

Defaulters. Are they worse off? Analysing reasons for this phenomenon amongst patients with diabetes with and without HIV infection

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Background: Ideal control of diabetes mellitus (DM) remains elusive globally. Identifying defaulting reasons in diabetes clinics can provide potential interventional areas.

Methods: Data of patients booked for the Edendale Hospital diabetes clinic (attendees and defaulters) between August 2019 and February 2020 were used to determine whether control in defaulters differed from attendees and to analyse defaulting reasons.

Results: A total of 581 patients living with diabetes (PLWD) attended; 213 defaulted (defaulting rate 26.79%). Defaulters (1) had poorer glycaemic and lipid control; (2) with HIV infection and type 2 DM (T2DM) had inferior glycaemic control; (3) performed more self-monitoring of blood glucose (SMBG). Substantially more females defaulted across all categories. They had poorer glycaemia and lipid control with higher body mass index. The commonest defaulting reasons were forgetting appointments, too many clinics (TMC), patient sick and work commitments (44.3% vs. 24.5% vs. 13.1% vs. 10.8%). Within HIV-infected defaulters, reasons ranged from TMC, work commitments and other reasons to forgot appointment (57.7% vs. 26.1% vs. 23.8% vs. 13.8%). A significant number of HIV-infected and patients on antiretroviral therapy, of both sexes, with T2DM, defaulted secondary to TMC. Patients with hypertension and chronic kidney disease (CKD) defaulted due to TMC. Bivariate analysis revealed that being a pensioner, increased age, employment and presence of T2DM were significantly associated with being sick. Older patients defaulted in poor weather while younger patients specified school/work commitments. Patients who complained of TMC had higher creatinine levels.

Conclusions: The defaulting rate in PLWD remains high. Defaulters had sub-optimal glycaemic and lipid control. TMC proved to be significant for patients with chronic diseases (HIV infection, hypertension and CKD) highlighting the need for combined communicable and non-communicable diseases clinics. Defaulting females and HIV-infected PLWD had high prevalence of cardiovascular risk factors. Afternoon clinics might assist with work/school commitments. Wireless uploading of SMBG results and teleconsultation is an option.

Keywords: chronic kidney disease, defaulter, diabetes mellitus, glycaemic control, HIV infection, hypertension, lipid control, obesity, defaulting reasons

Introduction

The diabetes mellitus (DM) pandemic continues to gather momentum globally. Ideal control remains elusive, especially in developing countries already overburdened by the combinatorial effects of infectious and non-infectious diseases. It is common knowledge that we need to create innovative strategies to improve diabetes control. One suggestion proposed by Van Olmen *et al.* in their literature review is that countries in sub-Saharan Africa (SSA) require rapid improvements in their approach to both communicable and non-communicable diseases through a concerted public health approach.¹

One of the major obstacles to achieving improved diabetes control is patients defaulting on clinic visits. Defaulting rates amongst patients living with diabetes (PLWD) vary globally, from as low as 4% to as high as 57%.^{2–8} No differences in defaulter rates were noted between developing versus developed countries in these studies.^{2–8} This finding signifies that the burden of defaulting remains a global hindrance to attaining better diabetes control. Many studies have shown that patients who default have poorer diabetes control with higher complication rates when compared with those patients who attend their visits.^{2,9–12} However, studies done in New Zealand and Malaysia showed that defaulters have similar metabolic parameters and were less likely to have retinopathy when

compared with their attending counterparts¹³ and that there was no difference noted between the defaulter and attending groups with regard to gender, age, duration of diabetes and educational background.³

Limited studies determining defaulter rates and reasons for this phenomenon have been conducted in Africa and South Africa. Ngwenya *et al.* showed in their study conducted in Johannesburg, South Africa that they had a defaulter rate of 35% and that the main reason for defaulting in their patients was forgetfulness followed by patients being out of town and work/school commitments.⁸ Their study did not further analyse the defaulter group to determine their level of diabetes control. The study conducted by Fiagbe *et al.* in Ghana found that patients with lower socio-economic status were more likely to default and that the defaulters had poorer diabetes control.⁹

Globally, various studies have presented a multitude of reasons for defaulting. Some differences do, however, exist in these defaulting reasons between or within developed and developing countries. In the study conducted by Simmons *et al.*¹³ in New Zealand many defaulting patients had no specific reason for not attending scheduled clinic visit while in Canada, patients who defaulted were more likely to have been on insulin with poorer overall diabetes control. In studies conducted in

developing countries, financial difficulties, long waiting periods, overcrowding of clinics, loss of appointment cards and fear of scolding and drug adverse effects made up the majority of reasons for defaulting on diabetes clinic visits. Another defaulting reason found in these developing countries was the use of alternative medications to treat their diabetes.^{3,12,14,15}

The primary objective of this study was to identify whether, in effect, these defaulting patients have poorer diabetes control and then secondarily to determine reasons for defaulting in our population. Despite having well-defined national and international guidelines, we are still not achieving optimal diabetes control in our patients. Identifying reasons for defaulting in our setting might provide possible areas of patient care that can be targeted to improve diabetes control, which can help clinicians and government alike to develop more effective strategies to deal with the issue of defaulting at diabetes clinics.

