Chapter XXIII

An Overview of Using Electronic Games for Health Purposes

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ABSTRACT

This chapter aims to provide an overall picture of the applications of electronic games for various health-related purposes, particularly for health education, health risk prevention, behavioral intervention, and disease self-management. We first summarize the electronic games for health that have been empirically tested by researchers in the past 20 years. Games that have not yet been evaluated but are promising and noteworthy are also included. These games are categorized based on their specific health-related functions (i.e., prevention, self-management, medical training, etc). Second, we synthesize the key features of electronic games that make them promising to be used for health-related purposes. Finally, implications of using electronic games for health-related purposes and future direction for research in this area are discussed. Game researchers, health providers, game designers, and potential game consumers will all find informative content in this chapter.

INTRODUCTION

The benefit of electronic gaming is no longer limited to entertainment. Electronic games have the potential to alter the lives of many people in fundamental ways. In the last two decades, plenty of research has been conducted to evaluate use of electronic games in the educational setting (for a general review, see Lee & Peng, 2006; Lieberman, 2006). Recently, a new movement of “serious games for health” has been proposed to apply electronic games for health-related purposes.
This chapter aims to provide an overall picture of the applications of electronic games for various health-related purposes, particularly for health education, health risk prevention, behavioral intervention, and disease self-management.

In this chapter, we first summarize the electronic games that have been empirically tested by researchers in various health-related settings. The research studies included in this part were obtained by a comprehensive search in Web of Science and MEDLINE databases using meaningful combinations of keywords including “video game,” “computer game,” “intervention,” “health,” and “cancer.” Papers published within the past 20 years were used in order to focus on modern electronic games and their applications. A thorough check of the references in the retrieved articles was conducted to locate more studies. Additionally, some newly developed health-related electronic games that have not been evaluated but demonstrate potential were also included for a more comprehensive overview. We categorized the located electronic games based on their specific health-related functions (i.e., prevention, self-management, medical training, etc). In the second part of this chapter, we discuss the key features of electronic games that make them promising to be used for health-related purposes. Finally, implications of using games for health-related purposes and future direction for research in this area are discussed. Different issues about these games faced by health providers, game designers, and researchers are discussed separately.

REVIEW OF HEALTH-RELATED ELECTRONIC GAMES

Disease and Risk-Prevention Games

Games in this category focus on promoting a healthier lifestyle and behaviors by delivering relevant knowledge and shifting unhealthy attitudes. These games are set in a variety of health domains, including promoting healthy nutrition, safe sexual behavior, anti-smoking, injury prevention, and heart attack early treatment.

Squire’s Quest! is a 10-session computer game designed to increase children’s consumption of fruit, juice, and vegetable (FJV), and thus prevent cancer and other illnesses in the long run (Baranowski et al., 2003). This game is set in a fantasy kingdom where the kid plays as a squire who faces challenges in his or her quest to become a knight helping the king and queen defeat invaders. The challenges for the squire were to master the skills to prepare FJV recipes to provide energy for the king and his court, with goals related to eating more nutritious FJVs. There was a wizard mentoring the squire through the challenges. Researchers at the Children’s Nutrition Research Center in Houston, Texas, developed this game and examined the impact of playing this game over five weeks, involving 1,578 children in a school setting. They found that children in the treatment group increased their FJV consumption by 1.0 serving more than those in the control group. This study demonstrated that the electronic game approach can be a very effective means to promote a healthier diet among children, because it achieved the second largest increase of serving size of FJVs compared to other school-based interventions (Baranowski et al., 2003).

