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SYMPOSIUM

Virtual Reality Technologies for Research and Education in Obesity and Diabetes: Research Needs and Opportunities

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Abstract

The rising rates, high prevalence, and adverse consequences of obesity and diabetes call for new approaches to the complex behaviors needed to prevent and manage these conditions. Virtual reality (VR) technologies, which provide controllable, multisensory, interactive three-dimensional (3D) stimulus environments, are a potentially valuable means of engaging patients in interventions that foster more healthful eating and physical activity patterns. Furthermore, the capacity of VR technologies to motivate, record, and measure human performance represents a novel and useful modality for conducting research. This article summarizes background information and discussions for a joint July 2010 National Institutes of Health – Department of Defense workshop entitled *Virtual Reality Technologies for Research and Education in Obesity and Diabetes*. The workshop explored the research potential of VR technologies as tools for behavioral and neuroscience studies in diabetes and obesity, and the practical potential of VR in fostering more effective utilization of diabetes- and obesity-related nutrition and lifestyle information.

Virtual reality technologies were considered especially relevant for fostering desirable health-related behaviors through motivational reinforcement, personalized teaching approaches, and social networking. Virtual reality might also be a means of extending the availability and capacity of health care providers. Progress in the field will be enhanced by further developing available platforms and taking advantage of VR's capabilities as a research tool for well-designed hypothesis-testing behavioral science. Multidisciplinary collaborations are needed between the technology industry and academia, and among researchers in biomedical, behavioral, pedagogical, and computer science disciplines. Research priorities and funding opportunities for use of VR to improve prevention and management of obesity and diabetes can be found at agency websites (National Institutes of Health: http://grants.nih.gov/grants/guide/index.html; Department of Defense: www.tatrc.org).

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Abbreviations: (3D) three-dimensional, (BMI) body mass index, (HMD) head-mounted display, (SOC) standard of care, (VE) virtual environment, (VR) virtual reality

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Introduction

This article summarizes background information and discussion highlights of a workshop entitled *Virtual Reality Technologies for Research and Education in Obesity and Diabetes* held from July 15–16, 2010. The purpose of the workshop was to explore the research potential of these technologies as tools for behavioral and neuroscience studies in diabetes and obesity, and the practical potential of virtual reality (VR) technology in fostering more effective utilization of diabetes- and obesity-related nutrition and lifestyle information.

The meeting was convened by six institutes and offices of the National Institutes of Health and the United States Army Telemedicine and Advanced Technology Research Center.[1] The co-chairs were Dr. Brian Wansink (Cornell University) and Dr. Albert Rizzo (University of Southern California). Speakers and attendees included university faculty, government program officers, medical professionals in academic and corporate practice, small business and other corporate representatives, and student interns with expertise ranging from endocrinology to videogame development (see **Appendices A**, **B**, and **C**).

Background

In the United States, approximately two-thirds of adults and nearly one-third of children and adolescents 2–19 years are either overweight or obese [for adults, body mass index (BMI) $\geq$25.0; for children, weight for age >85th percentile].[2,3] The prevalence of diabetes (both diagnosed and undiagnosed) is also high; in 2011 over 8% (25.8 million) of the U.S. population had diabetes, with higher rates (27%) among older adults (age 65 years or older).[4] An additional 79 million adults (age 20 years or older) have prediabetes, which is strongly associated with being overweight and obese and is particularly common (50%) in adults 65 years or older. Type 1 diabetes, requiring insulin treatment, is the most common form in children but also accounts for a modest fraction (5%) of cases in adults.[4–7]

Treatment and prevention strategies for diabetes and obesity typically include appropriate energy intake for weight loss or weight maintenance, suitable dietary macronutrient distribution, physical activity, medication, improved sleep habits, and in some cases bariatric surgery.[8,9] Successful implementation requires sustained behavioral changes, a high level of self-monitoring, and adherence to medication if prescribed. This is difficult, however, to achieve. For example, the American Heart Association has identified a panel of seven health behaviors (no smoking, BMI within healthy range, physical activity, and diet according to guidelines) and health factors (total cholesterol, blood pressure, and fasting blood glucose within guidelines) whose achievement at ideal levels represents a state of minimal cardiovascular risk.[10] However, only 5% of the U.S. population has achieved ideal levels for all elements of "Life's Simple 7."[10] Adherence to medication regimens lowers the risk of adverse outcomes, but non-adherence rates can be high (20–80%); for patients with diabetes, approximately one-third do not follow prescribed treatments.[11]

