Original Research

MMJ

Decentralising diabetes care from hospitals to primary health care centres in Malawi

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Abstract

Background
Non-communicable diseases (NCDs) such as diabetes and hypertension have become a prominent public health concern in Malawi, where health care services for NCDs are generally restricted to urban centres and district hospitals, while the vast majority of Malawians live in rural settings. Whether similar quality of diabetes care can be delivered at health centres compared to hospitals is not known.

Methods
We implemented a pilot project of decentralized diabetes care at eight health centres in four districts in Malawi. We described differences between district hospitals and rural health centres in terms of patient characteristics, diabetes complications, cardiovascular risk factors, and aspects of the quality of care and used multivariate logistic regression to explore factors associated with adequate diabetes and blood pressure control.

Results
By March 2019, 1339 patients with diabetes were registered of whom 286 (21%) received care at peripheral health centres. The median duration of care of patients in the diabetes clinics during the study period was 8.8 months. Overall, HIV testing coverage was 93.6%, blood pressure was recorded in 92.4%; 68.5% underwent foot examination of whom 35.0% had diabetic complications; 30.1% underwent fundoscopy of whom 15.6% had signs of diabetic retinopathy. No significant differences in coverage of testing for diabetes complications were observed between health facility types. Neither did we find significant differences in retention in care (72.1 vs. 77.6%; p=0.06), adequate diabetes control (35.0% vs. 37.8%; p=0.41) and adequate blood pressure control (51.3% vs. 49.8%; p=0.66) between hospitals and health centres. In multivariate analysis, male sex was associated with adequate diabetes control, while lower age and normal body mass index were associated with adequate blood pressure control; health facility type was not associated with either.

Conclusion
Quality of care did not appear to differ between hospitals and health centres, but was insufficient at both levels.

Keywords: Diabetes care, decentralization, non-communicable diseases, Malawi, health centres.

Introduction

In sub-Saharan African countries, non-communicable diseases (NCDs) such as diabetes and hypertension have become an increasing public health concern and are expected to overtake HIV/AIDS as the leading cause of death in 2030[1]. A recent large population-based study in rural and urban Malawi found a prevalence of hypertension of 14.7% and 13.6%, and a prevalence of diabetes of 3.0% and 1.7%, respectively[2]. Specialized health care services to manage NCDs are mostly situated in urban centres and hospitals, while the vast majority of Malawians live in rural settings. Rural health centres in Malawi have limited capacity to manage NCDs, especially diabetes. A study in health centres near Lilongwe found that staff lacked knowledge regarding diabetes diagnosis and only 20% of facilities had a glucometer and regular supplies of diabetes drugs[3]. In a similar study in 32 health centres in Northern Malawi, 32% of facilities had a glucometer and none had an uninterrupted supply of diabetic medication[4]. A study in 55 health centres in all three regions found that 38% of health centres had glucometers, 24% had urine glucose dipsticks and only 4% had first-line medicines for treatment of diabetes[5].

As structured NCD care has not been implemented widely in Malawi at local health centres, we describe a process of decentralizing diabetes care from district hospital to health centre level in four rural districts. After an initial 12 months of implementation, we describe differences between hospitals and health centres in terms of patient characteristics, diabetes and hypertension related complications, cardiovascular disease risk, and the quality of care provided for patients with diabetes. In addition, we explored factors associated with adequate diabetes control and with adequate blood pressure (BP) control.

Background

Health centres provide the first point of contact for most patients in the Malawi health system. Patients needing more advanced care are referred to a district hospital, from where further referral to one of four central urban hospitals is

possible. Prior to the pilot, diabetes care was only available at central and district hospitals in Malawi. Some health centres were able to diagnose diabetes, however for treatment, patients were referred to the district hospital. BP measurement was generally available at health centres but often only one anti-hypertensive drug was available and trained staff and equipment were limited. Screening for complications such as diabetic retinopathy was only conducted at district hospitals, and rates of screening were inconsistent. If retinopathy was detected, patients needed referral to a central hospital for laser treatment, although this happened inconsistently.

As 84% of the population of Malawi reside in rural areas far from district hospitals, the poor availability of diabetes treatment at health centres forced patients to travel long distances each month to receive care. Prior to the pilot we conducted an informal survey of diabetes patients receiving care at one district hospital by examining their health records and mapping their location of residence. This exercise revealed that 25% of patients travelled 80km or more to receive standard diabetic care.

