Assessment of the Siksika chronic disease nephropathy-prevention clinic

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Abstract

Objective To determine if a community-based multifactorial intervention clinic led by a nurse practitioner would improve management of First Nations people at risk of developing chronic kidney disease.

Design Qualitative descriptive study.

Setting A nephropathy-prevention clinic in Siksika Nation, Alta.

Participants First Nations people with diabetes, hypertension, or dyslipidemia who were referred to the clinic.

Main outcome measures Changes in blood pressure (BP), hemoglobin A_{1c}, and low-density lipoprotein levels, as well as in use of antiplatelet therapy, angiotensin-converting enzyme inhibitor or angiotensin receptor blocker medications, and statin therapy.

Results Members of the Siksika Nation were treated according to clinical practice guidelines. A total of 78 patients had at least 2 visits to the clinic and were included in this analysis (61.5% were women; mean age 56 years). Among those initially above target, a significant reduction was achieved in mean hemoglobin A_{1c} (0.96%; $P<.01$), systolic BP (15.84 mm Hg; $P<.05$), diastolic BP (7.16 mm Hg; $P<.001$), and low-density lipoprotein (0.62 mmol/L; $P<.01$) levels. There was a significant increase in the proportion of patients with clinical indications who were treated with acetylsalicylic acid (42.4%; $P<.01$), angiotensin-converting enzyme inhibitor or angiotensin receptor blocker medications (35.9%; $P<.01$), or statin therapy (35.9%; $P<.01$).

Conclusion A community-based, nurse practitioner–led clinic can improve many clinically relevant factors in patients at risk of developing chronic kidney disease. Studies have shown that achieving treatment targets is associated with a reduced risk of early death and cardiovascular events; the effect in the First Nations population on these hard clinical end points remains to be determined.

EDITOR'S KEY POINTS

- Canadian First Nations people with diabetes have higher rates of chronic kidney disease and end-stage renal disease than non–First Nations people.
- This study showed that a nurse practitioner–led clinic in a rural First Nations community helped patients achieve the guideline-based treatment targets for blood pressure, hemoglobin A_{1c}, and low-density lipoprotein levels. Use of antiplatelet therapy, angiotensin-converting enzyme inhibitor or angiotensin receptor blocker medications, and statin therapy also improved in this community.
- Multifactorial interventions have been linked to improved morbidity and mortality.

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Évaluation de la clinique de Siksika pour la prévention de la néphropathie et des maladies chroniques

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Résumé

Objectif Déterminer si une clinique d'intervention multifactorielle située en milieu communautaire et dirigée par une infirmière praticienne améliorerait le traitement des membres des Premières nations à risque de développer une maladie rénale chronique.

Type d'étude Étude descriptive qualitative.

Contexte Une clinique de prévention de la néphropathie chronique de la nation Siksika, en Alberta.

Participants Membres des Premières nations souffrant de diabète, d'hypertension ou de dyslipidémie qui ont été dirigées à la clinique.

Principaux paramètres à l'étude Changements de la tension artérielle (TA), des niveaux d'hémoglobine A1c et des lipoprotéines de basse densité, du recours aux antiplaquettaires, aux inhibiteurs de l'enzyme de conversion de l'angiotensine ou aux bloqueurs des récepteurs de l'angiotensine et aux statines.

Résultats Les membres de la nation Siksika ont été traités selon les directives de pratique clinique. Au total, 78 patients qui ont été vus au moins 2 fois à la clinique ont été inclus dans cette analyse (61,5 % étaient des femmes; âge moyen de 56 ans). Ceux qui avaient des valeurs initiales supérieures aux cibles ont obtenu des réductions significatives de d'hémoglobine A1c moyenne (0,96%; $P<,01$), des TA systolique (15,84 mm Hg; $P<,05$) et diastolique (7,16 mm Hg; $P<,001$) et du niveau des lipoprotéines de basse densité (0,62 mmole/L; $P<,01$). Il y a eu une augmentation significative de la proportion des patients avec indications cliniques qui ont reçu de l'acide acétylsalicylique (42,4%; $P<,01$), un inhibiteur de l'enzyme de conversion de l'angiotensine ou un bloqueur des récepteurs de l'angiotensine (35,9%; $P<,01$), ou un traitement par des statines (35,9%; $P<,01$).

