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Research Article

Factors Influence Diabetes Mellitus Control at a Primary Health Care Facility in Durban, South Africa

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ABSTRACT

Background: Type-2 diabetes mellitus, a non-communicable disease contributes significantly to morbidity and mortality in South Africa. It is considered a silent epidemic in certain countries in the world with the incidence expected to rapidly escalate due to ageing of the population. Little is known about the treatment outcome from Primary Health Care facilities in SA. The study estimated control and determinants of diabetes control among rural black patients attended a PHC facility.

Method: A cross-sectional prospective design was adopted. Chi-square test was carried out to find significant association between dependent and independent variables. Forward stepwise logistic regression was performed to determine the significant predictor for diabetes control. Two-sided statistical tests were performed at 0.05 level of significance.

Result: A total of 240 DM patients were recruited and (68.7%) of them had HbA1c level measured) and only 49 (29.7%) were found with glycaemic control. Logistic regression analysis showed that patients those read newspaper daily or almost daily were almost three times (OR=2.6) more likely to have control. Patients those measured the blood sugar at home were 4.4 times more likely to have their diabetes controlled. It was found that knowing normal blood sugar had four times more chances of controlling their diabetes than those did not know. Duration of DM treatment (5-9 years) was 60% less likely to have DM control than those had 10 or more years of DM treatment ($p < 0.05$).

Conclusion: Glycaemic control of DM was poor and identified several factors towards diabetes control among DM patient. Training and education to healthcare workers and DM patients may lead to improve DM control.

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Introduction

Type-2 diabetes mellitus (DM) is a non-communicable and chronic metabolic disease which is a major risk factor that contributes significantly to morbidity and premature death around the globe [1, 2]. It is evident that DM has emerged as an epidemic in certain countries in the world with the incidence of the disease expected to rapidly escalate due to ageing of the population [1]. This will inevitably cause an

additional and enormous burden to healthcare providers especially in the low-to-middle socioeconomic countries [1]. The International Diabetes Federation's (IDF) most recent update in April 2020 reports that the prevalence of diabetes in South Africa is 4,581,200 [2]. The prevalence of diabetes in the African continent is more than 19 million and this is expected to increase to 45 million in the next 15 years [2]. Thus, it is considered a major public health problem both in South Africa (SA) and globally.

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The World Health Organization (WHO) divides diabetic complications into micro-vascular (damage to small blood vessels) and macro-vascular complications (damage to large blood vessels) [3]. Both microvascular and macro-vascular complications are a result primarily from uncontrolled hyperglycemia [4]. The most common microvascular complications include retinopathy which can lead to blindness, nephropathy which can lead to renal failure and neuropathy which can lead to both diabetic foot disorders and impotence. The most common macro-vascular complications include cardiovascular disease such as myocardial infarction, cerebrovascular accidents and insufficiency in blood flow to the lower limbs which can result in amputation [3].

One of the most valued objectives in the management of type 2 Diabetes is to prevent both major and minor complications [4]. Therefore, appropriate public health interventions are considered to improve the prevention and control in order to decrease the burden of diabetes mellitus. The implementation of such interventions requires an early and adequate identification to prevent diabetic complications and an understanding of both non-pharmacological and pharmacological interventions. Non-pharmacological diabetes management should place emphasis on establishing and maintaining a weight-reducing diet and lifestyle modification such as planned, structured and repetitive exercise and the elimination of smoking whilst pharmacological intervention requires hormonal manipulation (mainly insulin) by the correct use of certain drugs such as biguanides [5]. Since inadequate glycemic control in diabetic patients can be attributed to poor adherence to lifestyle modifications, additional non-pharmacological interventions in achieving optimal control of diabetes were recently introduced and included the implementation of patient-mediated programmes that focus on counselling, explanation of possible complications, treatment compliance and empowering the patient to achieve better glycemic control and ultimately improve quality of life of DM patients [6].

A study conducted in Kenya reported that adherence to diabetic guidelines by healthcare workers was poor and worsened during patients' subsequent consultations with the healthcare practitioners [7]. Poor adherence to annual risk assessments was also observed. Only 30.2% and 47.2% of patients were referred for micro albuminuria and a lipogram respectively. This inevitably led to a missed opportunity by healthcare practitioners for early detection of preventable diabetic complications. A study from Cape Town in a primary healthcare facility, South Africa reported poor management of DM patients and only a quarter (28%) of DM patients reached their glycaemic targets (*HbA1c*) or control [8]. It was also found that the prescribing patterns of drugs did not align with the diabetic treatment guidelines. Another report from Bangladesh showed only 18% of DM patients had glycaemic control [9].