Several factors contribute to the success of this gaming intervention. First, the program including the game design and associated activities was based on social cognitive theory, which provides a framework to explain how people acquire and maintain behavioral patterns (Bandura, 1997). According to this theory, environment, people, and behavior are constantly influencing each other and contribute to a behavioral change all together. Environment includes both social and physical environments. Social environment includes family members, friends, and peers. Physical environment refers to the element such as a room and temperature. A relevant concept to physical environment is situation, which is the
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perception of the environment that may impact a person’s behavior. In this FJV intervention, the electronic game provides a simulated and attractive physical environment with an intriguing plot to engage the kids. Through multiple exposures, kids were able to increase their behavioral capability, the knowledge and skills to perform a certain behavior, which is preparing healthy FJV recipes in the intervention. Moreover, parents were also involved because one associated activity was that children asked for their favorite FJV to be more available at home, which could potentially change the environment to be more favorable to their FJV consumption. Reinforcements were also available in children’s gaming experience, defined as responses to a person’s behavior that either reinforce or disapprove it. In this case, children obtained points based on an assessment of whether their goals of making recipes were achieved, and the number of earned points determined the level of their knighthood. The second advantage of this gaming intervention is that it involves tailoring of decision making and goal setting to children’s baseline dietary assessment and reported FJV preferences.

An HIV/AIDS-prevention computer game called Life Challenge was developed by the New York State Department of Health to enhance adolescents’ skill and self-efficacy regarding safer sex negotiation (Thomas, Cahill, & Santilli, 1997). Self-efficacy is a critical concept in social cognitive theory, defined as a person’s confidence in performing a particular behavior. In the process of game development, five focus groups were formed to collect ideas and get responses from the target population. The game is a time travel adventure game in which knowledge and negotiating tasks for safer sex, such as turning down sex and negotiating for condom use, were involved. Computer kiosks with the game installed were field tested in 13 sites serving high-risk populations. The result showed significant knowledge gain in some aspects and also significant improvement in self-efficacy for those who started with a lower level of self-efficacy. Two of the biggest barriers to protected sex among adolescents are embarrassment and lack of skills to negotiate with partners for safer sex. In this game, players can talk to their imaginary partner and hear the playback to practice safer sex negotiation skills without getting embarrassed. However, the researchers also pointed out that this game was not intended to be used as an independent intervention, but would be better integrated into existing HIV/AIDS education programs due to the complexity of adolescent sexual behavior.

Two teenager pregnancy prevention games (The Baby Game! and Romance!) were targeted at adolescents who are sexually active and inclined to become parents during their adolescence. These games are aimed to improve adolescents’ knowledge of adolescent parenthood and sexual behaviors, and cause their attitude changes favoring delayed pregnancy and use of effective contraception (Paperny & Starn, 1989). The Baby Game! provides teenagers with the chance to experience a simulated life of a teenage parent through various scenarios and time/cost assessments. For teenagers who are sexually active or would like to be, through playing Romance! they can learn about contraceptive options, practice communication skills in dating situations, and experience simulated outcomes of their decisions on sexual activities. Experimental studies showed that improvements in participants’ knowledge about contraception, pregnancy risk, and cost of birth and child care were all significant, and related attitudinal improvements were mostly significant. Again, computer games demonstrated great potential to increase knowledge and cause attitude change through delivering health-related messages in a relevant simulated situation.

The smoking prevention game Rex Ronan was designed to strengthen preadolescents’ negative attitude toward smoking cigarettes (Lieberman, 2001). In this video game, users play as Dr. Rex Ronan, who can shrink and enter the body of a smoker who has many tobacco-related illnesses.
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They see all kinds of detrimental effects (negative outcomes) of smoking all over the inside of the body, and control Dr. Ronan’s scalpel to clean and cure the body. Besides the graphic portrayals of the physiological harm of smoking, the game also involves true-false questions about the impact of tobacco on health to test and improve users’ relevant knowledge, as well as an attractive role model who is antismoking. Evaluation studies showed that this game was very attractive to children, and playing it could increase their knowledge of specific negative effects of smoking on the body and their interest in learning more. Their anti-smoking attitude was also reinforced (Lieberman, 1997, 2001).

