*Sri Lankan Journal of Health Sciences*

*Article*

# Evaluation of Patient Related Factors, the Level of Glycemic Control; and Cost of Diabetic Medications of Patients Attending Selected Public Sector Diabetic Clinics in Sri Lanka

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## Abstract

**Background:** Diabetes Mellitus (DM) is a global epidemic. Globally the number of diabetic complications is increasing. Therefore, it is important to find the reasons for the escalating number of diabetic complications and associated mortality. The main objective of this study was to evaluate patients' knowledge and level of adherence to treatments, the cost associated with diabetic medications and the level of glycemic control. **Methods:** This study was a pretested, structured questionnaire-based cross-sectional survey with retrospective data collection from participants' clinic books. The questionnaire was developed to obtain data on socio-demographic variables; patients' knowledge on disease and medicines; patients' dietary control and adherence to the medications and non-medicinal recommendations. **Results:** Patients (n = 207) attending the diabetes clinics of two teaching- and two base-hospitals in Sri Lanka were taken as the sample. The majority of the participants demonstrated moderate knowledge (63%) on DM. Of the participants, 46% had moderate adherence to pharmacological and nonpharmacological recommendations of healthcare providers and 55% showed good glycemic control. The monthly average drug cost for a DM patient was 270.10 Sri Lankan Rupes (LKR). There was a significant association between participants' knowledge and level of adherence. However, there were no significant associations between participants' knowledge and glycemic control, or patients' adherence and glycemic control. There was a significant knowledge gap between the patients attending Teaching- and Base-hospitals. **Conclusion:** The majority of the diabetic patients had either moderate or above knowledge and adherence, but their glycemic control was sub-optimal and associated with factors other than patients' knowledge and adherence.

**Keywords:** Diabetes Mellitus; Knowledge; Adherence; Glycemic control

## Introduction

Diabetes Mellitus (DM) is a chronic disease condition that occurs due to the inability of the body to produce any or adequate amounts of insulin or to use insulin effectively which leads to hyperglycemia. There are three types of DM, Type 1 DM (insulin dependent DM (IDDM), Type 2 DM (non-insulin dependent DM (NIDDM) and gestational DM (GDM). Treatments for diabetes vary depending on the type. Type 1 DM is treated with insulin. For Type 2 nonpharmacological measures/oral hypoglycemic agents and insulin are used. Nonpharmacological measures and insulin are recommended for GDM.

**Citation:** Miriyagalla BD, Liyanaarachchie CPT. Evaluation of Patient Related Factors, the Level of Glycemic Control; and Cost of Diabetic Medications of Patients Attending Selected Public Sector Diabetic Clinics in Sri Lanka. Sri Lankan J. Health. Sci. 2022, 1(1): 19-26.
Received: 23.01.2022; Accepted: 20.02.2022; Published: 06.07.2022

DM has become a global epidemic. In 2021, 537 million 20-79 year old people have lived with diabetes and approximately 6.7 million deaths occurred due to DM or its complications (1). It has been estimated that the total number of diabetics would be 783 million by the year 2045 (1). In 2021, USD 966 billion were spent on diabetic health care (1). Most of the health care expenditure is associated with the complications of DM (2, 3). The prevalence of diabetes in Sri Lanka in 2021 was 11.3% and ranked 3rd among the South Asian countries (1).

Controlling blood glucose levels is important to prevent complications of diabetes such as cardiovascular disease, nephropathy, neuropathy, retinopathy and foot damage. Patient-related factors affecting the expected outcomes of treatment are age, gender, educational level, occupation, dietary patterns and knowledge and adherence on disease condition (4). The aim of the study was to evaluate patients' knowledge and level of adherence to medications and glycemic control. In addition, the cost associated with diabetic medications of patients attending selected diabetic clinics was also analyzed.

