

The advantages and limitations of digital games in children's health promotion

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Abstract

Childhood is an important period for forming the foundation for future health and well-being, and there is need for new methods for these health promotion purposes. Digital games are promising methods that could cover the challenges current health promotion efforts are facing. Ethical acceptability is an essential aspect of health promotion methods and special attention needs to be paid when promoting the health of children. This and increased interest in digital games as health promotion methods highlight the need for discussing the limitations, in addition to reasoning the advantages of digital games in children's health promotion, to advance ethically sustainable development and use of health games. The aim of this overview review is to summarize and discuss the advantages and limitations of digital games in children's health promotion based on the previous literature.

We conducted a systematic literature search from scientific databases, and supplemented the search with a manual search. In total 42 articles and other forms of literature were included to the content analysis. We found several advantages and limitations of digital games in children's health promotion. The findings considered: 1) issues related to the implementation of health promotion using digital games (perspectives of the provider and the player), and 2) possible outcomes of digital games in children (perspectives of physical, psychological, cognitive, social and health behavior related outcomes).

The found advantages give good reasons for the use of digital games in children's health promotion. However, the developers, publishers and professionals should consider carefully also the limitations of digital games in children's health promotion to support ethically sustainable development and use of health games in children. As the interest in health games and thereby the utilization of them increases, there is a need for guidelines for developers, publishers and professional who develop and recommend health games especially for children.

Keywords: health games, children, health promotion, ethics

Introduction

Childhood is an important period for forming the foundation for future health and well-being [1] and, therefore, actions to promote health should be taken already during childhood to guarantee equal opportunities for healthy life and to prevent the development of health disparities [2]. Health promotion is “the process of enabling people to increase control over and to improve their health” [3]. Challenges in the previous health promotion interventions have mainly occurred related to participant engagement and the amount of available resources for implementation [4]. Thus, there is a need for new, attractive and cost-effective interventions for children’s health promotion that are easy to implement in different environments.

Digital games are potential methods for health promotion that could cover the above challenges. Games, in general, interest both girls and boys of all ages [5,6]. About 97% of children aged 10 to 19 years old play computer, internet, mobile or console games [6], and digital game play in early childhood is increasing [7]. Interest in digital games as health promotion methods has also increased in the past years [8] and the amount of health games (digital games developed or used for health promotion purposes) is growing continuously. Readily available commercial games (e.g. active video games) can be used in health promotion, but digital games targeted for health education or health behavior change require most often starting the game development from scratch. This development process requires not only expertise in technical game development and comprehension of game mechanics, but also profound understanding and theoretical knowledge of the targeted health issue and health promotion [9].

Ethical acceptability is an essential aspect when developing health promotion methods. The ethical justification for health promotion lays on the respect of general human rights, autonomy, justice, honesty, reliability, doing good and avoiding harm, equality and empowerment [10,11]. However, the relation between evidence and ethics in the field of health promotion is frequently discussed in the literature [12,13]. The use of digital games in health promotion raises special questions

because of the attractive, and thus, powerful nature of games. There has already been general ethical deliberation related to the responsibility issues of possible negative effects of games [14,15]. However, as health games are relatively new branch of game industry, there has been less this kind of ethical discussion specialized in the health games field so far.

Children are a vulnerable group [16] and they have fewer skills to evaluate the content and consequences in games. Hence, the moral responsibility to evaluate the good and bad aspects of health games is mainly on the health game’s multidisciplinary development team and publishers, but also on the professionals and other adults who recommend these games for children. The current rating methods such as the Pan European Gaming Information (PEGI, <http://www.pegi.info/en/index/>) or Entertainment Software Rating Board (ESRB, <http://www.esrb.org/index-js.jsp>) rating systems do not cover all the aspects of health games. Thereby, there is need for discussion related to the limitations, in addition to reasoning the advantages of digital games in children’s health promotion, to advance ethically sustainable development and use of health games. The aim of this overview review is to summarize and discuss the advantages and limitations of digital games in children’s health promotion based on the previous literature.

Material and methods

An overview review was chosen as an approach for this review to gather a comprehensive picture of the topic. Overview reviews are designed to summarize the literature of the issue in question and describe its characteristics [17]. We searched literature for this review in two phases. First, we conducted a systematic literature search from scientific databases (CINAHL, The Cochrane Library, Embase, PubMed (Medline) and PsychInfo) in May–August 2013, and 1178 references were found. The search terms and words used covered “digital games” and “health promotion” as concepts. The search was limited to literature reviews including a systematic literature search as they summarize the existing evidence. We included those literature reviews (n=14) that focused on digital games aimed at promot-

ing children's health. A child was defined as any person less than 18 years of age. No other limitations were made. We conducted the second phase of the literature search in April-August 2014. This second phase consisted of a manual search from the scientific databases, reference lists and search engines. The purpose of this second search was to supplement the previously included literature.