Conclusion Une clinique en milieu communautaire dirigée par une infirmière praticienne peut améliorer plusieurs importants paramètres chez des patients à risque de développer une maladie rénale chronique. Plusieurs études ont montré que l'atteinte des cibles visées par les traitements s'accompagne d'une diminution du risque de décès et d'accidents cardiovasculaires prématurés; il reste à déterminer quel sera l'effet de l'atteinte de ces importants objectifs sur la population des Premières nations.

POINTS DE REPÈRE DU RÉDACTEUR

- Les membres des Premières nations canadiennes qui souffrent de diabète ont des taux de maladie rénale chronique et de néphropathie terminale plus élevés que les non-autochtones.
- Cette étude a montré qu'une clinique dirigée par une infirmière praticienne dans une communauté rurale des Premières nations a aidé les patients à atteindre les valeurs cibles recommandées par les directives pour la tension artérielle, l'hémoglobine A1c et les lipoprotéines de basse densité. Une augmentation de l'utilisation du traitement antiplaquettaire, d'agents inhibiteurs de l'enzyme de conversion de l'angiotensine ou de bloqueurs des récepteurs de l'angiotensine, et du traitement par les statines a aussi été observée dans cette communauté.
- Cette étude confirme que des interventions multifactorielles sont associées à une réduction de la morbidité et de la mortalité.

Cet article a fait l'objet d'une révision par des pairs.
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The prevalence of chronic kidney disease (CKD) and end-stage renal disease (ESRD) is substantially higher among the First Nations population.[1,2] The increased risk in this population might be related to a higher prevalence of diabetes, although other factors, including access to health care services, have also been shown to be relevant.[3-5] Compared with non–First Nations people, First Nations people with reduced kidney function are less likely to be referred to nephrologists[6] and are more likely to be admitted to hospital for conditions that, if managed in the outpatient setting, need not result in hospitalization.[7]

Multifactorial interventions among patients with diabetes have been shown to reduce the risk of adverse outcomes, including progression to ESRD.[8,9] A study in northern Alberta demonstrated that community-based, nurse-led clinics substantially increased the number of patients with diabetes meeting evidence-based treatment targets for many clinically important variables.[10] However, it is not known if a similar intervention directed specifically at First Nations people would have a comparable effect.

Owing to the high prevalence of diabetes among the First Nations population, the increased risk of CKD and ESRD, and their potentially limited access to specialized care, we implemented a nephropathy-prevention clinic in a First Nations community in southern Alberta. The purpose of this study was to evaluate the effectiveness of this clinic in achieving target blood pressure (BP), hemoglobin A_{1c} (HbA_{1c}), and low-density lipoprotein (LDL) levels, as well as in improving the use of clinically indicated medications, among members of the Siksika Nation.

METHODS

Participants with 1 or more risk factors for CKD were eligible for referral to the clinic, including patients with diabetes mellitus (with or without proteinuria), hypertension, or dyslipidemia. Most patients who were treated in the clinic (and all those included in this evaluation study) had diabetes mellitus. The clinic was established in 2006, and for the purpose of this study, follow-up was to February 2010. Referrals were initiated by any member of the health care team at the health centre or within the local community. The study was approved by the University of Calgary Conjoint Health Research Ethics Board and the governing body of Siksika Nation. Individual patient consent was not required, as this was part of a quality improvement project.

