District Level Hospital Diabetic Patients Referred to Intermediate Care: A Descriptive Analysis

by

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Acknowledgements, format and contributions

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Format

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Author guidelines can be accessed at https://safpj.co.za/index.php/safpj/pages/view/submission-guidelines#part_1

Contributions

Dr Rosa Jansen is the main author and completed this research as towards a Masters in Family Medicine at the University of Cape Town.

A/Prof Klaus Von Pressentin is the main supervisor and co-author.

Dr Jonathan Naude is the co-supervisor and co-author.

Ms Anneli Hardy provided biostatistical analysis and support and is co-author.

All authors discussed the results and approved the final manuscript.

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Abbreviations

ACEI:	Angiotensin-Converting Enzyme Inhibitor
AIDS:	Acquired Immunodeficiency Virus
ARB:	Angiotensin-Receptor Blocker
BMI:	Body Mass Index
CBS:	Community Based Services
CI:	Confidence Interval
COVID-19:	Coronavirus Disease of 2019
CVA:	Cerebrovascular Accident
DOH:	Department of Health
EML:	Essential Medicines List
eGFR:	Estimated Glomerular Filtration Rate
HbA1c:	Glycated Haemoglobin
HDL:	High Density Lipoprotein
HIV:	Human Immunodeficiency Virus
IQR:	Interquartile Range
KSD:	Klipfontein Subdistrict
LDL:	Low Density Lipoprotein
MDT:	Multidisciplinary Team
MPH:	Mitchell's Plain Hospital
MPIC:	Mitchell's Plain Intermediate Care
MPSD:	Mitchell's Plain Subdistrict
OR:	Odds Ratio
OS:	Overall Survival
PHC:	Primary Health Care
SA:	South Africa
SD:	Standard Deviation

SPV:	Single Patient Viewer
STGs:	Standard Treatment Guidelines
STI:	Sexually Transmitted Infection
TB:	Tuberculosis
WCG:	Western Cape Government

Abstract

Background

Diabetes mellitus contributes considerably to morbidity and mortality. By analysing a South African cohort with diabetes-related adverse outcomes, the researchers felt that reviewing their past primary care may reveal contributing factors resulting in these outcomes.

Methods

A retrospective cohort design was used. Data from an existing district-level hospital database of referrals to intermediate care were analysed, focusing on diabetic adult patients referred between 1 November 2020 and 31 August 2021. Additional data were collected on the standard of primary care, investigations performed on admission and patient demise within 12 months of the research window.

Results

The cohort comprised 188 patients. The mean age was 64.4 years, 113 (60.1%) were female, and 98.1% had low socioeconomic status. The majority were admitted with strokes 130 (69.2%) and 139 (73.9%) were referred for intense short-term rehabilitation. A quarter of patients were newly diagnosed diabetics at admission. Of known diabetics, 44 (30.8%) had no HbA1c in the preceding two years. ACE-inhibitors were not prescribed adequately, and insulin initiation was delayed. Accessible data 12 months post review window revealed that 53 (28.2%) had demised and of those, 29 (54.7%) had demised within a month of initial admission.

Conclusion

Diabetic screening and management in primary care need improvement. It appears that guidelines were not followed adequately and potentially may have contributed to the outcomes experienced by this cohort, as well as subsequent costs to the health system.

Contribution

The authors recommend that barriers to following primary care diabetes guidelines be explored further in future research.

Keywords: diabetes; primary care; intermediate care; district health system; retrospective cohort design

Introduction

A considerable number of South Africans live with diabetes. Based on the 2015 International Diabetes Federation (IDF) estimates for South Africa (SA), for adults aged 20 to 70 years, approximately 2.3 million were diabetic with a national prevalence of roughly 7% and of the 2.3 million diabetics, 1.4 million (61%) were undiagnosed.(1) A substantial number of patients are diagnosed with type 2 diabetes, which may be preventable through lifestyle change and effective primary health care screening measures.

The majority of diabetic South Africans are reliant on the public sector primary-level facilities for their acute and chronic care needs, which represents several challenges. Much like the rest of sub-Saharan Africa (SSA), SA also has challenges of resource depletion. Despite being classified as an Upper Middle Income Country by the World Bank,(2) SA has the additional challenges of a significant inequality gap.(3) In 2021, South Africa had the highest inequality in income distribution with a Gini score of 63.(4) This is further exacerbated by a quadruple burden of disease, namely HIV/AIDS and tuberculosis and other communicable diseases, perinatal conditions, maternal causes and nutritional deficiencies; non-communicable diseases; and injuries.(5) It is estimated that at least 80% of South Africans fall outside the medical aid net and are reliant on the public sector for health services.(6, 7) In the public sector in SA, preventative health care is primarily administered through primary care services by community health centres. These services are primarily nurse run with doctor support more readily available at the provincial clinics.(8) Diabetes care occurs at all levels of service, but by and large, primary care is where the main opportunity for preventative care is and is also where most patients receive care for chronic conditions. These services are guided by the government-developed Standard Treatment Guidelines (STGs) and Essential Medicines List (EML) for SA which prescribe the absolute minimum and mandatory practices for safe care of these patients and is freely available nationally.(9) Specific to diabetes, these guidelines outline clinical presentation, diagnostics and management which should be available at the primary care level and these guidelines are evidence-based and consider the cost. From the STGs and EML, sections on diabetes care are divided into diabetes “type 1 and 2” and then also with key differences in the presentations depending on age (children, adolescents and adults). Clinical presentation is described based on relevant signs and symptoms and investigations are done at diagnosis and then at intervals as described (see table 1). For this study, the focus will be on type 2 diabetes in adults.

