Health Games Research: Advancing Effectiveness of Interactive Games for Health
An RWJF National Program

EXECUTIVE SUMMARY

Health Games Research: Advancing Effectiveness of Interactive Games for Health supported 21 research projects and conducted research to discover evidence that could be used to improve the design and effectiveness of health games. Some projects looked at how existing games could be used to achieve health goals while others designed and tested new health games. Technologies used in grantee studies included video game consoles, the Web, mobile phones, exertion interfaces (e.g., dance pads), robots, social networks, and virtual worlds. RWJF supported this $8.25 million national program from September 2007 through September 2013.

A companion project, the Games for Health Project, supported the field by convening conferences and providing leadership to the health games industry.

Learn more about the program here.

CONTEXT

Interactive health games have the potential to change attitudes and behaviors and, thus, improve players’ health. But much more research was needed into how and why they worked, especially to identify the elements of effective health game design and how and why certain health games work and for whom.

The Robert Wood Johnson Foundation (RWJF) wanted to explore whether games could be used to improve health and health care. RWJF funding in this area began in 2004 when the Foundation provided support for the annual Games for Health Conference, which brought together researchers, medical professionals, and game developers. The excitement at these conferences, and the strong interest of the variety of stakeholders who attended, convinced RWJF that this field had great potential and that research funding
was needed to contribute more findings that would guide the design, implementation, and impact of future health games.

**THE NATIONAL PROGRAM**

From 2007 to 2013, a national program named *Health Games Research: Advancing Effectiveness of Interactive Games for Health* provided scientific leadership, developed resources such as an online searchable Health Games Database, and synthesized and presented research findings to help build the field while it also supported and provided technical assistance to 21 research projects and conducted its own research projects to discover evidence that could be used to improve the design and effectiveness of health games. During this period, the Games for Health Project also supported the field by convening conferences and providing leadership and consulting to the health games industry. The directors of the program and the project worked together.

**Program Description**

In 2008 and 2009, *Health Games Research* awarded 21 grants totaling $4 million for research on interactive games that use digital technology. Some projects looked at how existing games could be used to achieve health goals while others designed and tested new health games. The games ranged from traditional console video games to games played on the Web and on mobile phones to the use of exertion interfaces (e.g., dance pads) and alternate reality games, and many of them incorporated emerging game technologies such as robots, spirometers, sensors, GPS systems, accelerometers, social networks, cameras, and virtual worlds.

Research focused on games designed either to increase physical activity or improve self-care. Self-care games are intended to improve an individual’s health skills, behaviors, and/or outcomes related to lifestyle, prevention of disease, self-management of chronic conditions, or adherence to a treatment plan. The national program office at the University of California, Santa Barbara (UCSB) also conducted research and developed resources for, and provided leadership to, the health games field.

**Collaborating With Games for Health**

To coordinate efforts to build the health games field, RWJF funded both *Health Games Research* and the Games for Health Project.

The Games for Health Project has helped build the field through meetings and social networking, to serve health professionals, researchers, game developers, and others involved in the creation and implementation of health games. In addition to holding annual conferences, it has held regional meetings, worked to develop leaders in the field, posted resources on its website, and looked for other opportunities to build the field of
health games. RWJF funding for the Games for Health Project ran through June 2015, but their work is continuing beyond the funding period as they have been forming new industry partnerships to carry their work forward.

The directors of Health Games Research and the Games for Health Project shared information and research findings, and provided advice to each other. They also established a research track within the Games for Health Conference.

**KEY RESULTS**

According to the directors of Health Games Research and the Games for Health Project, grantee reports, and interviews with key participants, Health Games Research and the Games for Health Project achieved the following results.

**Health Games Research**

- Substantially contributed to the evidence base in the health games field through research that tested a wide range of behavioral health strategies to implement in health games with various target populations, game genres, technology platforms, health topics, and intended health outcomes.

The grantees and 114 of their co-authors produced 63 publications and made more than 150 conference presentations. The national program office staff published 18 articles, book chapters, and reports that presented research findings or reviewed and synthesized the research literature, and they gave 62 conference presentations at major meetings of health care providers, digital health leaders, game designers, and researchers in a wide range of allied fields.

>“These research projects comprise the largest single collection of people doing research in games for health anywhere on the planet. We helped establish a body of literature that would not have existed before.”—Paul Tarini, MA, RWJF senior program officer

- Conducted two large-scale, nationwide representative sample surveys of people in the United States, ages 1 to 93,^1^ to identify aspects of their video game use and the amount of time they spend playing video games on nine major video game platforms. Their report of findings includes information about video game use, health game use, and reasons for playing video games. Key findings included:

^1^ In these surveys, a parent responded on behalf of their child aged 1 to 7. All people ages 8 to 93 responded to the online questions themselves.
— Video game playing is widespread. Seventy-seven percent of people ages 1 to 93 played video games in 2013, up from 68 percent in 2010.

— In both 2010 and 2013, about half of all video game players in the United States were female and about half were male.

— About the same percentage of blacks (74%), Hispanics (76%), and whites (78%) played video games in 2013.

— A higher percentage of people with annual incomes of $75,000 or more (82%) played video games in 2013 than people with incomes of $29,999 or less (70%).

— People spend significant amounts of time playing video games. In 2013, video game players spent an average of 100 minutes per day, or about 12 hours per week, playing video games, up from 90 minutes per day, or about 10.5 hours per week, in 2010.

• Created an online searchable Health Games Database that contains information about hundreds of health games and hundreds of related publications, resources, organizations, and events.

“A growing body of research finds that well designed health games can be effective in improving players’ health-related knowledge, skills, attitudes, self-concepts, behaviors, and, as a result, health outcomes.”—Debra Lieberman, PhD, director, Health Games Research

Games for Health Project

• Held 10 annual Games for Health Conferences from 2005 to 2014. Attendees include researchers, medical professionals, and game developers from Nintendo, TEDMED, the American Heart Association, and Lucasfilm.

• Created a new focus on Health Games for Everyone, which focuses on developing health games that could help everyone (healthy people and people with health conditions) improve their health.

AFTERWARD

Nine of the 21 Health Games Research grantees received subsequent grants from other funding sources to continue their work. Some of the other grantees are also continuing the work they started under Health Games Research, which, Lieberman states, “influenced their research focus and helped them enter this emerging and growing research field.”
Staff members of *Health Games Research* are building on their experience as a national program to establish the Center for Digital Games Research at UCSB. In 2012, RWJF awarded UCSB a three-year grant\(^2\) to support further scientific leadership in the field and to provide seed money to establish the center.

The Games for Health Project concludes its RWJF-supported work in the summer of 2015 and has continued to forge new partnerships and alliances to support future health games conferences and meetings that should enable them to provide consulting to health game developers.

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**Program Management**

*Health Games Research* National Program Office: University of California, Santa Barbara  
*Health Games Research* Program Director: Debra Lieberman, PhD  
Games for Health Project Director: Ben Sawyer

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**CONTEXT**

Interactive health games are engaging, fun, challenging, and experiential—and have the potential to change attitudes and behaviors that can improve players’ health. Studies have shown that well-designed games focusing on a specific health topic and target population can improve attitudes and behavior, according to the call for proposals from *Health Games Research*.

Health game impacts that had been studied before the formation of *Health Games Research* included, for example, effects of games designed to intensify anti-smoking attitudes, improve prevention behaviors, influence dietary habits, increase physical activity, and improve self-management of chronic diseases, such as diabetes and asthma.

But much more research was needed into how and why these games worked. The field especially needed to identify the elements of effective health game design and know how and why certain health games were successful in changing health behaviors and outcomes, and for whom, so that the most useful design strategies could be used in future games.

**RWJF’s Interest in This Area**

In 2004, RWJF began funding work that would build the field of digital games for health. “We were looking for unconventional approaches to problems. We started looking at video games and whether there was a role for them to improve health and health care,” says Paul Tarini, MA, RWJF senior program officer.