Siksika Nation is a community of 6000 First Nations members located approximately 95 km east of the nearest tertiary care centre in Calgary, Alta. Siksika has an established health services centre, which offers primary health care services to its members as delivered by primary care physicians and nurses. Members can also access on-site laboratory, diagnostic imaging, and team-based services, such as chronic disease management, dietary counseling, and prenatal and postnatal care. Additionally, community health programs such as outbreak management are coordinated through this centre. For Siksika Nation members, travel to the nearest specialist requires approximately 1 hour of driving time.

Data collection

Before establishing the clinic, endorsement of the project concept was sought through meetings with members of the Siksika Health Committee and local elders. Concomitantly, input regarding clinic structure and promotion of the clinic to the local First Nations community was sought from the committee, as well as the Siksika Nation Chief and Council. Together, it was determined that the clinic would use evidence-based guidelines and operate on a once-weekly basis to balance increasing capacity, while ensuring the continuation of previously established services. Existing clinic staff members, including the First Nations community health worker, were recruited to participate in the operation of the clinic. These staff members initiated referrals for eligible patients and assisted in booking appointments.

At each initial visit a complete medical history and physical examination was conducted by a dedicated nurse practitioner. Baseline laboratory values were collected for HbA_{1c}, estimated glomerular filtration rate (in mL/min/1.73 m^2), microalbumin-creatinine ratio, and LDL cholesterol. All laboratory and clinic information was recorded in the clinic's secure electronic medical record.

Based on these data, and according to clinical standards of practice provided by the Canadian Diabetes Association,[11] Canadian Cardiovascular Society,[12] and Canadian Hypertension Education Program,[13] patients were counseled regarding lifestyle modifications and glycemic control, and were prescribed acetylsalicylic acid (ASA), angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) medications, or statin therapy at initial or subsequent visits, as clinically indicated. At each follow-up visit, an assessment of vital signs, medications, and laboratory investigations was conducted and adjustments to medications were made as required.

Patients with at least 1 baseline and follow-up visit were included in the analysis. The primary outcomes were reduction in HbA_{1c}, systolic and diastolic BP, and LDL levels, as well as improved use of indicated medications. Paired *t* tests were used to assess the difference between baseline and follow-up measurements of continuous variables, and χ^2 tests were used to assess the difference between proportions. A 2-sided *P* value of .05 was used to indicate statistical significance.

RESULTS

A total of 82 people were referred to the clinic; of these, 78 (95.1%) people had at least 2 visits and were included in the analysis. The mean age of the participants was 56.1 years old, and 61.5% of participants were women (**Table 1**). All patients included in the analysis had diabetes, and the mean duration of diagnosis was 12.0 years. The median duration of follow-up (from initial referral to last clinic visit before the close of data collection) was 17 months.

Table 1. Participant characteristics at baseline: *N* = 78.

VARIABLE	VALUE
Female sex, n (%)	48 (61.5)
Mean (SD) duration of diabetes, y	12 (9.0)
Mean (SD) age, y	56.1 (14.7)
Prescribed ASA, n (%)	37 (47.4)
Prescribed ACEI or ARB, n (%)	31 (39.7)
Prescribed lipid-lowering therapy, n (%)	24 (30.8)

ACEI—angiotensin-converting enzyme inhibitor, ARB—angiotensin receptor blocker, ASA—acetylsalicylic acid.

Table 2 shows the mean (SD) HbA_{1c}, systolic and diastolic BP, and LDL measurements of all patients, as well as those patients above target at baseline.

Reduction in HbA_{1c} level. Among patients with diabetes and at least 2 HbA_{1c} measurements (n = 68) there was a non-significant 0.17% reduction in mean HbA_{1c} ($P = .58$). Seventy-two percent of patients had HbA_{1c} levels above 7.0% at baseline. In this subgroup, there was a statistically significant reduction in mean HbA_{1c} from 9.67% to 8.70% (0.96%; $P < .01$) (**Figure 1**). At the end of the study, 35.3% of participants achieved the HbA_{1c} target of less than 7.0%, an absolute increase of 11.3% from baseline ($P < .05$) (**Figure 2**).