The Essential Drug List (EDL) in South Africa (SA) is intended to promote rational drug use, rationalize selection of drugs and utilization of drugs using Standard Treatment guidelines. Anti-diabetic drugs that are included in the national DM treatment guidelines form part of the EDL [10]. With the prevalence of diabetes exponentially rising placing a surmount burden within the healthcare system in SA and contributing to a poor quality of life in the diabetic patient, it is crucial to examine the care provided by healthcare workers and in particular to the adherence of healthcare workers to the diabetes national standard guidelines. Primary health care (PHC) facilities in SA offer the first level of care in diabetic patients which encompasses of preventing, promotive and

curative care. Within this context, very little is known about DM control and the determinants among black DM patients. Therefore, this study aimed to assess the prevalence of DM control and determinants of diabetic control among rural black people attending a PHC facility.

Method and Materials

I Setting and Population

KwaDebeka Community Health Center (KCHC) provides the first level contact between the community and health facility that provides comprehensive Primary Health Care (PHC) services. It provides health care services free of charge. The location of the health center is in a black township of KwaDebeka about 30 kilometers from the city center of Durban and is considered a peri-urban setting within the municipal boundaries of eThekweni. There are over 130, 000 homogenous black residence having tie with rural people or communities of KwaZulu-Natal (KZN) and Eastern Cape Provinces. They are mostly poor, living in informal (mainly) and formal types of dwellings as they have no formal residential addresses and mostly are reliant on public health facility (KCHC). There are over 4000 known DM patients receiving care at the facility. Among them, between 60 to 80 attend out-patients department (OPD) on a daily booking basis.

II DM Management Practices at KCHC and Control

The main purpose of treating patients with DM is to reduce blood glucose optimally to relieve and prevent any symptoms of hyperglycemia and the onset of known microvascular and macrovascular complications. In addition to drug therapy, monitoring of the biochemical parameters such as *HbA1c*, lipids, creatinine and calculation of eGFR, potassium, HIV status, weight, height, BMI (kg/m^2) are measured every 6 months. DM control is considered if the recorded blood glycated haemoglobin (*HbA1c*) level was ≤ 7 mmol/L in the last 6 months.

III Stepwise Approach to Diabetes Management

There is a national DM management guideline for all levels including PHC facilities in SA. The first measure is to treat DM in this PHC facility is multidisciplinary approach. At the first step lifestyle modification is considered and that includes self-care practices, education on DM and its complications and management, increased physical activity and healthy diabetic diet [10, 11]. If the blood glucose levels are still uncontrolled with the first step, then the uses of oral blood glucose lowering agents are prescribed. The stepwise approach is to first add metformin to the combination of dietary modification and physical exercise. Metformin 500mg is initiated and to be taken daily with meals. Titrate the dose of Metformin slowly depending on *HbA1c* and/or fasting blood glucose concentrations to a maximum dose of 850mg thrice daily. Combination therapy with Metformin plus a sulphonylurea is indicated if therapy with Metformin alone (together with lifestyle modification) has not achieved the *HbA1c* target. There are two sulphonylurea derivatives: Glimepiride and Glibenclamide.

If Glimepiride is chosen, it must be initiated initially at 1mg once daily with or before breakfast and be adjusted according to response in 1mg increments at 1 to 2-weeks intervals up to a maximum dose of 4mg once

daily. Glibenclamide is preferred in the elderly. If Glibenclamide is chosen, it should be initiated at a dose of 2.5mg once daily 30 minutes before breakfast. The dose of Glibenclamide should be titrated slowly depending on the *HbA1c* and/or fasting blood glucose levels up to a maximum of 15mg once daily. Glibenclamide should be avoided in the elderly and those patients with renal impairment. However, if the eGFR (estimated glomerular filtration rate) is less than 60mL/minute, both Glibenclamide and Glimepiride are avoided.

If the *HbA1c* level is persistently above the acceptable levels, despite adherence to the oral hypoglycemic drugs, then the addition of insulin and the withdrawal of the sulphonylurea are warranted. Lifestyle modification and Metformin should still be continued. An intermediate to long-acting insulin or a biphasic (administered twice daily) type of insulin are used. An intermediate to long-acting insulin is initiated initially at 10 units in the evening before bedtime, but not after 22h00. If 10 units are ineffective, insulin is increased in increments of 2-4 units per week up to 20 units. An intermediate to long-acting insulin is substituted with a biphasic type of insulin. The biphasic insulin is initially initiated at a total daily dose of 15 units. Two thirds of the total daily dose (10 units) is considered and is administered 30 minutes before breakfast. The remainder one third of the insulin dose (5 units) is asked to administer 30 minutes before supper. If this is ineffective in achieving glycemic control, the biphasic insulin can be increased by 4 units on a weekly basis. The first increment is added to the dose before breakfast. The second increment is added to the dose before supper. If it still fails glycaemic control of DM within 6 months, those patients are then referred to hospital.