Table 1 STGs and EML summary of type 2 diabetes diagnosis and monitoring in adults (9)

Management step	Key investigations in management plan
Diagnosis	• Symptoms of hyperglycaemia (thirst, polyuria, tiredness, periodic changes in vision, susceptibility to infections) plus with a random blood glucose ≥ 11.1 mmol/L. • Fasting* blood glucose ≥ 7.0 mmol/L (*defined as no caloric intake for more than 8 hours) *or* 2-hour plasma glucose in a 75 g oral glucose tolerance test ≥ 11.1 mmol/l. Note: if screening and not symptomatic: two positive tests done on separate days are required for diagnosis.
Monitoring	<u>Every visit:</u> • Finger-prick blood glucose • weight • blood pressure <u>Baseline:</u> Clinical examination and side room investigations: • BMI for cardiovascular risk assessment • foot examination • eye examination to look for retinopathy • abdominal circumference • Urine protein by dipsticks: If urine dipsticks are negative, the urine should be sent to the laboratory for albumin: creatinine ratio, unless the patient is already on an ACE-inhibitor. If dipsticks are positive, there is a high index of suspicion for diabetic nephropathy and should be managed accordingly. This management includes commencing an ACE-inhibitor, continued lifestyle change measures, prudent blood pressure and glycaemic control, additional cardiovascular and renal protection measures such as statin and aspirin therapy and referral to a nephrologist in severe cases. Laboratory-based investigations: • serum creatinine concentration to calculate eGFR • serum potassium concentration if on ACE-inhibitor or eGFR < 30 mL/min • blood lipids (fasting total cholesterol, triglycerides, HDL and LDL cholesterol) <u>Annual:</u> Clinical examination and side room investigations: • eye examination to look for retinopathy • foot examination • urine protein by dipsticks Laboratory-based investigations: • serum creatinine concentration to calculate eGFR • serum potassium concentration if on ACE-inhibitor or eGFR < 30 mL/min • HbA1c in patients who meet treatment goals (but every three to six months in patients who have had treatment adjusted)

Abbreviations: BMI: Body Mass Index, ACE-I: Angiotensin-converting Enzyme Inhibitor, HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein, HbA1c: Glycated Haemoglobin, mmol/L: millimole per litre

The STGs and EML provide non-pharmacological guidance with extensive information on lifestyle modification, including exercise, weight loss, smoking cessation and diet.(9) In terms of pharmacological management of type 2 diabetes, a stepwise approach is described in detail. It is suggested that metformin be added to lifestyle and dietary modifications.(9) Thereafter, combination therapy of metformin with a sulphonylurea is indicated if the previous regimen had not achieved the HbA1c target (see table 2). Should HbA1c levels persist above acceptable levels despite adequate adherence to oral hypoglycaemic agents, it is then indicated to add insulin and remove the sulphonylurea.(9) The major contraindications of each drug are also emphasised as well as relevant prescribing tips.

Table 2 Glycaemic and non-glycaemic targets for control as per STGs and EML (9)

Glycaemic targets:	
Patient type	**Target HbA1c**
Young, low risk Newly diagnosed No CVS disease	< 6.5%
Majority of patients	< 7.0%
Elderly High risk Hypoglycaemic unawareness Poor short-term prognosis	< 7.5%
Non-glycaemic targets: • Body mass index ≤ 25 kg/m². • BP ≤ 140/90 mmHg and ≥ 120/70 mmHg.	

Abbreviation: HbA1c: glycated haemoglobin

Upon review of literature on diabetes morbidity and mortality, the role that improved and high-quality primary care may have in the diabetes care continuum is far-reaching. There appears to be research done on the link between uncontrolled diabetes and cardiovascular morbidity and mortality outcomes in developed countries but similar research was not found for the African and South African context.(10, 11) Should patients develop a severe or life-threatening complication of diabetes mellitus (e.g., stroke, myocardial infarction, diabetes-related sepsis requiring surgical intervention), they are referred to a higher level of care. In the SA context, this is district, secondary or tertiary hospital for intervention or stabilisation of these conditions. After these have been managed, there is a decision to be made about whether patients may be discharged home, or whether care is required at an

intermediate care facility. Intermediate care facilities (or "step down" facilities) are run by multidisciplinary teams (MDTs) and strive towards holistic, patient-centred care. Patients who are referred to these facilities are often complex with multiple co-morbidities.

When reviewing the literature on intermediate care facilities in South Africa, one article explained that the concept of intermediate care has taken on many different meanings internationally in terms of services delivered to patients.(12) This same article identified a challenge in the South African setting which is that there is "a paucity of research on subacute care (SAC) in Lower Middle-Income Countries (LMICs) where the challenges for health systems are substantially different",(12) highlighting the need for further research in this area. In South Africa and specifically the Western Cape Province, intermediate care is an integral part of the functioning of the district health service (DHS). In 2011, the Western Cape issued a draft framework for dialogue on *The Future of Health Care in the Western Cape* which states that "(an) important component of an efficient district health service is a well-organised community-based system which focuses on continuity of care and preventive and promotive health services".(13) Notably, intermediate care involves de-hospitalised care which includes intermediate institutional care (rehabilitation, palliative and convalescent care) and falls under the umbrella of community based-services (CBS).(13) CBS has many different functions and includes long-term institutional care (respite, custodial and social care), domiciliary care to deliver community rehabilitation and psychiatric services, supported self-care, an integrated package of adherence support for all clients with long-term care needs, and community-based prevention and promotion activities that focus on promoting wellness.(13) Especially relevant in the Cape Metropole where there are significant bed pressures in hospitals and relevant to this research, is that intermediate care services provide significant relief for acute and specialised hospitals by providing appropriate services and interventions to help patients improve their functioning once their acute medical condition has been stabilised and ultimately, aiming to assist patients to function independently or with support as needed in the home environment.(13)