Methodology

From 1 April 2018 to 31 March 2019 we implemented a pilot project of decentralized care for patients with diabetes at eight health centres in four districts (Zomba, Phalombe, Machinga and Mulanje). Patients already in care in the diabetes clinics in the district hospitals were offered the opportunity to transfer their care to a health centre. Those newly diagnosed with diabetes either at the hospital or health centre were offered to continue their care at hospital or health centre level. Patients could make this choice at any time, but were encouraged to continue in care at the facility they had chosen.

Nurses and medical assistants (mid-level clinicians with 2 years of training) underwent three days training in diabetes diagnosis and management including screening for complications. The training was followed by two- weekly visits of a clinical-officer mentor (mid-level clinician with 3 years of training). This mentor worked closely with district pharmacists to establish systems of regular drug supply. At each facility an Expert Diabetic Client (EDC), a patient willing to disclose their diabetes diagnosis, known to have excellent adherence to life-style measures and medications and having good diabetic control, gave health education sessions at the health facilities and provided home visit support to patients with poor diabetic control. EDCs were members of the Diabetic Association of Malawi (DAM) and acted as the link between the DAM and patients at the facility level. Systems were developed to ensure patients requiring treatment at central hospital levels (e.g. laser treatment for diabetic retinopathy) were identified and referred as needed.

Data collection and statistical analysis

All diabetes clinics utilized a "NCD master-card" as a facility-based patient record. These standardized Ministry of Health tools were derived from the widely used antiretroviral therapy (ART) master-cards from the HIV program. Data from the NCD master-cards were captured electronically by a project roving data collection officer at the end of each clinic.

Classification of diabetes type 1 and type 2 was made on an individual basis using age of onset, requirement of insulin, Body Mass Index (BMI), duration of symptoms and nature of hospital admissions as criteria.

Urine was checked using urine dipstix and "proteinuria" was defined as any protein (trace to 3+). Retinal screening was performed by clinical officers trained in fundoscopy using the direct method with hand-held opthalmoscopes through a dilated pupil. At Zomba Central Hospital, a binocular indirect method was also used, using a combination of a slit lamp and 90D Volk lens. Retinopathy was defined as the presence of any retinal changes associated with diabetes including non-proliferative and proliferative changes. BP was measured by an automated measuring device (Cradle VSA Microlife blood pressure monitor). Glucose level was determined by point-of-care glucometers (SD Check). Glycosylated haemoglobin (HbA1C) testing was not available at the facilities involved in this pilot.

Adequate glucose control was defined as fasting blood glucose (FBG) <130mg/dL at the last visit. Adequate blood pressure (BP) control was defined as systolic <140 and diastolic <90 mmHg at the last visit. Quality of care was measured by completeness of measurements (BP, weight, FBG) and screening for feet abnormalities, proteinuria and retinopathy performed at clinic visits and documented in the NCD master-cards. Retention in care was defined as those ever registered who made a visit in the last quarter of the project.

Analysis

Descriptive statistics were used to characterize study participants who attended the NCD clinics in the hospitals and rural health centres and to describe the quality of care indicators. Characteristics were described with numbers and proportions or medians with interquartile ranges (IQR). Comparisons between groups were made using chi-square tests for categorical variables and non-parametric tests for medians. Missing data were treated as additional categories.

Multivariable binary logistic regression analysis was used to identify factors associated with adequate diabetes control and with adequate BP control. Univariate odds ratios (OR) with 95%CI were calculated for each variable in the model using normal approximation methods. Adjusted OR (aOR) with 95% confidence intervals (CI) were calculated for each model after adjustment for health facility type, age, gender, diabetes type, duration in care, BMI and HIV status. All variables were simultaneously entered in the logistic regression model and tested for removal through backward stepwise selection. A 0.05 significance level was set for statistical testing. Analyses were conducted using IBM SPSS Statistics 26 (IBM, Armonk, NY, USA).

Ethical considerations

As a retrospective audit of routinely collected, standard service delivery data that had been fully anonymized before analysis, we were exempted by the College of Medicine Research and Ethics Committee (P.09/18/2470) from obtaining individual informed consent. Before the implementation of the pilot project of decentralized diabetes care, we had obtained support from district health offices.