We included altogether 42 articles and other forms of literature to the analysis. The analysis was made using content analysis method. First, we looked deductively for different advantages and limitations of digital games in children's health promotion from the included literature, and divided the results under these two main categories. In second phase, the main categories were further divided inductively between sub categories. We named the sub categories with titles describing the content: 1) issues related to the implementation of health promotion using digital games (perspectives of the provider and the player), and 2) possible outcomes of digital games in children (perspectives of physical, psychological, cognitive, social and health behavior related outcomes).

Results

We found several advantages and limitations of digital games in children's health promotion. A summary of the results is presented in Table 1. We discuss the results next from these perspectives.

Advantages from the perspective of implementing health promotion

From the *provider's* perspective digital games offer a safe surrounding and possibilities to carry out practice of skills and situations that are difficult or even impossible to fulfill in real environments because of safety, economic or timing issues [18]. In addition, games can be designed so that the goal of the game supports the individual's health related motivation, and encourage setting and reaching health-related goals while playing the game. Games can be also developed for communication and interactive learning purposes [19]. This pro-

vides possibilities for communication for example between the player and the healthcare professional.

Games are attractive and thus, may be a channel to get through to those children that are difficult to reach with traditional health promotion methods [19]. Moreover, one advantage is that digital games are easy to distribute via the Internet, and especially mobile games are available anywhere and anytime [18]. Digital games are also feasible in different settings. Games can be played for example in hospital in patient rooms where the risk of infection is lower than in public areas [20]. Thus, games may be a useful tool in isolated circumstances, for example, to increase hospitalized children's physical activity [21].

From the *player's* perspective games can be fun and entertaining. Games can also allow the player to progress and learn things in his or hers own rhythm [22]. Moreover, the feedback that the player receives can be individualized [19] and games can include elements that allow the player to tailor the content according to own needs and wishes [23]. The game play can also support social interaction between the players in multi-player games regardless of location and distance [23].

Advantages from the perspective of possible outcomes

Related to *physical outcomes*, active video games have been shown to have potential in promoting children's light-to-moderate physical activity [24–32] and increase in energy expenditure [19,24–32], heart rate [25,31,32] and oxygen consumption [31,32]. Active video game use also seems to have some effect on weight status especially in overweight and obese children [28,33]. Games can be used for developing different motoric skills [18] and also for rehabilitative purposes [20]. Related to cognitive outcomes, health games can support children's understanding of abstract concepts such as nicotine addiction [34]. In general digital games can also develop different skills of the player, such as analytic skills [18] that can be beneficial when solving health-related problems. Moreover, previous results suggest that digital games can be even more effective in increasing knowledge and cognitive skills than traditional methods [35].

Table 1. A summary of the advantages and limitations of digital games in children's health promotion.