## Materials and Methods

### *Study Design*

This study was a pretested, structured questionnaire based cross-sectional study involving patients attending selected diabetic clinics combined with a retrospective data collection of clinic records. Patients who were attending the diabetes clinics of the teaching hospitals Kandy and Peradeniya, and the Base hospitals Warakapola and Mirigama in Sri Lanka were considered as the study population.

### *Ethical Approval*

Ethical approval was obtained from the Ethics Review Committee, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka (Reference number: AHS/ERC/2018/030). Approvals were obtained from the head of each institution to carry out the study. Informed consent was sorted from each participant before data collection.

### *Inclusion and exclusion criteria*

Type 1 or Type 2 DM patients over twelve years of age, registered in the selected diabetic clinics at least three months before inclusion in the study and provided written consent for participation were included in the study. Patients who have GDM, severe medical illnesses, including physical or mental handicaps, and patients unwilling to participate were excluded.

### *Sampling*

A total number of 207 patients; 67, 50 and 45 patients from Teaching Hospital (TH) Kandy, TH Peradeniya and each Base Hospital (BH) were conveniently included in the study. The researcher interviewed patients waiting in the clinic queues in a manner that did not disturb the doctor's visit. Before the interview started, the study's purpose and outline were explained to the participants. The list of the medications in participants' clinic records for the last three consecutive months was recorded with their glycemic values.

### *Data collection*

The pretested and finalized questionnaire contained three major sections: 1. socio-demographic information, 2. information on patients' knowledge and awareness of the disease, symptoms, complications, and medications, and 3. information on dietary control and adherence to the medications. The glycemic control of the patients was evaluated using the laboratory report values recorded in the clinic records.

The list of medications over the past three months was obtained from the clinic records of participants to analyze the cost of medications for each patient. Medicine unit prices were obtained from

the Department of Pharmacy, TH Peradeniya. Doses and the frequencies of medicines were considered for cost calculation.

*Data analysis*

Statistical Package for Social Science (SPSS 25) was used for data analysis. Associations between different variables were analyzed using the Chi-Square test and *p* values below 0.05 were considered significant.

## Results

*Socio-demographic data*

Among the participants, 42% were males, and 58% were females. Participants were included in 20-35, 36-50, 51-65, 66-80 and >81 year age groups. The majority of the participants were older than 50 years. When considering ethnicity, the majority was Sinhalese (84%). There were Tamil (9%), Muslim (6%), and Malay (1%) ethnic participants. Participants were from different educational levels. Of them, 5% had not attended school, 15% had received primary education, 27% had grade 6-9 education, 28% had General Certificate of Education (G.C.E) ordinary level (O/L), and 19 % had G.C.E. advanced level (A/L) education. Further, there were 2% diploma holders and 3% degree holders. Of the participants, 57% were not employed, 17% were employed, 24% were retired, and 2% were students.

*Knowledge assessment*

Knowledge of the participants was assessed using six questions related to causes, symptoms, recommendations, complications, and own antidiabetic medication. Marks were allocated (maximum 16 marks) for the answers. According to the marks obtained by the participants, they were categorized into good, moderate, or poor knowledge. The majority (63%) of the participants were in the moderate knowledge category. Further, 14 % of the participants had mentioned that they were not received health care advice from their healthcare providers. Table 1 summarises the distribution of participants' knowledge of diabetes concerning sociodemographic variables.

*Adherence assessment*

Adherence to treatments and non-medication recommendations was assessed using four questions. The majority (46%) of the participants had moderate adherence, whereas 35% of participants poorly adhered. Table 1 summarises the distribution of participants based on their adherence with respect to sociodemographic variables.

*Glycemic control assessment*

Of the participants, 55% had good glycemic control. Table 1 summarizes the distribution of participants based on their glycemic control status with respect to sociodemographic variables.

*Average monthly drug cost calculation*

The monthly average drug cost for a DM patient was 270.10 LKR. The average monthly cost distribution of each medicine is shown in Figure 1.

