

Modeling Adherence to Diabetes Mellitus Treatment

Fatemeh Ehteshami

The burden of Diabetes Mellitus (DM) has been rising over the past few decades, primarily driven by the continuous increase in the incidence of Type 2 DM (T2DM) cases. In 2021, there were around 537 million people aged between 20-79 years with DM globally, and about 80% of this population resided in low-and middle-income countries (LMICs). DM is projected to affect 783.2 million individuals by 2045.

World Health Organization recommends a comprehensive approach to the clinical management of T2DM, including pharmacological and non-pharmacological interventions targeting glycemic control. However, medication non-adherence remains prevalent among individuals with DM, which is associated with adverse outcomes and a high risk of severe complications, including heart disease, stroke, end-stage renal disease, vision loss, and foot gangrene. Effective adherence to T2DM treatment extends beyond taking prescribed medications and requires consistent self-monitoring, compliance with a healthy diet, and engagement in an active physical lifestyle. Patients often struggle to adhere to these self-management behaviors, leading to negative health outcomes such as suboptimal therapeutic outcomes, financial burden, and increased risk of morbidity and mortality. Non-adherence to treatment is particularly higher in LMICs, where limited access to medicines and medical equipment, as well as poor awareness and health education persist.

In this exercise, I develop a system dynamics model to assess the influence of different health interventions related to treatment adherence over time. The process involves the following steps:

1. Structuring a stock and flow diagram to represent the progression of the adult population with normal glycemic levels (aged 18 and above), the population with prediabetes, the population with diabetes, the uncontrolled diabetic population, and the diabetic population with complications such as micro and macrovascular diseases.
2. Subscribing the population based on demographic characteristics such as gender, age groups (18-24) (25-34) (35-44) (45-54) (55-64) (65-74) (>75), geographic location (urban, rural), socioeconomic status such as wealth index (poorest, poor, average, rich, richest). Population groups including normal glycemic, prediabetes, diabetes, and uncontrolled diabetes are categorized according to the level of fasting plasma glucose measures.
3. Testing the impact of effective health interventions that promote treatment adherence and self-management, such as awareness on the transition rates between population groups.

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