

Diabetes and Cardiometabolic Care, Pharmacotherapy, and Patient Outcomes in Two Regional Aboriginal Primary Care Health Centres: Lessons to be Learnt

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Received 28 April 2025; received in revised form 11 June 2025; accepted 23 June 2025; online published-ahead-of-print xxx

Background

Type 2 diabetes mellitus (T2DM) affects Aboriginal Australian populations six times more frequently than non-Indigenous Australians, with disparity increasing by remoteness. Contemporary guidelines recommend optimising cardiometabolic care, including achieving a target glycosylated haemoglobin (HbA1c) <7%, blood pressure <130/80 mmHg, and use of pharmacotherapy, including the maximal tolerated statin dose and consideration of sodium–glucose co-transporter 2 inhibitors and glucagon-like peptide-1 receptor agonists in selected subpopulations.

Aim

This study aimed to determine whether cardiometabolic treatment targets and pharmacological management met best practice guidelines in two rural Aboriginal Community Controlled Health Organisations.

Method

A retrospective audit of electronic medical records was conducted in two rural Aboriginal Community Controlled Health Organisations between January 2020 and January 2021. Data were collected for people aged over 18 years who regularly attended the clinic, identified as Aboriginal, and had a documented diagnosis of T2DM.

Results

A total of 274 patients met the inclusion criteria, 64% of whom were female. The median age of T2DM diagnosis was 44 years (interquartile range 32–50), with a median diabetes duration of 9 years (3–17), HbA1c 8.0% (6.9–9.4), body mass index 31.6 kg/m² (27–36.3), urine albumin–creatinine ratio (ACR) 3.8 mg/mol (1.1–20.0), and mean low density lipoprotein cholesterol 2.1 mmol/L (±0.8). Capture rates were 70% for HbA1c, 51% for urine ACR, and 51% for lipid studies. Among recorded results, 51/193 (26%) of HbA1c were <7%, 80/228 (35%) of blood pressure readings were below 130/80 mmHg. Nephropathy was present in 42% of patients, and obesity in 61%. Clinically significant albuminuria was observed in 69/140 (50%) of patients with available ACR data. Statins were prescribed in 50%, sodium–glucose co-transporter 2 inhibitors in 20%, and glucagon-like peptide-1 receptor agonists in 7% of the population.

Conclusions

This study has characterised a population with an early age of T2DM diagnosis, high rates of nephropathy and obesity, and suboptimal glycaemic control. Prescription rates of modern therapies were low. These findings highlight areas for targeted improvement in the quality of cardiometabolic care, including the increased use of modern diabetes agents.

Keywords

Aboriginal • Rural • Diabetes • Cardiometabolic • Pharmacotherapy

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Please cite this article in press as: Hayes AG, et al. Diabetes and Cardiometabolic Care, Pharmacotherapy, and Patient Outcomes in Two Regional Aboriginal Primary Care Health Centres: Lessons to be Learnt. Heart, Lung and Circulation (2025), <https://doi.org/10.1016/j.hlc.2025.06.1019>

Introduction

The burden of cardiovascular-kidney metabolic (CKM) syndrome is an urgent concern in Australia and worldwide. Collectively, these conditions accounted for more than 1 million deaths in the US in 2021 and cost an estimated \$1.7 trillion annually [1]. Type 2 diabetes mellitus (T2DM) is a major contributor to CKM syndrome in the Aboriginal and Torres Strait Islander population, where prevalence is among the highest globally [2]. Recent data describe a T2DM prevalence of 17% among Aboriginal people in Australia's Northern Territory, reaching up to 40% in some geographical locations, highlighting the importance of locally driven studies [3]. CKM syndrome has consistently been the leading cause of death in Indigenous Australians, implicated in mortality 5–7 times more frequently than in the broader Australian population [2,4,5]. T2DM specifically was the second leading cause of death in Aboriginal and Torres Strait Islander people in 2018 and remains a major contributor to the 10-year gap in life expectancy compared to non-Indigenous Australians [6,7].

The burden of diabetes on social, emotional, and cultural wellbeing is also critical. In the 2012 South Australian Aboriginal Health Survey, over 67% of surveyed participants (399/691) reported a reduced ability to perform activities of daily living due to diabetes [8]. National data concur, reporting that the burden of diabetes in 2018 was 3.6 times higher in the Aboriginal and Torres Strait Islander population than the non-Indigenous population [9].

