Diabetes guidelines and clinical practice: is there a gap? The South African cohort of the International Diabetes Management Practices Study

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Abstract

Objectives: The objective of this survey was to determine the therapeutic management of patients with diabetes in the South African private healthcare environment.

Design: The International Diabetes Management Practices Study is an international multicentre and observational study. In this paper, the local South African data from the cross-sectional cohort study are discussed.

Setting: South African healthcare providers who were involved in the management of patients with diabetes.

Subjects: Subjects included male and female adult patients who were diagnosed with type 1 or type 2 diabetes mellitus and who consulted their healthcare provider during a specified period of two weeks.

Outcome measures: Information on patient demographic and socio-economic profiles, relevant medical histories, data on previous and concomitant antidiabetic treatments, glycaemic status, patient education levels and the impact of diabetes on absenteeism and hospitalisation was collected.

Results: A total of 899 patients from 54 healthcare centres in South Africa participated. The mean age of patients in the study was 53.35 ± 14.47 years. The duration of diabetes was longer in type 1 diabetic patients. Of the type 2 diabetic patients, 46.4% were on oral antidiabetic monotherapy and 44.1% on two oral medications. Metformin was the most commonly prescribed oral medication. Of the 242 patients with type 2 diabetes on insulin and oral combination, 175 were on one oral medication combined with insulin therapy. The mean haemoglobin A_{1c} (HbA_{1c}) of study participants was 8.2%.

Conclusion: These data demonstrate that in accordance with current global findings, the glycaemic control of the majority of a cohort of patients with diabetes managed in the private healthcare sector in South Africa was suboptimal when assessed according to HbA_{1c} levels.

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Introduction

Diabetes mellitus comprises a group of disorders that are characterised by elevated levels of plasma glucose which result in microvascular and macrovascular complications in the long term. The main pathophysiological defect in type 1 diabetes is pancreatic β-cell destruction and consequent insulin deficiency. The main defect in type 2 diabetes is often a combination of insulin resistance, together with relative or absolute insulin deficiency. Type 2 diabetes is by far the most common form of the disorder (it is nine times more common than type 1 diabetes mellitus). The World Health Organization (WHO) and the International Diabetes Federation (IDF) recognise it as a growing global epidemic.[1]

Glycaemic control is central to diabetes management, as demonstrated in both the Diabetes Control and Complications Trial (DCCT) and the United Kingdom Prospective Diabetes Study, in which significant improvements in microvascular and, to a lesser extent, macrovascular complications were noted.[2,3] Diabetes care is more complex, though, and there are multiple interventions beyond blood glucose control which can improve clinical outcomes.[4] The American Diabetes Association (ADA) issues annual Clinical Practice Guidelines[5] to address these interventions, and many diabetes societies around the world have endorsed the ADA guidelines, with a few minor changes. The generally recommended glycaemic target is glycated haemoglobin A_{1c} (HbA_{1c}) < 7%. This has target has been endorsed by The Society of Endocrinology Metabolism and Diabetes of South Africa (SEMDSA). Moreover, the European Society of Cardiology and the EASD have also recently issued revised guidelines and targets for cardiometabolic parameters in people with diabetes

with and without coronary artery disease (CAD).[6] The most noteworthy recommendation relates to lipid parameters, in which the low-density lipoprotein (LDL) cholesterol target has been lowered. Individuals with type 2 diabetes mellitus who do not yet have CAD should have their LDL cholesterol lowered by 30-40% of their baseline values, while those with CAD should have their LDL cholesterol lowered to ≤ 1.8mmol/l.

Worldwide, a problem experienced in diabetes management is that, while guidelines and target levels relating to various clinical and metabolic parameters are widely published, these targets are often difficult to achieve in clinical practice. In the US, glycaemic control rates declined from 44.5% for the period 1988-1994 to 35.8% for the period 1999-2000.[7]

In South Africa, despite all these recommendations, a large number of patients are not well controlled, and do not reach the target HbA_{1c} value of < 7%.[8-10] In striving to achieve glycaemic control, it is also important to minimise drug adverse events, such as hypoglycaemic episodes. Therefore, the best available treatment should be chosen to fit each individual patient's needs. The aim of therapy is to achieve a level of glycaemic control that is associated with an acceptable level of side-effects and patient convenience, providing control without compromise.

Currently, there are no published data for the South African private healthcare sector that relate to diabetes management practices, or the success rates in achieving conventionally accepted management targets. Therefore, there is a need to assess current practices in diabetes management and to develop strategies to improve the quality of care for diabetes sufferers.

