Advances in technology offer both great promise to improve diabetes care delivery and potentially some interesting threats. Behavioral theory can help us to better understand how technology may improve patient outcomes and what we need to consider as we decide to integrate technology in treatment and care delivery. There are at least 6 ways that integrating technology can make a contribution: 1) enhancing sustainability of health-based behavioral interventions, 2) Obtaining frequent, objective measures of behavior, 3) Identifying the influence of individual treatment components that comprise a treatment package, 4) Enhancing cost-effectiveness of treatment, 5) Incorporating behavior analysis in the creation of consumer-based applications (apps) and 6) Reducing barriers to access and health disparities. The advantages and disadvantages of consumer directed apps are discussed and the values of using theoretical models in developing technology supported approaches to therapy are described.

References:

Novel Technologies for Promoting Behavior Change: What do we need to think about?

David G Marrero, PhD
Director, Diabetes Translational Research Center
Indiana University School of Medicine

The Assumption….
- The leading causes of morbidity and mortality are increasingly modifiable lifestyle factors
- Behavior analysts have the opportunity to promote health by combining effective behavioral methods with technology

The promise of technology…
- Increasing evidence that behaviorists can impact health behavior through the development and implementation of technology-based interventions.
- Technological innovations:
  - wearable sensors
  - devices to transmit patient data
  - mobile devices for support, education, and training
  - real-time access to therapeutic interventions via information technology

The potential of technology….
- The potential of such technology lies in its ability to permit “hovering” (i.e., real-time monitoring) of patients’ behavior during the everyday activities during which choices about health are typically made

The potential threat of technology….

Diabetes is not a “potent” behavioral paradigm:
- Positive versus negative reinforcement
  - Personal reinforcers
  - Social reinforcers
  - The role of punishers
  - Moms and hypoglycemia
  - Inability to sense high glucose levels

What can behavioral theory tell us about technology usability?
The problem through a behavioral lens...

- A behavior analytic approach to health holds that health behaviors are operant (i.e., voluntary behaviors that are determined primarily by their consequences)
- Some behaviors offer positive consequences in the short term, but can be harmful if such patterns persist long-term
- Abstaining from some behaviors may have punishing consequences in the short term, but offer benefits in the future

So how do we integrate technology?

- Enhancing sustainability of health-based behavioral interventions
- Obtaining frequent, objective measures of behavior
- Identifying the influence of individual treatment components that comprise a treatment package
- Enhancing cost-effectiveness of treatment

Integrating technology 2...

- Incorporating behavior analysis in the creation of consumer-based applications
  - “apps”
- Reducing barriers to access and health disparities

Enhancing Sustainability and Maintaining Treatment Gains

- Behavioral techniques have been established as an effective approach to promoting behavior change
  - the extent to which new behaviors endure remains a challenge
- Technology-based behavioral models can be embedded in more sustainable platforms
  - Maintenance of treatment gains may be accomplished by shifting from the delivery of the contrived consequences to more natural consequences (e.g., social reinforcers)

An example

- Enlisting social groups to detect and reinforce health behaviors using technology-based systems
  - Fitbits; uploads automatically-generated data to an individual's computer or smartphone.
  - The individual can then join online communities, with which he or she can share and receive social praise for his or her physical activity data and earn “badges” or other consequences.

Collecting Objective Measures of Behavior

- A hallmark of behavior analytic treatments is obtaining objective measures of target behaviors
  - These measures may be discrete instances of behavior (e.g., taking a medication) or byproducts of behavior (e.g., A1c) on which reinforcement is contingent
- Technology offers major advantages in the frequent collection of these measures and protect their integrity
A few examples…

- MEMs caps and med adherence
- Accelerometers and physical activity
- CGM and memory glucose meters
- Dietary trackers
- Patient Portals

Identifying the Effectiveness of Individual Treatment Components

- Most interventions are actually treatment packages, and the extent to which specific components contribute to their efficacy is often unclear.
  - Example: Diet regulation:
    - Food tracking
    - Fat or calorie restriction
    - Prescribed diet vs. adjustment of eating strategy
    - Social linkages

Evaluating cost-effectiveness

- Does the cost justify the potential impact?
  - Example: the case for using genetics to assess risk for developing type 2 diabetes
  - Is there a population in which costs are justified?
    - Women with GDM and their children….

Integrating Behavioral Analysis and Consumer-base Apps

- Lots of Apps out there; more than 8000 health Apps
  - Several that address behavioral health (e.g., anxiety, depression, PTSD, physical activity, diet, alcohol use)

Advantages

- Broad reach through smartphones; fast dissemination (WW example)
- Provide training support cheaply
- Flexibility in use: geared to the user’s schedule
- Can address willingness to engage in formal programs
- Health disparities and specific population reach
  - E.g., Stoops et al. (2009) developed an internet-based smoking cessation intervention that was feasible, efficacious, and well-liked among rural Appalachian smokers.
- Cost

Disadvantages

- Quality control:
  - Who developed and why?
  - Many are not grounded in empirically supported principles of behavior or reflective of public health recommendations
- Tailoring and individual responsiveness
- Need to be connected to a specific technology
Value of using theory in building technology

- The two behavior change techniques that are associated with the greatest changes in behavior are stress management and general communication skills training.
- Both techniques influence behavior change indirectly via mechanisms such as:
  ◦ facilitating problem-solving
  ◦ promoting self-efficacy
  ◦ diminishing the impact of stressors that may prevent behavior change

Value of theory…..

- Emotional control training was less effective in promoting behavior change.
- Of the 11 interventions (45%) that incorporated emotional control training, 5 reported negative effect sizes on behavior.
- In many of these interventions they simply included “strategies to manage mood” or “information on ... dealing with relationships and feelings.”
- In contrast, stress management training tended to be more intensive.

Their conclusion

- “The findings suggest that the effectiveness of Internet-based interventions is associated with more extensive use of theory (in particular the use of the theory of planned behavior), inclusion of more behavior change techniques, and use of additional methods of interacting with participants (especially text messages).”

Ok, so why use technology?

- Ability to embrace real-time, longitudinal assessment of behavior in naturalistic settings.
- With technology, the range of populations and behavior problems can be broadened substantially.

Why technology?

- Technology can produce new environment-behavior relations by arranging virtual communities and social media and/or by capitalizing on powerful observation, recording and feedback technologies.

Thank You!