Results

Demographics, comorbidities and risk factors at enrolment (Table 1)

By the end of the pilot (31 March 2019) 1339 patients with diabetes had been registered of whom 21% received care at peripheral health centres. Of all patients, 59.3% were female and the median age was 53 years (IQR 41-63); the median

Table 1. Patient Characteristics at Baseline (first visit)

	Overall	District Hospital	Health Centre	p-value*
Number of patients	1339	1053	286	
Age, median (IQR)	53 (41-63)	53 (41-63)	53 (41-63)	0.84
missing, n (%)	85 (6.3)	61 (5.8)	24 (8.4)	
Sex				
Male, n (%)	545 (40.7)	441 (41.9)	104 (36.4)	0.10
Female, n (%)	794 (59.3)	612 (58.1)	182 (63.6)	
Diabetes Type				
Type 1; n (%)	155 (11.6)	131 (12.5)	24 (8.4)	0.06
Type 2; n (%)	1180 (88.1)	918 (87.5)	262 (91.6)	
missing, n (%)	4 (0.3)	4 (0.4)	0	
HIV status				
Unknown	86 (6.4)	65 (6.2)	21 (7.3)	0.71
Positive	51 (3.8)	39 (3.7)	12 (4.2)	
Negative	1202 (89.8)	949 (90.1)	253 (88.5)	
ART status among those HIV+				
On ART	44 (86.3)	34 (87.2)	10 (83.3)	0.74
unknown	7 (13.7)	5 (12.8)	2 (16.7)	
BMI				
Median (IQR)	25.3 (21.5-29.8)	25.5 (21.6-30.1)	24.8 (21.0-29.2)	0.20
Underweight < 18.5	106 (7.9)	75 (7.1)	31 (10.8)	0.01
Normal weight 18.5 to 24.9	378 (28.2)	288 (27.4)	90 (31.5)	
Overweight 25 to 29.9	282 (21.1)	216 (20.5)	66 (23.1)	
Obese >= 30	251 (18.7)	200 (19.0)	51 (17.8)	
Missing, n (%)	322 (24.0)	274 (26.0)	48 (16.8)	
Hypertension Status				
Has diagnosis of Hypertension	720 (53.8)	552 (52.4)	168 (58.7)	0.14
No diagnosis of hypertension	541 (40.4)	436 (41.4)	105 (36.7)	
Missing, n (%)	78 (5.8)	65 (6.2)	13 (4.5)	
Duration of hypertension (months from diagnosis)				
Months, median (IQR)	25 (7-82)	25 (8-86)	25 (5-64)	0.92
Missing, n (%)	2 (0.3)			
Median (IQR) fasting blood glucose	180 (124-292)	179 (125-289)	182 (121-302)	0.80
Good glucose control (≤130)	346 (25.8)	285 (27.1)	61 (21.3)	0.001

Table 1 Cont...

Moderate glucose control (131 – 160)	173 (12.9)	142 (13.5)	31 (10.8)	
Poor glucose control (> 160)	698 (52.1)	567 (53.8)	131 (45.8)	
Missing, n (%)	122 (9.1)	59 (5.6)	63 (22.0)	
Median (IQR) systolic blood pressure	132 (117-151)	131 (116-148)	140 (121-161)	0.003
Missing, n (%)	141 (10.5)	105 (10.0)	36 (12.6)	
Median (IQR) diastolic blood pressure visit	84 (76-94)	84 (76-93)	88 (77-95)	0.01
Missing, n (%)	141 (10.5)	105 (10.0)	36 (12.6)	
Blood pressure Normal# blood pressure, n (%)	594 (44.4)			
Stage I& hypertension, n (%)	317 (23.7)	494 (46.9)	100 (35.0)	0.001
Stage II&& hypertension, n (%)	169 (12.6)	246 (23.4)	71 (24.8)	
		129 (12.3)	40 (14.0)	
Stage III&&& hypertension, n (%)	118 (8.8)	79 (7.5)	39 (13.6)	
Missing, n (%)	141 (10.5)	105 (10.0)	36 (12.6)	
Reported to have smoked in the last month, any amount				
Yes	23 (1.7%)	18 (1.7)	5 (1.7)	0.002
No	1054 (78.7)	808 (76.7)	246 (86.0)	
Missing, n (%)	262 (19.6)	227 (21.6)	35 (12.2)	
Reported to have consumed alcohol in the last month, any amount				
Yes	21 (1.6)	18 (1.7)	3 (1.0)	0.001
No	1051 (78.5)	803 (76.3)	248 (86.7)	
Missing, n (%)	267 (19.9)	232 (22.0)	35 (12.2)	

