Impact of point-of-care screening for hypertension, diabetes and progression of chronic kidney disease in rural Manitoba Indigenous communities

Oksana Harasemiw MSc, Thomas Ferguson MSc, Barry Lavallee MD, Lorraine McLeod RN, Caroline Chartrand RN, Claudio Rigatto MD, Navdeep Tangri MD, Allison Dart MD, Paul Komenda MD

ABSTRACT

BACKGROUND: In 2013–2015, we conducted point-of-care screening for hypertension, diabetes and chronic kidney disease in rural and remote Indigenous communities in Manitoba, Canada. In this study, we aimed to determine whether optimal follow-up care was provided, defined as proportion of individuals with appropriate kidney disease laboratory testing, medication prescriptions and physician visits.

METHODS: We linked screening data from participants to provincial administrative data sets to evaluate whether frequencies of laboratory testing, prescriptions of disease-modifying medications, and primary care and nephrology

visits differed in the 18 months before and after screening. We also conducted a propensity score matching analysis to compare outcomes between screened and unscreened adults.

RESULTS: Of 1353 adults who received the screening intervention and who had complete administrative data available, 44% were at risk of kidney failure at screening. Among these individuals, frequencies of comprehensive laboratory testing (estimated glomerular filtration rate and urine albumin to creatinine ratio) improved by 17.0% (95% confidence interval [CI] 11.5 to 22.5), antihyperglycemic medications improved by 4.4% (95% CI 1.0 to 7.8), and nephrol-

ogy visits for participants meeting referral criteria improved by 5.9% (95% CI 3.4 to 8.5). We observed significant improvements in laboratory testing, antihyperglycemic medications and nephrology visits in the screened group compared with the 1:1 matched comparison group.

INTERPRETATION: Point-of-care screening programs in rural and remote Indigenous communities are adaptable methods for increasing awareness, monitoring risk and treating chronic diseases. Interventions such as the development of a national screening program could improve chronic disease care in high-risk populations.

I ndigenous people living in rural and remote communities in Canada are often faced with poor clinical and patient-oriented outcomes, in particular higher rates of chronic kidney disease,[1,2] and its antecedent risk factors of diabetes[3] and hypertension.[4] They are also at a higher risk of kidney failure requiring dialysis at a younger age,[5–8] and are often required to relocate to urban communities for dialysis, which may negatively affect quality of life.[9] Although progression of chronic kidney disease to kidney failure can be delayed or prevented with earlier optimization of lifestyle risk factors[10,11] and targeted pharmacologic interventions,[12–14] timely identification and stratification based on risk of progressing to kidney failure is necessary. Barriers to care such as poverty and poor access to services, which are related to intergenerational exposure to systemic

racism, are salient in rural and remote Indigenous communities and contribute to people often presenting late in their disease course, reducing the time available for preventive interventions.

Targeted screening programs using point-of-care testing equipment directed toward high-risk populations with diabetes and high blood pressure, or populations known to progress rapidly or who have limited access to primary health care, have been shown to be cost-effective methods for identifying and triaging patients to best align resources and treatment pathways with risk of progression.[15–17] A program evaluation of a point-of-care testing program in Australia (the Quality Assurance for Aboriginal & Torres Strait Islander Medical Services) found that in the 2 years after the introduction of the program, there was an increase in monitoring

of hemoglobin A_{1c} (HbA_{1c}) and urine albumin to creatinine ratio (UACR) levels, and individuals became more aware of their risk and more compliant with monitoring of their risk factors.[18]

The First Nations Community-Based Screening to Improve Kidney Health and Prevent Dialysis (FINISHED) initiative was an Indigenous-led, multidisciplinary mobile point-of-care screening program for chronic kidney disease, diabetes and hypertension, in rural (accessible by road) and remote (accessible by flying-in or by ice roads in winter) Indigenous communities in Manitoba.[19] The program was designed and executed in close collaboration with Indigenous leaders and organizations.[19] Previous studies presenting cross-sectional results from FINISHED showed a greater than twofold higher prevalence of chronic kidney disease in people screened compared with the general Canadian population, with prevalence rates of chronic kidney disease and risk factors highest in remote communities.[20,21] However, the impact of the one-time screening program on ongoing surveillance of individuals who participated and how participants' health service utilization patterns compare with those of individuals living in unscreened communities remains unknown. We aimed to estimate the frequencies of appropriate follow-up laboratory testing, medication prescriptions and physician visits within the 18 months after screening, by linking the FINISHED database to provincial administrative databases.

