Effectiveness of digital games promoting young people's mental health: A review of reviews

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Abstract

Objectives: Digital games are a popular form of entertainment for youth. They are often used as a therapy for psychological problems, a mental health promotion intervention, and a preventative measure. Systematic reviews and meta-analyses have been conducted to assess the effectiveness of mental health-related digital games. However, a synthesis considering all evaluation results to inform their development is missing.

Methods: We performed a review of reviews to synthetize results of previous research to describe the impact of digital games on the mental health of young people aged <30 years old. We considered systematic reviews and meta-analyses published between 2012 and 2022. Searches were conducted in Scopus, Google Scholar, Pubmed, and Cochrane library systematic reviews (CENTRAL) during October 2023.

Results: Our final selection included 10 systematic reviews and meta-analyses on interventions targeting youth of both sexes aged 2–29 years old across the world. In total, 218 interventions were identified. Selected articles reported different types of games, e.g., active and non-active video games, virtual reality games, serious games. Not all digital games were conscientiously evaluated, but, in general, their impact on mental health was positive. Regarding the quality, 5 studies were of high quality, 3 of moderate quality and 2 of low quality.

Conclusions: Overall, elements of gamification were well-accepted, but they lacked assessment through rigorous experimental conditions. Digital games for mental health are promising, but in order to be consistently effective in promoting young people's mental health and prevent psychological diseases, they should present specific features.

Keywords

Digital, game, young, mental health, review

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Introduction

Globally, one child out of six under the age of 12 years suffers from a mental health problem, ranging from attention-deficit/hyperactivity disorder to intellectual disability.[1,2] In adolescents up to 19 years, mental disorders account for 13% of the global burden of disease with serious impairments in adulthood.[3] It is estimated that 50% of mental health problems including depression and anxiety are established by age 14 and 75% by age 24.[4] Thus, adolescence and early adulthood are critical periods for first-time mental illness. Furthermore, suicide is the second leading cause of death in young people aged 15–24 years.[5] Mental health problems in youth have been

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exacerbated by the coronavirus disease 2019 (COVID-19) pandemic. Depressive symptoms, anxiety, suicidal ideation and post-traumatic stress disorder among young people have increased during the crisis.[6] Yet, despite the risks of mental health problems, young people delay or avoid care because of misknowledge of services available and stigma, for instance. Online sources can help them with their emotional problems in an easily accessible environment that preserves their privacy.

Gamification consists of transposing game-playing techniques (e.g., challenges and levels) into a non-gaming domain, such as healthcare.[7] Games provide opportunities for unconventional and non-traditional learning and behaviour change processes. Previous research has shown that players experience rich sensory situations that promote learning new skills through achievement, immersion, sociability or exploration.[8] The digital environment increases the reach of games which can be accessed everywhere and at any time. The combination between digitalization and gamification shows promise for facilitating engagement to behaviour change based on education techniques. Digital games may constitute effective, economical, accessible, and attractive interventions.

For health-related topics, gamification is used to promote healthy behaviours and lifestyle, prevent diseases and engage players in a therapeutic process in the place of healthcare professionals.[9] It employs games or substantial game elements in an effort to educate and change patterns of experience and health behaviour. This is especially the case of psychopathologies where brain and mental health stimuli are particularly at stake.[10] Games are used as therapeutic tools for mental health problems, e.g., depression or attention-deficit/hyperactivity disorder, facilitating adherence to therapies and prompting access and use of mental healthcare services. Thus, the use of digital games holds promise for mental health treatment and prevention. This is especially the case for children, adolescents and young adults for which this type of intervention is very attractive.[11] Many young people have grown up surrounded by and using digital tools that often play an integral part in their lives. Data indicates that the average 8- to 14-year-old spends more than 1 h per day playing digital games[12] and, by the time adolescents reach the age of 21 years, they will have spent at least 10,000 h playing.[13]

Systematic reviews have been conducted to identify and collate studies on games for treating and preventing mental health diseases, and promote psychological well-being among young people. They present different types of games that have been evaluated heterogeneously without providing consistent results. In fact, findings are scattered and do not allow to draw conclusions on the characteristics a game should have to be effective in improving youth mental health. The next few years will be decisive in developing digital games such as treatment, prevention and promotion of mental health

conditions. For this reason, guidelines for their production are needed.