Methods

All patients visiting the Edendale Hospital diabetes clinic are consulted in a structured and comprehensive manner via the use of specialised diabetes datasheets since September 2012. This datasheet is completed in triplicate, and a copy is kept in the clinic for data auditing purposes. This has been approved by the University of KwaZulu-Natal Biomedical Research and Ethics Committee (BCA 194/15). An appointment diary has been kept since September 2012. This diary contains patient name, hospital number and telephone contact details. All patients who do not attend their scheduled clinic dates are contacted by phone the next day to identify reasons for defaulting and to re-book an appointment. The appointment diary, together with the reason for defaulting, was used for this study to provide the following:

- number of patients booked;
- number and percentage of defaulters;
- reasons for defaulting.

Other clinical and biochemical data were captured from diabetes datasheets kept at the clinic. The following data were needed to determine whether any differences exist between defaulters and attendees:

- age (years);
- gender;
- employment history;
- duration of diabetes (years);
- presence of HIV – if yes then:
 - duration of HIV (years);
 - duration of antiretroviral therapy (years);
- presence of co-morbid conditions;
 - hypertension;
 - chronic kidney disease;
- glycated haemoglobin (HbA1c);
- mean total cholesterol and triglyceride (mmol/l);
- mean LDL and HDL cholesterol (mmol/l);
- mean systolic and diastolic blood pressures (mmHg);
- urine dipstick for proteinuria using Makromed® dipsticks;
- urine protein creatinine ratio (PCR);

- renal insufficiency using estimated glomerular filtration rates. Chronic kidney disease was defined as patients who had an estimated glomerular filtration rate (eGFR) < 60 ml/min/1.73 m². This was done as the National Health and Laboratory Services (NHLS) routinely only provided a detailed breakdown of GFR when it was below 60 ml/min/1.73 m²;
- type of diabetes treatment (use of insulin injections versus only oral medication);
- use of self-monitoring of blood glucose (SMBG).

Data of all patients (both those that attended and defaulted clinic dates) between August 1, 2019 till February 29, 2020 were used for this study.

The reasons for defaulting were categorised as:

- patient sick;
- poor weather;
- cannot afford transport costs;
- work commitments;
- school commitments;
- forgot date of appointment;
- having too many clinics to attend;
- having domestic problems;
- other reasons which could include:
 - patient deceased;
 - strike or unrest in township;
 - transferred to another residential area for work purposes;
 - patient on holiday;
 - motor vehicle breakdown;
 - no family available to bring the patient to clinic appointment;
 - cellular details changed without notifying clinic sister.

Ethics approval for this study was obtained from the University of KwaZulu-Natal Biomedical Review and Ethics Committee (BREC-327/2019).

Continuous variables were documented as mean values ± standard deviations (SD). Numbers (*n*) and percentages (%) were expressed for categorical variables. Numerical data were compared using Anova, whilst categorical data relationships were determined using either chi-square or Fisher's exact tests. Odds ratios were calculated for variables of interest. A *p*-value < 0.05 was used as indicator of significance. Data were analysed using the Statistical Package for Social Science (SPSS) version 26 for windows (IBM Corp, Armonk, NY, USA).

Results

During the study period, a total of 581 patients with diabetes (PWD) were seen for consultation ('attendees') while a further 213 PWD defaulted on their clinic appointment date ('defaulters'). The overall defaulter rate translated into 26.79% for this study.

Table 1 illustrates that the majority of both defaulters and attendees were females. The bulk of the patients in both the defaulter and attendee cohorts had type 2 diabetes mellitus (T2DM).