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\(^2\) ID# 69651 ($730,000, September 1, 2012 to August 31, 2015)
RWJF began its funding in the field with an annual Games for Health Conference starting in 2004, organized by the Games for Health Project. The conference brought together researchers, medical professionals, and game developers interested in designing, developing, and implementing health games and game technologies.

Ben Sawyer, president of the game design firm Digitalmill (Portland, Maine), directed the Games for Health Project, which supported the health games industry through the annual conference and other meetings and provided leadership to the field. Discussions at these conferences and meetings revealed the need for “…a much larger bastion of research about health games and better support [for game development] from the research,” said Sawyer. “People were mostly doing stuff on their own or getting small bits and pieces of grants.”

“There was a strong need for outstanding research to help game designers create better games. The field was moving fast and unfortunately a lot of the work being done to design and implement health games was not evidence-based,” added Debra Lieberman, PhD, a media researcher at the University of California, Santa Barbara (UCSB), who specializes in the research and design of health games, and directed the RWJF Health Games Research national program.

Establishing an evidence base for health games was crucial, according to RWJF’s Tarini. “Unless you demonstrate the efficacy of games, doctors and other providers are unlikely to use them as therapeutic interventions,” he said. The Foundation also decided to focus on research that would discover and test health game design principles that could be applied to the design of new health games, he added, “… because exploring the design questions could provide insights to help improve the design of future games.”

THE PROGRAM

Health Games Research: Advancing Effectiveness of Interactive Games for Health provided scientific leadership to the field and developed resources, and it supported 21 research projects and conducted research studies of its own to discover evidence that could be used to improve the design and effectiveness of health games.

A companion project, the Games for Health Project, supported the field by convening conferences and providing leadership to the health games industry.

Program Description

Research Grants

In 2008 and 2009, Health Games Research awarded 21 grants totaling $4 million for research on interactive games that use digital technology. Some projects looked at how existing games could be used to achieve health goals while others designed and tested
new health games. The grants (12 in 2008 and nine in 2009) ranged from $94,992 to $287,976 and lasted up to three years and two months.

The games ranged from traditional console video games to games played on the Web and on mobile phones to the use of exertion interfaces (e.g., dance pads) and alternate reality games, and many of them incorporated emerging game technologies such as robots, spirometers, sensors, GPS systems, accelerometers, social networks, cameras, and virtual worlds.

Research focused on games designed either to increase physical activity or improve self-care. Self-care games are intended to improve an individual’s health skills, behaviors, and/or outcomes related to lifestyle, prevention of disease, self-management of chronic conditions, or adherence to treatment plan.

Physical activity games include:

- Exergames in which the player’s physical movements and exertion are the inputs into the game, such as dance pad games and camera-based games
- Mobile active games that use mobile devices and mobile phones to support physically challenging games in a real-world environment

Some projects looked at how existing consumer games, including “Dance Dance Revolution” and Wii Fit Games (to improve physical activity) and “Crazy Taxi” (to improve cognitive skills) could be repurposed to achieve health goals. Others focused on designing and testing new health games or game prototypes. See the Appendix for a list of the research projects.

**Developing Principles of Effective Health Game Design**

The aim of the research was to develop principles of effective health game design based on theory and evidence about learning and health behavior change with interactive games. RWJF’s Tarini gave some examples of the kinds of questions asked by the program:

- “If you want to get someone to participate in a weight loss game, how do you design the game?”
- Do you play in tandem with another person?
- Do you have to be in the room physically or online?
- Do you use an avatar as a competitor?”

He added, “We hoped that this research would help the next generation of games to be better and more effective.”
Just 25 percent of each grant’s budget could be used to develop games, because RWJF wanted funded projects to focus on studying health games, not developing them. “It was controversial that the program limited the percentage of funding that could be used for game development,” Lieberman says. “But there were already several outstanding commercial games to study, and grantees were able to create innovative new games or game prototypes to test in their research even with relatively small amounts of funding.”

“The field needed more well-designed and robust research studies and it was important not to cut corners in research support.”—Debra Lieberman, PhD

Management and Research by the National Program Office

National Program Office

Lieberman, at UCSB, directed Health Games Research. Her own research has focused on processes of learning and behavior change with interactive media, with special interests in games, health media, and children’s media. Before joining UCSB, she was vice president of research at Click Health, where she designed Nintendo-platform health video games based on principles of health promotion and behavioral health.

Maria Chesley Fisk, PhD, was deputy director from 2008 to 2011. Erica Biely, MA, who had been an administrative assistant in the program, was the deputy director for the rest of the program period from 2011 to 2013.

The national program office staff at UCSB provided grantees with technical assistance and helped them disseminate their findings. Staff also conducted research, developed resources, and provided leadership in the health games field. They also developed resources including a large-scale national representative sample survey on the video game usage of people ages 1 to 93, in 2010 and again in 2013, an online searchable Health Games Database, and resources to help game developers create and share online browser-based health games. See Overall Program Results for more information.

The national program office disseminated information about new developments and research findings in the health games field through the program’s website, social networking, press interviews, scientific publications, and presentations.

National Advisory Committee

The national advisory committee assisted with reviewing grant proposals and selecting the research projects to fund. J. Leighton Read, MD, a general partner at Alloy Ventures,

3 In these surveys, a parent responded on behalf of their child aged 1 to 7. All people ages 8 to 93 responded to the online questions themselves.
was the chair. Committee members were from the fields of games research, health care, public health, game design, and technology development, and, says Lieberman, “… were generous with their time and assistance during the six years of the national program, whenever the Health Games Research staff requested their input.” See the program website for a list of committee members and their backgrounds.

**Collaborating With Games for Health**

To coordinate efforts to build the health games field, RWJF funded Health Games Research and the Games for Health Project together.

The Games for Health Project, overseen by Sawyer, builds the field through meetings and social networking, to serve health professionals, researchers, game developers, and others involved in the creation and implementation of health games. In addition to holding annual conferences, it holds regional meetings, works to develop leaders in the field, posts resources on its website, and looks for other opportunities to build the field of health games.

Sawyer and his staff advised the Health Games Research national program staff about game genres, game design, software, technology, and trends in the games industry, and introduced the staff to several industry leaders.

Lieberman and her staff at Health Games Research gave Sawyer information about current research and how to interpret findings as he developed the agenda and selected the speakers for the annual Games for Health Conference, and to help him advise his clients on the design of their health games. Working together, they established a research track within the conference, where Lieberman and Health Games Research grantees often presented their work. Lieberman also organized a luncheon for researchers that occurred during the first day of the conference each year.

**OVERALL PROGRAM RESULTS**

According to the Health Games Research national program staff, the Games for Health Project, grantee final reports, and interviews with key participants, Health Games Research and the Games for Health Project achieved the following results.

**Building the Evidence Base for the Health Games Field**

Research conducted by the 21 grantees tested a range of behavior change strategies in health games with various target populations, game genres, technology platforms, interfaces, health topics, and intended health outcomes. The grantees and 114 of their co-authors produced 63 publications and made more than 150 conference presentations.
The national program staff contributed to the evidence base by publishing 17 articles, book chapters, and reports that presented research findings or reviewed and synthesized the research literature. They gave 62 conference presentations nationwide in the fields of health care, digital health, game design, and research, and in other fields that organized special conference sessions about health games, such as the fields of sustainable brands, climate change advocacy, entrepreneurship and executive leadership, venture capital investment, genomic research, pharmaceuticals, entertainment media and technology, children’s media, health education, and health journalism.

Lieberman assisted in the development and creation of a new scientific journal called *Games for Health: Research, Development, and Clinical Applications*, which began publication in 2011. She serves as the journal’s associate editor. She also co-edited a 2012 special issue of the *Journal of Diabetes Science and Technology* titled “Serious Games for Diabetes, Obesity, and Healthy Lifestyle” and featured five articles by program grantees.

“Published research findings are providing evidence-based principles of health game design that health game designers and others can use to increase the effectiveness of future health games,” Lieberman noted.