Methods

Study design and data sources

Using personal health identification numbers, we linked the FINISHED screening database with 5 provincial administrative health databases (Appendix 1, Supplementary Table 1, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.201731/tab-related -content) housed within the Population Health Research Data Repository at the Manitoba Centre for Health Policy.[22] Although health care services for individuals registered under the *Indian Act* of Canada living on reserves and traditional territories are predominantly funded by federal programs, the Manitoba government funds hospital and physician services in the province, and clinical visits are therefore captured in the provincial administrative databases. Also captured are laboratory tests from publicly funded laboratories, as well as all drug prescriptions.

Participants consented to having their screening data linked with administrative health databases. Additionally, we also received Band Council Resolutions for the linkage from the Regional Health Authority, and the Health Services of the Tribal Councils where screening occurred. Indigenous research principles of Ownership, Control, Access and Possession have been followed throughout this project.

Intervention group

Our study population included the adults screened as part of the FINISHED initiative between Mar. 11, 2013, and Mar. 26, 2015, who had administrative data available for the 18 months immediately before and after screening. The FINISHED screening program partnered with 2 Tribal Councils to recruit individuals from all of their communities (9 rural and 4 remote). In each of the communities, townhall meetings were conducted to raise initial awareness of the screening program and to provide community members with an

opportunity to ask questions and provide feedback. Before the screening sessions, door hangers were hand-delivered to each home with screening time and location information, and advertising campaigns were launched on provincial and local radio stations.

During each screening session, clinical teams collected demographic information, as well as one 0.1 mL droplet of blood that was analyzed for blood chemistry using the Piccolo Xpress (Abaxis). An additional finger-prick droplet was taken for analysis of HbA_{1c}, and a urine sample for UACR. Both samples were analyzed using the DCA Vantage Analyzer (Siemens). A mean of 6 blood pressure measurements were taken using the BpTRU Medical Device. Screeners conducted a comprehensive quality assurance process on the point-of-care testing equipment to ensure precision and accuracy and calibrated it to a mainframe laboratory. Screeners conducted the internal quality assurance process daily using human serum samples with predefined performance limits; this was monitored by an external reference method laboratory (Canadian External Quality Assurance Laboratory, Vancouver, BC).

Screeners entered all data into a customized iPad app that calculated participants' 5-year risk of kidney failure.[19] Participants received their results in real time during a risk-based counselling session. The program operated on the basis of a "closed loop" system of care, aiming to ensure risk-appropriate follow-up care was provided; each participant's results were sent to their primary care provider with specific treatment recommendations for ongoing surveillance, and intermediate- and high-risk individuals were referred to a nephrologist. Additionally, participants without a dedicated primary care physician were referred to the primary care team or nursing station located within their community for continued follow-up.
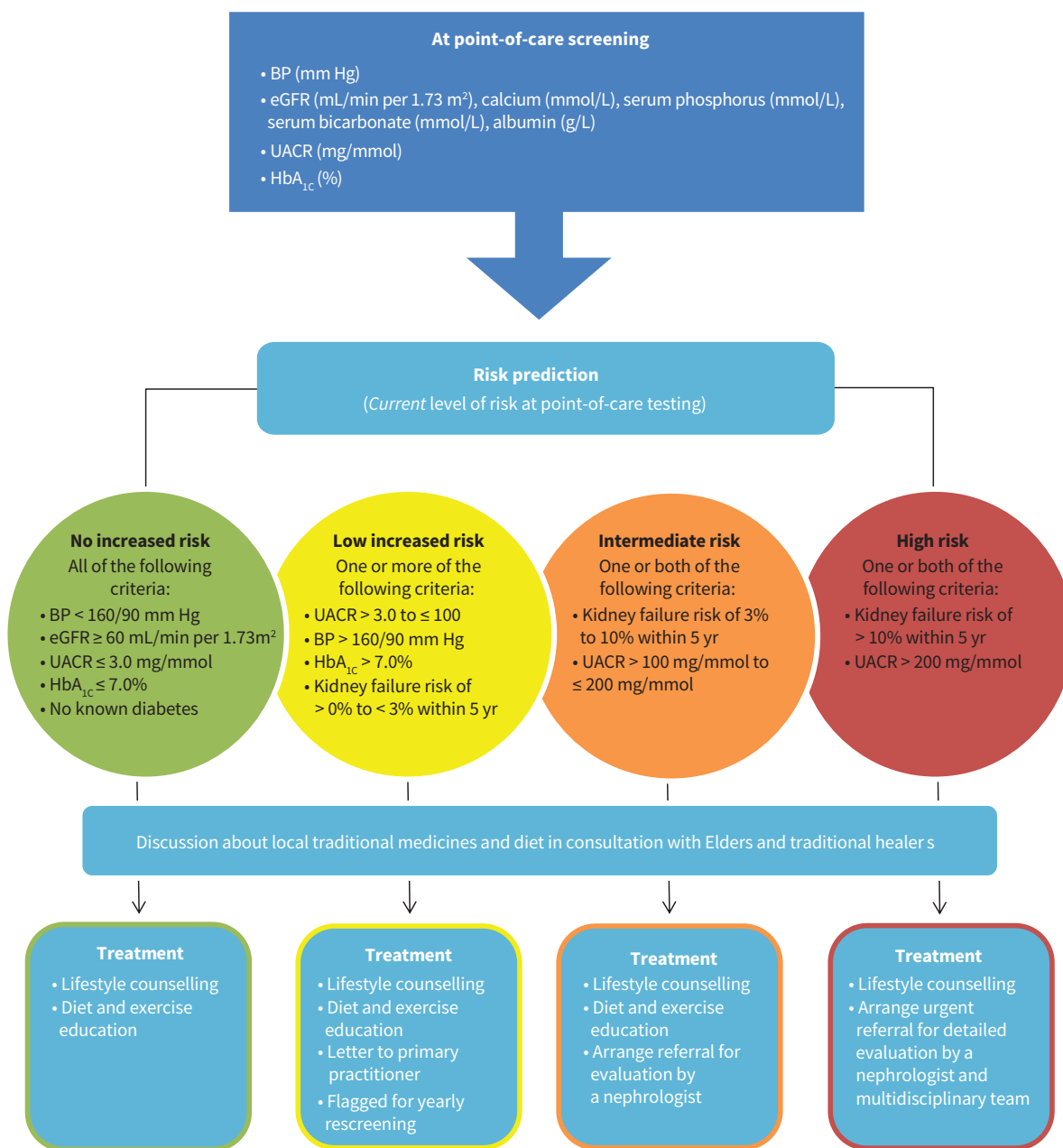
Kidney failure risk

