VIEWPOINT

Wearable Devices as Facilitators, Not Drivers, of Health Behavior Change

Mitesh S. Patel, MD, MBA, MS
Philadelphia VA Medical Center, University of Pennsylvania, Philadelphia.

David A. Asch, MD, MBA
Philadelphia VA Medical Center, University of Pennsylvania, Philadelphia.

Kevin G. Volpp, MD, PhD
Philadelphia VA Medical Center, University of Pennsylvania, Philadelphia.

Corresponding Author: Mitesh S. Patel, MD, MBA, MS, 423 Guardian Dr, Blockley Hall, 12th Floor, Philadelphia, PA 19104 (mpatel@upenn.edu).

Several large technology companies including Apple, Google, and Samsung are entering the expanding market of population health with the introduction of wearable devices. This technology, worn in clothing or accessories, is part of a larger movement often referred to as the "quantified self." The notion is that by recording and reporting information about behaviors such as physical activity or sleep patterns, these devices can educate and motivate individuals toward better habits and better health. The gap between recording information and changing behavior is substantial, however, and while these devices are increasing in popularity, little evidence suggests that they are bridging that gap.

Only 1% to 2% of individuals in the United States have used a wearable device, but annual sales are projected to increase to more than $50 billion by 2018.[1] Some of these devices aim at individuals already motivated to change their health behaviors. Others are being considered by health care organizations, employers, insurers, and clinicians who see promise in using these devices to better engage less motivated individuals. Some of these devices may justify that promise, but less because of their technology and more because of the behavioral change strategies that can be designed around them.

Most health-related behaviors such as eating well and exercising regularly could lead to meaningful improvements in population health only if they are sustained. If wearable devices are to be part of the solution, they either need to create enduring new habits, turning external motivations into internal ones (which is difficult), or they need to sustain their external motivation (which is also difficult). This requirement of sustained behavior change is a major challenge, but many mobile health applications have not yet leveraged principles from theories of health behavior.[2]

Feedback loops could be better designed around wearable devices to sustain engagement by using concepts from behavioral economics.[3] Individuals are often motivated by the experience of past rewards and the prospect of future rewards. Lottery-based designs leverage the fact that individuals tend to assign undue weight to small probabilities and are more engaged by intermittent variable rewards than with constant reinforcement. Anticipated regret, an individual's concern or anxiety over the reward he or she might not win, can have a significant effect on decision making. Feedback could be designed to use this concept by informing individuals what they would have won had they been adherent to the new behavior. Building new habits may be best facilitated by presenting frequent feedback with appropriate framing and by using a trigger that captures the individual's attention at those moments when he or she is most likely to take action.

Identifying and Addressing the Gaps

Using wearable devices to effectively promote health behavior change is a complex, multistep process. First, a person must be motivated enough to want a device and be able to afford it; this is a challenge, because some devices can cost hundreds of dollars. Perhaps for these reasons, wearable devices seem to appeal to groups that might need them least. In a survey of wearable device users, 75% described themselves as "early adopters of technology," 48% were younger than 35 years, and 29% reportedly earn more than $100 000 annually.[4] The individuals who might have the most to gain from these devices are likely to be older and less affluent. To better engage these individuals, wearable devices must be more affordable, or new funding mechanisms are needed. For example, employers and insurers might pay for a device that helps individuals better adhere to their medications, potentially yielding significant downstream health care savings. Or, devices that demonstrate effectiveness could be financed in a manner similar to that for prescription drugs.

Second, once a device is acquired, a person needs to remember to wear it and occasionally recharge it—additional behaviors required from individuals who may have a difficult time already. Many wearable devices require data to be sent to a phone or computer, adding additional steps and more equipment. According to one survey (n = 6223), more than half of individuals who purchased a wearable device stop using it and, of these, one-third did so before 6 months.[5] One potential solution might be to better leverage smartphones; most people with these phones carry them often. Ideally, using a smartphone does not require any effort beyond setup—like an app that gets its power from the phone that people are already accustomed to regularly charging. Because data can be transmitted passively via a cellular connection, there is no need for individuals to actively update their data. Although smartphones are expensive, many people already have them, and the reach of these devices is increasing.

