

Modeling Adherence to Diabetes Mellitus Treatment

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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 [1]. 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) [2]. DM is projected to affect 783.2 million individuals by 2045 [3].

World Health Organization recommends a comprehensive approach to the clinical management of T2DM, including pharmacological and non-pharmacological interventions targeting glycemic control [4-6]. However, medication non-adherence remains prevalent among individuals with DM, which is associated with adverse outcomes [7] and a high risk of severe complications, including heart disease, stroke, end-stage renal disease, vision loss, and foot gangrene[8]. 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 [7, 9, 10]. 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.

A few studies have previously conducted simulation models for DM, incorporating model structures for pre-DM diagnosis, DM, and DM with complications diagnosis to project the growth in DM prevalence trends and test some interventions [11-14]. However, the findings of a realist review (the ongoing study of my PhD project) showed that some interventions, such as mHealth and eHealth implementation effectively improve treatment adherence and glycemic control in LMICs. Thus, a simulation model is developed to achieve the following objectives:

- To examine the influence of treatment adherence on the incidence of complications
- To test the impact of health interventions aimed at improving access to healthcare services and self-management on treatment adherence

An overview of the underlying causal effects through a causal loop diagram is shown in Figure 1.

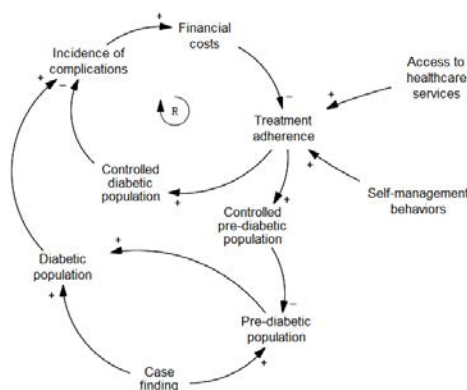


Figure 1 - A causal loop diagram on the dynamics of treatment adherence

Commented [h1]: This is a great introduction to the problem at hand. It sets up the problem neatly.

Commented [h2]: For an academic purpose, this may need more expansion to provide evidence for the need to develop a new model. I believe a more in-depth explanation of the structural shortcomings of currently available models that justify the need for the new model can help this argument immensely.

Commented [h3]: These are the interventions, scenarios, and policies you would want to test using the developed model. However, what the document misses the most is a description of the mechanisms you plan to model. My assumption is the mechanisms include aging chains of the population and chains of individuals' progression of diabetes. A more detailed explanation of such mechanisms together with the dynamic phenomenon you are planning to capture with said mechanisms can improve this problem definition greatly.

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