The objective of this review of reviews was to provide an up-to-date synthesis of information about the effectiveness of digital games on all mental health problems of young people, with the secondary outcome of providing evidence-based instructions for the development of future digital games for the psychological well-being of this population.

Methods

Electronic Databases and Information

The databases used to search for articles were Scopus, Google Scholar, Pubmed and Cochrane library systematic reviews (CENTRAL). Hand search and citation chaining were also performed. We developed search strategies using a combination of Medical Subject Headings (MeSH) terms and word keys: (mental AND health OR mental AND illness OR disease) AND (game* OR video-game* OR serious game* OR digital AND game*) AND (child* OR adolescent* OR teenage* OR student* OR youth OR young) AND (review OR meta-analysis). We limited the selection to the decade 2012–2022 and the last search was conducted in October 2023. Only published, peer-reviewed systematic reviews and meta-analyses were included. No original research papers, extended conference papers, theoretical studies, published opinions, and pre-prints were excluded. Duplicate citations were removed using Zotero citation software (Corporation for Digital Scholarship).

Considered interventions had to be "mental health-related" (i.e., referring to psychological wellbeing or mental diseases like depression or bipolar disorder), "digital" (i.e., based on new technologies like smartphone applications) and "gamified" (i.e., using game features like tokens and rewards). As for inclusion criteria, first we included articles listing at the minimum one mental health-related digital game among all reported eHealth interventions. Second, articles were included if the mental health-related digital game was addressed to a population of >30 years old. Articles were included if they referred also to other age groups, but the group of young people >30 could be easily extracted. Third, we considered mixed-gender. Fourth, mental health status had to be the primary outcome. Fourth, articles reporting results from all countries were included. Concerning exclusion criteria, articles that reported mental health-related digital interventions, except games were excluded. Inversely, digital games not referring to mental health were discarded. Finally, articles that were not written in English were excluded.

All articles were screened by CV and KGR for title and abstract based on eligibility criteria. In case of disagreement about eligibility, another reviewer (IM) helped reach a consensus. Five authors (CV, KGR, IM,

DT, DL) read and screened all full text of included publications independently.

Data extraction and synthesis

Data extraction was conducted by two reviewers (CV and KGR) and verified by a third (IM) for the following elements: year, journal, objectives of the study, number of included articles, type of digital game under study, target study, type of evaluation (randomized controlled trial, pre-post study, pilot, acceptability study, cohorts, case study) and reliability rating ("high", "moderate" or "low" quality). The definition of the quality was based on the JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses.[14] The five authors reading and screening all full-text publications (CV, KGR, IM, DT, DL), completed independently the check-list. Discrepancies in the rating were discussed during ad hoc meetings and consensus was established collectively, with IM supervising the meetings.

The data were described in a narrative form and synthetized in a data extraction table in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

(PRISMA) statement.[15] The PRISMA checklist for this study is available as Supplementary Material (S1).

Informed consent was not required since no personal data were processed in the current study. The original informed consent therefore allowed the secondary analysis without additional consent. As a review, ethics approval was not required for this study.

Results

A flow chart with the number of articles in each step of the review is presented in Figure 1. The flow chart follows the PRISMA statement. A total of 470 articles were retrieved through different search algorithms based on the MeSH terms on the four databases. Only 10 articles met the search criteria.

Table 1 presents the characteristics of included studies ($n = 10$).