		ADVANTAGES	LIMITATIONS
Perspective of implementation	Provider	<p>Game environment offers a possible surrounding to carry out practice of different skills and situations that are otherwise difficult to implement</p> <p>Games offer a channel to reach also those children that are difficult to reach with traditional health promotion methods</p> <p>The goal of the game can be designed to encourage setting and reaching health-related goals</p> <p>Games can be developed for interactive learning and communication purposes</p> <p>Games are easy to distribute via internet and can reach large audiences</p> <p>Mobile games are available anywhere and at anytime</p> <p>Games are feasible to implement in different environments</p>	<p>Carelessly designed content may lead to undesirable outcomes</p> <p>Equal accessibility may be limited due to unequal availability of devices, poor technological skills and different disabilities</p> <p>Issues related to information security</p>
	Player	<p>Games are fun, attractive and entertaining</p> <p>The player can progress in the game in his or hers own rhythm</p> <p>Games can be tailored according to player's own needs and wishes</p> <p>The player can get individualized feedback</p> <p>The player can connect with other players through some of the games</p>	<p>Immersion may lead to excessive use and even game addiction</p> <p>Games offer a possible environment for misuse (cyberbullying and sexual harassment)</p>
Perspective of possible outcomes	Physical outcomes	<p>Active video games offer possibilities for motor skills development</p> <p>Active video games can increase physical activity, energy expenditure, heart rate and oxygen consumption</p>	<p>Playing sedentary games increase physical inactiveness</p>
	Psychological outcomes	<p>Self-confidence can be supported with games</p> <p>Games can help patients to become more cooperative and enthusiastic</p> <p>Games can be used to reach psychotherapeutic goals</p>	<p>Cyberbullying has been connected to depression</p> <p>Large amount of screen time has been associated with depressiveness and negative self-esteem, and sleeping problems and disorders</p> <p>Aggressive content has been associated with aggressive behavior although studies on this are conflicting</p> <p>Game addiction may lead to similar symptoms experienced in psychological substance-related addictions</p>
	Cognitive outcomes	<p>Game play can promote analytic and cognitive skills</p> <p>Understanding of abstract concepts can be promoted with games</p> <p>Health related knowledge can be increased with games</p>	<p>Large amount of screen time has been associated with poor school performance and learning difficulties</p>
	Social outcomes	<p>Game play can support feeling of belonging in a group</p> <p>The player can get peer support through games</p>	<p>Large amount of screen time has been associated with alienation and loneliness</p>
	Health behavior related outcomes	<p>Positive health related attitudes, intentions and behaviors can be supported with games</p> <p>Health and treatment related motivation, self-efficacy, competence and self-management skills can be supported with games</p>	<p>Harmful content of digital media has been associated with negative changes in sexual behavior and increased substance use</p>

Concerning *psychological* outcomes, games have been used successfully in psychotherapy, especially when traditional therapy methods have failed. Moreover, games have been useful in young patients to increase their cooperation and enthusiasm about the treatment. [36] The player's self-confidence can be also promoted with games in different life situations [19]. The social interaction in games offers possibilities for peer support when connecting children experiencing the same health issues [37]. Moreover, game play may support the player's feeling of belonging in a group [38].

Previous results support the effectiveness of health games related to health behavior related outcomes. Games offer promising methods for health education [19,32,39,40]. Health games have been associated with promotion of healthy attitudes, intentions and behaviors [41], self-efficacy [42] and motivation [43,44]. Moreover, results have shown improvements in self-management skills especially in asthma patients after asthma-related health game play [39].

Limitations from the perspective of implementing health promotion

From the *provider's* perspective some content (e.g. aggressive content) included in games can result in negative effects in children [45]. Moreover, equal accessibility and information security are issues that are essential parts of the development and implementation of technology, as well as of health games. Use of digital games can be restrained by the absence of ownership and poor accessibility to digital devices or lack of needed skills for technology use [23]. The game play can be also inaccessible because of some disability such as visual impairment [46,47]. In addition, health related technology may interest also those with malicious aims. Thus, all health applications including any personal or health information should be secured from different kind of cyber-attacks [48].

Some negative effects can occur also if the *player* uses the game excessively [45] or gets psychologically addicted to the game [49]. Another limitation is that the player may encounter some misuse while playing the

game. The social interaction in digital games offers a channel for cyberbullying [50] and other misuse such as sexual harassment [22]. Cyberbullying is "disseminating harmful or cruel speech or engaging in other forms of social cruelty" using some kind of information communication technologies. Cyberbullying can be even more emotionally damaging than face-to-face bullying as it can occur continuously at any time of day or night, and it allows wide and rapid distribution of material used in bullying through internet that can be impossible to remove afterwards. Cyberbullying has been connected with depression, and in extreme cases, with suicide attempts, and thus, needs to be taken very seriously. [51].

Limitations from the perspective of possible outcomes

From *physical outcomes* perspective, there has recently been discussion about the increasing physical inactivity of children [52] that raises concerns of the use of sedentary (passive) games as health promotion methods. Recent findings show that sedentary behavior is an independent risk factor related to health and even mortality [53]. Moreover, physical activity is essential for a child's normal growth, development, health and well-being [54,55]. The amount of time spent using digital devices should not exceed 2 hours per day in school aged children according to the recommendations [56]. In addition, the use of virtual environments is recommended only occasionally in children up to 4 years of age and at most a quarter of an hour every three days in children aged 4 to 6 years old from the developmental perspective [22].