Optimal care, defined as evidence-based care (EBC), is known to improve outcomes and prevent or slow complications in people with T2DM. National guidelines, including the Royal Australasian College of General Practitioners (RACGP)/National Aboriginal Community

Controlled Health Organisation (NACCHO) National Guide to a Preventive Health Assessment for Aboriginal and Torres Strait Islander People and the RACGP/Diabetes Australia General Practice Management of Type 2 Diabetes Guidelines, recommend comprehensive care centred on glycaemic control (glycated haemoglobin [HbA1c] <7% for most adults), blood pressure (BP) <130/80 mmHg, and statin therapy for individuals over 40 years of age or with established cardiovascular risk [10,11].

Pharmacological optimisation in T2DM management extends beyond glycaemic control to include optimisation of cardiometabolic and renal health—leading drivers of morbidity and mortality in diabetes [12,13]. Sodium-glucose co-transporter type 2 inhibitors (SGLT2is) and glucagon-like peptide-1 receptor agonists (GLP-1RAs) have demonstrated significant reductions in rates of heart failure, atherosclerotic cardiovascular disease, weight, and renal disease progression [14–19]. Accordingly, the 2018 European and American diabetes guidelines (European Association for the Study of Diabetes and American Diabetes Association) marked a paradigm shift, incorporating these agents to improve cardiovascular, renal, and metabolic risk profiles (Table 1) [19–22]. Australian guidelines followed in 2020, recommending the use of both classes of medication where HbA1c remains above target after 3 months of first-line therapy (metformin, sulphonyl urea, or insulin) [23]. However, detailed data regarding their uptake in Aboriginal primary health centres—and their effect in this setting—do not yet exist.

In Australia, 134 Commonwealth-funded Aboriginal Community Controlled Health Organisations (ACCHO), or state-funded Aboriginal Medical Services, are the main providers of EBC to the Aboriginal and Torres Strait Islander population, particularly in rural and remote areas [24].

Table 1 Comparison of guidelines pertaining to SGLT2i in T2DM, current at the time of study as compared to recent updates.

Guideline	Year	SGLT2i mentioned?	Clinical context (2020)	2025 position
ADA Standards of Care [44,45]	2018	Yes	T2DM+CKD or ASCVD; albuminuria prioritised, eGFR>30 to 60 depending on agent	Strongly recommend if eGFR \geq 20 and albuminuria \geq 30 mg/g, or HF or ASCVD
ESC/EASD [46]	2019	Yes	T2DM + ASCVD or high risk of CKD, eGFR>30	Use if eGFR \geq 20 + albuminuria; not HbA1c-driven; cardioprotective regardless of glycaemia
KDIGO CKD Guidelines [47]	2012–2019	Not formally included	Did not address use of SGLT2i prior to 2020	2022 KDIGO: Recommend in all T2DM+CKD with eGFR \geq 20 + ACR \geq 30
Australian (RACGP/ADS) [10,23]	2020 (9th ed.)	Yes	T2DM + albuminuria or CVD, contraindicated if eGFR<45	2023/24: Strongly recommend if eGFR \geq 25 for renal, CVD and HF benefit

Abbreviations: SGLT2i, sodium glucose cotransporter type 2 inhibitor; T2DM, Type 2 diabetes mellitus; ADA, American Diabetes Association; CKD, chronic kidney disease; ASCVD, atherosclerotic cardiovascular disease; eGFR, estimated glomerular filtration rate; HF, heart failure; ESC, European Society of Cardiology; EASD, European Association for the Study of Diabetes; HbA1c, glycated haemoglobin; KDIGO, Kidney Disease Improving Global Outcomes; ACR, albumin-creatinine ratio; RACGP, Royal Australasian College of General Practitioners; ADS, Australian Diabetes Society; CVD, cardiovascular disease.

However, delivery of optimal primary care continues to be a challenge in these settings, where disparities in diabetes prevalence are further exacerbated and real-world data are lacking [24,25]. Available data are typically coarse and lack nuanced analysis of diabetes management, limiting the capacity for informed targeted improvements in EBC and timely evaluation [26–29]. This study assesses the attainment of key diabetes treatment targets in rural and remote ACCHOs already visited by specialists, to identify current gaps and inform strategies for improvement.

