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The Video Game Debate: Are Electronic Games Health Hazards or Health Promoters?

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Abstract

Do video games help or hurt our health? The answer to this question is complicated, and involves everything from the nature of gameplay (usually done while sitting, looking at a bright screen) to game content and gameplay setting, to various characteristics of the game player. It also goes beyond commercially available entertainment games. In recent years, there have been efforts to create games to prevent health risks and treat diseases.

A chapter on health effects of video games may call to mind early news reports of "Nintendonitis," or images of chubby kids on sofas clutching game controllers. Both research studies and media debates tend to focus on ways that video games might damage mental and physical health.

In reality, as electronic games become a routine part of daily life, they are bound to have a wide variety of effects, both trivial and meaningful, on mental and physical health. (1) Commercially available games may have risks and benefits, which vary for different types of players.

Increasingly, researchers and health professionals are modifying games or apps or creating new ones for specific health and medical needs. Educational games help children make healthier eating choices, model how to help someone having a heart attack, or teach someone diagnosed with a chronic illness how to manage their disease. Persuasive games help players set goals and change behaviors, such as quitting smoking. "Exergames" take advantage of motion tracking technologies to allow players to practice dance or sports moves or improve balance. (2)

This chapter will examine the effects video games may have on healthy development, mental health, and physical health—including risky behaviors and exercise habits. Finally, it will introduce the "Games for Health" movement and explore where it may be headed.

The Role of Video Games in Child and Youth Development

Children and teens seem to use video games to meet a wide range of emotional and developmental needs. For example:

Managing feelings. A survey of 1,254 middle-schoolers in two states found that many children use video games for emotional regulation: as an antidote to boredom and loneliness, to relax, and to vent angry feelings (3). This response, from focus groups with 13-year-old boys, was typical: "If I had a bad day at school, I'll play a violent video game and it just relieves all my stress." (4)

Trying on new identities. Many video games, especially online multiplayer games, allow players to safely experiment with new roles and identities. It's perfectly acceptable to play as a character of another age, gender, body shape, or species. Players can test how it feels to not only look different, but to take on a different personality or a new role on a team—and see how others react when they do (1).

Leadership and teamwork. Researchers have surveyed tens of thousands of people who play MMOGs (massively multi-player online games, such as *EverQuest* and *World of Warcraft*) about their motivations for and experiences with gaming. Online play in mixed-age teams, where no one knows how old or young you are, offers unique opportunities for teens and young adults to observe, learn and practice leading groups toward shared goals. Online leadership experience has been linked to managing others in "offline" settings, such as voluntary organizations (5).

Several studies suggest that team video game play encourages real-life helpful behavior. A study of British undergraduate students found that frequent players of computer games were more likely to cooperate for a win-win outcome with other players in "Prisoner's dilemma" experiments (6).

Competition and initiative. In response to a series of questions about why they play video games, more than four in five middle-school boys and almost two-thirds of

girls agreed with the statement, “I like to compete with others and win.” (3) The challenge and excitement of testing strategies against opponents may promote initiative and healthy youth development (7). However, there is an ongoing, vigorous debate (addressed elsewhere in this book) about whether aggressive competition in games with violent content might undermine empathy or promote harmful behaviors.

Curiosity, self-expression and testing limits. Video games allow children to escape real-world limitations and let their creativity soar. Boys in focus groups noted that over-the-top, gory games are fun because “I just love the fact that I know it can’t happen…. In a real world, there’s [sic] limitations to what you can do.” (3) Games that allow “modding” – from customizing characters to designing buildings, maps and more—let players express themselves in ways that would be costly and difficult in real life, and sometimes to share those mods with others. Players can also test theories or approaches, fail, and try again without real consequences. Suppose you build a *Sim Theme Park* without trash cans or bathrooms? Or erect a *Sim City* and set it on fire? (8)

Practice setting goals and coping with frustration. In the 1970s, psychologist Walter Mischel began a series of now-famous experiments with preschoolers on delay of gratification. A child briefly shared toys in a testing room with the experimenter, then was presented with a “reward object,” such as a marshmallow. She was given the choice to eat the marshmallow now, or wait (usually 15 minutes) until the experimenter came back from an errand, and get *two* marshmallows. This turned out to be a wonderful way to measure frustration tolerance and the ability to wait for a payoff. In longitudinal studies, Mischel’s team found that those children who learned ways to distract themselves and earn the second marshmallow had a wide range of advantages over their

marshmallow-gobbling peers. For example, they proved better at planning and thinking ahead; were more verbally fluent, resourceful, and attentive; less rattled under stress; and more socially outgoing. These gains persisted into adolescence; seconds of marshmallow-resistance time even statistically predicted higher S.A.T. scores. (9)

Although video games are not designed for this purpose, a challenging, age-appropriate video game is perfectly suited to train children to plan ahead, tolerate failure and frustration, and persist until they meet success.

