Diabetes care and complications in primary care in the Tshwane district of South Africa

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Abstract

Aims: To describe the diabetic population receiving primary care from the Tshwane district public health services and to assess the quality of care of members of this population, their level of disease control and the extent of their complications.

Methods: A cluster-randomised trial was conducted in 12 primary care clinics in Tshwane district. A total of 599 diabetic patients attending these clinics for review were consecutively interviewed and clinically examined. Data on the care received was also obtained from their clinical records for the previous 12 months. Patients randomised to the active arm of the study were screened for complications.

Results: The mean age was 58 years and 80.5% had a body mass index (BMI) $\geq$ 25kg/m^2. Sixty-eight percent of patients were female. Acceptable glycaemic control and LDL-cholesterol were found for only 27% and 33% of patients respectively (HbA1c<7%; LDL <2.5 mmol/l). Despite more than 79% of patients reporting to be hypertensive, 68% of patients had a systolic blood pressure above 130 mmHg and 64% had a diastolic blood pressure above 80 mmHg. Evaluating patient records of the preceding year, screening for eye complications was only reported in 8.2%, feet complications in 6.5%, kidney complications in 21.4% and cardiovascular complications in 7.8%. The screening prevalences found were 29% for retinopathy, 22% for maculopathy, 5% for neuropathy (neurothesiometer), 7% for nephropathy (eGFR stage3-5), 17% for possible infarction (Rose questionnaire) and 36% for severe erectile dysfunction (SHIM questionnaire).

Conclusion: Diabetes care and screening for complications at primary care level in the Tshwane district were found to be sub-optimal. Measures should be taken to address this.

Keywords: Diabetes, metabolic control, complications screening, primary care

Introduction

The global prevalence of diabetes and other non-communicable diseases is increasing rapidly, as a result of changes in lifestyle, urbanisation and population aging. Sub-Saharan Africa is not excluded from this rapid rise in prevalence, which is predicted to double within the next 20 years.(1, 2) In

addition to these factors, the sub-Saharan region suffers from high mortality from infectious diseases such as HIV infection, tuberculosis and malaria. It is, however, predicted that by 2020 the mortality from non-communicable diseases will overtake that of infections as the major source of mortality. The burden of non-communicable diseases in sub-Saharan countries is already proportionally greater than that found in developed countries. In sub-Saharan Africa diabetes care and costs have to compete with anti-retroviral drugs, tuberculosis treatment and malaria control programmes. (3, 4) Also, as far back as 1980 a Tanzanian research project carried out by Mhando and Yudkin stated that "there is no indication that the African diabetic is less vulnerable to complications of the disease, a fact which has become apparent with better follow-up". (5) Various studies conducted in South Africa, Nigeria, Ghana, Cameroon and Tanzania and others, as well as review articles on diabetes in Africa, confirm both the increase in prevalence and the changing epidemiology of diabetes complications. (3, 4, 6-8)

The Burden of Disease study group (9) estimated in 2000 that 5.5% of South Africans aged ≥ 30 years had diabetes, and that 4.3% of all deaths in South Africa were due to diabetes. Furthermore, 14% of ischaemic heart disease, 10% of stroke, 12% of hypertensive disease and 12% of renal disease were attributable to diabetes.

Chronic conditions in developing countries are usually managed at the primary health care level. Policy guidelines for the management and treatment of diabetes at primary care level are in place in South Africa. (10) These guidelines include recommendations for annual (or more frequently if indicated) blood tests for both glycaemic and lipid control, as well as screening for complications linked to the feet, eyes, kidneys and heart. The implementation of guidelines by health professionals confronts many barriers, as reported by Daniels *et al*. (11) and Rotchford & Rotchford.(12) These include time constraints, conflict with local practices, health system problems and patient beliefs about their disease.