To prevent sports injury in youth hockey players, a computer game named Symptom Shock was utilized in Canada to increase youth players’ awareness of concussion symptoms (Goodman, Bradley, Paras, Williamson, & Bizzochi, 2006). This game was modeled on the popular Tetris game, and players have to make stacks of matching icons and determine whether or not the icons represent concussion symptoms in order to score more goals than the computer opponent. Goodman et al. (2006) specifically tested the impact of game content on players’ knowledge about concussion symptoms, using both the actual game and a control version of the game with irrelevant content. It was demonstrated that the players of Symptom Shock significantly improved their knowledge on concussion symptoms and speed of answering related questions. In this study, participants were provided with an incentive to get involved in the game playing, which might be important to games that are not very attractive per se. They were informed that they were in a competition with other teams of the same age division for a prize based on how successfully they played the game.

Heart Sense is an online game developed at the University of Pennsylvania to promote heart attack awareness and reduce delay in seeking healthcare and treatment (Silverman et al., 2001). The target population is individuals who are at risk of having a first heart attack. The current version of Heart Sense is a role-playing computer game in which users play as a hero who encounters many characters in need of help to deal with their heart attacks, and thus the player needs to make decisions about how to react in a variety of heart attack situations. So far no empirical test of this game has been published. However, an evaluation of the game prototype showed that the intention of game users to call 9-1-1 and avoid delay was significantly increased, with a better understanding of heart attack symptoms. The animated pedagogical agent in the prototype was found to play an important role in reducing the complexity of user interface, providing companionship, and increasing entertainment. Heart Sense appears to be a promising approach that will help save lives by changing the treatment-seeking behaviors of patients and their families.

Self-Management Games

Video games have also been applied to improve self-management skills for coping with certain chronic diseases, such as asthma, diabetes, cancer, and so forth. All the games we identified were developed for children with the above diseases. It seems that electronic games are a more advantageous channel to reach children because they provide a fun and engaging environment for behavior rehearsal and repetitive skill practice without taking risk in real life, which is otherwise hard to achieve using traditional approaches. As playing electronic games has become one of the most popular leisure activities of youth, integrating the games into their medical regimen is very likely to be acceptable instead of being obtrusive.

Re-Mission is a computer game including 20 missions/levels designed for young cancer patients. The game is now available in English, French, and Spanish, and free of charge to young people living with cancer. The player will play as a nano robot that goes inside the body of cancer...
patients undergoing chemotherapy, radiation, or immunotherapy. By acting out as the nano robot inside a cancer patient body and observing how medication and chemotherapy help the body fight against cancer cells, players get to know more about cancer and become more confident in fighting the disease. A randomized controlled clinical trial with hundreds of young cancer patients from the U.S., Canada, and Australia revealed that users’ cancer-related knowledge, self-efficacy to communicate about cancer and manage side effects, as well as quality of life were all significantly increased (Cole, Kato, Marin-Bowling, Dahl, & Pollock, 2006).

Among the computer and video games with a purpose of improving self-management skills, most of them were developed for children with asthma, one of the most common chronic illnesses affecting children in the U.S. Example games are Watch, Discover, Think and Act, Asthma Control, Wee Willie Wheezie, and Bronkie the Bronchiasaurus (Bartholomew et al., 2000; Homer et al., 2000; Lieberman, 2001; Shames et al., 2004; Yawn et al., 2000). Social cognitive theory was used as the theoretical foundation for developing some of these games as well as understanding their benefits, with emphases on self-regulation, self-efficacy, modeling, and so forth. For instance, in the game Watch, Discover, Think and Act, players could improve their asthma-specific self-regulatory skills through managing the game character’s asthma. According to social learning theory, role models can impact people’s behavior. Children were found to pay much attention to role models, especially those in their age group but a little older (Parrott, 1995). This game involves an older child character serving as a role model to show the player how to manage asthma (Bartholomew et al., 2000). Another game called Bronkie the Bronchiasaurus emphasizes players’ self-efficacy related to asthma (Lieberman, 2001). In this game, kids play as a dinosaur with asthma and help him save his homeland while trying to avoid asthma triggers (i.e., dust, pollen, cold viruses) and keep asthma under control. Empirical study showed that playing the game for less than an hour resulted in significant improvements in a player’s asthma knowledge, self-efficacy for asthma self-management, as well as self-efficacy for talking with friends about asthma—both immediately after their playing and one month later. Participating children also increased their asthma-related communication and social support during the month after they played the game.