Socioeconomic and educational issues pose additional barriers. For example, successful glycemic control requires considerable text literacy (reading), numerical literacy (numeracy), and health literacy skills that many patients may not have.[12,13] Even coronary heart disease patients, who likely would benefit from cardiac rehabilitation therapy, often do not adhere to exercise recommendations.[14] Overall, the learning and application of complex information,[15] time and cost constraints, psychosocial factors, educational skills, and other issues make adoption of recommended behaviors and treatments challenging for health care providers, patients, and healthy individuals who wish to lower their risk.

Virtual Reality: A New Approach for Research and Education in Diabetes and Obesity

Virtual reality technology allows for the creation of controllable, multisensory, interactive, three-dimensional (3D), stimulus environments, within which human performance can be motivated, recorded, and measured, and offers clinical assessment and intervention options that are not possible using traditional methods.[16–19] Much as an aircraft simulator can serve to test and train piloting ability under a variety of controlled stimulus conditions, VR can be used to create relevant simulated environments that allow for the assessment and treatment of cognitive, emotional, and motor functioning. However, VR is not defined or limited by any one technological approach or hardware set-up. The creation of a virtual reality user experience can be accomplished using combinations of a wide variety of interaction devices and sensory display systems, and in the design of content presented in a computer-generated graphic world.

For example, immersive VR (http://journalofdst.org/March2011/media/5-212-v1.html) combines computers, head-mounted displays (HMDs), body-tracking sensors, specialized interface devices, and real-time graphics to immerse a participant in a computer-generated simulated world that changes in a natural way with head and body motion. In these systems, one of the key aims is to replace the outside world perceptually with that of a simulated environment (delivered within a HMD) to create a specific user experience. Immersive VR has been most commonly employed in applications where a controlled stimulus environment is desirable for constraining a user's perceptual experience within a specific synthetic world. This format has been used often in clinical VR applications for anxiety disorder exposure therapy,[20–28] analgesic distraction for patients suffering from acutely painful medical procedures,[29,30] and in the cognitive assessment of children with attention deficit hyperactivity disorder within a virtual classroom to measure performance under systematically delivered task challenges and distractions.[25,31–33] Some applications take advantage of simulated online worlds with functional representations (avatars) of humans and animals.[34]

By contrast, nonimmersive VR is commonly experienced using modern computer and console games systems (http://journalofdst.org/March2011/media/5-212-v2.html). This format presents a 3D graphic environment on a flatscreen monitor or television (no real-world occlusion) within which the user can navigate and interact. Albeit delivered on a less immersive display, such graphic worlds are still essentially a virtual reality environment.[35] Though less immersive, virtual environments (VEs) presented on widely available commodity display systems have the capacity to provide the user with significant options for interaction with dynamic digital content using traditional computer and game interface devices (e.g., keyboard, mouse, game pads, joysticks, etc.). The use of such ubiquitous display and interface devices has promoted widespread access to this form of nonimmersive interactive media, mainly in the domain of entertainment. Moreover, researchers have investigated the value and usability of commercially available interaction devices and methods that can be used with flatscreen-delivered VEs that can allow users to interact with digital content using more naturalistic body actions beyond what is possible with traditional game interfaces (e.g., Konami Dance Dance Revolution, Sony EyeToy, Nintendo Wii, Microsoft Kinect, etc.).[36,37] Virtual reality gaming technologies are now also being applied to preventive health and chronic disease management.[38]

Virtual reality technology might prove a useful tool for producing sustainable behavior change to manage weight. However, with the exception of one laboratory's work on clinical eating disorders (anorexia, binge eating),[39] VR applications for common weight control factors such as food selection, portion control, and cued eating represent a nascent research area. More work has been done on VR as a modality to encourage physical activity for children and in the rehabilitation setting.[38,40–42] The technology could be used to complement motivational interviewing, enhance motivation, assess emotional states of readiness for behavioral change, and help subjects manage their emotional reactions to food choices.[43,44] Visual presentations could assist subjects in adjusting distorted assessments of portion sizes, correcting unrealistic expectations of the rate of weight loss, managing adverse sensory experiences from behavior change (such as hunger from altered consumption patterns or delayed muscle soreness from unaccustomed exercise), and navigating complex food environments such as grocery stores,[45] restaurants,[46] and household food pantries.[47] Reinforcement and encouragement of the positive aspects of food choice and eating behaviors represent another potentially useful venue for VR.[48,49] Virtual reality could also be used as part of patient visits to personalize treatment[50] and improve adherence to diet, exercise, medication, and self-monitoring regimens.[51]