Table 1: Baseline differences between defaulters and attendees

Factor	Defaulters (n = 213)	Attendees (n = 581)	p-value
Mean age ± standard deviation (median) (years)	53.0±17.34(54)	53.54±15.59(56)	0.935
Number (n) (%):			
Males	63 (29.57)	179 (30.81)	< 0.001
Females	150 (70.42)	402 (69.19)	< 0.001
Employed patients, n (%)	57 (26.76)	99 (17.04)	0.003
Pensioners, n (%)	92 (43.2)	247 (42.5)	0.872
Patients, n (%)			
• smoke	9 (4.22)	16 (2.75)	0.358
• consume alcohol	10 (4.69)	21 (3.61)	0.535
Type of DM, n (%)			
• Type 1	34 (15.96)	77 (13.25)	< 0.001
• Type 2	179 (84.04)	504 (86.75)	< 0.001
Duration of DM (years):			
• Total	10.12±8.05 (9)	11.61±8.99 (10)	0.024
• Males	8.83±7.99 (7)	10.33±9.79 (7)	0.246
• Females	10.52±8.05 (9)	12.18±8.56 (11)	0.035
• T1DM	4.88±4.21 (3)	7.04±7.59 (5)	0.094
• T2DM	11±8.24 (10)	13.31±8.99 (11)	0.105
Patients with hypertension, n (%):			
• Total	147 (69.01)	414 (71.26)	< 0.001
• Males	43 (20.19)	101 (17.38)	0.104
• Females	104 (48.83)	313 (53.87)	0.050
• T1DM	5 (2.35)	16 (2.75)	0.601
• T2DM	142 (66.67)	398 (68.5)	0.915
Patients with chronic kidney disease, n (%):			
• Total	85 (39.91)	202 (34.88)	< 0.001
• Males	27 (12.68)	52 (8.95)	0.005
• Females	58 (27.23)	150 (25.82)	0.767
• T1DM	4 (1.88)	11 (1.89)	> 0.05
• T2DM	81 (38.03)	191 (32.87)	0.091
Patients performing SMBG, n (%):			
• Total	170 (79.81)	457 (78.66)	< 0.001
• Males	51 (23.94)	141 (24.27)	0.857
• Females	119 (55.87)	316 (54.39)	0.814
• T1DM	32 (15.02)	63 (10.84)	0.001
• T2DM	138 (64.79)	394 (67.81)	0.916
Mean HbA1c (%):			
• Total	9.92±2.37 (9.85)	9.11±2.1 (9)	< 0.001
• Males	9.34±1.86 (8.9)	8.82±1.98 (9)	0.008
• Females	10.15±2.53 (10.4)	9.22±2.13 (9.05)	< 0.001
• T1DM	9.97±2.53 (9.9)	9.43±1.88 (9.8)	0.004
• T2DM	9.92±2.36 (9.85)	9.04±2.12 (8.9)	< 0.001
Mean total cholesterol (mmol/l):			
• Total	4.68±1.42 (4.5)	4.42±1.24 (4.25)	0.049
• Males	4.09±1.51 (3.8)	4.26±1.36 (4.1)	0.684
• Females	4.92±1.33 (4.8)	4.5±1.17 (4.4)	0.05
• T1DM	4.36±1.1 (4)	4.21±1.29 (4)	0.351
• T2DM	4.75±1.48 (4.7)	4.45±1.23 (4.3)	0.323
Mean LDL cholesterol (mmol/l):			
• Total	2.65±1.18 (2.57)	2.38±0.96 (2.29)	0.048
• Males	2.23±1.22 (1.92)	2.21±0.87 (2.18)	0.925
• Females	2.82±1.14 (2.7)	2.47±0.99 (2.32)	0.042
• T1DM	2.55±1.17 (2.44)	2.34±1.06 (2.22)	0.619

(Continued)

Table 1: Continued.

Factor	Defaulters (n = 213)	Attendees (n = 581)	p-value
• T2DM	2.67±1.2 (2.61)	2.39±0.94 (2.3)	0.061
Mean creatinine (mmol/l):			
• Total	99.71±60.21 (76.5)	102.58±76.02 (77)	0.532
• Males	125.7±74.89 (112)	107.23±68.78 (86.5)	0.022
• Females	89.23±50.21 (71)	99.08±77.62 (73)	0.626
• T1DM	80.71±56.05 (65.6)	78.86±73.3 (67)	0.964
• T2DM	103.74±60.7 (87.5)	105.44±74.62 (78)	0.292
Patients with urine dipstick proteinuria, n (%)	23 (10.79)	23 (3.96)	< 0.001
Patients with urine protein creatinine ratio > 0.015, n (%)	33 (15.49)	40 (6.88)	< 0.001
Patients on insulin monotherapy, n (%):			
• Total	123 (57.75)	287 (49.40)	0.037
• Males	35 (16.43)	102 (17.56)	< 0.001
• Females	88 (41.31)	185 (31.84)	< 0.001
• T1DM	32 (15.02)	71 (12.22)	< 0.001
• T2DM	91 (42.72)	216 (37.18)	< 0.001
Patients on insulin and oral therapy, n (%)			
• Total	65 (30.52)	225 (38.72)	0.037
• Males	15 (7.04)	58 (9.98)	< 0.001
• Females	50 (23.47)	167 (28.74)	< 0.001
• T1DM	2 (0.94)	6 (1.03)	0.157
• T2DM	63 (29.58)	219 (37.69)	< 0.001
Patients on oral therapy only, n (%):			
• Total	24 (11.3)	68 (11.7)	> 0.050
• Males	13 (6.1)	19 (3.28)	0.289
• Females	11 (5.16)	49 (8.43)	< 0.001
• T2DM	24 (11.27)	68 (11.7)	< 0.001

Attendees had had DM for a significantly longer duration (in years) than defaulters. Hypertension (HPT) as a co-morbidity was substantially more common in the attendee cohort, while chronic kidney disease (CKD) was considerably more prevalent in defaulters than attendees. A significantly greater number of defaulters were performing self-monitoring of blood glucose levels (SMBG) as compared with attendees.

Defaulters had significantly poorer overall glycaemic control when compared with attendees (9.92±2.37 vs. 9.11±2.1; $p < 0.001$, respectively). This difference in glycaemic control within defaulters was noted in both sexes and types of DM.

Defaulters were found to have significantly elevated total cholesterol (TC) and low-density lipoprotein (LDL) cholesterol levels when compared with attendees. Both TC and LDL cholesterol elevations were substantially more prevalent in female defaulters with T2DM.

Serum creatinine levels and the prevalence of chronic kidney disease (CKD) were significantly elevated in male defaulter patients when compared with the attendees, with defaulters having a higher prevalence of urine dipstick proteinuria. These findings then translated into defaulters having a higher prevalence of urine protein-creatinine ratios (PCR) of greater than 0.015 when compared with attendees.

