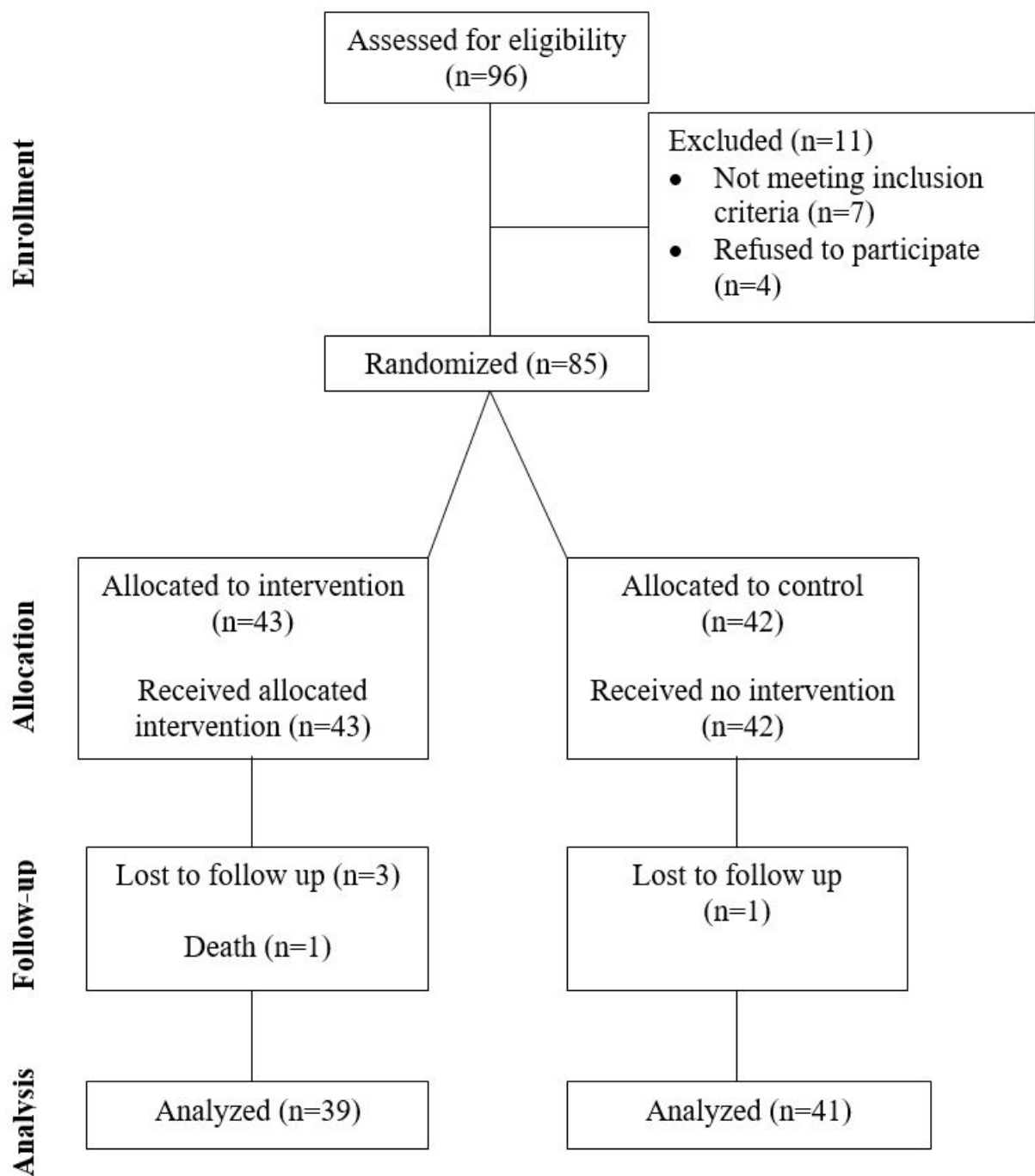


Impact of Self-Monitoring Blood Glucose on Glycemic Control among Insulin-Treated Patients with Diabetes Mellitus in Northeastern Tanzania: A Randomized Controlled Trial

Importance: Tracking of blood glucose levels by patients and care providers remains an integral component in the management of diabetes mellitus (DM). Evidence, primarily from high-income countries, has illustrated the effectiveness of self-monitoring of blood glucose (SMBG) in controlling diabetes. However, there is limited data on the feasibility and impact of SMBG among patients in the regions of sub-Saharan Africa.