Aims

Our overarching aim was to measure diabetes care delivery in two rural South Australian ACCHOs against best practice guidelines across cardiometabolic parameters. This was assessed by the proportion of patients attaining therapeutic targets, pharmacotherapy prescription rates, and by characterising the burden of disease and comorbidities that may influence disease control.

Methods

The study was designed to help inform Goal 3 of the South Australian Aboriginal Diabetes Strategy: Improve diabetes care and reduce complications, and Goal 6: Strengthen research, data usage, and population health monitoring [7].

Ethics Approval

A waiver of consent was obtained in line with the low-risk nature of the study and the National Health and Medical Research Council ethical requirements. The study received ethics approval from the South Australian Aboriginal Health Research Ethics Committee (#04-20-912).

Study Setting

Two regional ACCHOs participated, each serving a regular client base of over 1,000 patients living up to several hundred kilometres from the health centres. Both are located 360 to 750 kilometres from the nearest tertiary hospital. The centres are staffed by Aboriginal Health Workers, Registered Nurses, and regularly visiting General Practitioners. The centres also receive visits from an Endocrinologist approximately every 4–8 weeks. Facilities to measure point-of-care HbA1c and urine albumin–creatinine ratio (ACR) are available on site.

During the study period, the subsidised GLP-1RA available included exenatide and dulaglutide. SGLT2is were not yet recommended for use in patients with an estimated glomerular filtration rate (eGFR) <45 mL/min/1.73 m².

Study Design

A cross-sectional audit was conducted using electronic medical records from January 2020 to January 2021. In accordance with local and ethical requirements, data were collected and de-identified by trained local information

technology data managers working independently of the study team.

Patients were included if they: identified as Aboriginal, were aged over 18 years during the study period, had a documented diagnosis of T2DM, were classified as “regular” patients (defined as at least three clinic attendances over 2 years). All other patients were excluded.

Data collected included demographics such as age, age of diabetes diagnosis, and smoking status; anthropometric measures such as body mass index (BMI), BP, and biochemical measures: HbA1c, lipid profile, and renal function. Data regarding medications and comorbidities were also collected. As the practice software is used to print prescriptions for the practice, it was considered a reliable medication record. In the event of multiple attendances, the first for the calendar year was collected.

Glycaemic control, cardiovascular risk factors, rates of complications, and identification of treatment targets were assessed by the proportion of patients achieving best practice therapeutic targets as HbA1c <7%, BP <130/80 mmHg, and pharmacologic prescriptions of statins, SGLT2i, and GLP-1RA [21,23,30].

Nephropathy was noted if listed in the medical history, by urine ACR >3.5 mg/mmol in females, >2.5 mg/mmol in males, or eGFR <60 mL/min/1.73 m². Ischaemic heart disease, stroke, peripheral vascular disease, retinopathy, neuropathy, dyslipidaemia, hypertension, and smoking history were noted in the medical history. Mental health conditions, also noted in the medical history, included depression, anxiety, substance use disorders, bipolar disorder, and schizophrenia spectrum disorders.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics version 28 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarise screening rates, complication frequency, and prescription rates. For continuous variables, normally distributed data were presented as mean ± standard deviation, and non-normally distributed data were presented as median with interquartile range (IQR). Inferential statistics included independent *t*-tests for comparing means between two groups, χ^2 tests for categorical variable comparisons, and Mann–Whitney U tests for comparing medians of non-parametric data. A subgroup analysis was performed on patients with and without nephropathy.

Results

Across the two sites, 274 patients met the inclusion criteria, with a median age of 54 years and diabetes duration of 9 years (Table 2). Anthropometric and biochemical monitoring results were captured for height in 60%, weight in 69%, BP in 83%, HbA1c in 70%, urine ACR in 51%, creatinine in 65%, and lipids in 51% of patients. Full medical history was available for 95% of patients, and prescription history was available in 94%.

Table 2 Population demographics.

