Treatment Characteristics and Determinants of Poor glycaemic Control among Type 2 Diabetes Mellitus (T2DM) Patients Attending Clinics at the Three Selected Health Centres in Suva, Fiji between 2011-2016

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Abstract

Introduction and Aim: Type 2 Diabetes Mellitus (T2DM) is a global health problem that is reaching epidemic proportions. It Fiji, it has a high admission rate due to complications and is the number one cause of disease specific mortality. The aim of this study was to determine the proportion of poor glycaemic control level among adult T2DM patients, their treatment characteristics and determinants. Methods: This was a 5-year retrospective medical folder audit on randomly selected folders registered between August 1, 2011 to August 1, 2016 from the three selected health centres in Suva, Fiji who all met the following inclusion criteria: T2DM adults > 18 years old, has recent HbA1c test result in 2017, on treatment for > one year and > 4 clinic visits. A total sample of 338 was derived out of 2,073 T2DM registered during the 5-year period and was calculated using proportionate sampling method. The most recent HbA1c was the parameter used to measure glycaemic control. Logistic regression analysis in SPSS version 22 was used to assess the effect of patient?s treatment determinants on glycaemic control with p < .05 considered as significant. Results: There were 200 female (59.2

Index terms— treatment characteristics, determinants, glycaemic control, type 2 diabetes, fiji.

I. Introduction ype 2 Diabetes Mellitus (T2DM) is the most common form of diabetes mellitus which constitute 90 -95% of all cases. [1][2][3]. It is a global health problem reaching epidemic proportions where 425 million globally or 8.8% of adults 20 -79 years of age are estimated to have T2DM and accounted for 10.7% of global all-cause mortality in this age group. [4] In the Pacific Island countries and Territories (PICTs), diabetes prevalence rates of 40% is common with high rates of complications and poor clinical outcomes with over 70% of T2DM patients having poor glycaemic control. [5] In Fiji, T2DM has a prevalence rate of 15.6% in adults 25 -64 years and is projected to rise to 19.3% in 2020 due to rising obesity with consequences for premature mortality and reduced life expectancy. [6,7] It is also the number one cause of disease specific mortality accounting for 19.7% of all deaths in 2015 with a mortality rate of 151.8 per 1,000 population and hospital admission rate due to complications of 134.5 per 1,000 admissions. [8] T2DM is a heterogeneous metabolic disorder characterized by hyperglycaemia secondary to impairment of insulin secretion, defective insulin action or combination of both. [9,10] It comes in various forms and can range from those with predominantly resistant phenotype with sufficient beta cell reserve that can be managed by oral anti-hyperglycaemic medications to those with impaired insulin secretion that need to be managed with insulin upon diagnosis or in the early course of the disease. [10] T2DM is diagnosed using the diagnostic criteria recommended by the International Diabetes Federation (IDF) and World Health Organization (WHO) in which most of the diabetes management guidelines used worldwide. This diagnostic criteria include

the following: (1) Fasting Blood Sugar (FBS) > 7.0 mmol/L (126 mg/dL) or (2) 2-hour plasma glucose reading of > 11.1 mmol/L (> 200mg/dL) following ingestion of 75 g glucose load or Random Blood Sugar (T2DM) is a global health problem that is reaching epidemic proportions. It Fiji, it has a high admission rate due to complications and is the number one cause of disease specific mortality. The aim of this study was to determine the proportion of poor glycaemic control level among adult T2DM patients, their treatment characteristics and determinants.

Methods: This was a 5-year retrospective medical folder audit on randomly selected folders registered between August 1, 2011 to August 1, 2016 from the three selected health centres in Suva, Fiji who all met the following inclusion criteria: T2DM adults > 18 years old, has recent HbA1c test result in 2017, on treatment for > one year and > 4 clinic visits. A total sample of 338 was derived out of 2,073 T2DM registered during the 5year period and was calculated using proportionate sampling method. The most recent HbA1c was the parameter used to measure glycaemic control. Logistic regression analysis in SPSS version 22 was used to assess the effect of patient's treatment determinants on glycaemic control with $p < .05$ considered as significant.