IV Study Design, Sample Selection and Data Collection

A prospective cross-sectional study was conducted as part of routine clinical audit of DM management at KCHC between January to June

2018. The sample selection and data collection strategy were explained elsewhere [12]. The study sample was recruited from adult DM patients, with T2DM who received their diabetic care at the medical out-patient department of the facility. Patients who had at least one year of DM diagnosed and managed at the facility and gave informed consent for enrollment. DM with pregnancy, patients attending emergency care with DM complications and DM type 1 were excluded from the study.

V Data Analysis

Microsoft Excel 2010 was used to capture data and imported to SPSS 22.0.1 for window version for analysis after proper coding data. The demographic and baseline variables were summarized using percent for categorical variables. Chi-squared test was carried out to find significant association between dependent and independent variables. Forward stepwise logistic regression was performed to determine the significant predictor for DM control. All statistical tests were performed using two-sided tests at the 0.05 level of significance.

Results

A total of 240 DM patients were recruited of which most of them (74%) were female (Table 1). Most of the respondents (87.4%) belonged to older age group (ages ≥ 45 years) with having other comorbid chronic medical conditions (56.7%). The common conditions were hypertension 107 (78.6%) and 42.6% HIV infection. (data not shown).

Table 1: Demographic, household information and DM control of 240 diabetic patients.

Variables	Frequency	Percentage
Age (n=238)		
< 34 years	16	6.7
35- 44 years	14	5.9
45- 54 years	76	31.9
>55 years	132	55.5
Gender (n=234)		
Male	60	25.5
Female	174	74.5
Comorbidity (n=240)		
No comorbidity	104	43.3
Comorbidity	136	56.7
BMI (n=116)		
Overweight	43	37.1
Obese	73	62.9
Household conditions/situation (n=240)		
Read newspaper daily or almost daily (n=222)	113	50.9
Read magazine daily or almost daily (n=224)	162	72.3
Correct knowledge on normal blood sugar (n=217)	33	15.2
Knowledge on DM Complications (n=229)	76	33.2
Measure blood sugar at home (n=240)	62	25.8
Duration of DM treatment (n=239)		

Less than 5 years	50	20.9
Between 5 to 9 Years	113	47.3
10 years and above	76	31.8
DM control (n= 165)		
Uncontrolled DM	116	70.3
Controlled DM	49	29.7

BMI information was available only for 116 (44.6%) patients and of them 37.1% were found with overweight and 62.9% obese. Almost half (47.3%) of them had DM between 5 to 9 years and a third (32%) were more than 10 years. Half of them (50.1%) read newspaper almost daily,

more than two third (72%) read magazine regularly, however, only 15% and 33% knew normal blood sugar level and complications of DM respectively.

Table 2: Cross table analysis with Chi-square (X^2) and p values of DM control with demographic variables.

Variables		DM control in percent		Chi-square value (X^2)	p-value
		No	Yes		
Age category	25 - 34 years	3.9	13.3	11.844	.008
	35- 44 years	4.6	10.7		
	45 - 54 years	35.3	22.7		
	Over 55 years	56.2	53.3		
Gender	Male	31.4	40.8	1.993	0.158
	Female	68.6	59.2		
Education	No education	62.7	42.5	12.438	0.006
	1 - 5 years schooling	34.6	53.4		
	6 - 11 years schooling	2.6	1.4		
	Post matric/ Higher education	0.0	2.7		
Employment status	Full- time employment	52.3	50.0	6.578	0.087
	Part- time employment	34.2	46.1		
	Unemployed	11.4	3.9		
Relationship Status	Married	48.0	44.0	5.959	0.051
	Single	32.7	22.7		
	Other	19.3	33.3		
Monthly Income	No income	39.3	34.2	4.671	0.254
	< R1000	4.6	2.6		
	Between R1000 -R1999	54.2	57.9		
	Between R 2000-R2999	1.3	5.3		
Read Newspaper	Daily	62.5	25.7	44.844	0.000
	Almost daily	17.1	38.6		
	Sometimes	18.4	14.3		
	Never	2.0	21.4		
Read Magazine	Daily	81.0	53.5	20.902	0.000
	Almost daily	8.5	28.2		
	Sometimes	7.2	9.9		
	Never	3.3	8.5		
Knowledge on normal blood sugar	No	89.0	76.4	5.901	0.015
	Yes	11.0	23.6		
Knowledge on DM Complication	No	73.2	53.9	8.491	0.004
	Yes	26.8	46.1		
Measure Blood sugar at home	No	74.2	41.7	40.99	0.000
	Yes	25.8	58.3		
Duration of DM treatment	< 5 years	18.4	30.6	8.906	0.012
	5-9 years	52.1	28.6		
	> 10 years	29.5	40.8		