Reduction in LDL level. Overall, there was a non-significant reduction in mean LDL concentrations (0.32 mmol/L; $P = .09$). Forty-nine percent of patients had baseline LDL levels greater than 2.0 mmol/L. Among these patients, there was a significant decrease in LDL levels of 0.62 mmol/L ($P < .01$) (**Figure 1**). At the end of the study, 37.1% of patients achieved the LDL target of less than 2.0 mmol/L, a significant increase of 10.7% ($P < .01$) (**Figure 2**).

Reduction in BP level. Among all participants, there was a statistically significant reduction in mean diastolic BP (4.58 mm Hg; 95% CI 1.51 to 7.65 mm Hg; $P = .004$). There was a non-significant reduction in systolic BP (4.31 mm Hg; 95% CI -0.64 to 9.26 mm Hg; $P = .087$). Participants with baseline systolic BP greater than 130 mm Hg experienced a significant reduction in both systolic BP level (15.84; 95% CI 1.13 to 13.19; $P = .022$) and diastolic BP level (7.16 mm Hg; 95% CI 8.95 to 22.73; $P < .001$) (**Figure 1**). At the end of the study, there was a non-significant trend toward increased achieved target systolic BP rates ($P = .35$) (**Figure 2**).

Receipt of indicated drug therapy. At baseline, 39.7% of patients were prescribed ASA; this increased to 82.1% at the study's end ($P < .01$). Statin therapy also significantly increased from 30.8% at baseline to 66.7% ($P < .01$), and ACEI or ARB prescriptions increased from 47.4% to 83.3% ($P < .01$) (**Figure 3**).

DISCUSSION

Our data add to the evidence that targeted interventions can result in improvements in BP level and lipid and blood glucose control, and, more important, these results can be achieved among First Nations people with diabetes.[14] Specifically, we have shown that a once-weekly visit to a nurse-led clinic in a rural First Nations community improves achievement of guideline-based treatment targets. Among patients initially above target, there was a significant increase in the proportion achieving target HbA_{1c} ($P < .01$), LDL ($P < .01$), and systolic ($P < .05$) and diastolic ($P < .01$) BP levels. Use of antiplatelet therapy ($P < .01$), ACEI or ARB medications ($P < .01$), and statin therapy ($P < .01$) also significantly improved.

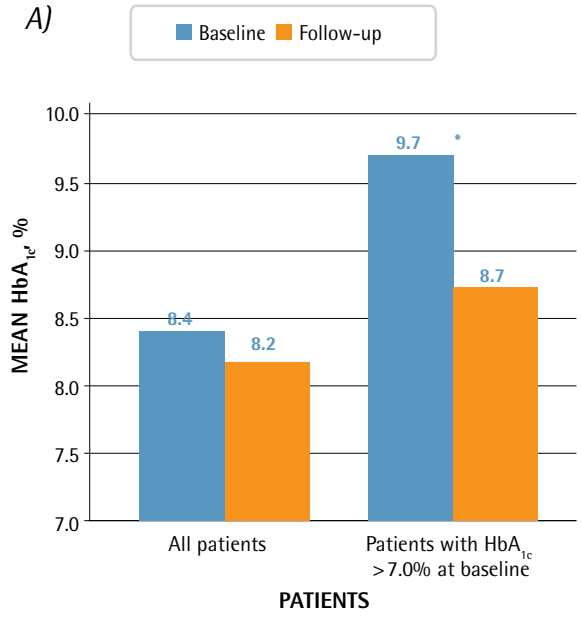
The development and progression of CKD can be due to a variety of factors and requires a broad approach to reducing its occurrence and progression.[15] Previous

Table 2. Mean (SD) HbA_{1c}, SBP, DBP, and LDL measurements of all patients and those above target at baseline