Virtual reality technology also presents new opportunities to apply advances in sleep research in relation to obesity and diabetes risk. Insufficient sleep (sleep deficiency) and poor sleep behaviors, including sleep-disordered breathing, have been causally linked with disordered endocrine and appetite regulation and with risk of metabolic syndrome, diabetes, hypertension, and clinical cardiovascular disease.[52,53] On average, U.S. adults and teens fall 2–3 hours short of their physiological requirements of 8 and 9 hours, respectively. Thus, many people are functioning in a chronic state of sleep-deprivation and circadian phase misalignment, akin to self-induced jet lag. Virtual reality could be used to evaluate individual sleep and alertness status objectively, deliver personalized guidance on healthy sleep behaviors, and implement and assess outcomes of physician-recommended treatments such as positive airway pressure devices and light therapy. Sleep parameters amenable to study with VR include sleep duration, timing, and quality; physical, perceptive, and affective aspects of sleepiness (e.g., cognizance of sleepiness and fatigue, self-monitoring of sleep habits, ocular markers of sympathetic tone); and sleep deprivation consequences (slower reaction times and impairments in memory, cognition, emotional processing, judgment, and decision-making).[54,55]

Virtual reality has unique and valuable characteristics as a research tool. One advantage is that the VR approach can simultaneously deliver an intervention and collect data on how it is utilized, particularly with regard to the cognitive and emotional processes involved. The virtual environments can be designed to address specific hypotheses, and detailed data on the study participant's response to the intervention can be collected without additional intrusiveness. Virtual reality environments can be used to study cue responsiveness and extinction through virtual exposure, which has been used in the study of phobias and addictions. Visual presentations can be tailored to the user, along with therapeutic guidance to modify affective reactions and choices, and can prepare the user for future real-world encounters, thus making VR suitable for role-playing and training. Performance feedback, an essential component of learning and skill acquisition, can occur in real time; thus, VR can be used as a teaching tool and also to study cognitive processing of information presented in increasingly complex (hierarchical) environments, a research approach that typically is impractical in real-world settings. Also, the capability to distribute identical virtual environments across multiple locations gives new meaning to the concept of multisite data collection. For VR applications addressing issues of dietary assessment and metabolic risk management, a particular challenge is the lack of food and nutrient databases with suitable accessibility, information content, and programming architecture.[56]

Workshop Discussion Highlights: Research Challenges and Opportunities

Presentations in the first part of the meeting addressed public health and behavioral challenges related to diet, exercise, and diabetes management; the scientific basis of learning and treatment adherence; and advances in VR applications for health promotion and disease management, including 3D computer simulations, video games, and simulated social environments. Discussion groups then considered study design issues and identified priorities for research in five potential areas of impact: motivating the desire for change, instilling healthier eating patterns, visualizing physical activity, managing daily life with diabetes, and improving clinical effectiveness.

Speakers raised the possibility that VR versions of traditional interventions may reinforce and enhance motivation for treatment, particularly among adolescents and young adults, since VR provides an opportunity to match interventions to various "ages and stages." Systems that encouraged goal-setting, monitored behavior, and provided regular feedback and rewards were considered important for motivating behavior change. Weight management education could potentially be embedded in existing video games and other consumer-based VR products.

Virtual reality has been studied in patients with eating disorders to modify distorted perception of body image and could be used similarly in obesity. Virtual reality could also provide a virtual support system to those with obesity and/or diabetes via virtual social networks, including children with diabetes who feel isolated and different because of their disease. Virtual reality could encourage family interactions in an environment where parents and children could more easily work on diabetes management concerns. Social network environments could provide credits for healthy eating and engaging in regular physical activity and other health-enhancing behaviors (such as smoking cessation and good sleep habits). These virtual social networks were considered to be applicable to extending health care provider services. In addition to using VR to train health care providers in weight and diabetes management, VR social networks could be used by subjects and providers to deliver interventions between visits and in a more accessible manner, particularly for those patients with transportation or mobility barriers. Using similar methodology as that used for anxiety disorders and substance abuse, VR cue exposure could be used to evaluate the effects of various cues on perceived hunger, food intake, and physical activity, and retrain the emotional and behavioral responses to these cues.