In view of comprehensive primary healthcare principles, which includes emphasis on preventative care and screening, it would seem that systems may have failed these diabetic patients who have experienced such detrimental complications which necessitate intermediate care admission following the acute hospital care phase. Therefore, the researchers feel that a review of their care records may shed light on potential factors which may have contributed to these outcomes, and subsequently allow reflection on how these factors may be improved. In the literature review with the search parameters used, there was no similar research found on the analysis of intermediate care referrals

specific to diabetic patients in the South African context or abroad. By delivering high-quality diabetes care at the primary care level, perhaps these outcomes may have been avoided (10, 11) and subsequently reduce the considerable cost to the public health system when one considers the cost of emergency, in-hospital, surgical and critical care in some of these patients' cases and the subsequent intermediate/palliative care cost. Results from a South African study showed that in 2018, public sector costs of patients diagnosed with type 2 diabetes were approximately R2.7 billion and R21.8 billion if both diagnosed and undiagnosed patients are considered.(14) Furthermore, projections showed that by 2030, cost of all type 2 diabetes cases is estimated to be just over R35 billion.(14) Especially relevant to this study, approximately 51% of these estimated costs for 2030 are attributable to the management of type 2 diabetes and 49% are attributable to complications (of diabetes).(14) Findings may potentially be able to influence improved future delivery of primary care to prevent morbidity and mortality as seen in these diabetic patients at the district and intermediate care level.

The aim of this study was therefore to analyse adherence to public sector primary care level guidelines in past primary care management of diabetic patients requiring intermediate care referral from an urban district level hospital. The researchers proposed to describe the basic demographics of the cohort studied including the reason for current district hospital admission and other co-morbid diseases; describe the extent to which primary care guidelines were adhered to in terms of baseline and annual investigation of diabetic patients with specific attention on HbA1c monitoring done and whether the glycaemic medication was adjusted appropriately in relation to significantly elevated HbA1c and also looked at creatinine monitoring done and whether patients were being prescribed ACE-inhibitors as per guidelines. Another objective that emerged was to analyse patient outcome and mortality data 12 months after the focus review window.

Research methods and design

Study design

A descriptive cohort study design was used with the aim of descriptive analysis of the parameters outlined in the study objectives. The patient cohort data was obtained from an existing electronic database of applications made between Mitchell's Plain Hospital (MPH) and intermediate care facilities. Data was reviewed retrospectively.

Setting

MPH and the main intermediate care facility receiving referrals called Mitchell's Plain Intermediate Care (MPIC) are both situated in the Mitchell's Plain subdistrict of Cape Town. Mitchell's Plain is a large area on the Cape Flats of Cape Town situated 28km out of the city centre.(15) MPH also serves certain areas of the Klipfontein subdistrict, which is also on the Cape Flats of Cape Town, and contains areas such as Manenberg and Nyanga. Mitchells Plain Hospital serves a total population of roughly one million people from both the Klipfontein and Mitchell's Plain subdistricts. According to the Western Cape Department of Health, the total population of Mitchell's Plain for 2020 was 615 422 and for the Klipfontein subdistrict, the total population for 2020 was 410 338.(16) Both subdistricts have low socioeconomic status. Specifically for Mitchell's Plain subdistrict according to 2011 census data, 76% of the labour force (aged 15 to 64 years) was employed and 38% of households had a monthly income of R3200 or less.(15) Furthermore, both subdistricts experience high levels of crime. The Western Cape crime trends report for 2021/2022 mentions that out of the top 10 listed police stations for reported murders, five of those police stations were in either the Mitchell's Plain or Klipfontein subdistrict.(17)

MPH opened in mid-2013 and has 330 beds. Although MPH is classified as a large district hospital, departments are specialist-run. The internal medicine department is run by three specialist physicians providing primary and secondary level care. The in-patient internal medicine service is supported by health and rehabilitation services, which include social work. The MDT also include nursing, pharmacy, administrative, radiology, laboratory, porters and cleaning staff. Care options include preventative, curative, rehabilitative and palliative depending on patients' prognoses and mutually agreed-upon MDT treatment plans. Because of the inherent nature of an inpatient service, the preventative care options mostly fall into the realm of secondary prevention rather than primary prevention. The departments of surgery and orthopaedics also function as part of an MDT. However, due to the nature of certain surgical and orthopaedic presentations, especially emergencies, referral pathways to district level and possible admission may differ compared to purely medical patients. This may have bearing

on primary health care (PHC) guideline usage depending on the patient's diagnosis or reason for referral.

MPIC received the majority of referrals for intermediate care from MPH. MPIC opened in 2017 and has 162 beds.(18) MPIC serves adult patients (18 years and older) from public sector facilities. In terms of services, MPIC offers care to patients post-acute hospital admission, short term enhanced care to patients with recent functional decline, short term rehabilitation care, rehabilitation care for patients with a fair to good prognosis, wound care for complex or chronic wounds and end of life care for palliative patients.(18) To provide this service, there is an MDT made up of doctors and nurses who work with the rehabilitation team of physiotherapists, occupational therapists, speech therapists and social workers. Pharmacy services to dispense medications for the facility is provided on site. Further services are provided by the housekeeping, maintenance, admin departments, and additional carers on a voluntary basis. This staffing information was made available through email correspondence with MPIC human resources management in August 2021.

Study population and sampling strategy

Study population were adult diabetic patients on the electronic database of referrals for intermediate care between 1 November 2020 and 31 August 2021. The electronic database was created by the MPH department of internal medicine to track and streamline referrals to intermediate care as the input of many members of the MDT is needed to facilitate a referral. The database entry is a doctor-initiated process where diagnosis or reason for admission and co-morbid disease is identified and highlighted and further information (such as relevant demographic and socioeconomic information) for referral is populated by other members of the MDT depending on their roles and responsibilities in the patient referral process. For example, the social worker would enter information regarding housing status, monthly income and government grant recipient status and the bed manager may have updated "patient outcome" should a patient have been discharged or demised.

