Assessment of Direct Cost of Care and Glycaemic Control among Diabetes Type 2 Patients in Two Mission Hospital Clinics in Kenya

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ABSTRACT

Non communicable diseases are fast becoming the leading cause of mortality and morbidity worldwide. It is estimated that 463 million people were living with diabetes in 2019. This number is estimated to increase by two folds by 2045. Diabetes mellitus, being a chronic disease, needs frequent hospital visits and follow up by clinicians. These contacts mean costs to the patient. The increase in cost limits the hospital visits, medications purchase and laboratory investigations which leads to poor management and prognosis. This study objective was to assess the direct cost of care and glycaemic control of diabetes mellitus type 2 patients attending diabetes clinics in two mission hospitals in Kenya. We used a cross-sectional study design was employed for this study. A Kirkwood formula was used to determine the sample size for this study at 384 participants. Random sampling technique was used to obtain the study subjects. A structured cost of care questionnaire having questions on direct medical and non-medical costs was used to collect data. Obtained data was analyzed using Microsoft excel and SPSS. Descriptive statistics entailed Frequency counts, mean median and percentages interquartile range while inferential statistics employed were- correlational and regression analysis. Most participants were aged over 60 with 21.6% being over 80 years. Mean total direct costs per visit was Kshs. 9,496.90 ± Kshs. 4,631.53 with drugs accounting for the larger proportion. Mean HbA1c and RBS values were established at 9.231% ± 2.4920% and 10.075 mmol/l ± 4.6503 mmol/l respectively. The direct cost of care of T2DM is still relatively high with a wide variation yet the levels of glycemic control are yet to be fully achieved in a larger proportion of diabetic type 2 patients.

Keywords: *Direct cost of care, Glycaemic control, Diabetes Mellitus Type 2*

INTRODUCTION

According to the World health organization (WHO), diabetes is a chronic disease that results from either when the pancreas fails to secrete enough insulin or when the body generally fails to respond to the secreted insulin (WHO, 2021). The former is called diabetes type 1 while the latter is called type 2 (WHO, 2021). Diabetes type 1 commonly occurs in the young and has previously been called juvenile-onset or insulin-dependent diabetes mellitus (WHO, 2021). Diabetes Type 2 occurs in adults and has been previously been called adult onset or non-insulin dependent diabetes mellitus (WHO, 2021).

Non-communicable diseases (NCDs) are fast becoming the leading cause of mortality and morbidity worldwide (WHO, 2016). In 2019, IDF estimated that 463 million adults were living with diabetes globally, and the number is expected to double by 2045, (IDF, 2021). This sharp increase in the prevalence of diabetes will eventually lead to an increased economic burden (Mutyambizi et al., 2018). According to IHME (2019), Kenya spent Kshs.11, 232 per person in 2019 on health and this is expected to double by 2050. As noted, Diabetic patients incur quite a significant amount of money to meet health care. For example, in 2020, the American diabetic association (ADA) noted that the cost of health care was five times higher in diabetes patients when compared to the non-diabetes population (ADA, 2019). These patients spent the biggest part of their healthcare costs on drugs (Mutyambizi, 2018). In her study in Nyeri, at the level 5 hospital, Githua (2019), found out that the average total direct cost of managing diabetes was Kshs. 16,349 per capita per month. This was way higher than what most people earn per month (KSH 6,498).

In 2019, out of pocket spending was 33 percent (Geordan et al., 2019), yet the insurance uptake remains low and full of inequity (Kazungu & Barasa, 2017). Figures from Kenya Household and Health Expenditure and Utilization Survey (MOH, 2017) of 2021 show that insurance coverage in Kenya was 20 percent, although higher rates have been reported in some counties. Gathua found out that insurance coverage rates were at 69.9 percent in Nyeri in 2019 (Gathua, 2019). Kipkalom (2019) reported that the majority of the diabetes patients in Thika level 5 hospitals did not have National Hospital Insurance Fund (NHIF) and that providing access to health care by reducing out of pocket spending was more likely to decrease the burden of managing diabetes. Nevertheless, there is more need to encourage enrollment in insurance schemes to reduce out of pocket spending.