> *“These research projects comprise the largest single collection of people doing research in games for health anywhere on the planet.”—Paul Tarini, MA, RWJF*

“We helped establish a body of literature that would not have existed before,” he added.

Lieberman also worked with staff at federal agencies such as the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC) to encourage more research funding and development support for health games, and she gave presentations to senior program officials and served on grant proposal review panels for the National Institutes of Health.

It is difficult to establish cause and effect, but Lieberman said that she has seen an increase in federal interest in health games and more calls for proposals from federal agencies since the RWJF program began. She also noted that more doctors and other clinicians are requiring evidence about health games before they will purchase or recommend them, and more game developers are posting research findings on their websites pointing to the effectiveness of their games as a way to promote them.

Lieberman noted that these advances would most likely have happened—albeit more slowly and in a more limited way—without the national program, but she says she “is certain that RWJF’s $8.25 million support since 2007 has vastly accelerated the process and broadened its scope, and has created a ripple effect. For example, it has increased the
participation of diverse public and private sectors, has attracted many individuals and organizations to the field of health games research and development, and has trained hundreds of researchers and developers who are now focused on health games.”

She goes on to note that the program “has boosted the quality and quantity of well-designed health games by adding to the evidence base and has helped establish a norm among decision-makers that (1) digital games are legitimate health interventions that have the potential to motivate and support health behavior change and thereby improve health outcomes, and (2) it is essential that health games be designed on the basis of well-established theory and evidence and that their effectiveness be tested in rigorous outcome studies.”

**Other Results From Health Games Research**

The program also:

- **Conducted two nationwide surveys of video game usage.** The report, *Playful Nation: Survey of Video Game Play in the United States, Ages 1 to 93*, presents responses from two national online representative sample surveys of people ages 1 to 93: 4,3751 people in 2010 and 3,816 people in 2013. It includes information about their use of video games—including health games—their reasons for playing video games, what they like about playing video games and the genres they prefer, the extent to which they play alone or with others in person or online, and parents’ rules about video game use by their children ages 1 to 7. Among the key findings were:

  — Video game playing is widespread. Seventy-seven percent of people ages 1 to 93 played video games in 2013, up from 68 percent in 2010.

  — In both 2010 and 2013, about half of all video game players in the United States were female and about half were male.

  — About the same percentage of blacks (74%), Hispanics (76%), and whites (78%) played video games in 2013.

  — A higher percentage of people with annual incomes of $75,000 or more (82%) played video games in 2013 than people with incomes of $29,999 or less (70%).

  — People spend significant amounts of time playing video games. In 2013, video game players spent an average of 100 minutes per day, or about 12 hours per week, playing video games, up from 90 minutes per day, or about 10.5 hours per week, in 2010.

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4 In these surveys, a parent responded on behalf of their child aged 1 to 7. All people ages 8 to 93 responded to the online questions themselves.
— Among people who play video games, the highest percentage played video games on a computer in 2013. Following are the percentages of players who played video games on each of nine platforms:
  
  - Computer (68% of video game players used a computer to play video games)
  - Console (55%)
  - Mobile phone (45%)
  - Tablet (37%)
  - Handheld game device (28%)
  - Arcade machine (13%)
  - Electronic toy (10%)
  - Electronic learning system (10%)
  - Gym game (5%)

— Features of video games that the most players said they liked in 2013 were:
  
  - Entertainment (77% of video game players said they liked this feature of video games)
  - Challenge: Using skills, trying to win, beating the game, and leveling up (73%)
  - Pleasure (71%)
  - Relaxation (66%)
  - Improving the brain (63%)

— The five game genres that the most players said they liked in 2013 were:
  
  - Puzzle games (56% of video game players said they liked this game genre)
  - Traditional games of skill and chance (56%)
  - Arcade-style games (51%)
  - Quiz and trivia games (51%)
  - Racing games (50%)

— Video game players, especially young players, often play with others in the same room or online. In 2013, 80 percent of players sometimes or always played video games with others.
Findings About Health Games

— Forty-two percent of all video game players played health games in 2013, similar to 2010 (41%).

— People who played health games in 2013 spent an average of 12 minutes per day playing them.

— Some 12 percent of video game players played self-care games in 2013, down from 15 percent in 2010. The self-care topics played by the highest percentage of adult self-care game players ages 18 and older were brain training and heart health. For young players (ages 4 to 12), the most commonly-played self-care topics were fire safety and the dangers of drugs.

● Created the online searchable Health Games Database, which contains information about hundreds of health games and hundreds of related publications, resources, organizations, and events. The database enables users to save searches, flag their favorite entries, and search for specific keywords and topics.

   “Clinicians, game designers, and others often ask me to help them find games and related publications and resources about a specific health topic. I show them how easy it is to search the database to find these items, save their search specifications, and run their search again in the future to find out if new items have been added to the database.”—Debra Lieberman, PhD

The Health Games Database is now housed at UCSB’s Center for Digital Games Research, which was established with start-up funding from RWJF. For more information, see Afterward.

● Launched the Body Game Builder community and created four nutrition games that people interested in developing health games will be able to use and modify for free. The four Web-based nutrition games, developed with the Unity game engine and designed on the basis of researched behavioral health principles, will be available online in a limited pilot until more funding is obtained to open the community to a wider group of participants.

Novice game developers will be able to share their games with other community members and create their own health games by modifying others’ games or using the tools and art assets from others’ games in new games of their own. Members will be able to communicate online to collaborate with and learn from each other.

“It is usually easier to take an existing game and modify it than to make your own game from scratch,” Lieberman said. “This is in answer to the game developer
novices, including many health care professionals, who have contacted me and said, ‘I have a great idea for a health game. How do I get started?’ ”

This work is continuing under another RWJF grant. For more information, see *Afterward*. Lieberman expects the Body Game Builder games and Web materials to be available in a limited pilot later in 2015.

**Results From the Games for Health Project**

According to grantee reports and Sawyer, the Games for Health Project:

- **Held 10 annual Games for Health Conferences from 2005 to 2014.** Attendees included researchers, medical professionals, and game developers from Nintendo, TEDMED, the American Heart Association, and Lucasfilm. Sessions featured an international array of speakers and covered topics such as exergaming, physical therapy, disease management, health behavior change, biofeedback, rehabilitation, epidemiology, training, cognitive health, nutrition, and health education.

  Attendance increased from 200 in 2005 to 429 in 2012, before dropping to 360 attendees in 2013. Sawyer attributes the decline to changes in the field, the need to attract more funding, and less marketing of the conference.

- **Partnered with Games for Health Europe.** Since 2011, Sawyer’s group has assisted in holding four Games for Health Europe conferences with 200 to 300 participants. The aim is to bring serious gaming and health care together in order to contribute to more advanced health care across Europe.

- **Partnered with the Healthcare Information and Management Systems Society to bring promising game developers to the attention of venture capitalists.** Games for Health Project began working with the Healthcare Information and Management Systems Society, a nonprofit focused on improving health through information technology, to persuade people with promising games to buy into booths at conferences such as the mHealth Summit where they could showcase their work in front of venture capitalists.

  The mHealth Summit, where health care and technology leaders gather to improve health outcomes through wireless and technological innovation, is the largest mobile health event in the world. At mHealth 2013, for example, the Games for Health Project had a booth where eight game developers exhibited their games. Games for Health Project also held a half-day tutorial session at the mHealth Summit on the work done by the Games for Health Project and on games in the public health space, with more than 70 paid participants.

- **Created a new focus on Health Games for Everyone.** In 2012, the Games for Health Project began focusing on ways to invest small amounts of money to help develop health games that could help everyone (healthy people and people with health conditions) improve their health. This initiative was borne out of a frustration...
that the field was not seeing more commercially successful health games being developed, in part because games were focused on niche groups such as people with diabetes. Among the projects:

— **Exergaming.** Health Games for Everyone created a toolkit that allows people to build their own exergames for mobile devices and save time in doing this. As of January 2015, the engine had not yet been released.

— **Health Finances.** Project staff developed a plan for games about health finances called “Healthynomical.”

