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Video Games and Health

A scoping, topic-modelling review

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Colophon

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Video Games and Health: A Scoping, Topic-Modelling Review

Executive summary

Key messages

- The scientific literature on video games and health is unevenly distributed across health domains. Cognitive, behavioural, and physical health dominate the evidence base, while financial health, sexual health, and developmental health remain critically underexplored.

- Across most domains, the summarising literature focuses predominantly on benefits, hypothesising that video games improve health outcomes. The exception is behavioural health research, where the main subject is internet gaming disorder: for that topic, risk-oriented hypotheses predominate. This asymmetry may reflect the genuine impact of various harms and benefits, publication bias, or funding priorities.

- Systematic gaps pop up across domains: older adults and non-Western populations are underrepresented; mechanistic understanding of how effects occur lags behind evidence that effects exist; dose-response relationships receive little attention; and longitudinal designs are rare.

- Financial health represents a critical blind spot. Only three summarising studies address this topic in an industry that generates large revenue streams annually through increasingly sophisticated monetisation mechanisms. These mechanisms exert pressure on consumers to spend their time, money, and attention.

- The relationship between video games and health defies binary framing. Effects depend on specific games, players, contexts, and outcomes. Policy and practice should account for this complexity rather than simplified narratives of universal benefit or harm. Conversely, complexity is not an argument for inaction: consumer/health protection guardrails and industry wide norms are lacking, as is the infrastructure for independent investigation of critical real-world data.

Overview

Video games have become one of the most pervasive forms of media worldwide, yet their relationship with health remains contested in public discourse, policy debates, and scientific investigation. This scoping review maps the landscape of scientific literature on video games and health, characterising the hypotheses that have guided research and identifying gaps requiring attention.

The review examined 443 meta-analyses and (systematic) reviews published between 2010 and 2025, identified through searches of Web of Science, PsycINFO, and PubMed. Health-related keywords were extracted and categorised into eight health domains through independent dual coding: cognitive health, mental health, physical health, social health, behavioural health, developmental health, financial health, and sexual health. Within these health domains, hypotheses regarding the relationship between video games and health factors were extracted to present a broad overview of the literature landscape.

Main findings

The literature base is unbalanced across topics and valence. Cognitive health (132 items), behavioural health (107 items), and physical health (104 items) account receive high research attention. Mental health (60 items) and social health (25 items) occupy a middle tier. Developmental health (9 items), sexual health (3 items), and financial health (3 items) remain underexplored – a distribution that does not correspond to the real-world significance of these domains.

Across most domains, research predominantly hypothesises benefits. Video games are hypothesised to improve learning and cognitive function, support physical rehabilitation, enhance motor development, and facilitate social connection. This positive perspective can also be found within mental health, with literature skewing toward examining therapeutic potential, rather than psychological harms. Risk-oriented hypotheses are most often found in behavioural health research, on the topic of internet gaming disorder (IGD). The near-absence of synthesised research on financial health is particularly conspicuous. The video game industry generates revenue through microtransactions, loot boxes, battle passes, and other monetisation mechanisms – yet the summarising literature offers virtually no synthesis of how these practices affect players' financial wellbeing. This gap exists despite growing regulatory attention and documented psychological parallels between certain monetisation mechanisms and gambling.

More generally, there is a lack of integrated health-wide guidance and perspectives that help to evaluate the impact of games across the lifespan. Research instead tends to be focused on singular issues and domains. The general public would benefit from evidence-based suggestions that cover a fuller spectrum of both risks and benefits, to evaluate and help them decide on their own gaming engagement, or the gaming-engagement of others.

Implications

For researchers, the findings point toward priorities including greater specificity in characterising game factors, attention to underrepresented populations, mechanistic studies examining how effects occur, and more balanced investigation of both benefits and risks. For policymakers and practitioners, the uneven evidence base means that robust synthesis exists in some domains (such as exergames for rehabilitation) but is absent in others where decisions are nonetheless being made – particularly around monetisation practices. In domains where the summarising literature is sparse (e.g., financial health, sexual health, many aspects of developmental health) practitioners and policymakers should recognise that decisions are being made in the absence of adequate evidence synthesis. Therefore, they may need to rely more heavily on precautionary principles or analogies from related domains.

For industry, the tension between commercial interests and independent research is clear. Historical parallels from tobacco and pharmaceutical industries underscore the importance of safeguards against selective publication and undue commercial influence over the research landscape. On the other hand, industry data forms one of the keys to answering some of the major questions. Frameworks for transparency, auditability, and independent engagement with industry warrant attention. The resulting clarity benefits both industry, researchers, and the general public.

As video games continue to evolve – incorporating new technologies, reaching new populations, and developing new business models – addressing these gaps is essential for enabling individuals, families, educators, clinicians, and policymakers to make informed decisions about a medium that shapes how billions of people live, learn, connect, and play.

This report is supplemented with a number of external expert commentaries, to provide a broader view of the field. These can be found in the section ‘Expert Commentaries’, at the very end of this document.

Video Games and Health: A Scoping, Topic-Modelling Review

Introduction

Video games have become one of the most pervasive forms of entertainment worldwide. From puzzle games that challenge the mind to sprawling multiplayer universes that connect players across continents, the medium has evolved far beyond its arcade origins into a cultural phenomenon that touches the lives of billions. In the Netherlands alone, 89% of primary school students play video games, a figure that remains substantial at 71% among 12-16 year-olds (1,2). But with this ubiquity comes a fundamental question that parents, educators, policymakers, and researchers alike continue to grapple with: what is currently known about the relationship between video games and health?

This question, deceptively simple as it may seem, resists easy answers. The landscape of commercial video games is extraordinarily varied, stretching from solitary experiences to team-based competitive eSports, from life simulations that mirror the rhythms of daily existence to action-packed first-person shooters that demand split-second reactions. Yet despite this breathtaking diversity, the scientific literature has often approached video games as if they constitute a monolithic phenomenon – as if playing *The Sims* and playing *Call of Duty* might carry identical implications for players' wellbeing. In this review we aim to map the literature landscape of the effects of video games on health, taking into account the heterogeneity of the medium, and assessing existing gaps in knowledge.

Rising concerns

The increasing popularity of video games has sparked concerns regarding their effects on users' health. These concerns have found institutional recognition in the World Health Organization's decision to introduce Gaming Disorder as a new diagnostic category (3), signalling that – at least for some individuals – engagement with video games can cross the threshold from recreational activity into clinically significant impairment.

Yet potential harms extend beyond addiction-like patterns of behaviour. For example, a growing body of evidence suggests that video games may impact physical health, such as added strain on the eyes (4) and physical effects from the sedentary behaviour that characterises many forms of gameplay (5,6). Research has also documented mental health concerns, with violent video gameplay associated with increased depressive symptoms in youth (7), and cognitive effects, such as an association with lower academic grades (8,9), potentially through displacement of study time and interference with sleep and attention. These concerns, among others, provide grounds for careful scientific attention to the relationship between commercial video games and health.

The case for benefits

A complete view of the system comprising video gameplay and health, however, cannot stop at cataloguing potential risks. Such an approach would miss half the picture. While video gameplay may strain certain aspects of users' health under certain conditions, it can simultaneously provide social, motivational, emotional, cognitive, physical, and mental health benefits (10–13).

Consider, for instance, the phenomenon of 'exergames' – video games specifically designed to stimulate physical exercise. These games have been shown not only to improve physical wellbeing but also to bolster psychological wellbeing, reducing symptoms of depression (14). Similarly, research suggests that

prosocial video gameplay is associated with increased empathy and higher social wellbeing that extends beyond the gameplay context itself (15).

Moving beyond the binary

The parallel occurrence of positive and negative effects within the same medium underscores a reality that is familiar from research on other forms of digital media (16): the relationship between technology use and health aspects is fundamentally complex. Effects are not uniform across individuals, across contexts, or across the myriad ways in which video games can be designed and played. What helps one person may harm another; what proves beneficial in moderation may become problematic in excess; what constitutes meaningful social connection for some may feel isolating to others.

While a recent review has shed valuable light on the effects of applied and casual video games on the mental health of young adults (17), no comprehensive overview currently exists of the relationships between video games and health more generally. The scientific literature in this area has grown substantially over the past fifteen years, but it remains fragmented across medical, psychological, and social scientific domains, with researchers in different fields sometimes working in parallel without full awareness of developments in adjacent disciplines.

Given this complex and multifaceted relationship between video games and health, a thorough, evidence-based mapping of the existing literature landscape is needed to guide future research and policy. Without such a map, we risk continuing to ask oversimplified questions – 'Are video games good or bad?' – when reality demands a more sophisticated inquiry: Good or bad *for whom*? Under *what conditions*? Through *which mechanisms*? With *what kinds* of games?

Mapping the landscape

The present review seeks to provide a comprehensive, high-level overview of the landscape of scientific literature on video games and health. Rather than focusing narrowly on a single outcome or a single genre, we aim to map the terrain as a whole – identifying the major topic domains that researchers have explored, characterising the hypotheses that have guided their investigations, and surfacing the gaps in our collective knowledge that require further scientific attention.

To do so, the present review adopts a scoping methodology, an approach well-suited to mapping broad and heterogeneous bodies of literature (18) where the primary goal is to identify key concepts, general contours of a research domain, and gaps in the evidence, rather than to answer a narrowly defined clinical question (18,19). Given the vastness and diversity of the video games and health literature – spanning disciplines from ophthalmology to psychology, from public health to cognitive neuroscience – a scoping approach allows us to capture this breadth, while maintaining systematic rigour.

What distinguishes the present review from conventional scoping studies is our integration of topic-modelling techniques to assist in the identification and categorisation of health-related themes within the literature (20). Rather than imposing a predetermined taxonomy of health aspects onto the data, we derive health domain categories empirically from the keywords that authors themselves have used to describe their research. This bottom-up approach ensures that our map of the literature reflects the terrain as researchers have actually shaped it, rather than as we might have anticipated it to look.

Our research questions are defined as follows:

1. Which topic domains are present in the landscape of scientific literature on video games and health aspects?

2. Within this corpus of literature, what are the expressed or implied hypotheses about the relationship between video games and health? Specifically: which video game factors are

present in hypotheses, which health factors are present in hypotheses, and what is the hypothesised relationship between the two?

3. Given the state of the landscape, which areas are underdeveloped and require further scientific inquiry in future research?

By answering these questions, we aim not only to synthesise what is currently being studied in the field of video games and health, but also to provide a foundation for more targeted and methodologically rigorous research in the years ahead.

Methods

Search strategy

Our search strategy was designed to be maximally inclusive, capturing the full breadth of research at the intersection of video games and health rather than targeting specific health aspects or game genres a priori. This means that we defined broad search terms for the video game component of our search while initially leaving the health component unspecified – allowing health-related themes to emerge organically through keyword extraction in subsequent phases.

Databases

Searches were executed across three major literature databases, selected to ensure comprehensive coverage from medical, psychological, and general academic perspectives: Web of Science (providing broad multidisciplinary coverage), PsycINFO (capturing psychological and behavioural research), and PubMed (encompassing biomedical and health sciences literature).

Search terms

The search string was constructed to capture the full range of terminology used to describe video games in the scientific literature, including variations in spelling, platform references, and gaming modalities. The complete search string is as follows:

> *(video game) OR (video games) OR (video gaming) OR (videogame) OR (videogames) OR (videogaming) OR (computer game) OR (computer games) OR (computer gaming) OR (internet game) OR (internet games) OR (internet gaming) OR (online game) OR (online games) OR (online gaming) OR (digital game) OR (digital games) OR (digital gaming) OR (electronic game) OR (electronic games) OR (electronic gaming) OR (e-game) OR (e-games) OR (e-gaming) OR (arcade game) OR (arcade games) OR (arcade gaming) OR (browser game) OR (browser games) OR (browser gaming) OR (cloud game) OR (cloud games) OR (cloud gaming) OR (console game) OR (console games) OR (console gaming) OR (mobile game) OR (mobile games) OR (mobile gaming) OR (pc game) OR (pc games) OR (pc gaming)*

The search was limited to publications from 2010 to 2025, a period that encompasses significant growth in the scientific literature examining video games' health implications. The exact syntax of the search string was adapted as necessary to conform to the formatting requirements of each individual database while maintaining consistent conceptual coverage.

Keyword extraction and health domain categorisation

The initial search yielded a 'full corpus' representing the vast majority of scientific literature on video games published during the target period. From this corpus – after deduplication and removal of incomplete records – we extracted health- and wellbeing-related keywords through a systematic coding process.

Keyword coding

Two independent coders reviewed the complete list of keywords appearing in the corpus and determined whether each keyword is related to health. Keywords unrelated to health (e.g., those pertaining solely to game design, player demographics without health implications, or technical specifications) were excluded from further consideration. In case of disagreement between coders, consensus was reached through discussion; if necessary, a third coder served as a tiebreaker. This process yielded a comprehensive list of health-relevant keywords derived empirically from the games literature – terms such as 'addiction,' 'mental health,' 'active video games,' 'lower back pain,' and many others.

Health domain categorisation

The resulting health-related keywords were then categorised into broader health domains. For example, keywords such as 'back pain,' 'eyesight,' and 'physical activity' were grouped into a 'physical wellbeing' domain, while terms like 'depression,' 'anxiety,' and 'psychological wellbeing' would become part of a 'mental health' domain. Matching our process for the coding of keywords, the health domain categorisation was likewise performed in duplicate.[1] A third coder was available to serve as tiebreaker if needed, however, in practice the tiebreaker role was not needed: any observed inconsistencies were discussed and resolved.

This process produced a structure with a total of ten health categories: broad health/wellbeing, contexts and use cases, social health, mental health, cognitive health, developmental health, financial health, behavioural health, physical health, and sexual health. Upon closer inspection of the domains 'broad health/wellbeing' and 'contexts and use cases', however, it became clear that there was a high degree of overlap with the other eight, more specific, health domains. The decision was made to drop these two general domains, as their added value to the structure and our understanding of the landscape was deemed insufficient to warrant inclusion. Keyword-based descriptions of the eight final health domains are provided in the results section.

To divide the full corpus up into health domains, we extracted relevant subsets of literature from the full corpus by conducting targeted searches within the full corpus' title fields using the pre-established game terms (see Search Terms) and domain-specific health terms. We chose to splice the corpus based on presence of both a game and a health term in the title in order to minimise the number of false positives in the individual health domain subsets. Note that with this approach, one and the same piece of literature may feature in multiple domains, as long as its title contains search terms pertinent to those domains. The R-code written to achieve this splicing of the corpus can be found in the full code file, available on OSF.

Eligibility criteria and screening

We used textual pattern recognition to determine the paper type (i.e., 'review') by evaluating if relevant words are present in the title of the manuscript. R and various R packages were used to organise and process the data. The OSF repository for this report contains the script with the analytical code used. It also produces the **Appendix** to support stepwise evaluation of the analytical approach. The game-and-health-term-in-title search previously described was limited to papers that had been determined to be 'summarising work', i.e. either a (systematic) review or a meta-analysis. This presents a deviation from our original protocol: originally trials were also included among the eligible study designs for hypothesis extraction. However, the summarising studies provided large amounts of content for the vast majority of topics, to the point of oversaturation. Ultimately this project has limited resources, length, and a very wide scope. We thus chose to focus solely on summarising literature. The full dataset of papers is available on OSF for external researchers that wish to follow-up on a specific health domain.

In a second deviation, we expanded beyond the research protocol and chose to supplement our original topic-modelling process with an AI-driven rapid exploration of the non-summarising literature (see *Rapid exploration of non-summarising literature*). This presents the second deviation from our registered protocol: a surface-level exploration of the primary literature was included to provide broader coverage of the research landscape.

[1] As this process relies on limited information, namely keywords, in very large volumes, it has the potential to lead to endless discussion and revisiting and tweaking of findings. As the process also has considerable benefits, we opt to accept a degree of debatability: we are confident that between the two coders, most health-relevant keywords were correctly identified, or - vice versa - wholly health irrelevant words are correctly excluded.

This resulted in subsets of articles that all contained at least one game term from the aforementioned search string and one domain-specific health term in their title. For an overview of the resulting domains and their size before screening, see **Table 1**.[2]

Table 1. Pre-screening counts of papers featuring a title containing domain-relevant health term as well as a game term.

Domain	Summarising literature (reviews, systematic reviews, meta-analyses)	Total*
Behavioural health	201	2.092
Cognitive health	259	2.664
Developmental health	17	317
Financial health	7	79
Mental health	132	1.711
Physical health	215	1.198
Sexual health	6	25
Social health	61	1.474
Total	**898**	**9.560**

* The total count includes the meta-analyses, (systematic) reviews, and trials, as well as other (primary) research publications.

Given the anticipated volume of literature within each health domain slice, eligibility criteria were established to ensure that the final selection represents the most robust and synthesisable evidence. The domains' subsets were screened for inclusion and exclusion criteria adapted from the PICOS framework (21). Inclusion criteria consisted of study design: (systematic) reviews, and meta-analyses, population: any, intervention/exposure: effect of aspects of video games or video gameplay, outcome: any health-related outcomes. The centralisation of reviews and meta-analyses reflects the strategic decision highlighted earlier. Papers were excluded if they focused solely on off-topic subjects (e.g., gambling).

Screening was performed in duplicate, with two reviewers independently evaluating each paper for relevance based on title and abstract. Any disagreements were resolved through discussion between the reviewing pair, with a third reviewer available to adjudicate persistent disagreements.

Hypothesis mapping

A distinctive feature of the present review is its focus on mapping not merely what has been studied, but *how* the relationship between video games and health has been conceptualised. For each included paper, two team members extracted information about the hypothesised relationship between video games and health.

[2] For the counts of final included summarising literature per domain after screening, see Table 2.

Specifically, we determined the following:

- Which **video game factors** are present in the hypothesis (e.g., time spent playing, genre, cooperative vs. competitive play, specific game mechanics)
- Which **health aspects** are present in the hypothesis (e.g., depression, social connectedness, physical fitness, cognitive function)
- The **hypothesised relationship** between the two (e.g., improves, reduces, correlates with, mediates)

This extraction yielded a structured overview of the conceptual landscape, which reveals not only which game factors and health aspects have received attention, but also the directionality of relationships that researchers have proposed and tested.

It is worth emphasising that hypotheses by definition do *not* provide insight into whether a presumed relationship between variables is or is not present. As noted earlier, evaluating the strength of the evidence surrounding video games' effects on health is not the goal of this review, and studies' hypotheses should not be interpreted as such. However, mapping hypotheses provides much-needed insights into the shape of the landscape, and highlights which topics are (and are not) at the forefront of researchers' minds.

Rapid exploration of non-summarising literature

To provide broader insight into the video games and cognitive health literature beyond summarising literature, we have executed a rapid AI-driven "at a glance" exploration of all non-summarising, primary research literature in all health domains. For this AI-analysis, we used Claude Opus 4.5 in January of 2026 and provided it with the following prompt, run separately for each health domain and adapted accordingly:

> *"Hey Claude. I've got an Excel file for you that contains the titles (column TI) and abstracts (column AB) of all the studies we've found in the scientific literature about video games and [health domain]. For the attached file, based on the TI and AB columns, generate a one- or two-word summary of the game-related topic of the respective paper, and add this summary to a new column titled 'gamefactor'. Then do the same for a second new column titled 'healthfactor' but instead focus on which [health-domain]-related topic is central to this paper. Also add a third new column with whether you think the hypothesised relationship between video games and [health domain] in that study is benefit-oriented, risk-oriented, neutral, or mixed. You can call this latter column 'valence'. Finally, if the paper is nót actually about the impact of video games on health, please indicate this in the valence column by assigning the value 'exclude'. It's a large file, so take your time to be thorough. Once you're done, make sure I can download this new Excel file."*

Accompanying this prompt, Claude was presented with an Excel file containing the entire subset that was created for the health domain (see *Eligibility criteria and screening*): this file contained each item's title, DOI, publication year, authors, and abstract. Using this file, Claude ran the prompted analysis and produced a new file containing additional columns for the extracted game factor, the extracted health factor, and an assessment of whether the study was risk-oriented, benefit-oriented, mixed, or neutral.