At the time of their point-of-care screening assessment, participants were classified into categories that reflected their risk of progressing to kidney failure within the next 5 years (no risk, low risk, intermediate risk or high risk) using our risk paradigm (Figure 1), which incorporated the Kidney Failure Risk Equation[23,24] and other clinically relevant risk factors. For the current analyses, we dichotomized the groups into no risk and some risk (low, intermediate, or high risk), owing to small cell sizes for some of the outcome measures.

Outcomes

Outcomes analyzed include the following outpatient laboratory tests: UACR or urine protein to creatinine ratio (UPCR), estimated glomerular filtration rate (eGFR) and HbA_{1c} in people with diabetes, within the 18 months before the date of screening ("the index date"), versus within the 18 months after the date of screening. We also evaluated the composite outcome of 1 or more UACR or UPCR test and 1 or more eGFR test in the pre- and postscreening periods.

We evaluated use of the following disease-modifying medications: statins, angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs) (for individuals with a UACR ≥ 3 mg/mmol, or diabetes), any other antihypertensive medications, and antihyperglycemic medications (in individuals with diabetes). All medications were classified according to the Anatomical Therapeutic Chemical system (Appendix 1, Supplementary Table 2).

At point-of-care screening
- BP (mm Hg)
- eGFR (mL/min per 1.73 m²), calcium (mmol/L), serum phosphorus (mmol/L), serum bicarbonate (mmol/L), albumin (g/L)
- UACR (mg/mmol)
- HbA$_{1c}$ (%)

Risk prediction
(*Current* level of risk at point-of-care testing)

No increased risk
All of the following criteria:
- BP < 160/90 mm Hg
- eGFR ≥ 60 mL/min per 1.73m²
- UACR ≤ 3.0 mg/mmol
- HbA$_{1c}$ ≤ 7.0%
- No known diabetes

Low increased risk
One or more of the following criteria:
- UACR > 3.0 to ≤ 100
- BP > 160/90 mm Hg
- HbA$_{1c}$ > 7.0%
- Kidney failure risk of > 0% to < 3% within 5 yr

Intermediate risk
One or both of the following criteria:
- Kidney failure risk of 3% to 10% within 5 yr
- UACR > 100 mg/mmol to ≤ 200 mg/mmol

High risk
One or both of the following criteria:
- Kidney failure risk of > 10% within 5 yr
- UACR > 200 mg/mmol

Discussion about local traditional medicines and diet in consultation with Elders and traditional healers

Treatment
- Lifestyle counselling
- Diet and exercise education

Treatment
- Lifestyle counselling
- Diet and exercise education
- Letter to primary practitioner
- Flagged for yearly rescreening

Treatment
- Lifestyle counselling
- Diet and exercise education
- Arrange referral for evaluation by a nephrologist

Treatment
- Lifestyle counselling
- Arrange urgent referral for detailed evaluation by a nephrologist and multidisciplinary team

Figure 1: Criteria for determining kidney failure risk. Note: BP = blood pressure, eGFR = estimated glomerular filtration rate, HbA$_{1c}$ = glycosylated hemoglobin, UACR = urine albumin to creatinine ratio.