Majority of the diabetic patients do not afford added costs of sugar monitoring consultation in terms of random blood sugars and regular HbA1C tests, and medicines, (Geordan *et al.*, 2019). Mutyambizi et al. (2019) found out that drug costs take up a significant portion of total costs of treatment costs. Consequently, expensive healthcare will make close to 5 billion people to fail to get access to health services, according to World Bank (2017). Given the fact that diabetes is a chronic medical condition that needs constant evaluation and monitoring of patients in and out of the hospital, there is a need to cushion patients by the government and other players in the health sector from the very erroneously expensive medical costs. To do so, there is a need to ascertain what is spent per patient on health. Therefore, the need to determine the relationship between the average cost of care and glycaemic control. Data from this study is of benefit to the government, NGOs and diabetic patients.

METHODOLOGY

We employed a cross-sectional design to gather data from participants at a single point in time. The study was conducted at the outpatient clinics of Chogoria Mission Hospital in Tharaka Nithi County and Maua Methodist Hospital in Meru County, Kenya. The target population included diabetic patients diagnosed at least six months prior to the study, aged 18 or older, attending the outpatient clinics. We included diabetic patients diagnosed at least six months before the study, aged 18 or older, able to give informed consent, and having HbA1c and random blood sugar tests done recently. We excluded first-time clinic visitors, unstable patients, those without recent test results, and those who could not understand English or Kiswahili. Participants were recruited using simple random sampling to ensure a representative sample. Approximately 10 participants per clinic day meeting the inclusion criteria were selected. The sample size was calculated to be 384 using standard statistical methods. We collected data using a cost of illness assessment questionnaire covering direct medical and non-medical costs, such as transport, meals, consultation fees, medicines, and laboratory services. The instrument was adapted from a previous study and pre-tested on a small group to ensure validity and reliability. Two trained clinical officers collected data after obtaining necessary approvals from ethics committees and research permit from the National Commission for Science, Technology and Innovation, NACOSTI (NACOSTI/P/23/29890). Participants were interviewed privately, with interviews lasting up to 40 minutes. Data was made anonymous and analyzed using Microsoft Excel and SPSS version 25. Descriptive and inferential statistics were used to analyze and interpret the data. Ethical considerations included prioritizing participant care, maintaining anonymity, and ensuring voluntary participation. The study posed minimal risks, primarily involving time for interviews. Results were shared with relevant health authorities and published for broader dissemination.

RESULTS

Demographic Characteristics

Age, gender and occupation of participants were the main socio-demographic characteristics that were analyzed. Majority of participants (21.6%) were 80 years and older and were closely followed by those aged 60 to 69 years (21.4%). In third place were those aged 50 to 59 years (20.3%) followed by those aged 70 to 79% (17.7%). Least number of participants in terms of age was those from 40 to 49 years (13.3%) and 30 to 39 years (5.7%). Notably, there was no participant below the age of 30 years. Participants were nearly equally distributed in terms of gender. Correspondingly, 52% of the participants were female while 48% were male, as shown in table 1 below.

Table 1:

Age & Gender Distribution of Study Participants

Demographic characteristic		Frequency (%)
Age	<30 years	0.0%
	30 – 39 years	5.7%
	40 – 49 years	13.3%
	50 – 59 years	20.3%
	60 – 69 years	21.4%
	70 – 79 years	17.7%
	≥80 years	21.6%
Gender	Male	48.0%
	Female	52.0%

