Appendix 1 (as supplied by the authors): Methods and results for incident cohorts

Methods:

Data for the study was obtained through linkage of administrative data from the provincial ministry of Alberta Health and Wellness and a province-wide repository of laboratory data (Alberta Kidney Disease Network). [1] The repository of laboratory data contains routine test results from both in-patient and out-patient settings for all Alberta residents, with measures of relevance to this study including hemoglobin A1c (i.e., glycated hemoglobin), serum creatinine, and urine protein. Provincial standards for laboratory testing and reporting are maintained. Alberta Health and Wellness maintains administrative data for Alberta including a population registry, ambulatory care file, inpatient encounters, physician claims and Alberta Blue Cross drug data, with internal audits for data quality. These files were used to obtain information on demographic characteristics including date of death for patients who died, hospitalizations and emergency department visits, physician visits and medication use (for subjects 65 years of age and older). In this analysis, for patients aged <65, our marker of low socioeconomic status was receipt of Alberta Income Support.

Since the impact of a primary care network (PCN) might differ in patients with longstanding diabetes, we created separate cohorts of patients with incident diabetes. We studied patients with incident diabetes before and after PCNs were established to control for possible improvements in diabetes care that occurred over time, independent of the establishment of PCNs. We studied two groups of patients in each time period: those who were managed by primary care physicians who eventually enrolled in PCNs and those who were managed by primary care physicians who never enrolled in PCNs. Assessment of quality and outcomes indicators occurred for up to 18 months after the diagnosis (see Figure 1 in main article for further information).

Analysis for incident cohorts:

For the four cohorts of patients with incident diabetes we used negative binomial regression to determine the rates of hospitalizations or emergency department visits for ACSC for patients managed by primary care physicians enrolled in PCNs compared with those managed outside PCNs, before and after establishment of PCNs, adjusting for patient demographics and comorbidities. A cross-product interaction term for the variables "time period" by "practitioner PCN status" was used to determine the impact of PCNs on each outcome. Linear regression was used to determine the independent association between the last A1C measure and PCN status after adjustment for potential confounders. Logistic regression was used to assess differences in use of medications in the subgroups proposed, with adjustment as above. For each of the binary outcomes, a relative risk or risk ratio (RR) was presented using a "modified Poisson" approach, which is appropriate when the outcome event is common (incidence of 10% or more). [2]

Results for Incident cohorts:

Incident 2003 and 2007 Cohorts

There were 18 PCNs as of 2007, with 6 established in 2005 and 12 established in 2006. There were 7098 and 8450 patients with diabetes in the 2003 and 2007 incident diabetes cohorts respectively (Table 1). In general, the baseline characteristics of patients with incident diabetes were similar between the four cohorts though patients managed by physicians in PCNs were slightly older, and had more comorbid diseases (Table 1), even among patients who had no diabetes medications introduced prior to the baseline A1C measure.

Hospitalizations or Emergency Department Visits for Ambulatory Care Sensitive Conditions

The rates of hospitalizations or emergency department visits for diabetes-specific ACSC, A1C, and use of indicated medications were similar across time periods for patients managed by physicians who never enrolled in PCNs, suggesting that care and outcomes did not change significantly over time for patients managed outside PCNs (Table 2).

The interaction for "time period" by "practitioner PCN status" was non-significant ($p = 0.36$), suggesting that the risk of hospitalizations or emergency department visits for ACSC did not vary by time period, comparing patients in and outside PCNs (Table 2). Compared with the 2007 incident cohort managed outside PCNs, the adjusted incidence rate ratio (IRR) of ACSC for patients with incident diabetes in 2007 managed in PCNs was 0.94 (95%CI 0.73 to 1.20, $p = 0.60$) (Figure 1).