These AI-evaluations were subjected to a cursory sample check to establish their accuracy. While the topics (both health- and game-wise) did not always have the specificity that manual coding would provide, they were deemed to be generally representative of the literature. The results of these AI-analyses, as well as AI-generated visualisations of the broader landscape's main themes, can be found in each domain's section *Remaining literature at a glance*.

Supplementation with grey literature

Recognising that academic literature may not fully represent the state of knowledge on video games and health – and that certain perspectives, particularly regarding potential benefits, may be underrepresented in peer-reviewed publications – we supplemented our systematic search with a scoping inventory of 'grey' literature found either through online searches or provided by stakeholders[3]. Grey literature includes industry reports from games companies and industry associations, publications from international public health organisations (e.g., UNICEF, WHO), and white papers and policy documents from governmental bodies.

Grey sources were identified through broad searches in non-academic search engines as well as through direct outreach to industry stakeholders. When reporting findings from commercial or industry-backed sources, clear attribution of source type is given. We acknowledge that commercial interests can play a role in stimulating research in certain directions or placing emphasis on selected topics. Findings from the grey literature are therefore presented under separate headings to maintain transparency about the evidence base.

Research gap identification

A central aim of this review is to identify not only what we know about video games and health, but also what we do not yet know – or do not know well enough. To systematically surface research gaps, we employ multiple complementary approaches:

- **Directional imbalance:** Assessment of whether the literature has predominantly focused on potential harms versus potential benefits, or vice versa.
- **Population coverage:** Evaluation of whether certain populations (e.g., older adults, clinical populations, non-Western samples) are underrepresented.

Based on the identified gaps, we formulate specific research questions that can guide future investigations, prioritising areas where additional research is most urgently needed to inform policy and practice.

[3] At the start of the research project, professionals working on video games and health in any capacity were invited during a WHO webinar to provide relevant grey literature, as well as disperse our invitation to others in their network.

Results

Overview of the included literature

Our screening and selection process has led to the inclusion of a total of 443 meta-analyses and (systematic) reviews. The cognitive (132 items), behavioural (107 items), physical (104 items) and mental health (60) domains are the largest within our corpus. Developmental, sexual, and financial health are notably smaller categories, all with fewer than 10 items of summarising literature included in our review. The social health domain includes 25 items. See **Table 2** for a full overview of the final included literature counts.

Table 2. Health domains and their subset size of summarising literature (after screening).

Health domain	Meta-analysis	Systematic review	Review	Both (systematic) review and meta-analysis	Total included summarising literature
Behavioural health	19	45	27	16	**107**
Cognitive health	24	58	40	10	**132**
Developmental health	3	6	0	0	**9**
Financial health	0	2	0	1	**3**
Mental health	3	29	18	10	**60**
Physical health	9	45	24	26	**104**
Sexual health	0	0	2	1	**3**
Social health	3	12	10	0	**25**
Total	**61**	**197**	**121**	**64**	**443**

Figure 1. Division of paper types within the corpus of included summarising research.

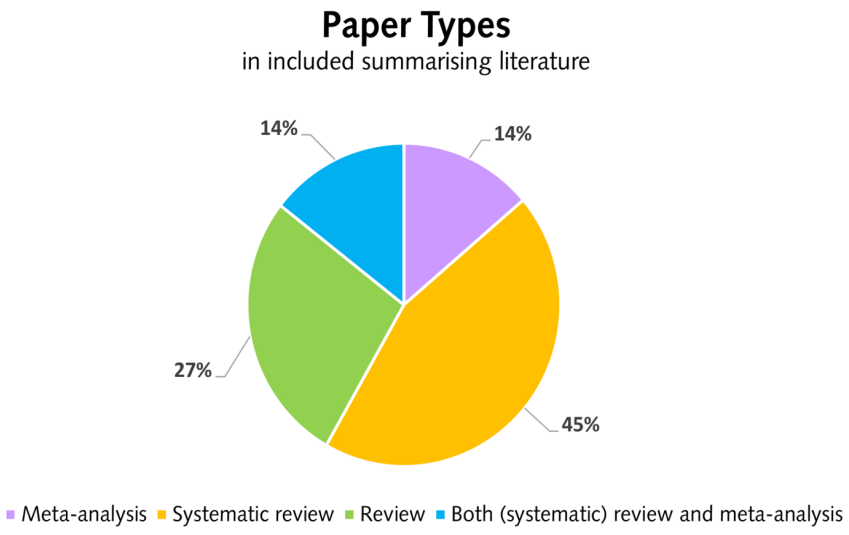
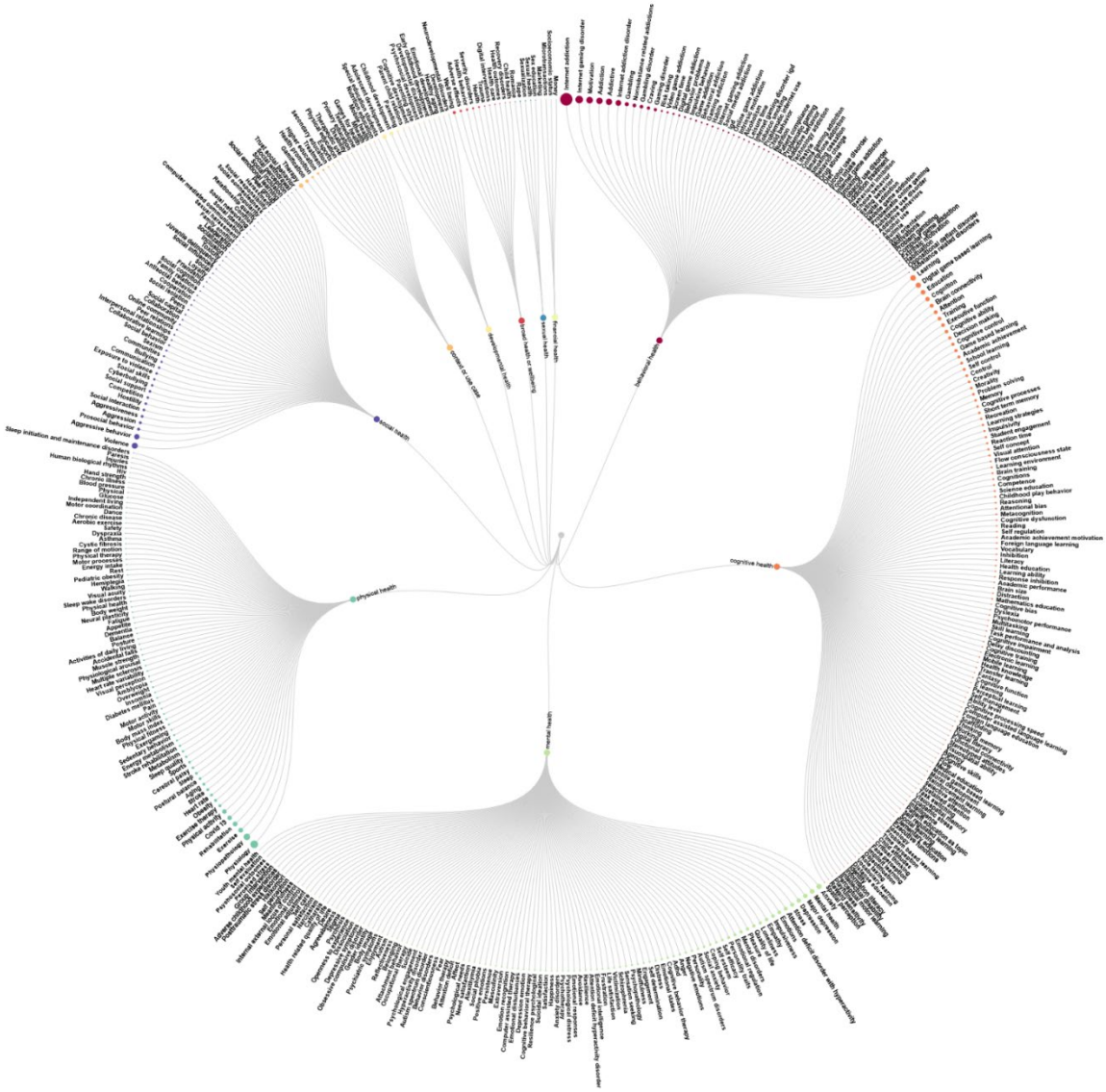


Figure 2. Overview of health domains and their keywords' frequency. Keywords with a frequency of 10 or higher are included. For a high-quality version of this figure, see OSF (tooling: Rawgraphs.io).



Behavioural health

Domain contents

The behavioural health domain covers the aspects that involve motivation and behaviour. Thus, it covers a variety of topics such as motivation, addiction/disorder/problematic use of games, eating behaviour / eating disorders, but also substance use and non-gaming risky/excessive behaviours. The most frequently occurring keywords are "internet addiction" and "motivation", followed by "gambling", "addiction", "addictive", and "screen-time", see **Figure 3**. While the entire topic group is varied in terms of keywords, the summarising literature we identified is fairly homogenous: research into internet gaming disorder dominates the results. The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF)**.** After deduplication and screening, we retained 107 meta-analyses and (systematic) reviews.

Figure 3. Word cloud illustrating the keywords present in the behavioural health domain.

Main hypotheses in the summarising literature

A first hypothesis that dominates the summarising studies is the idea that gaming behaviour can be classified or categorised as a gaming disorder (or gaming addiction) for some gamers. We identify a number of summarising studies that explore prevalence estimates for gaming disorder in various time-periods, methods (22), and samples (23–39). One study is explicitly critical about the concept of internet gaming disorder, and explores similarities and differences with drug use disorders (40).

While terminology is not always identical between studies, internet gaming disorder seems to be the dominant phrasing, as evidenced by our keyword analysis.[4] The remaining literature on (internet) gaming disorder can be subdivided into some groups. Firstly, treatment-oriented studies (41–57) cover a variety of pharmacological treatment options, technology based interventions, and psychological treatment options (including cognitive behavioural therapy). We also identify a paper with policy responses (58). Secondly, a large group of studies evaluated associations with a wide variety of psychological, social, and biological phenomena, including, but not limited to neural dysfunction/impulsivity, personality traits, the role of parenting, fear of missing out, and specific disorders (59–107). Four studies cover associations between gaming disorder and (decreased) physical health, including sleep and vision (108–111).

A set of six papers cover the relationship between recent innovations in game-monetisation and concerns about associations with gambling. These papers cover topics such as micro-transactions, loot boxes, skin-betting and gaming/gambling convergence (112–117). Three papers cover the potential of serious games to contribute to the promotion of healthy lifestyles (118–120), while one study deals with the idea that online gaming and eSports in general might negatively impact lifestyle (121).

Digital games are thought to improve motivation for learning (122), but gamers also have varying motivations and expectations when engaging with games (123). We find papers that suggest the use of serious video games to treat disordered eating behaviours (124), and that nutrition messages (with descriptive norms) can also be spread through video games to influence dietary intake (125). For the

[4] Given the high level of abstraction in our report, here and in subsequent domains we combine studies across terminology (ranging from problematic online gaming and excessive gaming to internet gaming disorder), acknowledging that measurement and details vary per study and warrant attention in detailed follow-up work.

COVID-19 period, we find one study that discusses alcohol and online gaming as problematic coping strategies (126), but video gaming is also mentioned as a form of stress relief and social connection during the early COVID period (127). One study questions if smoking imagery in games might stimulate smoking behaviour (128). **Table 3** shows a few examples of hypotheses in the behavioural health and video games literature.

Table 3. Examples of hypotheses in the summarising literature of the behavioural health domain.

Game factor	Association	Health factor	Population	DOI
Digital video gaming	may improve	Student motivation	K-12 maths students	10.1111/jcal.12618
Internet gaming disorder / excessive gaming / problematic online gaming	may be related to	Big Five personality factors	Not specified	10.1016/j.addbeh.2021.107193
Extensive video gaming	may be related to	Cognitive function changes	Pro gamers and individuals with gaming disorder	10.2196/25793
Internet gaming disorder / excessive gaming / problematic online gaming	may be related to	School refusal	Adolescents	10.1016/j.neurenf.2021.04.013

See **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and populations within the behavioural health domain.

Total literature at a glance

The total literature on behavioural health is very large, containing thousands of papers. Regarding game factors, we find that online gaming is mentioned most often. Educational games, video games, gaming disorder, screen time and gambling[5] are also regularly mentioned.

Various behavioural health factors feature in the total literature, from internet gaming disorder (IGD) and various addictions to risk-taking behaviours, substance use, self-control and gambling behaviours. Thus, the broader/primary literature mirrors the summarising literature fairly closely when evaluated as a whole. A closer look at specific individual studies could reveal more detail and nuance. For example, the interplay and conflation of video gaming and sedentary behaviour is a topic of interest (130). See **Figure 4** for a broad visualisation of the topic landscape within the domain of video games and behavioural health.

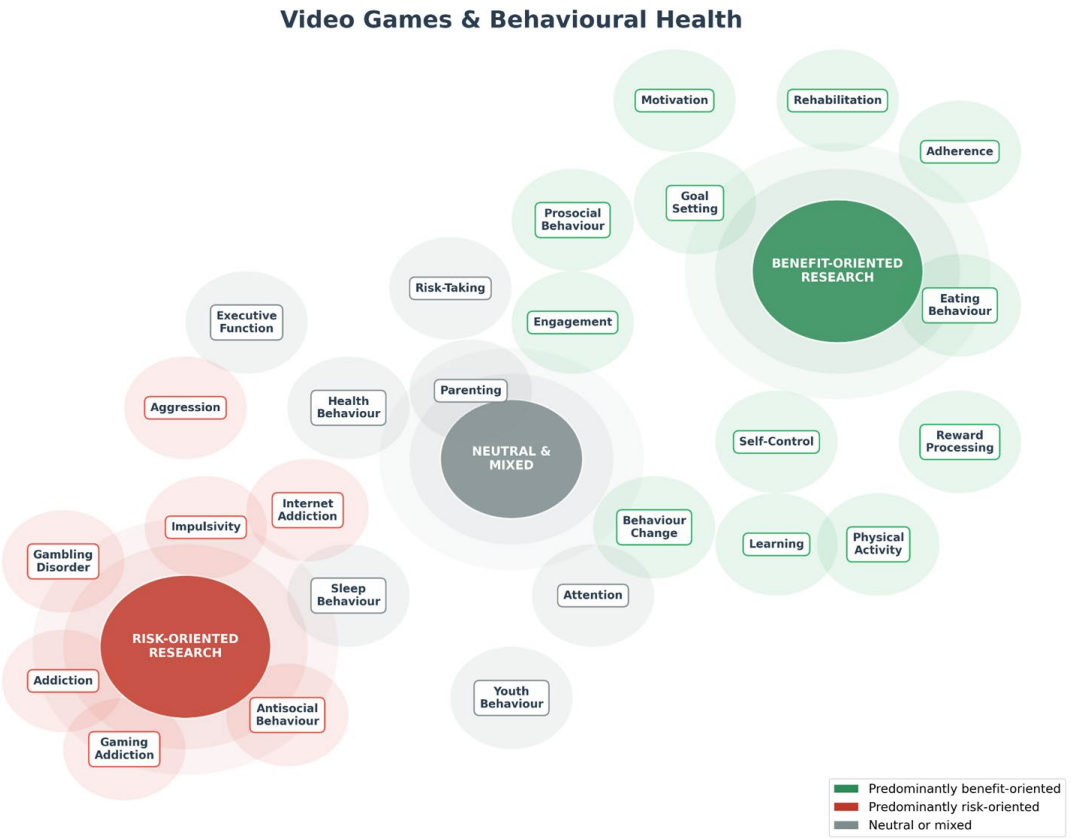
Grey literature on behavioural health

Findings from industry and nonprofit reports regarding behavioural health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

[5] Note that gambling contains false-positive papers due to the fact that gaming is sometimes used as a synonym for gambling, so this prevalence is inflated. Recent work has once again highlighted the risk of confusion between these terms (129). Cleanup of this large corpus is extremely labor intensive and beyond the scope of this project, so we report findings as-is. Readers can evaluate the source materials further at the open science location for this project.

The World Health Organization (WHO) included gaming disorder in ICD-11, defining it as a pattern of gaming behaviour characterised by impaired control, increasing priority given to gaming over other activities, and continuation despite negative consequences (3). The WHO notes that gaming disorder affects only a small proportion of people who engage in gaming activities. The American Psychiatric Association (APA) has included internet gaming disorder as a condition for further study in DSM-5 rather than as a formal diagnosis (131). Consequently, the academic literature already covers gaming disorder in great depth, including various debates, so grey literature is not needed to enrich the picture further. That said, gaming disorder and problematic gaming represent a significant area of focus in the grey literature, mirroring the scientific body of work.

Figure 4. Visualisation of the broader video games and behavioural health landscape.



Video Games Europe commissioned research that evaluated online harms via a panel survey. Beyond various content and social risks, the report identified "Spending too much time online" as a risk, which was scored positive by 13% of teens and 3% of adults for playing games (132).

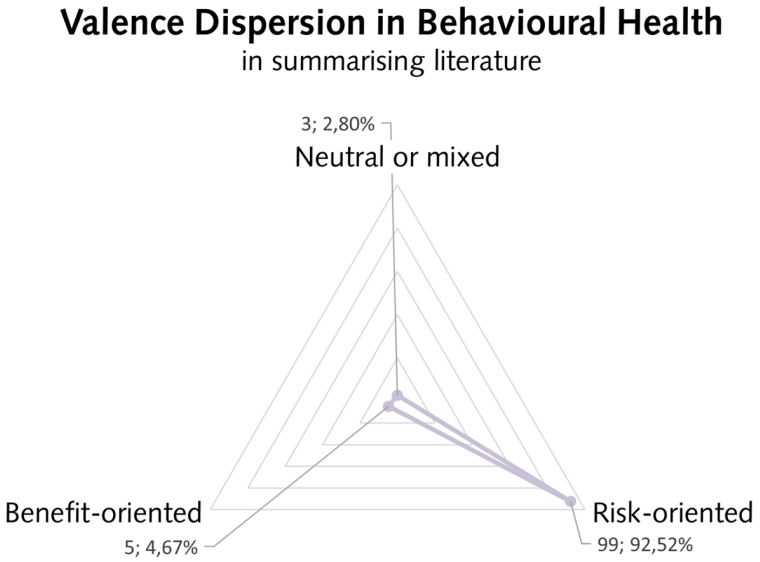
Moving beyond this topic, our own team has looked into behavioural design in a collaboration with two Dutch universities, in a bid to evaluate emerging behavioural pressure on gamers via game-design features that either stimulate healthy play or can potentially elicit harms (133,134). Extending the previous, UNICEF has defined some guard rails/boundaries, and has recommended practices on behavioural design in a detailed report (135), with an eye on stimulating healthy play and preventing harms.

Domain-specific gaps

Attention to risks versus benefits

The vast majority of summarising papers in the behavioural design topic approach games from a risk-oriented perspective, dealing with the minority of gamers that might be classified as having a gaming disorder, or problematic gaming behaviour in the sense that the gaming behaviour is excessive and disrupts life functioning. Benefits are recognised as well, for example in the power that games can have to motivate adults and children to change behaviour. See **Figure 5** and **Table 4** for a breakdown of the valence dispersion within the behavioural health domain.

Figure 5. Valence dispersion in the behavioural health domain's summarising literature.



Underrepresented populations

As the vast majority of summarising studies involve gaming disorder in some form, the literature focuses largely on the most vulnerable/harmed subsection of gamers. Extending this a little, harms associated with non-disordered gaming also receive substantial attention via survey-oriented work on problematic/excessive gaming (work that regularly also uses disorder/addiction terminology).