We identified visits to nephrologists and primary care physicians in outpatient settings 18 months pre- and postscreening using codes associated with physicians' practice, according to previously validated case definitions established by the Manitoba Centre for Health Policy.[25,26]

Matched control comparison

To assess whether the change in frequencies of each outcome measure observed over time in the intervention group significantly differed from a group of individuals who did not receive the intervention, we assembled a 1:1 matched comparison group consisting of adults living in rural and remote Indigenous communities that were not part of FINISHED, using propensity score methods. We assigned a pseudo-screening date to individuals in the comparison group based on the frequency distributions of time from start to end of the screening period.[27,28] We matched individuals screened by FINISHED 1 to 1 with individuals in the comparison group, without replacement, within a caliper distance of 20% of the pooled standard deviation of the logit of the propensity score.[29] Variables used in the propensity score model included age, sex, rural or remote dwelling location, and comorbidities. We calculated standardized differences for all characteristics to assess balance between groups and considered a greater than 10% difference between groups after matching to be unbalanced.
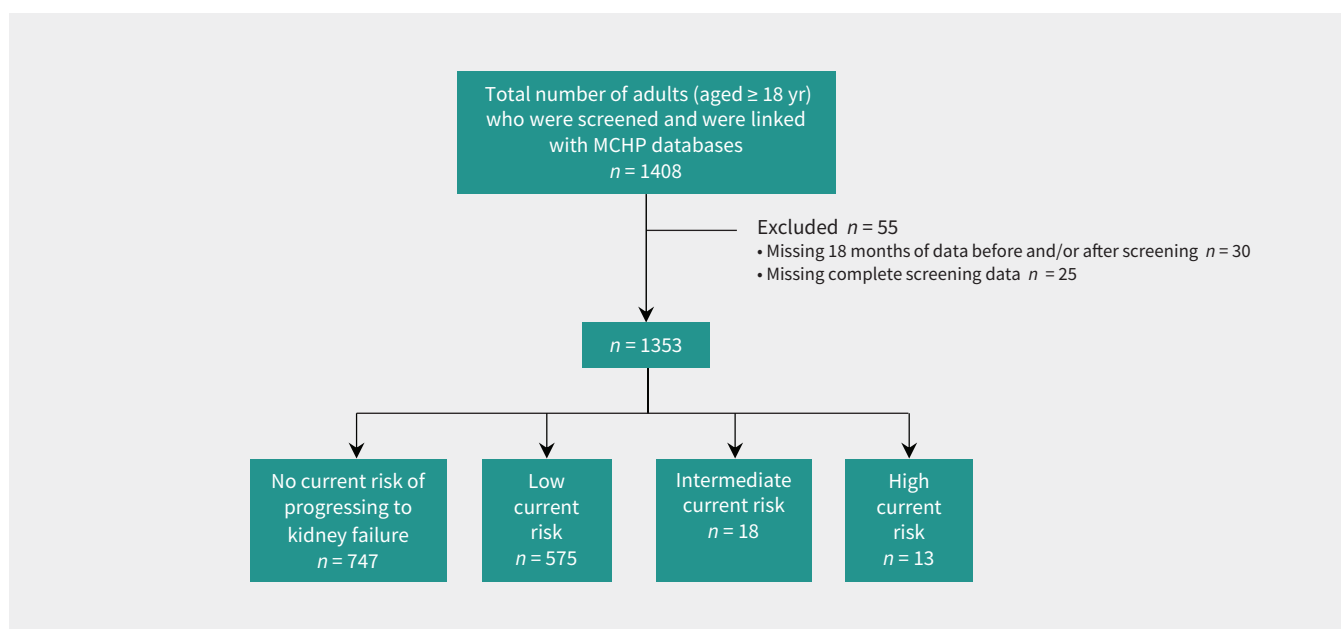
Figure 2: Study flow diagram. Note: MCHP = Manitoba Centre for Health Policy.

Table 1: Adult FINISHED participants with "no risk" of kidney failure versus those with "at least some risk" (low, intermediate or high risk), at time of their point-of-care screening*

