INTRODUCTION

Strong primary care is fundamental to effective, efficient and more equitable health care systems.[1-3] Attachment to a regular primary care provider (PCP), defined as formal or informal patient access to the same individual or a group of primary care provider(s),[4] is associated with delivery of more preventive care, better chronic disease management and reduced hospitalizations.[5-8] Lack of attachment to primary care has been associated with higher mortality, emergency department visits, hospitalizations and readmissions, presentation to care with more advanced disease and poor patient experiences.[9-11] Lack of attachment has important equity implications, as well. People who are new immigrants, live with low income, were previously incarcerated, were prescribed opioid agonist treatment, or have comorbidities such as serious mental illness, are more likely to be unattached.[12-18]

Despite the importance of consistent access to primary care, 14.5% of Canadians age 12 years and older (about 4.6 million people) reported not having a regular primary care provider in 2019, with considerable variation in rates across Canada, ranging from 8% in Ontario to 27.8% in Quebec.[19] High numbers of unattached patients have important implications throughout health care systems, driving high utilization of care in low-continuity settings such as emergency departments (ED) and walk-in clinics, as well as poor follow up post-hospitalization and higher morbidity.[9,10]

Understanding longitudinal trends in primary care attachment is a key policy priority across Canada[20] and is critical for ensuring effective health system planning that reduces inequities for structurally marginalized groups. There are many drivers of attachment including recruitment and retention of family physicians. Professional organizations have increasingly called for alternate payments and expansion of team-based care as factors that can incentivize physicians to practice family medicine.[21] We sought to examine trends in attachment to primary care in Ontario, Canada, including changes temporally related to restricted access to alternate payment models starting in early 2015, and to examine these trends through an equity lens.

METHODS

Context and Setting

The study was set in Ontario, Canada's largest province with a population of 14,789,778 million, in which medically necessary physician and hospital services are government funded for permanent residents without any direct charges to patients. Family physician and nurse practitioner visits are fully insured and free at the point of care. In 2002, following a period of declining policy support for primary care, Ontario increased investment and implemented broad voluntary reforms in the delivery and payment of primary care aimed at improving access, quality of care and physician retention.[22] Under the reforms, most physicians shifted from exclusive fee-for-service (FFS) remuneration to new models that incorporated blended capitation payments, patient enrolment, pay for performance and, in some cases, access to nonphysician health care professionals. Several models of care in Ontario require patient enrollment, including models in which physicians are compensated by blended capitation (monthly age and sex adjusted payments and a small proportion of fee for service payments), and those paid by fee for

service. Since early 2015, the Ontario government has limited new physicians entering capitation-based models to 20 new positions in Family Health Organization and Family Health Network compensation models in areas of high physician need only, or replacement of physicians in existing teams.[23]

Design, Setting and Participants

We conducted a repeated cross-sectional study using population level administrative data housed at ICES. Study participants included all Ontario residents with a health card number in each year from April 1, 2008 to Mar 31, 2019.

Data sources and linkages

We used linked administrative datasets to examine trends in attachment at the patient level. The datasets were linked using unique encoded identifiers and analyzed at ICES. ICES is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement. The use of the data in this project is authorized under section 45 of Ontario's Personal Health Information Protection Act (PHIPA) and does not require review by a Research Ethics Board.

We linked a the following databases: Registered Persons Database (a health insurance registry), the Corporate Provider Database (a registry of providers and groups eligible to bill OHIP for their services), the Client Agency Program Enrolment database (identifies patients enrolled in different primary care models over time), and the Community Health Centre database (which lists patients receiving health services at Community Health Centres, a model of care serving vulnerable Ontarians in which physicians are salaried). We assessed emergency department (ED) visits using the National Ambulatory Care Reporting System and hospitalizations using the Discharge Abstracts Database. We used the Johns Hopkins Adjusted Clinical Groups System Version 10 to capture morbidity according to Aggregated Diagnostic Groups.