While this subject is relevant, it also highlights that the remainder of the population is underrepresented, which is to say: the healthy gamers, gamers that suffer minor harms – either directly or over a longer period of time – or gamers that flourish and benefit via gaming.

Missing themes

Perhaps due to the relatively rapid changes and the evolving landscape, we find that the increase in pressure from games through their behavioural design (e.g., nudging practices, dark patterns, and monetisation choices in games) receives limited attention. These topics are complex and regularly go beyond regulatory and legal framework boundaries in their complexity. Consider, for a quasi-hypothetical example, games that intentionally slow down gameplay to sell 'speed-up' microtransactions. While a minor percentage of consumers buy these speed-ups, the majority of free-

to-play gamers deal with a game that puts extra pressure on their time, and by extension, their health. This is only an example of the increasing complex relationship between game-design and health: these topics warrant attention in the absence of clear boundaries/guardrails and recommended practices. Extending this, the opportunities and ecosystem wide incentives to create health-positive games – or highlight health and life-course positive game design choices – receive limited attention, with some notable exceptions in the grey literature (the work by UNICEF (135)).

Table 4. Valence dispersion in behavioural health per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Alcohol and online gaming		1		1
Digital video gaming	2	1	1	4
eSports and online video gaming		1		1
Extensive video gaming		1		1
Gaming behavior		15		15
Internet / online video gaming		3		3
Internet gaming disorder / excessive gaming / problematic online gaming		71		71
Loot boxes		1		1
Loot boxes, esports, skin betting		1		1
Microtransactions		1		1
Nutrition messages in videogames	1			1
Participatorily-designed serious games			1	1
Serious digital / video games			2	2
User engagement features in digital games for healthy lifestyle			1	1
Video games with simulated gambling		1		1
Video gaming and gambling convergence		1		1
Videogame micro-transactions		1		1
Total	**3**	**99**	**5**	**107**
Total percentage	**2,80%**	**92,52%**	**4,67%**	**100,00%**

Taking a step back, for a wider overview, the gambling harms literature is somewhat temporally ahead of the video games literature. In this domain, an authoritative overview report for the Lancet Commission was recently published (136). This report notes that the research attention in gambling has been very much focused on the individual impact of gambling and gambling disorder, at the expense of attention to the wider commercial gambling ecosystem – which involves advertising, marketing and product characteristics. The authors advocate firmly for a public health approach to gambling.

While video games are different from traditional gambling products, this particular trend can be identified in our corpus of the video games literature: the individual, medicalized disorder perspective dominates at the expense of wider public health perspectives and life course perspectives. There is limited attention for the role of product design, marketing, and the commercial game-industry space as a whole in eliciting healthy or harmful outcomes. While loot boxes have received ample attention, they are only one example of innovations in game design.

Future research directions

To address some of the gaps, we propose the following research questions for future work, with a particular focus on behavioural health. They focus on the higher-level trends and gaps that we identify, and do not cover every specific potential topic of interest.

1. How effective are games as tools for motivating behaviour change in adults and children across different behavioural domains?

2. What is the temporal relationship between gaming disorder and comorbid conditions – does gaming disorder precede, follow, or co-develop with other psychological difficulties?

3. How do behavioural health outcomes differ between casual, moderate, and intensive gamers who all remain below disorder thresholds?

4. How do specific game design features (e.g., variable reward schedules, time-gating mechanics, social pressure systems) influence player wellbeing across different player populations?

5. How can health-positive video game design be stimulated, to support maximum impact of video game benefits, while restricting the impact of video game harms to the minimum?

6. What is the health impact of rapidly evolving (behavioural design) techniques in game design that exert pressure on gamers' behaviour, attention, and time?

7. What implications should the video gaming disorder and problematic video game use have for (precautionary) measures at the product/industry and policy/regulatory level, including early detection systems of emerging harms and duty of care?

Behavioural Health and Video Games in Brief

The behavioural health domain reveals a broad thematic scope, yet the summarising literature is heavily dominated by research on internet gaming disorder. While keywords point to a diverse landscape – including positive motivation, goal setting, eating behaviour, self-control, and risky design practices – the systematic reviews largely centre on assessing the prevalence, correlates, and treatment of gaming disorder, alongside associated psychological, social, and biological factors. Links between gaming and gambling-like monetisation are also evaluated, as well as the use of serious games to support healthier behaviours.

At the level of primary studies, this focus on problematic or disordered use is mirrored, with online gaming, screen time, gambling elements, and addiction-related constructs appearing most frequently. Despite this rich body of work, the literature skews strongly toward vulnerable or high-risk subgroups, leaving healthy or flourishing gamers comparatively underrepresented. Broader behavioural design issues – such as dark patterns, nudging mechanisms, and the health implications of monetisation practices – receive limited attention, despite their growing relevance.

Taken together, these findings suggest a need for research that extends beyond an individualised disorder perspective, toward more comprehensive public health and life-course approaches. This includes examining the role of commercial design ecosystems, identifying health-positive game design opportunities, and understanding behavioural impacts across the wider gaming population. Developing such perspectives may not only refine harm-prevention strategies but also illuminate ways in which games can more effectively support healthy behaviour and long-term wellbeing.

Cognitive health

Domain contents

Cognitive health is a prominent health domain within the video gaming and health literature, represented by 415 health-relevant keywords that concern cognitive health, see **Figure 6**. The five most frequently occurring keywords in the scientific video games literature within this health domain are "education", "learning", "digital game-based learning", "cognition", and "decision-making". The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF). After selection and deduplication, the cognitive health domain contained a total of 132 meta-analyses and (systematic) reviews.

Figure 6. Word cloud illustrating the keywords present in the cognitive health domain.

Main hypotheses in the summarising literature

Within the domain of cognitive health, we have found a wide array of hypotheses in the final 132 meta-analyses and (systematic) reviews. Viewed from the game factor side of the landscape, we see that a large cluster of studies hypothesise that general video game factors such as "video games," "digital games," and "computer games" may positively affect cognitive and educational outcomes (104,137–139). However, more specific aspects of the gaming experience also feature in the summarising literature, such as gaming motivation (96). In another example of more specific game factors being explored, one study hypothesised that scaffolding in educational games may further boost student performance (140). This latter level of specificity, however, is rare within the literature; by far most extracted hypotheses pertain to general video game terms.

A subset of studies focuses specifically on digital game-based learning, which emerges as the most frequently studied specific game category, with studies examining its effects across educational levels

and outcomes, such as STEM learning outcomes and teachers' competences (141). Action video games also constitute a distinct cluster within the literature (142–144), and are consistently hypothesised to improve perceptual, attentional, and cognitive skills.

When it comes to the health factors that are represented within the field, we see a few larger themes, such as cognitive skills (145–147), learning (148–150), and brain function (93,97,151,152). These cognitive outcomes, with the exception of the latter category, are usually hypothesised to be improved by the use of video games. Brain (dys)function, on the other hand, is sometimes thought to associated with internet gaming disorder (107). Another subset of the summarising literature focuses on educational cognitive health outcomes, such as STEM learning, entrepreneurship learning, and reading fluency (153). Here too, the summarising literature in the cognitive health domain predominantly focuses on hypotheses and outcomes related to improvements in cognitive health.

As an exception, a subset of 11 studies examines internet gaming disorder (IGD) or excessive/problematic gaming as the game factor of interest, rather than gaming in general. This cluster is uniformly risk-oriented and focuses predominantly on cognitive deficits associated with disordered gaming. Health factors in this subset include impulsivity and inhibitory control deficits, response inhibition deficits, and reward-related decision-making deficits (88,93,107).

Studies within the cognitive health domain tend to focus on students/adolescents or the general population. In addition, however, summarising studies within cognitive health also include populations such as clinical patients (e.g., patients with attention deficit hyperactivity disorder (ADHD), neurological disorders, or internet gaming disorder patients) (88,107,154), younger children (155), and individuals from specific contexts such as geographic locations (156), or workplace settings (157). See **Table 5** for examples of hypotheses in the cognitive health and video games literature.

Table 5. Examples of hypotheses in the summarising literature of the cognitive health domain.

Game factor	Association	Health factor	Population	DOI
Digital game-based learning	may improve	Mathematics learning	Primary school students	10.29333/ejmste/14377
Violent video games	may increase	Aggressive cognitions and behaviours	Not specified	10.17645/si.9401
Serious video games	may improve	Cognitive rehabilitation	People with ADHD	10.3389/fpsyt.2022.798480
Video games	may improve	Processing speed and working memory	Healthy elderly people	10.1055/s-0043-1764413

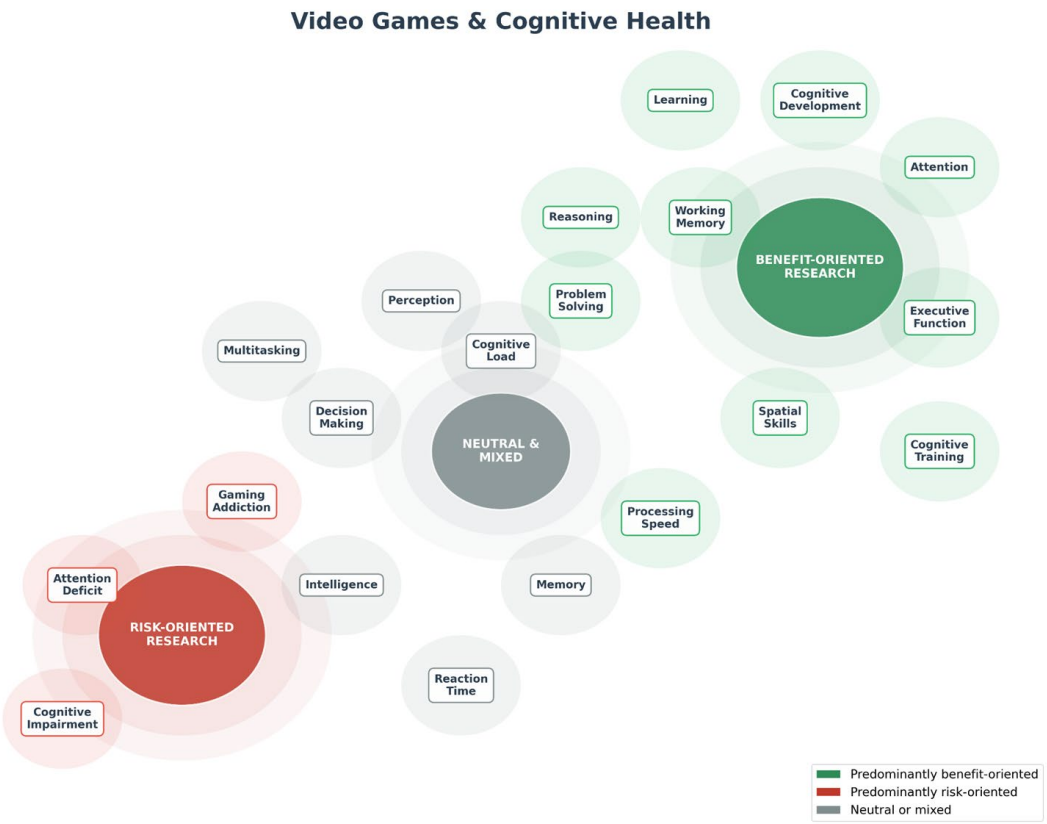
See **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and populations within the cognitive health domain.

Total literature at a glance

The full scope of literature within the field of cognitive health includes many primary research studies which cover a wide range of game topics, with a large part of the literature addressing the use of games for learning, training and/or education (e.g. surgical training, brain training). Smaller proportions of the field are dedicated to more specific aspects of video gaming, such as game modalities (e.g., mobile games, AR or VR games), game types (e.g., action games, exergames, serious games), and internet gaming disorder.

Similarly, various aspects of cognitive health are represented within the field, from learning, cognitive decline and memory to spatial cognition, problem solving and neuroplasticity. See **Figure 7** for a broad visualisation of the topic landscape within video games and cognitive health.

Figure 7. Visualisation of the broader video games and cognitive health landscape.



Grey literature on cognitive health

Findings from industry and nonprofit reports regarding cognitive health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

The grey literature on video games and cognitive health reflects both the educational and clinical potential of video games for cognitive outcomes, while also acknowledging the need for continued research and responsible integration. From an educational perspective, several major reports have addressed the role of digital games in learning environments. The Organisation for Economic Cooperation and Development's (OECD) *Digital Education Outlook 2021* has explored how smart technologies, including game-based assessments and adaptive learning platforms, can transform teaching and learning, noting that digital games and simulations expand opportunities to assess higher-order cognitive skills such as creativity and problem-solving (158). More recently, the OECD's 2025 working paper on the impact of digital technologies on students' learning discussed how game-based learning and serious games can influence student motivation and critical thinking, while noting that effectiveness depends on alignment with clear educational aims and teacher competence (159).

The Entertainment Software Association's (ESA) annual *Essential Facts* reports show that a majority of American adults believe video games provide mental stimulation and can improve cognitive skills (160). The ESA's *Power of Play: 2025 Global Report*, based on a survey of over 24,000 players across 21 countries, highlighted that gamers perceive cognitive benefits from play (161), such as perception, attentional control, and decision-making among video game players. Lastly, in 2020, the U.S. Food and

Drug Administration (FDA) authorised EndeavorRx in 2020 as the first prescription video game treatment for children with ADHD, with clinical trials showing 73% of children self-reported improved attention (192). The label was expanded in 2023 to include adolescents aged 13-17, and in 2024 an over-the-counter version (EndeavorOTC) was approved for adults with ADHD (193).

Domain-specific gaps

Attention to risks versus benefits

The predominantly benefit-focused research angle that we have found raises concerns about the underrepresentation of null or negative findings within the summarising literature. While several reviews do address clinical populations where video game use is conceptualised as potentially problematic – such as individuals with internet gaming disorder, comorbidity of gaming-related problems and ADHD, or reward-related decision-making deficits – these represent a minority of the overall summarising body of work.

Health factors such as "increased impulsivity and neural dysfunction," "large-scale brain network dysfunction," and "cognitive bias" appear in the dataset but are notably less frequent than benefit-oriented outcomes. This could mean that there are fewer risks than benefits for cognitive health, but it could also mean that negative effects are understudied or under-published. Even if there are fewer risks, the quality of the research in this domain would greatly benefit from studies that examine potential risks and show that they do not exist. See **Figure 8** and **Table 6** for a breakdown of the valence dispersion within the cognitive health domain.

Figure 8. Valence dispersion in the cognitive health domain's summarising literature.

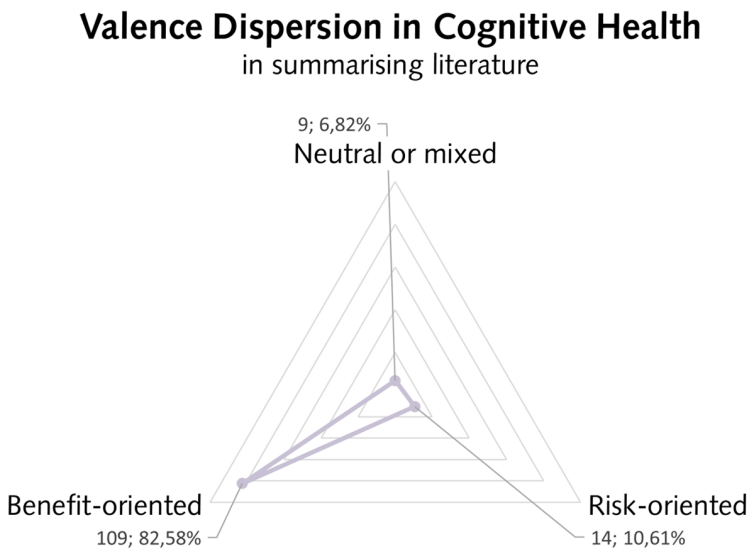


Table 6. Valence dispersion in cognitive health per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Action video games			4	4
Active video games			2	2
(Digital / mobile) Video gaming	6	1	52	59
Game-based learning or educational video games	1		33	34
Internet Gaming Disorder / problematic gaming		10		10
Serious games			5	5
Video game interventions/training			6	6
Violent video games		2		2
Specific splinter game types (e.g., VR, location-based)	1		6	7
Remaining splinter factors (e.g. gaming motivation)	1	1	1	3
Total	**9**	**14**	**109**	**132**
Total percentage	**6,82%**	**10,61%**	**82,58%**	**100,00%**

Underrepresented populations

Older adults represent a particularly underrepresented group in research relative to their potential to benefit from cognitive interventions. Although some reviews address healthy elderly populations and adults with cognitive impairments or dementia, these constitute a small proportion of the overall literature. Given the aging global population and growing interest in video games as tools for cognitive maintenance and rehabilitation in later life, this gap is significant.

Additionally, geographic and cultural diversity is strikingly limited in this health domain, as it is in others. Within our subset of cognitive health and video games studies we have only identified two explicitly non-Western populations that have been studied. This raises obvious questions about the cross-cultural validity of findings and whether the cognitive benefits observed in predominantly Western samples generalize to other contexts. Cultural factors may influence both the types of games played and the cognitive processes engaged during gameplay, but there is currently insufficient literature with diverse cultural populations to show these factors play a role.

Missing themes

While many reviews examine improvements in specific cognitive tasks or standardized assessments, fewer address whether these gains transfer to real-world cognitive functioning, academic performance, or daily living activities. The question of whether laboratory-measured cognitive improvements translate into meaningful functional outcomes remains insufficiently examined.

Furthermore, the summarising literature in the cognitive health domain tends to focus on *whether* video games affect cognitive health, rather than *how* they might do so. Questions about which specific game features drive cognitive change, what neural processes underlie observed effects, and how individual

differences moderate these mechanisms are addressed in some neuroscience-oriented reviews but remain secondary to efficacy questions in the broader field.

Future research directions

Based on the identified gaps, several directions for future research in the cognitive health and video games domain can be proposed. First, the field of video games and cognitive health would benefit from a more balanced approach that systematically examines both the potential cognitive benefits and risks of video game engagement. This includes not only the study of problematic gaming populations but also investigation of potential negative cognitive effects in general populations, such as attentional fragmentation, reduced sustained attention in non-gaming contexts, or displacement of other cognitively enriching activities. Additionally, the conditions under which video games may be harmful versus beneficial – including dose-response relationships, game genre, and individual vulnerability factors – require further study.

Moreover, research should prioritise populations currently underrepresented in the literature, including older adults, as well as populations in non-Western countries and diverse cultural contexts to assess the generalizability of current findings. Workplace applications and populations with disabilities beyond ADHD also warrant increased attention.

Based on the highlighted gaps and future directions, we formulate a selection of relevant research questions:

1. Can video games effectively prevent or slow age-related cognitive decline in older adults, and which game features are most beneficial for this population?

2. Do cognitive effects of video games generalize across cultural contexts and populations in non-Western countries?

3. What are the neural and cognitive mechanisms through which specific video game features exert their effects on attention, memory, and executive function?

4. Do cognitive improvements from video game training transfer to ecologically valid outcomes such as academic achievement, occupational performance, and daily functioning?

5. What is the optimal dose (frequency, duration, intensity) of video game play for cognitive benefits, and at what point do diminishing returns or harms emerge?

6. For whom are video games most beneficial or harmful for cognitive health, and how do age, baseline ability, gaming history, and individual vulnerability factors moderate effects?

Cognitive Health and Video Games in Brief

The cognitive health domain represents one of the most extensively studied areas within the video games and health literature, encompassing 133 meta-analyses and systematic reviews. The field spans educational applications – examining effects on knowledge acquisition, STEM achievement, language learning, and academic motivation – to clinical applications targeting cognitive rehabilitation in populations with ADHD, neurological conditions, and cognitive impairment.