Secondary outcomes

Compared with patients with incident diabetes in the 2007 cohort managed outside PCNs, patients managed in PCNs in 2007 were more likely to see an ophthalmologist or optometrist (RR 1.09 (95% CI 1.01 – 1.17), or have an albumin to Cr ratio measured (RR 1.05 (95%CI 1.01 to 10.09)), but no more likely to have their LDL or A1C measured. Compared with patients with incident diabetes in the 2007 cohort managed outside PCNs, patients with incident diabetes in the 2007 cohort managed in PCNs had slightly better glycemic control (adjusted mean difference in A1C -0.20 (95%CI -0.26 to -0.13; Table 2).

For patients with incident diabetes in 2007, the adjusted likelihood of statin use was similar for those managed in and outside PCNs (relative risk (RR) 1.07 (95%CI 0.99 to 1.17), $p = 0.10$). The proportion of patients with first diabetes drug used was similar across time periods for patients managed by physicians who never enrolled in PCNs (51.5% vs 53.0%, $p = 0.46$) (Table 3). However, PCN patients in the 2007 incident cohort were less likely to receive medications to manage hyperglycemia during the assessment period, compared to those in the 2003 incident PCN cohort (43.5% vs 47.9%, $p = 0.04$; Table 3; the interaction for "time period" by "practitioner PCN status" was significant, $p = 0.049$). Also, PCN patients in the 2007 incident cohort were less likely to receive medications to manage hyperglycemia during the

assessment period, compared to those in the 2007 incident non-PCN cohort (43.5% vs 53.0%, *p* < 0.001). Among those who received pharmacologic management for hyperglycemia, patients in the 2007 incident PCN cohort were as likely to receive first line therapy that included metformin compared to those in the 2007 incident cohort managed by physicians outside PCNs (82.6% vs 80.5%, *p* = 0.37; Table 3).

While we noted no statistically significant difference in the rates of internal medicine/endocrinology visits, in adjusted analyses, primary care physician visit rates were 8% higher for the 2007 incident diabetes cohort cared for in PCNs compared with the 2007 incident diabetes cohort cared for outside PCNs (IRR 1.08 [95%CI 1.04 to 1.12], *p* < 0.001; Table 2).

References

1. Hemmelgarn, BR et al. Overview of the Alberta Kidney Disease Network. *BMC Nephrol* 2009;10:30.
2. Zhou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol* 2004;159:702-6.

Table 1: Baseline characteristics of patients with incident diabetes, stratified by time period [2003 (before the creation of PCNs) and 2007 (after the creation of PCNs)] and whether the patient was managed in or outside of a PCN

Baseline Characteristic	Patients managed by physicians who never enrolled in a PCN		Patients managed by physicians who enrolled in a PCN	
	2003 Incident Cohort (n=3,687)	2007 Incident Cohort (n=5,303)	2003 Incident Cohort (n=3,411)	2007 Incident Cohort (n=3,147)
Age (in years), mean (SD)	55.9 (14.5)	55.3 (15.1)	59.5 (15.5)	59.1 (15.3)
Male sex, %	53.8	57.6	52.1	53.8
First Nations status, %	5.2	3.2	2.9	3.7
Income support, %	5.2	5.2	4.1	5.0
History Cancer, %	4.3	5.7	7.9	9.4
Cardiovascular disease, %	3.7	4.1	6.6	6.6
Congestive heart failure, %	4.9	5.9	8.9	8.3
Myocardial infarction, %	5.5	6.0	7.1	7.8
Peripheral vascular disease, %	2.9	2.6	4.0	4.9
Hypertension, %	45.8	44.5	50.3	58.1
Charlson score, mean (SD)	1.6 (1.2)	1.8 (1.6)	2.0 (1.8)	2.1 (1.9)
eGFR (ml/min/1.73 m^2), mean (SD)	75.9 (20.3)	84.7 (25.4)	72.7 (21.8)	79.0 (23.6)
eGFR • 60 ml/min/1.73 m^2, %[1]	81.5	86.0	74.9	81.2
eGFR 30-59.9 ml/min/1.73 m^2, %[1]	17.4	12.6	22.9	16.9
eGFR < 30 ml/min/1.73 m^2, %[1]	1.1	1.4	2.2	1.9
Not measured	n=845	n=578	n=669	n=190
Mean A1C, up to 3 m after index diagnosis date (SD)	7.75 (2.2)	7.8 (2.3)	7.6 (2.2)	7.3 (2.1)
First A1C, up to 3 m after index diagnosis date (SD)	7.7 (2.1)	7.6 (2.3)	7.8 (2.3)	7.4 (2.2)
Not measured, %	51.2	39.1	53.2	35.3
Urine dipstick proteinuria measured, %	52.8	64.6	49.0	61.3
Urine dip protein mild, %[1]	15.1	17.0	15.9	14.4
Urine dip protein heavy, %[1]	3.2	4.4	3.1	3.2
Urine albumin / Cr ratio measured, %	33.3	40.1	33.4	43.3
Urine albumin / Cr ratio 30-300 mg/day, %[*]	18.2	17.7	22.7	15.7
Urine albumin / Cr ratio >300 mg/day, %[*]	3.3	2.7	3.2	2.9
ACEi / ARB use[2], %	45.1 (n=122)	60.6 (n=241)	50.5 (n=204)	62.4 (n=178)
Statin use[3], %	28.2 (n=933)	33.1 (n=1244)	28.9 (n=1205)	43.4 (n=1029)

