Effects of Mobile Phone SMS to Improve Glycemic Control Among Patients With Type 2 Diabetes in Bangladesh: A Prospective, Parallel-Group, Randomized Controlled Trial

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Mobile phone technologies have emerged as an essential tool for strengthening health systems and improving disease outcomes in many countries (1). In recent years, the government of Bangladesh and the World Health Organization have adopted information technologies for health in their strategic plans. However, data to support a successful model of mobile phone short message service (SMS) in diabetes management are scarce. In this trial, we assessed whether the addition of an automated SMS service to standard diabetes care would improve glycemic control in patients with type 2 diabetes.

A total of 236 adult patients with type 2 diabetes (diagnosed within the previous 5 years) on oral medication therapy with access to SMS and attending the outpatient department of the Bangladesh Institute of Health Sciences in Dhaka, Bangladesh, were recruited (September 2013–August 2014) and randomly assigned 1:1 to SMS intervention and standard care groups. Data were collected through face-to-face interviews with a structured questionnaire, anthropometric measurements, and blood tests for HbA_{1c} using standard procedures (2). A total of 36 participants with missing HbA_{1c} data were excluded from the analysis. All participants in the intervention group received 90 SMSs, based on the principles of behavioral learning theory, randomly, once a day, over a 6-month period (2). An SMS delivery manager Web site was created and the SMSs were delivered in partnership with Grameenphone Bangladesh.

The demographics and baseline characteristics of the study groups were generally well balanced and similar to the general population with diabetes in Bangladesh (3). The mean ± SD age of the participants was 48.1 ± 9.7 years, and 54.2% were female. The majority of the participants were married (89.4%), had completed secondary education (70.3%), and had a family history of diabetes (65.7%). The median (Q1, Q3) duration of diabetes was 1 (0, 3) years. The mean ± SD HbA_{1c} at baseline was 8.4 ± 2.6% (68 ± 28.4 mmol/mol).

The least squares mean difference of HbA_{1c} from baseline to after 6 months (primary end point) was −0.85 (95% CI −1.05, −0.64) in the SMS group and −0.18 (−0.41, 0.04) in the control group (Table 1). The difference between means was −0.66 (−0.97, −0.35; $P < 0.0001$). In a secondary analysis, the mean medication adherence score (using the Morisky 8-Item Medication Adherence Questionnaire with the following cutoff scores: >2 = low adherence, 1 or 2 = medium adherence, and 0 = high adherence) decreased significantly in both the SMS and the control groups, indicating greater self-reported adherence to medication over time. There was no significant difference between the groups. Post hoc subgroup analyses suggested that the SMS intervention worked better in women, those with a baseline HbA_{1c} >8%, and those with a shorter duration of diabetes.

This is the first study to our knowledge that measured the effects of mobile phone SMS on glycemic control in a developing country. Our reported changes in HbA_{1c} in the intervention group seem to be lower than reports from previous studies (4,5). Our study participants were required to have access to a mobile phone SMS, thus generalizing the results to rural areas or poorer parts of society may not be possible.

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Table 1—Difference in HbA_{1c} (%) between baseline and 6 months

Primary outcome	Least squares mean (95% CI)	*P*
SMS group ($n = 106$)	−0.85 (−1.05, −0.64)	
Control group ($n = 94$)	−0.18 (−0.41, 0.04)	
Difference between means	−0.66 (−0.97, −0.35)	<0.0001

This study demonstrates the effectiveness of a simple SMS-based intervention as an addition to standard care for type 2 diabetes in urban Bangladesh. The intervention is low cost and scalable and therefore could improve diabetes care in Bangladesh and potentially other low-income countries.

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References

1. Peiris D, Praveen D, Johnson C, Mogulluru K. Use of mHealth systems and tools for non-communicable diseases in low- and middle-income countries: a systematic review. J Cardiovasc Transl Res 2014;7:677–691
2. Islam SM, Lechner A, Ferrari U, et al. Mobile phone intervention for increasing medication adherence to treatment for type 2 diabetes in an urban area of Bangladesh: protocol for a randomized controlled study. BMC Health Serv Res 2014;14:586
3. Akter S, Rahman MM, Abe SK, Sultana P. Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: a nationwide survey. Bull World Health Organ 2014;92:204–213.213A
4. Hussein WI, Hasan K, Jaradat AA. Effectiveness of mobile phone short message service on diabetes mellitus management; the SMS-DM study. Diabetes Res Clin Pract 2011;94:e24–e26
5. 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;34:1934–1942