Variable definition

Outcome

The dependent variable was the percentage of eligible Ontario residents attached to a primary care physician, measured with administrative data using an algorithm developed and validated by our group.[24] The algorithm involved hierarchical assignment of attachment. First, patients enrolled to a Patient Enrollment Model (PEM) were considered attached. Next, patients receiving clinical care at a Community Health Centre were included as attached. Next, patients were considered as attached if they received the majority of their primary care over the preceding 2-year period from a PCP with greater than 10% physician-level continuity of care. Continuity of care was a visit-based measure of the proportion of an individual PCP visits over all the physician's visits seen over a two-year time period, and as determined with a numerator of patients virtually rostered to a PCP divided by the denominator of all unique patients the same PCP had seen over two years. Finally, consistent with a previously validated algorithm used to examine pediatric health services access,[25] children who were virtually rostered with a primary

care pediatrician were also considered attached.[24] All others were considered uncertainly attached.

Covariates

We derived age, sex, rurality and immigration status from the Registered Persons Database. We measured rurality using the postal code and the Rurality Index for Ontario, using the following categories: urban (score 0–9), suburban (score 10–39) and rural (score ≥ 40).[26] We used postal code and the Ontario Marginalization Index to derive participants' Material Deprivation and Residential Instability quintiles. The Ontario Marginalization Index is an area-based index that seeks to understand differences in health between population groups or between geographical areas.[27] We examined two of the included dimensions. Material deprivation includes indicators such as the proportion of the adult population who are lone parent families, receiving government transfer payments, low income, unemployed or have no high school diploma. Residential instability is a measure of area-level concentrations of people who experience high rates of family or housing instability and includes (among others) indicators of the proportion of people living alone, dwellings that are apartment buildings, and the proportion of the population who have moved in the past 5 years. We identified recent immigrants using a proxy measure that identifies people with first time health care coverage in Ontario, the majority of whom are recent immigrants to Canada.

Statistical Analysis

We began by identifying attached and uncertainly attached populations for each year between 2008/09 and 2018/19 and their characteristics and rates of ED visits and hospitalizations. We examined changed in attachment over time, stratisfied by demographic group. Next, we used logistic regression models to examine the association between patient characteristics and patient attachment in 2018/19, adjusting for sex, age, rurality, comorbidity, resource utilization, recent immigration, material deprivation and residential instability. Because univariate models differed for both sexes by age, we tested for and identified an interaction between age and sex. We next developed stratified multivariate models for males and females of factors associated with attachment in 2018. Tolerance and variance inflation factors were consistent with lack of multicollinearity in the multivariate models.

To assess the association with policy changes restricting family physician entry to alternate funding models in 2015, we used segmented piece-wise linear regression models with correlated residuals including time, policy change in 2015 and time-after policy change as predictors. We tested for autocorrelation and reported the most parsimonious model.

RESULTS

In 2008, 80.5% of Ontario residents (n=10,352,385) were attached to a primary care provider. Attachment increased over the study period to 88.9% of the population in 2018 (n=12,537,172), and the increased attachment exceeded the rate of population growth. The characteristics of the attached and general population are summarized at three key time points in the study (2008, 2014 and 2018) in Table 1. Proportionately fewer males were attached both at baseline (77.4% vs

83.5% females) and in 2018 (86.9% vs 90.9 % females). Young adults (aged 19-34 years) had lower rates of attachment compared with all other age groups at baseline (71.5%) and study end (83.6%). Children and youth experienced the highest rates of attachment, followed by older adults. Attachment was lower among individuals who were rural dwelling individuals, had low comorbidity, highest residential instability, material deprivation and wererecent immigrants. About 25% of uncertainly attached individuals visited the ED, which remained stable throughout the study period. Hospitalization rates decreased from 12.1% in 2008 to 9.8% in 2018. Health system utilization was higher for attached patients, of whom about 37% visited the emergency department and 20-22% were hospitalized in a given year.

