower sleep quality and duration. Is this prevalent idea grounded and supported by evidence? Based on an online survey of 892 Turkish college students, video game use can lead to various sleeping issues (daytime sleepiness, poor sleep quality, and reduced sleep duration) (Akçay & Akçay, 2020). A longitudinal interview study within 12 months on 8317 Kuwaiti children also supported the finding of reduced sleep duration (Alqaderi et al., 2018). A questionnaire study on 217 French video game players

Vol. 2025 (3) 176 – 186
ISSN 2688-3651 [online]

concluded that the intensity of video game play is a risk factor for sleep quality (Altintas et al., 2019). A survey study conducted in Belgium that included 844 adults revealed that gaming volume is negatively related to sleep quality (Exelmans & Van den Bulck, 2015). A study interviewed 1508 Americans and found that the usage of devices before bedtime is shared. Interactive tech devices (video game consoles) led to the most sleep complaints/issues (Gradisar et al., 2013). Another study examined the effects of prolonged gaming in a single night session on sleep and memory. The study findings showed that excessive video game play during the evening can impair memory in male adolescents (Hartmann et al., 2019). An experiment study in Australia used polysomnography, which measures the sleep and heart rate of 17 male adolescents. They found that prolonged video gaming can significantly disrupt adolescent sleep even when sleep begins at regular bedtime (King et al., 2013).

3.3 Mental Health

Based on a survey study done on 1603 students in the People's Republic of China, "overall video game time prevalence was low (41 mins per week), there was a significant link between video game time and worse mental health outcomes according to subscale scores on the DASS-21 as well as a higher prevalence of symptoms at the moderate or above level" (Li et al., 2022). The DASS-21 is a scale system used to measure depression, anxiety, and stress. In another survey study done in Korea, there were multiple data collections done in waves over time, "multilevel regression models show that more game playing is associated with greater depression"; to determine if individuals had depression, the standards of the DASS-21 were "based on the (10 item) abridged version of the Center for Epidemiologic Studies Depression Scale Revised (CESD-R)" (Kim & Ahn, 2016). In a survey study done on Spanish adolescents (n=1488), the results came back that "mental health issues and problematic video game use correlate in a negative way" and that "adolescents with greater mental health difficulties scores also scored higher on problematic video game use" (García-Gil et al., 2022). Another study done in 2018 analyzed video games and their impact on emotional and mental well-being. The study revealed that those who suffer from internet and video game addiction are more likely to develop psychological and social illnesses such as depression, alcohol use, ADHD, and anxiety (Sussman et al., 2018).

3.4 Vision

Another health concern is visual discomfort induced by high-resolution displays during video game play. Visual discomfort is an increasing issue as many games now include virtual reality (3-dimensional/panoramic) utilizing state-of-the-art technology. One research study surveyed visual fatigue from video games (Kim et al., 2017). It consisted of 59 volunteers from 22-64 years old who were exposed to 1 hour of computer stimuli. Data regarding visual fatigue was collected through a survey that recorded questions regarding eye strain by scoring ten symptoms (Blurred vision, visual discomfort, dry eye, watery eye) on a scale of 1-6, with 1 being none and 6 representing severe symptoms. The study showed that viewing a computer screen led to a higher overall mean value for eye strain, with around a 15.7% mean value increase in visual fatigue and discomfort. The outcome of this study was self-reported symptoms and not objectively measured findings. Digital eye strain (DES) related studies have been underreported in relevant literature; A literature review conducted in 2020, only found 12 articles were directly related to the theme of vision (Mylona et al., 2020).

3.5 Diet/Nutrition

One health concern impacted by video game usage is diet and nutrition. For example, gamers tend to eat more due to a lack of focus on their food. Another diet issue is that video gamers are more likely to be exposed to unhealthy options such as fast food, junk food, or sweetened beverages. A research survey by researchers at New York University on diet looked at the comparisons and differences between non-gamers and gamers (Cemelli et al., 2016). The survey included 3 validated questionnaires (The Eating Behaviors Pattern Questionnaire, Sedentary Behavior Questionnaire, and Beverage Intake Questionnaire) to assess lifestyle behaviors. The sample included 292 participants aged 18-35. The study concluded that video gamers are likelier to consume highly sugared beverages, junk food, and fast food

Vol. 2025 (3) 176 – 186
ISSN 2688-3651 [online]

than non-gamers. Another study addressed the metabolic health issue for adolescents in the United Arab Emirates (Khan et al., 2019). With a sample size of 473 subjects, data was collected using nurses to identify metabolic syndrome (Mets). Evidence from the data revealed that those who play video games are more likely to get MetS compared to those who do not. In contrast, a separate study in Germany revealed that gamers were in good health, eating similarly to the German population (Soffner et al., 2023). However, it also showed that high-sugar beverages (energy drinks) were an apparent issue that positively correlated to video game usage.

3.6 Noise exposure/hearing

One health concern impacted by video game usage is noise exposure. For example, certain games have loud gunshots and noise from vehicle engines. Wearing headphones for an extended time during gaming can be a health concern for hearing. Does noise exposure from video games exceed the limit from the National Institute of Occupational Safety and Health (NIOSH) (85 dB over an 8-hour day)? A research study tested five different video games, from shooting to racing, and found that the noise exposure was close to the limits of NIOSH legislation, ranging from 78.9 dB to 84.5 dB over 8 hours (Iannace et al., 2019b). In this study, different scenarios of exposure to noise produced by video games have been simulated. Hearing damage caused by noise can depend on both acoustic power and exposure time.