[1] of patients who had at least one measurement
[2] among those age 66 and older with mild or heavy proteinuria

[3] among those age 66 and older

Table 2: Outcomes for patients with incident diabetes, stratified by time period [2003 (before the creation of PCNs) and 2007 (after the creation of PCNs)] and whether the patient was managed in or outside of a primary care network

| Outcome | Patients managed by physicians who never enrolled in a PCN | | | | Patients managed by physicians who enrolled in PCNs of interest | | | | Comparing the 2007 incident cohort cared for within PCNs to 2007 incident cohort cared for outside PCNs | |
| | 2003 Incident Cohort (n=3,687) | | 2007 Incident Cohort (n=5,303) | | 2003 Incident Cohort (n=3,411) | | 2007 Incident Cohort (n=3,147) | | | |
	Crude	Adjusted[2]	Crude	Adjusted[2]	Crude	Adjusted[2]	Crude	Adjusted[2]	Adjusted[2] Measure (95% CI)	p-value
Hospitalization or emergency department visit rate for diabetes specific Ambulatory care sensitive condition, per 1000 patient months (95%CI)	5.45 (4.52–6.56)	3.56 (2.94–4.33)	5.47 (4.73–6.32)	3.80 (3.25–4.45)	5.30 (4.49–6.26)	3.92 (3.27–4.69)	4.44 (3.60–5.46)	3.56 (2.87–4.42)	IRR: 0.94 (0.73–1.20)	0.60
Last A1C, mean (95% CI)	6.82 (6.77 – 6.87) (n=2582)	6.77 (6.72 – 6.82) (n=2582)	6.98 (6.93 – 7.03) (n=4086)	6.90 (6.85 – 6.95) (n=4086)	6.71 (6.66 – 6.77) (n=2343)	6.72 (6.67 – 6.78) (n=2343)	6.60 (6.55 – 6.65) (n=2443)	6.70 (6.65 – 6.75) (n=2443)	MD: -0.20 (-0.26 – -0.13)	<0.001
Last A1C < 7.0%, % (95% CI)	70.0 (68.2 – 71.8) (n=2582)	75.6 (73.8 – 77.3) (n=2582)	65.0 (63.5 – 66.4) (n=4086)	71.4 (69.8 – 72.9) (n=4086)	72.1 (70.3 – 74.0) (n=2343)	76.2 (74.3 – 78.0) (n=2343)	78.7 (77.1 – 80.3) (n=2443)	80.3 (78.5 – 81.9) (n=2443)	RR: 1.12 (1.09 – 1.15)	<0.001
% patients who visited an ophthalmologist/optometrist	29.1 (27.7, 30.6)	29.2 (27.7, 30.8)	24.2 (23.0, 25.3)	23.4 (22.2, 24.6)	34.4 (32.8, 36.0)	33.7 (32.1, 35.4)	27.3 (25.8, 28.9)	25.5 (24.0, 27.0)	RR: 1.09 (1.01 – 1.17)	0.026
% patients who had Albumin to Cr ratio measured	41.1 (39.5, 42.7)	41.4 (39.6, 43.1)	48.7 (47.3, 50.0)	44.1 (42.6, 45.6)	39.7 (38.1, 41.3)	41.4 (39.6, 43.2)	49.5 (47.8, 51.3)	46.6 (44.7, 48.5)	RR: 1.05 (1.01 – 1.09)	0.028
% patients who had LDL measured	57.8 (56.2, 59.4)	61.0 (59.2, 62.7)	67.8 (66.6, 69.1)	67.3 (65.9, 68.7)	58.2 (56.5, 59.8)	62.3 (60.5, 64.1)	68.4 (66.7, 70.0)	67.4 (65.5, 69.2)	RR: 1.00 (0.97 – 1.03)	0.89
% patients who had A1C measured	70.0 (68.5, 71.5)	79.0	77.1 (75.9, 78.2)	80.0	68.7 (67.1, 70.2)	79.0	77.6	80.0	RR: 1.00 (0.98 – 1.02)	0.87