How Video Games Affect Mental Health

Can video games worsen (or improve) ADHD? Children with attention-deficit disorder (ADD) both with and without hyperactivity often struggle to stay focused and pay attention, and are easily distracted--except when it comes to video games. Parents and teachers comment that children with attention problems seem to have no problem concentrating on a video game for long periods. (10)

Given the fast pace of many games, some have wondered if video games might aggravate attention problems. Some studies have linked greater time spent with video games (as well as television) to increased risk for attention-deficit hyperactivity disorder (ADHD) symptoms. (11) There's also evidence that "pathological" gaming—defined as persistent trouble controlling gameplay habits, despite bad consequences—is more common among young people who show signs of ADHD. One study found that teens with attention problems were more likely to go on to develop unhealthy gaming habits. (12)

Of course, the fact that one thing precedes another does not prove cause and effect. Attention problems and video games have a complicated and probably multi-directional relationship. Let's take a closer look.

Children with ADHD tend to have problems with "executive functions," such as working memory and response inhibition, that allow children to focus on what the teacher is saying, wait for their turn to talk, and keep track of assignments. A study comparing children with and without ADHD found that the first group did worse on a standard computer-based test of attention and inhibition (involving clicking on a series of alphabet letters). However, both groups did equally well on PlayStation EyeToy games that tapped similar skills. (13) This supports other research suggesting that children with ADHD do better with novel, stimulating tasks that offer immediate rewards, as many video games do.

This may explain why children with ADHD can have trouble tearing themselves away from video games. But it also points to opportunities to improve their skills and performance through wise use of games. (14) For example, researchers compared a standard computer-based working-memory training program for children with ADHD to a program that added game elements (including a story, animation and rewards). Children who trained with the game version stuck with training longer, improved faster, and made fewer mistakes. (10)

Other studies, that assigned children and adults to play action video games, found that gameplay improved sustained attention and reduced impulsivity. Despite these promising findings, researchers caution that it's too soon to add video games to ADHD

treatment plans. Results of studies on normal populations may not translate to people with attention problems, whose brains work a bit differently. (15)

Effects of videogames on depression.

Compared to attention problems, there are fewer studies looking at whether video games might contribute to depression. Findings vary depending on what researchers were looking for, and who they surveyed. In a large study of urban fifth graders, heavy play of violent video games (two hours-plus per day) was associated with a higher number of depressive symptoms. (16) In a study of Norwegian teens, scoring high on a measure of video game "addiction" was linked to depression, but time spent on games was not. (17) Similarly, young teens who self-report symptoms of depression don't spend more time playing video games (or violent games) compared to their peers, but they *are* more likely to play to cope with feelings and forget problems. (18)

A recent study of nearly 5000 young British teens found that those who kept video game play in balance with other activities (with less than one-third of daily free time devoted to gaming) scored higher on emotional and social wellbeing compared to non-gamers. However, children who spent more than half of their daily free time with video games had *more* emotional and behavioral problems, as well as lower life satisfaction. (19)

More research is needed to tease out the effects (good and bad) of different types of games and patterns of play on different individuals.

Videogames in psychotherapy. For some therapists working with children, video games fit into a tradition of using toys or board games during counseling sessions to create a nonthreatening ambience and to build rapport. Small studies suggest that video games may help therapists connect with children when traditional approaches have failed. Therapists can also gain insight into a child's inner world, emotional states or cognitive skills by playing a video game together, or observing the child's solo play and offering guidance as appropriate. Larger studies of video games in therapy that focus on treatment outcomes are needed. (20)

Games created or modified for therapeutic purposes show promise in helping with mental health issues such as depression, (21) anxiety, phobias, and post-traumatic stress disorder. For example, SPARX is a computer-based fantasy game designed to provide cognitive-behavioral therapy to depressed teens. After choosing an avatar, the player takes on a series of challenges to right a fantasy world overrun by GNATs (Gloomy Negative Automatic Thoughts). After each level, a guide character puts skills learned in the game world into real-life context. A multi-site New Zealand study of 187 adolescents seeking treatment for depression, who were randomized to SPARX or usual care (in this case, a median of four counseling sessions), found that SPARX worked at least as well as usual care. Impressively, 86% of subjects finished at least four SPARX levels—with minimal oversight, at their local counseling center or on their home computer—and 60% did all seven. (22)