Results: There were 200 female (59.2%) and 138 male (40.8%) T2DM patients 30 -82 years studied with a mean age of 56.5 years (SD = ± 9.9). The proportion of poor glycaemic control was 77.2%. The HbA1c ranged from 5.0% -16.6% with a mean of 8.6% (SD = ± 2.4). Majority of T2DM patients were on oral anti-diabetic medications (74.3%). Logistic regression analysis showed T2DM patients on insulin treatment regimen, (OR = 6.72, 95% CI = 2.20, 20.59, $p < .001$) have 7 times more chances of having poor glycaemic control compared to those taking oral anti-diabetic medications only.

Conclusion: There was a high proportion of poor glycaemic control among T2DM patients attending clinics in Suva, Fiji. Those on insulin treatment were significant determinant of poor glycaemic control. Health care providers should consider treatment determinants when managing T2DM patients to ensure better glycaemic control.

(RBS) of > 11.1 mmol/L (> 200mg/dL) in a symptomatic patient or HbA1c > 6.5% (48 mmol/L). [1,11, **??**2]. T2DM when poorly controlled increases risk of complications which require frequent hospitalizations, increasing medical care costs, lowering quality of life, disability and premature deaths. [13] Research studies have shown that treatment

Treatment factors include the anti-diabetic medications being used, the number of medications T2DM patients are taking daily, adherence to treatment and clinic attendance. There have been no current studies conducted in Fiji to determine the treatment characteristics and determinants of T2DM with glycaemic control. Hence, the aim of this retrospective study was to determine the proportion of poor glycaemic control level among adult T2DM adult patients attending clinics at the three selected Suva health centres between 2011 -2016, their treatment characteristics and determinants that were associated with it.

The findings of this study will be beneficial to the Fiji Ministry of Health and Medical services by providing information on the current proportion of poor glycaemic control among T2DM patients as well as the significant treatment determinants that will assist health care providers in providing effective diabetes management plan and interventions tailored to the individual T2DM patient's needs.

1 II. Methodology

This was a health centre-based 5-year retrospective study using randomly selected T2DM patients medical records registered between August 1, 2011-August 2016 at the three randomly selected health centres in Suva, Fiji. The following inclusion criteria were used in this study: (1) T2DM adults > 18 years old, (2) has recent HbA1c test result available in 2017, (3) on treatment for > one year and (4) > 4 clinic visits. Type 1 diabetics and those that did not meet the inclusion criteria including those with incomplete medical records (medical information and blood results) were excluded from the study. A total sample of 338 was derived out of 2,073 T2DM patients registered during the 5 year period who met the inclusion criteria and was calculated using proportionate sampling method (with 5% margin of error and 95% Confidence Interval (CI), with 32.2% proportion of uncontrolled T2DM. [14] The sample was proportionately distributed among the three selected health centres. The 338 T2DM medical records were selected using systematic random sampling method where every third folder were chosen from the diabetes register (sampling frame) of the selected health centres. A pre-tested data collection form was used to collect information from the T2DM patient's folders. The International Business Machine (IBM) Statistical Package for Social Science (SPSS) version 22 was used to analyze the data. The continuous variables were analyzed using descriptive statistics and presented as mean, median, standard deviation and range values while the categorical variables were presented as frequency and percentage distribution. The most recent HbA1c test result in 2017 was the parameter used to evaluate glycaemic control where HbA1c > 7% defined poor glycaemic control while HbA1c < 7% defined good glycaemic control. [1,11, **??**2] HbA1c is the gold standard in evaluating glycaemic control as it measures the patient's average blood glucose level during the preceding three months [15][16][17] and has a predictive value for diabetes complications. [18,19].