Characteristic	All† *n* = 1353	No risk†‡ *n* = 747	At least some risk†‡ *n* = 606
Mean age ± SD, yr	45.9 ± 14.4	42.5 ± 14.7	50.2 ± 12.7
Female sex, no. (%)	822 (60.8)	453 (60.6)	369 (60.9)
Dwelling location, no. (%)			
Rural	744 (55.0)	464 (62.1)	280 (46.2)
Remote	609 (45.0)	283 (37.9)	326 (53.8)
Mean systolic blood pressure ± SD, mm Hg	121.6 ± 16.4	117 ± 12.9	126.9 ± 18.6
Mean diastolic blood pressure ± SD, mm Hg	75.6 ± 10.5	73.8 ± 8.6	77.1 ± 12.2
Elevated blood pressure§, no. (%)	212 (15.7)	39 (5.2)	173 (28.6)
Mean eGFR ± SD, mL/min per 1.73 m^2	106.2 ± 21.4	108.9 ± 18.7	103.0 ± 24.0
No. (%) with an eGFR < 60 mL/min per 1.73 m^2	supp.	supp.	37 (6.1)
Median UACR (IQR), mg/mmol	1.5 (0.6 to 3.1)	0.8 (0.5 to 1.6)	3.7 (1.6 to 11.3)
HbA$_{1c}$ > 7.0%, no. (%)	398 (29.4)	–	398 (65.7)
Kidney failure risk‡, no. (%)			
No risk	747 (55.2)	747 (100)	–
Low risk	575 (42.5)	–	575 (94.9)
Intermediate risk	18 (1.3)	–	18 (3.0)
High risk	13 (1.0)	–	13 (2.2)

Note: DBP = diastolic blood pressure, eGFR = estimated glomerular filtration rate, HbA$_{1c}$ = glycated hemoglobin, IQR = interquartile range, SBP = systolic blood pressure, SD = standard deviation, supp. = value suppressed owing to small cell size, UACR = urine albumin to creatinine ratio.
*Some categories may not sum to 100% due to rounding.
†Data values are percentages unless otherwise specified in column 1.
‡The criteria for determining kidney failure risk are presented in Figure 1.
§Elevated blood pressure defined as SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg.

Table 2: Proportion of individuals receiving appropriate laboratory testing, disease-modifying medications and follow-up with primary care and nephrology physicians, before and after point-of-care screening, stratified by risk level

Characteristic	No risk at screening n = 747			At least some risk at screening n = 606			Difference in % change (95% CI)†
	% before screening	% after screening	% difference (95% CI)*	% before screening	% after screening	% difference (95% CI)*	
Comprehensive testing (eGFR + UACR or UPCR testing)	16.3	25.2	8.8 (4.8 to 12.9)	49.3	66.3	17.0 (11.5 to 22.5)	8.2 (1.5 to 14.9)
eGFR testing	38.4	53.2	14.7 (9.7 to 19.2)	64.7	82.0	17.3 (12.4 to 22.2)	2.6 (−4.5 to 9.7)
UACR or UPCR testing	24.1	27.4	3.4 (−1.1 to 7.8)	61.6	69.5	7.9 (2.6 to 13.3)	4.6 (−2.3 to 11.5)
HbA$_{1c}$‡	–	–	–	85.7	89.4	3.7 (−0.5 to 8.0)	–
Disease-modifying medications							
Statin	14.3	14.7	0.4 (−3.2 to 4.0)	51.3	55.0	3.6 (−2.0 to 9.3)	3.2 (−3.2 to 9.7)
Antihyperglycemic medications‡	–	–	–	90.5	94.9	4.4 (1.0 to 7.8)	–
ACE inhibitor or ARB§	–	–	–	65.3	67.5	2.2 (−3.4 to 7.8)	–
Any other antihypertensive	14.3	15.8	1.5 (−2.2 to 5.1)	36.8	41.4	4.6 (−0.9 to 10.1)	3.2 (−3.2 to 9.5)
Primary care visits	85.3	84.7	−0.5 (−4.2 to 3.1)	94.2	93.7	−0.5 (−3.2 to 2.2)	0 (−4.7 to 4.7)
Nephrology visits	supp.	supp.	–	2.5	8.4	5.9 (3.4–8.5)	–

Note: ACE = angiotensin-converting enzyme, ARB = angiotensin receptor blocker, CI = confidence interval, eGFR = estimated glomerular filtration rate, HbA$_{1c}$ = glycated hemoglobin, supp. = value suppressed owing to small cell size, UACR = urine albumin to creatinine ratio, UPCR = urine protein to creatinine ratio.
*The % difference was calculated as follows: (the % frequency in the postintervention period – the % frequency in the preintervention period).
†The difference in % change was calculated as follows: [(% frequency after screening in the "at least some risk group" – % frequency preceding screening in the "at least some risk group") – (% frequency after screening in the "no risk" group – % frequency preceding screening in the "no risk" group)].
‡For participants with either diabetes, or an HbA$_{1c}$ test result > 7.0 at time of screening or within the 18 months before screening.
§Only in individuals with known diabetes, or a UACR test result ≥ 3 mg/mmol in the prescreening period or at time of screening.