Challenges related to the accessibility, availability, and use of VR applications were noted. Virtual reality applications need to be easy to use and intuitive, even for older populations or for those with low vision and other sensory/physical disabilities. Technologies should accommodate user populations and study participants having low health literacy; VR is potentially a useful approach for understanding how health and nutrition information is processed and used by these groups. Cautions include the need to minimize the possibility that messages embedded in the technology might appear manipulative, controlling, or prescriptive, rather than facilitative. In addition, the potential for adverse effects (such as lack or loss of social skills through displacement to VR or dysfunctional avatar transference) needs to be understood. Usage costs such as purchase and maintenance expenses and time burden (amount of time spent in use, convenience of scheduling of interventions or sessions) need to be evaluated in various settings (research or private use; home, health care facility, school). Participants specifically noted the difference between television screen time, in which eating and drinking are common, and VR screen time, in which hand controls minimize opportunities to eat.

Other study design and methodology challenges that must be addressed when conducting rigorous VR efficacy and effectiveness studies are listed in **Table 1**. The computer gaming industry was noted to be a rapidly advancing, economically robust sector with enormous potential for health-related research and behavior change. Researchers need to document and evaluate currently available off-the-shelf programs because many projects can be conducted that take advantage of already existing tools, games, and software.

Priority topics for research and technology development and evaluation identified by the workshop discussion groups are summarized in **Table 2**. These include studies on the use of VR to develop and enhance individual, family, and community-level skills that foster desirable eating, physical activity, and other health-related behaviors; the representational capacity of VR to enhance motivation and learning and to serve as a teaching tool; the social networking capabilities of VR; VR as a modality to train and extend availability and capacity for physicians and other health care providers; and pain distraction, motivation enhancement, and balance training using immersive visual environments, haptic systems (simulated tactile feedback), and other VR modalities in supervised rehabilitation exercise therapy.

In summary, there has been very little development of VR as a modality for obesity and diabetes studies. For example, the National Institutes of Health has supported only a relatively small number of research projects using VR technologies, primarily for studies in neuroscience, mental health, sensory deficits, post-stroke rehabilitation, and use of online worlds for diabetes management.[57] The Department of Defense has a more developed VR portfolio particularly in treatment of posttraumatic stress disorder and post-amputation rehabilitation.[7] Progress in the field will be enhanced by multidisciplinary collaborations between the technology industry and academia, and among researchers with diverse expertise in biomedical sciences (such as endocrinology, nutrition, and exercise physiology), behavioral sciences, pedagogical disciplines, and computer sciences. There is a need for both developmental research leading to new technologies and potentially commercializable products as well as research that provides a venue for well-powered effectiveness trials of new interventions. Funding Opportunity Announcements and other related information on National Institutes of Health and Department of Defense research priorities are listed in **Table 3**.

Table 1.
Study Design Elements and Methodology Issues in Virtual Reality Research

Appropriate control groups and control conditions
Appropriate outcome measures, including clinical endpoints and surrogate markers
Ethical issues raised by different study designs such as direct comparison designs [Standard of Care (SOC) vs VR] and additive designs (SOC vs SOC+VR)
Effects of participant traits (such as age, literacy and numeracy level, motivation, and other cognitive and psychosocial traits) and previous gaming experience on technology usability and study outcomes
Well-defined metrics for assessment of interventions and outcomes, including actual as well as intended VR dose
Identification of suitable VR platforms for specific interventions
Development of VR research tools that could be used in group or multisite formats (e.g., classrooms)
Development of methods for mining data from existing health games for research purposes
Appropriate study population (by age, health condition, psychological status, education, or literacy level, etc.)