To be included in the study, patients must have been 18 years or older, must have been known with diabetes prior to the current admission or have evidence of diabetes diagnosed at this admission. This was determined through having laboratory evidence of diabetes, i.e., raised random glucose, raised HbA1c on the laboratory system or having diabetic medications prescribed under the folder number identifier used. PHC access also must have been in the Western Cape prior to admission. This is due to existing information systems capturing information using patient identifiers such as hospital

numbers and linking it to investigations and treatment prescribed on integrated platforms in the Western Cape.

On the existing electronic database of referrals made between MPH and MPIC between 1 November 2020 to 31 August 2021 (a ten-month period), all diabetic patients as identified by the referring clinician were selected to be analysed. This database was started by the internal medicine department in November 2020. All referrals between conception of the database and a cut-off date of 31 August 2021 were used, and this decision was arbitrary. No sample size calculation was done as intended analysis was purely descriptive.

Data collection

Data collection was done by review of intermediate care applications on the electronic database fulfilling inclusion criteria described in the research window described. Review entailed specifically looking at information captured on demographics, socioeconomic status indicators and other medical co-morbidities identified, reasons for admissions and reasons for application for referral to intermediate care.

Additional data were collected to review standard of care delivered at the PHC level prior to admission in terms of adherence to PHC guidelines on investigations done on diabetic patients and also recommendations made in guidelines in terms of diabetic treatment prescribed. Data were also collected on certain investigations done upon admission to hospital. This data was collected using the Single Patient Viewer (SPV) system. SPV was developed by the Western Cape Provincial Health Data Centre (PHDC). SPV allows access to consolidated patient data from multiple sources through a web-based electronic health record or portal.(19) SPV integrates clinical data for a single patient both longitudinally and cross-sectionally in tabular and graphical views to assist clinicians, and in this case researchers, in rapid information and data discovery.(19) SPV may only be accessed through a registered Western Cape Government (WCG) device with an active WCG email address and therefore this data collection was on site at a WCG facility. Information on mortality data was also accessed through SPV.

Data analysis

The first objective was to describe the cohort studied in terms of demographic information, socio-economic status, the reason for hospital admission and other medical co-morbidities.

The second objective was to establish the extent of adherence to PHC guidelines and the number of diabetics who were undiagnosed at hospital admission. Furthermore, records regarding investigations performed and medication dispensed at primary care level or prior to hospital admission was looked at and whether thresholds of HbA1c had any influence on subsequent pharmacological management. Also, under investigations done, another objective was to describe creatinine monitoring performed and whether patients were being prescribed ACE-inhibitors as per primary care guidelines.

Lastly, patient outcome data in terms of disposition and mortality was described. Descriptive statistics using means and standard deviations where the data did not seriously deviate from normality or medians and interquartile ranges otherwise for continuous variables and count and proportions for categorical variables were used to summarise patient characteristics. Stata 17 was used for statistical analysis.(20)

Ethical considerations

The confidentiality of patient data was upheld by masking the names of patients on the dataset. Only folder numbers were visible to researchers and records were searched using folder numbers only. Approvals were obtained via the University of Cape Town's Human Research Ethics Committee (HREC approval number *028/2022*), as well as the Western Cape Health Research Committee (approval number *WC_202201_020*).

Results

The cohort comprised of a total of 188 patients. When analysing demographic composition of these patients, the mean age was 64.0 years (standard deviation [SD] = 9.7; range: 38 – 92 years), 113 (60.1%) were female and 75 (39.9%) were male. In terms of socioeconomic indicators, 48 patients (30.2%) resided in self-owned dwellings and 156 (98.1%) had a monthly income of between R0 and R4 000 with 114 (71.7%) of the total group being government social grant recipients (old age pension or disability grant). In addition to diabetes mellitus, 158 (84.0%) had co-existing hypertension, 11 (5.9%) had ischaemic heart disease and 8 (4.3%) were HIV positive. Reasons for current admission to district level hospital were mainly for cerebrovascular accidents (CVA) or strokes (69.1%) and amputations (19.1%) and majority of referrals to intermediate care were made for intense short-term rehabilitation (73.9%) and also convalescent (19.2%) and palliative care (6.4%). See table 3 for further breakdown of demographic information, admission and referral reasons for the cohort.

Table 3: Cohort demographic information, medical co-morbidities, reasons for admission and referral to intermediate care

Variable	Frequency	Percent
Sex		
Female	113	60.1
Male	75	39.9
Total	188	100
Housing status		
Self-owned dwelling	48	30.2
Dwelling not self-owned	111	69.8
Total	159*	100
Monthly income		
R0-R4000	156	98.1
R4001-R8000	1	0.6
More than R8000	2	1.3
Total	159*	100
Receiving government social grant		
Yes	114	71.7
No	45	28.3
Total	159*	100
Patient diagnosis on admission		
Stroke	130	69.1
Amputation	36	19.1
Other	22	11.8
Total	188	100
Co-morbid diseases		
Hypertensive	158	84.0
Not known with hypertension	30	16.0

Total	188	100
Ischemic heart disease	11	5.9
Not known with ischemic heart disease	177	94.1
Total	188	100
HIV status		
Known HIV positive	8	4.3
HIV negative & HIV unknown	180	95.7
Total	188	100
Referral reason to intermediate care facility		
Intensive short-term rehabilitation	139	73.9
Convalescent care	36	19.2
Palliative care	12	6.4
Wound care	1	0.5
Total	188	100

Abbreviation: HIV: human immunodeficiency virus

* For *Housing status*, *Monthly income* and *Receiving state pension*, data was obtained by the social work department and entered onto the database for 159 of the 188 patients in the cohort

A large number of patients, 143 (76.1%) of the total group, were known with diabetes prior to hospital admission. Of these, 140 (97.9%) patients had evidence of HbA1c done. The three remaining patients were known with diabetes for less than a year prior to admission. Of these 140 patients, the median length of time of evidence of living with diabetes according to records accessed was 7.0 years (range: 1-13; interquartile range [IQR] 3-9). For the same group of 140 patients, HbA1c coverage data were calculated. This was done by dividing the number of years that HbA1c was done by the number of years since diabetes diagnosis per patient. The average HbA1c coverage was 61% (median 51%; range: 0%-100%; IQR 43%-83%). Of this group of 140 patients, 30 (21.4%) achieved 100% HbA1c coverage. See table 4 for further exploration HbA1c data for the cohort.