**Table 1**. Distribution of participants based on knowledge, adherence, and glycemic control concerning sociodemographic variables

| Variable | Participants knowledge % | | | | Participants' adherence% | | | | Participants' glycemic control% | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | Good | Moderate | Poor | Count | Good | Moderate | Poor | Count | Good | Poor |
| **Age** | | | | | | | | | | | |
| **20-35 years** | 3 | 33.3% | 0% | 66.7% | 3 | 33.3% | 0% | 66.7% | 3 | 33.3% | 66.7% |
| **36-50 years** | 25 | 36.0% | 60.0% | 4.0% | 25 | 8.0% | 64.0% | 28.0% | 25 | 48.0% | 52.0% |
| **51-65 years** | 94 | 37.2% | 46.8% | 16.0% | 94 | 18.1% | 45.7% | 36.2% | 94 | 39.4% | 60.6% |
| **66-80 years** | 82 | 30.5% | 50.0% | 19.5% | 82 | 22.0% | 42.7% | 35.4% | 82 | 51.2% | 48.8% |
| **>81 years** | 3 | 33.3% | 0% | 66.7% | 3 | 33.3% | 33.3% | 33.3% | 3 | 66.7% | 33.3% |
| **Gender** | | | | | | | | | | | |
| **Male** | 87 | 40.2% | 49.4% | 10.3% | 87 | 25.3% | 42.5% | 32.2% | 87 | 43.7% | 56.3% |
| **Female** | 120 | 30.0% | 47.5% | 22.5% | 120 | 14.2% | 48.3% | 37.5% | 120 | 46.7% | 53.3% |
| **Ethnicity** | | | | | | | | | | | |
| **Sinhalese** | 174 | 33.9% | 48.9% | 17.2% | 174 | 18.4% | 45.4% | 36.2% | 174 | 45.4% | 54.6% |
| **Tamil** | 18 | 38.9% | 44.4% | 16.7% | 18 | 22.2% | 33.3% | 44.4% | 18 | 50.0% | 50.0% |
| **Muslim** | 13 | 30.8% | 46.2% | 23.1% | 13 | 23.1% | 61.5% | 15.4% | 13 | 30.8% | 69.2% |
| **Others** | 2 | 50.0% | 50.0% | 0% | 2 | 0% | 100% | 100% | 2 | 100% | 0% |
| **Employment status** | | | | | | | | | | | |
| **Retired** | 49 | 55.1% | 38.8% | 6.1% | 49 | 26.5% | 44.9% | 28.6% | 49 | 40.8% | 59.2% |
| **Unemployed** | 119 | 24.4% | 50.4% | 25.2% | 119 | 13.4% | 45.4% | 41.2% | 119 | 48.7% | 51.3% |
| **Employed** | 35 | 40.0% | 54.3% | 5.7% | 35 | 28.6% | 45.7% | 25.7% | 35 | 42.9% | 57.1% |
| **Student** | 4 | 25.0% | 50.0% | 25.0% | 4 | 0% | 75.0% | 25.0% | 4 | 25.0% | 75.0% |
| **Highest educational level** | | | | | | | | | | | |
| **No school** | 10 | 10.0% | 50.0% | 40.0% | 10 | 30.0% | 30.0% | 40.0% | 10 | 40.0% | 60.0% |
| **Grade 1-5** | 32 | 12.5% | 46.9% | 40.6% | 32 | 12.5% | 43.8% | 43.8% | 32 | 56.3% | 43.8% |
| **Grade 6-10** | 55 | 27.3% | 52.7% | 20.0% | 55 | 14.5% | 49.1% | 36.4% | 55 | 41.8% | 58.2% |
| **Up to G. C. E. O/L** | 58 | 48.3% | 41.4% | 10.3% | 58 | 24.1% | 36.2% | 39.7% | 58 | 34.5% | 65.5% |
| **Up to G. C. E. A/L** | 40 | 42.5% | 52.5% | 5.0% | 40 | 17.0% | 57.5% | 25.0% | 40 | 52.5% | 47.5% |
| **Diploma** | 5 | 40.0% | 60.0% | 0% | 5 | 0% | 60.0% | 40.0% | 5 | 40.0% | 60.0% |
| **Degree** | 6 | 66.7% | 33.3% | 0% | 6 | 33.3% | 66.7% | 0% | 6 | 83.3% | 16.7% |
| **Post Graduate** | 1 | 0% | 100% | 0% | 1 | 100% | 0% | 0% | 1 | 100% | 0% |