Third, the device must be able to accurately track its targeted behavior. Accelerometers, commonly found within wearable devices, have been well studied for tracking step counts. However, newer technologies, such as those that measure heart rate or sleep patterns, have not been well validated. Similar to mobile health applications, the increase in the availability and types of wearable devices has not been matched by appropriate testing or oversight to make sure they work.[6] Wearable devices are unlikely to have the same capabilities as home devices that measure blood pressure or track medication adherence. However, a smartwatch may facilitate feedback from these devices, forming a better

feedback loop than a home device could do alone. For example, a medication bottle that glows red when a medication dose has been missed has little effect on an individual who does not see it. A wearable device could help facilitate this feedback to the individual by alerting him or her in real time—or, even better, by alerting the person when he or she is in proximity to the bottle and can take the medication and close the loop immediately.

Fourth, assuming information is collected accurately, it must be presented back to the user in a manner that can be understood, that motivates action, and that sustains that motivation toward improved health. Sustaining change may be relatively easy for the already motivated, quantified-self audience, but is likely to be difficult for the much larger group of persons with difficult-to-manage chronic health conditions. Workplace wellness programs may offer an environment to deploy interventions using wearable devices that leverage concepts from behavioral economics.[3] For instance, some current strategies by employers may focus on individual-based competitions and displaying leaderboards. These strategies tend to encourage the top performers, who may already be active and motivated, while discouraging the majority of others who need it most. Another approach is to leverage team-based designs and social norms feedback. Individuals form teams that provide peer support and promote a sense of accountability to use the device and stay engaged in the new behavior—perhaps aiming for everyone to achieve a minimum amount of activity (eg, 7000 steps per day), rather than simply rewarding the power walkers. For example, teams might be selected at random in a regular drawing, but winning teams would only be eligible to collect their reward if the team had achieved its targeted behavior on the previous day. This design leverages concepts of variable rewards and anticipated regret, which have been demonstrated to motivate behavior change.[3]

Conclusions

Although wearable devices have the potential to facilitate health behavior change, this change might not be driven by these devices alone. Instead, the successful use and potential health benefits related to these devices depend more on the design of the engagement strategies than on the features of their technology. Ultimately, it is the engagement strategies—the combinations of individual encouragement, social competition and collaboration, and effective feedback loops—that connect with human behavior.

ARTICLE INFORMATION

Published Online: January 8, 2015. doi:10.1001/jama.2014.14781.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Asch reported that he is co-owner and principal of VAL Health. Dr Volpp reported receiving a grant payable to his institution from the National Institutes of Health; serving as a consultant for CVS Caremark; receiving grants or grants pending from CVS Caremark, Humana, Weight Watchers, and Discovery (South Africa); and that he is a co-owner of VAL Health. Dr Patel reported no disclosures.

REFERENCES

1. Wang T. The Future of Biosensing Wearables. Rock Health website. http://rockhealth.com/2014/06/future-biosensing-wearables. June 9, 2014. Accessed July 15, 2014.

2. Conroy DE, Yang CH, Maher JP. Behavior change techniques in top-ranked mobile apps for physical activity. *Am J Prev Med*. 2014;46(6):649-652.

3. Loewenstein G, Asch DA, Volpp KG. Behavioral economics holds potential to deliver better results for patients, insurers, and employers. *Health Aff (Millwood)*. 2013;32(7):1244-1250.

4. Nielsen CLR. Are Consumers Really Interested in Wearing Tech on Their Sleeves? Nielsen website. http://www.nielsen.com/us/en/insights/news/2014/tech-styles-are-consumers-really-interested-in-wearing-tech-on-their-sleeves.html. March 20, 2014. Accessed July 15, 2014.

5. Ledger D, McCaffrey D. Endeavour Partners Report: Inside Wearables: How the Science of Human Behavior Change Offers the Secret to Long-term Engagement. Endeavour website. http://endeavourpartners.net/assets/Wearables-and-the-Science-of-Human-Behavior-Change-EP4.pdf. January 2014. Accessed July 15, 2014.

6. Powell AC, Landman AB, Bates DW. In search of a few good apps. *JAMA*. 2014;311(18):1851-1852.