The International Diabetes Management Practices Study (IDMPS) is an international multicentre observational study which comprised two parts: a cross-sectional study to assess current practices in the management of subjects with type 1 and type 2 diabetes mellitus, and a longitudinal study to evaluate all patients who were treated with insulin and to characterise insulin therapy.

In this paper, only the initial local South African data will be discussed, and then only data from the cross-sectional cohort study. The primary objective of this part of the IDMPS study was to determine the therapeutic management of patients with type 2 diabetes in current medical practice. A secondary objective was to assess the therapeutic management of patients with type 1 diabetes.

Method

An international, noninterventional, multicentre, cross-sectional survey of two weeks' duration was conducted. In this study, each physician enrolled the first 10 patients with type 2 diabetes and the first five patients with type 1 diabetes who visited him or her within the two-week study period. In the absence of a sufficient number of patients with type 1 diabetes, additional patients with type 2 diabetes could be enrolled.

To ensure that the participating physicians were representative of the practitioners who manage patients with diabetes and who are experienced in insulin therapy (initiation and titration), a stratified sample was randomly drawn. The stratification was based on the speciality (endocrinologists, specialist physicians or general practitioners) and on the type of healthcare structure in the country.

Patient selection

Male and female adult patients diagnosed with type 1 or type 2 diabetes mellitus who consulted their healthcare provider during the two weeks were asked for informed consent and invited to participate. Exclusion criteria included concomitant participation in a clinical trial and/or current temporary insulin therapy (gestational diabetes, pancreatic cancer and surgery).

Sample size determination

The sample size was determined on the basis of country, based on the primary objective, which was to assess the therapeutic management of patients with type 2 diabetes mellitus, and on the precision that was expected. Based on the assumption that insulin is the least prescribed therapy in terms of proportions, the sample size was determined in order to establish the frequency of patients who were treated with insulin.

The sample size was anticipated to give an estimation of proportions with an absolute precision of 20% and a confidence interval of 95%.

The following calculation was used:

$$n = p\,(1\text{-}p) \times (1.96/e)^2$$

n: per country sample size
p: estimated proportion of patients with type 2 diabetes mellitus who were treated with insulin
e: absolute precision (20%) x *p* = relative precision

Given this information, a computation table was built, which took into account the proportion of insulin treatments in all the prescriptions for patients with diabetes.

For example, if in a given country 10% of patients received insulin *(p)* with an absolute precision of 20%, the sample size (number of patients with type 2

diabetes mellitus to be recruited) would be 864 patients in this country for each cross-sectional survey, as was the case in South Africa.

Data collection

Assessments were carried out on the occasion of a routine visit of a patient with diabetes to his or her treating physician, and included patient demographic and socio-economic profiles, relevant medical histories (including diabetic complications and co-morbidity factors), previous and concomitant antidiabetic treatments, glycaemic status, patient education levels and the impact of diabetes on absenteeism and hospitalisation. HbA_{1c} was measured using the practitioner's local laboratory only if historical data for HbA_{1c} were not available for the preceding 12 months and if the practitioner did not intend requesting the test as part of his or her usual practice on the study day.

A printed data collection form was used for data collection.

Statistics

Data from all the participating centres in South Africa were combined and treated as one dataset for the purposes of the analysis. The statistical analysis was of a descriptive nature. Quantitative data were summarised by sample size, mean, median, standard deviation and minimum and maximum values. Qualitative data were summarised in frequency counts and percentages.

The statistical analysis was performed by ClinStat, Pretoria, South Africa. All analyses were carried out on SAS®, Release 9.1.3, run under Microsoft® Windows® XP.

Ethics

The survey was conducted according to the principles laid down in the 18th World Medical Assembly (Helsinki, 1964) and all subsequent amendments, and in accordance with the guidelines for good clinical practice. Ethics approval for the study was obtained from Pharma-Ethics. Written informed consent was obtained from all the participating patients.

Results

A total of 899 patients from 54 centres in South Africa were entered into the survey. The minimum number of recruited patients by a centre was three, and the maximum number that was recruited was 31. All patients who participated in the study complied with all the inclusion and exclusion criteria.

The baseline demographic information of the participating patients is summarised in Table I as percentages or mean values.

The mean age of patients in the study was 53.35 ± 14.47 years, and patients with type 1 diabetes were younger (39.05 ± 15.17 years) than patients with type 2 diabetes (57.4 ± 11.39 years). Figure 1 reflects the age distribution of the participating patients.

