

Digital Therapeutics: Leading the Way to Improved Outcomes for People With Diabetes

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■ IN BRIEF The shift from acute illness to the epidemic of chronic conditions is the hallmark of the past 50 years. In addition to the provision of high-quality, accessible, and comprehensive medical care, one key to improving outcomes for individuals with diabetes and other chronic conditions is to increase their ability to self-manage. Having a high degree of self-efficacy is key to a person's ability to self-manage. One major challenge is finding scalable and affordable approaches that successfully increase self-efficacy. The field of digital health encompasses a variety of technology-enabled tools to make clinical care and patient self-management easier and more impactful by providing effective treatments that lead to improved clinical and economic outcomes. Better Choices, Better Health, a self-efficacy-based, self-management support intervention, is an example of a successful digital therapeutic for adults with one or more chronic conditions, including diabetes.

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The epidemic of a range of chronic diseases, including diabetes, persists despite massive investments in health care, medications, drug delivery systems, and monitoring devices. Organizations accountable for the health of a given population have invested in chronic condition management and population health programs with less-than-stellar population-level results. In addition to the provision of high-quality, ac-

cessible, and comprehensive medical care, one key to improving outcomes for individuals with diabetes and other chronic health conditions is to increase their ability to manage their lives and their chronic conditions.

Increasing Self-Efficacy Is Key to Improving Clinical and Economic Outcomes

A high degree of self-efficacy (confidence) is needed to improve one's abil-

ity to manage challenges. Self-efficacy is the belief in one's own abilities, specifically the ability to meet present and future challenges and complete tasks successfully (1). People with a strong sense of self-efficacy view challenging problems as tasks to be mastered, develop deeper interest in the activities in which they participate, form a stronger sense of commitment to their interests and activities, and recover quickly from setbacks and disappointments. People with a weak sense of self-efficacy avoid challenging tasks, believe that difficult tasks and situations are beyond their capabilities, focus on personal failings and negative outcomes, and quickly lose confidence in their personal abilities (2).

Increasing self-efficacy has been demonstrated to have a variety of important positive effects (3–5). For example, having a high degree of self-efficacy has been demonstrated to:

- Accelerate behavior change
- Reduce depression, anxiety, and stress-related disorders
- Lessen perceived pain
- Slow cognitive decline
- Diminish social isolation
- Increase health program participation
- Improve health care system navigation

With increasing self-efficacy also comes improved quality of life; reduced incidence, prevalence, and burden of chronic conditions; and decreased health care costs.

Digital Health Can Provide Scalable Approaches

Technology-enabled approaches to improving outcomes for patients with type 2 diabetes and other chronic conditions have made great strides in the past decade. Digital health, the overall term for a variety of these approaches, encompasses a range of tools to make clinical care and patient self-management easier and more impactful.

Digital therapeutics is a newly defined class of digital health that uses digital technologies (e.g., apps,

the Internet, and text messaging) to provide health treatments that are proven effective and have demonstrated outcomes. Ideally, digital health initiatives use evidence-based approaches and publish peer-reviewed studies that demonstrate important and statistically significant improvements in clinical and economic outcomes resulting from their implementation. Below is a description of one example of a digital health therapeutic program—the Better Choices, Better Health (BCBH) self-efficacy-based self-management support intervention.

Characteristics of Digital Therapeutics

As is true for any medical therapy, there are key characteristics of a digital therapeutic that need to be determined and proven effective before anyone uses or recommends the treatment. These elements, and the way they apply to the BCBH intervention, include:

- Target population(s): adults with chronic conditions
- Mechanism of action: increases self-efficacy
- Active ingredient(s): user's experience with the digital therapeutic
- Contraindications: none
- Role with other treatments: adjunctive to clinical care and case/disease management
- Patient requirements for success: intact cognitive ability, digital access, and ability to use email
- Side effects: none
- Outcomes: improves clinical outcomes and saves money

Most important in this list of characteristics is mechanism of action, which delivers the promised impact to a specific target population.