In South Africa, limited data is available on the quality of diabetes care. For example, Levitt *et al.* (13) in 1997 found that in three primary care facilities in Cape Town, a need existed for improved diabetes care at primary level. No data were available to assess the quality of diabetes management at primary care level in the Tshwane district, a large metropolitan area in the Gauteng province. Primary care services are provided by both provincial and local government. In 1994 President Nelson Mandela announced that all health care for pregnant women and children under the age of 6 years would be free for users of public health facilities. This was extended to all services rendered at public primary health care facilities from 1 April 2006. (14)

We conducted a clinical audit and cross-sectional baseline assessment of patients who attended primary health care clinics in the Tshwane district. These patients participated in a cluster-randomised controlled trial for investigating the efficacy of a comprehensive care intervention for diabetes management at primary care level.

The primary objective of the audit and assessment was to report on glycaemic-, lipid- and hypertension control, as well as the prevalence of diabetes-related complications: retinopathy, neuropathy, nephropathy and cardiovascular complications. The secondary objective was to evaluate the adherence to screening guidelines for metabolic control and complications as set out by the South African diabetes guidelines. (10, 15)

Setting

Gauteng province is a landlocked province, one of nine provinces of South Africa. It is the economic hub of South Africa as it contributes 33.7% to the national GDP. It is highly urbanised (97%). The Tshwane district, one of five districts of the Gauteng province of SA has a population of 2,708,702, with 27.3% living in traditional and informal dwellings, shacks or squatter settlements. A total of 22.5% of households in the district have access to electricity for lighting. Facilities in the district providing health care are 90 health facilities, broken down into 68 clinics, 8 community health centres, 3 satellite clinics, 5 district hospitals, 1 regional hospital, 1 tertiary hospital and 4 specialist hospitals. The estimated primary health care expenditure per capita in Tshwane district for 2010/11 was R520 (US$52 at the time). (16, 17)

Prevalence data for diabetes in Tshwane district are not available. The management of diabetes at primary health care level is nurse led, with doctors doing sessional work (usually 4-8 hours per week) at the clinics. Community health centres have full-time doctors. The Essential Drug List of South Africa provides algorithms for health personnel to provide care in a stepwise way for diabetes and hypertension. Diabetic patients are seen by a health professional at least four times a year, although some patients attend primary care clinics monthly, to have their random glucose, blood pressure and weight checked and to collect their monthly supply of medication, whereas others have their medication delivered by a community health worker. The system is clearly fragmented and clinic-dependant.

Patients and Methods

Study design

We randomly selected six intervention clinics and six control primary health care clinics in the Tshwane district for a cluster randomised clinical trial. These were selected from three strata: those managed by the local authority; those managed by the provincial authority; and community health centres managed by the provincial authority. The intervention clinics were evaluated using a mobile screening service and the control clinics received standard care.

Participants

Diabetic patients attending the abovementioned primary health care clinics in the Tshwane district were invited to the mobile unit to participate in the study. Patients were eligible for inclusion to the study if: 1) they had type 2 diabetes (unspecified duration) or type 1 diabetes for five or more years; 2) they were older than 18 years of age; and 3) they were able to give informed consent.

Each patient was interviewed, examined clinically, and a 12-month retrospective clinical record review conducted with the use of a structured questionnaire. All interviews and examinations were conducted in the presence of the primary investigator, with the assistance of trained medical students from the University of Pretoria.

Interview and record review

The same questionnaire was used for data collection in both the intervention and control arm of the cluster-randomised trial. However, screening for complications was an added section to the questionnaire used in the intervention arm (6 clinics).

Baseline questions included demography (age, sex, and socio-economic status), history (smoking, duration of disease, concurrent diseases (e.g. hypertension)), previous referrals and hospital admissions as a result of their diabetes diagnosis. Treatment was confirmed by transcribing the latest prescription for every patient.

Socio-economic status was assessed using a housing-quality-index (HQI) questionnaire, validated for the South-African context. Questions focussed on the type of wall, floor and roof of the house in which the patient resided, whether there was electricity, the type of water supply, and where and what type of sanitation was available for the household. (18)

Patients were assessed for foot complaints using a standardised diabetic foot questionnaire, which included the neuropathy symptom score (NSS). (19)

Care received in the 12 months preceding the study was recorded by counting the number of times in the year a random glucose test, a fasting glucose test, blood pressure, weight and waist circumference measurements was recorded. The record review also focused on: whether the patient's body mass index (BMI) had ever been calculated; whether blood tests for HbA1c, cholesterol or creatinine had been ordered; and urine samples sent for microalbuminuria or albumin: creatinine ratios had been requested. The last urine dipstick results were also transcribed.