Video games have also been used to improve self-care among young people with diabetes. In the video game Packy & Marlon, players need to help their game characters, two adolescent elephants, manage their diabetes by monitoring blood glucose, taking proper amounts of insulin, reviewing a diabetes logbook, and finding appropriate food (Brown et al., 1997). Self-concept (including self-esteem and self-efficacy), social support, and knowledge were the key elements to be considered in the game design. In a randomized controlled field experiment, although participants’ self-efficacy for diabetes self-care did not achieve a significant change, the treatment group significantly improved their communication with parents about diabetes and self-care behaviors. Moreover, although the statistical result did not show a significant difference, urgent visits for diabetes dropped over 70% in the treatment group compared to an increase in the control group.

In sum, a typical scenario in self-care/management electronic games is that the player takes care of and helps the main character in the game control symptoms in various settings, so that the player’s self-management skills and related knowledge are increased from practicing during game playing. The player’s self-efficacy and received social support are important mediators for the improvements of self-care and self-monitoring. The game-based approach could function significantly better than an educational videotape to increase users’ self-efficacy for self-management, because the interactive feature of the game encourages users’ active involvement, provides them with
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unlimited chances of practice, and brings about more enjoyment in the learning process (Lieberman, 2001). Evaluation studies of these games have shown that in general knowledge improvement is prevalent and relatively easy; however, it is much more difficult to improve behaviors related to self-management, reduce symptoms, or impact clinical outcome variables by using the games (Homer et al., 2007; Huss et al., 2003; Shames et al., 2004; Yawn et al., 2000).

Therapeutic and Fitness Games

Electronic games have also shown the potential to have therapeutic benefits. For example, researchers developed a biofeedback pelvic floor muscle retraining program assisted by computer games for children with dysfunctional voiding, in which game action is controlled by patient pelvic muscle activity. Several sport games were used. For example, in a golf game, the strength of the pelvic contraction determined the distance the golf ball could travel. An empirical examination revealed that this computer-game-augmented therapy resulted in significant physiological improvements, with a significant decrease in urinary tract infection in the subjects. The advantage of this therapeutic program is that the incorporation of computer games effectively maintained the interest of children and focused their attention during the rehabilitating process (McKenna, Herndon, Connery, & Ferrer, 1999).

Researchers at NASA developed a video game neurofeedback system\(^3\) as alternative neurotherapy for Attention Deficit Disorder (ADD), a disease more commonly diagnosed in children. Video games such as car racing games and adventure games were reprogrammed to integrate the standard brainwave biofeedback system (Pope & Bogart, 1996). The difficulty of a game is contingent on the player’s attention, and thus the better the player maintains attention, the more the game appears to be manageable and favor the winning of the player. For instance, in an auto racing game, a car’s maximum speed increases when the player is more attentive. A randomized controlled experiment revealed that the video game biofeedback system is as effective as standard biofeedback training, but is much more motivating, enjoyable, and easier to learn for children. It may even become a “do-it-yourself” neurotherapy (Pope & Paisson, 2001). In other words, the entertainment and interactivity features of video games transformed traditional brainwave biofeedback training to be an effortless and fun activity that children are much more motivated to perform.