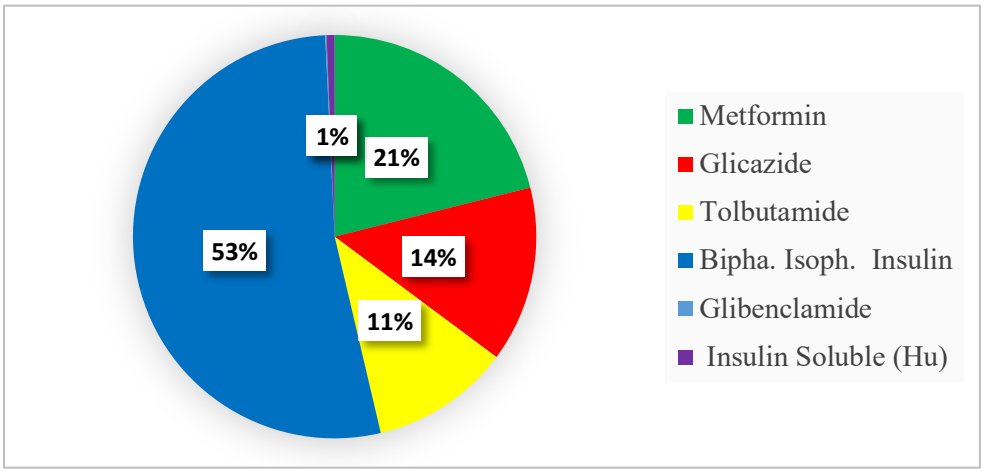


**Figure 1**. Distribution of average monthly cost per medicine

*Association between knowledge and adherence of participants*

There were significant associations between participants' knowledge and level of adherence (p = 0.028); dietary patterns and glycemic control status of patients ($p$<0.001); glycemic control, and average monthly costs for medicines ($p$ = 0.041). However, no significant associations were observed between participants' knowledge and glycemic control ($p$ = 0.374); and patients' adherence and glycemic control ($p$ = 0.099).

Table 2 compares the level of knowledge on diabetes between the participants in Teaching and Base hospitals. Among the participants of THs (117), 29% had a good level of knowledge of diabetes, whereas the majority (61%) had a moderate level, and only 10% had a poor knowledge level. Among the BHs' participants (90), only 8% had good knowledge, and 26% had poor knowledge.

**Table 2.** Distribution of participants based on their knowledge level concerning their hospital setting

| Hospital | Participants knowledge level on diabetese | | |
|---|---|---|---|
| | Good | Moderate | Poor |
| **Teaching Hospital** | 29% | 61% | 10% |
| **Base Hospital** | 8% | 66% | 26% |

Adherence levels between participants from selected Teaching and Base hospitals are compared in Table 3. Of the participants from THs, only 22% and 33% had good and poor levels of adherence to the medication therapies and other recommendations. Among the BH participants from BHs, only 14% had a good level of adherence, while 39% had poor adherence.

**Table 3.** Distribution of participants based on their adherence level with respect to their hospital setting

| Hospital | Particpants adherance to medications and non medication recomendations | | |
|---|---|---|---|
| | Good | Moderate | Poor |
| **Teaching Hospital** | 22% | 45% | 33% |
| **Base Hospital** | 14% | 47% | 39% |

Table 4 compares the glycemic control status between the participants from selected Teaching and Base hospitals. Of the THs' participants 39% had good glycemic control whereas 61% were of poor glycemic control. Among the participants from BHs, 53% of participants had a good level of glycemic control, while 47% had poor glycemic control.

