Appendix 1 (as supplied by the authors): Supplemental material

Chinook Primary Care Network

The Chinook Primary Care Network (CPCN) is located in the southwestern part of Alberta, and serves the city of Lethbridge and 12 rural communities. The primary care clinics participating in the CPCN are owned and operated by the primary care physicians; the majority of these physicians practice in fee-for-service model, while a smaller portion practice through a capitation alternative relationship plan.

The CPCN was established in 2005, and from its inception, created a culture of improvement amongst its members. Funding from a federal grant on Chronic Disease Management was used to bring Mark Murray & Associates to introduce Office Practice Redesign methodology to the participating physicians and teams. As the PCN expanded and brought on more members, the CPCN directly funded additional learning collaboratives. These teams learned to measure third next available appointment, along with other metrics such as Demand, Supply and Activity.

In 2008, the CPCN leadership required all physicians to continue measuring their TNA as a condition of being part of the PCN. Although the desired goal was to offer same/next day appointments for patients, physicians and their teams selected the type of delay they believed was appropriate for their patients. In this sense, the TNA data used in this study was not subject to any type of "gaming", as the only accountability expected of the physicians was to measure TNA, and not to obtain a certain level of delay. This notion was adopted for the province of Alberta in 2012 when TNA was selected as one of the accountability measures for primary care networks.

Relational Continuity Measures

The most common methodology undertaken to understand relational continuity is the Usual Provider Continuity Index. This is typically approached by calculating the percentage of visits made to the most common physician within a two or three year time period. Patients are also only included in the analysis if they had two or more visits within the time period. Our continuity methodology differed from the typical way it is measured for two reasons: 1) we wanted to calculate a weekly continuity measure on the same time frame as the access (TNA) measure; and 2) we had physician panels that corresponded to specific years of the study. Therefore, we did not exclude any patients based on their number of visits; we were interested in the activity of the patients each week. The use of the physician panels is critically important for our calculation, as knowing the identity of the attached physicians allowed us to determine how their weekly availability/access influenced where their own attached patients sought care.

Our outcomes measures were based on the choice patients had when wanting to access primary care, and how access to their physician may influence that choice. Their choices include (1) an appointment with their physician (provider continuity) (2) an appointment with another physician practicing in their clinic (clinic continuity), (3) an appointment with a physician practicing in another clinic (discontinuity), (4) or visiting the emergency department. We hypothesized, from the patient's perspective, if the wait for an appointment with their own physician was determined to be "too long", they would choose to

one of the other three options (2, 3 or 4). If the wait for an appointment was *not* too long from the patient's perspective (i.e. the wait time for the appointment was satisfactory), the patient would probably book an appointment with their own physician (option 1).

Based on this hypothesis, we were interested in four outcome measures

1. Provider Continuity – The percentage of total weekly visits attached patients made to their physician
2. Clinic Continuity – The percentage of total weekly visits attached patients made to their clinic
3. Discontinuity – The percentage of total weekly visits attached patients made to another physician within a 50km distance of the attached physician's clinic
4. Emergency Department visits – The number of visits attached patients made to the emergency department within a 50km distance of the attached physician's clinic

Because we wanted to link these outcomes directly to the TNA measure, the outcomes were summarized using the same week definition as the TNA. Table 1 is an example of the weekly data we collected on each physician. This example shows the data collected on three physicians (Drs. A, B, & C) practicing in two clinics (clinics AAA &BBB) during weeks 5 and 6 of 2010, including the TNA value, number of days worked that week, and the size of their panel that year.

The 2010 panels of the physicians were used to determine the total number of visits their patients made to a primary care clinic that week, as well as the number of visits to the emergency department. The total number of visits to primary care were subdivided into whether the visit occurred with their physician, with another physician in the same clinic, or to another physician in a different clinic. In addition to the 2010 panel size, the number of days worked in that clinic was calculated from the billing data. The TNA value for that week was added.

Supplemental Table S1: Example of the weekly data collected on each physician.