A substantially greater number of defaulters (females, both types 1 and 2 DM) were on insulin monotherapy while the majority of attendees were on combination therapies.

Sub-analysis of HIV-infected vs. HIV-uninfected patients with DM (Table 2)

A total of 121 patients (15.24%) were HIV-infected – 30 (24.79%) were from the defaulter cohort and 91 (75.21%) from the attendee cohort.

Females and patients with T2DM accounted for the significantly higher number in both attendee and defaulter HIV-infected groups.

A significant number of HIV-infected defaulter PWD had hypertension and were on antiretroviral therapy; this was evident in both sexes.

HIV-infected defaulters performed considerably more SMBG than their attendee counterparts, for both sexes and patients with T2DM.

Defaulting HIV-infected patients with T2DM had significantly poorer glycaemic control when compared with attendees.

Obesity remains a significant problem, especially in females, in both the defaulters and attendee HIV-infected cohorts of PLWD.

A significant proportion of the defaulting HIV-infected PLWD were on insulin monotherapy, for both sexes and patients with T2DM. Despite being on insulin therapy, these defaulting HIV-infected PLWD had poorer glycaemic control when compared with their counterparts, the HIV-infected attendee cohort, who were predominantly on combination therapy.

Table 2: Sub-analysis of HIV-infected patients with diabetes mellitus

Factor	Defaulters (n = 30)	Attendees (n = 91)	p-value
Mean age ± standard deviation (median) (years)	48.13±9.58(49)	47.77±9.55(48)	0.947
Number (n) (%) of			
• Males	11 (36.67)	31 (34.07)	0.002
• Females	19 (63.33)	60 (65.93)	< 0.001
p-value for males vs. females	< 0.001	0.002	
Type of DM, n (%):			
• Type 1	1 (3.33)	11 (12.09)	0.004
• Type 2	29 (96.67)	80 (87.91)	< 0.001
p-value for type 1 vs. type 2 DM	< 0.001	< 0.001	
Duration of DM (years):			
• Total	7.77±6.03 (7.5)	8.23±5.9 (7)	0.713
• Males	14.2±7.46 (10)	9.07±6.28 (7)	0.032
• Females	5.17±4.22 (4.5)	9.07±4.9 (8)	0.003
Patients on antiretroviral therapy, n (%):			
• Total	28 (93.33)	78 (85.71)	< 0.001
• Males	10 (33.33)	29 (31.87)	0.002
• Females	18 (60.0)	49 (53.85)	< 0.001
• T1DM	1 (3.33)	10 (33.33)	.007
• T2DM	27 (90.0)	68 (74.73)	< 0.001
p-value for males vs. females	< 0.001	0.024	
p-value for type 1 vs. type 2	< 0.001	< 0.001	
Patients with hypertension, n (%):			
• Total	21 (70.0)	56 (61.54)	< 0.001
• Males	8 (26.67)	17 (18.68)	0.072
• Females	13 (43.33)	39 (42.86)	< 0.001
• T1DM	1 (3.33)	5 (5.49)	0.102
• T2DM	20 (66.67)	51 (56.04)	< 0.001
p-value for males vs. females	0.275	0.003	
p-value for type 1 vs. type 2	< 0.001	< 0.001	
Patients with chronic kidney disease, n (%):			
• Total	8 (26.67)	28 (30.77)	< 0.001
• Males	4 (13.33)	8 (8.79)	0.248
• Females	4 (13.33)	20 (21.98)	< 0.001
• T2DM	8 (26.67)	28 (30.77)	< 0.001
p-value for males vs. females	> 0.05	0.023	
Patients performing SMBG, n (%):			
• Total	24 (80.0)	68 (74.73)	< 0.001
• Males	8 (26.67)	24 (26.37)	0.005
• Females	16 (53.33)	44 (48.35)	< 0.001
• T1DM	1 (3.33)	8 (8.79)	0.02
• T2DM	23 (76.67)	60 (65.93)	< 0.001
p-value for males vs. females	0.102	0.015	
p-value for type 1 vs. type 2	< 0.001	< 0.001	
Mean HbA1c (%):			
• Total	8.8±2.49 (8)	8.36±1.83 (8.3)	0.118
• Males	9.34±2.38 (8)	7.87±2.33 (7.05)	0.345
• Females	8.35±2.7 (8.1)	8.62±1.68 (8.6)	0.209
• T1DM	-	10.51±2.02 (7.9)	0.192
• T2DM	8.8±2.49	7.99±1.67 (7.9)	0.035
p-value for type 1 vs. type 2 DM	0.184	0.04	
Mean BMI:			
• Total	29.77±8.13 (32)	30.32±0.35 (30)	0.991
• Males	22.5±5.12 (20)	26.64±5.67 (26.5)	0.064

(Continued)

Table 2: Continued.