Table 4 HbA1c data for the two groups in the cohort

Groups	Group size	Evidence of HbA1C in the last 2-years before admission		Admission HbA1C		Admission HbA1C value if test done		
	n (%)	*n (%)*		*n (%)*		*Median*	*Range*	*IQR*
		Yes	*No*	*Yes*	*No*	*%*	*%*	*%*
Evidence of diabetes prior to admission	143 (76.1)	99 (69.2)	44 (30.8)	68 (47.6)	75 (52.4)[c]	9.9	4.9-18.7	7.9-11.7
Newly diagnosed with diabetes on admission	45 (24.0)	9 (20.0)[a]	36 (80.0)	35 (77.8)	10 (28.6)	10.0	6.5-15.0	8.8-12.1
Total	**188 (100.0)**	**108 (57.4)**	**80 (42.6)**	**103[b] (54.8)**	**85 (45.2)**	**10.0**	**4.9-18.7**	**8.0-12.0**

Abbreviations: HbA1c: glycated haemoglobin; IQR: interquartile range

Notes accompanying Table 4:

[a] Eight patients had HbA1c < 7%; one patient had HbA1c of 10.9% but no evidence of any diabetic treatment being commenced.

[b]: Of the total cohort, 103 (54.8%) had HbA1c's done at admission (median 10.0%, range 4.9-18.7%; IQR 8.0-12.0%).

[c]: Of those who had evidence of diabetes prior to admission, 71 patients had an HbA1c done previously. The HbA1c closest to admission had median HbA1c 9.3%; range 5.0-16.8%; IQR 7.6-11.4%. The remaining four patients had no prior HbA1c on the laboratory results system yet were found to have evidence of diabetic medication being prescribed prior to admission.

Regarding insulin use specifically, of the 143 patients who were known with diabetes prior to admission, 71 (49.7%) of these patients were commenced on insulin prior to hospital admission. Of these, 52 (73.2%) patients had been commenced on insulin with two or less HbA1c's >7.0% and 19 (26.8%) patients had been commenced on insulin with three or more HbA1c's >7.0%. Two (3%) patients had seven HbA1c's >7.0% prior to insulin being initiated.

Seventy-two (50.4%) of the 143 patients who were known with diabetes prior to admission were never prescribed insulin and were on non-insulin-based diabetic treatment only. Of this group, seven (9.7%) patients consistently had HbA1c's less than or equal to 7.0% and this is deemed to be well controlled on non-insulin-based therapy for most diabetic patients. Furthermore, 43 of these 72 (59.7%) patients

had two or more HbA1c's >7.0% despite medical therapy and therefore insulin was potentially indicated.

All patients except one had a baseline creatinine (i.e., earliest creatinine on the system) done at some point prior to admission, and the mean value for the total cohort was 90.3 micromole per litre (µmol/l) (median 70, range: 33-1091 µmol/l, IQR: 55-100.5 µmol/l). The median creatinine for the cohort on admission was 89 µmol/l (range: 29-1758 µmol/l; IQR: 62-139). Relevant to this, only 70 (37.2%) patients of the cohort had evidence of an ACE-inhibitor being prescribed prior to admission. There was limited drug data available for four patients, but 114 (60.6%) patients had evidence of other medications being prescribed.

In terms of mortality, accessible data 12 months after the focus review window revealed that 53 (28.2%) patients had demised and of those patients, 26 (13.8% overall; 49.1% of those that had demised) had demised during the initial admission to hospital. The date of death was available for 48 of the 53 demised patients and this revealed that 15 patients (8.0% of the total cohort) had demised within seven days of admission and 14 (7.5% of the total cohort) more patients had demised within a month (four weeks) of admission.

Discussion

A retrospective descriptive cohort study analysed an existing district hospital database of patients with diabetic complications referred to local intermediate care facilities for further rehabilitative care. Key findings demonstrate lapses in diabetic screening coverage, as well as the need to improve adherence to national guidelines in diabetic patients receiving care at primary care-level services. These lapses in following diabetic screening and comprehensive care guidelines may be contributing factors to the diabetes-related morbidity and mortality in this study cohort.

In terms of key demographic and socioeconomic findings, patients in this cohort were largely middle aged to elderly and of low socioeconomic status. These factors may have far-reaching effect on diabetic control and outcomes. Hawthorne et al wrote that when comparing elderly individuals with and without diabetes, those with diabetes suffer excess morbidity.(21) Moreover, when it comes to diabetes management and the managing complications, the elderly have special considerations that need to be taken into account. These include lifestyle interventions related to physical activity, challenges with dietary change and cognitive complications may make adherence to a medication problematic.(21) In 2015, a qualitative study in conducted at community health centres in Cape Town found that patients of low socio-economic status may be more vulnerable and often lack the health

literacy, material resources and self-efficacy to cope with the complex burden of self-care and therefore may require more support from healthcare workers.(22)