The adventure game *PlayMancer*, funded by the FP7 European Union research program, was designed as a complement to psychotherapy for patients with impulse-related disorders, targeting difficult-to-change emotional regulation and self-control

skills. The game uses a Bluetooth wireless mobile monitoring and feedback system (MobiHealth Mobile™) to track tracks player emotional states by measuring physical signs such as galvanic skin response, heart rate, breathing frequency, facial expressions and emotion in speech. The island-themed gameplay (plus several mini-games addressing specific skills) reinforces more self-controlled or relaxed reactions, e.g., by making fish easier to catch. Pilot studies found that patients felt comfortable using the game, that it was able to trigger and respond to the necessary emotional states, and seemed to increase patients' use of new coping styles in everyday stressful situations. (23) [video demo at: www.youtube.com/watch?v=osmo9EAClv8]

A customized version of the video game *Full Spectrum Warrior* has helped treat veterans of Iraq and Afghanistan suffering from post-traumatic stress disorder. This virtual-reality therapy, created with input from veterans, uses a head-mounted display along with therapist-controlled multisensory cues (sounds, smells, and vibrations) that call up memories of combat zones. (24) Based on promising results from these studies, researchers are looking for ways to reduce rates of PTSD and depression by using virtual reality pre-deployment to boost soldiers' resilience.

Small, randomized studies of "casual games" such as *Bejeweled* or *Peggle*, funded by game makers, claim that several hours of play per week can reduce symptoms of depression and anxiety. (25) As a form of "self-medication" for life's stresses, casual games do have advantages: they are fun, inexpensive and widely available.

Video Games and Physical Health

What effects might video games have on physical health? How can harmful effects be mitigated, and potential positive effects encouraged? Let's start by looking at medical uses of game technologies.

Both commercially available games and custom-built games have been used to treat or support people coping with a variety of medical problems. For example, a fun game's ability to distract attention can be a liability with homework or chores, but it's invaluable for pediatric cancer patients trying to cope with treatment-related nausea, or children about to undergo surgery. (26)

Video games and cancer. *Re-Mission*, one of the best-known video games used in healthcare settings, began as a PC game for children struggling with cancer. The game was thoughtfully designed to target a set of specific behaviors that increase the odds of treatment success (27), including sticking to prescribed chemotherapy and antibiotic regimen, using relaxation techniques, and eating despite nausea. Game players guide a nanobot character through 3D environments, destroying cancer cells with chemotherapy ammo and attacking chemotherapy side effects with weapons representing antibiotics, anti-nausea drugs, and stool softeners. In studies, even though most children didn't play the game as much as assigned, there were still differences in cancer knowledge, self-efficacy (feeling confident about participating in their treatment), and sticking with treatment. (28) The *Re-Mission* franchise continues to evolve. In 2013, a *Re-Mission 2* mobile app was launched. Six *Re-Mission 2* games are now available free online, supported by the nonprofit HopeLab <http://www.re-mission2.org/>

Videogames also have potential to help children manage chronic illnesses, such as diabetes and asthma, that require complex regimens of daily care. (29)

Games for managing pain. Severe burns require daily debridement over weeks or months to prevent infection and promote healing; skin grafts require additional care. Burn wound care can be excruciatingly painful. Pain also makes it difficult to complete physical therapy necessary for burn patients to keep the use of affected joints and limbs. Opioid analgesics are somewhat helpful, but patients often develop tolerance to medications, or have problems with side effects. Thus, finding ways to distract burn patients from pain is essential to recovery.

The logic behind this approach is that people have a limited capacity to pay attention (as anyone who's tried to multi-task knows). Distraction means there is less attention available to process incoming signals from pain receptors, so that patients spend less time thinking about pain and actually hurt less.