Statistical analyses

Descriptive statistics are expressed as mean ± standard deviation for symmetrically distributed variables; median and interquartile ranges for skewed variables; and percentages for categorical variables. We compared frequencies of laboratory testing, medication prescriptions, and visits to primary care and nephrology in the 18 months before the screening date versus the frequencies observed in the 18 months after screening. The index date for all analyses was the date of screening. To evaluate whether the change in the frequency of outcomes between time periods differed between groups in each of the analyses (no risk v. some risk; rural dwelling location v. remote in people with some risk; 1:1 matched control group v. intervention group), we applied a difference-in-differences approach, which helps to control for secular trends over time. We constructed generalized estimating equation models where the changes over time were compared using the interaction between group (e.g., intervention and control) and time (pre- and post-).[30,31] We performed analyses using SAS version 9.4.

Ethics approval

The FINISHED screening program was approved by the University of Manitoba Health Research Ethics Board and by the Tribal Council leaders, Chief and council leaders in each of the communities.

Results

Intervention group

In total, 1470 adults were screened (see screening rates in Appendix 1, Supplementary Table 3). We were able to link 1408 individuals with administrative data, and 1353 had complete screening and administrative data available (Figure 2 shows the flow diagram); we identified 747 as having no risk of progressing to kidney failure at time of screening, and 606 as having at least some risk. Table 1 displays the demographic and screening characteristics of the population.

Table 2 presents the proportions of laboratory testing in the 18 months before and 18 months after the point-of-care screening. In the group of participants with at least some risk at screening, comprehensive testing improved by 17% (95% confidence interval

Table 3: Proportion of participants with "at least some risk" at screening of progressing to kidney failure who received appropriate laboratory testing, disease-modifying medications and follow-up with primary care and nephrology physicians, stratified by dwelling location

| | At least some risk of kidney failure at screening | | | | | | |
| | Rural dwellers $n = 280$ | | | Remote dwellers $n = 326$ | | | Difference in % change (95% CI)† |
Characteristic	% before screening	% after screening	% difference (95% CI)*	% before screening	% after screening	% difference (95% CI)*	
Comprehensive testing (eGFR + UACR or UPCR testing)	26.8	55.7	28.9 (21.1 to 36.7)	68.7	75.5	6.8 (−0.1 to 13.6)	−22.2 (−32.5 to −11.8)
eGFR testing	39.3	73.9	34.6 (27.0 to 42.3)	86.5	89.0	2.5 (−2.6 to 7.5)	−32.2 (−41.1 to −23.2)
UACR or UPCR testing	53.2	61.4	8.2 (0.05 to 16.4)	68.7	76.4	7.7 (0.8 to 14.5)	0.6 (−11.1 to 10.0)
HbA$_{1c}$‡	78.5	84.9	6.3 (−1.1 to 13.8)	91.6	93.2	1.6 (−3.1 to 6.3)	−4.7 (−13.2 to 3.8)
Disease-modifying medications							
Statin	50.4	51.8	1.4 (−6.9 to 9.7)	52.3	57.7	5.5 (−2.1 to 13.2)	4.1 (−7.2 to 15.3)
Antihyperglycemic medications‡	88.3	94.6	6.3 (1.0 to 11.7)	92.4	95.2	2.8 (−1.4 to 7.1)	−4.5 (−10.3 to 3.2)
ACE inhibitor or ARB§	63.4	64.2	0.8 (−7.7 to 9.4)	66.8	70.0	3.3 (−4.1 to 10.6)	2.4 (−8.8 to 13.7)
Any other antihypertensive	35.4	40.0	4.6 (−3.4 to 12.7)	38.0	42.6	4.6 (−2.9 to 12.1)	0.04 (−11.1 to 11.0)
Primary care visits	96.4	96.8	0.4 (−2.6 to 3.4)	92.3	91.1	−1.2 (−5.5 to 3.0)	−1.7 (−2.2 to 5.5)
Nephrology visits	supp.	4.6	–	3.4	11.7	8.3 (4.3 to 12.3)	–

Note: ACE = angiotensin-converting enzyme, ARB = angiotensin receptor blocker, CI = confidence interval, eGFR = estimated glomerular filtration rate, HbA$_{1c}$ = glycated hemoglobin, supp. = value suppressed owing to small cell size, UACR = urine albumin to creatinine ratio, UPCR = urine protein to creatinine ratio.
*The % difference was calculated as follows: (the % frequency in the postintervention period – the % frequency in the preintervention period).
†The difference in % change was calculated as follows: [(% frequency after screening in the *remote dwellers* – % frequency preceding screening in the *remote dwellers*) – (% frequency after screening in the *rural dwellers* – % frequency preceding screening in the *rural dwellers*)].
‡For participants with diabetes or an HbA$_{1c}$ test result > 7.0 at time of screening or within the 18 months before screening.
§Only in individuals with known diabetes, or a UACR test result ≥ 3 mg/mmol in the prescreening period or at time of screening.

