Internet Blood Glucose Monitoring Systems Provide Lasting Glycemic Benefit in Type 1 and 2 Diabetes

A Systematic Review

Hugh D. Tildesley, MD[a,*], Michelle D. Po, PhD[b], Stuart A. Ross, MD[c]

KEYWORDS

• Diabetes • Glycemic control • Hypoglycemia • Self-monitoring of blood glucose • Internet medicine • Internet blood glucose monitoring system

KEY POINTS

- Internet blood glucose monitoring systems (IBGMS) result in glycemic improvement in patients with type 1 or 2 diabetes, including those with poorly controlled glycemia at baseline.
- IBGMS help decrease glycemic levels without increasing the risk of hypoglycemia.
- Other benefits, seen in some studies of IBGMS, include improvements in cardiovascular risk markers and quality of life outcomes.
- Glycemic improvements with IBGMS are not limited to patients on insulin or to those who increase their frequency of glucose self-monitoring as a result of the intervention.
- Glycemic improvements likely result from a combination of factors, including increased patient motivation and increased communication between patient and health care provider.

INTRODUCTION

Effective glycemic control is associated with reduced risk of complications of type 1 diabetes (T1D) and type 2 diabetes (T2D).[1–4] In controlled clinical trials, even when

Disclosures: H.D. Tildesley uses Internet blood glucose monitoring routinely in managing patients with diabetes. M.D. Po and S.A. Ross declare that they have no financial or other competing interest in the topics discussed here.

[a] Department of Endocrinology and Metabolism, St Paul's Hospital, University of British Columbia, Room 410, 1033 Davie Street, Vancouver, British Columbia V6E 1M7, Canada; [b] SCRIPT, 2010 Yonge St, Toronto, ON M4N 2K4, Canada; [c] University of Calgary, 2500 University Dr NW, Calgary, AB T2N 1N4, Canada

* Corresponding author.

E-mail address: hdtildesley@gmail.com

Med Clin N Am 99 (2015) 17–33

http://dx.doi.org/10.1016/j.mcna.2014.08.019 **medical.theclinics.com**

0025-7125/15/$ – see front matter

the early glycemic control is lost at a later point, patients who establish and maintain good control early in the course of their disease may enjoy reduced risk of macrovascular and microvascular complications of diabetes over a period of years to decades.[3–5] For this reason, current treatment guidelines emphasize the need for timely introduction of lifestyle and, if necessary, pharmacologic interventions, to bring patients to appropriate glycemic targets within months of diagnosis.[6] Despite this guidance, and despite clear evidence that effective glycemic control can prevent diabetic complications, only half of North American patients achieve the standard glycemic target of hemoglobin A_{1c} (HbA_{1c}) level less than 7%.[7–9]

For patients with T1D and insulin-using patients with T2D, American Diabetes Association (ADA) and Canadian Diabetes Association (CDA) treatment guidelines support regular self-monitoring of blood glucose (SMBG), which allows the patient to titrate insulin doses, evaluate their success in reaching glycemic targets, and gauge their risk of hypoglycemia.[6,10] However, the clinical usefulness and cost-effectiveness of SMBG in controlling glycemic levels in non–insulin-using patient with T2D is less clear. A recent meta-analysis showed that regular SMBG in this patient population was associated with a statistically significant but quantitatively minor glycemic benefit.[11] Uncertainty about the role of SMBG outside the context of insulin dose adjustment is reflected in the 2014 ADA guidelines; these guidelines recommend SMBG as a part of a broader educational context, and to help guide treatment decisions for non–insulin-using, as well as insulin-using, patients.[10]

We have proposed elsewhere[12–14] that increased patient-physician communication, in the form of ongoing Internet-based contact, could increase the effectiveness of SMBG as a means to improve diabetes management in combination with regular care. In this article, a systematic review of Internet blood glucose monitoring systems (IBGMS) is provided, which facilitate regular health care provider review and feedback regarding a patient's SMBG results. In such systems (**Fig. 1**), patients carry out regular glucose monitoring and upload the resulting data to a secure Web site. From there, the data are reviewed by a health care professional, who provides feedback on the results, offers encouragement, and, as appropriate, recommends changes to the patient's monitoring practices, insulin titration, or diet.

In this article, the efficacy, safety and other outcomes are evaluated from numerous small studies comparing patients using IBGMS with other patients with more

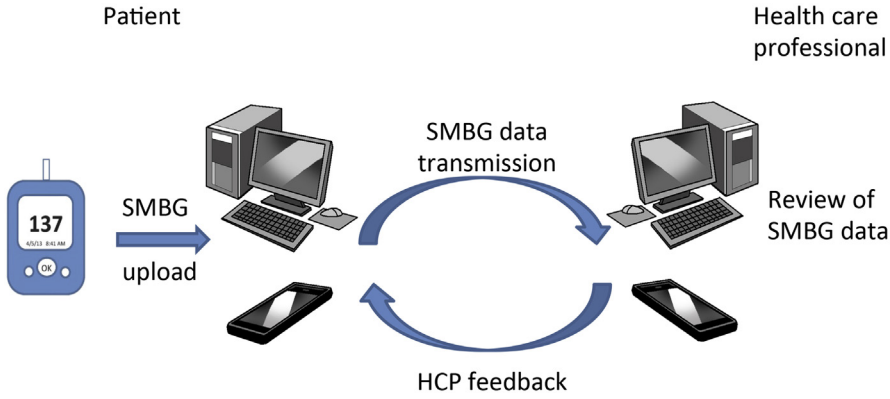

Fig. 1. IBGMs. All Internet-based interventions considered in this review include the following: (1) patient's SMBG, (2) uploading and transmitting the SMBG data to a health care professional (HCP), (3) the HCP reviewing and submitting feedback to the patient.