		(77.5, 80.4)		(78.7, 81.2)		(77.4, 80.4)	(76.1, 79.1)	(78.4, 81.5)		
A1C, mean (95% CI)	7.02 (6.96 – 7.07) (n=2582)	6.94 (6.90 – 6.99) (n=2582)	7.15 (7.10 – 7.19) (n=4086)	7.03 (6.98 – 7.07) (n=4086)	6.88 (6.83 – 6.94) (n=2343)	6.88 (6.83 – 6.93) (n=2343)	6.74 (6.68 – 6.79) (n=2443)	6.84 (6.79 – 6.89) (n=2443)	MD: - 0.19 (-0.25 – -0.13)	<0.001
Number of A1C measurements, mean (95% CI)	2.19 (2.14 – 2.25) (n=2582)	2.08 (2.03 – 2.13) (n=2582)	2.40 (2.35– 2.45) (n=4086)	2.22 (2.18 – 2.27) (n=4086)	2.21 (2.15 – 2.27) (n=2343)	2.10 (2.05 – 2.14) (n=2343)	2.53 (2.46 – 2.59) (n=2443)	2.32 (2.27 – 2.38) (n=2443)	MD: 0.04 (0.01 – 0.07)	0.004
Prescribed a Statin[1], % (95% CI)	46.1 (42.9 – 49.3) (n=933)	43.6 (40.2 – 47.0) (n=933)	45.9 (43.1 – 48.7) (n=1244)	45.0 (42.1 – 48.0) (n=1244)	42.4 (30.6 – 45.2) (n=1205)	42.7 (39.7 – 45.8) (n=1205)	50.2 (47.2 – 53.3) (n=1029)	49.0 (45.6 – 52.3) (n=1029)	RR: 1.07 (0.99 – 1.17)	0.10
Prescribed an ACE/ARBs, in patients[1] with proteinuria, % (95% CI)	73.0 (65.0 – 81.0) (n=122)	73.6 (63.5 – 81.7) (n=122)	66.0 (60.0 – 72.0) (n=241)	68.2 (61.7 – 74.1) (n=241)	65.7 (59.1 – 72.3) (n=204)	67.5 (59.9 – 74.4) (n=204)	68.5 (61.7 – 75.4) (n=178)	71.7 (64.2 – 78.2) (n=178)	RR: 1.05 (0.93 – 1.19)	0.45
Out-patient Primary Care Physician Visit rate, per 1000 patient months (95%CI)	745 (727 - 764)	752.2 (733.6 – 771.3)	685 (671 - 700)	683.7 (670.0 – 697.7)	757 (738 - 776)	738.0 (720.5 – 756.0)	794 (769 - 820)	739.1 (718.8 – 760.1)	IRR: 1.08 (1.04 – 1.12)	<0.001
Out-patient Internal Medicine / Endocrinology visit rate, per 1000 patient months (95%CI)	57 (53 - 61)	55.7 (52.0 – 59.8)	59 (56 - 63)	54.5 (51.3 – 58.0)	66 (60 - 71)	63.5 (58.4 – 68.9)	65 (60 - 72)	56.0 (51.4 – 60.9)	IRR: 1.03 (0.92 – 1.14)	0.62