Direct medical Cost of Care for Type 2 Diabetes Mellitus

The cost of prescribed drugs ranged from Kshs. 160 to Kshs. 26,022 with a mean value of Kshs. 2,219.82 ± Kshs. 1,634.87 and interquartile range (IQR) of Kshs. 1,719. The consultation cost and cost of RBS test were capped at Kshs. 200 and Kshs. 150 respectively for all cases. Cost of diagnostic tests ranged from Kshs. 150 to Kshs. 4,650 with a mean cost of Kshs. 216.5 ± Kshs. 353.82 with limited variability (IQR=0). The cost of glucometers ranged from Kshs. 500 to Kshs. 6,000 with a mean cost of Kshs. 3,499.16 ± Kshs. 836.91 and an interquartile range of Kshs. 1,000. Further, the cost of BP monitors ranged from Kshs. 4,000 to Kshs. 10,000 with a mean cost of Kshs. 4,044.81 ± Kshs. 439.86 and no variability (IQR=0). Finally, the cost of glucometer stripes ranged from Kshs. 750 to Kshs. 2,000 with a mean cost of Kshs. 1,341.14 ± Kshs. 331.35 and an interquartile range of Kshs. 400. The total costs per visit for treatment/services ranged from Kshs. 350 to Kshs. 30,522 with a mean cost of Kshs. 1,206.86 ± Kshs. 734.56 and an interquartile range of Kshs. 1,700. Additionally, the total cost of monthly lab/diagnostic test ranged from Kshs. 150 to Kshs. 2,650 with a mean cost of Kshs. 1,111.77 ± Kshs. 816.07 and an interquartile range of Kshs. 1,050.

Among the patients, 33.9% were accompanied by friends or family members, while 66.1% were not. In terms of cost distribution; one-way transport cost for patients ranged from Kshs. 50 to Kshs. 2,000 with a mean cost of Kshs. 326.46 ± Kshs. 224.67 and interquartile range of Kshs. 300. Additionally, one-way cost of food for family or friends accompanying the patients ranged from Kshs. 100 to Kshs. 2,000 with a mean cost of Kshs. 287.03 ± Kshs. 194.20 and interquartile range of Kshs. 207.5. In summary, per visit, the total cost incurred by family or friends accompanying the patients ranged from Kshs. 200 to Kshs. 8,000 with a mean total cost of Kshs. 609.68 ± Kshs. 701.86 and interquartile range of Kshs. 250 as shown in table 2 below.

Table 2:

Direct Medical Cost Associated with Type 2 Diabetes

	Amount (Kshs.)				
Item (Direct Medical expenditure)	Min	Max	Mean	SD	IQR
Cost of drugs	160	26,022	2,219.82	1,634.87	1,719
Consultation cost	200	200	200	0	0
Cost of diagnosis tests	150	4,650	216.5	353.82	0
Total costs spent per visit on treatment/services received	350	30,522	2,626.85	1,799.99	1,765
Monthly cost of other lab/diagnostic test [HBAIC/urinalysis/UEC]	250	2,500	1,206.86	734.56	1,700
Cost of RBS test	150	150	150	0	0
Total Monthly lab/diagnostic test cost	150	2,650	1,111.77	816.07	1,050
Glucometer cost	500	6,000	3,499.16	836.91	1,000
BP Monitor cost	4,000	10,000	4,044.81	439.86	0
Cost of other related instrument/devices	750	2,000	1,341.14	331.35	400

***SD** = standard deviation; **IQR**= interquartile range*

Direct non-medical Cost of Care for Type 2 Diabetes Mellitus

Table 4 provides an account of direct non-medical expenditures incurred by diabetic patients. Among the patients, 33.9% were accompanied by friends or family members, while 66.1% were not. In terms of cost distribution; one-way transport cost for patients ranged from Kshs. 50 to Kshs. 2,000 with a mean cost of Kshs. 326.46 ± Kshs. 224.67 and interquartile range of Kshs. 300.

Additionally, one-way cost of food for family or friends accompanying the patients ranged from Kshs. 100 to Kshs. 2,000 with a mean cost of Kshs. 287.03 ± Kshs. 194.20 and interquartile range of Kshs. 207.5. In summary, per visit, the total cost incurred by family or friends accompanying the patients ranged from Kshs. 200 to Kshs. 8,000 with a mean total cost of Kshs. 609.68 ± Kshs. 701.86 and interquartile range of Kshs. 250, as shown in table 3 below.