Factor	Defaulters (n = 30)	Attendees (n = 91)	p-value
• Females	35.83±3.76 (35)	32.22±5.92 (32)	0.075
• T1DM	-	29.33±6.98 (28)	0.116
• T2DM	29.77±8.13 (32)	30.49±6.34 (30)	0.731
p-value for male vs. females	0.001	0.005	
Patients on insulin monotherapy, n (%):			
• Total	22 (73.33)	51 (56.04)	0.001
• Males	7 (23.33)	19 (20.88)	0.019
• Females	15 (50.0)	32 (35.16)	0.013
• T1DM	1 (3.33)	10 (10.99)	0.007
• T2DM	21 (70.0)	41 (45.05)	0.011
p-value for males vs. females	0.088	< 0.001	
p-value for type 1 vs. type 2 DM	0.069	< 0.001	
Patients on insulin and oral therapy, n (%):			
• Total	4 (13.33)	30 (32.97)	< 0.001
• Males	1 (3.33)	9 (9.89)	0.011
• Females	3 (10)	21 (23.08)	< 0.001
• T2DM	4 (13.33)	29 (31.87)	< 0.001
p-value for male vs. females	0.317	0.028	
p-value for type 1 vs. type 2 DM	-	< 0.001	
Mean creatinine (mmol/l):			
• Total	81.45±34.11 (65)	106.8 (74)	0.595
• Males	99.8±42.36 (116)	94±38.52 (79.5)	0.563
• Females	66.17±16.57 (61)	113.44±127.06 (72)	0.400
• T1DM	-	66±9.21 (63.5)	0.343
• T2DM	81.45±34.11 (65)	113.8±112.52 (77)	0.511
p-value for male vs. female	0.035	0.015	
p-value for type 1 vs. type 2 DM	0.158	0.003	

Analysis of defaulter group by gender and type of DM (Table 3)

Significantly more female PLWD defaulted clinic appointments across all categories of defaulting reasons as compared with male PLWD.

Females defaulters had considerable poorer glycaemic and lipid control (elevated total cholesterol and LDL cholesterol and lower HDL cholesterol levels) and also had a higher body mass index than their male counterparts, especially so in patients with T2DM.

Defaulting patients with T2DM were older and had had DM for a more significant duration than patients with T1DM. These type 2 DM patients had a higher prevalence of chronic diseases (HIV infection, hypertension and chronic kidney diseases) when compared with their type 1 counterparts.

The cohort of type 2 PLWD also had poorer systolic blood pressures, triglyceride and creatinine levels compared with the type 1 patients. As expected, patients with T1DM were predominantly on insulin therapy while those patients with T2DM were significantly on combination therapy or oral monotherapy.

Analysing reasons for defaulting (Table 4)

The most frequent reasons provided for defaulting in our study were, in descending order of frequency, forgetting clinic appointment date, too many clinics to attend, patient sick and

work commitments (44.3% vs. 24.5% vs. 13.1% vs. 10.8%, respectively).

Older patients were more likely to miss clinic dates as a result of being sick or due to poor weather while younger patients gave reasons of school or work commitments as reasons for defaulting.

A considerable proportion of defaulting patients were unemployed across all defaulting reasons (range 13–100%). Within those who were employed, there was a significant association noted between employment and providing work commitment as a defaulting reason.

Patients with T2DM were significantly most likely to provide reasons of being sick while type 1 PLWD were more likely to offer school commitments as a defaulting reason.

Within the HIV-infected defaulter cohort, reasons for defaulting ranged, in descending order, from too many clinics to attend, work commitments, other reasons, to forgot clinic appointment date (57.7% vs. 26.1% vs. 23.8% vs. 13.8%, respectively). A significant number of HIV-infected patients of both sexes with T2DM defaulted as a consequence of too many clinics to attend.

The two primary reasons provided for defaulting in patients with chronic diseases such as hypertension and chronic kidney disease were too many clinics to attend (69.2% vs. 30.8%, respectively) and forgetting date of appointment (75.5% vs.