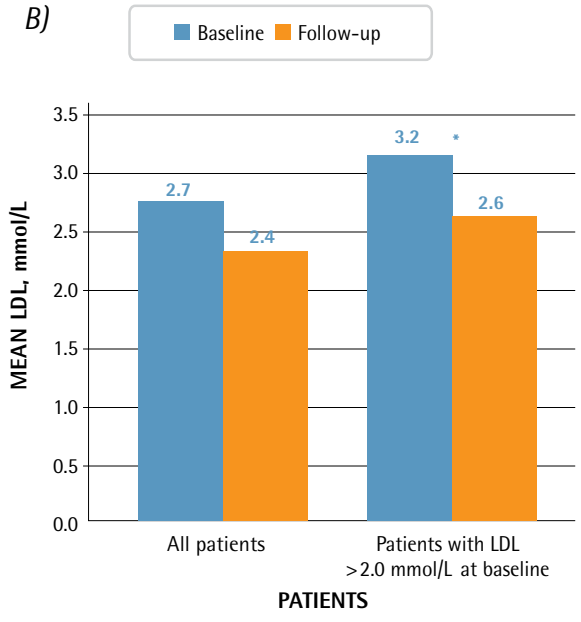
	OVERALL		ABOVE TARGET AT BASELINE	
VARIABLE	NO. OF PATIENTS, N (%)	MEAN (SD) OF VALUE	NO. OF PATIENTS, N (%)	MEAN (SD) OF VALUE
HbA_{1c}, %	75 (96.2)	8.5 (2.7)	56 (71.8)	9.67 (1.79)
SBP, mm Hg	65 (83.3)	129.6 (16.4)	25 (32.1)	146.1 (12.2)
DBP, mm Hg	65 (83.3)	79.6 (10.1)	25 (32.1)	85.4 (10.4)
LDL, mmol/L	53 (67.9)	2.68 (1.02)	38 (48.7)	3.19 (0.84)

DBP—diastolic blood pressure, HbA_{1c}—hemoglobin A_{1c}, LDL—low-density lipoprotein, SBP—systolic blood pressure.

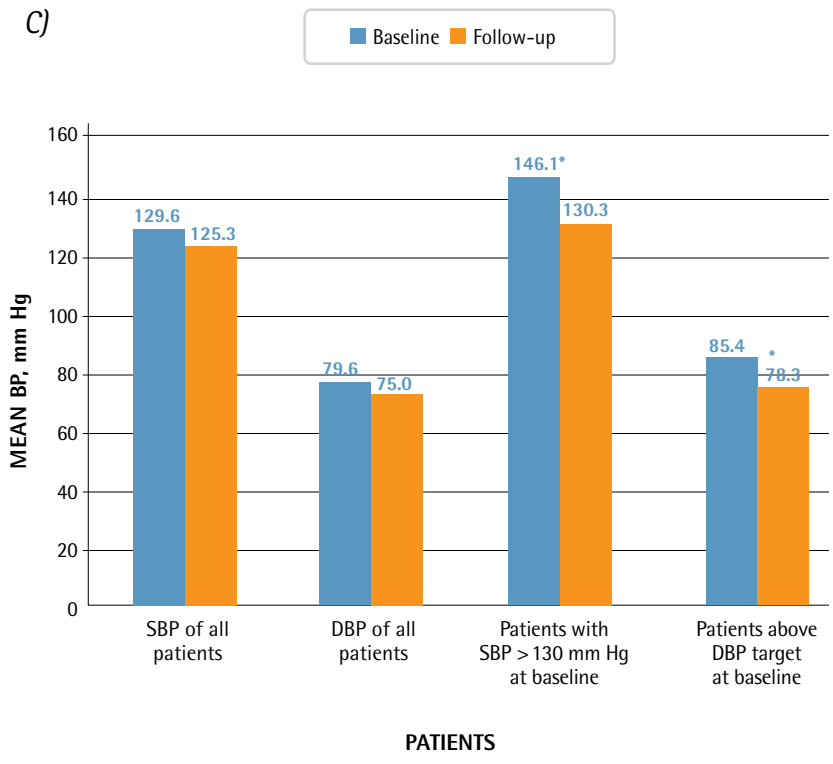
Figure 1. Changes in mean measurements in all patients and those above target at baseline: *A) HbA_{1c} levels, B) LDL levels, and C) SBP and DBP levels.*



HbA_{1c}—hemoglobin A_{1c}.
*Denotes significant difference ($P < .01$).