The prevailing hypothesis is that video games confer cognitive benefits, reflected in the preponderance of reviews examining how games might enhance learning, improve attention, and support cognitive function across the lifespan. Research has concentrated on students across educational levels, with clinical populations – particularly individuals with ADHD and internet gaming disorder – also receiving substantial attention. Grey literature from international organisations, industry bodies, and regulatory agencies complements this scientific evidence base, exemplified by the FDA's approval of EndeavorRx as a digital therapeutic for paediatric ADHD.

Despite the breadth of this literature, notable gaps remain. The focus on benefits over risks creates an asymmetry that may not fully reflect the complexity of video games' cognitive effects, while older adults, geographically diverse populations, and workplace settings remain underrepresented.

Mechanistic questions, dose-response relationships, long-term effects, and the transfer of cognitive gains to real-world functioning are insufficiently addressed, and the high level of generality in how video games are characterized limits conclusions about which specific game features drive observed effects. Realizing the full potential of this research will require expanding the evidence base to include diverse populations, systematically examining risks alongside benefits, and attending to the ecological validity and durability of cognitive effects.

Developmental health

Domain contents

The domain of developmental health represents one of the smaller domains in the literature, as a total of 36 health keywords have been assigned to the developmental health domain. The five most-occurring keywords in the scientific video games literature are "childhood-development", "adolescent-development", "parenting", "parent-child-relations" and "development", see **Figure 9**. The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF)**.** After selection and deduplication, the developmental health domain contained nine meta-analyses (systematic) reviews.

Figure 9. Word cloud illustrating the keywords present in the developmental health domain.

Main hypotheses in the summarising literature

The summarising literature focuses predominantly on motor development and cognitive outcomes in children with developmental challenges. The most studied are active video games, with researchers hypothesizing that they may improve gross motor skills, motor function, and balance in non-typically developing children and adolescents (162–164). Digital game-based training is thought to enhance cognitive abilities and metacognitive skills in children with neurodevelopmental disorders (165).

Social development is also addressed, with studies examining whether active video games may improve social behaviours, social functioning and cooperation in children with autism spectrum disorder, cerebral palsy, or developmental coordination disorder (166,167). Digital games are hypothesised to support phonological awareness and literacy development (168).

Target populations in the high-level developmental health literature centre primarily on children with specific developmental needs, particularly those with neurodevelopmental disorders such as cerebral palsy, developmental disabilities, autism spectrum disorder, and developmental coordination disorder. The framing is predominantly therapeutic and benefit oriented, with researchers exploring how games might serve as intervention tools to support development in vulnerable populations. See **Table 7** for examples of hypotheses in the developmental health and video games literature.

Table 7. Examples of hypotheses in the summarising literature of the developmental health domain.

Game factor	Association	Health factor	Population	DOI
Active video games	may improve	Development of gross motor skills	Non-typically developing children	10.1186/s13102-022-00532-z
(VR) Video games	may improve	Motor outcomes	Children with developmental coordination disorder	10.1186/s12887-018-1381-7
Digital games	may improve	Social relationships	Children with neurodevelopmental disorders	10.21723/riaee.v1513.13069
Active video games	may improve	Motor skill development	Non-typically developing children and adolescents	10.1016/j.jsams.2017.05.001

See **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and populations within the developmental health domain.

Total literature at a glance

Educational games represent the most prominent theme on the game factor side within the body of primary research work on developmental health and video games. This reflects the significant interest in using video games for learning and skill development. Video games in general and online gaming also feature, alongside serious games and VR gaming. Active gaming, exergaming, and violent games also receive attention, with eSports, gaming disorder, and mobile gaming featuring as well.

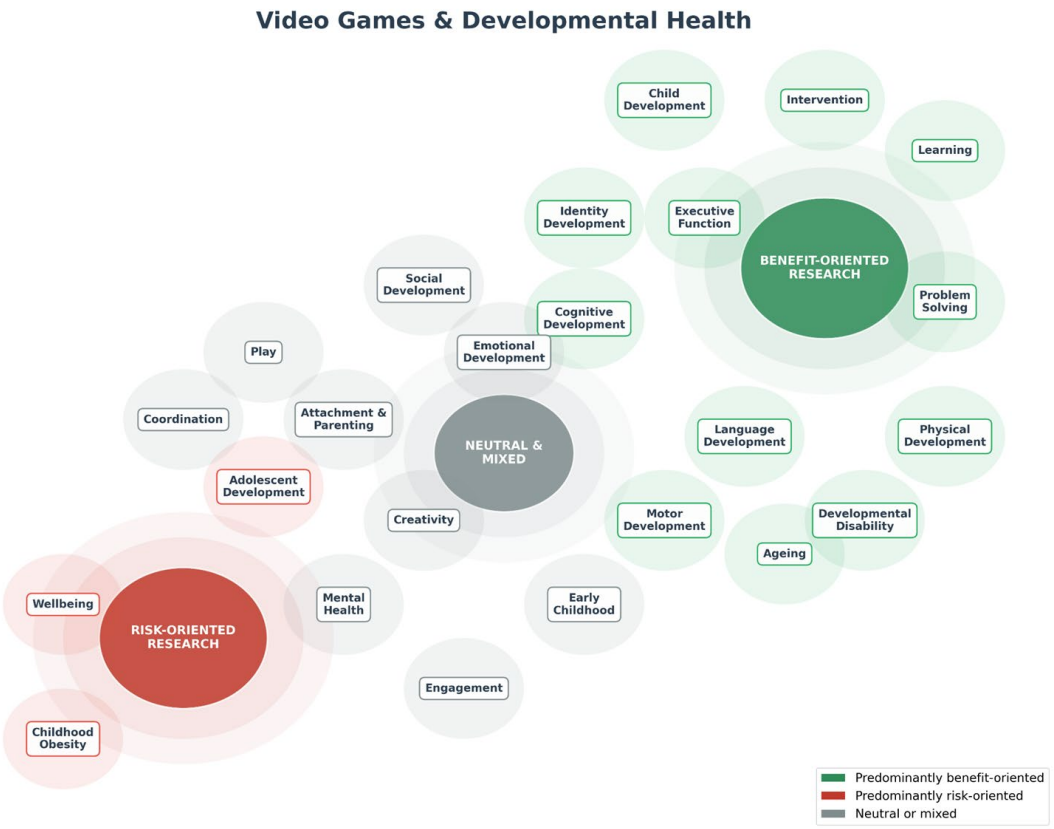
The health factors studied in non-summarising research in the developmental health domain centre largely on child development and adolescent development, although later life development also features (e.g. aging, cognitive decline). Learning features prominently, as do cognitive and language development. Problem solving and physical development also appear as areas of focus. Attachment and parenting are present in the literature as well, alongside play, emotional development, identity development, and motor development. See **Figure 10** for a broad visualisation of the topic landscape within video games and developmental health.

Grey literature on developmental health

Findings from industry and nonprofit reports regarding cognitive health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

The grey literature on video games and developmental health emphasizes the role of games in supporting child development through family engagement and skill-building. Industry reports from the Entertainment Software Association show that 82% of parents who play video games play with their children, with 52% playing at least weekly (160,161). Parents identify developmental benefits including problem-solving and creative thinking (78%), with LEGO Group's Play Well Study 2024 finding that two-thirds of parents view digital play as beneficial for their child's development (169). The LEGO Group has developed "Build & Talk" resources to facilitate family discussions about healthy digital play habits (170).

Figure 10. Visualisation of the broader video games and developmental health landscape.



In Canada, the Entertainment Software Association of Canada's Beyond Entertainment report profiles organizations leveraging video games for developmental purposes (171). Examples include Shoelace Learning using game-based approaches to support reading development, and eSports programs in remote First Nations communities like York Landing that have led to higher attendance, stronger sense of belonging, and improved self-worth among students (160). These initiatives demonstrate how games can provide customized environments that support development, particularly for populations facing educational challenges.

Domain-specific gaps

Attention to risks versus benefits

The summarising literature on developmental health and video games exhibits an exclusively positive framing, with all nine included studies hypothesising that games may improve developmental outcomes. While this therapeutic potential is valuable, the absence of studies examining potential developmental risks or trade-offs (e.g., whether time spent gaming might displace other developmentally important activities) represents a significant gap in our understanding. See **Figure 11** and **Table 8** for a breakdown of the valence dispersion within the developmental health domain.

Figure 11. Valence dispersion in the developmental health domain's summarising literature.

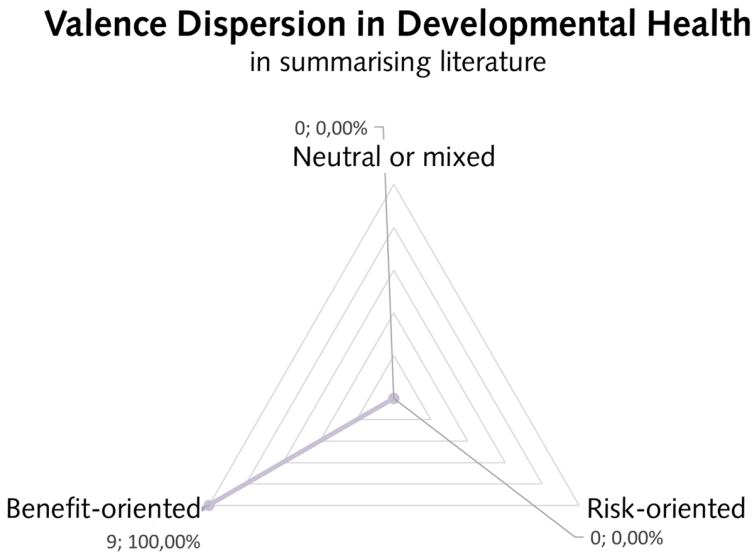


Table 8. Value dispersion in developmental health per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Game based learning			2	2
Active video games			4	4
VR video games			1	1
Digital video games			2	2
Total	**0**	**0**	**9**	**9**
Total percentage	**0,00%**	**0,00%**	**100,00%**	**100,00%**

Underrepresented populations

The studied populations show a clear focus on children with special developmental needs. While this focus is valuable for therapeutic applications, typically developing children are underrepresented in high-level summarising literature, as are adolescents and young adults who are also undergoing important developmental transitions. Cross-cultural and socioeconomically diverse samples are notably absent. The literature focuses primarily on children, with limited attention to; infants and toddlers (early developmental windows), adolescents (identity formation, social development), and the transition to young adulthood (emerging independence, role transitions).

Missing themes

Motor skills and motor development dominate the health aspects examined in this domain. While motor development is important, other critical developmental domains receive limited attention, including emotional development and emotion regulation, moral and ethical development, identity formation (particularly during adolescence), executive function development beyond basic cognitive abilities, and language development beyond phonological awareness. Also, other game genres and types that might support development, such as narrative games for social-emotional development, creative games for

artistic development, or strategy games for planning and executive function, are largely absent from the research landscape.

Furthermore, while studies examine whether games can support development, few explore the mechanisms through which developmental benefits occur. Questions about optimal dosage, frequency, duration, the role of adult scaffolding or co-play, and how game-based development transfers to real-world contexts remain largely unaddressed. Lastly, the reviews focused primarily on immediate or short-term developmental outcomes. The long-term trajectories of game-based interventions and gaming in general (e.g. whether benefits persist, whether they generalize to other contexts, and whether there are any delayed effects) remain unclear.

Directions for future research

The developmental health literature would benefit from expanding beyond its current focus on motor development in clinical populations. Future research could examine more typically developing children, adolescents navigating identity formation, and other developmental domains such as emotional regulation, moral development and development of executive functions. Longitudinal research which tracks whether benefits persist and transfer to real-world contexts is essential, as is mechanistic research and research on the role of adult scaffolding. Investigation of diverse games beyond exergames (creative, strategy, and/or narrative games) would provide a more complete picture of potentials and risks in the developmental game domain.

Based on the highlighted gaps and future directions, we formulate a selection of relevant research questions:

1. How does video game engagement affect identity formation and social development during adolescence?

2. How do high-frequency versus low-frequency gaming patterns in childhood predict developmental outcomes over a longer period of time?

3. What is the relationship between video game play and emotional regulation development in typically developing children and adolescents?

4. How does time spent gaming relate to time spent in other developmental activities (outdoor play, reading, peer interaction), and what are the developmental implications of time displacement?

5. Does parental involvement during video game play (co-play and guidance) enhance cognitive and social-emotional outcomes compared to independent play?

6. Do benefits gained from game-based interventions transfer to real-world performance measures and persist over time?

7. What is the differential effect of creative/sandbox games, narrative-driven games, and fast-paced action games on socio-emotional development and moral reasoning in children?

Developmental Health and Video Games in Brief

The developmental health literature at the summary level, while small (9 studies), reveals a predominantly therapeutic orientation. The available research hypothesises that games may improve developmental outcomes, with active video games being the most studied intervention. The focus in this health domain appears to centre on motor development in children with special needs, particularly those with neurodevelopmental disorders or developmental coordination disorder.

The literature's predominantly positive framing may represent genuine effects or a limitation in the summarising evidence. The apparent absence of high-level reviews examining potential developmental trade-offs suggests an incomplete picture at this level of synthesis. Typically developing children appear underrepresented in summary studies, as do adolescents and young adults navigating critical developmental transitions.

The focus on motor skills in available reviews means that other developmental domains (emotional regulation, identity formation, moral development, executive function) receive limited attention. The literature also lacks consolidated mechanistic insight into how developmental benefits occur and whether they persist over time. Future research could expand beyond motor development and clinical populations to examine games' role in normative development across the developmental spectrum.

Financial health

Domain contents

The domain of financial health represents a small area of inquiry in the literature, as highlighted by a total of 27 health keywords that have been assigned to the financial health domain. The three most-occurring keywords in the scientific video games financial literature are "marketing, "money", and "socioeconomic-status", see **Figure 12**. The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF)**.** After selection and deduplication, the financial health domain contained 3 meta-analyses and (systematic) reviews.

Figure 12. Word cloud illustrating the keywords present in the financial health domain.

Main hypotheses in the summarising literature

The financial health domain, though limited in scope with only three summarising studies, reveals important concerns about the intersection of commercial gaming practices and consumer wellbeing. Video game-based food marketing is hypothesised to worsen health outcomes (bodyweight, BMI, dental caries) via its influence on consumer brand awareness, attitudes, preferences, purchase behaviour, and consumption patterns in children and adolescents (172). Advergames and in-game advertising are examined for their effects on engagement and consumption patterns more broadly (173). The relationship between microtransactions (particularly loot boxes) and internet gaming disorder is also explored, with researchers hypothesising that these monetisation mechanisms may be associated with problematic gaming behaviours in adolescents (174).

While the corpus is small, the literature reflects growing attention to how commercial gaming practices, especially those involving financial transactions and marketing, may affect players' consumer behaviour and, by extension, their financial and health outcomes. The target populations vary from children and adolescents to gamers more generally, though the evidence base remains notably underdeveloped given the scale and sophistication of contemporary gaming monetisation. See **Table 9** for examples of hypotheses in the financial health and video games literature.

Table 9. Hypotheses in the summarising literature of the financial health domain.

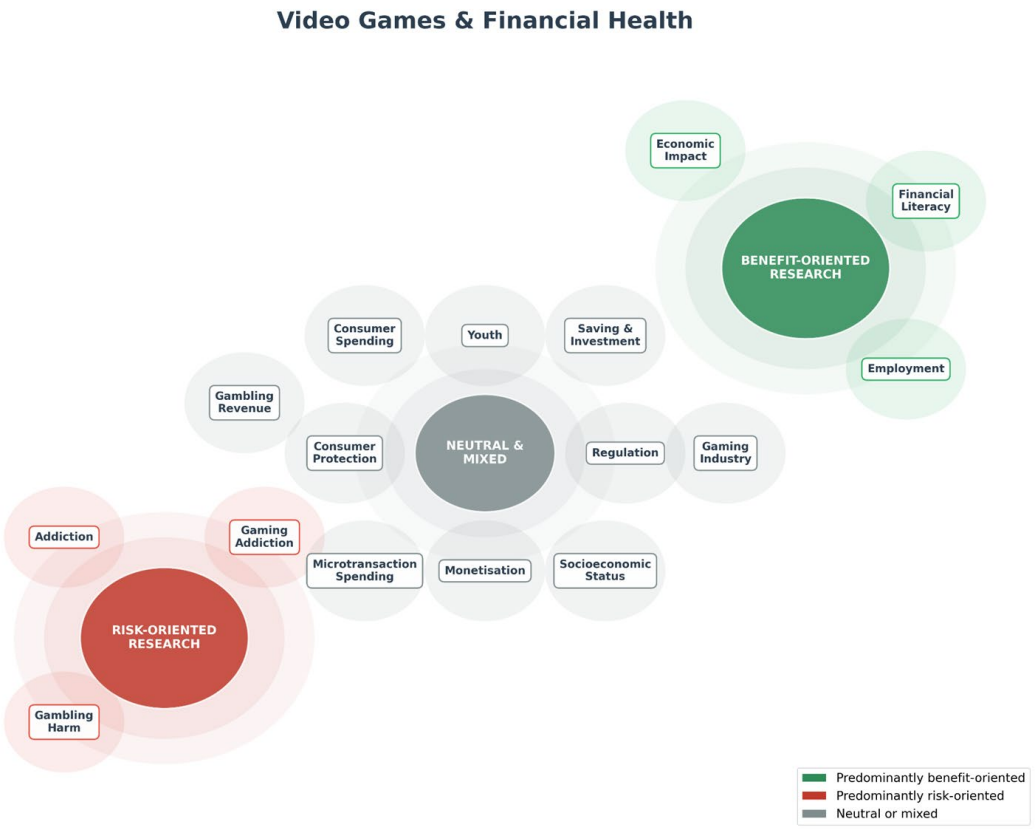
Game factor	Association	Health factor	Population	DOI
Video game-based food marketing	may worsen	Bodyweight, BMI, and dental caries, via consumer brand awareness, attitudes, preferences, purchase, and consumption	Children and adolescents	10.1111/obr.13630
Advergames, in-game advertising	affect	Engagement and gamers' consumption patterns	Not specified	10.1007/s11846-025-00876-z
Microtransactions, loot boxes	may be related to	Internet gaming disorder	Adolescents	10.1016/j.abrep.2022.100415

Total literature at a glance

A look at the full body of literature on financial health and video games, including primary research, seems to suggest that, on the game factor side, general video games/gaming represents the most prominent factor, followed by gambling, which features heavily due to its direct financial implications. Online gaming also appears as a distinct category, alongside general gaming and microtransactions, which have emerged as a notable area of study as many popular games have implemented microtransactions in recent years. Mobile gaming, virtual goods, gamification, and educational games also receive attention, with eSports, screen time, social media, and VR gaming featuring to a lesser extent.

Within the health factors present in the non-summarising literature, gambling harm represents a significant area of focused research, reflecting concerns about the financial consequences of problematic in-game gambling behaviour. Socioeconomic status and consumer spending also feature prominently. Consumer protection appears as a distinct research area, as do employment, youth financial outcomes, and saving. Financial literacy, monetisation practices, and gaming addiction are present in the literature, though in fewer instances. See **Figure 13** for a broad visualisation of the topic landscape within video games and financial health.

Figure 13. Visualisation of the broader video games and financial health landscape.



Grey literature on financial health

Findings from industry and nonprofit reports regarding financial health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

The grey literature on video games and financial health focuses primarily on parental supervision of children's in-game spending. Video Games Europe's annual surveys since 2018 across five European markets consistently show that 95% of parents actively monitor their children's spending, while 76% report their children make no in-game purchases (175). Among children who do spend, average monthly expenditure decreased from €39 in 2023 to €31 in 2024, with 73% spending between €1-€20 monthly. Engagement with controversial features remains limited: only 11% of players aged 11-64 spend on in-game currency and just 4% on loot boxes, with 71% unaware of loot boxes entirely. Importantly, there has been no growth in children's in-game spending since 2018 despite increasingly sophisticated monetisation practices. However, these sources focus predominantly on children in Western markets, leaving gaps regarding adult spending behaviours and financial impacts across diverse socioeconomic contexts.