Chronic Disease Self-Management Program

The in-person, peer-to-peer, group-based Chronic Disease Self-Management Program (CDSMP) was originally developed by Dr. Kate Lorig at Stanford University in the

1980s (6). Its evolution has been supported by foundational research documenting the central role of enhancing self-efficacy and the importance of providing self-management support. The CDSMP has been deployed worldwide in 30 countries and in 17 languages to more than 1 million participants. Hundreds of articles have documented its effects on adults with a variety of chronic conditions (e.g., arthritis, diabetes, depression, and multiple coexisting chronic conditions) (7). The CDSMP protocol and curriculum have evolved over the years based on relevant national standards, new information, wisdom from studies, and technological innovations.

Better Choices, Better Health

BCBH is the Web-enabled digital version of the CDSMP. It has been deployed since 2006 and has served more than 20,000 individuals. Individuals are eligible for the service if their health plan, health care provider organization, employer, or public Health Department offers the service. Faithfully following the CDSMP protocol and curriculum, BCBH digitally provides participants with content and user experiences that have been proven to increase self-efficacy and yield clinical and economic outcomes similar to those seen with the in-person CDSMP. A number of studies (8–10) have demonstrated increased self-efficacy, decreased A1C, reduced depression, improved medication adherence, reduced health care utilization for comorbid conditions, reduced 12-month all-cause health care utilization, and savings of \$815 in the year after intervention for people who have used BCBH. This intervention is being used as: 1) a stand-alone component of disease management programs, 2) an integrated element of a chronic condition/population health program, 3) part of well-being initiatives offered by employers, and 4) part of coordinated digital and in-person programs offered as part of clinical care.

Conclusion

The future promises significant improvement in the outcomes that matter for adults with diabetes and other chronic conditions. The real challenge will always be to create programs that meet the diverse and changing needs of a diverse population and attract enough individuals to participate in any health-related program to make a difference on a population level. Digital health and digital therapeutics will no doubt be a major contributor to preventing chronic diseases and their progression.

Duality of Interest

N.K. is the co-founder, owner, and chief medical officer of Canary Health, which has the rights to market and sell the BCBH inter-

vention described in this article. No other potential conflicts of interest relevant to this article were reported.

References

1. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 1977;84:191–215
2. Ackerman C. What is self-efficacy theory in psychology? Available from positivepsychologyprogram.com/self-efficacy. Accessed 6 August 2019
3. Zlatanović L. Self-efficacy and health behavior: some implications for medication anthropology. *Journal of the Anthropological Society of Serbia* 2015;51:17–25
4. Bandura A. Self-efficacy. In *Encyclopedia of Human Behavior*, vol. 4. Ramachandran VS, Ed. New York, N.Y., Academic Press, 1994, p. 71–81
5. Kavanagh D. Self-efficacy and depression. In *Self-Efficacy: Thought Control of Action*. Shwarzer R, Ed. Berlin, Germany, Freie University, 1992, p. 172–194
6. Self-Management Resource Center. Help your community take charge of its health. Available from www.selfmanagementresource.com. Accessed 6 August 2019
7. Self-Management Resource Center. Bibliography. Available from www.selfmanagementresource.com/resources/bibliography. Accessed 6 August 2019
8. Lorig K, Ritter PL, Turner RM, English K, Laurent DD, Greenberg J. Benefits of diabetes self-management for health plan members: a 6-month translation study. *J Med Internet Res* 2016;18:e164
9. Lorig K, Ritter PL, Turner RM, English K, Laurent DD, Greenberg J. A diabetes self-management program: 12-month outcome sustainability from a nonreinforced pragmatic trial. *J Med Internet Res* 2016;18:e322
10. Turner RM, Ma Q, Lorig K, Greenberg J, DeVries AR. Evaluation of a diabetes self-management program on type II diabetes patients' comorbid illnesses, healthcare utilization, and cost. *J Med Internet Res* 2018;20:e207