* p-value based on non-parametric median test or chi- square test
# normal: systolic <140 and diastolic <90
& stage I: systolic between 140 and 159 or diastolic between 90 and 99
&& stage II: systolic between 160 and 179 or diastolic between 100 and 109
&&& stage III: systolic > 179 or diastolic >109

Table 2. Quality of Care by Site Status

	Overall	District Hospital	Health Centre	p-value
No. of patients	1339	1053	286	
Median number of months in the program (first visit to last visit) (IQR)	8.8 (3.7-11.4)	9.5 (3.7-11.7)	7.2 (3.9-9.7)	0.001
Retention in care - patients who had a visit in last quarter (1 Jan 2019 to 31 March 2019) among those ever registered; n (%)				
Did not have visit	358 (26.7)	294 (27.9)	64 (22.4)	0.06
Did have visit	981 (73.3)	759 (72.1)	222 (77.6)	
Patients who had weight recorded on master-card at the last visit, n (%)				
Not recorded	221 (16.5)	178 (16.9)	43 (15.0)	0.45
Recorded	1118 (83.5)	875 (83.1)	243 (85.0)	
Patients who had their blood glucose recorded on master-card (FBS or RBS) at the last visit, n (%)				
Not recorded	100 (7.5)	44 (4.2)	56 (19.6)	0.001
Recorded	1239 (92.5)	1009 (95.8)	230 (80.4)	
Patients who had their blood pressure recorded on master-card at the last visit, n (%)				
Not recorded	102 (7.6)	75 (7.1)	27 (9.4)	0.19
Recorded	1237 (92.4)	978 (92.9)	259 (90.6)	
HIV test coverage, n (%)				
Tested – new or previous (pos or neg)	1253 (93.6)	988 (93.8)	265 (92.7)	0.47
Not tested	86 (6.4)	65 (6.2)	21 (7.3)	
Patients in the cohort who had retinal screening done at any time, n (%)				
Never done	936 (69.9)	663 (63.0)	273 (95.5)	0.001
Ever done	403 (30.1)	390 (37.0)	13 (4.5)	
Findings suggesting diabetic retinopathy among patients who received retinal screening, n/n (%)	63/403 (15.6)	59/390 (15.1)	4/13 (30.8)	0.13
Patients who had urine testing done at any time, n/n (%)				
never done	1327 (99.1)	1051 (99.8)	276 (96.5)	0.001
done	12 (0.9)	2 (0.2)	10 (3.5)	
Patients with proteinura in those who had urine testing, n/n (%)	4/12 (33.3)	2/2 (100)	2/10 (20.0)	0.03

Table 2 Cont...

Patients who had foot check done at the last visit, n (%)				
done	926 (69.2)	695 (66.0)	231 (80.8)	0.001
not done	413 (30.8)	358 (34.0)	55 (19.2)	
Patients with abnormalities among those who had foot screening at last visit, n/n (%)	324/926 (35.0)	286/695 (41.2)	38/231 (16.5)	0.001
No. of patients who have been on diabetes treatment at least 6 months in the project	874	695	179	
mean fasting blood glucose of all patients on last visit (who have been on treatment at least 6 months)	186 (+/- 101)	187 (+/- 103)	182 (+/- 93)	0.38
mean systolic blood pressure on last visit of all patients (who have been on treatment at least 6 months)	135 (+/- 27)	135 (+/-27)	138 (+/-28)	0.34
mean diastolic blood pressure on last visit of all patients (who have been on treatment at least 6 months)	84 (+/-15)	84 (+/-15)	85 (+/-15)	0.82
mean difference in systolic blood pressure between first visit and last visit (of patients on treatment at least 6 months)	0.51 (+/- 25.7)	1.8 (+/-25.2)	-4.8 (+/-27)	0.38
mean difference in diastolic blood pressure between first visit and last visit (of patients on treatment at least 6 months)	-1.4 (+/- 15.2)	-0.9 (+/-15.2)	-3.2 (+/-14.7)	0.44
mean difference in fasting blood glucose between first visit and last visit (of patients on treatment at least 6 months)	-19 (+/- 122)	-18 (+/-124)	-26 (+/-111)	0.52