— **Nutrition.** Project staff created “NomNom,” a nutrition board game kit that allows people to rapidly prototype games about food. The goal is to help nutritionists and game designers fill in the information that is outside of their expertise—either game design or nutrition—in order to quickly build a game.

— **CDC Game Jam.** In September 2013, Games for Health Project partnered with the CDC to carry out the first ever government sponsored game jam. In the three-day event, CDC and Southern Polytechnic State University hosted 250 college students who built 40 games. The games addressed CDC’s large-scale health priorities such as disease prevention, outbreak investigation, and healthy, active lifestyles. The winning game was on food safety.

With funding from the U.S. Department of Health and Human Services, CDC hosted the second game jam in September 2014.

**Communications Results**

**Health Games Research**

In addition to the research articles and conference presentations already mentioned, Lieberman, director of *Health Games Research*, gave more than 50 press interviews. Articles about the program and about research findings related to health games appeared in the *Associated Press, Reuters, Wall Street Journal, US News and World Report, The Nation’s Health*, and many other publications.

Also, two Twitter accounts, @GamesResearch and @DebLieberman, highlighted grantee publications and awards, announced news about health-related digital media and games, and discussed events, products, publications, and research findings.

**Games for Health**

Besides the conferences it hosts, Games for Health Project communications efforts included a Twitter feed, a Facebook page, and a website that has resources including a listserv and a page on funding.
KEY PROJECT ACTIVITIES & RESULTS

Here are some of the noteworthy grantee projects funded by Health Games Research:

Self-Care Games

- **Video Driving Game for Older Adults.** A video game called “NeuroRacer” developed by Adam Gazzaley, MD, PhD, at the University of California, San Francisco, challenged older people to drive a car while simultaneously responding to signs that popped up. Gazzaley found that the game improved seniors’ ability to multitask and other cognitive functions such as attention span and working memory. The findings were published in *Nature* (September 2013) and were featured on the journal’s cover with the headline, “Game Changer.”

  Gazzaley is now co-founder of a new game development company, Akili Interactive Labs, which is developing a version of the game for the mass market. See the sidebar, *A Brain Game That Might Be a Game Changer*, for more details.

- **Breath Biofeedback Video Game for Children with Cystic Fibrosis.** Peter Bingham, MD, a pediatrician at the University of Vermont, developed two breath biofeedback video games that used a spirometer breath controller as the game interface. He studied whether children with cystic fibrosis who played the games would improve their use of inhaled medicines and would be motivated to spend more time doing breathing exercises since they would be doing those exercises as a way to make progress in highly engaging and immersive games. The research team developed the games in collaboration with patients.

  The games increased the amount of time patients spent on breath exercises and, as a result, it improved their ability to take deep breaths. Bingham received additional funding from the NIH and the University of Vermont to support the use of this approach with patients who have asthma. See the sidebar *Kids With Cystic Fibrosis Use Breath to Play Video Games* for more details.

- **“Lit to Quit: A Game for Cigarette Smokers.”** Researchers at Columbia University’s Teachers College, New York, directed by Charles Kinzer, PhD, developed and evaluated a smoking cessation game, “Lit to Quit,” that was played on a mobile platform, initially on the iPod Touch and iPhone.

  The player blows air, sometimes in short bursts and other times with long slow breaths, into the mobile device’s microphone to control the game, which uses sound, color, images, challenges, and feedback to get the player to breathe in a way that mimics the stimulating (Rush mode) and relaxing (Relax mode) effects of smoking. The idea is to get smokers who are trying to quit to reach for this game instead of a cigarette, to reduce their cravings.

  Kinzer and his team found that players felt stimulated in the Rush mode and relaxed in the Relax mode and 88 percent thought the game was fun. There was not enough
evidence to determine whether the breath control interface more closely elicits the body’s reactions to smoking than playing the game without breath control.

- **Facial Expression Recognition Game for Children with Autism.** Researchers at the Children’s Hospital of Philadelphia, led by Robert Schultz, PhD, collaborated with game developers to create and study seven Web-based games to help children with an autism spectrum disorder better recognize facial expressions and emotions. They tested the games, called “FaceStation,” against a series of games that Schultz had developed earlier, called “Let’s Face It.” Study participants demonstrated significant improvements in facial recognition skills with the new “FaceStation” games developed with *Health Games Research* funding. They also played these games for double the number of hours they had played “Let’s Face It” games. See the sidebar **Helping Children with Autism Recognize Facial Expressions** for more details.

- **“Time to Eat!”** This mobile phone game for middle and high school students rewards players’ healthy eating habits. The game uses eating tips, mobile phone snapshots of foods that players are about to eat, and virtual pets that thrive or decline as a way to provide feedback to players about their food choices. Researchers at Cornell University, Ithaca, N.Y., directed by Geri Gay, PhD, adapted their “Mindless Eating Challenge” game into a game called “Time to Eat!” and investigated impacts of virtual pet feedback on healthy behaviors in daily life.

  Researchers found that students who received both positive (thriving health) and negative (declining health) feedback from their virtual pet, based on the students’ own eating habits, were twice as likely to eat breakfast than those in a comparison group with pets that only provided positive feedback. They also found that boys did better than girls when given the opportunity to view one another’s pets.

### Physical Activity Games

- **College Freshmen Playing an Alternate Reality Game.** “Skeleton Chase,” an alternative reality game, promotes physical activity and a healthy lifestyle among college freshmen enrolled in a course on fitness and wellness. The game immerses players in an interactive fictional story—a mystery that takes eight weeks to solve—unfolding across a variety of media (email, website, and phone calls) and posing real-world physical and mental challenges that players must surmount to gather clues.

  The research and development of “Skeleton Chase” was directed by Jeanne Johnston, PhD, at Indiana University, Bloomington. She and her collaborators found a significant increase in physical activity for a group of freshmen who played the game in a fitness and wellness course compared with a group in the same course who did not play the game but instead did their workouts as traditional assignments. Both groups gained about the same amount of weight. See the sidebar **An Alternate Reality Game for College Freshmen** for more details.
● **Seniors Cybercycling.** This project studied whether virtual cybercycling (using stationary bikes with screens that let riders bicycle through a virtual reality landscape and engage in races against others or against their own personal best racing time) would improve the cognitive functioning of seniors more than an equivalent amount of time spent stationary biking with no screen and no game challenges. Cay Anderson-Hanley, PhD, at Union College in Schenectady, N.Y., and her colleagues found that cybercyclers demonstrated significantly better executive functioning in specific cognitive skill areas (important cognitive abilities for independent living) than those who used stationary bikes with no screen for an equivalent amount of time per week.

Anderson-Hanley and colleagues published their findings in the *American Journal of Preventive Medicine* (2012). Readers voted it number three in the Five Most Influential Research Articles funded by RWJF in 2012, which is a look at the most influential Foundation-supported research that has impacted health and health care. In 2013, Anderson-Hanley received a three-year grant from the National Institutes of Health to continue the research. See the sidebar Cybercycling Improves Older People’s Cognition for more details.

● **Individuals with Strokes Playing Wii and PlayStation.** This project studied whether playing selected Nintendo Wii or Sony PlayStation 2 games helped improve balance, mobility, and fear of falling for people who were recovering from a stroke. It was the first blinded, randomized clinical trial to investigate changes in balance and motor function post-stroke following an active gameplay intervention. One group of stroke patients played the games while a control group did not.

Stacy Fritz, PhD, PT, at the University of South Carolina Arnold School of Public Health in Columbia, said that the gameplay group experienced more positive effects on balance, endurance, and perceptions of improvement since their stroke compared with the control group. See the sidebar Interactive Video Games to Help Stroke Patients for more details.

● **Robot Motivator.** This study, led by Maja Mataric, PhD, at the University of Southern California, in Los Angeles, examined whether a human-looking robot exercise coach might improve people’s motivation to exercise, compared with a robot exercise coach that appeared on a computer screen. Study participants, consisting of older and younger adults, were randomly assigned to exercise following the lead of either: (1) the human-looking robot, Bandit, which demonstrates exercises in the room with them, or (2) an animated presentation of the same robot, Bandit, on a computer screen. (See video for demonstration of Bandit).