Playing an exercise video game (i.e., biking) during actual exercise was found to promote the psychological benefits of exercise (Plante, Alldridge, Bogden, & Hanelin, 2003). Researchers compared three groups: bicycling only, playing a computer bicycle game only, and participating in a virtual race on computer while bicycling. Participants in the last group experienced the least tiredness and the most relaxation and exertion compared to the other groups, suggesting that the virtual or simulated reality in the computer game enhances some of the psychological benefits of exercise when combined with exercise. It seems that virtual reality in video games has the potential to draw people into an enjoyable and/or challenging environment so that the psychological benefits of exercise are increased.

In this sense, the upcoming video game system *Wii Fit* by Nintendo is very likely to provide users with similar benefits discussed above. *Wii Fit* includes a unique Wii Balance Board that can sense body movements when a user is doing exercise such as Yoga and step aerobics on it. The user can also see a virtual self on the screen doing the same exercise with same movements. Some people may suspect that working out using *Wii Fit* cannot achieve the same exercise intensity or effects as in a gymnasium. However according to Plante et al.’s (2003) findings and arguments, combining virtual and actual exercise can enhance...
a users’ exercise experience, especially the mood benefits of exercise.

Positive effects of playing sports video games such as *Wii Sport* and *Dance Dance Revolution* have been reported by users and observers, and “exertainment” is becoming a popular term characterizing those games. An online survey of fitness professionals was recently conducted by the International Sports Sciences Association (ISSA) to investigate the potential benefits of movement-based video games on the fitness of American people. Several positive impacts of exertainment games were proposed by those professionals. First, exertainment can be used by every segment of the population. Second, exertainment promotes physical activity in an attractive way, and the enjoyable process helps people develop their exercise habits. Third, exertainment involves a lot of aerobic exercise, which can increase one’s metabolism and help one to lose weight when having fun. Last, exertainment can provide privacy to deconditioned and obese people who may feel embarrassed to exercise in a public place (ISSA, 2007).

A special population of wheelchair users can also benefit from electronic games by an interface called GAMEWheels. GAMEWheels is a portable interface between a wheelchair roller system and a computer designed to enable manual wheelchair users to play commercially available computer games by driving their wheelchair. It was aimed to help improve users’ cardiovascular fitness level. Evaluation studies showed that users could achieve a higher physiological work level by playing computer games with the interface, and 87% (13) of them reported that this system would help motivate them to exercise regularly (O’Connor et al., 2000; O’Connor, Fitzgerald, Cooper, Thorman, & Boninger, 2001).

**Attention Distraction Games**

Electronic games are so engaging that they can also be used as a distraction tool for children and young people to reduce the discomfort in medical procedures and treatments. The game content does not necessarily need to be health related in this context. Instead, entertainment and interactivity of games are the key elements contributing to the benefits. This can be a low-cost and convenient approach, because in most circumstances a commercially available electronic game can achieve the effect. Prior research has demonstrated that having children play electronic games alone or combined with other means is effective in reducing pain and anxiety before venepuncture and surgery (Franck & Jones, 2003; Patel et al., 2006; Rassin, Gutman, & Silner, 2004), and decreasing adverse effects of chemotherapy such as nausea (Redd et al., 1987). Compared to other non-computer-game-based intervention strategies, using electronic games to help children cope with discomfort and distress in medical procedures appears to be a more feasible approach requiring fewer staff resources at a healthcare facility as well as less training time for children (Franck & Jones, 2003; Redd et al., 1987).

Redd et al. (1987) investigated the effectiveness of video game distraction in reducing conditioned nausea in pediatric cancer patients receiving chemotherapy. In their first study, patients in the experiment group selected one from 25 commercially available video games and played the game for 10 minutes, while patients in the control group were provided access to toys, books, non-computer games, and television, either before or during the chemotherapeutic procedure. The result showed that conditioned nausea was significantly reduced in patients playing video games. Their second study involved additional baseline assessment and repeated measures after two 10-minute sessions of playing video games. Again, video game playing resulted in significantly less nausea across time among subjects. Similarly, playing a self-selected handheld video game was found to effectively reduce pediatric preoperative anxiety (Patel et al., 2006).
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Although the mechanisms underlying the effects are not fully understood, researchers hypothesized that being involved in a distracting and challenging task such as playing video games could block pain to some extent by consuming part of the attentional capacity that would otherwise be devoted to perceive the stressful event. Practical advantages of using the electronic game approach were also pointed out by the researchers, including the convenience of integrating it with most existing chemotherapy administration procedures, lower cost than traditional means (e.g., hypnosis, relaxation), portability, and little needed supervision (Patel et al., 2006; Redd et al., 1987).