Objective: This study aimed to assess SMBG, its associated factors, and its effect on glycemic control among insulin-treated patients with diabetes mellitus in northeastern Tanzania.

Design, Setting, and Participants: This was a randomized clinical trial conducted in Tanzania from December 2022 to May 2023. The study included DM patients who had already been on insulin treatment for at least 3 months.



Intervention: Participants were assigned to the intervention and the control groups by a simple randomization method. The intervention group received glucose meters, test strips, logbooks, and extensive SMBG training. The control group received the usual care at the outpatient clinic.

Main Outcomes and Measures: The primary and secondary outcomes were adherence to the SMBG schedule, barriers associated with the use of SMBG and the ability to self-manage DM, logbook data recording, and change in glycated hemoglobin (HbA1c).

Results: The majority of participants (51.3%) in the intervention group were within the age range of 35–59 years, while participants aged >60 years constituted a larger proportion (65.9%) in the control group. The majority of the participants were females in both the intervention and control groups, with 24 (61.5%) and 33 (80.5%), respectively. Both the intervention group (64.1%) and the control group (65.9%) had a similar proportion of married individuals. Most of the participants were unemployed (51.3% vs. 75.6%). The intervention group had a median total insulin dose of 48 units (IQR 36–64) per day, compared to 55 units (IQR 36–72) in the control group. For the intervention and control groups, the mean waist circumference was 93.9 cm (SD 12.9) and 95 cm (SD 13.2), respectively. In both groups, most participants were diagnosed with DM for more than 10 years and were on insulin treatment for more than 1 year.

About 24 (61.5%) of patients in the intervention group showed good adherence to SMBG based on tests recorded in the logbooks and glucometer. Education on SMBG was significantly associated with adherence. Structured SMBG improved glycemic control with a HbA1c reduction of -1.01 (95% CI -1.39, -0.63) in the intervention group within 3 months from baseline compared to controls of 0.18 (95% CI -0.07, 0.44) ($p < 0.001$). Higher formal education levels were associated with increased HbA1c by 1.21%. There was a post-intervention reduction of HbA1c within the intervention group of -1.01 (CI -1.39, -0.63) and a 0.18 (CI -0.07, 0.44) reduction in the control group, whereby the mean difference in the intervention group was statistically significant ($p < 0.001$). While studying the differences

between the two groups, the mean HbA1c in the intervention and control groups pre-intervention was 11.1% and 10.7%, respectively. The mean difference in HbA1c between the two study arms was 0.39 (CI -0.42, 1.21), which was statistically insignificant during the commencement of the study but rendered a significant difference of -0.806 (CI -1.59, -0.02) at the end of the study. Similarly, FBG pre-intervention was 8.91 mmol/l and 10.23 mmol/l in the intervention and control groups, respectively, with the post-intervention FBG being 6.85 mmol/l in the intervention group and 8.55 mmol/l in the control group, respectively. This was a -1.69 (CI -2.68, -0.70) difference, showing statistical significance in FBG between the two groups.

Among the intervention group, the study found that the majority of participants (62%) demonstrated good adherence to SMBG based on logbook records, whereas 38% had poor adherence with fewer blood glucose readings. Social demographic characteristics such as age, education level, occupation, marital status, and body mass index (BMI) did not appear to significantly influence SMBG adherence in the intervention group. However, there was a potential, albeit statistically insignificant, association between the duration of insulin prescription and SMBG adherence (p value 0.096). Interestingly, participants with a longer history of insulin use tended to exhibit lower adherence rates (46.7%). These results suggest that while demographic factors may not be major determinants of SMBG adherence, the duration of insulin therapy might play a subtle role in influencing adherence levels.

Conclusion and Relevance: Structured SMBG positively impacted glycemic control among insulin-treated patients with diabetes in the outpatient clinic. The results suggest that implementing a structured testing program can lead to significant reductions in HbA1c and

fasting blood glucose levels. Additionally, higher educational attainment showed a significant association with glycemic control.