Any mention of an eye evaluation was recorded, using "retinopathy, cataracts, visual acuity or eye problems" as keywords.

Evaluation of retrospective screening for feet-related complications was done using the keywords "amputation, poor sensation, ulcer(s), abnormal pulses, gangrene or no reflexes".

Retrospective evaluation of nephropathy was conducted by looking for any serum-creatinine blood tests ordered or results in the patient's file, and using "urine protein dipstick and nephropathy" as keyword searching tools.

Historical screening for cardiovascular complications was done and sought ECG output in the patient file or by searching for keywords such as "abnormal ECG recorded, intermittent claudication recorded, angina or chest pain recorded, heart failure recorded or myocardial infarction recorded".

Physical examination

Patient weight was determined to the nearest 0.1 kg with the use of an electronic platform scale. The scale was zeroed between patients. Patients were asked to remove their shoes and heavy clothing. Height was determined to the nearest millimetre using a wall-mounted measuring stick. BMI was calculated according to the formula: weight (kg)/[height (m)]^2.

Blood pressure was measured with patients in a seated position and with the use of a Welch-Allen rechargeable mobile device (CE 0297). Blood pressure was measured twice by the same observer with a five-minute rest in between measurements. An appropriate blood pressure cuff size was used, based on the mid-arm circumference of the patient. The mean value of the two measurements was used for analysis.

Patients in the active arm of the cluster randomised trial had an eye assessment, which included measurement of visual acuity (using a 6-meter Snellen-chart) and retinal photos with dilated pupils (Mydriacyl; 1% Tropicamide) with the use of a Canon Cr-1 camera. Visual acuity was regarded as normal (6/4-6/18), visually impaired (<6/18-6/60) or blind (<6/60). Retinal photographs were interpreted and graded by a specialist ophthalmologist according to the Scottish Retinopathy grading system of 2003. (20)

Patients in the active arm of the cluster-randomised trial had a foot examination. This comprised of a physical examination of the feet, checking for bone/joint abnormalities, signs of ulceration, infection and amputation. Each foot was then evaluated using (1) a Semmes-Weinstein 5.07/10 g monofilament for touch sensation; (2) a 128 Hz tuning fork for vibration sense; and (3) a neurothesiometer (Williams Medical) where 25Hz was used as a cut-off point for peripheral neuropathy.

Erectile dysfunction was evaluated using the Sexual Health Inventory for Men (SHIM) questionnaire in the active arm of the cluster-randomised trial. (21)

Patients in the active arm of the cluster-randomised trial were screened for cardiovascular complications with the standardised WHO/Rose questionnaire and the intermittent claudication questionnaire. (22, 23)

Venous blood and urine tests

Non-fasting blood samples were collected for HbA1c to assess glycaemic control (all patients), direct low-density lipoprotein (LDL) cholesterol as a marker of lipid control (intervention arm only) and serum-creatinine as an indicator of renal function (intervention arm only). A Micral urine test strip (Accu-chek)(intervention arm only) and a Combi-6 urine test strip (Macherey Nagel)(all patients) were used to test for albuminuria. All blood samples were analysed by means of a Beckman Coulter Synchron LX system®. The glomerular filtration rate was calculated with the use of the modification of diet in renal disease (MDRD) formula. (24)

Data management and analysis

Data were captured in Epidata (25) and analysed using STATA version 12.(26) Descriptive statistics are reported as means and standard deviations for parametric data and medians with 25^{th} and 75^{th} quartiles for non-parametric data. Data were summarised with descriptive statistics. The role of clustering between different clinic clusters was evaluated by the intraclass (intracluster) correlation coefficients (ICC). Diabetes control parameters were categorised using clinical cut-off points as prescribed by local and international clinical care guidelines. Data from all the screening tools used were classified and analysed as prescribed by the developers. Data collection started on 29 June 2010 and was completed on 4 March 2011.