SnowWorld was a pioneering effort to use virtual reality for healthcare. As pop music plays, patients are immersed in a world among snowmen, penguins, and wooly mammoths, and can even throw virtual snowballs via computer mouse or head tracking. Studies of patients undergoing painful medical procedures (including burn wound care) while using *SnowWorld* had statistically significant and clinically meaningful reductions in pain. (30) These researchers are now investigating whether an inexpensive virtual reality headset (Oculus Rift) could distract patients from pain even more effectively. (31) Other researchers are studying the use of new and relatively inexpensive motion sensing game controllers, such as Kinect for Xbox One and PlayStation Move, to help children recovering from burns manage the physical demands of rehabilitation. (32)

Videogames and Health-Risk Behaviors

Game technologies have potential to increase or discourage behaviors that affect health. Some research has looked at how specific types of video game content might influence risky real-life behaviors, such as reckless driving. A review of studies of "risk-glorifying" media—from video games based on illegal street racing to movies with risk-taking heroes to television shows featuring extreme sports or stunts (such as the TV series *Jackass*) found an overall correlation between exposure to such content and risk-positive attitudes, feelings and behaviors. (33) In this set of studies, the link between risk-promoting media and real-life risk-taking was stronger for video games than other media.

The authors suggest this could be due to the active nature of gameplay versus simply watching movies or listening to lyrics. What's not clear is the direction of causality. "Sensation-seeking" personalities may differentially seek out risk-glorifying media; in turn, that media exposure might amplify their natural affinity for risky acts. Experimental studies support the idea that exposure to risk-promoting media content may cue or trigger high-risk behaviors or attitudes. However, we don't know how long those effects last, or whether controlled lab studies are relevant to understanding the influence of risk-glorifying media in the real world, where self-selected games and movies are often group activities, engaged with over months or years.

Just as subtypes of game content may have different effects[1], some subgroups of people are likely to be at greater risk for problems. A survey of 4,028 high school

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[1] Some health effects of games may have more to do with the screen that its contents. The presence of game consoles in bedrooms has been linked to later sleep times and fewer hours of rest. Bright screens seem to

students did not find that video gaming in general was strongly linked to risky or problematic behaviors. Male gamers were significantly less likely to smoke cigarettes than their non-gaming peers. Female gamers were less prone to depression but more likely to get into fights. (In this study and many others, gaming was a mainstream activity [2]for boys but only played by a minority of girls.) About 6% of boys reported problems with gaming (i.e., they agreed on the survey that a family member had expressed concern about their video gaming, that they sometimes felt irresistible urges to play video games, and that they'd tried to cut back on gaming); this group of boys were more likely to be regular cigarette smokers. (34) (For more on video games and addiction, see Chapter 6.)

Many studies have examined the effects of portrayals of smoking and drinking in movies and television on children's behavior, with some evidence for concern; for example, multiple studies have found that young people heavily exposed to movie smoking were more likely to start smoking themselves. (35) Studies on video games are lacking, but it's not unreasonable to worry that games might "model" substance use and encourage children to copy it. Game ratings organizations have taken note.

The Entertainment Software Rating Board rates virtually all games sold at retail in the U.S. and Canada. Along with age-based ratings, the ESRB may assign any of 30 "content descriptors" to help parents make informed decisions about games. Six of those descriptors address substance use: "use of tobacco," "use of [illegal] drugs," "use of alcohol," "drug reference" (images of or references to illegal drugs), "alcohol reference" and "tobacco reference." The two descriptions alerting parents to questionable lyrics also

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affect melatonin metabolism. Of course, physiologically arousing gameplay may be incompatible with sleep. (36)

encompass alcohol/drug use. <http://www.pegi.info/en/index/id/33/> The PEGI rating system, used in 30 countries including most of Europe, features eight icon-like "descriptors" to alert buyers to questionable content. An icon of a syringe signals that the game "refers to or depicts the use of drugs." <http://www.pegi.info/en/index/id/33/>

Games and food choices. The video game equivalent of the television commercial is the online "advergame." Most websites promoted on children's television shows feature advergames, usually with familiar brand characters and logos, and often promoting sugary cereals or other less-healthy foods. Nutritionists worry about the effects of advergames on children's food choices. For example, one study found that young children who played a Froot Loops® advergame were more likely than non-players to say they preferred that cereal. In experimental studies, children who played advergames for sugary snacks chose and ate more of those foods. Children who played fruit-related games chose more healthy snacks, and children playing non-food games fell in between. (37)

Videogames and obesity

Many researchers (and parents) assume that video games encourage sitting, and that sitting promotes obesity. Some studies see all time spent in front of computer monitors and televisions as equivalent, regardless of what is on the screen or how the watcher may be interacting with it. Based on that logic, dozens of studies have been published of programs intended to reduce children's "screen time." (38)