DM control was measured only for 116 (68.7%) patients as they had HbA1c level measured within last 6 months and only 49 (29.7%) were

found with glycaemic control. Table 2 showed the significant difference of glycaemic control of DM with demographic variables. Significantly

higher rate (53%) of DM control was found among older age group (> 55 years) as $p < 0.05$. DM control was achieved in a quarter (25.7%) of patients that read the newspaper daily and a higher rate of 38.6% for those who read almost every day ($p < 0.05$). Education of DM patients were significantly associated with glycaemic control as patients that received no formal education and patients that had 1 to 5 years of schooling had higher DM control (42.5%) and (53.4%) respectively ($p < 0.05$). DM patients who read magazine daily had a significantly higher rate (53.5%) of DM control than those read sometimes or did not read ($p < 0.05$). Patients those did not know the normal blood sugar had achieved significantly higher (76.4%) DM control than those did know (23.6%) normal blood sugar level ($p < 0.05$). There was a statistically significant result in those patients that had no knowledge on the complications of diabetes and achieved a higher diabetic control rate of 54% than those did not know (23.6%) as $p < 0.05$. DM patients received treatment for more than 10 years had significantly higher rate of DM control (41%) compared to those receiving treatment between 1-9 years ($p = 0.012$). patients that measured their blood sugar at home had a significantly higher DM control (58%) than those did not ($p < 0.000$).

Diabetic control was higher (57.9%) of patients that received an income of between R1001 to R2000 per month however, this result was not

statistically significant ($p > 0.05$). Diabetic control was achieved in half (50%) of patients that are employed on a full-time basis and in 46.1% of patients that are employed on a part-time basis. Only 3.9% of unemployed patients have their diabetes controlled. These differences were not significant ($p > 0.05$). Similarly, there were no significant differences of DM control of gender, marital status, having comorbidities and BMI of the respondents.

Forward stepwise logistic regression analysis was undertaken to determine the factors for glycaemic control of DM. Variables those found association with DM control from the bivariate analysis were included in the model. Results showed (Table 3) that patients that read newspaper daily or almost daily were almost three times ($OR = 2.6$) more likely to have control of diabetes than those did not read the newspaper. Patients those measured the blood sugar at home were 4.4 times more likely to have their diabetes controlled. It was found that knowing normal blood sugar had four times more chances of controlling their diabetes than those did not know. Duration of DM treatment (5-9 years) was 60% less likely to have DM control than those had 10 or more years of DM treatment ($p < 0.05$).

Table 3: Logistic regression analysis output for factors associated with DM control of respondents.

Variables	B	Wald	df	p-value	Odds Ratio (OR)	95% C.I. for OR	
						Lower	Upper
Read regular Newspaper	.964	22.628	1	.000	2.623	1.763	3.903
Knows normal blood sugar	1.361	8.873	1	.003	3.900	1.593	9.548
Measure blood sugar at home	1.488	12.816	1	.000	4.429	1.961	10.004
Duration of DM treatment		8.148	2	.017			
Duration of DM treatment (1)	.182	.204	1	.652	1.200	.544	2.648
Duration of DM treatment (2)	-.906	5.487	1	.019	.404	.189	.862
Constant	-3.311	37.484	1	.000	.036		

Variable(s) entered on step 1: Read Newspaper; b. Variable(s) entered on step 2: Measure blood sugar at home; c. Variable(s) entered on step 3: Knows normal blood sugar; d. Variable(s) entered on step 4: Duration of DM treatment.

Discussion

The residence of KwaDabeka is poor and the health center is in the heart of the community. Services offered are free of charges thus the utilization rate is considered high. This is a facility-based study and thus does not represent all DM cases of KwaDebeka population. However, it is found from a household-based study from a rural community of KZN that for chronic conditions a higher rate (75%) of population attends to public health facilities in the province [13]. The DM control of our study of 30% is considered low. However, the DM control rate is comparable to the report from similar PHC set up in Cape town and other results from Bangladesh [9, 10]. However, DM control in our study is better than the rate reported from Bangladesh (19%). This low rate of DM control from the PHC facilities like a Community Health center is not expected as multidisciplinary (physiotherapist, dieticians, social workers, counsellors) team is appointed for comprehensive management of DM in PHC facilities. Furthermore, the blood test to estimate DM control (HbA1c level) is not adequate as one third of DM patients did not

have the results. Similarly, the BMI estimation is also low of 44%. However, we do not know whether the treatment guidelines are followed or not. The programme manager must therefore ensure training (in-service) to healthcare professionals on national guidelines to manage DM at the facility. On the patients profile a higher proportion (57%) of them had comorbidities (hypertension and HIV are the commonest) that lead to polypharmacy. The different drug interactions and side effects are yet to be confirmed using further study.