Ethics approval

Informed consent was obtained from all patients and health care providers attending or working, respectively, in the clinics where the study was carried out. The study was approved by the University of Pretoria's Faculty of Health Sciences Ethics Committee on 21 April 2010 (Protocol # 61B/2010), by the Tshwane Metropolitan Council on 2 March 2010 and by the Tshwane Metsweding Region Research Ethics Committee on 18 May 2010 (Project # TMREC 2010/19). (Registered with www.clinicaltrials.gov; NCT01275040)

Results

Demographic and social

A total of 599 patients were enrolled in the study from 12 primary health care clinics (328 from the intervention clinics and 273 from the control clinics).

Table 1 shows the baseline characteristics of the study population. The mean age of the patients was 58 (± 11) years (range: 20 to 90 years) and the majority were female (68%). Only 32% (n=183) of patients indicated that they were employed, and more than 45% (n=260) were pensioners.

Table 1: **Description of study participants**

Variable		**N**	**%**
Gender	Female	407	68.0
	Male	192	32.0
Diabetes type (self-reported)	Type 1	22	3.7
	Type 2	422	70.3
	Unknown	155	26.0
Hypertension (self-reported)	Yes	469	78.7
	No	112	18.8
	Unknown	15	2.5
Duration of Diabetes (self-reported)	<5 years	283	47.3
	5-10 years	132	22.0
	>10 years	121	20.2
	Unknown	63	10.5
Current treatment	Oral agents only	431	72.0
	Insulin only	41	6.8
	Oral and insulin	105	17.5
	Diet and exercise	9	1.5
	Unknown	13	2.2
Smoking status (self-reported)	Current	65	11.0
	Never	449	75.8
	Ex-smoker (stopped >1 year ago)	78	13.2
Socio-economic status*	Adequate	279	46.7
	Inadequate	320	53.3
	Mean (SD)	Min	Max
Age	58 (11)	20	90
BMI	31 (7)	14	67

** Using the HQI as a measure of socio-economic status, almost half of the patients were regarded as adequate - that is they lived in a house with a zinc or tile roof, built with bricks, had running water in the yard and had their own sanitation in the yard as either a flush toilet or a septic tank.*

BMI ranged from 14 kg/m^2 to 67 kg/m^2. A clear gender difference in BMI was found, with the mean BMI for men 27.4 kg/m^2 and for females 32.2 kg/m^2 ($p<0.001$). Of the females, 88.5% (n=355) had a BMI above 25 kg/m^2 (overweight or obese) compared to 69.3% (n=131) of the males ($p<0.001$).

Normal vision was observed in 87% of patients and 4.5% (n=23) were blind.

Variables that were self-reported included age, smoking history, history of concurrent disease such as hypertension, duration of disease and type of diabetes. Referral for diabetes-related problems was also self-reported.

Twelve-month record review results

The file review of health care received for the 12 months preceding the study indicated that for monthly visit indicators, random glucose was recorded in 70.3% (n=421) of participants with a mean of 5.6 times in the previous 12 months. Also, blood pressure was recorded for 66.8% (n=400), weight for 45.7% (n=274) and waist circumference for 13.4% (n=80) of patients. A fasting glucose test was found for only 9 patients (1.5%). Only 23% (n=140) of patients had an HbA1c recorded and only 26% (n=155) had a lipogram or a total cholesterol test recorded for the preceding year. Kidney function with a serum-creatinine level was recorded for 21% (n=126) of the patients, but a urine test strip result was recorded for 60% (n=357) during the preceding year. Only 8% (n=48) of patients had had an eye assessment and 6% (n=38) a foot assessment recorded in the preceding year. Cardiovascular screening during the previous year was recorded for only 8% (n=46) of patients.