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The study found that both older and younger study participants strongly preferred having the robot Bandit in the room with them over the animated presentation of Bandit. Following the directions of the robot and playing interactive movement games with the robot, versus the animated computer version, also led to significantly greater improvement in user enjoyment and performance.

- **Wii Active Exergame for Low-Income Overweight and Obese African-American Adolescents.** This project, directed by Sandra Calvert, PhD, at Georgetown University in Washington, compared cooperative versus competitive Wii Active exergame play, during lunchtime and after school, on weight loss, social and emotional health, and cognitive outcomes in overweight and obese African-American adolescents. The study randomly assigned participants to one of three groups: adolescents who played with a teammate (cooperative play), adolescents who played against each other (competitive play), and adolescents who did not play the game (control group).

Adolescents who played Wii Active with a teammate (cooperative play) lost weight, while those who played competitively did not lose weight. The social friendship involved in cooperative game play was an important influence on weight loss.

On the other hand, competitive play led to stronger improvements in certain cognitive skills involved in executive functioning and also led to stronger increases in physical exertion during game play, compared with the cooperative group and the control group. The cooperative group and the control group improved in self-efficacy (self-confidence) for engaging in physical activity.

**SIGNIFICANCE OF THE PROGRAM**

The *Health Games Research* national program and the Games for Health Project helped build and advance a field that was in its very early stages of research and design and they developed insights and evidence about elements of effective games. RWJF’s Tarini said, “Did we prove definitively that there is an evidence base for health games? No. Is there a body of researchers now talking about games and efficacy that didn’t exist before? You betcha.”

Lieberman had this perspective on the significance of the program. “There is a growing body of research that shows that when games are well designed they can be effective,” she said. “When I started researching and designing health games more than 20 years ago, I was often asked, ‘Aren’t video games bad for you?’ But now people understand that games can be harmful or beneficial, depending on their content and how they are used. There are now many well-known games for learning, training, social change, and health, and so games are not assumed to be the villains anymore.”
“Hospitals, health plans, schools, and after-school programs are offering games to improve health. They understand that well designed games can be powerful environments for learning and behavior change. Games are part of the culture now in many positive ways. We have contributed to changing the norm.”—Debra Lieberman, PhD

Health Games Research also helped establish the expectation among health game producers and consumers that high-quality health games must be based on evidence.

LESSONS LEARNED

1. **Investing in both research and an annual conference can be an effective way to help build a field.** Supporting research that investigated the design, processing, and effects of health games helped build an objective evidence base and supporting an annual conference helped bring that work to the attention of those who could fund and disseminate it widely.

   “Simply supporting research alone would not have been enough to help build a field. There needs to be a venue where researchers can regularly report what they are learning to people who can make use of those findings.” (RWJF Program Officer Paul Tarini)

2. **Integrating new entrants into the multidisciplinary health games field is essential—so training, technical assistance, and community-building are important ways to support and develop this emerging field.** The 21 Health Games Research grantees and the broader research and game design community interested in health games, and the thousands of people who attended conferences and events hosted by the Games for Health Project, come from a wide variety of scientific disciplines, professional fields, industries, health care priorities, patient needs, and consumer interests. The two programs funded by RWJF dedicated considerable time and resources to teaching and training these interest groups, fostering communication among them, and helping them bridge the gaps. Many members of these groups had a strong desire to learn and to find ways to participate.

   “A dedicated and well-funded effort, such as the work of Health Games Research and the Games for Health Project, can offer training, mentoring, and resources to diverse interest groups and stakeholders, and can bring them together—face-to-face and online—to help them develop a shared vocabulary, communicate with one another and collaborate effectively, and contribute their expertise to the field,” said Lieberman.
3. **Investing in smaller, less expensive health games targeted to everyone might be a more profitable business model than investing in health games that target a subset of people, the Games for Health Project suggested.** Large game companies are reluctant to make commercial health games for small populations, such as autistic children or people with cystic fibrosis. Games for Health Project is working on low-cost health games with topics that benefit everyone, such as games that promote healthy lifestyle habits. Reaching a large population promises to unlock the potential of health games.

The case for this still needs to be made, however. “We’re not at the point where we have great health games to point to that are commercially viable and have an impact,” Sawyer said. “We achieved something—getting this idea out about health games—but now we need to make those leaps.”

4. **Looking outside the conventional players can help bring promising ideas to scale.** Large game developers like Nintendo, Sony, Activision, and Electronic Arts are not inclined to develop health games commercially because there is no guarantee they will be profitable as consumer products. The only health game categories that have achieved widespread commercial popularity and success so far are brain games such as Lumosity.com and active games such as “Dance Dance Revolution” and “Kinect” camera-based games.

However, from the early days of health games more than 25 years ago, there were health game developers who focused on health care cost savings. They made games aimed at improving patient outcomes in order to reduce the cost of care, and they considered their primary customers to be health plans, hospitals, insurers, and employers who might make major purchases of health games, provide them to their patients and employees at no charge, and benefit from the ensuing health care cost savings, according to Lieberman, who used this approach in the 1990’s.

“We thought these organizations might buy and distribute large quantities of games to help their patients and employees succeed at self-management of chronic conditions such as diabetes and asthma, and improve their prevention behaviors such as smoking prevention and healthy lifestyle habits—and thereby bring down their health care costs,” she said. There was some interest, but sales were not robust enough to be profitable, even though we had impressive evidence from long-term randomized controlled trials demonstrating that our games changed players’ health behaviors and significantly reduced the cost of their care.

> “Today’s health games, in contrast to 25 years ago, are delivered on more powerful and affordable digital media platforms that are in some cases networked, mobile, and connected to sensors. There is also wider acceptance of games as health interventions and a growing body of
research that demonstrates their effectiveness. With these changes in technology, public attitudes, and the depth of the evidence base, business models focused on health care cost savings have gained traction and some digital media and games companies are moving in this direction.”—Debra Lieberman, PhD

5. Keep building a field by focusing on what the field needs, rather than what individual people in the field might need. Games for Health Project struggled in maintaining interest in its conferences and work after some of the initial participants moved on to other pursuits. Initially, the Games for Health Project focused on “fanning the flames” of those early participants, which may have been a mistake, Sawyer said.

“We should have sat back a little more and asked how we can be more deliberate in creating communities around certain technology approaches,” Sawyer said. “It’s really easy to fall into a trap of supporting just the people that you see. But I want to support the next person that we don’t see and put competitive pressure on the person we do see. We spent time around traditional mechanisms rather than places like open source communities and engineering communities that can drive technological innovation.”

AFTERWARD

Nine of the 21 grantees in Health Games Research have received follow-up grants to continue their work, from funding agencies such as the National Institutes of Health. Other grantees are also continuing the work they started under Health Games Research.

In 2012, the Health Games Research national program received a three-year grant from RWJF to build on the program’s work by continuing to provide scientific leadership to the field and by establishing the Center for Digital Games Research at UCSB.

The center staff, and its affiliated faculty members from a wide range of fields in the sciences, social sciences, and humanities, conducts research on the design, uses, processing, and effects of digital media, games, and game technologies. The center’s website includes the Health Games Database that was originally funded by the Health Games Research national program; the center’s staff continues to update its contents.

6 ID# 69651 ($730,000, September 1, 2012 to August 31, 2015)
The center investigates:

- Psychological and social impacts of popular entertainment games that are commercially available and widely played
- New ways to design and implement games and game technologies for beneficial purposes related to health, learning, public policy, government, the arts, social change, and other areas
- Research methods and metrics related to the study of digital games

Lieberman is seeking funding to support a Body Game Builder community of subject matter experts who are new at making health games and want to share their games, offer art assets from their games to other developers, and modify others’ health games posted online. Body Game Builder began under Health Games Research and the staff developed four online games to share with the community—two about nutrition and weight management, and two about cholesterol management through healthy eating of good fats and good carbs.