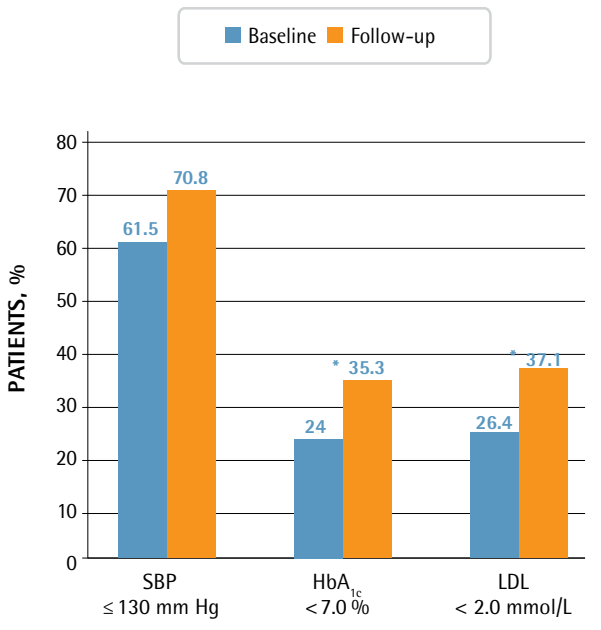


LDL—low-density lipoprotein.
*Denotes significant difference ($P < .01$).



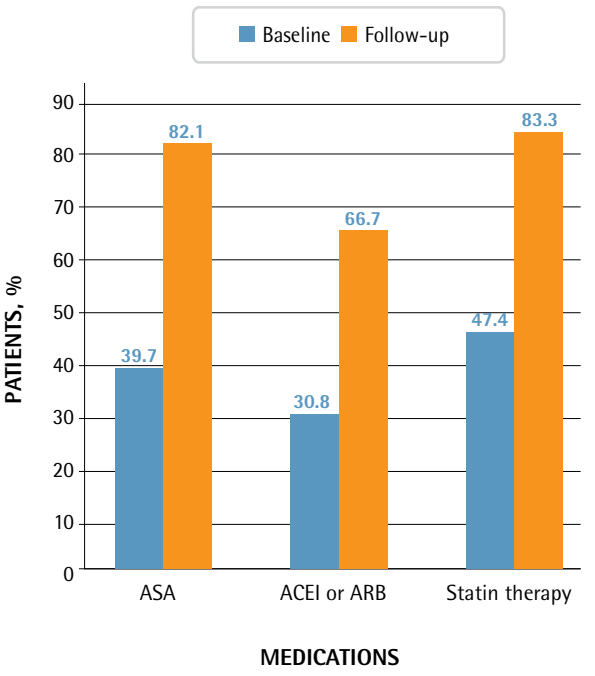
BP—blood pressure, DBP—diastolic blood pressure, SBP—systolic blood pressure.
*Denotes significant difference ($P < .05$).

Figure 2. Percentage of patients achieving guideline-recommended SBP, HbA_{1c}, and LDL targets at baseline and follow-up



HbA_{1c}—hemoglobin A_{1c}, LDL—low-density lipoprotein, SBP—systolic blood pressure.
*Denotes significant difference ($P < .05$).