Baseline assessment of participants at intervention and control clinics

Table 2: **Diabetes control indicators**

	Done (N)	Mean (SD)	Range
HbA1c (%)	589	8.8 (2.4)	4.9-17.3
Lipids (s-LDL; mmol/l)*	323	2.8 (0.9)	0.4-6.2
Renal function (s-Creat; umol/l)*	323	72.8 (41.8)	26-579
Blood pressure (mmHg)	581		
Systolic		143 (23)	85-237
Diastolic		85 (11)	50-127

**Note: Only collected in the intervention clinics*

Using the South African Diabetes Guidelines of 2009 as valid for the study period, the proportion of patients with poor control can be appreciated (Table 3). More than 70% of patients had an HbA1c value above 7%. A one-way Anova revealed that patients who were already switched to insulin had the highest HbA1c level ($p=0.0014$).

Table 3: **Diabetes control categories using South African Diabetes 2009 guidelines**

	Cut-off used	N	Proportion (%)
HbA1c (%)	≥ 7	434/591	73
LDL cholesterol (mmol/l)	≥ 2.5	217/323	67
Blood pressure (mmHg)	Systolic ≥ 130	405/581	68
	Diastolic ≥ 80	385/581	64
BMI (kg/m^2)	Males (unknown 3(2%))		
	<25	62	32
	25-29	75	39
	30+	52	27
	Females (unknown 6 (1%))		
	<25	53	13
	25-29	105	26
	30+	243	60

Similarly, more than 67% of patients had an LDL cholesterol values above 2.5mmol/l. The most recent prescription in the patient's clinic files indicated that 157 (26.2%) of patients were receiving statin treatment for dyslipidaemia.

Thirty-two percent of patients had a very high systolic blood pressure. More than 80% of the diabetes patients were overweight and, of those, 51% were obese. When the updated 2012 guidelines are applied to the study, more than 85% of patients had an HbA1c value above 6.5% and more than 84% had an LDL cholesterol value above 1.8 mmol/l. (27)

Results for complications screening at the intervention clinics

All patients enrolled at the six intervention clinics were screened for diabetes complications. Table 4 shows the results of different screening tests for complications linked to diabetes.

Retinopathy of any severity was found in 29% of patients. Of these, 7% required laser therapy and received it from the mobile unit within two weeks after being diagnosed with the complication. (Three patients were lasered at a hospital eye clinic.)

Subjective neuropathy according to the NSS questionnaire (NSS score >3) was found in more than 97% of patients. Objective evidence of neuropathy as assessed by the Semmes-Weinstein monofilament examination identified 25% of patients; and vibration sense evaluated with a 128Hz tuning fork confirmed that 11% of patients had neuropathy. The neurothesiometer identified 5% of patients with peripheral neuropathy. Absent dorsalis pedis and posterior tibial pulses in either foot for a diabetic patient was identified in 4% and 10% respectively of patients.

From the calculated glomerular filtration rate chronic kidney disease (CKD) was present in 7.4% (N=24) of patients.

Possible macro-vascular complications as detected by the Rose questionnaire found that: 43% of patients suffered from dyspnoea and 0.6% from angina; 17% possibly had a previous myocardial infarction; and 1.3% suffered from intermittent claudication. A degree of erectile dysfunction (ED) was reported by 88% of diabetic men, of which cases 36% were considered to be severe. (Out of a

Table 4: **Screening results for neuropathy, retinopathy, nephropathy and macro-vascular complications at the six intervention clinics**