Table I: Baseline demographic information

Demographics	Type 1	Type 2	Total
Number of patients	198	701	899
Age in years [mean (SD)]	39.1 (15.2)	57.4 (11.4)	53.4 (14.5)
Gender (male, %)	56.1	56.1	56.1
Urban (%)	94.4	94	94.1
Positive family history of diabetes (%)	46.1	60.4	57.2
Waist circumference in cm [mean (SD)]			
Male	94.5 (15.3)	108.3 (14.3)	105.2 (15.6)
Female	86.5 (14)	101.7 (13.9)	98.5 (15.2)
Body mass index, kg/m² [mean (SD)]			
Male	27.1 (5.1)	31 (5.6)	30.1 (5.7)
Female	26.3 (5.6)	32.7 (6.8)	31.3 (7.1)
Systolic blood pressure in mmHg [mean (SD)]	125.9 (15.5)	132.9 (17.5)	131.4 (17.3)
Diastolic blood pressure in mmHg [mean (SD)]	77.4 (10.2)	80 (10.2)	79.4 (10.2)
Diagnosed with hypertension (%)	37.9	77.6	68.8
Diagnosed with dyslipidaemia (%)	40.3	62.3	57.5
Smokers (%)			
Male	25.2	17.1	18.9
Female	16.3	7.2	9.2

SD: standard deviation

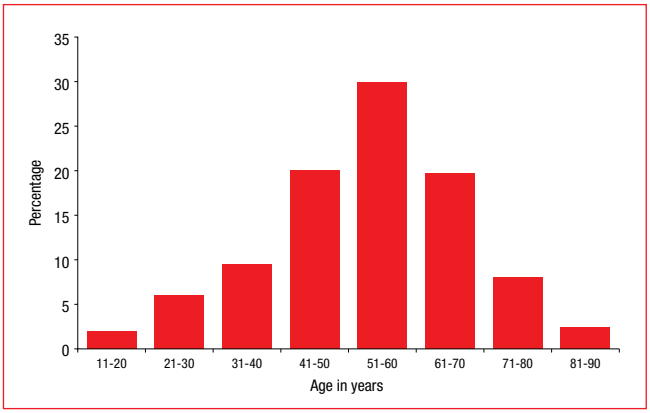

Figure 1: Age distribution of participating patients

Most of the participating patients in the IDMPS were from urban areas. Only 5.9% were from rural areas.

A positive family history of diabetes mellitus was noted in 60% of type 2 subjects, and surprisingly in 46% of type 1 subjects. However, no information was available regarding the type of diabetes in family members.

The waist circumference values are reflected as means without differentiation in the different ethnic groups, as the majority of the population used the cut-off value of < 80 cm in female patients and < 94 cm in male patients, according to the IDF criteria for waist circumference.[11]

The smoking status of patients who quit smoking was also collected. This was an additional 16.2% of male patients and 4.6% of female patients in the type 1 diabetic patient group. In the type 2 diabetic patient group, quitters constituted an additional 25.6% of male patients and 8.2% of female patients.

The race distribution according to the study's definition of the patients entered in the survey is documented in Table II. Patients of mixed ethnic ancestry (so-called "coloured" patients) were included in the category of "other" ethnic groups.

Table II: Race distribution

Race	Number (%) of patients
Black	199 (22.1)
Caucasian	489 (54.5)
Oriental, Arab, Persian	1 (0.1)
South Asian	38 (4.2)
Other Asian	97 (10.8)
Other	75 (8.3)
Total	899 (100)

The duration of diabetes differed between the type 1 and type 2 diabetes groups. Generally, type 1 diabetes had been present for longer in the studied groups. The distribution of the duration of diabetes is presented in Table III.

Table III: Distribution of the duration of diabetes

Duration of diabetes (years)	Number (%) of patients	
	Type 1 diabetes	Type 2 diabetes
1-1.9	3 (1.6)	32 (4.6)
2-3.9	20 (10.5)	119 (17.2)
4-5.9	12 (6.3)	97 (14.1)
6-9.9	37 (19.4)	166 (24.1)
10-14.9	34 (17.8)	142 (20.6)
15-19.9	18 (9.4)	69 (10)
≥ 20	67 (35)	65 (9.4)
Total	191 (100)	690 (100)

The number of patients who received oral hypoglycaemic agents as part of their treatment regimen in this study population was 17.8% of patients with type 1 diabetes and 94.3% of patients with type 2 diabetes. Of the patients with type 2 diabetes, 46.4% were on monotherapy and 44.1% on two oral medications, while only 3.4% were on triple therapy. Metformin was the most commonly prescribed oral medication in all the patients. The different classes of medication used are represented in Table IV.