Characteristics of included articles

Two studies were systematic reviews,[16,17] three were both systematic reviews and meta-analyses,[18–20] one was an
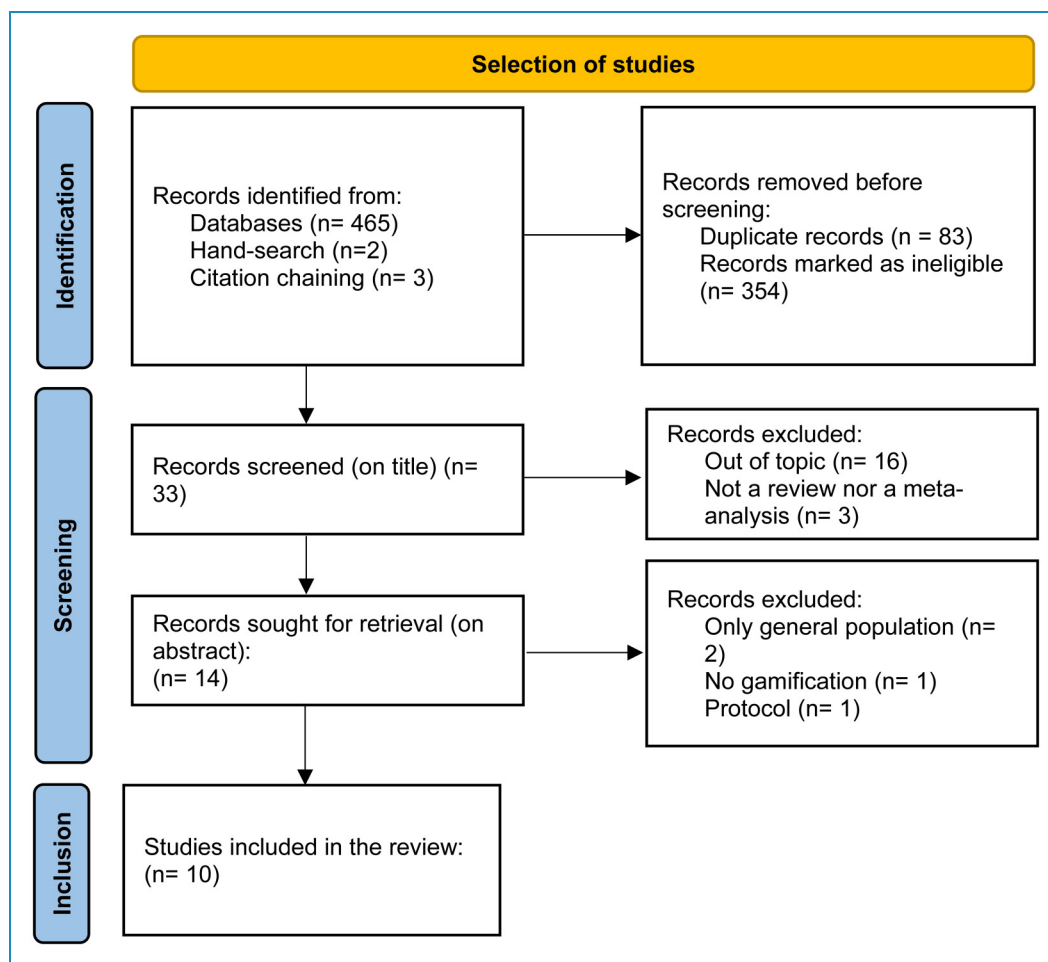

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analys (PRISMA) flowchart of retrieved articles.

Table 1. Synthesis of retrieved articles (*n* = 10).

Authors	Year	Journal	Objectives of the study	Number of included articles	Type of digital game under study	Target audience	Type of evaluation	Reliability rating
David et al.[20]	2020	Child & Youth Care Forum	To offer a comprehensive picture on the evidence-based status of serious games for mental health promotion and health-related behavioural change.	34 studies	Serious games	Children and adolescents <18 years	Clinical and experimental randomized studies.	High
Dewhirst, Laugharne, Shankar[23]	2022	BJPsych Open	TO evaluate the current evidence of acceptability and effectiveness of serious games in improving mental disorders.	14 studies (6 on children)	Serious games/video games	General population, including children <18 years	Post-treatment.	Moderate
Dos Santos et al.[21]	2021	Int J Environ Res Public Health	To synthesize the evidence on the effects of AVGs on the mental health (self-esteem) and functioning of children and adolescents.	17 studies	Active video games	6–19 years	Randomized studies with control group or no evaluation.	High
Ferrari et al.[22]	2022	Front Digit Health	To identify the existing literature on digital games for youth and map the evidence on the broad aims of these games and their use by young people with a full range of mental health and substance use problems.	49 studies	Smartphone app, role-playing games, RPG adventure games, serious games, platforms	12–29 years	Randomized clinical trials, pre-post game assessment, pilot sequential game assessment, satisfaction questionnaires.	High
Halldorsson et al.[16]	2021	J Child Psychol Psychiatry	Torovide an up-to-date assessment through a systematic review of studies that have assessed the effectiveness of applied games or virtual reality in treating mental health	19 studies	Virtual reality games	7–19 years	Evaluation of the interventions according to different criteria: adherence to the game, acceptability, expectations of the game, experience of the game.	Low