Table 3: Defaulter cohort stratified by gender and type of diabetes mellitus

Factor	Males (n = 63)	Females (n = 150)	p-value	Type 1 DM (n = 34)	Type 2 DM (n = 179)	p-value
Mean age ± standard deviation (median) (years)	52.93±14.81 (56)	52.11±17.44 (54)	0.124	25.36±6.73 (24.5)	58.08±11.72 (58)	< 0.001
Duration of DM	8.87±7.73 (8)	10.05±7.98 (9)	0.078	3.29±2.89 (2.5)	11.08±7.94 (10)	< 0.001
HIV infection, n (%)	11 (17.46%)	19 (12.67%)	0.392	1 (2.94%)	29 (16.20%)	0.046
Patients on ARVs, n (%)	10 (15.87)	18 (12%)	0.507	1 (2.94%)	27 (15.08%)	0.046
Hypertension, n (%)	43 (68.25%)	104 (69.33%)	0.871	5 (14.71%)	142 (79.33%)	< 0.001
Chronic kidney disease, n (%)	27 (42.86%)	58 (38.67%)	0.646	4 (11.76%)	81 (45.25%)	< 0.001
SMBG, n (%)	51 (80.95%)	119 (79.33%)	> 0.05	32 (94.12%)	138 (77.09%)	0.032
Mean HbA1c (%)	9.34±1.86 (8.9)	10.15±2.53 (10.4)	0.044	9.97±2.53 (9.9)	9.90±2.54 (9.85)	0.218
Systolic blood pressure (mmHg)	130.78±26.16 (126)	134.16±28.17 (130)	0.862	114.5±16.64 (114)	137.15±27.78 (135.5)	< 0.001
Diastolic blood pressure (mmHg)	79.09±14.97 (79)	79.05±13.3 (79)	0.219	73.71±14.68 (73)	80.2±13.33 (80.5)	0.2
Total cholesterol (mmol/l)	4.09±1.51 (3.8)	4.92±1.33 (4.8)	0.011	4.36±1.09 (4)	4.75±1.48 (4.7)	0.517
Mean triglyceride (mmol/l)	1.49±0.79 (1.35)	1.71±1.06 (1.36)	0.470	1.46±1.2 (0.87)	1.69±0.94 (1.43)	< 0.001
HDL cholesterol (mmol/l)	1.17±0.44 (1.03)	1.38±0.42 (1.35)	0.031	1.14±0.53 (1.06)	1.36±0.41 (1.35)	0.819
LDL cholesterol (mmol/l)	2.33±1.22 (1.92)	2.82±1.14 (2.7)	0.048	2.55±1.17 (2.44)	2.67±1.2 (2.61)	0.717
Mean creatinine (mmol/l)	125.73±74.89 (112)	89.23±50.21(71)	< 0.001	80.71±56.05 (65.5)	103.74±60.69 (87.5)	< 0.001
Mean BMI (kg/m ²)	27.35±7.21 (26)	32.11±7.48 (32)	< 0.001	27.25±7.35 (25)	31.48±7.59 (30.5)	< 0.001
Urine dipstick proteinuria, n (%)	9 (14.29%)	14 (9.33%)	0.337	1 (2.94%)	22 (12.29%)	0.138
Urine PCR > 0.015, n (%)	10 (15.87%)	23 (15.33%)	0.029	2 (5.88%)	31 (17.32%)	< 0.001
Insulin monotherapy, n (%)	35 (55.56%)	88 (58.67%)	0.651	32 (94.12%)	91 (50.84%)	< 0.001
Combination of insulin and oral antidiabetic therapy, n (%)	15 (23.81%)	50 (33.33%)	0.193	2 (5.88%)	63 (35.2%)	< 0.001
Oral therapy only, n (%)	13 (20.63%)	11 (7.33%)	0.008	0	24 (13.41%)	0.017

41.5%, respectively). This pattern was also observed in patients on insulin monotherapy who defaulted citing reasons of too many clinics to attend.

Patients who defaulted secondary to work commitments had a significantly lower BMI.

Table 4 provides both a bivariate and multivariate analysis (after controlling for age and gender) comparing defaulting reason with demographic and biochemical data. Bivariate analysis revealed that being a pensioner, increased age, being employed and the presence of T2DM were all significantly associated with a patient providing a defaulting reason for being sick. Males provided being sick as a defaulting reason approximately twice as frequently as females. Multivariate analysis revealed that a longer duration of DM was significantly associated with the patient providing the defaulting reason of being sick.

Increasing age was significantly associated with poor weather as a defaulting reason.

Both bi- and multivariate analysis showed that poorer HbA1c and better HDL cholesterol were significantly associated with the default category of cannot afford transport.

Male gender was significantly associated with the work commitment category of defaulting. This association was further strengthened as being employed increased the odds of providing work commitment as a defaulting reason. Males were more likely to submit work commitment as a reason for defaulting compared with women. Multivariate analysis revealed that patients on antiretroviral (ARV) therapy and those performing

SMBG were more likely to provide work commitment as a defaulting reason.

All 30 HIV-infected patients and 28 (93.33%) of those who were on ARV therapy significantly cited too many clinics to attend as their defaulting reason.

Multivariate analysis revealed that patients who complained of too many clinics to attend had significantly higher creatinine levels, suggesting underlying renal impairment. Both males and patients with T2DM substantially used too many clinics to attend as their defaulting reason.

Increasing age was significantly associated with providing other reasons for defaulting, which might include patient having died.

Discussion

Every avenue deserves to be fully explored in the quest to optimise diabetes control. Guidelines, even at the best of times, are difficult to adhere to if patients do not turn up for their clinic appointments. Analysing reasons for this defaulting will help in developing implementable intervention in public health programmes.

Results of our study, conducted in KwaZulu-Natal, demonstrated a defaulter rate of 26.79%. This rate is within the range of what is experienced globally (4–57%) and translates into over one-quarter of our patients defaulting on their clinic visits. Our defaulter rate correlated well to what Ngwenya *et al.* found in their study in Johannesburg, South Africa (35%).⁸

Results of studies have been conflicting with regard to glycaemic control achieved in defaulting PLWD. Our research