Table 3:

Direct Non-Medical Cost Associated with Type 2 Diabetes

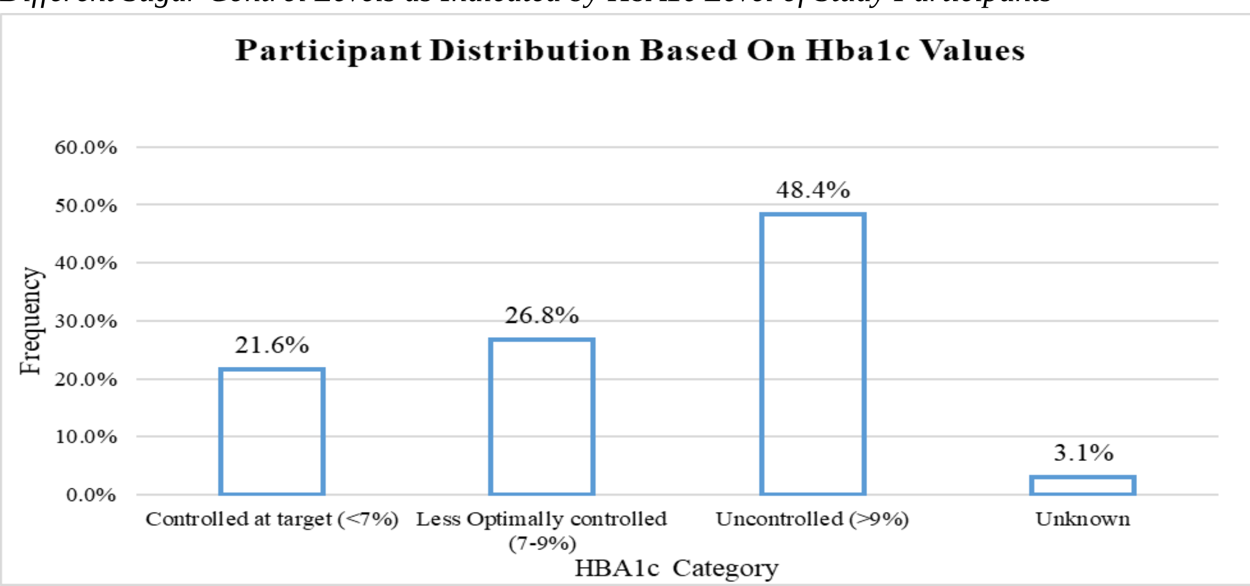
Accompanied by friend/family				Yes 130 (33.9%)	No 254 (66.1%)
			Amount (Kshs.)		
Item (Direct Non-medical expenditure)	Min	Max	Mean	SD	IQR
One Way Transport Cost (Patient)	50	2000	326.46	224.67	350
One way transport cost (Family/friend)	50	6000	331.00	547.98	300
One way cost of food (Family/friend)	100	2000	287.03	194.20	207.5
Total cost (family/friend)	200	8000	609.68	701.86	250

Distribution of Levels of Glycated Hemoglobin in Diabetes Type 2 Patients

21.6% of participants had their sugar levels controlled within normal values (<7%). In contrast, blood sugar levels of majority of participants (48.4%) were uncontrolled (>9%) while 26.8% of participants had their blood sugar levels less optimally controlled (7%-9%). About 3.1% of participants neither knew their current nor last glycated hemoglobin levels. Majority of participants (43%) had a high level (43%) falling in the category of suspected diabetes. They were followed by those whose RBS readings categorize them as prediabetes at 21%. Notably, in third place, were those whose RBS reading placed them as low normal. The least group at 3% were those whose RBS values fell in the high normal bracket as shown in figure 1 below.

Figure 1*:*

Different Sugar Control Levels as Indicated by HbA1c Level of Study Participants



Association between Direct Cost of Care, Glycated Hemoglobin and Random Blood Glucose in Diabetes Type 2 Patients

Correlational Analysis

That the mean total direct cost of care for the study participants was approximately Kshs. 9,496.90 ± Kshs. 4,631.53 while the mean HbA1c value was approximately 9.231% ± 2.4920%. Additionally, the mean RBS reading for the participants was approximately 10.075 mmol/l ± 4.6503 mmol/l. Pearson Correlation coefficient between total direct costs & HbA1c reading and between HbA1c reading & RBS reading was approximately 0.088 and -0.009 respectively although the correlation for both was found not to be statistically significant *[P=0.089]* and *[0.868]* respectively at 0.05 level. In contrast, the Pearson Correlation coefficient between total direct costs and RBS reading was approximately 0.435 and the correlation was statistically significant *[P=0.000]*, as shown in table 4, 5, and 6 below.