3.7 Death

The most devastating health concern is death. A research study done in 2022 aimed to determine how many individuals have succumbed to death through video game-related means (Kuperczko et al., 2022). In this study, internet search was the primary method used to determine the death count. The conclusion was that there were 24 case studies in which people died from video games. Upon examining the results, most of the deaths were found in Asia, and many fatalities were linked to internet cafes (places where people pay to use computers typically for video game use). Fatalities occurred due to prolonged dosages of video game playing.

Furthermore, causes of death from these case studies ranged from issues in the lungs, brain, and heart. The causes of death might be linked to specific effects of video game play, such as dehydration and sleep deprivation, which is present when video game usage is out of control. The method used in the study has a limitation as there is a shortage of evidence when only using an internet search. Sometimes, the hospital and family of the deceased are unwilling to disclose death information publicly.

4. Discussion

This study aims to increase the awareness of health concerns for video game players as a population. The primary audiences are video game players, the public, health care providers (such as Pediatrics), and parents.

4.1 For public

One study tried to determine if internet game disorder was a public health issue. The survey study had 175 criminologists, psychologists, and media scholars voice their ideas and opinions. The study found no scholarly consensus about video games being a public health issue. Furthermore, only 15.3% of the individuals believed violent video games could lead to increased youth assaults (public health concern) (Ferguson & Colwell, 2017). One concern is the possible impact video games have on public health. One research study in 2020 tried to see if there was a correlation between the amount of time video games played and any possible physical consequences. The study peer-reviewed 12 articles that were examined for deep study. The conclusion was that time gaming was associated with several health outcomes: a higher BMI (Body Mass Index) and a lower self-reported general health status. One study limitation was the need for additional evidence to prove other behaviors, such as sleep and fatigue, dietary behavior, or musculoskeletal pain (Huard Pelletier et al., 2020).

Vol. 2025 (3) 176 – 186
ISSN 2688-3651 [online]

4.2 For health care providers (e.g., pediatrics)

Pediatrics wants to know the impact video games have on children and adolescents. One literature review done in 2023 examined the influence video games have on adolescent development. The review looked at several sources and examined the impact video games had on physical health, cognitive development, and mental health. The conclusion was that playing video games was a risk factor for obesity, poor and reduced quality sleep, higher aggressive behavior, and cyberbullying for children. However, video games also reduce stress and anxiety when played moderately, leading to weight loss in some patients using active video games (Alanko, 2023). One literature review in 2021 analyzed the association of extensive video game use and its impact on cognitive function using brain imaging of those with gaming disorders. The results revealed that pro gamers were more likely to have structural and functional alterations in brain regions along with improved cognitive function and control in pro gamers.

In contrast, those with gaming disorders were likelier to see impaired cognitive control and function and higher craving levels for video games (Choi et al., 2021). Furthermore, one study done in 2017 investigated the impact video games had on the psychosocial well-being of children. The study had 194 children who reported their gaming frequency, their tendencies to play video games, and their parents' feedback on their child's psychosocial health at two different time points. The results revealed that gaming in time one was associated with increased emotional problems. Moreover, the study showed no association between violent video games and changes in psychosocial health. Cooperative video games also did not induce prosocial behavior, while competitive gaming led to decreased prosocial behavior, but only to those who played with a high frequency (Lobel et al., 2017).

4.3 For parents

Many parents are torn apart about whether to intervene with their children's video game play for health concerns. Some parents apply time restrictions, while others use video games as a reward. An itching question emerges in parents' minds should they step in as parents to reduce their kids' playing time? Will it positively affect them, and most crucially, will they have an impact? The parent's dilemma between intervention and non-intervention in gaming is becoming increasingly widespread as more kids are starting to play video games/have access to devices at a younger age. A survey study was done on 5,864 Norwegian kids and their guardians; the purpose of the study was to determine if a parental guide for video game intervention given to parents would affect their kids' video game time/use (Krossbakken et al., 2018). The study revealed that preventative material (parental guide) did not have a noticeable impact/effect on kids' gaming. A different study had 163 parents intervene in their kids' gaming (Li et al., 2019). In that study, a different intervention method called Game Over Intervention (GOI) was used. The study found that parents using the GOI method reduced video game duration, gaming disorder, and exposure to violent video games.

5 Conclusion

The study identified the top two health concerns for video game players, "gaming disorder" and "sleep." There is a lack of research on specific health concerns, such as mental health, vision, hearing, and nutrition. This study's findings will increase the awareness of population-based healthcare management among people who play video games, the public, health providers, and parents.

This literature review identifies a lack of long-term studies for a variety of health concerns, such as vision and hearing, which is crucial for healthcare providers and public health policy makers. For future works, the authors can work with an encyclopedic style and integrate some findings in this article into related Wikipedia articles . In addition, based on the risk factors and symptoms of gaming disorders in this literature review, the authors can design and develop a smartphone app to screen gaming disorders to detect this disease early and respond to it quickly. There is a lack of research on specific health concerns, such as vision. If there are research funds on those topics in the future, it will be significant to have longitudinal studies on those health concerns. For example, the authors hope to find out if there is a correlation between eye diseases and video game playing at the population level in the long term.

Vol. 2025 (3) 176 – 186
ISSN 2688-3651 [online]

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