Game play may also have an influence on *psychological, cognitive, social and health behavior related outcomes*. Aggressive content in games may lead to increased aggression [45] although studies on this are conflicting [57]. Moreover, some content (e.g. exposure to alcohol, tobacco or drug use promoting content or content that creates unrealistic expectations and body dissatisfaction) in digital media have been connected to changes in sexual behavior (sexual beliefs and early sexual initiation), substance use (alcohol, tobacco and drug use), and body image. Excessive amount of screen time has

been associated with poor school performance and learning difficulties, developmental concerns (attention-deficit disorder, language delays) and other negative health effects, such as sleeping problems and disorders. [45] Moreover, social interaction through digital devices may compensate real life social connections, and thus, reduce engagement in real life social connections and participation. It has been noted that at first the virtual environment of a game offers to the player a world where to act and experiment in, and thus, decrease depressive symptoms, loneliness and negative self-esteem. However, later it may influence them adversely and increase appearance of these negative psychosocial symptoms [58].

An extreme phenomenon of game play that raises concerns is game addiction. Most of the children have no problems with their game play, but there is a small amount of players who use games so excessively that it has an effect on their everyday life [58]. Excessive playing of games that are graphically advanced and feel realistic may cause alienation from the real life. The immersive experience that is usually seen as an important and valued feature of digital games may be connected to game addiction in a negative way. [59] The game genre that is most often connected to game addiction is Massive Multiplayer Online Role Playing Games which regularly introduce new content and thus, require continuous playing to keep up with the game [58]. Other genres such as First Person Shooters or Real Time Strategy games can lead to similar situations as well. Game addiction may in a minority of cases lead to even similar symptoms that are traditionally experienced in substance-related addictions. These are mood modification, tolerance and salience [49].

Discussion

This review presents an overview of the literature discussing the advantages and limitations of digital games in children's health promotion. These presented issues point out some clear advantages that digital games have as health promotion methods. However, we can observe also some limitations. Recognizing and noticing these issues are crucial in the light of ethically sustaina-

ble health game development and use. However, these limitations should not be seen as an obstacle, but they need to be carefully considered.

The fun and engaging nature of games may result in an amount of game play that does not meet the recommendations for children [22,56], and thus, may increase children's physical inactivity and occurrence of negative outcomes. Designing some kinds of technical time limitations in the health games or other ways to restrain the game play could be considered to prevent the harmful consequences. In addition, use of player's motions to control the game could be used in educational health games to support children's physical activity instead of using only controllers that promote sedentary behavior.

The content [45] of health games, used platform [22,50], and security [48] and accessibility [46,47] issues are also essential in light of avoiding harm and promoting equality. Carefully considered, age appropriate and professionally developed content help reaching the goals set for health promotion and decrease the risk for harmful consequences in children. Moreover, the platform of online games can be designed so that it does not offer a platform for bullying or other inappropriate behavior, or a moderator could be included in the game to prevent this misuse. The security problems could be prevented by minimizing saved health data or limiting it to data not easily misusable along with other more traditional security measures. In addition, there are different possibilities in game design that could be used to enable the equal game play of children with different disabilities [46,47].

The strength of this review is that the authors include specialists from the fields of healthcare, game technology and ethics. Based on this and the two-phase literature search we have sought for a comprehensive approach to the topic. However, the possible limitations of this review are that we included all kinds of literature related to the topic and thus, the included literature may have variable level of methodological quality. In addition, the literature search was only partly systematic. Thus, some information may still be missing that was not covered by the included literature. For example

issues related to the provider's role during the implementation of a health game, and false or incorrect information and feedback that a carelessly designed game may provide raised questions among the authors. Moreover, the health games could hypothetically have a positive or negative impact for example on the relationship between the child and health professionals, but no studies related to these issues were found.

This review concentrated on the advantages and limitations of digital games in children's health promotion. Discussing and balancing between these potentially good and bad consequences (utilitarianism) is central regards of ethically based development and use of health games. However, there is also need for discussing the ethically sustainable health game development and use from a wider viewpoint. There is need to consider for example the motives and intentions of health game developers and publishers (duty ethics), and protection of the rights of children during the game development and implementation process (human rights). [15] For our knowledge there is not much previous literature concentrating on health game ethics specifically, thus, this area needs more consideration in the future.

Conclusions

Digital games have several advantages as health promotion methods which give good reasons for the use of digital games in children's health promotion. However, the ethical aspects are crucial when developing and recommending health promotion methods for children. Developers, publishers and professionals who develop and recommend these health games for children have a moral responsibility to take notice of the limitations of digital games in children's health promotion and consider them with sufficient seriousness. As the interest in health games and, consequently, the utilization of them at home, in healthcare and school settings increases, there is need for guidelines for ethically sustainable development and use of health games especially for children.

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