Most participants (DM clients) in this study that achieved diabetic control are over the age of 55 years. This is consistent with the findings of other reports from Australia and Iran [14, 15]. Both the studies found that older DM patients had better glycaemic control than the younger ones. This could be that the younger DM patients prefer to eat fast food known as unhealthy diet leading to obesity and hence lead to a greater level of insulin resistance [16]. On the other hand, older patients are found to attend health care facilities more often than the younger ones and thus lead more compliant with DM treatment and a healthy or

diabetic diet [16]. The report from Iran concluded that the risk of developing diabetic complications is higher in the middle and older (>60 years) age groups and better glycaemic control to older DM patients [15]. It is therefore, commendable that in this study a higher rate of glycemic control is observed in the older (>55 years) age group and as older people with diabetes are at an increased risk of cardiovascular, renal and other microvascular complications and hence the management of diabetes may differ in the young age group where emphasis must be given to achieve glycaemic control [17, 18]. An opposite situation is also reported from America that there is an inverse relationship between age of DM patient and diabetic control [19].

Respondents of our study participants are found with no formal (59%) and only with primary education (39%) constitute an overwhelming 98% and that indicates most DM patients had little or no formal education, a finding similar to other South African reports among black South Africans with DM patients [20, 21]. Results of the present study is supported by the report from United Kingdom that a lower level of education is found associated with better glycaemic control of DM [22]. This inverse relationship between glycaemic control and educational level could be attributed to uneducated or less educated patients are more likely to follow the advice of the healthcare professionals that could help in controlling and managing [23]. The findings of diabetic control being better in those that received no or little formal education is contrary to the findings to other studies that show a poorer glycaemic control is more prevalent in little or no educated patients [22, 23]. Reports from Saudi Arabia and Bosnia show that educational level had no association to diabetes control, however those patients that attained a higher level of education are found with good knowledge on the symptoms of DM complications [23, 24].

Majority of the DM patients are found to be living in poverty in our study, with 38% indicated having no personal income and majority (55%) earning (ZA) between R1000 – R1999 per month that equates in USA dollar between 66 to 132. This income level of our participants is like the results of other studies of DM patients and the South African income distribution and poverty study that higher percentages of black South Africans are found to have low income [20, 21]. A study from Canada argued that low-income level of DM patients is one of the predictors for poor diabetic control [25]. Lower level of income is one of the socio-economic indicators that measures poor living condition that negatively influences DM patients. The report from Canada also explains that DM patients living in poverty are highly likely to use a mechanism known as “avoidance coping” in relation to their illness [25]. This translates to denial of their diabetes and or actively refusing or denying an effort to control their diabetes. Similarly, a study reported from Mexico City, a low income area, found that DM control is indirectly influenced by poor socioeconomic conditions, where DM burden is high, indicating the need to educate diabetic patients urgently and to provide primary level of care on DM that directly impacts on glycaemic control [26].

The poor socioeconomic conditions is found associated with poor diabetic control is reported in a study conducted in Bangladesh and explaining the reason for this association is health-related behaviour were differed according to the socioeconomic gradients [27]. These health-related behaviours are seen to differ between the poorer and underdeveloped areas those comprise of the use of tobacco, unhealthy

diet, no or less physical activity and non-compliance to medication, in contrast to developed areas or countries. The report from Mexico City illustrates that the complications of DM is highly prevalent in poverty-stricken communities or countries as a results inequality in health constantly persists resulting in poor DM control and on the contrary a study from Canada reports that DM patients from lowest income group are highly likely to recurrent admissions to hospitals for uncontrolled diabetes [26, 28].

The findings in this study illustrate that 44% of patients whose diabetes is well controlled are married. Marital status, family support, good knowledge, positive attitudes and practices of monitoring blood sugar at home all are known positive predictors of good DM control [28, 29]. One of the cornerstones in achieving and maintaining glycemic control is the reinforcement of education in diabetic patients, especially in a low-income area such as the patients attending KwaDabeka Community Health Center. Our study indicates that of those patients that are currently in a stable condition with their diabetes controlled, 37.8% of patients knew the definition of diabetes mellitus, 23.6% knew what the normal blood sugar is, 52.6% knew the risk factors for diabetes, 43.2% know the symptoms of complicated diabetes, 46.1% have knowledge on the complications of diabetes and 59.2% of patients know what the target fasting blood sugar for control is. These findings are lower than the rates reported from Ethiopia where higher rates are found [30]. The differences could be due to our study is in a primary care setting whereas the study conducted in Ethiopia is hospital-based with better access to health education programmes.