Table 4: Bivariate and multivariate analysis of defaulting reasons

Defaulting reason	Variable	Bivariate analysis				Multivariate analysis		
		Unadjusted OR	CI	χ^2	p-value	Adjusted OR	CI	p-value
Patient sick	Gender	0.62	0.253–1.518	1.11	0.201	1.886	0.454–7.338	0.383
	Age	1.04	1.013–1.068	8.89	0.002	1.038	0.966–1.117	0.309
	Employed	0.34	0.114–1.024	3.97	0.032	0.164	0.021–1.296	0.087
	Pensioner	3.00	1.363–6.601	7.927	0.006	0.282	0.036–2.272	0.230
	Type of DM	6.96	0.917–52.82	4.667	0.034	0	0	0.998
	Duration of DM	1.03	0.984–1.075	1.566	0.197	1.102	1.002–1.212	0.044
Poor weather	Age	1.18	1.015–1.373	4.681	0.025	1.457	0.796–2.667	0.222
Cannot afford transport	Mean HbA1c	1.24	0.973–1.583	3.068	0.049	1.707	1.044–2.792	0.033
	HDL cholesterol	0.15	0.023–0.942	3.398	0.044	0.125	0.018–0.868	0.035
Work commitments	Gender	2.95	1.326–7.109	6.229	0.017	6.151	0.459–82.432	0.17
	Employed	27.39	7.725–97.091	47.356	<0.001	0	0	0.996
	Alcohol	0.42	1.664–24.78	9.221	0.014	0.11	0.001–9.182	0.328
	Combination therapy	0.31	0.088–1.073	3.766	0.048	29.751	0.663–1335.423	0.08
	Age	0.96	0.933–0.982	12.524	<0.001	0.754	0.569–0.999	0.049
	BMI	0.94	0.888–1.001	3.823	0.042	0.974	0.847–1.112	0.711
	Antiretroviral therapy	2.68	0.955–7.515	3.733	0.093	0.001	0–0.494	0.028
	SMBG	0.88	0.305–2.514	0.06	1	295.1	1.615–53918.33	0.032
	Type of DM	0.01	0.002–0.111	48.299	< 0.001	0	0	0.993
	Age	0.85	0.78–0.925	36.508	< 0.001	0.924	0.754–1.132	0.444
School commitments	Duration of DM	0.85	0.742–0.983	5.567	0.016	0	0	0.955
	Mean creatinine	0.93	0.586–0.982	5.209	< 0.001	0.8	0–1.158	0.997
	Insulin monotherapy	2.12	1.08–4.171	4.880	0.035	3.261	0.595–17.878	0.173
	Combination of insulin + oral medication	0.39	0.177–0.855	5.778	0.024	0.944	0.165–5.401	0.948
	Gender	1.20	0.614–2.359	0.292	0.603	12.956	2.005–81.272	0.006
	HIV infection	210.91	27.350–1626.434	107.523	< 0.0001	241.496	30.64–1903.54	< 0.0001
	ARV therapy	180.0	23.37–1386.47	99.264	< 0.0001	195.35	25.03–1524.38	< 0.0001
	Type of DM	2.77	0.027–8.274	3.564	0.08	7.306	0.954–55.972	0.046
	Mean creatinine	1.00	0.991–1.003	1.06	0.5	0.972	0.95–0.994	0.012
	Other reasons	Combination therapy	0.21	0.048–0.947	4.898	0.043	0.019	0–1.055
Insulin therapy		1.92	0.715–5.166	1.721	0.246	0.012	0–0.863	0.043
Age		1.02	0.99–1.047	1.561	0.195	1.067	0.999–1.138	0.043

has proved that patients who default on their clinic visits have significantly poorer glycaemic control (this significant HbA1c difference was present in both sexes and both types of DM), elevated total cholesterol and LDL cholesterol. This deadly combination of inadequate lipid and glucose control places these defaulting patients at substantially higher risk of developing DM-related micro- and macro-vascular complications. These results reflecting suboptimal glycaemic and lipid control in defaulting patients are in stark comparison with results demonstrated by studies conducted in New Zealand and Malaysia^{3,13} but similar to what Fiagbe *et al.* found in Ghana.⁹ Our study serves to provide one of the first sets of data on glycaemic and lipid control achieved in defaulting PLWD in South Africa and Africa. These results

assist in strengthening the call for improving defaulting rates in PLWD.

Defaulters had significantly higher serum creatinine, urine protein-creatinine ratios (PCR) and urine dipstick proteinuria levels, and subsequently had a greater prevalence of chronic kidney disease (CKD). Poor long-term glycaemic control translates into increased risk of microvascular complications such as nephropathy, which was evident in our study.

Of note was that self-monitoring of blood glucose (SMBG) was being performed significantly more often by defaulting PLWD, both with and without HIV infection. A possible explanation

for this phenomenon is that these patients are trying to use SMBG as a surrogate for attending their clinic appointments. This finding might help us in developing an effective strategy to improve defaulting rates. Utilising these machines to upload readings to software packages employed by diabetes clinics would allow doctors to offer telemedicine to this select group of patients. Telemedicine provides a vital role in healthcare, especially within the current COVID-19 pandemic.

When compared with the overall attendee group, the defaulting group had a significantly lower prevalence of hypertension. However, HPT proved to be substantially more common in the defaulting HIV-infected PLWD, especially in female patients with T2DM. It must also be noted that these defaulting HIV-infected patients also had suboptimal glycaemic control. The combination of sub-optimal control and increased prevalence of both HPT and obesity in these HIV-infected defaulting patients will only serve to increase their risk of diabetes-related complications.