Table 1. Continued.

Authors	Year Journal	Objectives of the study	Number of included articles	Type of digital game under study	Target audience	Type of evaluation	Reliability rating
		problems in children and youth.					
Martinez et al.[17]	2021 JMIR Serious Games	To bring together the most recent serious games with a new approach centred on their applications: awareness, prevention, detection and therapy; and to analyze the implementation, development and evaluation of these tools in order to obtain trends, strengths and weaknesses for future lines of research.	34 studies	Serious games for PC, smartphone and virtual reality device	6–19 years	Common assessment tools that are standardized questionnaires that measure skill acquisition or symptom reduction.	High
Reynard et al.[18]	2022 JMIR Serious Games	To synthesize the evidence on the effectiveness, feasibility, and acceptability of digital emotion regulation interventions in children and young adolescents.	11 studies	Digital interventions specific to emotion regulation	8–14 years	Evaluation of the interventions according to their acceptability, reliability and effectiveness.	Moderate
Rodríguez-Rivas et al.[19]	2022 JMIR Serious Games	To critically and systematically review, synthesize, measure and discuss experimental studies that measure the effect of technological interventions on levels of stigma.	9 studies	Video games, audiovisual simulation of hallucinations, virtual reality and electronic contact with users of mental health services	16–24 years	Not available.	High
Rojas et al.[24]	2019 Frontiers Public health	To research available sources describing the use of the Internet and digital	2 studies	Online bullying (harassment) awareness game, internet game and	From 10 years	Several types of evaluations depending on the interventions: acceptability study, controlled trials,	Low

(continued)

Table 1. Continued.

Authors	Year	Journal	Objectives of the study	Number of included articles	Type of digital game under study	Target audience	Type of evaluation	Reliability rating
			technologies in mental health in Chile.		step care programmes for teen depression prevention and early intervention		feasibility and acceptability studies.	
Tozzi et al.[25]	2018	JMIR Pediatr Parent	To summarize and critically review the literature evaluating the acceptability and effectiveness of using technology with anxiety treatment and prevention programmes in young children and adolescents; and to improve understanding of what would be essential for the future development of effective technological interventions.	19 studies	E-health programmes for 2–18 years managing anxiety in children		Several types of evaluation depending on the interventions: feasibility and/or acceptability studies, non-randomized and non-controlled applicability studies, randomized controlled trials, usability study, pilots, non-controlled and case studies.	Moderate

PC: personal computer; AVGs: active/electronic motion games.

"overview" study,[21] two were systematic scoping reviews,[22,23] one was a narrative review,[24] and one was an exploratory review.[25] Three articles reviewed digital games among other types of eHealth interventions.[19,24,25]

All studies focused on young people of both sexes with an age ranged from 2 to 29 years. Two studies[23,24] included the general population with a sub-sample of young people <30 years old, and <18 years old, respectively. Players were mostly lower than 18 years old and were either healthy or presenting a mental health problem. The number of studies included ranged from 9 to 49. In total, 218 interventions were identified. The majority of the interventions had been retrieved by Reynard et al.[18], i.e., 27 were games.

Cited interventions were conducted across all continents, but Africa. Half of the studies had a high-quality rate, three a medium rate and two a low rate. High-quality studies scored highly for the research question being sufficiently described, detailed methodology, and structured results presentation, especially concerning games evaluation.