Table 4:

Descriptive Statistics of Total Direct Costs, HbA1c and RBS Values

	Mean (Ksh)	Std. Deviation	N
Total Direct Costs	9496.90	4631.528	384
HbA1c value (%)	9.231	2.4920	372
RBS reading (mmol/l)	10.075	4.6503	384

Table 5:

Correlational Analysis of Total Direct Costs, HbA1c and RBS Values

		Total direct costs	HbA1c reading	RBS reading
Total Direct Costs	Pearson Correlation	1	.088	.435**
	Sig. (2-tailed)		.089	.000
	N	384	372	384
HbA1c reading	Pearson Correlation	.088	1	-.009
	Sig. (2-tailed)	.089		.868
	N	372	372	372
RBS reading	Pearson Correlation	.435**	-.009	1
	Sig. (2-tailed)	.000	.868	
	N	384	372	384

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 6:

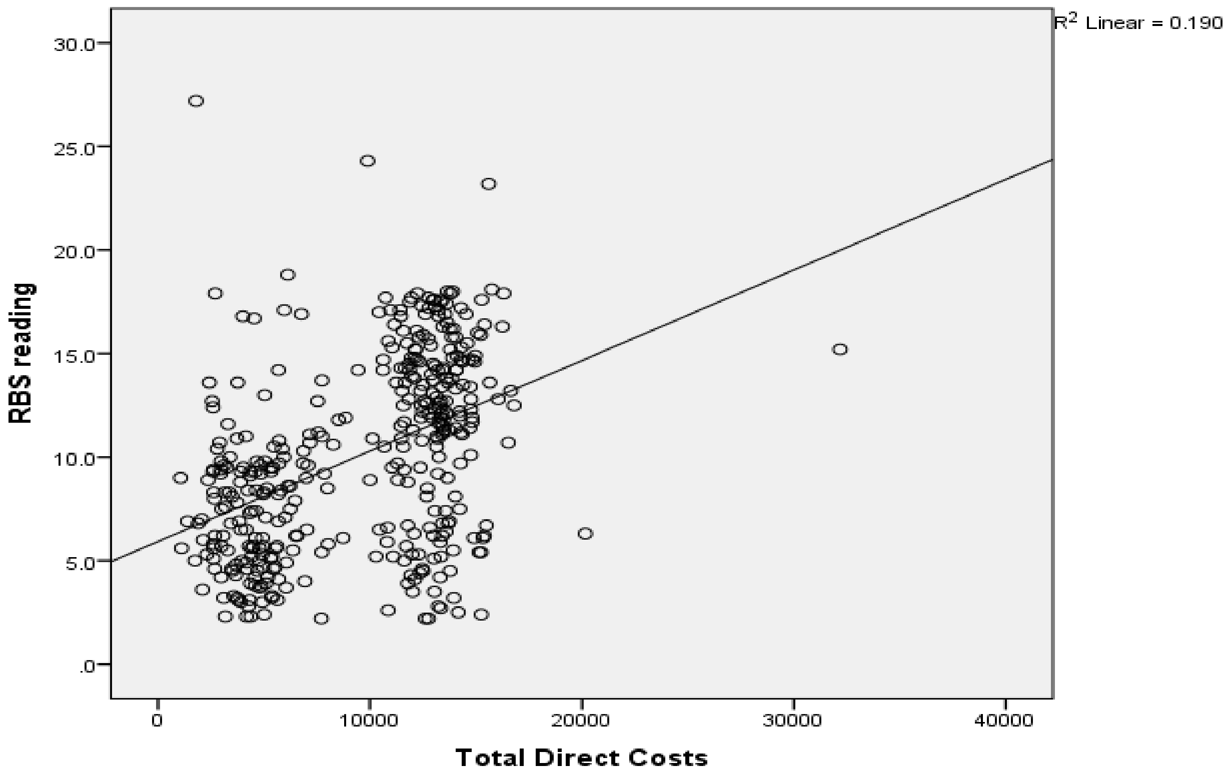
Correlational Analysis When Confounding Variables are controlled