Our findings are also lower compared to a study conducted in our neighbour Free State province, where 49.6% of DM patients know the normal blood sugar/glucose level and 66.3% of DM patients have knowledge on the complications of DM [31]. This could be explained by the lack of education amongst participants in our study, where an overwhelming 59% of participants received no formal school education compared to only 10% of participants in that study conducted in the Free State. A study from China reported on the association between knowledge, attitude and practices (KAP) of DM patients and control of DM found that patients with higher label of knowledge are highly likely to achieve DM control, however attitude and practice are not associated glycemic control [32]. Our study found that a quarter (25.7%) of patients that read the newspaper daily and just over a half (53.5%) read magazines regularly have their diabetes controlled. Furthermore, the logistic regression indicates that those patients who read the newspaper daily are about two and a half times likely to have better control of their diabetes than those who do not.

In this study, diabetic control is seen in 69.8% of participants who have been diagnosed with diabetes in the last one to five years. The findings in this study illustrate that poorer glycemic control is seen with a longer period of diabetes which is consistent with many other studies [33-36]. However, the finding of our study is not consistent with other studies that found no link between the duration of treatment of diabetes and glycemic control [37, 38]. A study that assessed the impact of duration of diabetes treatment on the relationship between glycemic control and risk of death concluded that the risk of death is higher in patients that have been diagnosed with diabetes for more than five years with a strict glycemic control and a low risk of death in patients that have been diagnosed diabetes for under five years duration with similar glycemic

control [39]. Therefore, it is recommended that optimal glycemic control is important in all patients with diabetes.

Diabetes is a heterogenous condition and adequate management thereof requires input from various role players. It thus requires continuous support and supervision from a multidisciplinary team of health professionals assisting people living with diabetes to make the right choices around food, medication, and exercises [40]. People those are living with diabetes, their caregivers and families should be involved and skilled in numerous self-management initiatives and activities in order to manage effectively [40]. The ultimate goal is to empower people living with diabetes to be more engaged and informed about the condition. It is recommended that successful self-management of diabetes is to ensure compliance of drug therapy, personal attributes (diet and exercise) and quality of life goals are achieved [40]. Diabetes-Self Management Education (DSME) strategy has been recommended as it is found to improve glycaemic control [41]. It is the educator's role to assist with this endeavor and make it as trouble-free as possible. The words of Elliot P. Joslin still hold true "The person with diabetes who knows the most lives the longest" [41]. DSME and Diabetes-Self Management Support (DSMS) should be considered as ongoing strategies of facilitating knowledge, skill, ability and motivation for self-care of people living with diabetes. It integrates the needs, goals and life experiences of the people and is grounded on evidence-based principles. DSME is not a once-of event but a lifelong necessity starting at diagnosis. Diabetes self-management and education by trained health care workers are equally effective in improving glycaemic control, self-care activities and quality of life [41].

Conclusion

Glycaemic control of DM was poor. However, this study has identified several factors towards diabetes control among DM patients. There is a need for improvement of DM management practices for treating and educating diabetic patients for positive practices. Educational interventions are advised to update the clinicians to detect and manage DM. DSME and DSMS are a few of the proven strategies that may improve diabetes management. Further study targeting the healthcare workers' KAP should be undertaken.

Ethical Consideration

Prior approval was obtained from the institutional review board and institutional management team to conduct this audit. Participation was voluntary by the DM patients. Participants signed informed consent once agreed to participate in the study. Participants' anonymity and confidentiality were maintained at all times as no name was used in presenting data.

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Competing Interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Author Contributions

AMH & SB, (Kwadabeka CHC, Durban) were involved in the conceptualisation of the study, data analysis and drafting and finalizing of the manuscript. MEH (MANCOSA) & MH (South African College of Applied Psychology) were involved in recoding, analysis of data and review of the manuscript for important intellectual content.