Table 2.
Priority Topics for Research and Technology Development and Evaluation

Using VR to Foster Desirable Eating, Physical Activity, and Other Health-Related Behaviors
• Making smarter eating choices in various locations (such as home, restaurants, school cafeteria) • Training for more healthful food purchasing and food use decisions (including shopping lists, budgeting, menu planning, and food preparation skills) • Counteracting food marketing efforts • Assisting parents in teaching small children better eating habits (e.g., eat at table, eat variety of foods, try new foods, eat fruits and vegetables) • Training in portion size effects on weight gain and loss • Retraining conditioned emotional and behavioral responses to food and eating contexts (cue-exposure of unhealthful foods or contexts where unhealthful eating behaviors occur) • Assessing reliability and outcomes of existing health games or serious games • Improving self-efficacy by VR-guided practice of desired behaviors, including role-playing, scenario navigation, and presentation of information matched to individual learning style and motivational factors • Evaluating genetic/familial influences on perception of portion size and other visual dimensions of food availability/appearance in relation to food choices, caloric intake, and satiety • Evaluating and modifying sleep patterns and behaviors, especially in relation to diet, physical activity, and other aspects of obesity and diabetes prevention and management
Utilizing Motivational and Teaching Aspects of VR Technology
• Embedding obesity and diabetes education and motivation in existing VR games and systems • Using VR to make behavior change more reinforcing and participatory • Monitoring behavior and providing individualized feedback, including rewards and goal-setting • Understanding the cognitive processes involved in learning and applying health- and nutrition-related information • Understanding the short-term vs long-term motivational aspects of VR, including attenuation of novelty and how this influences effectiveness and adherence • Understanding determinants of decision processes involved with acceptance, adoption, maintenance, and other aspects of good vs poor adherence to prevention and treatment regimens for obesity and diabetes • Understanding the role of external visual cues in providing reinforcement and motivation for exercise and increased daily physical activity in sedentary patients with diabetes or obesity or in patients needing cardiovascular exercise rehabilitation • Understanding components of cue responsiveness in diabetes and obesity management skills under environmental conditions of increasing complexity • Understanding cognitive processing of written vs visual presentations of health and nutrition information in obese or diabetes patients with low print or numerical literacy skills.
Using VR to Extend the Availability and Capacity of Health Care Providers
• Establishing extended classrooms for diabetes education • Providing less threatening and more accessible behavioral coaching for children • Enhancing displays and presentations of patient data for review by health care providers • Providing clinician training in how to counsel subjects on weight management • Understanding and modifying social bias factors in health care interactions with obese patients
Using VR to Motivate by Fast-Forwarding to the Future
• Illustrating how changes in physical activity or diet will lead to changes in weight and body size • Using avatars or intelligent agents to show consequences of unhealthful behavior and to model healthful behavior • Understanding characteristics of avatars that modify effectiveness of interventions, including the degree to which they must be sufficiently similar to how user views self • Modifying perception of body image and other aspects of appearance • Modeling effects of changes in community food choice availability and built environments on weight, physical activity, health, and illness
Utilizing Social Network Capabilities of VR
• Evaluating impact of social network systems with reward systems (points or credits) for desirable health-related behaviors (buying or eating healthful foods, engaging in physical activity, improving sleep habits, improving diabetes self-monitoring) • Exploring how social context affects competitive or collaborative activities • Providing and evaluating family interventions • Evaluating usefulness of VR for social support for diabetes

**Table 3.
Funding Agencies and Funding Opportunity Announcements**

Department of Health and Human Services, National Institutes of Health
• National Heart, Lung, and Blood Institute (www.nhlbi.gov) • NIH Guide to Grants and Contracts (see http://www.nih.http://grants.nih.gov/grants/guide/index.html)
Department of Defense, U.S. Army Medical Research and Materiel Command
• Telemedicine and Advanced Technology Research Center (www.tatrc.org) • USAMRMC Broad Agency Announcement (BAA) 10-1 (see http://www.tatrc.org/?p=funding_baa)

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Appendix A. Workshop Planning Committee

National Institutes of Health, Bethesda, Maryland

National Heart, Lung, and Blood Institute: Abby G. Ershow, Sc.D. (Committee Chair), Timothy Baldwin, Ph.D., Susan Czajkowski, Ph.D., William T. Riley, Ph.D., Pothur Srinivas, Ph.D.

National Cancer Institute: Jill Reedy, Ph.D., David Portnoy, Ph.D., M.P.H.

National Institute on Aging: Judy Hannah, Ph.D., Lyndon Joseph, Ph.D., Chhanda Dutta, Ph.D.