	N	Proportion (%)
Neuropathy screening	N=326	
NSS score ≥3 (N=322)	311	97
Monofilament abnormal (L or R)	82	25
Vibration sense abnormal (L or R)	37	11
Neurothesiometer abnormal (L or R)	17	5
Retinopathy screening	N=309	
Retinopathy (R1-R4)	90	29
Maculopathy (M1-M2)	67	22
Lasered	22	7
Referred	54	18
Visual acuity	N=507	
Normal	441	87.0
Visually impaired	43	8.5
Blind	23	4.5
Nephropathy screening	N=276	
1. Micral strip *(unknown = 50 (15.3%))*		
Negative	146	2.9
≥ 20 mg/l	48	17.4
≥ 50mg/l	50	18.1
≥ 100mg/l	32	11.6
2. Urine test strips *(unknown =41 (12.6%)*	(N=285)	
Protein detected	23	7.1
3. Serum creatinine	N=323	
≥100 umol/l	30	9.3
4. eGFR *(ml/min/1.73m^2)*	N=323	
Stage 1CKD (GFR≥90)	247	76.5
Stage 2 CKD (GFR 60-89)	52	16.1
Stage 3 CKD (GFR 30-59)	20	6.2
Stage 4 CKD (GFR 15-29)	3	0.9
Stage 5 CKD (GFR <15)	1	0.3
Cardio-vascular screening (Rose questionnaire)	N=326	
1. ***Dyspnoea*** *(unknown = 9 (2.8%)*	141	43.3
2. ***Angina*** *(unknown = 9 (2.8%))*	2	0.6
3. ***Possible infarction*** *(unknown = 22 (6.8%))*	54	16.6
4. ***Intermittent claudication*** *(unknown = 14 (4.3%))*	4	1.3
Erectile dysfunction (SHIM questionnaire)	N=92	
Severe	33	36
Moderate	12	13
Mild to moderate	20	22
Mild	16	17
None	11	12

possible 25 points that can be scored using the SHIM questionnaire, these patients rated their score as ≤ 7.)

To satisfy the requirements of the CONSORT statement for cluster-randomised trials, we can report that a very small variation in the response of patients between the clinics was found, indicating that the variation observed in biological measurements was not due to clustering but rather to variations between patients (Table 5).

Table 5: **Intracluster correlation coefficients (ICCs) as calculated for selected variables**

Variable	ICC	s.e.	95% CI
Age	0.053	0.030	0.000-0.111
BMI	0.011	0.013	0.000-0.036
HbA1c	0.050	0.029	0.000-0.106
LDL-cholesterol	0.000	0.012	0.000-0.023
s-Creatinine	0.002	0.013	0.000-0.027
BP Systolic	0.074	0.039	0.000-0.150
BP Diastolic	0.042	0.027	0.000-0.094

Discussion

A clinical audit and baseline data of 599 people with diabetes provide the opportunity to assess the level of diabetes care as well as the clinical status of diabetic patients receiving care at primary health care clinics in the Tshwane district, Gauteng province, South Africa.

The South African Diabetes guidelines as set by the South African Society for Metabolism, Diabetes and Endocrinology (SEMDSA) and subsequently adopted by the South African Department of Health clearly stipulate minimum diabetic care requirements; e.g. frequency of blood tests and physical examinations.

Glycaemic control as measured by the HbA1c test at primary health care clinics in the Tshwane district is poor. Less than 30% of patients had an HbA1c below 7%. Similar results have been found in Cape Town and the US (NHANES study) where 49.4% and 52.2% respectively reported HbA1c levels below 7%. (28, 29) More than 68% of patients also had a systolic blood pressure above 130 mmHg. Most patients were aware that they have hypertension and close to 80% reported that they are hypertensive and have diabetes.

Lipid control was poor, with 67% of patients having a LDL-cholesterol value above 2.5mmol/l. The latest guidelines (SEMDSA 2012) require an even lower LDL level of 1.8mmol/l for most diabetic patients. On the basis of this lower LDL level, more than 80% of patients in the study have uncontrolled lipids. This study found a mean LDL level of 2.8mmol/l, which is better than the 3.7mol/l for women and 3.5mmol/l for men reported by Levitt *et al* in 1997. (13) The lower level of LDL could be due to differences in diet or the fact that many of the patients in this study were already on simvastatin, as the Essential Drug List (EDL) now includes a 10mg simvastatin daily for all type 2 DM patients seen at primary care level. (30)

More than 50% of patients were found to be obese. The prevalence of obesity in women (59.7%) was more than double that found in men (27.1%). A similar trend was reported in the South African Demographic and Health Survey of 2003, where 27.4% of women and 8.8% of men were obese. (31)

Retinopathy was detected in 29% and maculopathy in 26% of patients. These findings are similar to those found by Mash *et al* (32) in primary care facilities in Cape Town, where 7% of retinopathy cases detected needed laser therapy. The primary care facilities study in the Cape Town study (13) identified a higher proportion of patients with retinopathy (63%) but a lower proportion with maculopathy (15%) when compared with our study. However, Motala *et al* (33) reported in 2001 that in diabetic patients with more than 10 years' disease duration, retinopathy was present in 53% of type 1 DM patients and 64.5% of type 2 DM patients.