An overwhelming majority of patients had co-existing hypertension. For a large proportion of patients, the reason for current hospital admission was for CVAs which is the likely explanation for why most patients required referral to intermediate care for intense short-term rehabilitation. It is important to note that the dataset used did not distinguish between ischaemic and haemorrhagic strokes but the risk of stroke is increased for diabetic patients in both types of strokes. Related to this, a retrospective record review was done in an emergency department in Johannesburg, South Africa, on patients who were presenting with strokes. This study found that diabetes was the second most common comorbidity/risk factor and was three times more likely in patients with ischaemic strokes compared with haemorrhagic strokes.(23) Another example of where diabetes risk for stroke is acknowledged in clinical practice is with stroke risk calculators, and the presence of diabetes drastically increases the score obtained.(24, 25) This finding of diabetes increasing general risk of stroke is supported by local data. A South African cross-sectional study published in 2020 which aimed to explore the seasonality and trend of stroke cases in South Africa and found that diabetes was a significant predictor of the likelihood of stroke (odds ratio [OR] 14.5; 95%, confidence interval [CI] 13.4 – 15.8, p<0.0001).(26) However, the presence of hypertension in the large majority of patients [n=158 (84.0%)] may also have disproportionately increased the risk of stroke in this cohort of patients.

Recommendations from the EML regarding diabetes investigation that are relevant to this study are a baseline creatinine and a minimum of one HbA1c annually in patients who meet treatment goals and three to six monthly in those who have therapy adjusted, until they are stable.(9) Just over half of the total cohort had HbA1c's done on admission and of those who had this investigation done, this showed that their diabetic control was suboptimal. However, just over three-quarters of the total cohort were known with diabetes prior to hospital admission and the data revealed an average HbA1c coverage of only 61% and just under a third had no HbA1c on the system in the last two years preceding admission. Regarding diabetic control using HbA1c as a marker, this study's findings showed poor control among those who were known with diabetes prior to admission and, expectedly, among only diagnosed with diabetes at admission to hospital. Interestingly, when looking at HbA1c data between the patients who were known with diabetes prior to admission and those diagnosed at admission, there was no significant difference. The findings of poor glycaemic control are consistent with other studies. In 2015, a cluster-randomised trial in 12 primary care clinics in Tshwane District in Gauteng, South Africa was conducted with a total of 599 diabetic patients. Data on the care received in the previous 12 months was analysed and found that 27% of patients were found to had HbA1c <7%.(27)

An important finding of this study is that approximately a quarter of patients were undiagnosed with diabetes and only diagnosed at admission following a major morbidity. This highlights a major screening failure in diabetes detection in our health services. Abroad, there have been developments in policymaking and strategy regarding improving diabetes prevention, screening, retention in care and management. An example of this is in Canada where the "Diabetes 360° framework for Diabetes strategy" has set targets, modelled on strategies such as the 90, 90, 90 targets used in tackling the HIV/AIDS epidemic and other diseases in low and middle- income countries.(28, 29) These targets are that 90% of Canadians live in an environment that preserves wellness and prevents the development of diabetes, 90% of Canadians are aware of their diabetes status, 90% of Canadians living with diabetes are engaged in appropriate interventions to prevent diabetes and its complications and 90% of Canadians engaged in interventions are achieving improved health outcomes.(28) South Africa is one of the countries that has implemented the 90, 90, 90 strategy for HIV/AIDS and while targets have not been reached, it has provided clear, measurable goals and considerable progress has been made.(30) From this and other studies, it is clear that considerable work needs to be done in diabetes detection and for known diabetic patients, improvement is needed across the care continuum and therefore a similar strategy to 90, 90, 90 for diabetes is being considered by policymakers in South Africa. The National Strategic Plan for The Prevention and Control Of Non-Communicable Diseases (2022 – 2027) outlines a strategy similar to the 90, 90, 90 approach for HIV and AIDS.(31) It has been initially intended to address the burden of disease posed by diabetes and hypertension but it hopes to include other non-communicable diseases going forward.(31) It proposes a "90-60-50 cascade" for diabetes and hypertension where it aims to have 90% of all people over 18 knowing whether or not they have raised blood pressure and/or raised blood glucose, 60% of people with raised blood pressure or blood glucose receiving intervention and 50% of people receiving interventions being controlled.(31)

In 2018, the Western Cape Government Department of Health (WCG DOH) compiled a joint audit report for diabetes and HIV/ AIDS, STIs (Sexually Transmitted Infection) and TB (Tuberculosis) for Metro Health Services,(32) which included the two sub-districts, Klipfontein (KSD) and Mitchell's Plain (MPSD), that are home to the patients who are referred to MPH for admission. The diabetic audit data was gathered by folder audit at different facilities and latest available data is for 2017 and 2018.(32) The findings relevant to this study are tabulated (see table 5).

Table 5 Relevant data from PHC Audit Report on Diabetes and HIV/AIDS, STIs and TB 2018.(32)

Variable	2017	2018
Annual HbA1c		
Klipfontein health subdistrict	54.0%	51.0%
Mitchell's Plain health subdistrict	46.4%	48.9%
HbA1c <8%		
Klipfontein health subdistrict	14.3%	38.0%
Mitchell's Plain health subdistrict	20.0%	20.5%
HbA1c >10%		
Klipfontein health subdistrict	32.1%	32.9%
Mitchell's Plain health subdistrict	50.0%	53.8%
If HbA1c above target, was action taken?		
Klipfontein health subdistrict	62.5%	75.0%
Mitchell's Plain health subdistrict	75.0%	72.0%
Is the patient on insulin?		
Klipfontein health subdistrict	38.0%	43.5%
Mitchell's Plain health subdistrict	35.7%	38.9%
Annual recording of serum creatinine?		
Klipfontein health subdistrict	58.0%	56.8%
Mitchell's Plain health subdistrict	53.6%	54.4%
Is the patient on an ACEI or ARB?		
Klipfontein health subdistrict	53.1%	48.6%
Mitchell's Plain health subdistrict	50.0%	65.2%

Abbreviations: ACEI: angiotensin-converting enzyme inhibitor, ARB: angiotensin-receptor blocker