National Institute of Diabetes and Digestive and Kidney Diseases: Mary Evans, Ph.D., Sandy Garfield, Ph.D.

Eunice Kennedy Shriver National Institute of Child Health and Human Development: Lynne Haverkos, M.D., M.P.H.

Office of Behavioral and Social Sciences Research: Deborah Olster, Ph.D.

Office of Research on Women's Health: Lisa Begg, R.N., Dr. P.H.

Center for Scientific Review: Nancy Sheard, Ph.D., R.D.

National Science Foundation, Arlington, Virginia

Science of Learning Centers Program: Joan Straumanis, Ph.D.

U.S. Army, Telemedicine and Advanced Technology Research Center, Fort Detrick, Maryland

Sylvain Cardin, Ph.D., COL Karl Friedl, Ph.D., Charles M. Peterson, M.D., M.B.A.

Ex Officio

David Klonoff, M.D., Diabetes Technology Society

Albert "Skip" Rizzo, Ph.D., University of Southern California (Workshop Co-Chair)

Brian Wansink, Ph.D., Cornell University (Workshop Co-Chair)

Appendix B. Workshop Speakers

Albert "Skip" Rizzo, Ph.D., University of Southern California, Marina del Rey, California (Co-Chair)

Brian Wansink, Ph.D., Cornell University, Ithaca, New York (Co-Chair)

Abby G. Ershow, Sc.D., National Heart, Lung and Blood Institute, Bethesda, Maryland (Project Officer)

Tom Baranowski, Ph.D., Baylor University, Houston, Texas

Patrick Bordnick, M.P.H., Ph.D., University of Houston, Houston, Texas

Ray Burke, Ph.D., Indiana University, Bloomington, Indiana

William Clarke, M.D., University of Virginia, Charlottesville, Virginia

Judy Deutsch, Ph.D., P.T., University of Medicine and Dentistry of New Jersey, Newark, New Jersey

Sheryl Flynn, Ph.D., Blue Marble Rehabilitation, Inc., Altadena, California

Geri Gay, Ph.D., Cornell University, Ithaca, New York

Andrea Grimes Parker, Ph.D., Georgia Institute of Technology, Atlanta, Georgia

Walter Greenleaf, Ph.D., InWorld Solutions, Palo Alto, California

Rachel Jones, Ph.D., University of Utah, Salt Lake City, Utah

Kanav Kahol, Ph.D., Arizona State University, Tempe, Arizona

Belinda Lange, Ph.D., University of Southern California, Marina del Rey, California

Ernie Medina, Dr.P.H., MedPlay Technologies, Loma Linda, California

Alma S. Merians, Ph.D., P.T., University of Medicine and Dentistry of New Jersey, Newark, New Jersey

Jackie Morie, Ph.D., University of Southern California, Marina del Rey, California

Susan Persky, Ph.D., National Human Genome Research Institute, National Institutes of Health, Bethesda, Maryland

Guiseppe Riva, Ph.D., University of Milan, Milan, Italy

Ben Sawyer, Digitalmill, Inc., Portland, Maine

Bonnie Spring, Ph.D., Northwestern University, Chicago, Illinois

Joan Straumanis, Ph.D., National Science Foundation, Arlington, Virginia

MAJ Brett Talbot, M.D., Telemedicine and Advanced Technology Research Center, Fort Detrick, Maryland

COL Robert Vigersky, M.D., Walter Reed Medical Center, Washington, District of Columbia

Appendix C. Workshop Agenda

Virtual Reality Technologies for Research and Education in Obesity and Diabetes

July 15–16, 2010

Pooks Hill Marriott, Bethesda, Maryland

Sponsors:

National Heart, Lung, and Blood Institute, National Institutes of Health

Telemedicine and Advanced Technology Research Center, Department of Defense

Office of Behavioral and Social Science Research, National Institutes of Health

National Cancer Institute, National Institutes of Health

National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health

Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health

Office for Research on Women's Health, National Institutes of Health

Thursday, July 15

7:30 a.m. Registration

8:30 a.m. Welcome; Meeting Goals; Overview of NIH Support of VR Research
Abby Ershow, Sc.D., Division of Cardiovascular Sciences, NHLBI

Session I: The Challenges

8:45 a.m. Changing Eating and Activity Behaviors
Brian Wansink, Ph.D., Cornell University