The four games will be posted online for the Body Game Builder community to modify into different games dealing with food choices and related health outcomes. The games contain tools that others may want to use, as well.

For example, the four games contain a set of more than 60 foods and beverages and three portion sizes for each of them. Every food and beverage portion size is categorized by its calories, calorie density, food type (such as whether it is a protein, dairy, simple carb, complex carb, good fat, bad fat and/or other type of food), and nutritional attributes. Players can select each food and beverage portion size and place it onto plates to create a daily meal plan of three meals and two snacks per day.

The games are programmed to calculate the daily calorie goal of a game character based on the character’s BMI, gender, and amount of moderate and vigorous daily physical activity, and all of these characteristics are selected by the player to customize the character. The games are also programmed to analyze the nutritional value and the health outcomes of daily meal plans that players have created for each character, and the programs can project outcomes over time, such as BMI, as the character eats the same meal plan over a five-year period into the future.

Members of the Body Game Builder community will be welcome to make new games that use these food selection, character selection, and health outcome calculation assets in new games dealing with nutrition and weight management topics.

The Games for Health Project concludes its RWJF-supported work in the summer of 2015. Sawyer is looking for new sponsors for the Games for Health Conference and plans
on revamping the website to make it easier for people who are building games to connect with one another.

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Sidebars

**A BRAIN GAME THAT MIGHT BE A GAME CHANGER**

Brain games are ubiquitous these days. But many lack rigorous research that backs up their claims of improving cognitive abilities. That’s until Adam Gazzaley, MD, PhD, along with his collaborators, created a game that had such strong and compelling findings that his study landed on the front page of *Nature*, with the title “Game Changer.”

Gazzaley, the director of the Neuroscience Imaging Center at the University of California, San Francisco, wanted to build a video game to try and improve cognition in older adults. But the National Institutes of Health had twice rejected funding for the project. A *Health Games Research* grant provided him with the support to work with game developers to build it—a 3-D video game called “NeuroRacer”—and then rigorously test it.

“NeuroRacer” tests the ability to multitask by having players drive a car down a winding road while also responding as rapidly as possible to the appearance of signs. To study the effects of “NeuroRacer,” Gazzaley and his team randomly assigned 46 adults ages 60 to 85 to one of three groups: multitasking (driving and responding to the signs), single tasking (just driving or just responding to signs), or no game play.

Participants played “NeuroRacer” on a laptop at home for one hour a day, three times a week for four weeks. They returned for a post-training assessment after one month, and follow-up assessments after six months.

As reported in *Nature*, researchers found that participants in the multitasking group improved their abilities to multitask outside of playing the game and showed gains in other cognitive functions such as attention and working memory compared to the other two groups. The multitasking group also maintained the gains in multitasking, attention, and working memory six months later.

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“We learned that you can build a custom designed video game to improve cognition in older adults. The fact that they sustained their ability after six months surprised us.”—Adam Gazzaley, MD, PhD

Gazzaley presented his findings at a Games for Health conference and met a venture capitalist with whom he founded a company called Akili Interactive Labs, which is developing a mobile video game that is based on the technology behind “NeuroRacer.” Some of the first target populations will be children with attention deficit hyperactivity disorder, and people with depression, post-traumatic stress disorder, and early dementia.

**KIDS WITH CYSTIC FIBROSIS USE BREATH TO PLAY VIDEO GAMES**

Kids who have cystic fibrosis must regularly clear their lungs of mucus, a maneuver that is similar to coughing and is called huffing. But many do not perform this nearly as often as they need to.

Peter Bingham, MD, a professor in the department of neurological sciences at the University of Vermont in Burlington, wondered whether video games that required such breathing exercises might encourage children to do them more. “We hoped to learn whether one could design video games that kids could use at home that would promote a certain kind of breath maneuver that keeps the airways of cystic fibrosis patients clearer,” Bingham said.

Bingham and students at Champlain College developed two games that are controlled by a digital spirometer rather than a handheld controller. The spirometer measures how fast and with how much air the player breathes out.

In one game, players’ breath moves a race car down a track and they can fill up the car with gas and wash it. In another game, players go out on a wilderness exploration on a quest for treasure. When players find animals covered with slime, they can blow it off with their breath.

Some 13 children participated in the study, spending about two weeks playing the video games at home and about another two weeks not playing the games. They used a spirometer throughout the study. Bingham carried out pulmonary function tests, quality of life measures, and interviews to compare the results from the times that participants played the games to when they did not and tracked those results for a month after they finished playing.

Bingham found that few of the children were doing the recommended huffing before the study. While they participated in the study, both groups were huffing more than they had
in the past. One result that surprised Bingham was that participants’ ability to take a deep breath, called vital capacity, improved significantly after they had played the games.

“One strong possibility explaining why they improved the breathing techniques they need for the test that pulmonologists give them is that the games gave them a chance to interact with and control the spirometer better,” Bingham said.

“This study is significant because it is doing something that is palliative for a devastating condition like cystic fibrosis. It’s something that comforts and facilitates the daily lives of kids.”—Peter Bingham, MD

Since the study ended, Bingham has carried out a small research project, funded by the National Institutes of Health and University of Vermont, to see how this work might apply to helping patients with asthma.

HELPING CHILDREN WITH AUTISM RECOGNIZE FACIAL EXPRESSIONS

Children with autism often have difficulty reading facial and nonverbal expressions, which can lead them to make blunders in social interactions. Engaging games that help them learn to recognize facial expressions might help them in their social functions.

“The motivation for using gaming is that the kids are training themselves. Treatment for kids with autism is expensive. Anything you can do to automate it is attractive,” says Robert Schultz, PhD, director of the Center for Autism Research at the Children’s Hospital of Philadelphia.

In 2000, Schultz created a set of games called “Let’s Face It” to help children on the autism spectrum learn how to better recognize facial expressions and emotions. With his Health Games Research grant, Schultz worked with game developers to create a new suite of more engaging games, “FaceStation,” which he hoped children would play longer than the previous set of games. Schultz also developed and validated a new functional MRI (fMRI) assessment to test for differences in brain activations between children with autism playing games and a control group.

“The key ingredient for these games is playability,” said Schultz. “You want a training regime that is deep—hundreds of hours. Our goal was to get to 50 hours as a start, which would be much more than “Let’s Face It” which kids played for around 15 hours. We wanted to know if the treatment effect would be bigger if the kids played games longer.”
“FaceStation” is a suite of seven computerized Web-based games that include a variety of actors’ facial expressions along with music, all designed to be pleasing, engaging, and motivating. Among the games are:

- **Face Puzzle Fighter**, in which players match similar faces and explode them
- **Face Invaders**, in which players attack aliens identified by their faces
- **T-Rex Trample**, in which players help a small dinosaur outrace a hungry T-Rex by consuming the right faces

Schultz enrolled 34 children with autism in his study, dividing them equally into the intervention and waitlist control groups. Those in the waitlist control group played the games three months after the intervention group.

Children with autism played “FaceStation” an average of 30 hours, or double the number of hours they played “Let’s Face It,” though short of the goal of 50 hours. They showed significant improvements in face recognition skills compared with those in the wait list group who showed no improvement.

The fMRIs of children who played the games showed signals that suggested that the games engaged the reward circuitry of the brain but the effects were too small to be statistically significant, Schultz said.

“We found significant improvements on our primary outcome variable and we’re happy that our games were twice as playable as ‘Let’s Face It.’” Schultz said. “The children got better at discriminating emotion and identifying ‘Who am I and what am I feeling?’”

“We have produced real evidence that is so much more rigorous than anything you would find online for treatment of autism,” Schultz said. “That’s valuable. It’s noninvasive, it doesn’t hurt. There are a lot of crazy therapies for kids with autism that potentially hurt.”