BMI was 25.3 (IQR 21.5-29.8) and 88.1% of patients had type 2 diabetes; 94% received HIV testing of whom 3.8% were HIV positive. At the time of enrolment, 53.8% of patients had pre-existing hypertension that had been present for a median period of 25 months (IQR 7-82). While the prevalence of known hypertension was not significantly different between patients in district hospitals and patients in health centres, the latter had significantly higher median blood pressure and higher prevalence of raised blood pressure. There were no significant differences in age, sex, type of diabetes, median FBG, median BMI and HIV status between patients attending District Hospitals and Health Centres at baseline. Significant differences in smoking, use of alcohol, BMI categories and diabetes control were caused by large differences in missing data between district hospitals and health centres.

Quality of care and complications (Table 2)

Patients were followed in the pilot for a median duration of 8.8 months. Follow up time was significantly longer for patients attending district hospitals (9.5 months vs. 7.2 months; p = 0.001). Retention in care was 73.3%, with no difference between hospitals and health centres.

There were no differences between patients at hospitals and health centres in HIV test coverage (93.6%), weight measurements (83.5%) or BP measurements (92.4%)

recorded on the NCD master-card. Blood glucose was recorded in 92.5% of patients at their last visit with a significantly higher proportion done among patients in hospitals (95.8% vs. 80.4%; p=0.001).

Of patients who had been on anti-diabetic treatment for at least 6 months, mean FBG on the last visit was 186 mg/dL (+/- 101), representing a mean decrease in FBG between enrolment and the last visit of 19 mg/dL (+/-122), with no significant differences between hospitals and health centres. Foot examination was done among 69.2% of patients during their last visit; with a higher proportion done at health centres compared to hospitals (80.8% vs 66.0%; p=0.001). Of patients who had foot screening, 35.0% had either ulcers, deformities or vascular disease, with a higher proportion reported at hospitals compared to health centres (41.2% vs 16.5%; p=0.001).

Only 30.1% of patients received any retinal screening during the study period, with a higher proportion reported at hospitals compared to health centres (37.0% vs 4.5%; p=0.001). Of those screened, 15.6% had findings suggesting diabetic retinopathy. The proportion of patients who had urine testing was very low (0.9%), with a significantly higher proportion done in health centres compared to hospitals (3.5% vs 0.2%; p=0.001).

Table 3. Factors associated with Diabetes control and with Blood Pressure control

	DM control (fasting blood glucose reading (FBS) ≤ 130 in last visit)*					BP control (BP reading systolic <140 AND diastolic <90) in last visit**					
	n/n	%	Univariate (unadjusted)		Multivariate (adjusted)		n/n	%	Univariate (unadjusted)		Multivariate (adjusted)	
			OR (95%CI)	p-value	aOR (95%CI)$	p-value			OR (95%CI)	p-value	aOR (95%CI)$	p-value
	437/1231	**35.5**					**631/1237**	**47.1**				
Health Facility												
DH	350/1001	35	ref				502/978	51.3	ref			
HC	87/230	37.8	0.8 (0.6-1.2)	0.41		NS	129/259	49.8	0.9 (0.7-1.2)	0.66		NS
Age (in years)			1.0 (0.9-1.1)	0.75		NS			0.9 (0.9-1.0)	0.0001	0.9 (0.9-1.0)	0.01
Gender												
Male	205/502	40.8	ref				271/507	53.5	ref			
Female	232/729	31.8	0.7 (0.5-0.8)	0.001	0.7 (0.5-0.9)	0.02	360/730	49.3	0.8 (0.7-1.1)	0.15		NS
Diabetes Type												
Type 1	58/141	41.1	ref				100/131	76.3	ref			
Type 2	375/1086	34.5	0.8 (0.5-1.1)	0.12		NS	531/1102	48.2	0.3 (0.2-0.4)	0.001		NS
Missing	4/4	100					0/4	0				
Duration in care (months)&			1.0 (0.9-1.1)	0.53		NS			1.0 (1.0-1.0)	0.49		NS
BMI												
Underweight (< 18.5)	24/93	25.8	0.6 (0.4-1.0)	0.06		NS	63/86	73.3	1.9 (1.1-3.2)	0.02	1.9 (1.0-3.4)	0.04
Normal weight (18.5 to 24.9)	125/343	36.4	ref				209/355	58.9	ref		ref	
Overweight (25 to 29.9)	100/267	37.5	1.0 (0.8-1.5)	0.80		NS	134/271	49.4	0.7 (0.5-0.9)	0.02	0.7 (0.5-1.0)	0.09
Obese (≥30)	85/239	35.6	1.0 (0.7-1.4)	0.80		NS	84/241	34.9	0.4 (0.3-0.5)	0.001	0.4 (0.3-0.6)	0.001
Missing	103/289	35.6	1.0 (0.7-1.3)	0.80		NS	141/284	49.6	0.7 (0.5-0.9)	0.02	0.8 (0.6-1.1)	0.22
HIV status												
Unknown	27/78	34.6	0.9 (0.6-1.5)	0.80		NS	30/75	40	0.6 (0.4-1.0)	0.07		NS
Positive	11/47	23.4	0.5 (0.3-1.1)	0.08		NS	32/47	68.1	2.0 (1.1-3.8)	0.03		NS
Negative	399/1106	36.1	ref				569/1115	51	ref			