Figure 3. Percentage of patients receiving indicated medications at baseline and at last follow-up: *For all medication groups, P <.01 for comparison between baseline and follow-up.*



ACEI—angiotensin-converting enzyme inhibitor, ARB—angiotensin receptor blocker, ASA—acetylsalicylic acid.

research exploring the use of nonphysician health care workers has demonstrated improvement in modifiable CKD risk factors in rural populations. The DREAM 3 (Diabetes Risk Evaluation and Microalbuminuria) trial—which randomized 95 First Nations patients with hypertension and diabetes to either home-care nursing with a treatment algorithm for hypertension, or home-care with hypertension-management decisions made solely by the primary care physician—showed a significant decrease in systolic BP for both groups ($P < .001$), with an additional significant decrease in diastolic BP in the home-care plus algorithm treatment arm ($P = .05$).[16] Results from a case-control study of almost 300 Australian Aborigines similarly demonstrated significant reductions in BP when local health care workers instituted multifactorial interventions targeting BP, lipid levels, and glycemic control ($P < .05$). More important, this study found a mortality and cost benefit to this intervention.[17] Our work corroborates and extends these findings to nurse-led interventions with First Nations people in Alberta's rural setting. However, it is important to note that the services provided in this nurse-led clinic are similar to those provided by primary care physicians.

The cornerstones of multifactorial risk management for those with elevated CKD risk, such as people with diabetes, includes BP and cholesterol reductions, along with antiplatelet therapies, to lower the risk of progression to CKD, as well as the risk of adverse cardiovascular events.[18] The landmark Steno-2 trial, which randomized high-risk patients with diabetes to either an intensive, target-driven, multifactorial program or conventional control, demonstrated the efficacy of multifactorial interventions in a community setting. After 7.8 years of follow-up, there were significant improvements in HbA_{1c} ($P < .001$), fasting LDL cholesterol ($P < .001$), and BP levels ($P < .01$) for those patients in the intensive therapy group, which translated to reductions in the primary composite cardiovascular outcomes and secondary microvascular outcomes.[8] When follow-up was extended to 13.3 years, a trend to lower cardiovascular deaths and a 20% absolute risk reduction in death emerged among the intensively treated individuals. Additionally, intensive control lowered diabetic nephropathy, retinopathy, and autonomic neuropathy rates. Finally, progression to ESRD requiring dialysis was significantly lowered by the intensive, multifactorial targeted management strategy.[9] The beneficial effect

of interventions directed at multiple risk factors in patients with diabetes appears to be additive.

Limitations

The results of our study should be considered in light of the study limitations. First, our results are based on a pre-post comparison of patients who attended the nephropathy-prevention clinic, and did not include a control group. While the lack of a control group was a limitation, there were no other changes to health care delivery during that period, which might have influenced the outcome. Second, the results are based on a single-centre experience; however, there is no reason to believe that these results could not be generalized to other First Nations communities in Canada, as well. Third, baseline measures of BP were missing in approximately one-quarter of patients, although there is no reason to believe that the data were missing in a systematic manner, and thus would not bias the study results. Finally, our study was not designed to detect mortality differences nor to evaluate the rates of microvascular and macrovascular disease progression, but rather to find relevant and important surrogate outcomes including achieved improvements in BP, LDL cholesterol, glycemic control, and ongoing medical therapies as recommended by the Canadian Diabetes Association, Canadian Cardiovascular Society, and Canadian Hypertension Education Program.[11-13]

Conclusion

Adequate management of patients at high risk of developing CKD is complex, and First Nations people in Canada in particular are at a higher risk of developing kidney disease. We found that this community-based, nurse-led clinic in this population substantially improved the achievement of guideline-based treatment targets for BP, diabetes, and lipid control, as well as increased the use of antiplatelet therapy, ACEI or ARB medications, and statin therapy. More important, improvements in relevant laboratory test results were seen to a greater degree among patients whose initial values were above guideline-recommended targets. The effect of these interventions has been shown in other studies to reduce the risk of death and cardiovascular events; the effect in the First Nations population on these hard clinical end points remains to be determined.

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Contributors

All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

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