“**Here is an approach that makes common sense, has no side effects, benefits the children, and solves a real problem.**”—Robert Schultz, PhD

Schultz and his colleagues started another study, completed in September 2014, with the University of Minnesota to look at the effectiveness of giving children oxytocin, a drug that may improve social functioning in people with autism, to facilitate social learning through “FaceStation.” Some 30 participants received oxytocin 10 minutes before playing the video games. Schultz hopes to learn whether providing the oxytocin will help children who play these games improve their attention and social interactions. As of January 2015, he was still analyzing the results.
AN ALTERNATE REALITY GAME FOR COLLEGE FRESHMEN

Freshman year in college is notorious for weight gain and slacking off on exercise. Researchers at Indiana University wanted to test whether a game that combined solving a mystery with hunting for clues around campus could help change that.

“Physical activity decreases and weight increases in the first year of college. This is the first time young adults take responsibility for themselves and their decisions are going to set their future behavior,” said Jeanne D. Johnston, PhD, clinical associate professor, at Indiana University’s School of Public Health-Bloomington. “It’s a critical period.”

Johnston brainstormed with her colleagues to come up with a game that focused on physical activity and capitalized on college students’ learning preferences: learning in groups, having fun, and being social. Johnston and her colleagues created an alternate reality game, which involves multiple media to reveal a story and is an interactive narrative that takes place in real time in the real world.

The game, called the “Skeleton Chase,” involves a kidnapped professor and her former teaching assistant. The teaching assistant had become obsessed with a wildflower called a skeleton plant that the professor had used as a key ingredient for a new health drink. As the game unfolds, it becomes clear that the nutrition company that had funded the professor’s research had been illegally testing the new drink on unsuspecting students.

Participating students were part of teams that received new clues each week through their cell phones, the professor’s blog, emails, audios, and videos. Students had to walk to different parts of the 2,000-acre campus to find clues and participate in live events to solve the mystery. Individuals in each team were supposed to complete 50,000 steps per week, measured by accelerometers they wore. If all team members did this, the team got points.

Participating students were from a freshman health course. One section of the course was assigned to the game group while the other sections served as the control group.

“There was a significant increase in physical activity for the game group,” Johnston said. “It went up and stayed up throughout the course. Whereas for the control group, their physical activity decreased much like we would expect. We were able to see a positive impact on the game group’s physical activity.”

Playing the “Skeleton Chase,” however, did not impact weight. “Both groups gained a significant amount of weight,” Johnston said. This indicates the need for another intervention on nutrition for weight maintenance and loss.
Johnston has not continued testing the game. Still, she said that the results hold lessons for other seeking to help college students stay active and avoid the average freshman year weight gain of 15 pounds.

“We can have a positive impact on college students,” she said. “Future studies might want to look at ways to capitalize on games and technology to make an impact on this critical population.”

**CYBERCYCLING IMPROVES OLDER PEOPLE’S COGNITION**

One of the scariest parts of growing older is the specter of dementia. Physical exercise may prevent or delay dementia, yet few older people exercise regularly. In fact, fewer than one in 10 older adults exercise at the recommended levels.

“That’s discouraging,” said Cay Anderson-Hanley, PhD, assistant professor in the department of psychology at Union College, Schenectady, N.Y. “There are benefits of physical activity but how do you get people to engage in them? I started to hear about exergaming and it seemed like a promising area that might help people engage in an activity that is known to be beneficial.”

For her *Health Games Research* project, Anderson-Hanley tested whether virtual-reality enhanced exergames involving cybercycling would be fun and interesting enough to get older people to exercise regularly, and in turn, improve their cognitive functioning. An exergame requires physical exertion as the interface to a video game. Wii Fit and PlayStation Move are examples of popular exergame platforms.

People who use stationary bikes can engage in exergames when they see a screen that puts them into virtual bike trails with interesting scenery, and they race against their own personal best time or they compete in races individually or as a member of a team. The challenge to win the race may motivate cybercyclers to exert themselves more and continue cycling for longer periods of time than they would spend without an exergame to play.

While psychological benefits of cybercycling had been reported, no randomized clinical trial had evaluated the cognitive benefits of virtual reality-enhanced exercise. Anderson-Hanley sought to fill that gap.

She recruited 63 senior volunteers from eight independent living facilities who participated in the study. Researchers randomly assigned the volunteers to ride either a regular stationary bike or a cybercycle equipped with a screen displaying 3-D tours that took them through a virtual landscape along a scenic route past mountains or oceans. Cybercyclers also competed against their last best ride and with other riders on the screen.
Participants rode their stationary bikes on average three times a week for three months. Researchers did cognitive testing on both groups when they enrolled (preintervention), one month later, and three months later (postintervention).

Participants in the cybercycling group had significantly higher scores on tests of certain executive functioning skills than those who rode the traditional stationary bike. Both groups put about the same amount of effort and time into cycling. Executive functioning is the most important cognitive ability for maintaining independence, Anderson-Hanley said.

“There seems to be something special about the body and mind working in sync—that is, watching a virtual reality scene unfold and interacting with it as you pedal and steer the bike.”—Cay Anderson-Hanley, PhD

Anderson-Hanley and colleagues published their findings in the American Journal of Preventive Medicine (2012). The abstract is available online. That same year, readers voted it number three in the Five Most Influential Research Articles Funded by RWJF.

“This study has pushed forward the scientific understanding of the specific exercise factors that might benefit cognition in later life,” Anderson-Hanley added. “There is very solid literature showing that exercise is good for cognition for older people but will people do it? Motivators like exergaming might make good sense.”

In 2013, Anderson-Hanley received a three-year grant from the National Institutes of Health to study older adults with mild cognitive impairment who will cybercycle for six months. She is hoping to learn whether the intervention will slow the decline in cognitive impairment. Anderson-Hanley has also conducted pilot studies on effects of cybercycling on people with schizophrenia and effects of exergaming on people with autism.

“If you chip away at it you can decrease the total number of people who meet the criteria for dementia. That has a huge benefit for the individual, their caregiver, and society as a whole.”—Cay Anderson-Hanley, PhD

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INTERACTIVE VIDEO GAMES TO HELP STROKE PATIENTS

As a physical therapist, Stacy Fritz, PhD, PT, knows that the most effective exercises are the ones that patients actually do. That knowledge made her want to investigate the potential of popular exergames to help her patients who were recovering from a stroke.

“Often times we send people home with exercises that are really boring,” noted Fritz, an associate professor at the University of South Carolina, Arnold School of Public Health. “Patients just don’t want to do them.”

When Fritz learned about the Health Games Research program, she saw it as the perfect opportunity to see if exergames might help people who had had a stroke improve their balance and gait (walking). Selected games played on the Nintendo Wii Fit and the Sony PlayStation 2 consoles seemed ideal to test because they required a lot of weight shifting, which is an important part of regaining balance, Fritz said.

For the project, Fritz recruited 30 participants who had had a stroke an average of three years earlier and had not fully recovered. They were assigned either to a games group that played Nintendo Wii Fit or Sony PlayStation 2 games for 50 to 60 minutes a day, four days a week, over a five-week period, or to a normal activity control group involving no game play. Fritz liked the idea of using off-the-shelf games because if she found that they made a difference in her patients it would be easier to ask them to play the games at home. She also wanted to find out whether the selected Wii Fit games or PlayStation 2 games had better outcomes for patients.

When participants played the games, they did not receive any other form of physical therapy beyond what the games provided. The control group continued with their regular activity. Fritz and her colleagues measured both groups prior to and after the five-week game playing period, and three months after the completion of the study—on their balance, gait, walking, cardiovascular endurance, and perception of recovery.

Fritz found no statistically significant differences between the game group and control group on these measured outcomes and no differences between the two types of games used, but she did find small, marginally significant positive effects of the games on measures of balance, cardiovascular endurance, and perception of recovery. She published her findings in Topics in Stroke Rehabilitation (2013).

“The big take home message is that even though the only intervention was game play, there were positive effects,” Fritz said. “I think it’s pretty exciting that just playing a game makes a difference, even if it’s a small difference.”