Correlations					
Control Variables			Total direct costs	RBS value	HbA1c reading
Gender & Duration of treatment	Total direct costs	Correlation	1.000	.063	-.016
		Significance (2-tailed)	.	.222	.757
		df	0	380	380
	RBS value	Correlation	.063	1.000	-.032
		Significance (2-tailed)	.222	.	.536
		df	380	0	380
	HbA1c reading	Correlation	-.016	-.032	1.000
		Significance (2-tailed)	.757	.536	.
		df	380	380	0

Scatter Plot Analysis

Since only total direct costs and RBS had a meaningful relationship based on the correlation analysis above, we plotted a scatter plot of the two variables. There may be a positive relationship between total direct costs and RBS, i.e. as the reading of RBS continues to rise, there is also a rise in total direct costs associated with type 2 diabetes mellitus. The coefficient of determination (R^2) was reported at 0.190, as shown in figure 2 below.

Figure 2:
Scatter Plot Visualization of Association between RBS Reading and Total Direct Costs



Regression Analysis

HbA1c reading and RBS values. There was a moderate positive correlation between dependent variable (total direct costs) and the combination of predictor variables (HbA1c reading and RBS reading) *[R=0.461]*. Further, 20.8% of the variation in total direct costs can be accounted for by the linear relationship with HbA1c reading and RBS reading as noted by the value of adjusted R square *[adjusted R^2=0.208]*. A one-unit increase in HbA1c reading is associated with a change of Kshs. 170.529 in total direct costs when RBS reading is held constant. Similarly, a one-unit increase in RBS reading causes a change of Kshs. 452.617 in total direct costs when HbA1c is held constant. Notably, the t-statistic for the constant is 3.735 indicating it is statistically significant. Moreover, the p-value of HbA1c reading and RBS reading were 0.047 and 0.000 respectively indicating statistical significance as shown in table 7 below.

Table 7:
Model Summary for the Regression Analysis for the Relationship between Total Direct Costs, HbA1c and RBS Values

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.461[a]	.212	.208	4103.211

***a. Predictors**: (Constant), RBS reading, HbA1c reading*

Table 8 below presents the results of an Analysis of Variance (ANOVA) performed to assess the relationship between total direct costs and the two predictor variables: HbA1c reading and RBS values.

Table 8:
ANOVA Analysis of the Relationship between Total Direct Costs, HbA1c and RBS Values

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1674372643.584	2	837186321.792	49.725	.000[b]
	Residual	6212609196.319	369	16836339.285		
	Total	7886981839.903	371			

***a. Dependent Variable:** Total Direct Costs*
***b. Predictors**: (Constant), RBS reading, HbA1c reading*

DISCUSSION

The patient's direct medical cost for diabetes type 2 patients was mainly driven by medicine expenses. Similar findings have been reported in south Africa by Mutyambizi et al. (2019). The cost of drugs for diabetes management exhibits a wide range, from Kshs. 160 to Kshs. 26,022, with a mean cost of Kshs. 2,219.82 with a considerable standard deviation (± Kshs. 1,634.87). This indicates significant variability in drug expenses among individuals. The variability could be attributed to various factors, such as the choice of medications, the severity of diabetes, the varying price of the same medications based on location, complications from the disease, and the availability of generic or branded drugs. This study reported capped costs for consultation and RBS tests at Kshs. 200 and Kshs. 150, respectively, with no variability (SD=0).

Diagnostic tests showed a range from Kshs. 150 to Kshs. 4,650, with a mean cost of Kshs. 216.5. The costs of medical devices, specifically glucometers and BP monitors, exhibit more variability. The total costs per visit for treatment and services show a wide range from Kshs. 350 to Kshs. 30,522, with a mean cost of Kshs. 1,206.86. This substantial variation underscores the unpredictable potential financial burden faced by individuals with diabetes, which could be influenced by factors such as the presence of complications and insurance coverage. Several studies have showed variations in the estimated cost of managing diabetes (Marsanutto et al., 2006, Kesekek et al., 2014). For example, Alouki et al., (2015) found wide variation in out of pocket spending (OOP) cost of care in different African countries and between private and public hospitals. They found out that presence of complication and co morbidity increased the cost significantly. The total cost of monthly lab and diagnostic tests shows a moderately narrow range from Kshs. 150 to Kshs. 2,650 with a mean cost of Kshs. 1,111.77 demonstrating some variability in these expenses as well. However, it is important to note that the cost of monthly tests can accumulate significantly over time and impact the overall financial burden on patients. Ultimately, the summation shows that the mean total direct cost of care per visit was approximately Kshs.