Domain-specific gaps

The financial health domain reveals a striking research gap. With only three studies meeting inclusion criteria, financial health is dramatically underrepresented in the high-level scientific literature on video games, despite growing commercial sophistication in the gaming industry (as evidenced by the influx and growth of new monetisation strategies in the last decade, covering loot boxes, micro transactions, battle-pass systems, ad-watching, et cetera).

Attention to risks versus benefits

Within the limited amount of summarising literature on video games and financial health we see a slightly more risk orientation of hypotheses (2 out of 3 studies). See **Figure 14** and **Table 10** for the valence dispersion within the area of financial health.

Figure 14. Valence dispersion in the financial health domain's summarising literature.

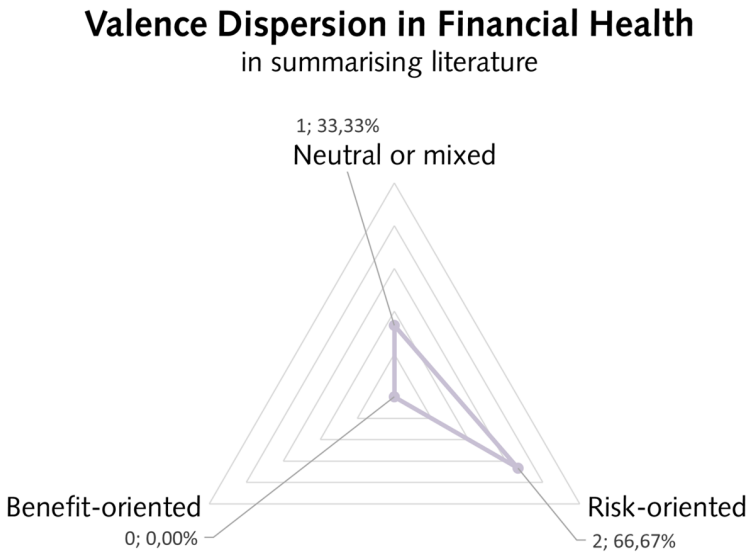


Table 10. Value dispersion in financial health per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Microtransactions, loot-boxes		1		1
Advergames, in-game advertising	1			1
Video game based food marketing		1		1
Total	**1**	**2**	**0**	**3**
Total percentage	**33,33%**	**66,67%**	**0,00%**	**100,00%**

Underrepresented populations

The limited summarising research focuses exclusively on children and adolescents, yet adults represent the majority of gaming revenue and may also face financial impacts from gaming expenditure. Also missing in high-level literature are vulnerable populations such as individuals with gambling problems, young adults developing financial skills and economically disadvantaged players.

Missing themes

Financial health remains vastly underrepresented in summarising video games literature, with only three studies identified. Direct financial impacts remain underexplored: spending on games and

microtransactions, loot boxes and gambling-like mechanisms, subscription costs, problematic spending patterns, and gaming-related debt.

Critical gaps also exist regarding regulatory evidence to inform policy on monetisation practices, and mechanisms explaining how game design features influence spending behaviour. The low amount of high-level research in this domain contrasts with the commercial scale of the industry and consumer protection concerns that are voiced by various parties, including consumer protection organizations and market regulators in Europe.

Future research directions

Based on the profound gaps identified in this domain, financial health represents a research priority. Research is urgently needed on the prevalence and distribution of gaming-related financial harm, particularly among adults who remain virtually absent from summarising literature despite generating the majority of revenue. Studies examining vulnerable populations and the effectiveness of regulatory interventions would provide essential evidence for policy development.

Based on the highlighted gaps and future directions, we formulate a selection of relevant research questions:

1. What is the prevalence and severity of problematic gaming-related spending across different age groups and socioeconomic backgrounds?

2. How do specific monetisation mechanisms (microtransactions, loot boxes, battle passes, subscription models) differ in their psychological and financial impacts on players?

3. What individual characteristics (e.g., impulsivity, gambling problems, financial literacy) moderate the relationship between gaming monetisation and spending behaviour?

4. How effective are regulatory interventions (spending limits, transparency requirements, age verification) in reducing financial harm from gaming?

5. What is the relationship between gaming expenditure and household financial stress or debt accumulation?

6. How do game design features exploit psychological vulnerabilities to encourage spending, and which populations are most susceptible?

7. What financial decision-making processes do players employ when engaging with in-game purchases, and how do these differ from other consumer contexts?

Financial Health and Video Games in Brief

The financial health domain reveals gaps in the high-level summarising literature. With only three studies identified, this area appears to represent one of the most profound gaps in our understanding of how video games affect health and wellbeing, particularly given the multibillion-dollar scale of the industry and its increasingly sophisticated monetisation practices.

The available summarising research focuses exclusively on children and adolescents, leaving the majority of gaming revenue contributors (adults) largely unexamined at this summary level. Critical populations such as individuals with gambling problems, young adults developing financial skills, and economically disadvantaged players appear underrepresented. Direct financial impacts, including spending on microtransactions, loot boxes, subscriptions, and gaming-related debt, remain virtually unexplored in high-level reviews.

The limited evidence examining regulatory interventions or the mechanisms through which game design influences spending behaviour suggests policymakers may lack sufficient synthesized scientific foundation to develop informed responses. This domain appears to represent a priority for future research.

Mental health

Domain contents

The mental health domain within the video games and health literature is characterised by 267 keywords related to mental health, see **Figure 15**. Mental health domain keywords encompass a wide variety of topics, from emotions and personality traits to neurodivergence, therapy types, and mental disorders. The five most frequently occurring mental health keywords in the video games literature are "mental health", "anxiety", "emotions", "quality of life" and "stress". The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF). After selection and deduplication, the mental health domain contained a total of 60 meta-analyses and (systematic) reviews.

Figure 15. Word cloud illustrating the keywords present in the mental health domain.

Main hypotheses in the summarising literature

Within the domain of mental health, hypotheses surrounding video games' effects on health are mostly benefit-oriented and positive, with the exception of the subset of literature addressing internet gaming disorder (IGD) and excessive/problematic video gaming. Within the game factors present in the summarising literature on mental health we have found a number of larger clusters of work.

A large cluster of literature uses general terminology (such as "digital / video games") to examine broad associations with mental health (176,177). These studies span both benefit-oriented work (e.g., examining games' potential to bolster eudaimonia (178) and emotion regulation (177)) as well as risk-oriented research (e.g., studying potential displacement of beneficial activities, or games' relationship to physiological stress responses (179)).

Exergames and active video games form another benefit-oriented cluster, with multiple studies hypothesising mental health benefits through exercise-mediated pathways. The mechanism implied

across these studies is that games' capacity to motivate physical activity produces downstream mental health benefits, for instance for players' perceived quality of life (180) or anxiety and mood (181).

Numerous studies address IGD and excessive/problematic video gaming (69,80), hypothesising a link between problematic video gaming and mental health outcomes. Specifically, IGD and excessive gaming is often hypothesised to be associated positively with factors such as depression, impulsivity, social anxiety and other comorbid psychopathologies more broadly (63,65,69,78).

We also see games being mentioned frequently as game-based interventions or tools (182,183). Some studies mention more specific game factors (e.g., video game design (184) and game types such as exergames or serious games (185)), generally hypothesising that they may be beneficial for video game players' mental health.

On the health factor side, studies within the mental health domain seem to be focused on various health aspects, ranging from depressive symptoms and stress (65,186) to emotional skills (187), neurodivergence (e.g., ADHD, ASD) (138,188), and personality traits (80,189). See **Table 11** for examples of hypotheses in the mental health and video games literature.

Studied populations within the mental health field tend to be more specialised than in some other health domains, with many studies focusing on people with specific diagnoses.

Table 11. Examples of hypotheses in the summarising literature of the mental health domain.

Game factor	Association	Health factor	Population	DOI
Game-based interventions / tools	may improve	ADHD symptoms	People with ADHD	10.1002/brb3.3265
Violent video games	may worsen (decrease)	Empathy	Not specified	10.1037/a0018251
Internet gaming disorder / problematic gaming	may be associated with	Mood disorders, specifically depression	Not specified	10.1016/j.jad.2021.02.014
Music in video games	may improve	ADHD symptoms	People with ADHD	10.2196/37742

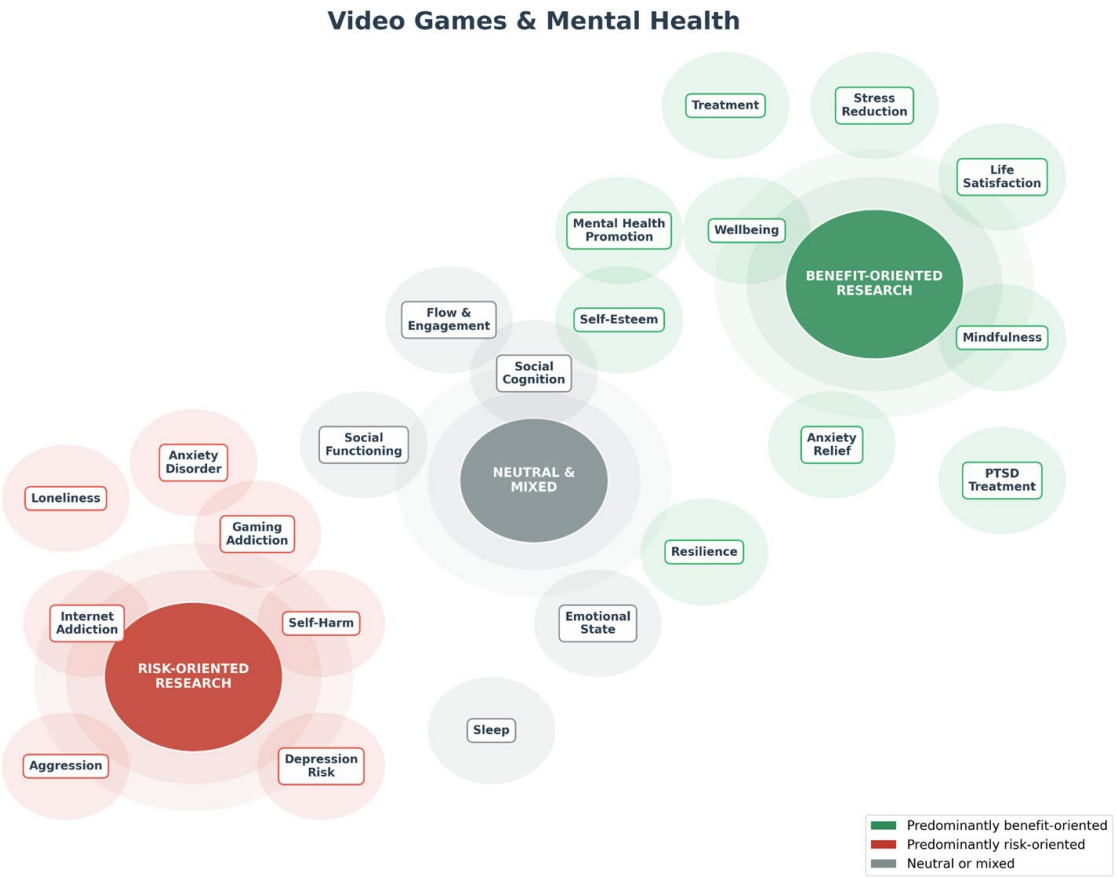
See **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and populations within the mental health domain.

Total literature at a glance

The full range of literature (including primary research) within the domain of mental health and video games spans various game factors, with larger topics being online gaming, games for education or training, and video games broadly. Additionally, a number of smaller, more specific game factors can be found within the broader field, including game modalities (e.g., VR gaming, mobile gaming) and game types (e.g., action games, serious games, violent games).

On the health side, a number of themes emerge within the mental health domain, such as internet gaming disorder or excessive gaming, flow and engagement, depression, stress, and anxiety. Additionally, a number of less frequent but important health topics are also represented within the broader video games and mental health field, such as post-traumatic stress disorder (PTSD), psychosis, mindfulness, and self-harm. See **Figure 16** for a broad visualisation of the topic landscape within video games and mental health.

Figure 16. Visualisation of the broader video games and mental health landscape.



Grey literature on mental Health

Findings from industry and nonprofit reports regarding mental health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

Industry reports highlight the perceived mental health benefits of video gaming. The ESA's 2025 *Power of Play* report found that 77% of players globally indicate that gaming helps them feel less stressed (161). U.S. army veterans are also reported by the ESA to experience video game play as an outlet for their stress and anxiety (190). The UK Mental Health Foundation, in its *Mind Gaming* research, found that players use games to manage worry and anxiety, de-stress, relax, and connect with others, though some reported negative experiences including frustration and feeling like games interfered with other priorities (191).

The relationship between video games and neurodiversity has similarly received substantial attention from industry and civil society organisations. As highlighted previously in the section on cognitive health, the U.S. Food and Drug Administration (FDA) authorised EndeavorRx in 2020 as the first prescription video game treatment for children with ADHD, with clinical trials showing 73% of children self-reported improved attention (192). Research by Internet Matters, in partnership with video game company Roblox and autism organisations including Autistica and the Autism Society of America, found that 90% of neurodivergent young people play video games, with 58% reporting that gaming makes them happy. The research identified benefits including relaxation, skill development, social support, and improved communication, while also noting challenges such as managing other life demands and online safety concerns (194).

Various nonprofit organisations have developed mental health support initiatives within gaming communities. Take This, founded in 2013 following the suicide of a gaming journalist, provides mental health resources and operates "AFK Rooms" at gaming conventions – quiet spaces staffed by licensed clinicians for attendees experiencing anxiety, depression, or other mental health challenges (195).

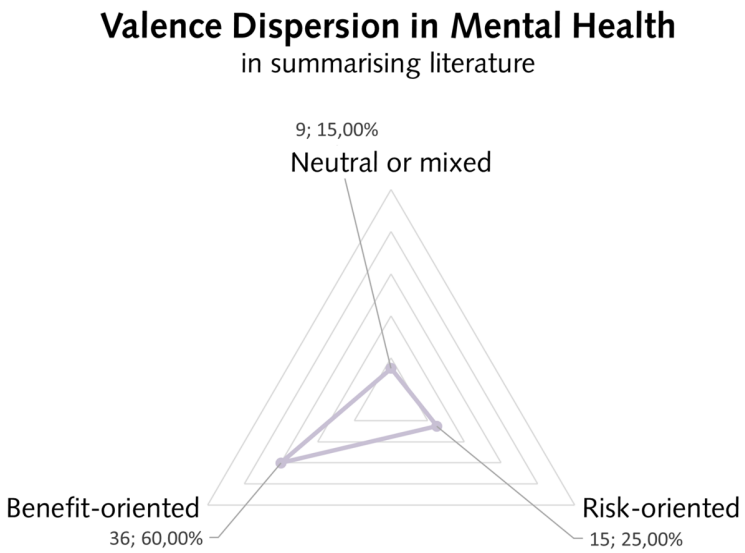
Domain-specific gaps

Attention to risks versus benefits

The summarising literature on mental health and video games displays a focus on benefits of video games, with almost two-thirds of the hypotheses concerning a beneficial hypothesised relationship between video games and mental health. Most risk-oriented hypotheses have to do with internet gaming disorder and excessive/problematic gaming, followed by concerns about violent video games and their potential impact on mental health.

On the benefit-oriented side of the hypothesis landscape we see that game-based interventions and exergames are more often than not hypothesised to bring certain benefits to mental health. Hypotheses about more general gaming terms such as "video gaming" or "digital games" also tend to be more benefit-oriented than risk-oriented. See **Figure 17** and **Table 12** for a breakdown of the valence dispersion within the mental health domain.

Figure 17. Valence dispersion in the mental health domain's summarising literature.



Underrepresented populations

Despite the considerable size of the mental health domain (60 meta-analyses and (systematic) reviews), several populations remain underrepresented in the summarising literature. Older adults are largely absent from reviews examining video games and mental health. Additionally, there is limited representation of diverse cultural contexts, with most summarising literature drawing primarily from studies with Western populations.

Furthermore, while neurodivergent populations such as individuals with attention deficit hyperactivity disorder (ADHD) or autism spectrum disorder (ASD) appear in the literature, they are often studied primarily in relation to problematic gaming or IGD risk rather than as populations who might benefit from tailored game-based interventions or who might experience other risks unrelated to excessive gaming.

Missing themes

The role of specific game design elements (e.g., monetisation mechanics, social features, narrative content) in shaping mental health aspects has received limited systematic attention, with most reviews focusing on broad game categories (e.g., "video games," "exergames," "serious games") rather than specific design features.

Additionally, longitudinal mental health trajectories associated with gaming across the lifespan – from childhood through older adulthood – have not been comprehensively studied. Finally, while internet gaming disorder has received substantial attention, the potential protective factors that distinguish healthy engaged gaming from problematic use remain underexplored in the summarising literature.

Table 12. Valence dispersion in mental health per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Augmented reality and online multiplayer games	1			1
Brain-computer interface serious video games			1	1
Commercial video games			4	4
Computer game-based interventions	1		10	11
Digital / video games	3	2	9	14
Digital / video games and virtual reality (vr)	1		1	2
Easy-to-use, casual video games			1	1
Exergames / active video games			3	3
Exergames and educational video games			1	1
Exergames and cognitive training games			1	1
Internet Gaming Disorder / problematic gaming	1	11		12
Mobile game characteristics	1		1	2
Music in video games			1	1
Online games	1		1	2
Serious games			1	1
Video game design			1	1
Violent video games		2		2
Total	**9**	**15**	**36**	**60**
Total percentage	**15,00%**	**25,00%**	**60,00%**	**100,00%**

Future research directions

Given the gaps present in the high-level mental health and video games literature, there is a clear need for reviews that examine how gaming may simultaneously confer benefits and risks depending on individual, contextual, and game-related factors. Future studies should prioritise currently underrepresented populations, including older adults, neurodivergent individuals beyond the lens of addiction risk, and populations from non-Western cultural contexts. Given that neurodivergent young people report high rates of gaming engagement and subjective wellbeing benefits, research should examine how games might be designed or leveraged to support their mental health rather than focusing predominantly on vulnerability to problematic use.

Based on the highlighted gaps and future directions, we formulate a selection of relevant research questions:

1. What are the individual, contextual, and game-related factors that moderate whether video game play is associated with mental health benefits versus risks?
2. Which specific game design elements (e.g., monetisation mechanics, social features, difficulty progression, narrative content) are associated with positive or negative mental health aspects?
3. What are the prevalence, predictors, and mental health consequences of protective and risk factors in online gaming environments, including social support, belonging, harassment and toxic behaviour in online gaming environments?
4. What are the long-term mental health trajectories of individuals who engage in regular video game play from childhood through adulthood?
5. How does video game play affect mental health aspects (e.g., depression, anxiety, loneliness, cognitive function) in older adult populations?
6. What are the mental health risks and benefits of video game play for neurodivergent individuals, and how can games be designed to support the wellbeing of players with ADHD, ASD, or other neurodevelopmental conditions?
7. How do the mental health effects of video games differ across cultural contexts, and to what extent are findings from Western populations generalisable globally?

Mental Health and Video Games in Brief

The mental health domain is one of the largest within the video games and health literature, encompassing 267 keywords and 60 meta-analyses and systematic reviews. The domain spans a wide range of topics, from emotions and personality traits to neurodivergence, therapy types, and mental disorders.

The summarising literature takes a predominantly benefit-oriented approach, examining how video games and game-based interventions may improve mental health aspects including depressive symptoms, anxiety, stress, and emotional skills. The exception to this positive framing is a considerable subset of literature addressing internet gaming disorder (IGD) and excessive or problematic gaming, which focuses on associations with mood disorders and other negative outcomes.

