Virtual Coaching to Enhance Diabetes Care

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Abstract

Rates of diabetes are increasing worldwide and there is not a sufficient clinical workforce to care for these patients. Diabetes-related apps are a feasible way to provide diabetes education to large numbers of people with diabetes but attrition rates are high. Apps enhanced by virtual coaching may be a way to circumnavigate these problems. Virtual coaches are able to address common treatment barriers and other health disparities by providing data-driven individualized support in real time, at any time of day, and from anywhere. Enhanced glycemic benefits have been seen in those who use an app plus virtual coaching versus those who use an app alone, along with clinically meaningful behavior change, psychosocial effects, prolonged engagement, and high levels of satisfaction with the system. More research needs to be done to determine the longitudinal and widespread effects of virtual coaching in different populations.

Keywords: Diabetes, Virtual coach, Telemedicine, Diabetes education.

Introduction

WITH THE BURGEONING rates of diabetes worldwide,¹ diabetes clinicians do not have enough time in their day to help everyone who needs assistance. A person with diabetes (PWD) spends 168 h per week, or ~720 h per month, managing his or her disease. A 1-h visit to their diabetes clinician every 3 months would mean that the PWD only has assistance from a professional in his or her diabetes management 0.05% of the time. If these individuals were to be able to speak to a diabetes clinician for 1 h every day, 5 days per week, they would still only be working with a professional for their diabetes management 3% of the time. Subtracting time spent sleeping does not alter these numbers much. Only approximately half of the adults with diabetes in the United States have been able to achieve a hemoglobin A1c (HbA1c) $\leq 7.0\%$ with such minimal amounts of interaction with a diabetes professional,²⁻⁵ and only 14% meet targets for glycemic control, blood pressure, and cholesterol while abstaining from smoking.⁶

The projected number of diabetes clinicians in the workforce further confounds the issue. Supply and demand estimates for adult endocrinologists through the year 2025 showed that in 2011, demand already exceeded supply by >1000 full-time endocrinologists.⁷ Furthermore, projections estimated that the gap between supply and demand would not close for at least the next 10 years unless significant changes

were made to recruitment and retention of new additions to the adult endocrinology workforce.⁷

Enlisting the help of a diabetes coach can help those who are struggling with their diabetes management do better. Diabetes health coaches help with goal setting, knowledge acquisition, individualized care, and frequent follow-up. Significant reductions in HbA1c have been seen in those who use diabetes coaches for up to 18 months of follow-up.^{8,9} Based on their in-depth review of the literature on health coaches for type 2 diabetes, Sherifali and et al. concluded that “Diabetes health coaching has an emerging role in healthcare that facilitates self-care, behaviour change and offers frequent follow up and support. This review finds that health coaching for those with diabetes is an effective intervention for improving glycemic control, which may be of greater benefit when offered in addition to existing diabetes care.” (p. 84).⁸ However, there are not enough diabetes educators available to serve as a health coach for all those who may desire one.¹⁰

Virtual Education and Medical Visits

Virtual education and medical visits using telemedicine may be a way to circumnavigate these problems. Telemedicine services that utilize the Internet, videoconferencing services, and apps to enhance diabetes care and self-management for individuals with diabetes are becoming

increasingly popular and can be used to provide both diabetes education and coaching. Research has found that glycemic and psychologic outcomes from telemedicine visits were equivalent to or better than in-person visits for both children and adults with type 1 diabetes (T1D).^{11–15} When behavioral family systems therapy for teenagers with diabetes was delivered using a videoconferencing service, overall family conflict was reduced and parents reported improved acceptance of illness.¹² In another study on 18–55-year-old patients with T1D, there was a tendency toward less impact of diabetes on quality of life in the group receiving telemedicine visits ($P=0.061$).¹³ Additional benefits of telemedicine were increased attendance at visits,^{15,16} less time spent traveling to and attending visits,^{11,13,17,18} and lower cost.^{11,13} In addition, the use of telemedicine versus in-person visits did not affect the therapeutic relationship between providers and adolescent patients¹⁹ and may actually empower patients to better manage their diabetes.^{13,17,18}

Virtual environments, which are Internet-based real-time computer-generated three-dimensional representations of a contrived or natural environment in which patients and clinicians self-represent as avatars,²⁰ are also being studied as a means of providing diabetes self-management (DSM) education to a greater number of individuals. Preliminary results suggest that virtual environments may be another viable means of overcoming both a shortage of diabetes clinicians and barriers to accessing in-office care. In addition, they provide the added benefit of allowing participating members of the diabetes community to interact with each other, which has beneficial effects on both metabolic and psychosocial outcomes.^{21–23} However, there may be some attrition in using these services over time.^{21,22}