**Table 4.** Distribution of participants based on their glycemic control status concerning their hospital setting

| Hospital | Particiants glycemic control status | |
|---|---|---|
| | **Good** | **Poor** |
| **Teaching Hospital** | 39% | 61% |
| **Base Hospital** | 53% | 47% |

## Discussion

This study was conducted in two THs and two BHs in Sri Lanka to assess patient-related factors and evaluate the outcomes related to DM. Unlike most studies in developing countries reporting patients' poor knowledge of DM, the current study shows that the majority (>83%) had moderate/above moderate knowledge. In addition, gender, age, and ethnicity had no significant association with knowledge of DM. The current findings related to knowledge of diabetes in males and females were different from other reported studies conducted in developing countries., In Bangladesh, males were found to have higher knowledge about the disease (5-7). Previous studies from developing countries and the current study revealed a significant association between level of education and knowledge of diabetes (8-10). However, there was a significant knowledge gap between participants of THs and BHs.

Non-adherence is the major cause leading to increased complications and mortality of diabetic patients. Results of the study revealed that 65% of the participants had moderate or above moderate adherence. There was a significant association between patients' knowledge and adherence ($p = 0.028$). Many previous studies in similar settings to Sri Lanka reported poor adherence, but those reported that the patients' knowledge was also poor (6, 7, 9, 10).

Diabetic dietary plans and physical activities are among the recommended non-drug management procedures for diabetics (11). The current study revealed that 65% of the participants followed diabetic dietary plans. In addition, 51% were used to engaging in physical activities on a regular basis. However, nearly 58% of the participants were non-adherent to their medicines. The results were similar to other studies (12). Healthcare instructions received from healthcare providers could have enhanced knowledge of DM in 83% of the participants. Some studies have reported that medication adherence is satisfactory when health care providers are emotionally supportive and treat patients as equal partners (13).

Most of the diabetic outpatients in the present study had poor glycemic control status (55%). The present finding is consistent with previous studies conducted in Asia and America (14,15). The current study revealed that participants' glycemic control is dependent on variables other than patients' knowledge of the disease and adherence to medication, dietary, and exercise-based recommendations. Unavailability of particular medicines in government hospitals could be one of the reasons for this poor glycemic control. The possibility of prescribing new medicines for glycemic control is a barrier in Sri Lankan government hospitals. Poor glycemic control in patients indicates a need for further studies to find the associated reasons and correct the issue. Another fact is that, though the HbA1c test is the better predictor of glycaemic control (16), in Sri Lankan government hospitals, it is performed once a year or in special circumstances only, which is hardly adequate for correct predictions.

To the best of our knowledge, this study is the first attempt to measure a DM patient's total average drug cost per month in outpatient clinics in Sri Lanka. The calculated average drug cost per month is

270.10 LKR. However, the study did not consider other associated costs and the costs for drugs other than antidiabetic agents. There was an association between glycemic control and the average monthly cost of a patient ($p = 0.041$). It reflects that the higher the cost, the treatments more effective. It could be that the patients on comparatively expensive insulin therapy, show higher glycemic control.

## Conclusion

The findings of this study revealed that, even though the majority had either moderate/above moderate knowledge and adherence, their glycemic control status is sub-optimal and is associated with factors other than patients' knowledge and patients' adherence to treatment and other non-pharmacological recommendations.

**Author Contributions:** Conceptualization, CPTL; methodology, BDM and CPTL; validation, BDM; formal analysis, BDM; investigation, BDM; data curation, BDM; writing—original draft preparation, BDM; writing—review and editing, CPTL; visualization, CPTL; supervision, CPTL; project administration, BDM. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding

**Acknowledgments:** Authors acknowledge the staff of four hospitals, administrators, and the participants for the support extended for the successful completion of the study.

**Conflicts of Interest:** The authors declare no conflict of interest

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