Physician	Clinic	Year	Week	Panel Size	# Days Worked	TNA	Total Visits by Panel Patients to Primary Care Clinic	# of Visits by Panel Patients	# of Visits Panel Patients to Other Physician in Clinic	# of Visits Panel Patients to Other Clinic (within 50 km)	# of Visits Panel Patients to Emergency Department (within 50 km)
Dr. A	AAA	2010	5	1216	5	12	215	152	45	18	21
Dr. A	AAA	2010	6	1216	4	14	202	137	44	21	17
Dr. B	AAA	2010	5	1087	3	3	134	99	26	9	5
Dr. B	AAA	2010	6	1087	3	1	133	110	18	5	5
Dr. C	BBB	2010	5	1105	3	7	172	104	28	40	20
Dr. C	BBB	2010	6	1105	3	7	191	111	36	44	14

Table 2 describes how the outcome measures were calculated. The provider and clinic continuity, and discontinuity were a percentage of the number total number of visits the physician's paneled patients made to a primary care clinic that week. The emergency department visits were expressed a rate per 1000 patients.

Supplemental Table S2: Example of the outcome measures

Physician	Clinic	Year	Week	Panel Size	# Days Worked	TNA	Total Visits by Panel Patients to Primary Care Clinic	Provider Continuity*	Clinic Continuity‡	Discontinuity (within 50 km)¥	Rate of Emergency Department Visits per 1000 paneled patients (within 50 km)฿
Dr. A	AAA	2010	5	1216	5	12	215	0.71	0.21	0.08	17.27
Dr. A	AAA	2010	6	1216	4	14	202	0.68	0.22	0.10	13.98
Dr. B	AAA	2010	5	1087	3	3	134	0.74	0.19	0.07	4.60
Dr. B	AAA	2010	6	1087	3	1	133	0.83	0.14	0.04	4.60
Dr. C	BBB	2010	5	1105	3	7	172	0.60	0.16	0.23	18.10
Dr. C	BBB	2010	6	1105	3	7	191	0.58	0.19	0.23	12.67

* Provider Continuity = # of Visits by Panel Patients / Total Visits by Panel Patients to Primary Care Clinic

‡ Clinic Continuity = # of Visits Panel Patients to Other Physicians in Clinic / Total Visits by Panel Patients to Primary Care Clinic

¥ Discontinuity = # of Visits Panel Patients to Other Clinic (within 50 km) / Total Visits by Panel Patients to Primary Care Clinic

฿ Rate of Emergency Department Visits = (# of Visits Panel Patients to Emergency Department *1000) / Panel Size

Supplemental Table S3: Full Outputs of Multi-Level Models of Outcome Variables (Provider Continuity, Clinic Continuity, Discontinuity, and Emergency Department Visits)