Diabetes App Use

Diabetes-related apps are a feasible way to provide diabetes education to large number of people with diabetes. A total of 80% to 90% of adults in the United States and ~75% of adults worldwide currently own a smartphone.^{24,25} Smartphones are the device of choice these days, with upwards of 53% of adults using them to access an app. Desktop computers are used one-third of the time or less.²⁶ Users report high levels of satisfaction with diabetes apps.^{27,28} Increased app use has been strongly correlated with improved diabetes management, including improved knowledge about diabetes and improved DSM behaviors such as blood glucose (BG) monitoring and insulin administration^{27–30} and reductions in HbA1c.^{31–33} However, the sheer number of diabetes apps available can be overwhelming. Using the search term “diabetes” in the Apple Store (iPhone apps) in 2017 resulted in ~1200 apps; only 85 of those apps had the intention of tracking BG levels.³⁴ In addition, diabetes-related app use wanes over time.²⁸ Earlier studies have reported attrition rates of up to 37% in a group of individuals with T1D who were 92% white.^{35,36} So a diabetes-related app by itself may not be the answer to helping the masses with DSM.

The “Virtual Coach”

Enter the virtual coach. Similar to an in-person health coach, a virtual coach supports patients with chronic conditions and their caregivers in disease self-management by providing personalized guidance and support.^{37,38} However,

unlike in-person health coaches, virtual coaches are accessible any time of day and night, and can be contacted by the PWD from anywhere. There are two types of virtual coaches: human and artificial intelligence (AI). A human virtual coach is a person who is accessible using a conferencing or messaging service contained within an app or web-based program.³⁹ An AI virtual coach is computer software that has been specifically designed to work and act like a human.⁴⁰ Both will analyze an individual’s data and give personalized feedback based on it. Virtual coaches are able to address common treatment barriers and other health disparities by providing data-driven individualized support in real time.⁴¹ Although diabetes coaching that is provided through telemedicine or in a virtual environment is technically considered to be virtual coaching, the recent focus on virtual coaching for diabetes has been on combining it with a diabetes app.

Diabetes App+Virtual Coach Outcomes

Enhanced glycemic benefits have been seen in those who use an app plus virtual coaching versus those who use an app alone.^{30–33} A meta-analysis of systematic reviews published in 2017 found “clear evidence that technology-enabled diabetes self-management education and support is effective in reducing A1c in the context of a complete feedback loop” (p. 1021).³¹ Namely, the ability to have two-way communication with a health care provider facilitated engagement and improved outcomes. Apps that also analyzed personal health data, tailored education, and individualized feedback were the most effective.³¹

Since virtual coaching alongside diabetes app use is relatively new, there is a paucity of results-based peer-reviewed literature on the topic. However, the existing literature demonstrates clinically meaningful benefits beyond glycemic control. These include improved medication adherence,³⁰ improved exercise habits,³⁰ prolonged weight loss including in those who were at risk for diabetes,^{33,42–44} fewer symptoms of hypoglycemia,³⁰ fewer symptoms of depression,³⁰ and significant cost savings.⁴⁵

Prolonged engagement with the system also looks promising.^{32,43} In one 65-week study, a diabetes prevention program using virtual coaching was able to engage 80% of subjects for the majority of the study and 69% of subjects for the entire duration of the study, resulting in 7.36% and 8.98% weight loss, respectively.⁴³ Furthermore, users report high levels of satisfaction with virtual coach-enhanced apps.^{46,47} The benefits of virtual coaching are similar to what has been found with diabetes health coaching,⁸ but they have the potential to be more widespread.

Conclusion

Virtual coaching has demonstrated significant benefits over and above telemedicine or app use for glycemic control, behavior change, and psychosocial support, because of the data-driven individualized support it provides. There appears to be better engagement with the system and users report high levels of satisfaction. More research is needed to determine the longitudinal and widespread effects of virtual coaching in different populations, maintaining engagement with virtual coaching systems over extended periods of time, and patient

preferences regarding interactions with their diabetes providers and virtual coaches.

Clinical Implications

Using virtual education/medical visits and coaching does not replace the need for diabetes clinicians. Rather, it allows diabetes clinicians to reach a larger, more diverse group of individuals with diabetes by increasing access to care without overburdening the clinical workforce, thereby facilitating better outcomes for individuals with diabetes. Virtual coaching can be especially beneficial for individuals with diabetes who have difficulty attending office visits or those who need more attention at any point in time than can be given during a single follow-up visit by providing personalized diabetes management, thereby improving metabolic control and psychosocial well-being for those who may otherwise not have the means to achieve this.

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