	Mean/median, SD/IQR	Capture rate, n (%)
Age (years)	54 (43–63)	274 (100)
Age of diagnosis (years)	44 (32–50)	274 (100)
Duration of diabetes (years)	9 (3–17)	274 (100)
Sex (F), n (%)	174 (64)	274 (100)
HbA1c, median (%)	8.0 (6.9–9.4)	193 (70)
HbA1c <7%; n (%)	51 (19)	
HbA1c 7%–8%; n (%)	45 (16)	
HbA1c >8%; n (%)	97 (35)	
BMI (median [kg/m ²])	31.6 (27–36.3)	159 (58)
Systolic blood pressure (median [mmHg])	131 (117–145)	228 (83)
Diastolic blood pressure (mmHg)	80 (72–85)	228 (83)
Serum creatinine (mmol/L)	66 (48–88)	179 (65)
Urine albumin: creatinine ratio	3.8 (1.1–20.0)	132 (48)
Total cholesterol (mmol/L)	4.4 (±1.2)	141 (51)
HDL (mmol/L)	1.1 (±0.26)	141 (51)
LDL (mmol/L)	2.1 (±0.84)	131 (48)
Triglycerides (mmol/L)	2.6 (±1.4)	141 (51)
Comorbidities, n (%)		260 (95)
Nephropathy	112 (43)	
Ischaemic heart disease	38 (14)	
Stroke	16 (6)	
Peripheral vascular disease	6 (2)	
Neuropathy	14 (5)	
Retinopathy	24 (9)	
Mental health diagnosis	100 (37)	
Cardiovascular risk factors, n (%)		
Male	100 (46)	274 (100)
Smoking		202 (74)
Non-smoker	50 (18)	
Ex-smoker	52 (19)	
Smoker	100 (37)	
Hypertension	136 (50)	260 (95)
Dyslipidaemia	98 (37)	260 (95)
Obesity (BMI>30 kg/m ²)	97 (61)	159 (58)
Age >30 years	256 (93)	274 (100)
Nephropathy	112 (43)	260 (95)
Number of documented cardiovascular risk factors in addition to Indigenous ethnicity, n (%)		274 (100)
0	0	
1	115 (42)	
2	23 (8)	
3	46 (17)	
4	8 (3)	
5	64 (23)	
6	18 (7)	

Table 2. (continued).

	Mean/median, SD/IQR	Capture rate, n (%)
Medications prescribed, n (%)		256 (93)
Metformin	168 (66)	
Sulphonylurea	44 (17)	
DPP4 inhibitor	85 (33)	
SGLT2i	51 (20)	
GLP-1RA	19 (7)	
Insulin	43 (17)	
ACEi/ARB	128 (50)	
Statin	128 (50)	

Nephropathy was noted if listed in medical history, by urine ACR >3.5 mg/mmol in females, >2.5 mg/mmol in males, or eGFR <60 mL/min/1.73 m². IHD, stroke, PVD, retinopathy, neuropathy, dyslipidaemia, hypertension and smoking history were noted in medical history. Mental health conditions, also noted in medical history, included depression, anxiety, substance use disorders, bipolar disorder, and schizophrenia spectrum disorders.

Abbreviations: SD, standard deviation; IQR, interquartile range; F, female; HbA1c, glycated haemoglobin; BMI, body mass index; HDL, high density lipoprotein; LDL, low density lipoprotein; SGLT2i, sodium glucose cotransporter type 2 inhibitor; GLP-1RA, glucagon like peptide 1 receptor agonist; ACEi: angiotensin converting enzyme inhibitor; ARB, angiotensin II receptor blocker; eGFR, estimated glomerular filtration rate; ACR, albumin to creatinine ratio; IHD, ischaemic heart disease; PVD, peripheral vascular disease.

Glycaemic control was assessed by HbA1c, which was below 7% in 19% of patients, between 7%–8% in 16%, above 8% in 35%, and not captured in the remaining 30% of patients (Table 2). While 69% of patients were above the target HbA1c of 7%, only 73% of these were prescribed metformin, 22% a sulphonyl urea, 38% a DPP4 inhibitor, 26% a SGLT2i, 9% a GLP-1RA, and 23% were prescribed insulin therapy. Figure 1 also shows that 13% of patients with an HbA1c over 8% were not prescribed any pharmacotherapy for T2DM, and 23% remained on a single agent.

