Can mobile applications improve non–adherence in diabetes management?

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Diabetes has remained a silent yet dangerous epidemic for decades, with nearly 7% of the Canadian population diagnosed as of 2015.[1] Though advances in drug development, medical technology, and physician education make it possible for many patients to prevent and manage diabetes, there is a discordance between medical knowledge and clinical outcomes. An estimated half of Canadian patients fail to meet hemoglobin A1c targets, suggesting a high rate of non–adherence to recommended treatments.[2,3,4] In response to such concerns, mobile applications (apps) for patients with diabetes have emerged with the goal of simplifying diabetes management. The Google Play Store alone lists over a thousand diabetes apps, and this number is projected to increase.[5,6] With the revolutionary integration of smartphone apps into our daily lives in the past decade, such apps offer the promise of making diabetes management more approachable and of improving treatment adherence.

Perhaps what has drawn 4.1 million users[7] to the diabetes app market is the convenience and clarity that the apps offer to diabetes self–management. A typical recommended regimen for patients with diabetes consists of diet and exercise, appointments, self–monitoring, and more[8] in the context of other daily priorities—a daunting responsibility considering the devastating consequences of diabetes left untreated.[9,10] Adolescents with type 1 diabetes who are already undergoing physical and psychological transition can find these responsibilities especially disruptive.[11] Since the mainstay of diabetes treatment lies in the motivation and availability of patients to implement the physician's recommendations,[3,12] patients can experience stress and frustration when these tasks become overwhelming.[13] Diabetes apps can help alleviate this tension by simplifying multiple domains of diabetes management into one platform and by relieving patients of some of the pressures of making their own health–related decisions.

The current diabetes app market consists of roughly two categories. The first includes tracking/monitoring apps such as MyNetDiary, BGMonitor, and Glucose Buddy, which allow users to record their blood glucose, exercise, carbohydrate intake, and medication regimens in visually appealing pie charts and trend graphs.[5] Some "gamify" treatments with virtual points to encourage users to achieve personal goals.[5,14] The second category of apps have support/feedback, data transfer, and social media features in addition to tracking/monitoring features. These apps, which include Health2Sync, MySugr, and SocialDiabetes, provide timely advice in response to blood glucose levels. Some allow import of data from insulin pumps or fitness devices (e.g., Fitbit) and export of data to physicians. Many also feature community boards and messaging systems to help patients connect to other patients and family members.[5,15,16]

Features such as visual graphs, personalized feedback, and gamification can encourage patients to reflect on their progress and develop intrinsic motivation, thereby improving treatment adherence.[14,17,18,19] These tools offer opportunities especially for youth with diabetes, for whom analog monitoring methods have proven suboptimal due to high error rates, lack of data, and discontinuity of real–time feedback and motivation.[14] Furthermore, improved data availability to physicians and timely feedback can provide better opportunities for patient education and reduce patient anxiety over fluctuations in blood glucose.[20]

Of course, the rise of mobile diabetes apps is not without concern—those apps that do not follow clinical guidelines pose potential danger to patients.[21] In response to these concerns, some researchers and health care professionals (HCPs) have developed their own apps. Diabetes in Check and MyBCD, developed here in B.C. by the multidisciplinary team at BC Diabetes, are two examples. In addition to the monitoring, feedback, gamification, and social media features of other apps, these apps allow patients to message nurse case managers or certified diabetes educators directly from their phones.[5,15] This personalized and accessible expert care paradigm can potentially further encourage patient adherence by cultivating a stronger sense of support and empowering patients to openly communicate realistic expectations with their HCPs.

Though more research is needed in this rapidly growing field, existing studies show improved blood glucose measures and patient satisfaction, demonstrating the potential of mobile apps to aid in diabetes management.[6,14,17,22] Evident in their high user ratings, mobile diabetes apps are already helping millions of users better integrate diabetes self–management into their everyday lives.[5] With continued development and ongoing HCP support, these apps have the potential to empower patients via an evolution from expert–led care to that of patient–physician collaboration, fostering motivation and responsibility. In effect, mobile applications may themselves be a treatment for the issue of non-adherence in diabetes and have the potential to greatly benefit the millions of Canadians living with this condition.