* data missing, n=108

** data missing, n=102

$ adjusted for all other variables in the model; significant associations reported only (NS=not significant)

& Months in care from first to last visit during the reporting period

Factors associated with diabetes and blood pressure control (Table 3)

At the end of the project period, adequate diabetes control was achieved by 35.5% of all patients, with no significant difference between those receiving care in hospitals or health centres (35.0% vs. 37.8%; p=0.41). In multivariate logistic regression analysis, only sex was independently associated with diabetes control: females were less likely to achieve adequate glucose levels (aOR 0.7;95%CI 0.5-0.7) when adjusted for health facility type, age, diabetes type, duration in care, BMI and HIV status.

Adequate BP control was achieved by 47.1% of all patients, with no significant difference between those receiving care in hospitals or health centres (51.3% vs. 49.8%; p=0.66)

In multivariate logistic regression analysis, age and BMI were independently associated with achieving BP control. Increasing age (aOR 0.9; 95% CI: 0.9-1.0) and being underweight (BMI<18.5: aOR 1.9; 95% CI 1.0-3.4) or obese (BMI>30: aOR 0.4; 95% CI: 0.3-0.6) were associated with a decreased likelihood of achieving BP control when adjusted for health facility type, sex, diabetes type, duration in care, BMI and HIV status.

Discussion

We demonstrated that decentralizing diabetes care from district hospitals to health centres was possible using a mentorship approach. Retention measured over only 12 months was similar in district hospitals and health centres. Our findings revealed no differences in glucose or BP control in patients managed by nurses or medical assistants at health centres compared to those managed by clinical officers in hospitals. Other studies from the region showed similar outcomes. In a nurse-managed community-based hypertension program in Ghana, 72% of patients were retained in care at 12 months with good BP control[6]. In a rural setting in South Africa, nurses were able to successfully manage patients with hypertension and diabetes[7,8,9]. In nurse led diabetes clinics at health centres and hospitals in Rwanda, nurses were reported to have high levels of adherence to treatment protocols and successful treatment outcomes after two years of follow-up[10,11].

Our study had several limitations; we used FBG instead of HBA1C and assessed control based on a single (last) measurement We thus were unable to assess glucose control over time. We only had one size of BP cuff which may have produced inaccurate readings in patients with very low or high BMI.

By the end of the intervention period, 21% of patients chose to receive their diabetes care at a health centre, rather than at a hospital. This was similar to our initial estimate of 25% of diabetes patients likely to choose services offered closer as they lived 80km or more away from the hospital. Other rural settings in Africa have shown variable use of decentralized health centre services for diabetes. In rural South Africa, 79% of patients with NCDs, including diabetes, transferred care from the hospital to health centres[7], whilst in rural Ethiopia only 11% of patients with diabetes transferred from a hospital to a health centre[12].

Our retention rate of 73% compares favorably to other settings but our follow-up was limited to less than one year on average. Defaulting or loss-to-care is a significant challenge in many NCD programs in Africa. In Soweto, 47% of diabetic patients were lost from NCD focused care services

within two years[13]. A hypertension program in Ghana had a retention rate of less than 30% at 12 months[6]. In contrast, in Rwanda where mentoring was conducted at health centre diabetes clinics, only 17 % of diabetic patients were lost to follow-up after 24 months[11].