Fritz said that her research has borne out the importance of making exercise appealing for patients undergoing physical therapy. “We need to encourage our patients to move more,” Fritz said. “There is a lot of good therapy out there but if they don’t do the exercises, it won’t work. The key is to find out what is most engaging for the participant.”
APPENDIX

Project List

Research on reward circuitry, autism and games that teach social perceptual skills
Children’s Hospital of Philadelphia (Philadelphia, Pa.)
ID# 066727 (September 2009–December 2012) $285,705
  Principal Investigator: Robert T. Schultz, PhD
  (267) 426-7541
  schultzrt@chop.edu

Investigating the impact of feedback in a mobile phone health game using the Mindless Eating Challenge game
Cornell University (Ithaca, N.Y.)
ID# 064440 (May 2008–April 2010) $163,901
  Principal Investigator: Geri Gay, PhD
  (607) 255-7737
  gkg1@cornell.edu

Research on the physical and psychological factors behind effective games for use in inner city school physical education programs
George Washington University, Milken Institute School of Public Health (Washington, D.C.)
ID# 066726 (September 2009–August 2011) $99,829
  Principal Investigator: Todd Miller, PhD
  (202) 994-2572
  tamiller@gwu.edu

Using a Wii Active exergame intervention for clinically overweight and obese low-income African American adolescents
Georgetown University, Children’s Digital Media Center (Washington, D.C.)
ID# 066723 (September 2009–June 2011) $138,089
  Principal Investigator: Sandra Calvert, PhD
  (202) 687-7019
  calvertsl@gmail.com
Evaluating the efficiency of an ultimate reality game for physical activity and healthy lifestyle behaviors in the college-age population
Indiana University, School of Health, Physical Education, and Recreation (Bloomington, Ind.)
ID# 064442 (May 2008–April 2010) $184,398
   Principal Investigator: Jeanne D. Johnston, PhD
   (812) 855-5073
   jdjohnst@indiana.edu

Measuring the efficacy of dance video game training in reducing the risk of falls among patients with Parkinson’s disease
Long Island University (Brookville, N.Y.)
ID# 066720 (September 2009 –August 2011) $287,976
   Principal Investigator: Shaw Bronner, PhD, EdM, PT, OCS
   (718) 246-6377
   sbronner@liu.edu

Studying the effects of family-based video exercise games on families with overweight children
Maine Medical Center (Portland, Maine)
ID# 064436 (May 2008–July 2010) $200,000
   Principal Investigator: Ann E. Maloney, MD
   (207) 885-8138
   malona1@mmc.org

Harnessing group dynamics to boost individual motivation to exercise
Michigan State University (East Lansing, Mich.)
ID# 066718 (September 2009–August 2011) $144,813
   Principal Investigator: Deborah L. Feltz, PhD
   (517) 355-4732
   dfeltz@msu.edu

Short- and long-term effectiveness of exergames for young adults
Michigan State University (East Lansing, Mich.)
ID# 066725 (September 2009–February 2012) $282,527
   Principal Investigator: Wei Peng, PhD
   (517) 432-8235
   pengwei@msu.edu
Developing and testing a game for smokers who would like to quit
Teachers College, Columbia University (New York, N.Y.)
ID# 066721 (September 2009–August 2011) $150,000
    Principal Investigator: Charles Kinzer, MA, PhD
    (212) 678-3344
    kinzer@tc.edu

Studying the effect on senior citizens of virtual team cybercycling on exercise behavior, neuropsychological function and physiological outcomes
Union College (Schenectady, N.Y.)
ID# 064449 (May 2008–December 2010) $199,961
    Principal Investigator: Cay Anderson-Hanley, PhD
    (518) 388-6355
    andersoc@union.edu

Using behavioral choice theory as a framework for understanding how adolescents choose among entertainment games
University of California, San Diego, School of Medicine (La Jolla, Calif.)
ID# 064439 (May 2008–September 2010) $192,818
    Principal Investigator: Gregory J. Norman, PhD
    (858) 457-7296
    gnorman@uscd.edu

Assessing the efficacy of a video game to enhance cognitive health in older adults
University of California, San Francisco (San Francisco, Calif.)
ID# 066724 (September 2009–August 2011) $286,496
    Principal Investigator: Adam Gazzaley, MD, PhD
    (415) 476-2162
    adam.gazzaley@ucsf.edu

Designing and testing an interactive health game as an adjunct to standard treatment for alcoholism
University of Central Florida, College of Medicine (Orlando, Fla.)
ID# 064446 (May 2008–June 2010) $163,177
    Principal Investigator: Marcia L. Verduin, MD
    (407) 823-4067
    mverduin@mail.ucf.edu
Investigating the use of an action video game to improve everyday cognitive functions in older adults
University of Florida, College of Public Health and Health Professions (Gainesville, Fla.)
ID# 064441 (May 2008–July 2010) $94,992
   Principal Investigator: Patricia Da Cunha Belchior, PhD
   (352) 273-6132
   belchior@phhp.ufl.edu

Study on predicting sensory and control effects of console video games in young adults
University of North Carolina at Chapel Hill, Gillings School of Global Public Health (Chapel Hill, N.C.)
ID# 064438 (May 2008–December 2009) $95,685
   Principal Investigator: Deborah F. Tate, PhD
   (919) 966-7546
   dtate@unc.edu

Studying the effects of commercially available interactive video games for individuals with post-stroke chronic mobility and balance deficits
University of South Carolina, Arnold School of Public Health (Columbia, S.C.)
ID# 064450 (May 2008–June 2011) $112,000
   Principal Investigator: Stacy L. Fritz, PhD, PT
   (803) 777-6887
   sfritz@mailbox.sc.edu

Effectiveness of social mobile networked games in promoting active lifestyles for wellness
University of Southern California, School of Cinematic Arts (Los Angeles, Calif.)
ID# 064448 (May 2008–September 2010) $199,053
   Principal Investigator: Marientina Gotsis, MFA
   (310) 760-7606
   mgotsis@cinema.usc.edu

Using physical and virtual robots to increase the effectiveness of health games to encourage physical activity
University of Southern California, Viterbi School of Engineering (Los Angeles, Calif.)
ID# 066719 (September 2009–August 2011) $149,763
Principal Investigator: Maja Mataric, PhD
(213) 740-4520
mataric@usc.edu

Developing and testing a novel respiratory fitness game for children with cystic fibrosis
University of Vermont, College of Medicine (Burlington, Vt.)
ID# 064443 (May 2008–November 2010) $189,772
   Principal Investigator: Peter M. Bingham, MD
   (802) 847-3749
   peter.bingham@uvm.edu

Study to develop and test video games for dietary behavior change and improved glycemic control among diabetics
University of Washington, Information School (Seattle, Wash.)
ID# 064443 (May 2008–November 2010) $192,526
   Principal Investigator: Wanda Pratt, PhD
   (206) 543-6653
   wpratt@u.washington.edu

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Articles


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Websites

[www.cdgr.ucsb.edu](http://www.cdgr.ucsb.edu). Center for Digital Games Research at the University of California, Santa Barbara, contains current information about health games and the broader field of digital games. It also contains the online searchable Health Games Database.

[www.gamesforhealth.org](http://www.gamesforhealth.org). Games for Health Project, provides information about upcoming conferences they will host and news about people and products in the field of games for health.

[www.healthgamesresearch.org](http://www.healthgamesresearch.org). The program’s website was archived in 2013. It contains information on grantees, publications, and other resources.

Twitter Accounts

@bensawyer. This Twitter account of Ben Sawyer includes personal reflections and opinions on digital media and games, and news about events hosted by the Games for Health Project.

@DebLieberman. This Twitter account of Debra Lieberman, who directed *Health Games Research* and currently directs the Center for Digital Games Research, discusses principles of game design for learning and health and it highlights noteworthy games and related research findings.

@gamesforhealth. This Twitter account of the Games for Health Project announces their conferences and presents news about people and products in the games for health field.

@GamesResearch. This Twitter account of the Center for Digital Games Research shares information about products, research publications, events, and other developments in the field of digital media and games, and it announces the center’s news and events.