Medical Education

Electronic games are not just used for health promotion and health education among patients. They can also be utilized as medical education and training tools for medical students and health professionals. Breast Cancer Detective Game is a Web-based learning tool about breast cancer screening for senior medical students. This game is primarily text based with a goal to get more points by answering problem-based questions. Surveyed student users reported some positive feelings, especially the accessibility of the game (Roubidoux, Chapman, & Piontek, 2002), but the efficacy of the game on knowledge learning remains unclear. The game can be accessed and played on the Internet. Two adapted versions of the game were targeted for Native American healthcare providers and Native women separately, but so far empirical testing of them has not yet been conducted (Roubidoux, 2005).

The popular computer simulation game SimCity has been used to help nursing students critically consider community issues and practice community planning (Bareford, 2001). Game scenarios consist of hypothetical communities with various environmental problems (e.g., traffic, crime, nuclear meltdown, flooding, etc.). During game-play, students need to identify the critical factors impacting the environmental health of the community, implement interventions to solve the problems, and evaluate the effectiveness of interventions based on game statistics. According to the researcher’s observation of participating nursing students, students all achieved their game goals. Through the practice of thinking, planning, and evaluation in a simulated community environment, students’ understandings of community planning and their application of Systems Theory were effectively and efficiently increased. Obviously, using electronic games to rehearse community planning and interventions is a low-cost and risk-free approach for nursing students.

A computer simulation game was also used to educate hospital staff about the casemix concepts in Australia. In the specifically designed game, a player takes the role of a manager in a large hospital, with a goal of keeping the hospital within budget while ensuring that the specialties offer a good quality of service by casemix. The player views the operation of the hospital and makes various decisions on a quarterly basis in a time-compressed manner. Once all changes have been made, the simulation process starts, in which either monthly progress statistics or a graphical animation of patients moving through the four specialties are displayed on the screen. After that, warning messages about service quality and a financial statement will be shown (Cromwell, Priddis, & Hindle, 1998). Again, easy rehearsal and active learning are two of the most important advantages of using electronic games in the training context.

There is a new trend that medical experts and electronic game developers cooperate to develop sophisticated medical education games using most advanced gaming technologies. Pulse!! is a representative game created by Texas A&M University-Corpus Christi and the game development company BreakAway. This computer game employs cutting-edge computer-game technologies to
provide users a high-fidelity and complex virtual clinical environment, as well as case-based, interactive, and customized game content relative to medical training. In the game, medical students and other trainees will play as a physician or nurse experiencing various rare and life-threatening scenarios. Through repetitive practice with performance feedback provided in the game, users can test their medical knowledge, practice skills, and correct errors without any risk to patients in real life. This game is now undergoing field testing in three leading medical institutions.