In our cohort, levels of glucose and BP control were poor (36% and 47%, respectively and not significantly different between District Hospitals and Helath Centres). Other studies in Africa have reported similar poor levels of glucose- and BP control amongst diabetics enrolled in care[14,15,16].

Quality of care was measured by completeness of measurements and screening for feet abnormalities, proteinuria and retinopathy. Routine measurements of BP and glucose were relatively easy to achieve and similar to rates reported in rural Rwanda (BP 96%, glucose 93%[10]). Rates of foot screening (69%) although incomplete was also comparable to rural Rwanda (72%)[10] but higher than previously reported in rural Malawi (17%)[17]. Only 30% of patients received fundoscopy in our cohort. However, most patients receiving care at health centres needed referral to hospital (where clinical officers trained in fundoscopy are based) for retinal screening, a step which very few managed to take. Monitoring of complications that require additional pathways such as retinal and urine screening are especially challenging to achieve. Monitoring of diabetic complications with methodologies appropriate for health centers and with a functioning referral system for severe organ disease require urgent investments, including in human resources and (innovative) diagnostic equipment.

One of the features of our pilot was the introduction of new clinic-based NCD master-cards. These cards were well accepted as they were based on the widely used ART master-card. Their use required the training and presence of an NCD-clinic clerk, a lay cadre allocated to this duty on clinic days. Incomplete documentation, especially of baseline complications was challenging and required continuous attention. The introduction of protocols and standardized clinical forms have been used in other settings with variable success. The introduction of structured clinical records for hypertension and diabetes in primary health care clinics in Cape Town had no effect on glucose or BP control[18]. In Soweto, a "traffic light system" was successful at identifying patients needing referral, but less successful for patients needing closer monitoring or yearly screening[13]. The use of an integrated clinical tool combined with educational outreach to nurses in health centres in South Africa, did not lead to an intensification of treatment in patients with hypertension or diabetes compared to facilities who did not use the tool[19].

We believe that in our pilot, the on-site mentorship, rather than the new record system brought improvement. The introduction of the master-card alone, before the mentoring visits resulted in poor documentation. Training without mentorship is thought to be insufficient to improve quality of care[20]. The HIV program in Malawi has used clinical mentorship as an effective way to ensure that training information is put into practice, leading to improved quality of care[21].

A key part of this intervention was the involvement of expert people living with diabetes giving patient education. Patient education is often lacking in overstretched primary health care clinics. A study assessing quality of care in 75 diabetic patients in rural Malawi found that 40% of patients had

no information about diabetes[17]. At health centres in Cape Town, patients with diabetes had little understanding of how to manage hyper- or hypoglycaemia and poor knowledge of the importance of good blood glucose control[15]. The utilization of "expert patients" was advocated for in the UK in 2002 and was later used successfully in a program in rural South Africa[22,23]. Similar to our experience in Malawi, leaders such as school teachers, nurses or community health workers living with diabetes were selected and trained in the use of a "Zakhe" (his/hers) diabetes programme that included use of pictorial flip charts[8]. The DAM was formed in 2007 as a channel for health awareness about diabetes and patient advocacy. Using EDCs from this association strengthened the relationship between the association and patients and enabled DAM members to play a new role in the health system.

Conclusion

Decentralisation of diabetes care to health centres showed satisfactory uptake and short-term retention. EDCs played an important role in health education, peer support and small administrative tasks. Quality of care as measured by diabetes and BP control and consistency of screening for complications did not differ between hospitals and health centres, but was insufficient at both levels. A higher priority for delivering quality diabetes care at all levels of the health system is needed, and especially at peripheral health centres, given the large affected population residing in rural areas.

Declarations

Ethics approval and consent to particiapate

Ethical approval was obtained by the College of Medicine Research and Ethics Committee (P.09/18/2470) and we obtained prior support from district health offices. As a retrospective audit of routinely collected, standard service delivery data that had been fully anonymized before analysis, we were exempted from obtaining individual informed consent.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

CP, JVO, JT and AA conceived the project. CP, TA , CM and GM led the guideline and training curriculum development process. TA, JM, SN and MJ gave technical support on guideline and curriculum development. AA, MVL, GK and SK led data analysis. CP, MVL and JVO led manuscript writing. All authors contributed to and approved the final manuscript.

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