Some recent studies try to separate out the effects of television watching and game playing. A study of over 9,000 German and American preteens and adolescents, focusing on the relationship between media use and socioeconomic status, found that the relationship between overweight and lower SES was mediated in part by time spent watching TV shows and to TVs in bedrooms—but not by video gaming or movie watching. (39) A meta-analysis combining the results of dozens of studies of media use and physical activity among children aged 3 to 18 found a small but statistically significant link between television viewing and body fatness, but little to support a relationship between electronic game use and excess weight. (40)

Other differences between video game play and TV watching include greater exposure to advertising on television, and the practical difficulties of snacking while using a game controller or keyboard.

Are "Exergames" Good For Your Health?

Since affordable dance games came to home consoles in the late 1990s, dozens of studies have looked at the effects of physically demanding games and their potential to promote health. "Exergames" make use of innovative game controllers such as foot touch pads for dancing, balance boards, and motion sensing cameras. Reviews of the most rigorous exergaming research suggest that under the right circumstances, active games can help children and teens get moving. Another benefit: for children struggling with their weight, exergames may help limit weight gain. (41; 42)

Dance games can give players a vigorous workout. (43) But in most cases, exergames promote light to moderate activity (akin to brisk walking) rather than working

up a sweat, but this varies by the type of game, game controller, and individual motivation. Studies measuring energy expended playing the groundbreaking exergames in Wii Sports (for the Nintendo Wii console) found them less vigorous than real tennis, boxing or bowling; however, Wii Sports did demand 51% more energy from players than an ordinary sedentary video game.

Even if *Wii Tennis* can't match real tennis, it still gets you off the couch[3]. We now know that time spent sitting is a separate risk factor for obesity and ill health among adults and children, independent of regular exercise. (44) This has sparked interest in creating games that both reduce sedentary time and break it up with intermittent bursts of light activity – what some researchers call "energames." (45)

One example of promoting intermittent light activity through games is the Pokéwalker—a pedometer accessory for the Nintendo DS. Shaped like the familiar Poké Ball, the pedometer comes with and connects to select Pokémon games via infrared signals. Players earn in-game currency, called "watts," by racking up steps.

<http://nintendo.wikia.com/wiki/Pok%C3%A9walker>

Given expanding game technology options and the importance of combating child obesity on multiple fronts, one physician (47) proposed that video games be rated based

[3] Exergames have other potential health benefits, such as improving balance and preventing falls—a major cause of injury and death for the elderly. (46)

on energy expenditure, on a four-point scale from “sedentary” to “high intensity,” to guide game-buying parents.

Exergames at school. Schools have begun to include exergames in their physical education offerings. West Virginia, a state with high rates of child obesity, was a pioneer in school exergaming. After promising results from at-home tests and a 2004 pilot study at 20 middle schools, the state rolled out *Dance Dance Revolution* to all of its schools, with the help of a grant from its maker, Konami. (48) In *New York Times* interviews, children favorably compared DDR to sometimes hyper-competitive school sports such as baseball or basketball, noting that with DDR, “you don’t have to be on a team or go anywhere special to play” and that “you don’t have to be good at it to get a good workout.” (49)

Encouraging exergaming. This is surprisingly complicated. One study that tried to assess the effects of exergames in everyday life, gave 84 children aged 9 to 12 a Wii console and let them pick one of five popular sports or dance titles such as *Wii Fit Plus.* (A control group got a non-active game.) As in real life, children could use the game console as they wished during the three-month experiment, and received no special instructions on how or when to play the exergame. Children were weighed, and wore an elastic belt with an accelerometer for two non-consecutive weeks to measure activity levels. The result? Children given an exergame were no more physically active than the control group kids. (50) The children’s diaries and interviews, as well as Wii console records, suggest that the active games were used. So, what might explain this finding?

The children may have played at lower levels of intensity. Exergaming may have replaced (rather than added to) other everyday physical activity. There was also some "contamination" of the experiment: children in each group acquired and used exergames and non-active games on their own. Interviews with the children hint at other factors, such as confusion about how to play, not having someone to play with, finding a game too hard, or not liking it. It may have been too much to expect fairly young children to try, learn and make a habit of using an unfamiliar game with no instruction or encouragement from adults, siblings or peers.