Grey literature reinforces the benefit-oriented perspective, with industry surveys reporting that a majority of players perceive stress relief and reduced loneliness from gaming. Potential risks identified in the grey literature also encompass IGD and the effects of harassment in online gaming environments.

However, notable gaps remain in the summarising literature. Underrepresented populations include older adults, neurodivergent individuals, and non-Western cultural contexts. Missing themes include the mental health implications of gaming community participation (both supportive and toxic), the effects of specific game design elements, and longitudinal trajectories across the lifespan. Future research should address these gaps through integrative approaches that examine when and for whom gaming supports versus harms mental health, with particular attention to currently underserved populations and the contextual factors shaping mental health aspects.

Physical health

Domain contents

Physical health is a cornerstone in any conceptualisation of health. This importance is also visible in our results here, as we identified a total of 386 physical health related keywords in our corpus, which we gather in this topic domain. The most frequently occurring physical health keywords in our video game corpus were “physiology”, “rehabilitation”, “exercise”, “physical-activity”, “Covid-19”, “exercise-therapy”, and “sedentary-behavior”. **Figure 18** below provides a visual impression of the keywords via a word-cloud. The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF**)**. After selection and deduplication, the physical health domain retained 104 meta-analyses and (systematic) reviews.

Figure 18. Word cloud illustrating the keywords present in the physical health domain.

Main hypotheses in the summarising literature

Video game based therapy is thought to achieve a variety of health aims (154,196–206) including physical limb function (200,207,208), balance/gait (209), pain reduction (210,211), daily activity (212). Game-therapy covers a wide variety of target groups such as children with health conditions (207), adult patients with stroke (209,213,214), Parkinson’s disease (180), mild cognitive impairment (215), central nervous system diseases (200), people with intellectual disabilities (216), or older adults (206,217). Neurofeedback games are hypothesised to potentially improve ADHD symptoms (218). Virtual reality and video games are also used (219–226) in a variety of patient groups, to support both emotional (e.g. depressive mood), cognitive, and physical health (e.g. motor function, pulmonary function).

Active video games, or exercise games/exergames, are widely used to achieve health aims, for a wide variety of populations, covering children, adults, the elderly and various types of patients. The hypothesised benefits include rehabilitation, reduction of overweight, increases in physical activity, functional mobility, and more (162,227–263). A subset of studies discuss the use of ‘commercial’

(active) video games to achieve physical benefits (264–267), and sometimes cognitive health improvements in specific patient groups (including patients with multiple sclerosis) are likewise hypothesised (268).

Video game risks that are hypothesised include decreased physical health (269), triggering cardiac arrhythmia (270), disruption of sleep health (108,271,272), hearing issues (273), game-related injuries (111,274), and injuries specifically related to augmented reality games (275,276). Video games are also hypothesised to be viable vehicles for eliciting physiological stress in various experimental settings (179). A minority evaluates games more broadly, across various health aims (277,278), or explicitly covers both risks and benefits (279–281).

Some specific topics that emerge are video game accessibility (282) for people coping with specific diseases (such as motor neuron disease). One paper centralises the 'myth of the chubby gamer' (283). Motivation for physical exercise or rehabilitation could be supported by gamification and video games (284,285). Beyond curative approaches, video games are thought to support physical health related training (286–288) and prevention, such as obesity prevention (289), physical literacy and sports participation (290), and disease self-management (291–294). See **Table 13** for examples of hypotheses in the physical health and video games literature.

Table 13. Examples of hypotheses in the summarising literature of the physical health domain.

Game factor	Association	Health factor	Population	DOI
Active video games / exergames	can help with	Increasing physical activity levels, reducing BMI and body fat	Children and adolescents	10.1111/sms.14176
Augmented reality video games	can facilitate	Videogame-related illness and injury	Not specified	10.1089/g4h.2016.0090
Heavy (arousing) video game usage	can cause	Poor sleep quality, and delayed sleep timing	Not specified	10.1016/j.sleep.2024.09.015
Motion-controlled video games	can help with	Hand and arm function	Cerebral palsy patients	10.2340/16501977-2633

See **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and populations within the physical health domain.

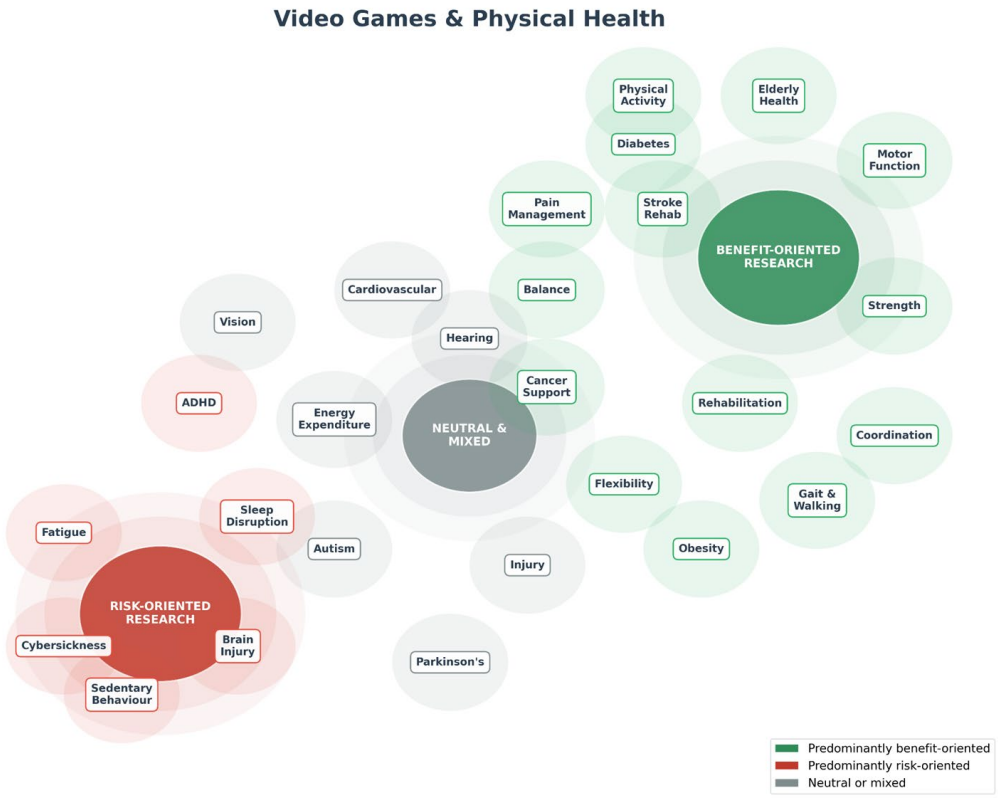
Total literature at a glance

The broader body of research literature in the domain of physical health and video games includes many primary studies and is characterised by a largely benefit-oriented research profile. Various game factors are addressed by primary research, dividing into a number of streams. Firstly, much attention is being paid to active and movement-based gaming technologies (e.g., exergaming, active video games) and their potential to transform sedentary time into physical activity. Therapeutic and educational games such as rehabilitation games and serious games are also featured in the physical health domain. Finally, various other gaming types are represented, such as online gaming, VR gaming, and eSports.

Among the studied health aspects, general physical health-related aspects feature regularly with users' activity levels and sedentary behaviour as potential outcomes of video gaming. Other primary work in the physical health domain focuses on more specific motor and movement outcomes, such as strength, balance, motor function and coordination, and flexibility. Various conditions are also featured in the body of work, representing populations of video game users whose physical health may benefit from video games (e.g., attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD),

cerebral palsy, and Parkinson's disease). See **Figure 19** for a broad visualisation of the topic landscape within video games and physical health.

Figure 19. Visualisation of the broader video games and physical health landscape.



Grey literature on physical health

Findings from industry and nonprofit reports regarding physical health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

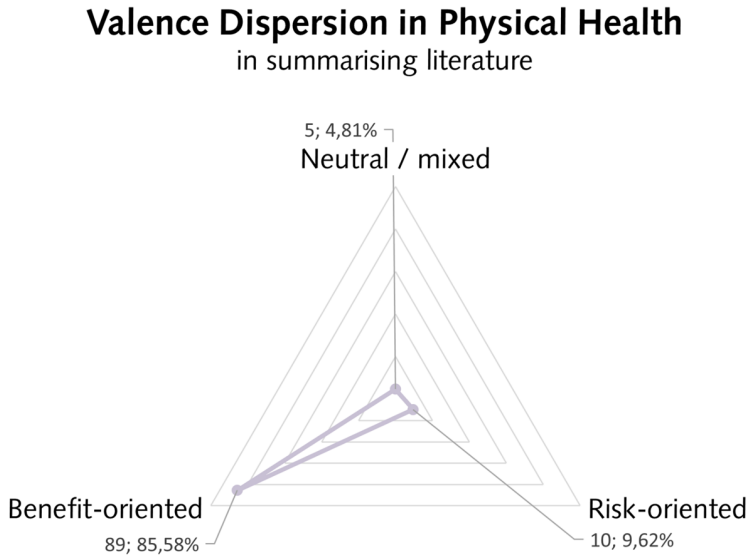
The World Health Organization provides explicit and detailed recommendations on sedentary behaviour, physical activity and sleep for children in the age of 5 (295). This advice splits sedentary screen time and active screen-based games explicitly. Regarding sedentary screen time, the report is fairly negative for these young ages: strong moderation or even non-use is the recommended course of action. Given the high importance of physical and tactile development of children at very young ages these recommendations seem sensible - and the report cites a robust body of evidence. That said, the recommendations seem heavily based on the physical-health evidence: the report is somewhat more limited regarding the negative and positive social and mental impact of media such as games at a very young age – an issue also flagged in the literature (296).

Domain-specific gaps

Attention to risks versus benefits

We found that the vast majority of summarising papers in the physical health domain approach games from a benefits-oriented perspective, often focusing on the instrumental use of games to achieve specific health aspects. Concerns and risks about physical health are the focus of only a minority of summarising papers. See **Figure 20** and **Table 14** for a breakdown of the valence dispersion within the physical health domain.

Figure 20. Valence dispersion in the physical health domain's summarising literature.



Underrepresented populations

As the vast majority of summarising studies has a focus on instrumental use of video games to achieve health benefits, populations generally involve vulnerable groups (e.g. elderly / children-adolescents) or various types of patients. Early adulthood and college student groups are less prevalent in these papers. The general (adult) population also receives limited attention.

Missing themes

The identified literature dominantly takes an instrumental perspective towards games, viewing them as tools to improve physical health. The negative and positive impact (or effects) of engagement with games as a form of leisure over the life course receives limited attention, with the exception of a small set of studies that cover risks for sleep, sedentary behaviour, or physical pain issues.

Table 14. Valence dispersion in physical health per grouped game factor.

Game factors	Neutral / mixed	Risk-oriented	Benefit-oriented	Total
Active Video Games / exergames			34	34
Videogames / digital games	1	3	8	12
Commercial Video Games			5	5
Virtual Reality video games			5	5
Interactive Video Games			3	3
Video games training (vgt)			3	3
Internet gaming disorder / excessive gaming / problematic online gaming		2		2
Motion-controlled video games			2	2
Serious digital games			2	2
Video game-based interventions			2	2
Video games and e-sports	1	1		2
(Active) Video Gaming, including Nintendo Wii			1	1
Active and educational video games			1	1
Adjusted video games			1	1
Commercial video consoles, which are based on motion capture			1	1
Computer-game-based therapy or non-immersive virtual rehabilitation			1	1
Digital Game-Based Interventions			1	1
Exercise and Neurofeedback in Computer Game-Based Interventions			1	1
Gamification and active videogames			1	1
Health Videogames			1	1
Heavy video game usage		1		1
Home-based active video games			1	1
Mobile gaming (mobile gaming exergames)			1	1
Nintendo Wii usage		1		1
Non-Immersive Virtual Reality and therapeutic Video Games			1	1
Physically based interactive computer games (icgs)			1	1
Research-developed serious games			1	1
Sedentary video gaming	1			1
Serious Videogames and Motion Capture Systems			1	1
Sports video games (svgs)			1	1
Video-Game-Based Therapy			1	1
Video game-based therapy with a leap motion controller			1	1
video game use (both disordered play and non-pathological)	1			1
Video game or virtual reality interventions			1	1
Video game technology			1	1
Video Games (augmented reality and online multiplayer ones)	1			1
Video games and video consoles			1	1
Augmented Reality Video Games		2		2
Videogames, Gamification, and Virtual Environments			1	1
Videogaming (i.e., exergames and computerized cognitive training)			1	1
Virtual Reality and Active Video Games			1	1
Virtual Reality and Serious Videogame-Based Instruments			1	1
Total	**5**	**10**	**89**	**104**
Total percentage	**4,81%**	**9,62%**	**85,58%**	**100,00%**

Future research directions

At the moment, physical health research focuses heavily on video games as instrumental tools for rehabilitation and therapy and is mostly benefit-oriented in nature. This domain would benefit from widening its scope, examining video games as a widespread leisure activity with potential health implications across the general population. More systemic attention could be paid to potential physical health risks and trade-offs, across the lifespan and including (healthy) adults. Furthermore, the intersection of gaming as a leisure activity with physical health aspects such as sleep, physical activity and sedentary time in non-clinical populations warrants further attention.

To address these gaps, we propose the following research questions for future work:

1. What are the long-term physical health trajectories associated with regular game play across the lifespan in non-clinical populations?

2. How does video game play as a leisure activity affect sleep quality, sleep duration, and circadian rhythm patterns across different age groups?

3. What is the relationship between video game play and overall physical activity levels, sedentary behaviour, and adherence to physical activity guidelines in the general population?

4. Which specific game design features (e.g., session length prompts, movement mechanics, reward structures) are associated with positive versus negative physical health outcomes?

5. How do the physical health effects of video games differ between therapeutic/rehabilitation contexts and recreational use in healthy populations?

6. What are the prevalence, risk factors, and prevention strategies for gaming-related musculoskeletal injuries, repetitive strain injuries, and other physical risks, including eye and hearing health?

7. How effective are active video games compared to traditional physical activity interventions for long-term behaviour change and sustained health benefits

Physical Health and Video Games in Brief

The physical health domain in video game research emphasises therapeutic and rehabilitative applications. Much of the summarising literature highlights how games, particularly active video games, VR applications, and rehabilitation-focused serious games, might be used to support motor function, physical activity, balance, gait, and various condition-specific outcomes across a wide range of vulnerable or clinical populations.

While benefits are the dominant focus, a smaller body of work also suggests potential risks, including sleep disruption, injuries, sedentary behaviour, or other physical health issues. Primary research echoes this benefit-oriented landscape, with substantial attention to exergaming, serious games, and movement-based interventions.

Across the corpus, several gaps emerge. Research disproportionately targets clinical or vulnerable groups, with limited attention being paid to healthy adults and general population leisure gamers. Broader patterns of everyday gaming as a leisure activity – and its physical health implications for the general population – remain markedly underexplored. Risks receive less coverage than benefits, and little work investigates long-term or systemic physical health trajectories linked to gaming across the lifespan. Future research would benefit from exploring how recreational gaming interacts with sleep, sedentary behaviour, physical activity, physical health (eye health/hearing), musculoskeletal health, and broader behavioural patterns outside therapeutic contexts.

Sexual health

Domain contents

The domain of sexual health is one of the smaller domains, with a total of 17 health keywords. The five most-occurring keywords in the scientific video games literature within this domain are "sexuality", "pregnancy", "sexual health", "sexual behaviour" and "sex education", see **Figure 21.** The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF)**.** After selection and deduplication, the sexual health domain contained 3 meta-analyses and (systematic) reviews.

Figure 21. Word cloud illustrating the keywords present in the sexual health domain.

Main hypotheses in the summarising literature

The sexual health domain, represented by only three summarising studies, reflects a predominantly benefit-oriented and educational approach. Serious digital games and educational video games are hypothesised to improve sexual health promotion and sexual health outcomes, particularly among young people aged 15 to 25 years and broader populations (297–299). These interventions are examined for their potential to enhance sexual health knowledge, attitudes, and behaviours through interactive, game-based learning experiences.

Additionally, LGBTQ+-inclusive video games are explored for their potential impact on gamer norms and gamer culture (297). This research examines how representation and inclusion in gaming content may shape attitudes and perceptions around sexual and gender diversity within gaming communities.

The studied populations vary from young people (aged 15-25) to generic gamer audiences, though the limited corpus reflects primarily a therapeutic and educational framing. Researchers investigate how games might serve as vehicles for sexual health education and norm change, with minimal attention to potential risks associated with gaming content or practices.

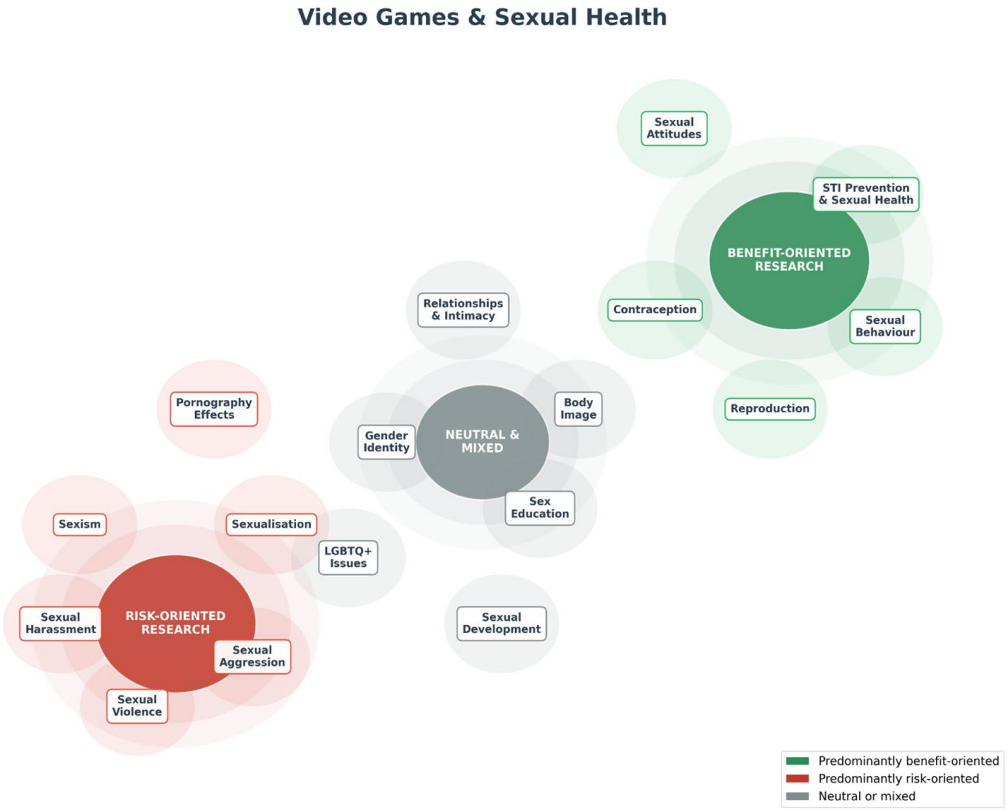
As the sexual health domain's hypotheses are small in number, we refer directly to **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and populations within the sexual health domain.

Total literature at a glance

Sexual health is one of the smallest health domains within the broader field of video games and health, with only few summarising articles. However, a look at the broader body of research on sexual health and video games offers more insight into the game factors and health aspects that have been studied. Various game factors have received attention within this field, with the largest being dating or romantic/explicit video games. Mobile gaming, VR gaming, and online gaming also feature as game factors, as well as general gaming/video games.