Table IV: Current classes of oral hypoglcaemic agents used by patients

Class	Number (%) of patients	
	Type 1 diabetes	Type 2 diabetes
Meglitinides	–	9 (1.5)
Biguanides	23 (95.8)	527 (88.6)
Sulphonylureas	4 (16.7)	286 (48.1)
Thiazolidinediones	2 (8.3)	21 (3.5)
Alpha glucosidase inhibitors	–	1 (0.2)
Other	–	2 (0.3)

Of the 242 patients with type 2 diabetes on insulin and oral medication, 174 were on one oral medication combined with insulin therapy (71.9%). Sixty-six patients were taking two oral medications (27.3%) with their insulin therapy and two patients were using three oral medications and insulin therapy.

HbA_{1c} measurements were available for 96.4% of the patients. Most of the patients underwent an HbA_{1c} test once or twice a year. The mean HbA_{1c} of this study was 8.2% (median 7.8%). It was 8.8% (median 8.6%) in patients with type 1 diabetes, 8.1% (median 7.5%) in patients with type 2 diabetes.

The distribution of the most recent HbA_{1c} values is depicted in Table V. A value was reported for only 96.4% of patients. Thirty per cent of patients had an HbA_{1c} value less than 7%, as defined as the target value according to guidelines.

Table V: Distribution of the most recent haemoglobin A_{1c} values

HbA_{1c} value (%)	Number (%) of patients
< 6	67 (7.7)
6.-6.9	197 (22.7)
7-8.4	272 (31.4)
8.5-9.9	178 (20.5)
10-11.9	110 (12.7)
12-14.9	36 (4.2)
≥ 15	7 (0.8)
Total	867 (100)

Glycaemic control varied substantially when comparing the different treatment regimens in the patients with diabetes. The HbA_{1c} was 7.62% in type 2 diabetic patients who were treated with oral medications only and 8.51% in those on oral medication and insulin therapy. This compares to an HbA_{1c} of 9.02% in the insulin-only group. In evaluating the different insulin regimens in patients with type 2 diabetes, the basal insulin had an HbA_{1c} of 8.25% only, the basal-prandial group's an HbA_{1c} of 8.71% and the premix insulin group an HbA_{1c} of 8.66%.Table VI provides a summary of the effects of the treatment regimens of HbA_{1c} levels.

The most common indicated reasons by doctors for

Table VI: Treatment regimens with respective haemoglobin A_{1c} values

Regimen	Type 1		Type 2		All	
	n	HbA_{1c} % mean (SD)	n	HbA_{1c} % mean (SD)	n	HbA_{1c} % mean (SD)
Oral antidiabetic agents only	1	6.9	335	7.62 (1.87)	336	7.61 (1.87)
Insulin only	140	8.77 (1.95)	67	9.02 (2.33)	207	8.85 (2.08)
Insulin and oral agents	23	8.86 (2.08)	240	8.51 (1.82)	263	8.54 (1.84)

Table VII: Different insulin regimens with haemoglobin A_{1c} values

Type 1 diabetes mellitus			
Regimen	**n**	**HbA_{1c} % Mean (SD)**	**Units/day Mean (min/max)**
Basal only	10	9.26 (2.45)	38.2 (16/60)
Basal and prandial	144	8.79 (1.88)	Basal: 27.28 (4/80)
			Prandial: 29.8 (3/102)
Premix	30	9.11 (2.71)	45.83 (17/100)
Type 2 diabetes mellitus			
Regimen	**n**	**HbA_{1c} % Mean (SD)**	**Units/day Mean (min/max)**
Basal only	73	8.25 (1.88)	28.04 (4/96)
Basal and prandial	65	8.71 (1.8)	Basal: 31.43 (8/96)
			Prandial: 32.62 (8/90)
Premix	176	8.66 (1.94)	49.66 (6/120)
All patients			
Regimen	**n**	**HbA_{1c} % Mean (SD)**	**Units/day Mean (min/max)**
Basal only	83	8.37 (1.97)	29.27 (4/96)
Basal and prandial	209	8.77 (1.85)	Basal: 28.57 (4/96)
			Prandial: 30.67 (3/102)
Premix	206	8.72 (2.07)	49.11 (6/120)

HbA_{1c} not being at target level were lack of compliance by the patient with lifestyle recommendations (29.5%) and the lack of efficacy of their current antidiabetic treatment (23.5%).

In this study, 321 (45.8%) of patients with type 2 diabetes were on insulin treatment as part of their management. These patients were analysed further according to the different types of insulin that they were taking. Table VII details patients' different insulin treatment regimens and respective HbA_{1c} values. All the patients with type 2 diabetes who were on insulin were uncontrolled, with a mean HbA_{1c} > 8%.