Some noteworthy points from this data are that, unlike this study which used an HbA1c cut-off of <7% to measure control, the audit report used HbA1c <8%. It was found that KSD had a large variation in patients with HbA1c <8% between 2017 and 2018 (14.3% and 38.0% respectively) and MPSD had roughly 20% in both years.(32) Both subdistricts showed poor glycaemic control. The WCG DOH audit report, showed that KSD had 38.0% and 43.5% of diabetic patients audited on insulin in 2017 and 2018 respectively and MPSD 35.7% and 38.9%.(32) Our findings showed that nearly half of known diabetics (49.7%) were commenced on insulin prior to hospital admission. A possible reason for this may be selection bias in that these patients already had advanced disease and thus presented with a serious complication and the likelihood of being on insulin in the cohort selected is higher. On the other hand,

of those who were known with diabetes who were never prescribed insulin prior to admission, more than half had two or more HbA1c's greater than 7%.

Locally, there has been research done on barriers to insulin initiation. A recent qualitative study conducted at primary care facilities in Cape Town found that the main barriers to initiation of insulin were multifactorial and included "time constraints and high workload in clinical practice, poor continuity and retention in care, inadequate education, counselling and support, fears of self-injection and concerns of the impact on lifestyle".(33) A 2004 study also conducted at primary health care facilities in Cape Town, identified doctors' barriers to initiating insulin therapy and findings included lack of knowledge, lack of experience with and use of guidelines related to insulin therapy, language barriers and fear of hypoglycaemia.(34)

When reviewing the EML guideline on insulin initiation for type two diabetes, the guideline states that "insulin is indicated when oral therapy fails". Table 2 provides targets for control which includes target HbA1c percentages. The EML further states that "for persisting HbA1c above acceptable levels and despite *adequate adherence* to oral hypoglycaemic agents, add insulin and withdraw sulphonylurea". The guideline is not explicit regarding what adequate adherence is, nor does it state how many times a raised HbA1c should be permitted to try to allow for adherence to be improved before initiating insulin. These decisions are left to the discretion of the treating clinician and perhaps could be a possible explanation for why insulin initiation is seemingly delayed when looking at HbA1c in isolation. If clinicians assess adherence to oral agents as poor, they may be reluctant to start insulin where the perceived risk with non-adherence or inconsistent use may be greater. Clinicians may also be hesitant to up-titrate insulin, which may explain why there was minimal difference between the diagnosed versus the undiagnosed diabetic patients' HbA1c levels in this cohort.

Annual creatinine coverage for both KSD and MPSD were low with a maximum of 58% being achieved between the two years audited.(32) There is no suitable comparator for this from results of this study as baseline creatinine was taken as the earliest creatinine on the system which varied considerably between patients. Current guidelines in the EML recommend that ACE-I be commenced with any evidence of diabetic nephropathy. This should be by annual urine dipsticks looking for proteinuria and measurement of serum creatinine. Should dipsticks be negative, urine should be sent for albumin to creatinine ratio at the laboratory.(9) In this study, there was an increase in mean baseline creatinine (90.3 millimoles per litre) to mean creatinine on admission (129.7 millimoles per litre). While this rise in creatinine could be attributed to changes due to co-morbid hypertension and other lifestyle causes such as smoking, poorly controlled diabetes and consequently diabetic nephropathy is also a likely contributor. This study showed that 70 (37.2%) of the cohort had evidence of an ACE-inhibitor being

prescribed prior to admission which is less than the findings of the PHC audit report which showed ACE-I or ARB prescription for between 48.6% and 65.2% between 2017 and 2018 for the two subdistricts.(32) Again, selection bias may explain this as this cohort has had poor outcomes and this could be because of a number of reasons including non-adherence, defaulting appointments or medications not being prescribed as per guidelines.

Available data revealed that by 12 months after the focus review window, just over a quarter of the cohort had demised. Of those who had demised, roughly 15% had died within a month of admission. One should bear in mind that available data may have underestimated actual mortality figures as accessible data sources did not include all possible sources of mortality data. As most patients (almost 70%) in the cohort had suffered from a stroke, information on survival after stroke was sought. A systematic review and meta-analysis published in 2021 on stroke case fatality in sub-Saharan Africa. This study revealed that the one-month pooled stroke case-fatality rate was 24.1% [95% CI: 21.5–27.0] and 33.2% [95% CI: 23.6–44.5] at one year.(35) Furthermore, diabetes was associated with poor prognosis at 6 and 12 months with odds ratios of 1.6 [95% CI: 1.2–2.2] and 1.9 [1.3–2.8], respectively.(35) Second to strokes, amputations were another major reason for patients in this cohort to be admitted to hospital accounting for 18.8% of admissions. A retrospective study published in 2021 in Finland showed that one- and five-year overall survival after diabetic foot infection to be 81.2% (95%CI 77.5–84.9%) and 49.7% (95% CI 44.8–54.6%), respectively.(36) This study also found that major amputation was one of the factors that reduced the overall survival of patients after being diagnosed with diabetic foot sepsis with the one- and five-year overall survival (OS) was 41.7% (95%CI 13.9–69.5) and 8.3% (95%CI 0.0–24.0%), respectively.(36)

It should be acknowledged that the timing of the research window (1 November 2020 to 31 August 2021), was during the coronavirus disease of 2019 (COVID-19) pandemic and may have had considerable impact on these patients in this cohort throughout their healthcare journeys. Due to initial hard lockdowns, many patients would not have been able to access healthcare for anything except emergency care and thus screening for chronic disease such as diabetes would have been neglected. Those who were known with diabetes may not have been able to attend their chronic appointments due to staff shortages or other practical constraints with far-reaching effects on investigations done and treatment being prescribed. Many of these patients may have been infected with COVID-19 themselves also potentially impacting their functioning.