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REFERENCES

1. Olokaba AB, Obateru OA, Olokaba LB (2012) Type 2 diabetes mellitus: a review of current trends. *Oman Med J* 27: 269-273. [[Crossref](#)]
2. International Diabetes Federation (2015) IDF Diabetes Atlas, 7 ed. Int Diabetes Fed.
3. World Health Organization.
4. Abiodun OO, Olaogun AAE, Akinpelu AO (2020) Educational Intervention Impacts on Knowledge and Performance on Self-Care Practices among Type 2 Diabetes Mellitus Patients in Selected Hospitals in Southwestern Nigeria. *Int J Diabetes Clin Res* 7: 124.
5. Raveendran AV, Chacko EC, Pappachan JM (2018) Non-pharmacological Treatment Options in the Management of Diabetes Mellitus. *Eur Endocrinol* 14: 31-39. [[Crossref](#)]
6. Leite RGOF, Banzato LR, Galendi JSC, Mendes AL, Bolfi F et al. (2020) Effectiveness of non-pharmacological strategies in the management of type 2 diabetes in primary care: a protocol for systemic review and network meta-analysis. *BMJ Open* 10: e034481. [[Crossref](#)]
7. Puoane G (2013) Do Healthcare Workers Adhere to Diabetic Clinical Care Guidelines? A Study at a national Hospital, Kenya. *J Hypertension*.
8. Monanabela KB, Van Huysten M, Coetzee R (2019) Describing medicine therapy management of type 2 diabetes mellitus at primary health care facilities in Cape Town. *Health SA* 24: 1051. [[Crossref](#)]
9. Afroz A, Ali L, Karim MN, Alramadan MJ, Alam K et al. (2019) Glycaemic control for People with Type 2 Diabetes Mellitus in Bangladesh – An urgent need for optimization of management plan. *Sci Rep* 9: 10248. [[Crossref](#)]
10. Republic of South Africa (2018) Essential Drugs Programme. Primary Healthcare Standard Treatment Guideline and Essential Medicine List. 6th ed. *Repub S A Nat Depart Health*.
11. The Society for Endocrinology (2017) Metabolism and Diabetes of South Africa Type 2 Diabetes Guidelines Expert Committee. The 2017 SEMDSA Guideline for the Management of Type 2 Diabetes Guideline Committee. *JEMDSA* 21: S1-S196.
12. Hoque AM, Hoque ME, Singh S, Chinnasamy Y, Hoque M (2020) Knowledge, Attitudes and Practices of Diabetes Amongst Diabetes