Mental health conditions under study were: self-esteem, self-efficacy and socialization[21]; depression and depressive symptoms[16,17,20,22–24]; anxiety[16,17,22,23,25]; autism spectrum disorder[16]; suicidal ideation, peer-victimization[24]; emotion regulation difficulties[17]; schizophrenia[23]; bipolar disorder[23]; attention deficit hyperactivity disorder[20,23]; substance use disorder, alcohol use disorder and binge-drinking[23]; complex trauma, obsessive-compulsive disorder, bulimia nervosa, specific phobia, post-traumatic stress disorder, first episode psychosis[22]; and any mental health problem.[19] Stigmatisation was also considered.[19]

Four stages of mental health conditions were taken into account: (a) severe and complex mental health conditions, (b) mild to moderate mental health conditions, (c) at-risk groups or suspected mental health problems, and (d) mental health promotion/prevention/education and youth population-based interventions.

Types of digital games

Across all studies, nearly all interventions were serious games. These are described as tools combining learning strategies and game elements to teach specific skills, knowledge and attitudes.[26] One in five included an interaction with a therapist. The other digital games were played by the young individual alone, i.e., stand-alone games. The majority of digital games were on personal computers (PC). One review[21] included active/electronic motion games (AVGs) like Wii Balance or Dance Revolution. One of the two scoping reviews focused on the use of digital games on youth health services[22] and included a large selection of gamified interventions: games on PCs, consoles (handled or not), mobile devices and virtual reality using computer modelling and simulation that enables a person to interact with an artificial three-dimensional visual or other sensory environment. The majority of games described in this scoping review had been co-created by groups of young people, service providers, therapists-clinicians and researchers. Another systematic review identified and examined applied or serious games and virtual reality (VR) interventions addressed exclusively to young people with mental illness.[16]

Martinez et al.[17] presented 3 game genres: (a) arcade minigames, that have short durability and simple playability with various objectives; (b) social simulations, referring to day-to-day environments and issues to learn optimal resolutions and necessary skills, and (c) adventure world, in which the player takes on the role of an avatar and must interact with missions, characters and items. The 3 game genres were used mostly to decrease depression and anxiety symptoms, as well as to teach cognitive behavioural therapy (CBT).

Reynard et al.[18] reviewed several types of digital interventions including hybrid games with a debriefing with a healthcare professional. They insisted on co-creation as the key to improve the acceptability of the game. An additional review[19] included several technology-based interventions among which digital games.

One systematic review and meta-analysis on digital interventions to reduce mental health stigma,[19] considered serious games, virtual reality and videogames using avatars. The other one included either educational or therapeutic serious games.[20] The narrative review by Rojas et al.[24] included online games on PC. Tozzi et al.[25] reviewed CBT web-based computer games, serious games, and three-dimensional games played with a therapist.

Impact on youth mental health

AVGs were found to improve the self-esteem, self-efficacy (perception of success and confidence) and socialization of children and adolescents when compared to a control group, even if with small effect sizes. Impact was higher if parents played with their children.[21].

Digital games for mental health promotion showed significant improvement in the reduction of stigma, mental health literacy, and improved quality of life.[22] Health behavioural changes were also prompted.[20] Interventions also increased self-efficacy scores on resistance to substances and abstinence. Satisfaction, acceptability, and programme adherence were also high for the majority of games reviewed. Those with a game design not adapted to young people were the less successful.

The work by Halldorsson et al.[16] showed robust evidence that applied games reduced depressive symptoms in adolescents. However, insufficient research attention was given to the efficacy of virtual reality interventions. For some digital games, nonsignificant effects were found before and after having played even when compared to a

control group. For some other games, the size effects were medium. This was also reported by David et al.,[20] considering differences in terms of age, and number and length of sessions.

Martinez et al.[17] studied serious games applied to young people's depression and anxiety through four applications in mental health: awareness; prevention; detection; and therapy. In order to be effective on young people's mental health, digital games had to combine the four applications. However, the review did not present data on the impact on young people's mental health, but commented on the type of measurements, e.g., satisfaction questionnaires.