Small studies suggest that children are more likely to stick with exergaming in the context of structured classes and/or multiplayer game options. (51) For most children, socializing is a major part of video gaming, and they commonly learn to play new games from siblings and friends. (4)

To encourage young gamers to start and stick with active games, they should ideally be easy to start playing, offer fun short-term challenges that adapt to player skill level to sustain motivation, give feedback on player performance and accomplishments, and allow the option of social play. (45)

Videogames may also have untapped potential to encourage exercise away from the screen. Playing videogames that feature realistic sports (such as basketball, soccer or skateboarding) is correlated with spending more time on real-life exercise, at least for boys. (52) Sports videogames have the potential to introduce players to new sports, increase motivation to practice sports moves or try out for teams, and boost confidence in sports-related abilities. Games that feature real-life athletes as characters allow players to "interact" with people they admire. Personalization of characters can also build

motivation; some games even allow players to upload a photo of their own face to create a realistic-looking character.

Using Video Games to Promote Health: The "Games For Health" Movement

After the turn of the century, the idea of using video games for serious purposes, including health promotion and disease management, began attracting researchers and funders. Founders of the Games for Health Project (53) envisioned five areas where games might be used in health or medicine: Preventative (such as "exergames" or games to manage stress), Therapeutic (games to manage diseases or help with rehabilitation), Assessment (games that rank or measure some aspect of health), Educational (teaching skills such as first aid), and Informatics (games that create health records for use by individuals, doctors or researchers). The Robert Wood Johnson Foundation, Games for Health, Health Games Research and other groups funded, conducted or publicized research to see whether games had the potential to improve health, and (if so) how to make them more effective[4].

Improving the effectiveness of health games

"Games for health" have been used everywhere from school classrooms to game consoles and smart phones to medical clinics to Boy Scout gatherings. (54) But video game technology may not be a good fit for all health topics or goals. For example, researchers have created games to promote nutrition knowledge and increase fruit and vegetable consumption. "Escape from Diab" and "Nanoswarm: Invasion from Inner Space": were multipart adventure games designed (at a cost of several million dollars) to

[4] The University of Santa Barbara's new Center for Digital Games Research has a database of health games research and information at http://www.cdgr.ucsb.edu/db

match the quality of commercially available video games. After a total of about six hours of gameplay, young players reported eating more fruit and vegetables (about half a serving per day) compared to a control group. (55) In another study, a Xbox Kinect game that let preteens feed nutritious or less-healthy foods to an alien increased nutrition knowledge, especially among a subgroup that did short cardio exercises as part of the game. (56)

Efforts like these help advance our understanding of the potential of game technology. But in future studies, it's important to consider whether custom-created video games are the most effective, or cost-effective, way to teach particular facts and skills. The goal of a health game should be specific, feasible and translatable to real life. Food choices are complicated, and many factors influence them. A more modest goal, such as a game that helps parents encourage preschoolers to try new foods, may improve odds of success.

Games may be particularly well suited to health issues that are complicated, emotional, and potentially costly in terms of dollars and disability. For example, a video game that successfully teaches a child newly diagnosed with diabetes to manage technologies for testing blood glucose and administering insulin—*and* helps that child stay motivated to take care of himself—might reduce emergency room visits as well as future health complications. And unlike rushed health care providers, games are endlessly patient; players can repeat content as much as needed, and practice skills at their own pace until they succeed.

Health game designers need to understand behavior change theory. We know, for example, that learning facts is not enough to create change. Even well-thought-out health

games need well-designed studies to demonstrate their worth. For example, the Kinect nutrition game mentioned above included just twenty students—not nearly enough to draw conclusions about effects. A review of 149 published studies on health game research found that most studies were done in lab settings, over just five weeks, with players spending less than 100 minutes with the game. (57) Larger studies, conducted under real-world conditions, for longer periods of time are needed to give games a chance to show effects. Similarly, game ideas and prototypes should be tested using focus groups and pilot studies, and final versions assessed in randomized controlled trials. (58)

The best health games are useless if they sit on the shelf. Health game designers need to think about whether their intended game users (or purchasers) are comfortable with game technologies, and feel able to use them properly in clinics or homes. This is particularly challenging given the rapid evolution of game technologies.

Finally, privacy protections will be particularly important when it comes to health games. It's one thing to have companies collect data about your Web searches or online shopping habits; it's another to have data on what you eat, how much you exercise, or your use of medicines or devices (such as blood glucose monitors or asthma inhalers) shared with parties unknown.

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