Nephropathy was the most frequent comorbidity and possible complication of diabetes, recorded in 43% of patients (Table 2, Figure 2). The median duration of diabetes in those with nephropathy was 13 years (IQR 3.3–18) compared to 6 years (IQR 2–12) for those without ($p<0.001$). Urine ACR was recorded in 51% of patients, with a median urine ACR of 3.8 mg/mmol. Of those, 69/140 patients (50%) had clinically significant albuminuria. Among patients with elevated urine ACRs, 44/69 (64%) were prescribed angiotensin blockade, 9/69 had an eGFR<45 mL/min/1.73 m², with 15 of the remaining 60 (25%) were prescribed SGLT2is (Table 3, Figure 2). Ischaemic heart disease was more frequent in patients with nephropathy (23% vs 8% $p\leq 0.001$), as was hypertension (66% vs 42% $p\leq 0.001$), and other microvascular complications retinopathy (17% vs 3% $p\leq 0.001$) and neuropathy (11% vs 1% $p\leq 0.001$).

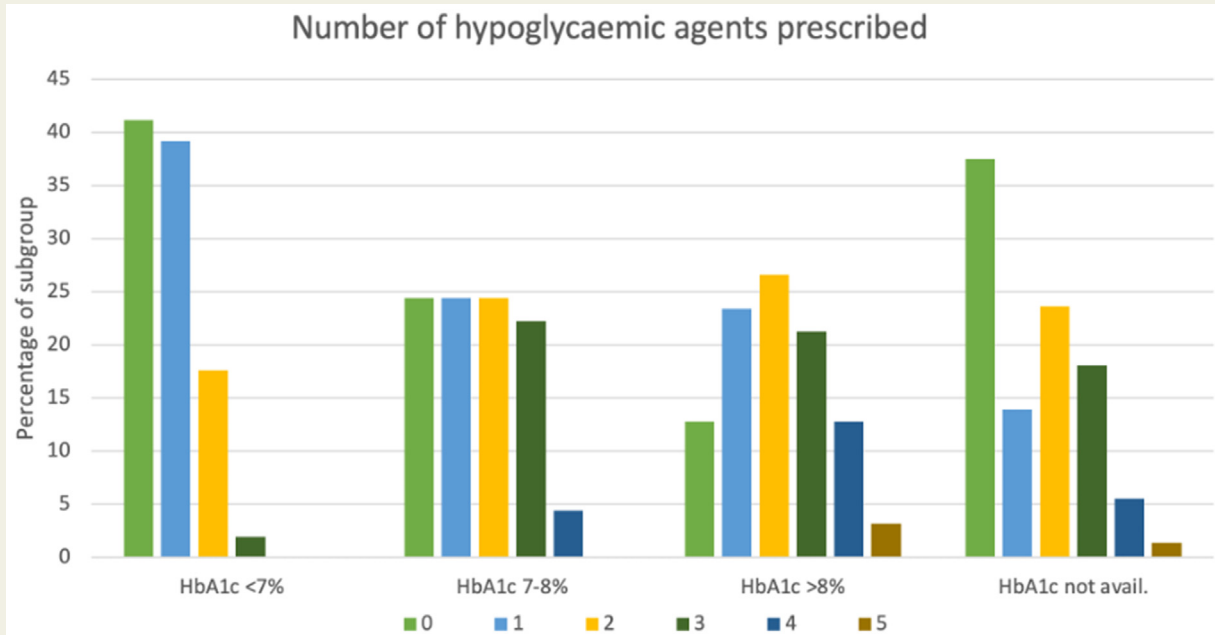


Figure 1 Prescription patterns regarding the number of hypoglycaemic pharmacologic agents used as glycated haemoglobin (HbA1c) increased from within target to above target.

Established ischaemic heart disease was reported in 38 (14%) of patients. Of those, 67% were prescribed an angiotensin converting enzyme inhibitor or angiotensin II receptor blocker, 75% statin therapy, 29% were active smokers, and 55% had obesity.

Dyslipidaemia was listed in 98/274 (37%) patients, and statins were prescribed in 128/256 (50%). Biochemical lipid assessment was performed in 68/128 (53%) patients on statin therapy, 44/98 (45%) with listed dyslipidaemia, and 10/38 (26%) patients with listed ischaemic heart disease.