Logistic regression analysis was performed to assess the effect of treatment characteristics on glycaemic control. This was first done using bivariate regression analysis to determine the association of each independent variable to glycaemic control. Then, model 1 was created where all the independent variables were put together in the model to determine their probabilities of contributing to poor glycaemic control to eliminate confounding effects as there were more than one independent variables. Statistical variables with $p < .05$ were considered significant. Further

analysis was done using forward stepwise logistic regression to test the likelihood ratio (chi square difference), starting with the constant only model and adding independent variables one at a time. All the factors that were significant were ultimately introduced in the final model where statistical variables with $p < .05$ were accepted.

Ethics approval were obtained from the Fiji National University College Health Research Ethics Committee (CHREC) and the Fiji National Health Research Ethics and Review Committee (FNHRECRC).

2 III. Results

Out of the total 354 T2DM patient records that were considered eligible for this study, data were collated from 338 records with a response rate of 95%. Sixteen records were excluded due to incomplete information. There were 200 female (59.2%) and 138 male (40.8%) T2DM patients 30 -82 years studied with a mean age of 56.5 years (SD = ± 9.9).

3 a) Glycaemic Control of T2DM Patients

This study found 77.2% of T2DM patients were poorly controlled (HbA1c > 7% while only 22.8% achieved good glycaemic control (HbA1c < 7%). The HbA1c ranged from 5.0% to 16.6% with a mean of 8.6% (SD ± 2.4). The frequency and percentage distribution of glycaemic control is presented in Table 1.

4 b) Treatment Characteristics of T2DM Patients

The T2DM patient's treatment characteristics are presented in Table 2. Majority were on oral antidiabetic medications (74.3%). The mean number of anti-diabetic medications taken daily was 6.46 tablets/injections (SD = ± 3.93). Most of them did not miss taking their daily medications (85.8%) and did not default their clinic appointments (84.0%). 3 presents the bivariate analysis results of participant's treatment factors on HbA1c control. As shown in Table 3, more than half of T2DM patients with poor glycaemic control were on oral anti-diabetics only (53.3%). More than one-third of those taking 5-10 medications daily (36.1%), those who did not miss their medications (66.3%) and those who were regular with their clinic attendance (65.1%) have poor glycaemic control. However, in logistic regression analysis, T2DM patients on insulin as part of treatment regimen, was significantly associated with poor glycaemic control (p<.001).

5 IV. Discussion

The aim of this study was to determine the proportion of poor glycaemic control, its treatment characteristics and determinants among T2DM patients attending clinic at three selected health centres in Suva, Fiji between 2011 -2016 using a 5 year retrospective folder audit. The results of this study found a mean HbA1c of 8.6% (SD = ± 2.04). This was higher compared to the results of the study conducted by Brian et al among 1,131 T2DM patients in Fiji as part of the HbA1c data collected during the Fiji Eye Health Survey 2009 (FEHS2009) where they found a mean HbA1c of 6.5% (SD = ± 1.3). This study found 77.2% of T2DM patients had poor glycaemic control (HbA1c > 7%) which is similar to the results of the study conducted in Fiji by Kumar et al on their descriptive analysis of diabetesrelated amputations at the Colonial War Memorial Hospital (CWMH) in Fiji between 2010-2012. [20] This proportion of poor glycaemic control is also comparable to the results of studies conducted in low and middle income countries. [21][22][23] Research had shown that generally over 60% of T2DM patients do not achieve the recommended glycaemic targets (HbA1c < 7%) despite stringent control to prevent complications. [24].

Using logistic regression analysis, this study found that thoseT2DM patients on insulin treatment regimen (OR = 6.72, 95% Confidence Interval = 2.20, 20.59, p <.001) have 7 times more chances of having poor glycaemic control compared to those on oral antidiabetic medications only. This is similar to studies conducted by Ahmad et al after studying 557 T2DM patients in Malaysia where they found that those receiving oral anti-diabetics were more likely to have good glycaemic control compared to those receiving a combination of insulin and oral anti-diabetics [25] and by Huri et al after studying 220 T2DM patients where they found that insulin in combination with oral antidiabetic medications were associated with poor glycaemic control. [26] Also, De-Pablos Velasco et al after studying 5,817 T2DM patients across Europe found that those T2DM patients on more complex anti-diabetic treatment were strongly associated with poor glycaemic control (OR = 11.19: 95% CI = 6.94, 18.04: p <.001). [27] This maybe because the use of insulin or combination of insulin and oral anti-diabetic medications are usually reserved to T2DM patients with complicated and progressive disease to control their diabetes. Insulin resistance increased due to diabetes deterioration over the years resulting from decline in ?-cells function. [28].

