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Do diabetes mellitus patients adhere to self-monitoring of blood glucose (SMBG) and is this associated with glycemic control? Experiences from a SMBG program in western Kenya

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ABSTRACT

Aims: Among diabetes mellitus (DM) patients with poor glycemic control enrolled into a self-monitoring of blood glucose (SMBG) program in Kenya, to assess the level of SMBG adherence, its associated factors and its relation to glycemic control (defined as HbA1c <7% and/or 2% absolute reduction relative to baseline).

Methods: In this retrospective cohort study, we used routinely collected data of patients enrolled during 2012–2013. We assessed adherence to SMBG by dividing the number of glucose tests performed by the number recommended. A level of ≥80% was considered 'good adherence'. Glycemic control was considered as absolute change from baseline of 2%.

Results: Of 164 patients (59% female; 76% rural), the proportions with good SMBG adherence were 34%, 17%, 15% and 10% during 0–6, 7–12, 13–18 and 19–24 months into the HGM program respectively. In multivariate analysis, male gender, urban place of residence and payment for glucostrips were associated with poor adherence during 0–12 months. The mean reduction in HbA1c compared to baseline was 1.2%, 1.1%, 0.8% and 0.7% at 6, 12, 18 and 24 months, respectively. We did not find any association between SMBG adherence and glycemic control.

Conclusions: Adherence to SMBG was sub-optimal, especially among those who had to pay for glucostrips. Patient education and provision of free glucostrips are recommended to improve adherence and glycemic control.

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1. Introduction

Globally, there were an estimated 387 million people living with DM (about half of them undiagnosed) and 4.9 million deaths in 2014 [1]. Nearly half of all DM deaths occurred in people aged less than 60 years globally, reaching 75% in less developed regions of sub-Saharan Africa. The number of DM patients is projected to increase to an astounding 592 million by 2035 [1]. In Kenya, the rising burden of DM remains largely neglected as the country is still struggling with infectious diseases. It is estimated that in 2014 775,210 DM cases were recorded in Kenya with 582,000 people with DM remaining undiagnosed [1]. Most of these patients present late and may not get the standard of care they need, leading to high morbidity and mortality.

A key component of DM management is self-monitoring of blood glucose (SMBG), which is proven to improve glycemic outcomes in patients with DM [2–4]. SMBG is tailored to meet the needs of the patient and varies depending on the treatment the patient is on [5]. Like in other interventions, patient adherence remains key to achieving good outcomes [6]. Adherence is defined by the World Health Organization as the extent to which a person's behavior – taking medication, following a diet and/or executing lifestyle changes – corresponds with agreed recommendations from a health care provider [7]. Adherence to SMBG therefore requires that patients test their blood sugar as advised by the healthcare provider, in terms of frequency and timing. The overall evidence about adherence to SMBG among DM patients is limited and most of the evidence comes from the United States of America, Europe or Asia [2,3,8,9]. We could not identify any published evidence on this issue from Africa.

At the Moi Teaching and Referral Hospital (MTRH) in Kenya, patients with DM who meet a certain criteria (Section 2.3) are enrolled into a home-based SMBG program, educated and provided with an electronic blood glucose meter to conduct intensive SMBG. Patients are contacted via telephone once a week and are expected to give the SMBG readings for that week. The SMBG readings are then used to guide a healthcare provider in adjusting their medication. However, it has been observed in the program that the glycemic control of some of the patients remains lower than expected and it is not clear whether this is related to patient's adherence to SMBG. Therefore we aimed to assess the adherence to SMBG in this group and its relation to glycemic control. The specific objectives were to (1) determine the adherence to SMBG at different time points into the program, (2) identify the demographic and clinical characteristics associated with non-adherence to SMBG and (3) assess whether adherence to SMBG is associated with glycemic control and hospital admissions and emergency room visits.

2. Methods

2.1. Study design

This is a retrospective cohort study using the routinely collected data of DM patients enrolled into the home based care program.

2.2. General setting

Kenya is located in East Africa with a population of 43.2 million as of 2012. The country is divided into 47 administrative counties. The health care delivery system in Kenya is divided into six levels. Level 6 represents the national referral hospitals which are currently two in the country, level 5 represents county referral hospitals, level 4 represents sub county referral hospitals and levels 3–1 represent the primary health care facilities. Currently DM management is mostly confined to level 4, 5 and 6 hospitals where comprehensive DM management teams and services are likely to be found. The current DM prevalence in the country is estimated at 3.6% [1] which may be an under representation due to lack of data collection tools to report on DM cases in the country as well as the fact that most DM patients remain undiagnosed.

The Moi Teaching and Referral Hospital, located in Eldoret town (310 km Northwest of Nairobi, the capital city of Kenya), is the second largest referral hospital in the country. The hospital serves a catchment population of 16.4 million people [10]. The hospital runs DM outpatient clinics and currently has about 3000 patients on care. The main occupation in the catchment population is farming with most people engaging in subsistence farming.

The Academic Model providing Access to Health Care (AMPATH) is a collaboration between Moi University College of Health Sciences (MUCHS), Moi Teaching and Referral Hospital (MTRH) and a consortium of North American academic medical centers led by Indiana University. AMPATH was first established as a response to the HIV pandemic but in collaboration with Ministry of health (MOH) has diversified to other chronic illnesses [11]. The chronic disease management (CDM) program of AMPATH oversees management of DM patients including those in the SMBG program in western Kenya.

2.3. Home glucose monitoring (HGM) SMBG program

As part of chronic disease management program, patients are enrolled into a home glucose monitoring program based on strict pre-defined criteria that includes all children, adolescents and adults with poor glycemic control. The program has two distinct arms. Arm 1 constitutes all children, adolescents and adults with very poorly controlled DM as assessed by an HbA1c above 13% and/or established DM complications. Arm 2 constitutes financially able adults who are mainly on Oral Glucose Lowering Agents (OGLAS) or on insulin. These patients are also poorly controlled but have HbA1c below 13% and meet a certain criteria for SMBG such as hypoglycemic episodes or an established DM complication. The patients in arm 1 receive free glucometers and glucostrips while those in Arm 2 receive a free glucometer but pay a subsidized fee of Kshs 500 (\$5.90) which is much lower than the market price of Kshs 3000 (\$37.50) for a box of 50 glucostrips. All the patients receive free DM diaries and have access to all the HGM services irrespective of the arm assigned.

Once enrolled, the patients are trained by a DM educator on SMBG, use of the DM diary and their medication. The diabetes clinic currently has one diabetes educator who serves all the clients. As a result of this, most patients receive one session of diabetes education which in most cases is individualized

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