References

1. Statistics Canada. Health Fact Sheets: Diabetes, 2015 [Internet]. Government of Canada. 2015 [cited 2017 10 14]. Available from: http://www.statcan.gc.ca/pub/82-625-x/2017001/article/14763-eng.htm
2. Braga M, Casanova A, Teoh H, Dawson KC. Treatment gaps in the management of cardiovascular risk factors in patients with type 2 diabetes in Canada. Can J Cardiol. 2010 Jun 1;26:297-302.
3. Funnell MM, Anderson RM. The Problem with Compliance in Diabetes. JAMA. 2000 Oct 4;284:1709.
4. McCrate F, Godwin M, Murphy L. Attainment of Canadian Diabetes Association recommended targets in patients with type 2 diabetes: a study of primary care practices in St John's. Can Fam Physician. 2010 Jan;56:e13-9.
5. Hood M, Wilson R, Corsica J, Bradley L, Chirinos D, Vivo A. What do we know about mobile applications for diabetes self–management? A review of reviews. J Behav Med. 2016 Dec;39:981-94.
6. Ristau RA, Yang J, White JR. Evaluation and Evolution of Diabetes Mobile Applications: Key Factors for Health Care Professionals Seeking to Guide Patients. Diabetes Spectr. 2013 Sep;26:211-215.
7. Jahns, R–G. Research 2 Guidance [Internet]. The addressable market for diabetes apps in 2016 has increased to 135.5M potential app users (diagnosed diabetics), out of which 4.1M are active users. 2017 [cited 2017 Dec 12]. Available from: https://research2guidance.com/the-addressable-market-for-diabetes-apps-in-2016-has-increased-to-135-5m-potential-app-users-diagnosed-diabetics-out-of-which-4-1m-are-active-users/

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8. Harris SB, Petrella RJ, Leadbetter W. Lifestyle interventions for type 2 diabetes. Relevance for clinical practice. *Can Fam Physician*. 2003;49:1618.
9. Brown, JB, Nichols, GA, & Perry, A. The burden of treatment failure in type 2 diabetes. *Diabetes Care*. 2004 Jul;27(7):1535-40.
10. Fowler MJ. Microvascular and macrovascular complications of diabetes. *Clin Diabetes*. 2008 Apr;26(2):77-82.
11. Faulkner MS. Quality of life for adolescents with type 1 diabetes: parental and youth perspectives. *Pediatr Nurs*. 2003 Sept-Oct;29:362-8.
12. Russell LB, Suh D, Safford MA. Time requirements for diabetes self–management: too much for many? *J Fam Practice*. 2005 Jan;54:52-6.
13. Debono M, Cachia E. The impact of diabetes on psychological well-being and quality of life. The role of patient education. *Psychol Health Med*. 2007 Oct;12(5):545-55.
14. Cafazzo JA, Casselman M, Hamming N, Katzman DK. Design of an mHealth app for the self–management of adolescent type 1 diabetes: a pilot study. *J Med Internet Res* 2012 May 8;14(3):e70.
15. Goyal S, Cafazzo JA. Mobile phone health apps for diabetes management: current evidence and future developments. *QJM* 2013 Dec;106(12):1067-9.
16. Healthline. Healthline Media. The Best Diabetes Apps of 2017 [Internet]. 2017 [cited 2017 Dec 13]. Available from: https://www.healthline.com/health/diabetes/top-iphone-android-apps
17. Quinn CC, Shardell MD, Terrin ML, Barr EA, Ballew SH, Gruber–Baldini AL. Cluster–randomized trial of a mobile phone personalized behavioral intervention for blood glucose control. *Diabetes Care*. 2011 Sep;34(9):1934-42.
18. Miller AS, Cafazzo JA, Seto E. A game plan: Gamification design principles in mHealth applications for chronic disease management. *Health Informatics J*. 2016 Jun;22(2):184-93.
19. Rose, K. J., M. Koenig, and F. Wiesbauer. Evaluating success for behavioral change in diabetes via mHealth and gamification: MySugr's keys to retention and patient engagement. *Diabetes Technol Ther*. 2013 Feb 1;15(2):a114.
20. Bonoto B, de Araujo V, Godoi I, de Lemos LL, Godman B, Bennie M, et al. Efficacy of Mobile Apps to Support the Care of Patients With Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *JMIR Mhealth and Uhealth*. 2017 Mar 1;5(3):e4.
21. Huckvale K, Adomaviciute S, Prieto JT, Leow MK, Car J. Smartphone apps for calculating insulin dose: a systematic assessment. *BMC Med*. 2015 May 6;13:106.
22. Jo I, Yoo S, Lee DY, Park C, Kim EM. Diabetes Management via a Mobile Application: a Case Report. *Clin Nutr Res*. 2017 Jan;6(1):61-7.