RESEARCH SYNTHESIS

In the previous section, we summarized electronic games used and evaluated in the past 20 years for behavior intervention, disease self-management, health education (both for patients and healthcare providers), and other health-related purposes such as distracting attention to relieve pain and motivating users to exercise. We also introduced some newly designed and promising electronic games to show the new trends. These electronic games serve a wide spectrum of patients with different conditions. However, they all actually have the same major function—providing a simulated and interactive environment where players can engage in behavioral rehearsal. Be it disease management for patients, healthcare skills for professionals, or behavior modification for a particular population for risk prevention in an interactive trial-and-error way, the core element is simulation. The simulated environment serves as a safe test bed for them to practice self-management skills (e.g., take insulin, check blood pressure, check peak flow, etc.). Players can observe detrimental effects of their own mismanagement of a disease without engaging themselves in real danger. For instance, players can observe the severe consequence to their game characters if they fail to use an inhaler and learn a lesson. In reality, this will be an impossible way for the patients to learn the lesson of disease mismanagement. In addition, game simulation provides the opportunity for individuals to observe the consequence of certain behaviors in an accelerated manner. For instance, for nutrition education, an electronic game can simulate the long-term effect of caloric intake and physical activity, together influencing weight in just hours of game playing (Peng, in press). Simulation is the fundamental advantage of using electronic games in health-related contexts. This also implies that taking the electronic game-based approach will be more beneficial for health interventions that demand trial-and-error and behavior rehearsal.

Another unique feature of electronic games is their ability to engage and motivate users. For patients (e.g., asthma or diabetic patients), especially children and adolescents, using the format of electronic game can provide a vivid and appealing environment where they will be motivated to learn more about self-management and engage in repetitive behavior rehearsal without getting bored. For many disease self-management processes, the knowledge and skills needed are finite, yet repetitive practice and habit formation is critical. This is exactly what the game format can offer. A well-designed game can be played dozens and even hundreds of times without making the player feel bored. The fun aspect is thus another key component of the electronic game-based health education and health promotion approach, which draws the player in and keeps the player’s interest in using the game. The element of fun is also the primary feature that makes attention distraction and exertainment successful.

IMPLICATIONS

For Healthcare Providers and Researchers

Our review of the games used for health-related purposes indicates that electronic games can be effective tools for health education and interven-
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tion, disease self-management training, therapy, physical activity promotion, attention distraction to relieve pain, and medical education. In the health domain, electronic games are a better medium for education and intervention when active participation and behavior rehearsal are required. Additionally, electronic games prove to be a better channel to gain attention and to motivate people. Healthcare providers and researchers can take advantage of the unique characteristics of electronic games when the particular purpose of a health education or intervention program requires behavior rehearsal in a safe way.

From the summary of the evaluation studies on the effectiveness of electronic games used for health-related purposes, we found that almost all the games demonstrate a strong effect in teaching related knowledge to the players except when the players already have rather sufficient knowledge. Some of the studies also included mediating variables—such as attitude towards behavior, self-efficacy, behavior intention, skills, and so forth—as indicators of the success of the games. Even though the ultimate goal of any health intervention should be the modification of behavior, most of the studies reviewed did not include behavior outcome as the dependent measure. Therefore, even if the evaluation studies demonstrated that the electronic games were favored by the users and did increase knowledge and influence mediating variables, it is still not a guarantee that those games could influence behaviors or indeed improve health status. Therefore, the interpretation of the effectiveness of electronic games used for health-related purposes deserves more cautionary examination.

Before healthcare providers or researchers move to the development of an electronic game-based health intervention, one important factor to be considered is cost effectiveness. Most of the electronic games reported in this chapter were supported by federal grants as a research effort to test new means of health intervention. As it is still quite costly to develop an electronic game (even for a very simple game), some other channels might be more appropriate for certain health intervention needs. In addition, very few empirical studies have been conducted to compare whether the electronic game-based approach will be more effective than other less costly approaches, such as brochures. Without the empirical evidence, it is hard to conduct any cost-effectiveness analysis. At the same time, comparing the game-based approach with other approaches might be challenging as well, because it is extremely difficult to control confounding variables. For instance, it is not an easy task to make sure that the game approach is comparable to the other approach in terms of content and is only different in terms of delivery.

Another challenge and responsibility for researchers is to sort out which particular element or feature of the game actually contributes to effectiveness so as to better inform game designers. Since many studies only conducted simple comparison of treatment and control groups, it is hard to say which of the game components contributes to the effect, such as the plot of the game, simulation, customization, or merely the fun element that attracts the player’s attention. By identifying the specific features of electronic games that contribute to success, researchers can help game designers more effectively and efficiently include those features to design effective games for health. For instance, one of the common conceptions is that realistic graphics are needed in electronic games to engage users. However, little empirical research has investigated this. As we all know, realistic graphics require a lot of resources. If researchers can show that simplistic graphics can also be as effective as photorealistic graphics in health promotion and education games, game designers can save a lot of time, money, and resources.