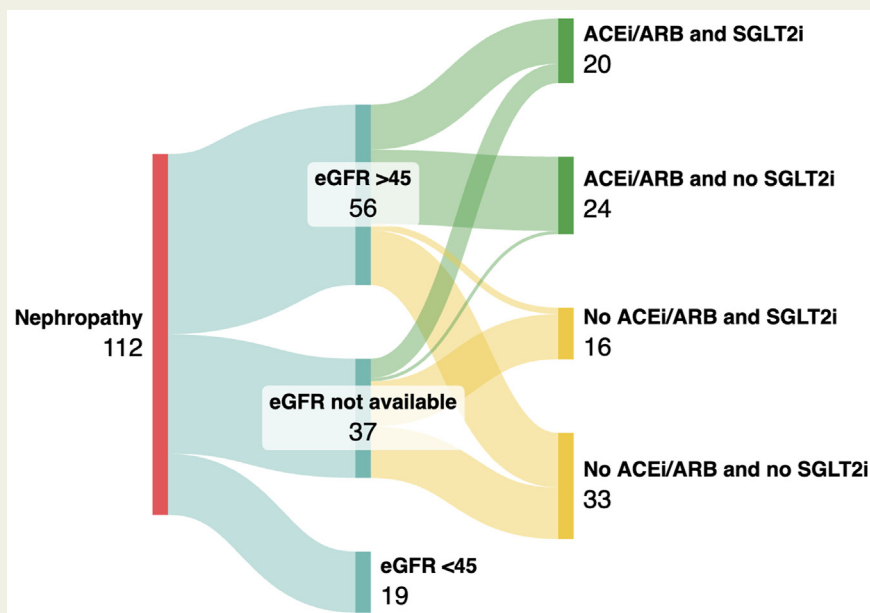


Figure 2 Prescription trends in patient with nephropathy for antiproteinuric agents ACEi/ARBs and SGLT2i. Despite established nephropathy few patients were prescribed both agents (green, top line) and many more were prescribed neither (yellow, fourth line).

Abbreviations: ACEi, angiotensin converting enzyme inhibitor; ARB, angiotensin II receptor blocker; eGFR, estimated glomerular filtration rate; SGLT2i, sodium glucose cotransporter type 2 inhibitor.

Table 3 Prescription of GLP-1RA and SGLT2i in subpopulations of obesity (BMI>30 kg/m²) and nephropathy.

	HbA1c <7%	HbA1c 7%–8%	HbA1c >8%	HbA1c not available
Obesity (n=94)				
GLP-1RA (10/94, 11%)	1 (4%)	1 (3%)	7 (19%)	1 (33%)
SGLT2i (20/94, 21%)	3 (12%)	6 (21%)	10 (27%)	1 (33%)
Nephropathy eGFR>45 (n=6)				
SGLT2i (23/96, 24%)	1 (5%)	4 (21%)	13 (32%)	5 (33%)
GLP-1RA (7/96, 7%)	0 (0%)	1 (5%)	4 (10%)	2 (13%)
Nephropathy eGFR>20 (n= 02)				
SGLT2i (23/102 23%)	1 (5%)	4 (20%)	13 (29%)	5 (31%)
GLP-1RA (9/102 9%)	0	1 (5%)	6 (13%)	2 (13%)
CVD (n=36)				
GLP-1RA (1/36 3%)	0	0	1 (7%)	0
SGLT2i (6/36 17%)	0	1 (25%)	4 (27%)	1 (13%)

Abbreviations: GLP-1RA, glucagon like peptide 1 receptor agonist; SGLT2i, sodium-glucose cotransporter type 2 inhibitor; BMI, body mass index; HbA1c, glycated haemoglobin; eGFR, estimated glomerular filtration rate; CVD, cardiovascular disease.

Pharmacotherapy Targets

Prescription rates of diabetes agents are listed in Table 2. Sixty-one percent of patients had a BMI over 30 kg/m². Ten percent of obese patients with T2DM were prescribed GLP-1RA therapy. In patients with nephropathy, 29% of eligible patients were prescribed SGLT2i therapy in line with best practice guidelines of that time (eGFR>45 mL/min/1.73 m²) (Tables 1 and 3; Figure 2). Of those with established ischaemic heart disease, 75% were prescribed statin therapy, 29% received aspirin, and 46% achieved an in-clinic BP <130/80 mmHg.

Discussion

This study provides a unique, granular insight into diabetes care delivery in two remote Aboriginal populations. It highlights a gap between evidence-based guidelines and real-world implementation. This helps inform pragmatic future improvements in cardiometabolic assessments and pharmacotherapy.