- Patients at A Primary Health Care Centre in Durban, South Africa. *Med Clin Res* 5: 258-267.
13. Hoque M (2009) Economic activities, illness pattern and utilisation of health care facilities in the rural population of KwaZulu-Natal, South Africa. *Afr J Prm Health Care Fam Med* 1: 58-62. [[Crossref](#)]
 14. Nanayakkara N, Ranasinha S, Gadowski AM, Davis WA, Flack JR et al. (2018) Age-related differences in glycaemic control, cardiovascular disease risk factors and treatment in patients with type 2 diabetes: a cross-sectional study from the Australian National Diabetes Audit. *BMJ Open* 8: e020677. [[Crossref](#)]
 15. Shamshirgaran SM, Mamaghanian A, Aliasgarzadeh A, Aiminisani N, Iranparvar Alamdari M et al. (2017) Age differences in diabetes-related complications and glycaemic control. *BMC Endocr Disord* 17: 25. [[Crossref](#)]
 16. Ahmad NS, Ramli A, Islahudin F, Paraidathathu T (2013) Medication adherence in patients with type 2 diabetes mellitus treated at primary health clinics in Malaysia. *Patient Prefer Adherence* 7: 525-530. [[Crossref](#)]
 17. Sinclair AJ, Abdelhafiz AH, Forbes A, Munshi M (2019) Evidence-based diabetes care for older people with Type 2 diabetes: a critical review. *Diabet Med* 36: 399-413. [[Crossref](#)]
 18. Panduru NM, Nistor I, Groop P, Biesen WV, Farrington K et al. (2017) Considerations on glycaemic control in older and/or frail individuals with diabetes and advanced kidney disease. *Nephrol Dial Transplant* 32: 591-597. [[Crossref](#)]
 19. El Kebbi IM, Cook CB, Ziemer DC, Miller CD, Gallina DL et al. (2003) Association of younger age with poor glycaemic control and obesity in urban African Americans with type 2 diabetes. *Arch Intern Med* 163: 69-75. [[Crossref](#)]
 20. Okonta HI, Ikombele JB, Ogunbanjo GA (2014) Knowledge, attitude and practice regarding lifestyle modification in type 2 diabetic patients. *Afr J Prm Health Care Fam Med* 6: E1-E6. [[Crossref](#)]
 21. Department of Health, Medical Research Council, OrcMacro (2007) South Africa Demographic and Health Survey 2003. Pretoria: Department of Health.
 22. Khan Ataur R, Al Abdulk Lateef ZN, Al Aithan MA, Bu Khamseen MA, Al Ibrahim I et al. (2012) Factors contributing to non-compliance among diabetics attending primary health centres in the Al Hasa district of Saudi Arabia. *J Family Community Med* 19: 26-32. [[Crossref](#)]
 23. Al Rasheedi AA (2014) The Role of Educational Level in Glycaemic Control among Patients with Type II Diabetes Mellitus. *Int J Health Sci (Qassim)* 8: 177-187. [[Crossref](#)]
 24. Herenda S, Tahirovic H, Poljakovic D (2007) Impact of education on disease knowledge and glycaemic control among type 2 diabetic patients in family practice. *Bosn J Basic Med Sci* 7: 261-265. [[Crossref](#)]
 25. Houle J, Lauzier Jobin F, Beaulieu MD, Meunier S, Coulombe S et al. (2016) Socioeconomic status and glycemic control in adult patients with type 2 diabetes: a mediation analysis. *BMJ Open Diabetes Res Care* 4: e000184. [[Crossref](#)]
 26. Booth GL, Hux JE (2003) Relationship between avoidable hospitalizations for diabetes mellitus and income level. *Arch Intern Med* 163: 101-106. [[Crossref](#)]
 27. Rahman M, Nakamura K, Hasan SMM, Seino K, Mostof G et al. (2020) Mediators of the association between low socioeconomic status and poor glycemic control among type 2 diabetics in Bangladesh. *Sci Rep* 10: 6690. [[Crossref](#)]
 28. Jones D, Evelyn J (2014) Is Marital Status a Determinant Of Self-Monitoring Of Blood Glucose? *Electronic Theses Dissertations*.
 29. Osuji NA, Ojo OS, Malomo SO (2018) Relationship between glycaemic control and perceived family support among people with type 2 diabetes mellitus seen in a rich kinship network in Southwest Nigeria. *Family Med Commun Health* 6: 168-177.
 30. Asmelash D, Abdu N, Tefera S, Baynes HW, Derbew C (2019) Knowledge, Attitude and Practice towards Glycemic Control and Its Associated Factors among Diabetes Mellitus patients. *J Diabet Res*. [[Crossref](#)]
 31. le Roux M, Walsh C, Reid M, Raubenheimer J (2019) Diabetes-related knowledge, attitude and practices (KAP) of adult patients with type 2 diabetes mellitus in the Free State province, South Africa. *S Afr J Clin Nutr* 32: 83-90.
 32. Yang H, Gao J, Ren L, Li S, Chen Z et al. (2017) Association between Knowledge-Attitude-Practices and Control of Blood Glucose, Blood Pressure, and Blood Lipids in Patients with Type 2 Diabetes in Shanghai, China: A Cross-Sectional Study. *J Diabet Res* 2017: 3901392. [[Crossref](#)]
 33. Haghighatpanah M, Nejad ASM, Haghighatpanah M, Thunga G, Mallayasamy S (2018) Factors that Corralte with Poor Glycemic Control in Type 2 Diabeted Mellitus Patients with Complications. *Osong Public Health Res Perspect* 9: 167-174. [[Crossref](#)]
 34. Alramadan MJ, Afroz A, Hussain M, Batais MA, Almigbal TH et al. (2018) Patient-Related Determinants of Glycemic Control in People with Type 2 Diabeted in the Gulf Cooperation Council Countries: A Systematic review. *J Diabet Res* 2018: 9389265. [[Crossref](#)]
 35. Mamo Y, Bekele F, Nigussie T, Zewudie A (2019) Determinants of poor glycaemic control among adult patients with type 2 diabetes mellitus in Jimma University Medical Centre, Jimma zone, south west Ethiopia: a case control study. *BMC Endocr Disord* 19: 91. [[Crossref](#)]
 36. Chetoui A, Kaoutar K, Elmoussaoui S, Boutahar K, El Kardoudi A et al. (2017) Prevalence and determinants of poor glycemic control: a cross-sectional study among Moroccan type 2 diabetes patients. *Int Health* 10: 107. [[Crossref](#)]
 37. Kim HJ, An SY, Han SJ, Kim DJ, Hong CH et al. (2019) The association of diabetes duration and glycemic control with depression in elderly men with type 2 diabetes mellitus. *J Res Med Sci* 24: 17. [[Crossref](#)]
 38. Al Balushi KA, Al Haddabi M, Al Zakwani I, Al Za'abi M (2014) Glycemic control among patients with type 2 diabetes at a primary health care centre in Oman. *Prim Care Diabetes* 3: 239-243. [[Crossref](#)]
 39. Ghouse J, Isaksen JL, Slov MW, Lind B, Svendsen JH et al. (2020) Effect of diabetes duration on the relationship between glycemic control and risk of death in older adults with type 2 diabetes. *Diabetes Obes Metab* 22: 231-242. [[Crossref](#)]
 40. Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM et al. (2015) Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *J Acad Nutr Diet* 115: 1323-1334. [[Crossref](#)]
 41. Chvala CA, Sherr D, Lipman RD (2016) Diabetes self-management education for adults with type 2 diabetes mellitus: A systematic review of the effect on glycemic control. *Patient Educ Couns* 99: 926-943. [[Crossref](#)]