The health factors that are studied within the sexual health domain revolve to a large extent around sexual behaviour, sexual violence/aggression, and sexual relationships. Sexual education is also featured, though in fewer studies, followed by health aspects such as gender identity, sexual attitudes, and LGBTQ+. Sexual health/STI's, reproduction and contraception are also health topics that are present in the literature. Finally, pornography and sexual addiction are addressed in the body of primary research work, but only in very few instances. See **Figure 22** for a broad visualisation of the topic landscape within the domain of video games and sexual health.

Figure 22. Visualisation of the broader video games and sexual health landscape.



Grey literature on sexual health

Findings from industry and nonprofit reports regarding sexual health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

The grey literature on video games and sexual health primarily addresses the potential of digital games as tools for sexual health education. UNESCO's *International Technical Guidance on Sexuality Education* acknowledges the potential of digital platforms for reaching young people with sexual and reproductive health information (300). Planned Parenthood has similarly embraced digital approaches, having launched "Our Stories, Our Journeys: A Sexual Health Game" in 2024 specifically for young

people with intellectual and developmental disabilities (301). GLAAD's inaugural *State of LGBTQ Inclusion in Video Games* report (2024) found that while 17% of active gamers identify as LGBTQ+, games with LGBTQ+ content account for less than 2% of available titles (302).

A smaller body of grey literature addresses sexual safety risks in gaming. UNICEF has highlighted that gaming environments can facilitate grooming due to regular communication and perceived familiarity between players (303), while the WeProtect Global Alliance's *Global Threat Assessment* (2023) reported that high-risk child grooming situations can develop in as little as 45 minutes in social gaming environments (304). The Tech Coalition has developed specific guidance for addressing online child sexual exploitation in gaming, including grooming and financial sextortion (305).

Domain-specific gaps

Attention to risks versus benefits

Within the limited amount of summarising literature on video games and sexual health we see a slight skew towards benefits of video games for sexuality-related aspects of health (i.e., two out of three papers). None of the meta-analyses or reviews covered risks to sexual health, despite the fact that such risks are present in the broader primary literature on this topic. See **Figure 23** and **Table 15** for a breakdown of the valence dispersion within the sexual health domain.

Underrepresented populations

The summarising literature on sexual health and video games, due to its generally limited size, lacks work on neurodivergent populations (e.g., video game players with autism spectrum disorder (ASD) or attention deficit hyperactivity disorder (ADHD)). Furthermore, work on (older) adults' sexual health and video game play also is underrepresented, as is research on how video games might affect sexual health behaviours and attitudes in non-Western populations.

Figure 23. Valence dispersion in the sexual health domain's summarising literature.

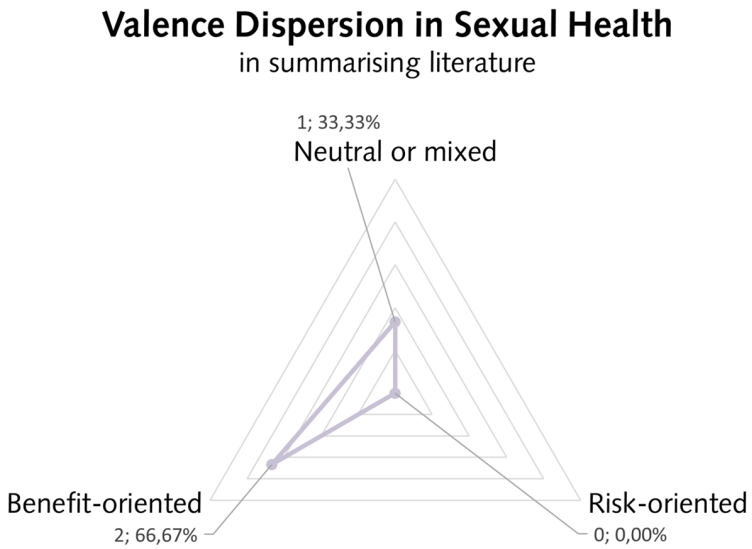


Table 15. Value dispersion in sexual health summarising literature per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Serious games			1	1
Educational video games			1	1
LGBTQ+ inclusive games	1			1
Total	**1**	**0**	**2**	**3**
Total percentage	**33,33%**	**0,00%**	**66,67%**	**100,00%**

Missing themes

Several themes seem to remain underexplored in the summarising literature on sexual health and video games. First, existing reviews seem to focus primarily on intentional interventions (such as serious games designed for education), while entertainment video games and their potential (positive or negative) influence on sexual and gender attitudes, norms, and behaviours remain largely unaddressed at the level of summarising literature. Moreover, research may not only address the effect of sexual content in general video games, but also the effect of the genre 'erotic games' more specifically, as it represents a substantial and popular genre within the gaming landscape (as seen for example on the gaming platform Steam). Risks associated with video game play and sexual health such as exposure to sexualized content, sexual harassment, or online grooming have also not yet been systematically reviewed.

Future research directions

There is a clear need for systematic reviews that examine potential risks of video gaming for sexual health, supplementing the current focus on benefits and educational applications. Additionally, research should investigate how commercial video games may shape sexual attitudes, knowledge, and behaviours among players. For example, it is unclear how video games may impact how players view gender and sexual diversity.

Research looking at the relationship between video gaming and sexual health, both in terms of education as in terms of risks and benefits, should also focus on diverse populations. These include, but are not limited to, older adults, neurodivergent populations, people in LGBTQ+ communities, and people with a non-Western background. Furthermore, longitudinal research examining the sustained effectiveness of game-based sexual health interventions is needed to move beyond short-term outcome assessments.

Based on the highlighted gaps and future directions, we formulate a selection of relevant research questions:

1. What are the effects of exposure to sexualised content in video games on players' sexual attitudes, norms, and behaviours?
2. What factors contribute to or protect against negative sexual experiences in video gaming environments?
3. How do online grooming dynamics manifest in video game contexts, and what platform features or player behaviours increase vulnerability?
4. What is the relationship between LGBTQ+ representation in entertainment video games and players' attitudes toward sexual and gender diversity?

5. How can game-based sexual health interventions be effectively designed for and evaluated in diverse populations, including (older) adult populations, neurodivergent individuals, and people with a non-Western background?

6. What is the long-term effectiveness of game-based sexual health interventions on knowledge retention and behaviour change?

Sexual Health and Video Games in Brief

The sexual health domain represents one of the smaller areas within the video games and health literature. The available summarising evidence is limited to three meta-analyses and reviews, which predominantly highlight the potential benefits of serious and educational games for sexual health promotion among young people. The literature also acknowledges the role of LGBTQ+-inclusive games in shaping social and cultural norms.

However, notable gaps exist: risks to sexual health remain unexamined at the review level, several populations are underrepresented, and the influence of entertainment games on sexual health aspects has not been systematically synthesized. Future research should aim to address these imbalances and expand the evidence base across diverse populations, game types, and health aspects.

Social health

Domain contents

The domain of social health is one of the larger domains in the literature, with 180 health keywords that have been assigned to the social health domain. The five most frequently occurring keywords in the scientific video games literature are "violence", "cooperative behavior", "aggressive behavior", "communication" and "social behavior", see **Figure 24**. The complete table with keywords and associated frequencies can be found in **Table 3** of the **Appendix** (see OSF)**.** After deduplication and screening, we retained 25 meta-analyses and (systematic) reviews in the social health domain.

Figure 24. Word cloud illustrating the keywords present in the social health domain.

Main hypotheses in the summarising literature

The social health domain reveals a dual focus on both potential benefits and risks of video game engagement. A substantial portion of the literature examines the relationship between violent video games and aggression, hypothesising that exposure to violent content may increase aggressive behaviour, aggressive cognitions, and reduce prosocial outcomes in children, adolescents, and young adults (306–308). Internet gaming disorder and excessive gaming are similarly explored for associations with social dysfunction, social anxiety, and reduced social wellbeing (64,73,309).

Conversely, research also examines prosocial gaming experiences and their potential benefits. Prosocial video games and cooperative gameplay are hypothesised to enhance prosocial behaviour, cooperation, social capital, and positive social interactions (166,167,310,311). Multiplayer games and gaming community membership are examined for their potential to reduce prejudice, strengthen group identity, and facilitate social movements and activism (312,313).

The summarising literature also addresses gender-based harassment and discrimination within gaming spaces, examining how gaming environments may both enable and amplify these negative social dynamics (314,315). Active video games are hypothesised to improve social behaviours in children with neurodevelopmental disorders (166).

Target populations span from children and adolescents to community-dwelling older adults, students, and gaming communities more broadly, though children and adolescents receive the most attention. The social health domain reflects recognition that video games constitute complex social environments capable of both supporting healthy social development and enabling harmful social dynamics. See **Table 16** for examples of hypotheses in the social health and video games literature.

Table 16. Examples of hypotheses in the summarising literature of the social health domain.

Game factor	Association	Social health factor	Population	DOI
Video games	may be related to	Aggressive behaviour, apathy	Children and adolescents	10.23750/abm.v94i2.14019
Violent video game play / prosocial video game play	may worsen/ may improve	Aggression / prosocial outcomes	Not specified	10.1177/0146167215591992
Excessive / problematic (online) video gaming	may be associated with	Social anxiety	Not specified	10.1007/s40429-021-00406-3
Prosocial video game play	may improve	Moral activity	Not specified	10.1007/s10639-022-11072-x

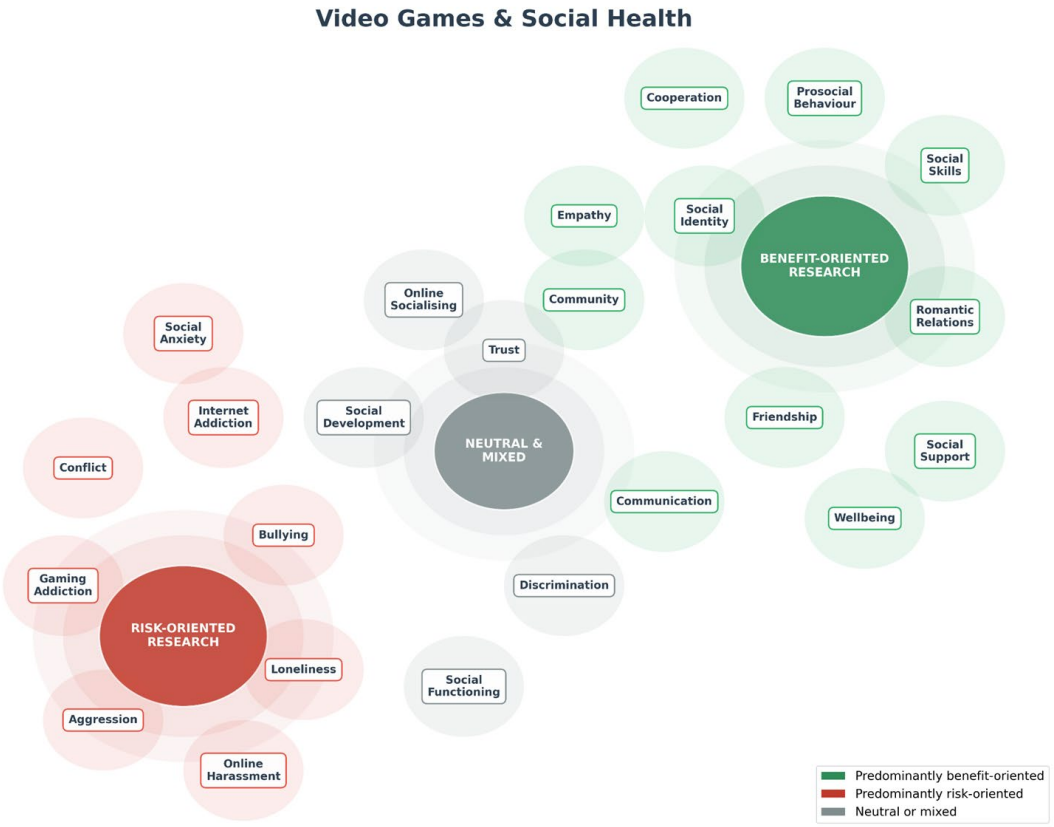
See **Table 13** in the **Appendix** (see OSF) for a complete overview of the extracted hypotheses and studied populations within the social health domain.

Total literature at a glance

A look at the broader body of research on social health and video games shows that online gaming represents the most prominent game factor in the field, reflecting the inherently social nature of multiplayer and internet-connected play. Educational games also feature strongly, alongside general gaming/video games. Various other game types feature in the field (e.g., RPG games, exergames, serious games, VR gaming, simulation games) also receive attention in the field of video games and social health.

The health factors studied within the social health domain centre largely on social connection, cooperation, and communication. Community and aggression also feature prominently, followed by family relations, friendship, and social support. Online socialising, loneliness, and social identity appear as distinct areas of focus. On the risk side, internet addiction, gaming addiction, discrimination, conflict, and bullying have all received attention. Social anxiety, social exclusion, and online harassment also feature in the body of primary research work. See **Figure 25** for a broad visualisation of the topic landscape within video games and social health.

Figure 25. Visualisation of the broader video games and social health landscape.



Grey literature on social health

Findings from industry and nonprofit reports regarding social health are presented below as descriptive context and should be interpreted separately from peer-reviewed evidence.

The grey literature on social health and video games reflects both the prosocial potential and documented harms associated with (online) gaming, drawing on industry surveys, nonprofit initiatives, and corporate sources. The Entertainment Software Association' 2025 *Power of Play: Global Video Games Report* found that 71% of video game players find that games introduce people to new friends and relationships (161). The ESA's 2024 and 2025 *Essential Facts* reports document similar patterns in the U.S., noting that 82% of parents who play video games play with their children, and that younger generations frequently report forming meaningful relationships through games (160).

Fuelled by the promise of video games for social good, corporate initiatives have sought to promote prosocial gaming communities. For example, the company TELUS launched GameRx in 2025 (316), a wellness-focused platform offering evidence-based game recommendations for addressing stress, loneliness, and social connection. Similarly, the Entertainment Software Association of Canada's (ESAC) 2024 report *Beyond Entertainment* profiles organisations that use games for community building (171), including the Manitoba First Nations Educational Resource Center. They brought eSports to reserve schools and reported improved belonging and self-worth among students.

Counterbalancing these positive findings, grey literature also documents persistent threats to video game players' social health in video gaming spaces. The Anti-Defamation League's annual *Hate is No Game* surveys provide the most comprehensive tracking of harassment in online gaming: the 2023 report found 76% of adult players experienced harassment in online games, with 67% being called offensive names, 44% experiencing sustained harassment, and 15% exposed to white supremacist

ideologies (317). Boston Children's Hospital Digital Wellness Lab also evaluated digital gaming in 2024 and reported mixed findings on social gaming experiences, with one in five adolescents reporting multiplayer gaming sessions with strangers as "toxic" (318). Pew Research Center's 2024 *Teens and Video Games Today* survey similarly found that 43% of U.S. teens reported experiencing harassment or bullying in video game contexts (319). The grey literature thus reflects a dual focus – prosocial potential versus toxicity and harassment – that mirrors the scientific literature on video games and social health.

Domain-specific gaps

Attention to risks versus benefits

The summarising literature in the social health domain shows a pronounced focus on potential harms, with 14 studies examining negative outcomes (aggression, violence, addiction, disorders) compared to only 8 studies exploring potential benefits. This imbalance suggests that prosocial effects, positive social interactions, and social capital building through gaming deserve more research attention. See **Figure 26** and **Table 17** for a breakdown of the valence dispersion within the social health domain.

Underrepresented populations

Several populations are underrepresented or absent in the literature. Most research concentrates on children and adolescents (nine studies), with minimal attention to older adults (one study), despite the growing population of older gamers and the potential for video games to address social isolation in this demographic.

Other underexplored groups include female gamers and gender-specific social experiences (despite evidence of gender-based harassment), culturally diverse populations and non-Western samples, and individuals with social anxiety or autism spectrum disorders (ASD) who may particularly benefit from online social interaction.

Figure 26. Valence dispersion in the social health domain's summarising literature.

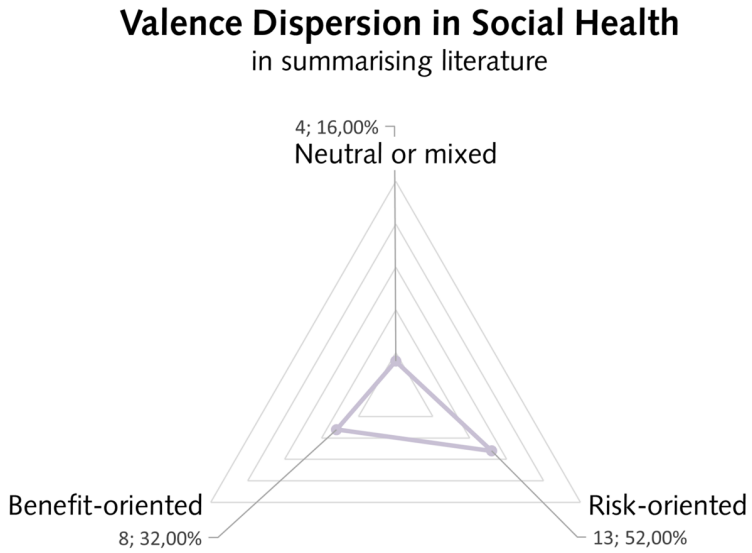


Table 17. Valence dispersion in social health per grouped game factor.

Game factors	Neutral or mixed	Risk-oriented	Benefit-oriented	Total
Violent game play		6		6
Multiplayer / cooperative digital games			2	2
Prosocial digital games			2	2
User-avatar relationships	1			1
Internet gaming disorder/ excessive gaming / problematic		3		3
Video games	1	2	2	5
Active video games			1	1
Cybersexism		1		1
Being part of a gamer community	1		1	2
Gamer identity		1		1
Violent video game play / prosocial video game play	1			1
Total **Total percentage**	**4** **16,00%**	**13** **52,00%**	**8** **32,00%**	**25** **100,00%**

Missing themes

Although the domain includes diverse social health aspects, certain areas remain understudied. These include social support networks and friendship quality in online gaming communities, cross-cultural social interactions in global multiplayer environments, intergenerational social connections through gaming, and the role of video games in combating loneliness and social isolation (particularly relevant post-COVID-19).

While the literature frequently examines whether violent video games relate to aggression, there is limited exploration of the specific game mechanisms that drive social outcomes. Studies examining cooperative versus competitive gameplay, specific game genres, or particular social features of games are remarkably scarce in high-level summarising literature, making it difficult to provide nuanced recommendations about which types of games might promote positive social outcomes.

There is insufficient high-level research examining how specific design features affect social outcomes, such as: voice chat versus text communication systems, guild/clan structures and their impact on social capital, in-game reward systems for prosocial behaviour, and moderation systems and their effectiveness in reducing toxic behaviour.

Future research directions

The social health domain will benefit from by examining positive social outcomes with the same rigor as currently applied to aggression and toxicity. Future research could focus on longitudinal studies examining these social outcomes, population-specific research on underrepresented groups such as older adults and clinical populations. Also, the field is lacking mechanism-focused studies, identifying which specific game design features promote positive versus negative social outcomes. Research examining friendship quality in gaming communities, cross-cultural and intergenerational connections, and effective interventions to reduce (gender-based) harassment would address important gaps.

Based on the highlighted gaps and future directions, we formulate a selection of relevant research questions:

1. How do video games facilitate or hinder social connection among older adults, and what are the implications for combating social isolation in aging populations?

2. What specific game design features (voice/chat systems, guild structures, cooperative mechanics) promote positive social outcomes versus toxic behaviour?

3. How do experiences of harassment and discrimination in gaming environments differ across gender, sexual orientation, and other demographic characteristics?

4. What is the effectiveness of different moderation systems and prosocial design interventions in reducing harassment and promoting inclusive gaming communities?

5. How do cross-cultural social interactions in global multiplayer games affect cultural understanding and prejudice?

6. What role do video games play in facilitating intergenerational social connections within families?

7. How do video games support social skill development and social connection for individuals with autism spectrum disorder (ASD) or social anxiety?