9,496.90 ± Kshs. 4,631.53, which is lower than the cost in public hospitals as per the study findings from, Oyando et al., (2019) even in the face of inflation and changes in strength of currency. In comparison to this study findings, they reported that the mean annual direct patient cost was Kshs. 53,907 in public health care facilities in Kenya; of which medicines accounted for 52.4% and transport accounted for 22.6%. Similarly, Butt et al., (2022) reported that the annual total cost for diabetes care in Pakistan was USD 740.1 mostly being constituted for by medicine (USD 274.5) followed by hospitalization (USD 319.7). In terms of one-way transport costs for patients, the study finds a range from Kshs. 50 to Kshs. 2,000, with a mean cost of Kshs. 326.46 and an interquartile range of Kshs. 300. This data suggests that transportation expenses for patients can vary widely, potentially due to factors such as distance to healthcare facilities, mode of transportation used (e.g., public transport or private car), and the geographical location of patients. The relatively high standard deviation (± Kshs. 224.67) indicates substantial variability in these costs among patients. Additionally, the study reports the one-way cost of food for family or friends accompanying the patients, ranges from Kshs. 100 to Kshs. 2,000, with a mean cost of Kshs. 287.03 and an interquartile range of Kshs. 207.5. The presence of family or friends often leads to additional expenses, including meals, which can significantly contribute to the overall economic burden on patients and their support networks. Expensive health related costs have been a barrier to health seeking behavior (WHO, 2019), and patients with chronic illnesses will reduce clinic visits in an effort to cut costs. This will make patients to seek for health services only when necessary or when they are very sick (Tarus, 2022).

We found the mean HbA1c value at approximately 9.231% ± 2.4920%. A relatively small proportion of participants, specifically 21.6%, achieved optimal blood sugar control with HbA1c levels below 7%. In contrast, a significant majority, 48.4%, had uncontrolled blood sugar levels, indicated by HbA1c levels exceeding 9%. Additionally, 26.8% of participants fell into the less optimal control range, with HbA1c levels between 7% and 9%. A prospective, observational single-center study at the Preoperative Assessment Centre (PAC) of Singapore found 20.8% of the study population had HbA1c ≥ 6.1% (Teo et al., 2020). Kulkarni et al (2020) found a 76.0% poor glycemic control and Mean HbA1c of 9.55% in type 1 diabetes in India. Muhamed et al., (2018) found glycemic control for patients on treatment at 33%. In their meta-analysis Azevedo&Alla (2008) reported that high diabetes treatment cost was associated with poor glycemic control in sub-Sahara Africa. Uncontrolled diabetes has been found out to be among the risk factors for diabetic foot (Nduati et al., 2022). Uncontrolled diabetes puts the patients at an increased risk of diabetes-related complications like cardiovascular events (Wan, 2016), renal insufficiency (Orsi, 2018 and Li, 2020), and microalbuminuria (Dorajoo, 2017). Compelling evidence shows that the risk of diabetes-vascular-related complications rises exponentially as HbA1c levels increase (Akselrod, Friger, &Biderman, 2021). Prentice et al., (2016) demonstrated that HbA1c variability during follow up is a risk factor for patients to develop diabetic complications and mortality. Akselrod et al., (2021). A 1% increase in HbA1c is associated with an increase in likelihood of ICU admission, hospital length of stay (LOS) and greater risk of major complications (Yong et al., 2018).