[CI] 11.5% to 22.5%) an increase that was 8.2% (95% CI 1.5 to 14.9) greater than for people not at risk. eGFR testing increased by 17.3% (95% CI 12.4 to 22.2), and UACR or UPCR testing increased by 7.9% (95% CI 2.6 to 13.3). However, these improvements were not statistically different than for the people not at risk. For nephrology visits, in people with at least some risk at screening, visits significantly increased by 5.9% (95% CI 3.4 to 8.5).

Table 3 displays the results for individuals with at least some risk of kidney failure at screening, stratified by dwelling location. Substantial increases for laboratory testing, including UACR or UPCR, occurred in both rural and remote groups, and eGFR and HbA$_{1c}$ testing increased in the rural dwellers. The increase in comprehensive testing and eGFR testing in the rural group was statistically significantly higher than the increase in the remote group.

Intervention group versus matched comparison group
Appendix 1, Supplementary Table 4 presents demographic and comorbidity data on the intervention and comparison groups. The groups were balanced on age, sex, and comorbidities (the

standardized differences were all less than 0.1). Table 4 shows data comparing outcomes of the 2 groups; versus the comparison group, the intervention group overall had a significantly greater change in comprehensive laboratory tests completed (5.0% [95% CI 0.1% to 9.8%]), UACR or UPCR testing (5.8% [95% CI 0.7% to 10.9%]), HbA$_{1c}$ (7.0% [95% CI 0.6% to 13.3%]), antihyperglycemic medications (7.7% [95% CI 2.7% to 12.6%]) and nephrology visits (1.9% [95% CI 0.3% to 3.4%]). We did not observe any other statistically significant differences between groups with the remaining outcomes.

Interpretation

After point-of-care screening, we observed notable increases in laboratory testing of kidney function and urinary protein, prescriptions of disease-modifying medications, and visits to nephrology for individuals who had some risk of progressing to kidney failure at time of screening. Rural dwellers with at least some current risk had the greatest improvement in testing

Table 4: Propensity-matched comparison of percent change between the screened group and the nonscreened comparison group*

Characteristic	Comparison group n = 1353			Intervention group n = 1353			Difference in % change (95% CI)‡
	% before index date	% after index date	% difference (95% CI)†	% before index date	% after index date	% difference (95% CI)†	
Comprehensive testing (eGFR + UACR or UPCR testing)	19.8	27.4	7.5 (4.4 to 10.7)	31.1	43.6	12.5 (8.9 to 16.1)	5.0 (0.1 to 9.8)
eGFR testing	33.6	52.0	18.4 (14.7 to 22.1)	50.2	66.1	15.9 (12.2 to 19.6)	−2.5 (−7.7 to 2.7)
UACR or UPCR testing	31.4	31.0.	−0.4 (−3.9 to 3.1)	40.9	46.3	5.4 (1.7 to 9.1)	5.8 (0.7 to 10.9)
HbA$_{1c}$ testing§	80.4	77.0	−3.3 (−8.4 to 1.7)	85.4	89.0	3.6 (−0.3 to 7.6)	7.0 (0.6 to 13.3)
Disease-modifying medications							
Statin	23.1	26.7	3.6 (0.4 to 7.9)	30.9	32.7	1.9 (−1.7 to 5.4)	−1.8 (−6.6 to 3.0)
Antihyperglycemic medications§	91.9	88.0	−3.1 (−6.8 to 0.5)	88.6	93.1	4.5 (1.1 to 7.9)	7.7 (2.7 to 12.6)
ACE inhibitor or ARB¶	67.6	69.1	1.5 (−4.1 to 7.2)	63.3	65.8	2.4 (−2.7 to 7.6)	0.9 (−6.8 to 8.6)
Any other antihypertensive	27.0	28.2	1.2 (−2.2 to 4.6)	24.4	27.3	2.9 (−0.4 to 6.2)	1.7 (−3.0 to 6.4)
Primary care visits	80.5	76.9	−3.6 (−6.7 to −0.5)	89.2	88.8	−0.5 (−2.9 to 1.8)	3.1 (−0.08 to 7.0)
Nephrology visits	1.6	2.4	0.7 (−0.3 to 1.8)	1.3	3.8	2.6 (1.4 to 3.8)	1.9 (0.3 to 3.4)