Strengths and limitations

A retrospective cohort study design was used with the aim of answering the research question. While it had the advantage of reducing the time needed to complete the study as data was partially collected, this design is prone to several sources of bias. By virtue of this patient cohort having been admitted to hospital for a serious morbidity, there was certainly selection bias in this sample, potentially skewing results towards showing more uncontrolled disease in this cohort. There are also additional potential sources of bias in cases of patients who were critically ill on admission and may have demised in the emergency centre or wards thereby not necessitating intermediate care referral. In some other cases, patients may have been admitted for a short stay or had a satisfactory home discharge plan and thus did not require intermediate care referral.

Another possible limitation is that possible human error when the electronic database of referrals was created. The referral to intermediate care was a doctor-initiated process but required the input of a number of members of the MDT to facilitate a complete referral. There was therefore room for human error on manual entry. As far as possible, relevant data points to this study were checked by corroborating evidence with what was available on SPV and National Health Laboratory Service (NHLS) regarding investigations and data. For example, if a patient was labelled diabetic but had no evidence of an HbA1c or random sugar done or had never been prescribed diabetic treatment, they were removed from the cohort. Data on demographics, socioeconomic status and co-morbidities were not cross checked.

The decision to use SPV to gather data was somewhat based on convenience as data on prior investigations done, medications prescribed, date of admission to hospital and mortality is accessible under a single patient profile and using a single programme. However, should a patient have migrated between the Western Cape and other provinces or across national borders for healthcare services, their information on healthcare rendered in these circumstances would not be accessible via SPV. Consideration should also be given to the limited data sources used via SPV for mortality data as outlined above.

When looking at results of investigations done, the number obtained for patients who were known with diabetes prior to admission and who did not have an admission HbA1c done, a possible explanation for this could be that the admitting clinician found a recent HbA1c on the system and deemed the investigation to have limited value if done too soon. This should be considered as clinicians are encouraged to be judicious with investigations when working in a resource-limited setting such as MPH.

It is acknowledged that this study was done in one community of patients in a specific area of Cape Town and findings may not be generalisable to other communities in South Africa or elsewhere.

Recommendations

This study has uncovered the need for further work on improving diabetes prevention, early detection and screening efforts and effective diabetic management to prevent considerable morbidity and mortality. This information may be helpful for policymakers in highlighting the need to further prioritise diabetes prevention and management as service needs and allocating resources and services accordingly.

Access to PHC guidelines should be promoted and clinicians should be encouraged to adhere to guidelines for investigation and management as far as possible, bearing in mind resource-limitation and constraints of busy public sector services. Particular attention and focus should be given to initiating insulin in patients not controlled on oral agents and doing so timeously to prevent morbidity as far as possible. For the existing EML guideline, perhaps more specific guidance on assessing adherence to diabetic medication and the use of HbA1c in these situations could be more explicit.

Findings in this cohort showed that serious diabetes-related morbidity was experienced which necessitated referral for rehabilitative services at the intermediate care facility. Furthermore, findings revealed a high mortality rate in the first month after admission with a diabetes-related morbidity which highlights the importance of involving palliative care services for these patients and their families.

There is potential for future research in this population with a larger, higher-powered study that could possibly gather correlation data and find associations between certain factors and poor outcomes. Barriers to adherence to primary care diabetes guidelines could also be explored further in future research.

Conclusion

This cohort study of patients living with diabetes in Cape Town confirmed that diabetes continues to contribute significantly to morbidity and mortality in the South African context. Adherence to national diabetic guidelines on screening, investigations and management is being done sub-optimally at primary care level. Efforts should be made to address these issues to prevent further burden on the health care system.

Competing interests

The authors declare that they have no conflict of interest or competing interests related to this study.

Funding

This research received a grant of R5000 from the University of Cape Town which is allocated for Masters research and this was used for statistical support.

Data availability

Data are available from the corresponding author, upon reasonable request.

Disclaimer

The views and opinions expressed are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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Appendices:

Appendix A

Ethics Approval letter from UCT Human Research Ethics Committee reference 028/2022

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45, E-52- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

17 January 2022

HREC REF: 028/2022

A/Prof K von Pressentin
Public Health & Family Medicine
Email: klaus.vonpressentin@uct.ac.za
Student: rosajansen89@gmail.com

Dear A/Prof von Pressentin

PROJECT TITLE: DIABETIC PATIENTS REQUIRING INTERMEDIATE CARE REFERRAL AT A DISTRICT LEVEL HOSPITAL IN CAPE TOWN, SOUTH AFRICA: A DESCRIPTIVE ANALYSIS (MMED DEGREE – DR ROSA JANSEN)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020: 06 July 2020 & 01 July 2021.

Approval is granted for one year until the 30 January 2023

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: -Dr Rosa Jansen will also be involved in this study.

Please quote the HREC REF 028/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Appendix B

PHRC: National Health Research Database approval letter WC_202201_020

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 0866: fax: +27 21 483 6058
5th Floor, Norton Rose House,, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za)

REFERENCE: WC_202201_020
ENQUIRIES: Dr Sabela Petros

University of Cape Town
Anzio Road
Observatory
Cape Town
7925

For attention: Prof Klaus Von Pressentin, Dr Rosa Jansen, Dr Jonathan Naude

Re: Diabetic patients requiring intermediate care referral at a District Level Hospital in Cape Town, South Africa: A descriptive analysis.

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.
Please contact the following people to assist you with any further enquiries in accessing the following sites:

Mitchells Plain Hospital	**Jonathan Naude**	**021 377 4760**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted and the constraints caused by the Covid-19 epidemic above are respected and adhered to.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**Annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the *estimated* completion date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
4. The reference number above should be quoted in all future correspondence.

Yours sincerely

PROF. V ZWEIGENTHAL
DIRECTORATE: HEALTH INTELLIGENCE
DATE: 18 February 2022
CC