In terms of RBS reading, we found the mean RBS reading at approximately 10.075 mmol/l ± 4.6503 mmol/l. Majority of participants, specifically 43%, had high RBS levels. High RBS levels can indicate impaired glucose regulation and a potential risk for diabetic complications. Our poor glycemic control findings could be attributed to high cost of medicines, lab tests, and low adherence rates in patients in mission hospitals. Both HbA1c and RBS readings indicate there is still need for intervention since majority of the diabetic patients have uncontrolled blood sugar levels. Sugar control is very important in preventing diabetic complications and premature death (Mohamed et al., 2018). One study at Kenyatta National Hospital found out that patients had diabetic ketoacidosis due to uncontrolled diabetes had a high fatality rate (Mbugua et al., 2005).

This study went ahead and conducted inferential analysis (table 6). We found that the correlation coefficient between total direct costs and HbA1c reading was approximately 0.088, suggesting a non-significant weak positive correlation (p=0.089). This indicates that patients who spend more on their diabetic management might achieve better glycemic control and vice versa. This finding is similar to study among type 1 diabetes patients in India which found a negative correlation between cost of care and HbA1c levels (Kulkarni et al., 2020).

The correlation between total direct costs and RBS reading was moderate (approximately 0.435) and statistically significant (p=0.000), indicating a meaningful relationship between these two variables.

Further analysis was carried using scatter plot to illustrate the association between RBS reading and total direct costs. The plot depicted a positive relationship, indicating that as RBS levels rise, there is a corresponding increase in total direct costs and 19% of the variation in total direct costs indicated by the linear relationship with RBS readings (R^2=0.190). High random blood glucose resulted into a direct increase in total cost. Clinicians responded more to a high random blood glucose that a high hba1c, in terms of adding an additional drug to control glucose, or sent a patient for investigations or to casualty to get insulin injection or normal saline, which all increased the cost to the patient. We however noted that such reactions were not so with a high HbA1c.

We did a regression analysis to model the relationship between total direct costs and two predictor variables: HbA1c reading and RBS readings. Evidently, a moderate positive correlation (R=0.461) between total direct costs and the combination of HbA1c and RBS readings was established, with 20.8% of the variation in total direct costs explained by these variables. Moreover, analysis of variance showed that at least one of the predictor variables (HbA1c reading and RBS readings) significantly contributes to explaining the variance in total direct costs echoing the results of the initial correlational analysis in.

Finally, the coefficients and statistics for the regression analysis showed that a one-unit increase in HbA1c reading is associated with a change of Kshs. 170.529 in total direct costs when RBS reading is held constant. Similarly, a one-unit increase in RBS reading causes a change of Kshs. 452.617 in total direct costs when HbA1c reading is held constant again shows how clinicians were easy to respond to a high RBS than a high HbA1c. Notably, both HbA1c reading and RBS reading were statistically significant predictors of total direct costs (p=0.047 and p=0.000, respectively). Lage&Boye, (2020) found out that patients with an HbA1c index above ADA target, a reduction of 1% in HbA1c resulted in a reduction in all-cause, total, and one-year costs. Their results further indicated that good glycaemic control is associated with savings on costs (Lage&Boye, 2020). These study findings suggest a statistically significant association between total direct costs and RBS readings among type 2 diabetes patients.

This study is the first to assess the cost of managing diabetes type 2 in mission hospitals in Kenya, and its association with HbA1c. Its findings create a basis for further research in other settings.

Conclusion

The study showed substantial direct cost met by diabetes type 2 patients in seeking health care, and that treatment costs are higher and mainly driven by medicine cost and this had an impact on treatment and glycemic control in mission hospitals.

Recommendations

Based on the findings, discussion and conclusions, we recommend that governments and county governments should come up with ways to cushion patients with diabetes and other chronic diseases against high direct cost of medical care in order to prevent poor management and follow up. This could be done through NHIF for NCDs. This will encourage patients to attend clinics and also afford drugs. Secondly, healthcare providers should tailor treatment plans based on individual HbA1c and RBS readings. Patients with consistently high readings may require more intensive interventions or medication adjustments. We also note that exploration of strategies to manage the costs of T2DM care, with a particular focus on drug costs, which constitute a significant portion of direct expenses. This could involve promoting the use of cost-effective generic medications when available or initial management with non-pharmacologic alternatives. Additionally, more T2DM patients need to be encouraged to enroll in health insurance schemes, such as the National Health Insurance Fund (NHIF), to alleviate the financial burden associated with diabetes care.

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