Note: ACE = angiotensin-converting enzyme, ARB = angiotensin receptor blocker, CI = confidence interval, eGFR = estimated glomerular filtration rate, HbA$_{1c}$ = glycated hemoglobin, UACR = urine albumin to creatinine ratio, UPCR = urine protein to creatinine ratio.
*The index date is the date of screening in the intervention group, and the pseudo-screening date in the comparison group.
†The % difference was calculated as follows: (the % frequency in the postintervention period – the % frequency in the preintervention period).
‡The difference in % change was calculated as follows: [(% frequency after screening in the *intervention group* – % frequency preceding screening in the *intervention group*) – (% frequency after screening in the *comparison group* – % frequency preceding screening in the *comparison group*)].
§For participants with diabetes or an HbA$_{1c}$ test result > 7.0 at time of screening or within the 18 months before screening.
¶Only in individuals with known diabetes, or a UACR test result ≥ 3 mg/mmol in the prescreening period or at time of screening.

rates, whereas we saw only modest improvements among remote dwellers. This was in part because of low testing rates before screening in rural communities. Additionally, compared with a control group of individuals from unscreened Indigenous communities, screening was associated with substantially greater improvements in comprehensive testing, UACR or UPCR testing, use of antihyperglycemic medications and nephrology visits. Large-scale improvements in public health interventions take time to implement, scale and spread. We observed a larger than expected baseline level of testing and treatment compared with other studies from the general population.[32] We view this as positive in that the message regarding proper kidney disease screening had an effect on these primary care systems by a relatively small number of care providers and bodes well for the implementation of earlier, targeted interventions more widely available now, such as SGLT-2 inhibitors. These findings provide evidence to support the use of robust point-of-care testing programs that improve the identification of chronic kidney disease and risk factors,

which could help ensure individuals receive appropriate preventive care moving forward.

In population-based Canadian cohort studies of people with diabetes or chronic kidney disease or both, Indigenous individuals were less likely than non-Indigenous individuals to receive tests monitoring HbA$_{1c}$ and kidney function,[7,33] less likely to visit a nephrologist[34,35] or primary care physician, and had less continuity of care.[34] In a study assessing the management of type 2 diabetes and hypertension in select Canadian Indigenous communities, most individuals did not meet glycemic, lipid and blood pressure targets. Among people with diabetes, 55.1% were prescribed a statin, 72.1% an ACE inhibitor or an ARB, and 84.2% of people with hypertension were on an antihypertensive medication.[36] In a study assessing care indicators in Indigenous communities in northwestern Ontario, 28.3% of people had at least 1 eGFR test, and 15.2% at least 1 UACR test. Among people with recognized chronic kidney disease, 52.7% received a statin and 33.3% received an ACE inhibitor or ARB.[37]

Limitations

Although we were able to capture all prescriptions and physician visits, and our relatively short follow-up time allowed us to assess immediate impact, our length of follow-up was not sufficient to examine long-term outcomes such as mortality, dialysis initiation, kidney function, rates of home dialysis or cardiovascular outcomes.[38,39] In Manitoba, as much as 30% of laboratory testing is performed by non-DSM laboratories, which were not captured by the available data, therefore potentially leading to an underestimation of the frequency of laboratory testing. However, because the invention and comparison communities are located in regions that do not have non-DSM laboratory locations nearby, we expect that this number would be small. We believe that there were few exclusions due to incomplete screening data and missing administrative (< 4%) data and they did not substantially bias the results.

Additionally, in our propensity score model, we were not able to control for factors such as lifestyle, and other social determinants of health such as housing, food security or intergenerational trauma. Furthermore, given that substantial advertising was conducted during the FINISHED study, we may have inadvertently reached physicians and individuals in nonscreened communities, which may have had an impact on increased rates of testing observed in the comparison group. Lastly, we recruited participants in the program using convenience sampling, in turn potentially introducing a self-selection bias.

Conclusion

Indigenous communities located in low-resource intensity areas often lack dedicated resources for chronic disease management and prevention. Point-of-care screening programs directed by multidisciplinary teams can opportunistically identify individuals at risk of kidney failure, and provide results to participants in real time with counselling and referrals to nephrology and specialist services to "close the loop" of care, helping to ensure follow-up care to mitigate risk of progression. The FINISHED screening program provided the pilot evidence needed to develop and launch the Kidney Check program: a permanent chronic kidney disease surveillance system in rural and remote Indigenous communities across Canada, working toward introducing a new paradigm of care to decrease the burden of chronic kidney disease and kidney failure with early detection, education and treatment.[40–43]

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Affiliations: Chronic Disease Innovation Centre (Harasemiw, Ferguson, Rigatto, Tangri, Komenda), Seven Oaks General Hospital; Max Rady Department of Internal Medicine (Harasemiw, Ferguson, Rigatto, Tangri, Komenda), University of Manitoba; First Nations Health and Social Secretariat of Manitoba (Lavallee, McLeod); Manitoba Keewatinowi Okimakanak Inc. (Lavallee, Chartrand); Department of Pediatrics and Child Health (Dart), University of Manitoba; Children's Hospital Research Institute of Manitoba (Dart), Winnipeg, Man.

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