

Virtually Better Diabetes Care?

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Despite growing awareness of the problem, the diabetes epidemic shows no signs of abating and continues to pose a public health problem of grave concern (1).

Nonpharmacologic interventions focused on lifestyle modifications, including diet and exercise, remain a major component of therapy. Individualized nutrition therapy has been shown to be effective for improvement of the metabolic profile and weight loss. However, most studies of popular diets are usually of short duration and have high attrition rates (15–50% within 1 year) (2). Adherence to any prescribed diet is a real challenge, especially when we are surrounded by easily accessible, processed food of high caloric and low nutritional value. It is therefore not surprising that lifestyle modification often fails, and as health care providers (HCPs), we find ourselves compelled to add more and more pharmacotherapies and often recommend metabolic surgery to achieve therapeutic goals. Indeed, despite significant advances in pharmacotherapy, there has been no significant change in the percentage of people who achieve therapeutic goals (3).

A key question that needs to be addressed is how HCPs can help patients adhere to a treatment plan that will enable them to achieve and sustain improvements in metabolic control. One of the most essential components of diabetes care is access to an HCP. There is a significant shortage of primary care providers

and endocrinologists in the United States, with the rising number of patients with diabetes outstripping the number of HCPs (4).

Endocrinologists are asked to see more patients in less time, and new patients may have to wait for months to be seen. The problem is even worse for patients in remote areas, who must travel long distances to be seen. It is also commonly observed that patients lose their momentum along the path to improved metabolic health, despite their initial enthusiasm at a face-to-face office visit; this is not surprising given the paucity of time patients spend in direct contact with their HCPs. Thus, there is a need for ongoing support between office visits to help patients maintain their motivation, navigate day-to-day realities, overcome obstacles, and follow an individualized treatment plan, whether involving lifestyle modification or medication. Diabetes management is a long-term, high-touch endeavor.

The current model of health care delivery, with a shortage of HCPs and brief office visits, is inefficient and costly and fails many of our patients. The key to improving outcomes is ongoing education and coaching in the hope that patients will remain engaged and motivated to continue to manage their conditions optimally. Recent great advances in technology, such as telemedicine, present opportunities for a much-needed paradigm shift in health care delivery. Our increasingly hyper-connected society

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may be the optimal way to promote easy and frequent access to care for many patients at a relatively lower cost (5).

There is evidence that technological approaches to diabetes prevention and management are effective. Vadheim et al. (6) studied a group of patients in a remote frontier community and showed that patients' participation in a group-based diabetes prevention lifestyle intervention through telehealth videoconferencing helped them achieve similar weight loss, physical activity, and diet goals and outcomes as patients who received onsite care. Similarly, Ciemins et al. (7) examined the effectiveness of a diabetes prevention program using videoconferencing technology and found similar weight loss in the telehealth and traditional care groups. In an earlier study (8), the same authors compared diabetes care outcomes of patients who had face-to-face office visits to those of patients in a remote area with limited access to HCPs and face-to-face visits who received medical care using telehealth technology, specifically videoconferencing. This study demonstrated effectiveness of telehealth on comprehensive diabetes management and outcomes that was similar to that of the traditional health care delivery model that includes office visits. Recent meta-analyses of randomized controlled trials using either teleconsultation or device-based telemonitoring also support the effectiveness of telemedicine interventions in achieving better A1C levels and in prevention of hypoglycemic events of moderate severity (9,10). Of note, whereas technology and telehealth in the form of teleconsultation and videoconferencing confer beneficial health outcomes, use of wearable devices such as physical activity monitors alone, without feedback and encouragement from an HCP, has been shown to be less effective for changing diet or physical activity behaviors compared to standard intervention (11). Taken together, it seems that telehealth models using applica-

tions that connect patients with their HCPs and facilitate ongoing education are most effective.

A recent study by Ramadas et al. (12) examined the effectiveness of a Web-based platform that provided patients in a developing country continuous education about dietary modification in conveying necessary dietary information, comprehension, and skills to participants. It found significant improvement in participants' Dietary Knowledge, Attitude, and Behavior scores and a tendency of participants to have improved A1C. This recent study highlights the advantages of telemedicine in promoting patients' diabetes education and providing support to this vulnerable patient population, helping them cope with the vast array of complexities and complications that can arise from diabetes.

Another recent study by Hallberg et al. (13) looked at the effectiveness and safety of a novel comprehensive care model for people with type 2 diabetes in a specific area in the United States, utilizing a nutritional intervention. The innovative approach was that the novel care model, which involved a very-low-carbohydrate diet, provided continuous supervision by a health coach and doctor and a high level of support to enable long-term maintenance of behavioral and metabolic change through continuous remote care. Patients in the novel care group had access to a Web-based software application for biomarker reporting and monitoring, education, and communication with a remote care team. The authors reported a significant decline in A1C, a 12% weight loss, and reduction in medication use in the novel care model group compared to a group of patients undergoing usual care. Most impressive was the relatively small attrition rate; 83% of the participants in the novel care model group were retained through 1 year. The authors attributed this success to improved patient perceptions of favorable health outcomes through individualized continuity of

care, close relationships with health coaches, ongoing education, biometric feedback, and peer support. The intervention in this study was a ketogenic diet that is typically very difficult to maintain. However, most participants achieved and maintained nutritional ketosis through 1 year. More than the specific dietary intervention, the success story here is the novel approach to treating a chronic disease, which requires a high degree of ongoing support.

Although the use of telehealth is promising, there are many challenges that need to be considered. There is a concern about protecting the privacy of health information. In a world in which cybercrime is a palpable reality, it is important that patient data and electronic encounters be protected when Web-based applications are used. In addition, although younger generations are comfortable navigating the digital world, older patients may find it overwhelming to engage in virtual care. Development of user-friendly applications might be the solution to this barrier. There is also concern that telemedicine may compromise the directness of in-person physical encounters and partially jeopardize the nature of physician-patient relationships (14). Some studies have shown that home telemedicine programs are cost-effective; however, detailed cost data are incomplete, and a comprehensive analysis of the cost of this type of health care delivery is needed (15). This information is crucial and will help us integrate telemedicine into the current model of health care delivery, particularly if cost-effectiveness of larger-scale applications can be demonstrated and if the new approaches provide fair compensation for this type of care.

Considering the poor health outcomes linked to diabetes, we should embrace the advances of modern technology and employ them to provide innovative therapeutic solutions to manage chronic diseases such as diabetes. Telehealth technology combining teleconsultations, video-

conferencing with health coaches, educational sessions, and use of data from wearable devices such as physical activity monitors or continuous glucose monitoring systems could help our patients feel more connected to their HCPs, provide access to care that is literally “one click away,” and encompass ongoing education, all of which will lead to better adherence to lifelong treatments and lifestyle changes.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Author Contributions

M.T.V. reviewed the literature and wrote the initial draft of the manuscript. J.R.D. edited and revised the manuscript. M.J.A. supervised and edited the manuscript. M.J.A. is the guarantor of this work and, as such, takes responsibility for the integrity of the presented data.

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