In the study by Reynard et al.,[18] only digital games significantly reduced negative emotional experience especially in youth at risk of anxiety compared to other types of digital interventions like smartphone applications. Other findings showed that emotion regulation was increased after playing virtual or augmented reality games. Digital game interventions incorporating biofeedback provided the most evidence for the transference of learned emotion regulation skills to real life. Concerning acceptability, digital games had moderately to highly positive results for usability, helpfulness, relevance, flow, appeal, difficulty, and likability.

For Rodriguez-Rivas et al.,[19] digital games had a medium effect on stigma reduction. Virtual reality was especially effective. In the narrative review on Chilean digital interventions,[24] two games had a positive effect on peer victimization and depression, respectively. However, for the first game, the effect did not change when included in a larger digital intervention with online lessons. The second game was addressed to girls who reported positive acceptability rates. Results concerning the games reviewed by Tozzi et al.[25] were mixed. Some games showed favourable impact on clinical improvement regarding anxiety reduction, while others did not allow reaching conclusions regarding their effectiveness.

Dewhirst et al.[23] reported that serious games were cost-effective interventions. However, the intervention dose, the target audience, and the disease had to be considered before drawing conclusions.

Evaluation of the games

All reviews reported whether digital games were evaluated and through which designs indicators. These included randomized clinical trials, pre-post game assessment, pilot sequential game assessment, structural equation models, interviews, mixed-methods, case study, and post-game satisfaction questionnaire. Only two reviews[19,20] included exclusively randomized controlled trials. Across reviews, indicators or outcomes related to mental health conditions (e.g., symptoms severity or access to care), and acceptability, adherence, expectancy, play experience and

satisfaction concerning the game. Measurement tools and techniques were mostly questionnaires and semi-structured interviews.

Discussion

The number of digital games is skyrocketing as well as the number of literature reviews, scoping reviews or meta-analyses examining them. In order to facilitate future research on this topic, and guide the development of new mental health-related digital games, we realized a review of reviews. We identified 10 manuscripts considering more than 218 mental health-related digital games addressed to young people aged <30 years. The majority of the games were about depression and anxiety, two very frequent psychological troubles in young people.[27] Benefits varied depending on the type of digital game which were evaluated in terms of effectiveness for mental health problems and acceptability.

Indeed, we observed divergent findings due to the different games and the heterogeneity of evaluation designs and measurement of the outcomes. Some studies did not produce robust results. The lack of any impact on mental health outcomes was mostly due to the sample size. For this, authors claimed for further research on larger groups of young people to prove the effectiveness of digital games which had showed promising although not conclusive effects.

We also noted the absence of Africa among the continents proposing mental health-related digital games. It might be interesting to observe why studies on serious games lacked in this continent. It could be a matter of difficulty in evaluating these games or that they merely do not exist in Africa. Reasons should be further explored to understand how African young people's mental health is addressed.

Effectiveness of digital games for young people's mental health

Digital games generally produced positive mental health outcomes in young people, across all age ranges and diseases, independently from their typology. Even if to different extent, serious games, gamified smartphone applications, virtual reality, etc., all contributed to the reduction of symptoms and stigmatization, and the increase of mental health literacy[28] and promotion of well-being.[20] Evidence suggested that, in general, these interventions were an effective format to reduce mental health diseases, but results of their evaluation were more promising than robust.[16] However, some studies reported clear positive outcomes when comparing digital games to a placebo. For instance, active digital games proposing physical fitness were effective in children and adolescents to

promote self-esteem, self-efficacy, self-concept, and socialization, the benefit varying on the level of competitiveness.[21] As a whole, players' empowerment and motivation were enhanced, and players were endowed with the capacity of identifying mental health problems and treat them with a timely therapeutic relationship.[29] In some cases, positive effects were similar or higher to outcomes from classical face-to-face treatment.[30] However, compared to standard care, digital games were more efficient in optimizing cognitive flow,[31] feelings of autonomy,[32,33] and were fun.[34]

Indeed, the features of digital games were more important than their format. Digital games of all types were found to be effective if co-created,[35,36] immersive[37,38] and personalized,[25] by considering all age groups and mental health problems.[22] Furthermore, digital games decreased the symptomatology of young people if pinpointing a specific disease like depression or anxiety, and not mental health in general.[25] In particular, remission from depression was high in adolescents playing digital games including psychoeducation, relaxation skills, activity scheduling, and problem solving.[16] Using a hybrid format,[24] the implication of a health professional or a parent increased the impact of the digital game on young people's mental health,[25] especially when referring to a CBT. Digital games had positive repercussions, especially on children suffering from attention deficit and hyperactivity disorder who were more captivated by the flow of the game compared to other control interventions.[23]

Finally, effectiveness was mostly measured in terms of acceptability. The adherence to digital games was lower, suggesting that much effort should be put into making young people continue playing even outside experimental conditions.