Electronic games have great potential for health promotion and intervention. But we only have very limited popular “serious games for health” on the market, with the exception of some
exercise games such as Dance Dance Revolution, Yourself! Fitness, EyeToy Kinetic, and Wii Sports, and those games used for distraction. In the future, healthcare providers and researchers need to reach out with game designers and get them involved in the production of games with health messages implicitly embedded. For instance, the game Sims could incorporate certain features (e.g., smoking will not be a good indicator for sociability) to implicitly disseminate the health message. Only in this way can computer and video games become as effective as other mass media to reach massive audience.

For Serious Game Designers

From the review of the electronic games designed for health purposes, we found that almost all games that have been empirically evaluated and proved successful share one characteristic: a theoretical underpinning for the design. Social cognitive theory is the mostly cited theory in the design of electronic games for health-related purposes. When designing games for health, serious game designers need to work closely with healthcare providers and researchers to incorporate the theoretical elements and implement game features based on theories so as to maximize the effectiveness of games.

The designer’s instinct usually guides the designing process. Aesthetic appeal and playability are usually valued to a great extent by designers. However, designing serious games for health-related purposes goes beyond enjoyment and entertainment. Therefore, when making designing decisions, game designers need to take into consideration the content and subject matter, the users, and the environment where the game will be played. For instance, Ben’s Game was designed to help kids who have cancer to fight back, and relieve some of the pain and stress involved with treatment. To increase the player’s self-efficacy of fighting with cancer, unlike traditional games, the game character was designed never to die in the game. From the entertainment perspective, a game that you will never lose probably is not that fun. However, considering the content and context of this game, this feature is particularly important.

Of all the games reported in this book chapter, almost all of them were designed targeting children and adolescents. Since electronic games are highly appealing to children and adolescents (Raney, Smith, & Baker, 2006), it is natural to use the game format to approach them, especially when it is otherwise hard to draw attention of this population to topics like a healthy lifestyle. However, electronic games also have the potential to appeal to the older population. For instance, Nintendo actually has released the Brain Age game to stimulate the brain for adults. Wii Sports games are also great workouts for seniors. One cautionary remark for game designers is that the interface of the game should be appropriate for seniors with limited computer skills and eyesight if they plan to target the older population.

REFERENCES


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**KEY TERMS**

**Disease Self-Management:** The skills of patients with a chronic disease to effectively look after themselves.

**Evaluation Study:** Research study on the effectiveness of a service or program involving empirical data.

**Health Education:** A process of delivering health-related information to help people learn to behave in a manner conducive to the promotion, maintenance, or restoration of health.

**Health Intervention:** A planned program aimed to help people improve or maintain their health by adopting new behavior or changing old behavior.

**Health Promotion:** A process that encourages a healthy lifestyle for optimal health.

**Randomized Controlled Experiment:** A research methodology in which subjects are randomly assigned to treatment and control groups in order to test causal relationships.

**Serious Game:** Games with a purpose beyond entertainment, including but not limited to games for learning, games for health, and games for policy and social change.

**Self-Efficacy:** One’s belief that one is capable of performing in a certain manner or attaining certain goals.

**Simulation:** A computer-assisted imitation of behavior in real-world situations.

**ENDNOTES**

1. The game Web site is at http://www.acasa.upenn.edu/heartsense/play.htm
2. The game Web site is at http://www.re-mission.net
3. The game Web site is at http://smartbrain-games.com/
4. The game Web site is at http://www.med.umich.edu/lrc/breastcancerdetective
5. The game Web site is at http://www.sp.tamucc.edu/pulse/