The major findings include a young age of diagnosis, high rates of nephropathy, and low rates of modern pharmacotherapy uptake. The median age of diagnosis in this population was 44 years, which is 15 years earlier than the nationwide median of 59.6 years [31]. Nearly two-thirds of the population were female, which contrasts with the general Australian population, where diabetes is more prevalent in males, but aligns with the prevalence of T2DM among Indigenous populations globally [32]. The female predominance in this rural population aligns with the greater gap in life expectancy compared to the metropolitan non-Indigenous population [33]. Diabetes and cardiometabolic treatment targets for rural-living Aboriginal Australians are not being met [3].

Disease Monitoring and Complication Screening

Routine assessments of cardiometabolic risk factors, including smoking status, BMI, BP, HbA1c, and lipids, were generally high, but key gaps were noted. Low rates of urine ACR (51%) suggest missed opportunities to identify and modify the progression of nephropathy. Incomplete anthropometric data (height missing in 40% and weight in 31%) likely reflect modifiable system issues, which could be due to data entry or retrieval techniques and may be addressed by improved training and retention of clinic staff, as our group has previously highlighted [34,35].

The study population also demonstrated a high burden of disease, with elevated rates of active smoking (37%), dyslipidaemia (37%), and hypertension (50%)—important modifiable cardiovascular risk factors in a young population.

Patient-Centred Pharmacotherapy

Prescription rates seen in this study (Table 2) are similar to another Australian study reporting antidiabetic prescription rates of 71.6% (95% confidence interval 69.0–74.0) in Aboriginal and Torres Strait Islander patients with diabetes [36]. Similarly, metformin was prescribed in 60.4% of rural patients, SGLT2i in 15.2%, and GLP-1RA in 5.8%. This compares to reports from the United Kingdom and United States of America, where sulphonylureas were prescribed in 43% of patients as second-line therapy and DPP4 inhibitor in 18%–36% [37]. None of these earlier studies matched prescription data to clinical or biochemical data. Factoring in treatment adherence could further reduce true rates of therapy, but this was not able to be assessed in this or similar studies.

Targeted pharmacotherapy to optimise cardiovascular risk, nephropathy, and obesity was low. Although supply

issues with GLP-1RA were not a major concern during this period and funding was not a barrier—as prescriptions could be funded outside the Pharmaceutical Benefits Scheme (PBS)—the decision to prescribe SGLT2i and GLP-1RA appeared more driven by glycaemic control than by broader cardiometabolic risk assessment (Table 3). Concern about the risk of ketoacidosis may have reduced SGLT2i prescriptions, although this is thought to be less likely. Low prescription rates more likely reflect unfamiliarity with newer diabetic agents in the primary care setting rather than prescription inertia or therapeutic nihilism.

Nephropathy

The high prevalence of nephropathy (43%), compounded by suboptimal ACR testing, suboptimal glycaemic control, and low SGLT2i use, reflects a critical gap in preventative care. Given that dialysis usually requires relocation off Country (traditional homelands), interventions to prevent progression to dialysis dependence carry particular importance [38]. SGLT2i have provided a novel method to reduce the development and progression of nephropathy in patients with and without T2DM as compared to placebo [16,17]. The threshold of eGFR for commencement has been lowered from 45 mL/min at the time of study commencement to 20 mL/min [39].

A particular opportunity for intervention therefore, lies in the identification and treatment of those with nephropathy and uncontrolled T2DM. There was a strong association observed between hypertension and nephropathy, though causality cannot be inferred. Other causes such as hypertensive nephrosclerosis may coexist but were not excluded in this analysis, and renal biopsies are rarely feasible. The bidirectional relationship between diabetes and hypertension underlines the importance of dual risk-factor control. Importantly, only 63% of patients with nephropathy were prescribed angiotensin converting enzyme inhibitor/angiotensin II receptor blocker therapy and 21% were prescribed SGLT2i, an area for improvement given their antiproteinuric effects.

Obesity

Obesity is known to be associated with insulin resistance and the pathogenesis of diabetes. In this population, 90% of patients with T2DM were either overweight or obese, which compares to 63.9% of Indigenous persons living in remote locations nationally [26]. A recent systematic review has shown the limitations of lifestyle interventions in Indigenous Australians (up to 8 kg weight loss), particularly when compared to bariatric surgery (approximately 26 kg loss) but pharmacological agents such as GLP-1RA are yet to be studied in this population and have been identified as a high priority [40].