The higher proportions could be explained by the fact that the study population consisted of tertiary care patients, whereas our study was done at primary care level.

The NSS questionnaire used as a screening tool for neuropathy does not seem to be that useful, as 97% of patients reported symptoms of neuropathy based on the subjective reporting of pain and this tool was not in agreement with the other measures of neuropathy, which was also reported elsewhere. (33) Examination with Semmes-Weinstein monofilament and 128Hz tuning fork detected neuropathy in 25% and 11% of patients respectively. These results are similar to the findings of a study at an outpatient clinic in a community hospital within the Tshwane district carried out 10 years earlier. (33)

Urine test strips identified proteinuria in 9.3% of patients, whereas the Micral strip detected albuminuria in the ≥20 mg/l to < 100 mg/l range in 35.5% of patients and in the ≥ 100 mg/l in 11.6% of patients. Serum creatinine was elevated in 9.3% of patients in this study. Motala *et al* (32) reported in 2001 that 23% of diabetes patients whose duration of disease exceeded 10 years had persistent proteinuria, and 17% of type 1 DM and 25% of type 2 DM patients had abnormal serum creatinine. (33)

During cardiovascular screening using internationally validated questionnaires, it was found that 0.6% of diabetic patients had angina, 43% had dyspnoea, 16% had a possible prior myocardial infarction, and 49% reported intermittent claudication. However, these questionnaires were administered in English (not the first language of most patients) and have not been validated in South Africa.

Of the male patients, 36% reported severe ED. Only 12% did not report ED. A study carried out in Cape Town on ED found that ED was significantly associated with diabetes (OR=3.35 [95% CI1.8-6.3]. (35) A US study (36) evaluated ED and quality of life in Type 2 diabetes patients and found that 34% of patients reported frequent erectile problems, 24% reported occasional problems and 42% reported no problems. Penson and Wessells report in a review article (37) that ED ranges between 26% and 64% for different studies where both Type 1 DM and Type 2 DM patients were studied.

At Kalafong Hospital, an education programme aimed at physicians has been tested. The programme makes use of a structured consultation schedule. This programme resulted in improved patient care outcomes, but at the expense of time. (38) This type of intervention could be adapted for training at primary care level. Patients also need to be empowered to understand their disease, their own biological measurements and targets needed for good metabolic control. Once patient knowledge has been established, quality comprehensive care can be demanded by informed patients. Yuen reported in 2012 that the odds of having annual preventative care is 2.6 to 5.8 times higher for participants who had health professionals specifically telling them to have such examinations. (39) Kengne *et al* also makes an argument for protocol driven nurse-led care at primary health care level for type 2 diabetes patients in Cameroon. (40)

International questionnaires such as the NSS for neuropathy, the ROSE questionnaire and the SHIM questionnaire provided us with questionable data. The unexpected high rates found by these instruments is probably unreliable in the local population, and needs to be investigated further. Also, due to possible confounders such as high obesity rates, we suggest more direct measurements such as the neurothesiometer and ECG screening to complement the information obtained from the questionnaires.

There is a need for new models of care, such as mobile health care to offer specialised screening services for chronic conditions such as diabetes, which demands more than a routine visit with medication.

Limitations and strengths of the study

Limitations: Self-reported variables such as duration of disease, age, compliance with medication and the neuropathy symptoms score proved difficult to interpret and have not been validated for the study.

Strengths: The sample is one of the largest studies done in South Africa in evaluating complications for diabetes at primary care level and more than one method has been used to measure complications.

Conflict of interest

There are no conflicts of interest.

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