When the defaulter group was stratified according to gender and type of DM, we showed that significantly more female PLWD defaulted on clinic appointment dates across all categories of defaulting reasons compared with male PLWD. Females defaulters had considerable poorer glycaemic and lipid control (elevated total cholesterol and LDL cholesterol and lower HDL cholesterol levels) and also had a higher body mass index than their male counterparts. These findings place female PLWD at a much higher risk of developing diabetes-related complications. Defaulting patients with T2DM were older and had had DM for a more significant duration than patients with T1DM. These type 2 DM patients had a higher prevalence of chronic diseases (HIV infection, hypertension and chronic kidney diseases) when compared with their type 1 counterparts. The cohort of type 2 PLWD also had poorer systolic blood pressure, triglyceride and creatinine levels compared with the type 1 patients. Patients with T1DM as expected were predominantly on insulin therapy while those patients with T2DM were significantly on combination therapy or oral therapy. BMI was significantly higher in female patients with T2DM.

Forgetting the clinic date was the main defaulting reason (44.3%) in our clinic, situated in KwaZulu-Natal, and was identical to what Ngwenya *et al.* found in their study conducted in Johannesburg, South Africa.⁸ This highlights the similarities in the primary defaulting reason between these two provinces in South Africa and must be taken cognisance of when planning an effective diabetes public healthcare response. In the era of technology and mobile phone usage, a solution to this might lie in bulk mobile SMS reminders of clinic appointments a day before the scheduled visit date.

Having to attend too many clinics proved to be a highly significant aetiology for defaulting. This was primarily found in patients with chronic diseases (HIV infection, hypertension, chronic kidney disease) and patients on ARV therapy. Patients who used this defaulting reason had higher serum creatinine levels, suggesting underlying renal disease, this being more common in males and patients with T2DM. These study findings underline the importance of the introduction of combined communicable and non-communicable disease clinics. Patients with co-morbidities often have to attend multiple clinics, resulting in added patient-incurred costs and increased work absenteeism, culminating in a vicious circle.

Patients who defaulted secondary to not being able to afford transport costs had significantly poorer glycaemic control and

lower HDL cholesterol results. One explanation for this inadequate control is that poor finances often lead to unhealthy dietary choices, comprising highly refined and processed meals.

Interestingly, patients who defaulted secondary to work commitments had a lower BMI. Work-related physical activity might account for this finding.

As expected, patients with T1DM, being younger, defaulted due to school commitments and had lower creatinine levels. In contrast, patients with T2DM were older and defaulted due to work commitments. Understanding this paradigm is integral to planning an optimal diabetes service. Arrangements must be made to accommodate students and workers in afternoon diabetes clinics in an effort to try and improve compliance. This will require adjustments in the running of these clinics, and in patient and staff mindsets, but will likely lead to a decrease in defaulting rates amongst this cohort of patients.

Our study identified that pensioners defaulted significantly as a result of being ill, or secondary to poor weather. Infrastructure or mobile phone applications need to be developed to allow pensioners to self-report these reasons to their clinics. This would allow for re-direction of medication being performed accordingly.

Increased duration of DM was considerably associated with being sick and not able to attend scheduled clinic appointments. This is expected, as increased duration of DM is often associated with increased diabetes-related complications.

Patients on ARV therapy were more likely to provide work commitments as a defaulting reason. A possible explanation for this observation is that these patients have multiple clinics to attend and then have to choose one to avoid unnecessary work absenteeism.

Limitation of study

Sub-analysis of 'other reasons for defaulting' were not collected. This would have added further understanding of factors (such as township unrest or strikes) intrinsic to a developing country like South Africa.

Conclusions

Our study demonstrated that the rate of defaulting in PLWD remains high.

We have shown that defaulting patients (both HIV-uninfected and -infected) have sub-optimal glycaemic and lipid control, thereby increasing their risk of diabetes-related complications in the form of chronic kidney disease as shown in our study.

Identifying the reasons for defaulting would help in planning effective public healthcare intervention strategies.

Findings from this study showed that the most prevalent defaulting reasons in the HIV-uninfected cohort were forgetting clinic dates, too many clinics to attend and the patient being sick, while among the HIV-infected patients too many clinics, work commitments and forgotten clinic dates proved to be the major defaulting reasons.

Too many clinics to attend was demonstrated to be a significant factor for patients with chronic diseases (HIV infection, hypertension and chronic kidney disease). This striking finding highlights

the urgent and dire need for the introduction of combined communicable and non-communicable disease clinics in South Africa, a country known to have the highest HIV prevalence globally.

Special attention needs to be directed towards defaulting female PLWD, who were shown to be significantly more obese and had poorer lipid and glucose control than their male counterparts. These three risk factors are integral to developing diabetes-related complications.

Another particular area of concern lies in the HIV-infected defaulting PLWD cohort in whom we showed a high prevalence of hypertension and obesity, and suboptimal glycaemic control. Once again, these are three conditions that are known to increase cardiovascular morbidity and mortality.

Work and school commitments made up a sizeable portion of defaulter rates in PLWD. The introduction of afternoon diabetes clinics could ameliorate the effect on defaulting of work and school commitments.

Use of current technology in the form of wireless uploading of glucometer results to diabetes clinics with subsequent teleconsultation might provide a solution for elderly patients during the COVID-19 pandemic. Similarly, mobile technology making use of bulk SMS reminders could aid with those forgetting clinic dates.

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