Acknowledging the importance of lifestyle modification as first-line treatment, GLP-1RAs offer an effective adjunctive treatment [27]. During the study period, weekly dulaglutide and twice-daily exenatide were available on the PBS and effective in lowering HbA1c concurrently with weight loss [20]. Semaglutide, a more potent agent offering up to 15%

weight loss, was not as widely available as it is today but was PBS listed in the latter half of the study period [20,41].

Cardiovascular Risk

Cardiovascular risk is a major driver of morbidity and mortality in Aboriginal populations. Indeed, 58% of participants in this study had at least two cardiovascular risk factors in addition to their ethnicity (Table 2). Recommendations valid since prior to this study move beyond fixed biochemical targets and focus on the maximum tolerated statin dose [30]. Pharmacotherapy in cardiovascular disease also aims to lower BP and target cardiac remodelling with angiotensin converting enzyme inhibitors or angiotensin receptor blockers. Similarly, there appears to be a suboptimal prescription rate of these agents across the population, regardless of cardiovascular disease status (Table 2).

The strength of our study is our ability to collect a cardiometabolic snapshot of Aboriginal patients living in rural and remote South Australia, correlate it with their treatments, and document the extent to which treatment targets and evidence-based guidelines are being met. Previously, there has been a paucity of data available from this patient group.

The limitations of this study include that the study period occurred during 2020, which may have affected engagement with the clinic and visiting endocrinologist. However, the area was relatively protected from high rates of COVID-19 infections. While the pandemic significantly restricted interstate travel, medical and visiting health services to this area from within South Australia were relatively preserved and supported by increased availability of video consultations.

The success of the data collection relied upon data storage and retrieval techniques within the electronic medical record. For this reason, we worked closely with the practice IT managers and Quality Coordinators to ensure thoroughness and consistency. Missing data points were therefore assumed to have not been recorded and were represented as such in the primary outcome. This study was unable to capture patient preferences, tolerability, adherence, and other factors in therapeutic decisions. It also did not reliably capture details on retinopathy and neuropathy screening or complication rates, nor cardiac function assessments to inform diabetic burden and service access.

Future Directions

Findings from this study were presented to the participating ACCHOs for feedback, context, and to inform changes to local practice. Record-keeping practices uncovered by this study have already driven change in the use of the electronic medical record, as guided by a newly appointed Quality Coordinator at the practice, to ensure transparency and identify patients due for review.

This study sets the stage for contextually informed interventions in optimal diabetes care delivery in rural Aboriginal Australian populations [34,35,42]. Such interventions focus on education for ACCHOs and primary

care physicians to enhance complication screening, care delivery, and utilisation of disease-modifying pharmacotherapy. Education aims to empower ACCHOs to maintain autonomy, enhance health engagement, and enable targeted screening and implementation of EBC. The high rates of documented mental health conditions also highlight the importance of considering the broader context of diabetes in the individual and community.

Non-pharmacological means to enhance diabetes care could include the use of continuous glucose monitoring in similar populations, which is currently under investigation [43].

Conclusions

This study has provided a granular, real-world view of T2DM and CKM syndrome in two rural ACCHOs. Most patients were reviewed for anthropometric testing and biochemical complications of diabetes, although urinary ACR was recorded in fewer than half of patients with T2DM. These findings have already led to changes in local practice. Despite suboptimal glycaemic control, high rates of obesity, and high rates of nephropathy, prescription rates of pharmacotherapy targeting these issues were lower than expected. This offers opportunities for targeted intervention and a baseline with which to compare future progress.

Funding Sources

O.P. is supported by an National Health and Medical Research Council (Australia) Investigator Grant [GNT2026852]. O.P. and D.J. receive support from MRFF APP 1200314

C.S.M. is supported by the Central Adelaide Local Health Network Florey Fellowship, SA, Australia.

Declaration of Competing Interests

There are no conflicts of interest to disclose.

Acknowledgements

We would like to acknowledge the participating sites, although they will not be named, at their request, to maintain confidentiality. Without this input, we cannot hope for translation of culturally and contextually informed diabetes management.

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