Abbreviations: IRR, incidence rate ratio; RR, relative risk (or risk ratio); MD, mean difference.

[1] among patients age 66 and older

[2] adjusted for the demographic factors including age, sex, socioeconomic status, and Charlson comorbid conditions, hypertension, baseline HbA1C, and kidney function (as estimated by eGFR)

Table 3: First diabetes drug used in patients 66 years of age and older with incident diabetes, stratified by time period [2003 (before the creation of PCNs) and 2007 (after the creation of PCNs)] and whether the patient was managed in or outside of a primary care network.

First Diabetes Drug Used	Patients managed by physicians who never enrolled in a PCN		Patients managed by physicians who enrolled in one of 18 PCNs of interest	
	2003 Incident Cohort (n=933)	2007 Incident Cohort (n=1,244)	2003 Incident Cohort (n=1,205)	2007 Incident Cohort (n=1,029)
No drug prescribed during outcomes assessment period, n(%[1])	453 (48.5)	584 (47.0)	628 (52.1)	581 (56.5)
Any drug prescribed during outcomes assessment period, n(%[1])	480 (51.5)	660 (53.0)	577 (47.9)	448 (43.5)
Among patients prescribed a drug during the outcomes assessment period				
Biguanide monotherapy, n(%[2])	331 (69.0)	491 (74.4)	365 (63.3)	362 (80.8)
Sulfonylurea monotherapy, n(%[2])	85 (17.7)	48 (7.3)	95 (16.5)	34 (7.6)
Insulin monotherapy, n(%[2])	12 (2.5)	21 (3.2)	22 (3.8)	13 (2.9)
Meglitanide monotherapy, n(%[2])	7 (1.5)	13 (2.0)	16 (2.8)	8 (1.8)
Biguanide and sulfonylurea combination therapy, n(%[2])	18 (3.8)	40 (6.1)	32 (5.6)	8 (1.8)
Avandia monotherapy, n(%[2])	12 (2.5)	11 (1.7)	19 (3.3)	6 (1.3)
Actos monotherapy, n(%[2])	3 (0.6)	10 (1.5)	8 (1.4)	6 (1.3)
Any agent or combination, n(%[2])	12 (2.5)	26 (3.9)	20 (3.5)	11 (2.5)

[1] Among patients age 66 and older
[2] Among patients age 66 and older who received any agent

Figure 1: Unadjusted and adjusted hospitalizations or emergency department visit rate for diabetes specific ambulatory care sensitive conditions (per 1000 patient months) for patients with incident diabetes stratified by time period and whether the patient was managed in or outside of a PCN

Cohort		Rate (95% CI)
Incident Diabetes Cohorts:		
Care by a physician who never joins a PCN, 2003	Unadjusted	5.45 (4.52 - 6.56)
	Adjusted	3.56 (2.94 - 4.33)
Care by a physician who eventually joins a PCN, 2003	Unadjusted	5.30 (4.49 - 6.26)
	Adjusted	3.92 (3.27 - 4.69)
Care outside of a PCN, 2007	Unadjusted	5.47 (4.73 - 6.32)
	Adjusted	3.80 (3.25 - 4.45)
Care within a PCN, 2007	*Unadjusted*	*4.44 (3.60 - 5.46)*
	Adjusted	*3.56 (2.87 - 4.42)*

Rate (per 1000 patient months)