Guidelines for developing digital games for young people's mental health

We conducted a review of reviews to provide a comprehensive picture about the strengths and weaknesses of digital games through a unique synthesis. We aimed at proposing recommendations for the development of future digital games based on evidence.

The Collaboration and Maximising the impact of E-therapy and Serious Gaming (COMETS) framework is meant to help improve videogames interventions, the player's experience and overall impact of mental health intervention in a naturalistic setting in the general population.[40] Compared to the COMETS, our study adds new information with detailed instructions on specific features to be used in mental health-related digital games addressed particularly to young people. Our instructions are based on solid data from previous published reviews and meta-analyses and propose standardization of development guidelines for these unique interventions.

The first recommendation is to include young people in the co-creation of the digital game, as "experts by experience."[41] All studies reported that co-creation was essential to increase digital games' effectiveness. Previous research confirms the role co-creation plays in the success of health-related interventions since the latter are tailored on end-users' needs with cultural, generational and sociodemographical fit.[35,36] In this line, games should use a user-centric approach, with iterative feedback, participatory design, and end-user validation.

Second, we recommend to use a hybrid format with a debrief with a health professional and not stand-alone tools. Contents of the digital can be reinforced by talking, and young people feel reassured in case they present a mental health problem. Digital games with a therapeutic purpose would benefit of a blended format with digital and face-to-face interactions.

Third, digital games involving multiple players can have a positive effect on mental health since they mobilize cooperation and social interaction.

Fourth, puzzle-games, action and adventure games, and exploration games hold promise for improving mental health conditions based on their interactive versus passive approach. Role-playing and character customization are features increasing players' adherence to a healthy behaviour.

Fifth, data protection must be assured. Data must not be shared outside the digital game.

Finally, we suggest to favour games with a real-situation scenario, by paying attention to the story-line. We should incorporate real-life experiences and difficulties, and encourage young people to practice learned skills in their daily lives.

Strengths and limitations

This review of reviews has several strengths, namely its consideration of evidence-based effectiveness of digital games for young people's mental health in terms of mental health outcomes and acceptability/appreciation. The focus on youth is a strength as it enables an understanding of this important developmental period when mental health problems can be detected in early stages and treated in time. Collected information allows us to list a series of evidence-based recommendations for developing mental health-related games. This helps advance work in this area as advocated by the authors of the reviews. Furthermore, the systematic nature of our review ensured a rigorous approach with careful data extraction, quality rating and critical evaluation of the findings.

Concerning limitations, this study was based on only 10 reviews and meta-analyses. Nonetheless, several studies with a large number of digital games were included, which strengthens the reliability of our review. Furthermore, the lack of standardization in the evaluations

and their criteria can explain the difficulty in comparing and interpreting the results of the reviews. The overall methodological quality of retrieved reviews requires improvement. Thus, we underline the need to be cautious when interpreting the results. The evidence to date is at a very early stage and there is a clear need for further co-design, development, and evaluation of digital games. This is a new field of research that needs to be constantly explored with the skyrocketing number of digital games that are produced.

Conclusion

Today more than ever, mental health problems are highly present among youth worldwide. It is urgent to set up interventions to prevent them and promote young people's psychological well-being. Digital games can be used as a powerful solution to engage young people in behavioural changes, access to care and treatment for mental health. We synthetized the literature on the topic, and provided some instructions to increase the effectiveness of digital games, such as the necessity to include the user in the design and development of the digital game and to propose a real-life scenario. Through these instructions, we promote the usefulness of gamification as the solution to improve universally youth's mental health.

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