	Beta Coefficient (95% CI), p value			
	Provider Continuity	Clinic Continuity	Discontinuity	Emergency Department Visits
Fixed Effects				
Intercept	68.90 (52.16 to 8.64), <0.001‡‡‡	83.13 (73.51 to 92.74), <0.001‡‡‡	13.21 (5.61 to 20.82), 0.001‡‡‡	0.55 (0.19 to 0.92), 0.003‡‡‡
Week	0.02 (0.00 to 0.03), 0.071‡	0.01 (0.00 to 0.02), 0.122	-0.02 (-0.03 to -0.01), <0.001‡‡‡	-0.002 (0.00 to 0.00), <0.001‡‡‡
Percent of Panel on Multiple Panels	-0.38 (-0.50 to -0.27), <0.001‡‡‡	-0.56 (-0.62 to -0.50), <0.001‡‡‡	0.45 (0.40 to 0.50), <0.001‡‡‡	0.013 (0.01 to 0.02), <0.001‡‡‡
Percent panel complex	0.76 (0.22 to 1.29), 0.006‡‡‡	0.40 (0.09 to 0.70), 0.011‡‡	-0.35 (-0.59 to -0.11), 0.005‡‡‡	0.015 (0.00 to 0.03), 0.007‡‡‡
Physician Panel Size (x100)	-0.06 (-0.23 to 0.10), 0.457	-0.25 (-0.34 to -0.15), <0.001‡‡‡	0.08 (0.00 to 0.16), 0.043‡‡	-0.010 (-0.010 to -0.010), <0.001‡‡‡
Physician is Female	-2.14 (-6.77 to 2.49), 0.365	1.48 (-1.30 to 4.27), 0.296	-3.58 (-5.87 to -1.28), 0.002‡‡‡	-0.15 (-0.29 to -0.01), 0.037‡‡
Mean Age of Panel (years)	0.01 (-0.36 to 0.38), 0.954	0.05 (-0.16 to 0.27), 0.632	-0.02 (-0.18 to 0.15), 0.832	0.006 (0.00 to 0.01), 0.169
Rural Physician	-6.53 (-9.90 to -3.16), <0.001‡‡‡	-0.24 (-2.32 to 1.84), 0.821	-2.86 (-4.62 to -1.09), 0.002‡‡‡	0.52 (0.41 to 0.63), <0.001‡‡‡
Number of physicians per clinic	-0.15 (-0.52 to 0.22), 0.426	-0.06 (-0.27 to 0.16), 0.615	-0.10 (-0.28 to 0.08), 0.264	-0.01 (-0.02 to 0.00), 0.005‡‡‡
Percent of panel female	-0.01 (-0.13 to 0.10), 0.820	-0.01 (-0.08 to 0.06), 0.826	0.03 (-0.02 to 0.09), 0.211	0.00 (0.00 to 0.00), 0.967
Percent of panel over 60 years of age	0.22 (-0.01 to 0.44), 0.064‡	0.20 (0.07 to 0.33), 0.003‡‡‡	-0.19 (-0.30 to -0.09), <0.001‡‡‡	0.004 (0.00 to 0.01), 0.124
# Days Worked Less than Normal	-11.09 (-11.22 to -10.97), <0.001‡‡‡	-2.92 (-2.99 to -2.86), <0.001‡‡‡	1.65 (1.60 to 1.70), <0.001‡‡‡	0.006 (0.00 to 0.01), 0.001‡‡‡
Starting TNA	-0.13 (-0.29 to 0.03), 0.121	-0.06 (-0.14 to 0.03), 0.217	-0.02 (-0.09 to 0.05), 0.543	0.000 (0.00 to 0.00), 0.969

Stable TNA Trajectory (ref)	--	--	--	--
Improving TNA Trajectory	-2.30 (-5.14 to 0.54), 0.113	-0.40 (-2.02 to 1.22), 0.630	1.66 (0.28 to 3.04), 0.019‡‡	0.042 (-0.01 to 0.09), 0.114
Worsening TNA Trajectory	-0.70 (-3.50 to 2.09), 0.622	-0.93 (-2.53 to 0.68), 0.256	0.57 (-0.78 to 1.93), 0.409	0.013 (-0.04 to 0.07), 0.614
Stable TNA Trajectory*week (ref)	--	--	--	--
Improving TNA Trajectory*week	0.13 (0.08 to 0.18), <0.001‡‡‡	0.02 (-0.01 to 0.06), 0.154	-0.04 (-0.06 to -0.01), 0.009‡‡‡	-0.002 (0.00 to 0.00), 0.001‡‡‡
Worsening TNA Trajectory*week	-0.12 (-0.17 to -0.07), <0.001‡‡‡	-0.02 (-0.06 to 0.01), 0.163	0.01 (-0.01 to 0.04), 0.353	0.001 (0.00 to 0.00), 0.001‡‡‡
Random Effects				
Inter-physician variance	91.50 (79.19 to 105.72)	31.49 (27.08 to 36.61)	31.43 (23.22 to 42.56)	0.12 (0.09 to 0.15)
Within-Physician variance	184.67 (181.86 to 187.52)	49.85 (49.09 to 50.62)	49.85 (49.09 to 50.62)	0.135 (0.13 to 0.14)
Variance – Week	0.03 (0.02 to 0.03)	0.02 (0.01 to 0.02)	0.01 (0.01 to 0.02)	0.00 (0.00 to 0.00)
Covariance – Intercept, Week	-0.58 (-0.78 to -0.37)	-0.38 (-0.47 to -0.29)	-0.38 (-0.47 to -0.29)	0.00 (0.00 to 0.00)
Inter-clinic variance	74.47 (54.12 to 102.48)	31.43 (23.22 to 42.56)	31.43 (23.22 to 42.56)	0.12 (0.09 to 0.15)
Intraclass correlation	0.331	0.387	0.387	0.463

TNA=third next available appointment

‡Denotes significance at p<0.1, ‡‡Denotes significance at p<0.05, ‡‡‡Denotes significance at p<0.01