Discussion

The reflected data in this study are based on the information from healthcare providers in South Africa who prescribe insulin therapy. Therefore, this will not necessarily reflect the situation of all patients in South Africa, as these doctors probably manage their patients more aggressively than healthcare providers who do not prescribe insulin therapy. This study also reflects the information from patients in the South African private healthcare sector, about whom there has been very little available information in scientific publications.

The racial distribution is not representative of the total South African population, nor of the private healthcare population, but is rather indicative of the patients who visited the selected insulin-prescribing healthcare providers in South Africa.

The positive family history in approximately half of the patients with type 1 diabetes was very surprising. In future studies, it may be worthwhile to explore this further with regard to the specific type of diabetes of family members. It is also interesting that patients with type 2 diabetes had a positive family history in only 60% of cases.

The data on waist circumference measurements in patients deserve comment. The mean waist circumference for both type 1 and type 2 diabetes patients was above the current IDF cutpoint (i.e. 94cm for males and 80cm for females). As expected, patients with type 2 diabetes had a higher mean waist circumference, 102 cm for females and 108 cm for males. It is noteworthy that approximately 15% of the sample population comprised males of South Asian descent, for whom a lower cutpoint of 90 cm should be applied. These values highlight the importance of weight-loss therapy as part of the management of patients with diabetes. The importance of lifestyle therapy, in the form of nutritional advice and support and exercise participation according to specific patient needs, cannot be overstated.

As can be expected, according to the healthcare providers who looked after these patients, approximately two-thirds of the patients with type 2 diabetes had hypertension and dyslipidaemia. In contrast to data from elsewhere in the world, South African patients' blood pressure was relatively well controlled. They had a mean systolic blood pressure of 131.4 mmHg and a mean diastolic blood pressure of 79.4 mmHg.

Smoking remains a common problem in patients with diabetes in South Africa, as can be seen from these data. If the combined number of current and past

smokers is examined, this is definitely an area that may require more aggressive management if the mortality and morbidity of cardiovascular diseases is to be decreased.

It is interesting to note that 29 of the 191 type 1 diabetes patients were also taking oral antidiabetic medications in addition to their insulin treatment. These patients may represent a subgroup of type 1 patients suspected of also having insulin resistance. This notion is supported by the elevated waist circumference in type 1 diabetes patients alluded previously. Hence, the additional oral medication may have been prescribed in an attempt to lower insulin requirements.12 One patient with type 1 diabetes on oral medication may have been a misclassification, as the patient seemed to be well controlled on the oral medication. This data set also demonstrates that prescribing triple therapy is not a common practice in South Africa, and that insulin initiation after failed dual medication therapy is more common.

The reported HbA1c values were obtained from the practitioners' usual source of laboratory testing. In the majority of cases, this was performed at either the Ampath or Lancet group of laboratories. These laboratories utilise different assay methods for glycated haemoglobin, but both are DCCT standardised and National Glycohemoglobin Standardization Program (NGSP) certified. However, the two methodologies do not yield identical results, and it is accepted that this may have affected the overall accuracy of the results. Notwithstanding the nonstandardised assay methodology for all subjects, the data accurately reflected the HbA1c values on which practitioners base their clinical decisions daily, and for this reason, the data remain relevant.

The data demonstrated that similar to the rest of the world, patients with diabetes in South Africa are not optimally controlled through evalution of their glycaemic control levels, as reflected by the HbA_{1c} levels. Only 30.4% of patients were well controlled and had HbA_{1c} values < 7% (the target recommended by the SEMDSA guidelines at the time of the survey). This implies that 70% of patients were still not optimally controlled. From these data, it is clear that management of patients with diabetes is suboptimal and could still be improved. Patients who were treated with insulin reflected the worst glycaemic control, as assessed by HbA_{1c} levels. This will need to be addressed by healthcare workers. If the different treatment regimens of the patients with type 2 diabetes are compared, it seems that the oral group had the best control. This is probably a reflection of the fact that type 2 diabetic patients who are in the early stages of the disease are on oral medication, while patients in the later stages of the disease are on insulin treatment. Based on these data, it seems that doctors are aware of the fact that they should prescribe insulin for patients timeously. It is clear from the data on patients with type 2 diabetes who were on insulin that patients' insulin dosages were not titrated enough to achieve optimal control. The use of patient-driven dose optimisation in patients on insulin may be important to achieve target values in more patients who are being treated with insulin.

Therefore, it is very important that all healthcare providers and their patients become more aware of the recommended target levels for glycaemic control according to guidelines, and that they strive to bridge the gap between the guidelines and practice.

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