9:15 a.m. Managing Diabetes in Adults
COL Robert Vigersky, M.D., Walter Reed Medical Center

9:45 a.m. Managing Diabetes in Children
William Clarke, M.D., University of Virginia

10:15 a.m. Break

Session II: Approaching the Problems

10:45 a.m. The Science of Learning: Breaking News
Joan Straumanis, Ph.D., National Science Foundation

11:15 a.m. Addressing Adherence
Bonnie Spring, Ph.D., Northwestern University

Session III: Learning about Virtual Reality

11:45 a.m.	Introduction to VR Technologies Skip Rizzo, Ph.D., University of Southern California
12:15 p.m.	Department of Defense Support of VR Research MAJ Brett Talbot, M.D., Telemedicine and Advanced Technology Research Center
12:30 p.m.	Lunch

Session IV: Virtual Reality Sampler

1:30 p.m.	Gaming and Exer-Gaming Belinda Lange, Ph.D., University of Southern California
1:45 p.m.	Gaming and Exer-Gaming Sheryl Flynn, Ph.D., Blue Marble, Inc.
2:00 p.m.	Online Worlds and Mobile Social Network Devices Jackie Morie, Ph.D., University of Southern California
2:15 p.m.	VR and Telemedicine Systems for Prevention, Wellness, and Clinical Intervention Walter Greenleaf, Ph.D., InWorld Solutions
2:30 p.m.	Motivation and Self-Monitoring: VR/Addiction and Virtual Humans Patrick Bordnick, M.P.H., Ph.D., University of Houston
2:45 p.m.	Virtual Reality-Augmented Mobility Judy Deutsch, Ph.D., P.T., University of Medicine and Dentistry of New Jersey
3:00 p.m.	Haptic Systems: Interactive Biomedical Devices & Virtual Hospitals Kanav Kahol, Ph.D., Arizona State University
3:15 p.m.	Haptic Systems for Physical Therapy Alma S. Merians, Ph.D., P.T., University of Medicine and Dentistry of New Jersey
3:30 p.m.	Break

Session V: State of the Art: Keynote Lecture

4:00 p.m.	Keynote: Treating Eating Disorders With VR Giuseppe Riva, Ph.D., University of Milan

Session VI: State of the Art: Diabetes and Obesity Applications Sampler

4:30 p.m.	Overcoming Provider Bias in Counseling Obese Patients Susan Persky, Ph.D., National Human Genome Research Institute, NIH
4:45 p.m.	Behavioral Science in Video Games for Children's Diet and Physical Activity Change Thomas Baranowski, Ph.D., Baylor University
5:00 p.m.	Avatars for Improving Children's Eating Habits Geri Gay, Ph.D., Cornell University
5:15 p.m.	Break

5:30 p.m. Poster and Exhibit Reception: Interacting With Virtual Reality Technologies

6:30 p.m. Adjourn

Friday, July 16

8:30 a.m. Day 1 Review
Skip Rizzo, Ph.D., University of Southern California
Brian Wansink, Ph.D., Cornell University

Session VII: Building Virtual Reality Synergy

8:45 a.m. VR Simulations for Shopper Marketing Research
Ray Burke, Ph.D., Indiana University

9:15 a.m. Simulated Shopping Exercises
Rachel Jones, Ph.D., Utah State University

9:30 a.m. Celebratory Technology for Food and Eating
Andrea Grimes, Georgia Institute of Technology

9:45 a.m. Games for Health: Serious Games, Hopelab, Ruckus Nation
Ben Sawyer, Digitalmill, Inc.

10:15 a.m. Health Intervention Research Using VR Technologies
Ernie Medina, Dr.P.H., MedPlay Technologies

10:30 a.m. Break

Session VIII: Advancing the Field

10:45 a.m. Envisioning the Virtual Future: Breakout Groups
Impact Area 1: Motivating the Desire for Change
Impact Area 2: Instilling Healthier Eating Patterns
Impact Area 3: Visualizing Physical Activity
Impact Area 4: Managing Daily Life with Diabetes
Impact Area 5: Upgrading Clinical Effectiveness

12:15 p.m. Lunch

Session IX: Next Steps

1:00 p.m. Highlights from Breakout Groups

2:30 p.m. Summary

3:30 p.m. Adjournment