Social Health and Video Games in Brief

The social health domain represents one of the more moderate areas of investigation at the summary level but reveals an imbalance toward risk-focused research. Sixteen studies examine potential harms, particularly the relationship between violent video games and aggression, while nine explore potential benefits such as prosocial behaviour and social capital building.

The summarised literature presents a dual narrative: violent video games are hypothesised to increase aggression and social dysfunction, while prosocial games and cooperative gameplay are hypothesised to enhance positive social interactions. This body of high-level work concentrates on children and adolescents, with limited attention to older adults despite the potential for games to address social isolation.

Gaps in the summarising literature include seemingly underexplored populations (older adults, female gamers, individuals with social anxiety or autism) and understudied themes (online friendship quality, cross-cultural interactions, intergenerational connections). While available reviews frequently address whether violent games relate to aggression, they appear to rarely examine which specific design features promote positive versus negative social outcomes.

Future research could benefit from greater attention to positive social outcomes in systematic reviews, expansion to underrepresented populations, and a more mechanistic approach identifying which game features foster meaningful social connections.

Discussion

This review set out to map the landscape of scientific literature on video games and health, characterising the hypotheses that have guided investigations, and surfacing gaps that require further attention. Across 443 meta-analyses and (systematic) reviews spanning eight health domains, a complex picture emerges – one that resists the simple narratives of video games as either uniformly harmful or universally beneficial.

The findings reveal a field that has made substantial progress in certain areas while leaving others virtually unexplored, and that has developed sophisticated questions in some respects while remaining more rudimentary in others.

Synthesis of the landscape's topics and hypotheses

The predominance of benefit-oriented research

Perhaps the most striking pattern to emerge from this review is the extent to which the summarising literature presents a predominantly benefit-oriented perspective on video games and health. Across cognitive, physical, developmental, and social health domains, the prevailing hypothesis is that video games confer positive effects – improving learning outcomes, supporting physical rehabilitation, enhancing motor development, and facilitating social connection. This optimistic framing is not universal; the behavioural health domain, with its substantial focus on internet gaming disorder, represents a clear exception where risk-oriented hypotheses predominate.

This asymmetry warrants careful interpretation. It may reflect genuine differences in the balance of evidence across domains, with benefits more robustly demonstrated than harms in many contexts. Alternatively, it may signal publication bias, disciplinary orientations that favour intervention-focused research, or the influence of funding streams that prioritise therapeutic applications. What seems clear is that the summarising literature does not yet offer a fully balanced accounting of both the potential benefits and risks of video game engagement across health domains.

Uneven development across health domains

The distribution of summarising literature across health domains is strikingly uneven. Cognitive health (132 items), behavioural health (107 items), and physical health (104 items) together account for the vast majority of the evidence base. Mental health (60 items) and social health (25 items) occupy a middle tier, while developmental health (9 items), sexual health (3 items), and financial health (3 items) remain underexplored.

These disparities do not correspond to the real-world significance of each domain. Financial health is only represented by three summarising studies, where we would expect more, considering the video game industry is an industry generating large revenue streams annually through increasingly sophisticated monetisation practices. Sexual health, similarly sparse in the literature, encompasses critical issues from sex education to online safety to identity development. The relative absence of high-level synthesis in these domains means that policymakers and practitioners lack the evidence base they need to make informed decisions regarding the bigger picture of video games' health impacts, both negative and positive.

Persistence of general game factors

Despite the extraordinary diversity of video games – spanning genres from puzzle games to first-person shooters, modalities from mobile to virtual reality, and social modes from solitary play to massively multiplayer environments – the summarising literature continues to treat games with remarkable generality. Terms like "video games," "digital games," and "computer games" appear as game factors

far more frequently than specific genres, mechanics, or design features. This pattern persists even as researchers increasingly acknowledge that different types of games may have fundamentally different health implications.

Some specificity has emerged: exergames and active video games are now studied as distinct categories in physical health research; serious games and game-based interventions are recognised in educational and therapeutic contexts; and violent video games receive targeted attention in behavioural research. Yet the field has not developed a shared taxonomy of design choices, psychological mechanisms, and game features that would allow systematic comparison across studies, and most reviews aggregate evidence across highly heterogeneous game types. This limits the actionability of findings: knowing that "video games" may improve cognitive function offers little guidance about which games to recommend, for how long, or under what conditions.

Gaps cutting across the health landscape

Certain limitations appear consistently across health domains, suggesting systemic gaps in the field of video games and health research.

Underrepresented populations

Three population gaps recur with particular frequency. First, older adults remain vastly understudied relative to their potential to benefit from video game engagement, particularly for cognitive health. Second, non-Western populations are dramatically underrepresented, raising questions about the cross-cultural validity of findings that have been derived predominantly from North American and European samples. Third, socioeconomically diverse populations receive insufficient attention, limiting our understanding of how resource constraints, access barriers and contextual factors may shape the relationship between gaming and health. Last, many other minority population groups - such as individuals with intellectual disabilities - appear rarely if at all in the summarising literature. As games reach all audiences, consideration of these groups is important – both in terms of risks and benefits.

Mechanistic understanding

Across health domains, the literature is substantially more focused on effects of video games (either positive or negative) than on explaining how or under which circumstances these effects may occur. Questions of mechanism – which particular game features drive health effects, through which psychological processes, and how these mechanisms interact with individual characteristics – remain secondary to basic efficacy questions. This has practical consequences: without mechanistic understanding, it is difficult to design games optimised for health benefits, to predict who will benefit most from which game interventions, or to identify for which commercial game features policy is needed to enhance benefits and limit harms.

Ecological validity and transfer

Laboratory-demonstrated effects do not automatically translate to real-world, relevant health outcomes. Cognitive improvements on standardised tests may not result in enhanced academic performance. Social skills practiced in game environments may not transfer to face-to-face interactions. The summarising literature has not yet systematically addressed these questions of ecological validity and transfer, leaving some uncertainty about the real-world manifestation of certain video game effects.

Methodological considerations

Strengths of the present approach

The scoping methodology employed in this review, combined with topic-modelling techniques for health domain categorisation, offers several advantages for mapping a heterogeneous body of literature. By deriving health domains empirically from author-assigned keywords rather than imposing

predetermined categories, the review captures the terrain as researchers have actually shaped. The focus on summarising literature – meta-analyses and (systematic) reviews – provides a high-level view of what the field has considered sufficiently important to synthesise, while the AI-assisted rapid exploration of primary literature offers complementary breadth.

Limitations

Several limitations warrant acknowledgment. The focus on summarising literature, while strategically appropriate for a scoping review of this extent, may miss emerging research directions that have not yet been subject to systematic synthesis. The English-language restriction excludes potentially valuable literature from non-Anglophone research traditions. The reliance on author-assigned keywords means that health aspects not captured in keywords may be underrepresented, and the categorisation of keywords into health domains, while conducted systematically, involves interpretive judgments that others might make differently.

The AI-assisted analysis of non-summarising literature, while providing valuable breadth, carries its own limitations. Topic extraction at this scale necessarily sacrifices specificity, and the accuracy of AI-generated categorisations, while validated through sampling, cannot be guaranteed for every individual study. These analyses should be understood as providing a broad orientation to the landscape rather than precise characterisations of each study.

Implications

For policymakers

The uneven development of evidence across domains has direct implications for policy. In areas with robust evidence bases, such as exergames for physical rehabilitation or game-based learning for specific educational outcomes, policy can draw on synthesised evidence with reasonable confidence. In domains where the summarising literature is sparse (e.g., financial health, sexual health, many aspects of developmental health) policymakers should recognise that decisions are being made in the absence of adequate evidence synthesis. Therefore, they may need to rely more heavily on precautionary principles or analogies from related domains.

The financial health domain deserves particular policy attention. The combination of sophisticated monetisation practices, documented psychological parallels with gambling, growing public concern about the impact of design on behaviour, and near-total absence of synthesised evidence or guard-rails on emerging practices creates conditions where regulatory action may outpace the evidence base. Investing in research that can inform evidence-based policy in this domain should be considered a priority.

For industry

The video game industry occupies an inherently complicated position in relation to health research. As the entity that designs, distributes, and profits from the products under investigation, the industry has clear financial interests in research outcomes – interests that do not always align with those of players, public health authorities, or independent researchers. Historical parallels from other industries warrant reflection.

The tobacco industry is known to have engaged in a decades-long campaign to manufacture doubt about the health effects of smoking (320). Similarly, the pharmaceutical industry has sometimes fallen prey to selective publication of favourable trial results (321). The commercial influence of the gambling industry over evidence and the health discourse is a key concern among experts (136). These examples demonstrate how commercial interests can distort scientific understanding in the absence of appropriate safeguards. The video game industry is not immune to similar dynamics. Industry-funded research, industry-sponsored conferences, and industry relationships with researchers all create conditions in

which findings favourable to commercial interests may be amplified while unfavourable findings may be minimised or suppressed. Effects can also be more subtle, involving group think and (subconscious) self-censorship.

At the same time, a purely adversarial framing of industry-research relations would be counterproductive. The industry possesses data, access, and technical expertise that academic researchers lack. Player behaviour data at scale, the capacity to conduct in-game experiments, and detailed knowledge of design processes all reside within companies rather than universities. Realising the full potential of video games research – including research that could ultimately benefit both players and the industry – requires some form of contact or collaboration.

Several principles might guide such contact while protecting against the distortions that have plagued other industry-research relationships. First, transparency is needed. Funding sources, data access arrangements, and any constraints on publication should be disclosed clearly in all research outputs, and registries of industry-funded research could enable systematic assessment of whether such research differs from independently funded work.

Second, independence must be safeguarded. Research questions, methods, and interpretations should remain under the control of researchers rather than funders, with contractual protections ensuring the right to publish regardless of findings. Third, industry could commit to making anonymised player data available to qualified independent researchers through secure data enclaves, enabling research on questions the industry might not choose to investigate itself.

Finally, rather than funding research directly, industry could contribute to disconnected, independent funding bodies – analogous to health research charities – that set up grants through peer-review processes, insulated from commercial influence. To ensure independence, funding preferably comes from (non-voluntary) levies from video game revenues, with legally binding statutes to protect these funds from industry influence/agenda-setting, as is similarly proposed in the field of gambling research. Such structures should ideally be oriented towards longer term, deeper work to stimulate further independence (322). As a first area of focus for such work, a commercial ecosystem-wide approach would be worthwhile, to identify the boundaries and recommendations with regards to rapidly evolving commercial practices in modern games. While some grey literature sources are already addressing this, and both UNICEF (135), a multidisciplinary Dutch team (133,134), and researchers in various other countries (323–325) are working on the topic, the work remains in need of development.

The absence of such frameworks – and the valuable results from such efforts - to date has contributed to the gaps documented in this review. As regulatory attention to video games intensifies – particularly around monetisation, child safety, and manipulative design – the industry faces a choice. It can engage constructively with independent research, accepting that some findings will be uncomfortable, but that credible evidence serves long-term interests better than manufactured uncertainty. Or it can resist scrutiny, fund sympathetic research, and challenge unfavourable findings – a strategy that may delay regulation and other restrictive societal action, but will ultimately undermine public trust and invite more adversarial policy responses. The experience of other industries suggests that the latter path is both ethically problematic and strategically short-sighted. It also conflicts with the ambitions of many workers in the game industry that seek to deliver beautiful art, meaningful experiences, and worthwhile healthy play for all generations.

For practitioners

Those working directly with video game players and their social network (e.g., clinicians, educators, and community organisations) can draw on a substantial evidence base in some areas while recognising its limitations. The cognitive and physical health domains offer the most robust evidence for potential benefits of specific game types in specific contexts. The behavioural health literature provides guidance on recognising and responding to problematic gaming patterns. However, practitioners should be

cautious about generalising findings across game types, populations, or contexts that are not well represented in the literature and should maintain awareness that the absence of evidence for harm is not the same as evidence of safety. For some audiences and mechanisms (e.g., under-age loot box exposure), a precautionary approach might be warranted.

Conclusion

The relationship between video games and health is neither simple nor static. The present review is but a starting point for future work, having mapped a literature landscape characterised by substantial development in some regions and conspicuous gaps in others. Our review of the literature has revealed a landscape shaped by disciplinary traditions, funding priorities, industry interests, and the evolving nature of video games themselves. The 443 meta-analyses and (systematic) reviews examined here represent considerable scientific investment, yet they leave ample room for further development of the field of video games and health.

What emerges most clearly is the inadequacy of binary framings. Video games are not uniformly good or bad for health; they are a diverse medium whose effects depend on the specific games played, the people playing them, the contexts of play, and the health outcomes in question. The scientific literature has begun to grapple with this complexity but has not yet developed the conceptual and methodological tools to address it fully.

As video games continue to evolve – incorporating new technologies, reaching new populations, and developing new business models – the research enterprise must evolve alongside them. The gaps identified in this review are not merely academic; they represent areas where individuals, families, educators, clinicians, and policymakers lack the evidence they need to make informed decisions. Addressing these gaps should be understood not as a luxury but as a necessity for navigating a world in which video games are an inextricable part of how billions of people live, learn, connect, and play.

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Expert Commentaries

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The review provides a comprehensive mapping of the scientific literature on video games and health. By analysing 443 meta-analyses and systematic reviews across multiple domains, it offers a rare, high-level perspective on how the field has developed over the past decade.

One important finding is the pronounced imbalance in topic coverage. Cognitive, behavioural, and physical health dominate the evidence base, while developmental, sexual, and financial health are barely represented. The limited attention to financial health is particularly notable given the scale and sophistication of monetisation systems in contemporary games and their potential implications for player well-being.

The review also highlights an asymmetry in how research questions are framed. Behavioural health research is largely risk-oriented, with a strong focus on Internet Gaming Disorder, whereas other domains tend to emphasise potential benefits, such as cognitive or rehabilitative outcomes. In addition, the authors identify several cross-cutting limitations, including the underrepresentation of older adults and non-Western populations, limited attention to mechanisms and dose–response relationships, and a relative scarcity of longitudinal designs.

Taken together, the review provides a clear synthesis of what has been studied, how it has been studied, and where important gaps remain.

The current state of the research landscape

More broadly, the research landscape is marked by both expansion and fragmentation. The field has moved beyond earlier debates centred on violence or addiction and now spans mental health, social connection, cognition, rehabilitation, and well-being. However, this expansion has not yet produced a fully cumulative science. Many studies still rely on broad category labels such as video games or total time spent playing, despite substantial differences in mechanics, social environments, pacing, monetisation systems, and intended uses.

Recent work increasingly treats gaming as a heterogeneous activity whose effects depend on the interaction between individual vulnerabilities, social context, and specific design features rather than on gaming per se. Although the field is becoming more methodologically sophisticated, familiar limitations remain. Longitudinal and ecologically valid work is still relatively scarce, many findings rely on self-report, and some populations remain underrepresented.

At the same time, this is beginning to change. Newer work has started to examine gaming in more naturalistic contexts. However, the literature as a whole still has not settled the debate on when, for whom, and under what conditions gaming is beneficial, harmful, or neither.

Key priorities and directions for future research

Drawing on my recent multi-sector study, as well as the broader evidence base, progress will require moving beyond isolated datasets toward shared evidence infrastructures. Four priorities are particularly salient:

1. Strengthening evidence: Progress depends on improving the credibility, relevance, and cumulative value of research in the field. This includes greater use of longitudinal and ecologically valid designs, clearer attention to mechanisms, and the ability to capture how gaming unfolds over time and across contexts. It also requires recognising null or mixed findings as informative rather than as failures, supporting a more balanced

and trustworthy evidence base.

2. Improving communication: A recurring barrier identified across sectors is how evidence is interpreted, communicated, and used. Simplified or polarised narratives can obscure nuance and limit the uptake of research findings. More effective communication will require translation across audiences, including policymakers, industry stakeholders, and the public, as well as more iterative, bidirectional engagement between those producing and those using evidence.

3. Fostering sustained collaboration: Many of the field's constraints, particularly around data access and external validity, cannot be addressed by any single sector. Therefore, structured forms of collaboration are essential. This includes developing models of data sharing and joint research that maintain scientific independence while navigating legal, commercial, and ethical constraints.

4. Building literacy: There is a need for greater literacy across all groups involved in the video games ecosystem. This includes supporting policymakers and the public in understanding contemporary game design and research evidence, as well as enabling researchers to remain informed about rapidly evolving technologies and practices.

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The report by the Trimbos Institute titled Video Games and Health: A Scoping, Topic-Modelling Review provides a timely and valuable synthesis of the rapidly growing body of research exploring the relationship between video games and health (Griffioen et al., 2026). The study offers a broad overview of how scholars have approached the topic across multiple health domains while also highlighting important gaps in current knowledge. This also adds value to Saudi Arabia's vision on gaming.

The report aligns with how video games today are one of the most widely adopted forms of digital media worldwide, shaping how people learn, socialize, and spend leisure time (Entertainment Software Association, 2023; Newzoo, 2024). Gaming also plays an increasing role in social interaction (culture) and digital culture, particularly among younger generations. This trend is especially visible in the recent pioneering momentum of the gaming ecosystem in Saudi Arabia. As the report highlights, the relationship between gaming and health cannot be framed simply as beneficial or harmful. Outcomes depend on context, such as the type of game, the motivations of the player, patterns of engagement, and the social environment surrounding play (Granic et al., 2014; Przybylski & Weinstein, 2019). Recognizing this fundamental complexity is essential if research is to move beyond polarized debates toward a more digitally balanced and evidence-based understanding.

One important point highlighted in the report is that cognitive, behavioural, and certain aspects of physical health dominate the literature, while developmental, financial, and sexual health remain significantly underexplored (Griffioen et al., 2026). This imbalance raises an important question: Does the current research agenda adequately reflect the real-world complexity of gaming as a global social and economic phenomenon? In addition, cultural contexts are often insufficiently explored, despite the fact that culture can strongly influence gaming behaviours, motivations, and health outcomes. For instance, several large cross-national meta-analyses and surveys have found significant nation- and region-level variance in rates of problematic gaming (Cheng et al., 2014; Chia et al., 2020; Thomas et al., 2023). Typically and speculatively, such observed differences are attributed to national cultural values, such as individualism and collectivism, yet there has been very little systematic empirical exploration of these or other cultural variables that might shape gaming behaviour and the functions it serves.

From a regional perspective, the relatively limited representation of populations outside of Europe, North America and East Asia leaves important gaps in our understanding of gaming behaviours and health outcomes in regions such as the Middle East and Africa (OECD, 2022). This gap is particularly relevant in the context of Saudi Arabia, where gaming and esports have become a strategic component of national digital transformation efforts. Under Saudi Vision 2030, gaming is being developed not only as an entertainment sector but also as a driver of economic diversification, youth engagement, and technological innovation (Savvy Games Group, 2023; Saudi Ministry of Communications and Information Technology, 2022). The Kingdom has one of the youngest and most digitally connected populations in the region, and participation in gaming is widespread.

The rapid growth of the gaming ecosystem also highlights the need for regionally grounded research. Cultural norms, family structures, and patterns of technology use in the Middle East may shape gaming experiences differently from those observed in Western contexts. Strengthening regional research partnerships between universities, health organizations, and

industry will therefore be essential for developing evidence-based approaches to digital wellbeing. The report also did not make any specific focused findings on the broader population of casual or passive gamers, whose experiences may differ from those of highly engaged or professional players and this is a significant part of this community.

Globally, there is a need for more longitudinal studies that examine how gaming affects health over time, as well as greater attention to the mechanisms that explain these relationships (Przybylski et al., 2020). Additionally, the near absence of research on financial health—particularly in relation to modern monetization systems such as microtransactions and loot boxes—represents a significant gap that deserves urgent attention (Zendle & Cairns, 2018). As gaming continues to expand globally, building a more inclusive and internationally representative evidence base will be essential to understanding how games influence wellbeing across diverse societies and cultures.

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