In this study, the number of medications taken daily was not associated with poor glycaemic control. Studies, however, confirmed that T2DM patients taking 5 or more medications were likely to have poor glycaemic control compared with patients taking fewer than 5 medications. [27,[29][30][31] Also in this study, T2DM patients who missed taking medications was not significantly associated with poor glycaemic control. However, a study in the US on missed doses of oral anti-hyperglycaemic medications by Vietri et al found 30% of T2DM patients who reported missing oral antidiabetic medications in the prior 4 weeks is associated with poor glycaemic control. [32] This study found that missing their clinic attendance is not significantly associated with poor glycaemic control. This is similar to the results of the study by Chung et al where they found no statistically significant difference in the clinical outcomes between diabetes clinic attendees and nonattendees. [33] Most studies, however, found that

clinic nonattendance or one or two missed clinics were found to be a significant risk factor for poor glycaemic control as it resulted to poor treatment adherence. [21,34,35] V. Conclusion T2DM is the most common form of diabetes mellitus which constitute 90%-95% of all diabetes mellitus cases. It is a global health issue reaching epidemic proportions. T2DM prevalence rates of 40% is common in PICTs including Fiji with poor clinical outcomes. The aim of this 5-year retrospective study was to determine the proportion of poor glycaemic control among adult T2DM patients attending clinics at the three selected health centres in Suva between 2011-2016, their associated treatment characteristics and determinants.

The results of this study showed the age of T2DM patients ranged from 30 to 82 years with a mean age of 56.5 years (SD = ± 9.9) with majority of them females (59.2%). The proportion of poor glycaemic control was 77.2% with a mean HbA1c of 8.6% (± 2.4). On logistic regression analysis, T2DM patients on insulin treatment regimen had 7 times more chances of having poor glycaemic control compared to those on oral antidiabetic medications only ($p < .001$). This may be because the use of insulin is usually reserved for T2DM patients with complicated and progressive disease to control their diabetes. Other treatment determinants such as number of medications taken daily, missed taking medications and defaulted clinic appointments were not significantly associated with poor glycaemic control.

This study has a number of strengths worth noting. The results of this study provide an updated proportion of poor glycaemic control among T2DM patients attending clinics in Suva, Fiji and has also identified the treatment determinant of poor glycaemic control.

The results of this study must be interpreted in the context of its limitations. Since this study was done on secondary data taken from T2DM patient's folders, and variance in the it has some limitations in terms of incomplete documentation, problem with verification of information and variance in the quality of information recorded by the different medical professionals who provided consultation for a particular patient.

1

Glycaemic Control	Frequency (n)	Percentage (%)
Good (HbA1c < 7%)	77	22.8
Poor (HbA1c >7%)	261	77.2
Total	338	100.0

Figure 1: Table 1 :

2

Variable	n (%) (n = 338)
Type of Treatment	
Oral Anti-Diabetics Only	252 (74.3)
Insulin Alone +/-Oral	86 (25.7)
Number of Medication Taken Daily (*M = 6.46, **SD = ± 3.93)	
< 5	132 (39.1)
5-10	157 (46.4)
> 10	49 (14.5)
Missed Taking Medications	
No	290 (85.8)
Yes	48 (14.2)
Defaulted Clinic	
No	284 (84.0)
Yes	54 (16.0)

*M -Mean, **SD -Standard Deviation

c) Association of T2DM Patient's Treatment Characteristics on Glycaemic Control

Table

Figure 2: Table 2 :

3

Year 2018
3

Figure 3: Table 3 :

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