Attachment increased over the study period overall and for all demographic groups, with the largest relative gains seen for new immigrants, 19-34 year olds, and those with low comorbidity. Overall gains were seen between 2008-2014, after which attachment plateaued (Figure 1). Gaps between some groups narrowed from 2008-2014, after which the rate of change slowed overall (Figure 2). The disparity in attachment for recent immigrants continued to close after 2014, though more slowly than before 2014. Rapid gains were seen for those with low comorbidity until 2014, after which the rate was essentially unchanged. Limited reduction in disparities by material deprivation was observed between 2008 and 2014, but the gap continued to close throughout the study period.

We used sex stratified univariate (Table 2) and multivariate models for the final study year to further examine predictors of attachment (Table 3). Compared with adults aged 50-64 years, children and youth were most likely to be attached (aOR males 2.70 [2.67, 2.73], females 2.40 [2.37, 2.43]. Adults aged 19-34 years were least likely (aOR males 0.86 (0.86, 0.87), females 0.64 [0.63, 0.64]) to be attached. Older adults were more likely to be attached, with higher point estimates for males than females. For all ages, males were more likely to be attached except ages 35-49 years. Both males and females with moderate to high comorbidity were two to three times more likely to be attached, with higher odds of attachment for males. Those with moderate to high health care utilization had 4-7 times greater odds of attachment, but in this case the odds were higher for females than males.

However, we also identified lower odds of attachment for people who recently immigrated to Ontario (aOR males 0.56 [0.56, 0.56], females 0.50 [0.50, 0.51]). In addition, lower odds of attachment was observed for those with higher instability [aOR highest instability males 0.67 (0.67, 0.68), females 0.72 (0.71, 0.73)] and higher deprivation [aOR highest deprivation males 0.75 (0.75, 0.76), females 0.80 (0.79, 0.80)]. Both marginalization measures followed a gradient along instability and deprivation marginalization quintiles, with lower odds of attachment for more vulnerable males than females.

We examined changing trends using segmented regression models with correlated residuals. There was no evidence of either first or second-order autocorrelation. There was a significant trend before 2014 (slope=1.47; $p<0.0001$), which flattened after 2014 (slope =0.13, $p=0.16$), indicating that the line is flat.

INTERPRETATION

Our study examined primary care attachment longitudinally in Ontario and found that the crude number of attached persons increased by 21.1% over the study period, a rate in excess of population growth (9.6%). Growth in attachment was impressive until 2014 after which it was stagnant. The most substantial gains were observed for people with low comorbidity, males, young adults and new immigrants.

Attachment increased rapidly during the period of introduction and growth of a broad array of payment and enrollment reforms, including new primary care models of care based on patient enrollment and blended capitation payment. Attachment plateaued around the time that the Ontario government restricted entry to blended capitation models, many of which were also interprofessional teams.[28] Beginning in early 2015, expansion of alternate models was limited to physicians practicing in underserved areas or addressing attrition within existing teams. These results provide a strong rationale for investment in reforms in primary care funding and expansion of interdisciplinary teams. It is noteworthy that expansion of primary care alternate models was included in the recently approved Ontario Physician Services Agreement.[29]

Importantly, a substantial proportion of uncertainly attached people had frequent contact with the health system, including about 25% of uncertainly attached patients had an ED visit and 10-12% were hospitalized in a given year. Each of these encounters represents an opportunity for attachment, which will require appropriate policy innovations.

While equity in enrollment improved overall during the study period, important gaps remained for specific groups. Inequities were persistent for new immigrants and for people living with economic and residential insecurity, with greater gaps observed for men than women. Targeted interventions are needed to reach these communities, who have not benefited as much from structural and payment reforms in primary care.[30]

In other jurisdictions, attachment has either decreased or remained fixed over time. In the United States, attachment among adults decreased from 77% (95% CI, 76%-78%) in 2002 to 75% (95% CI, 74%-76%) in 2015 (aOR, 0.90 [95% CI, 0.82-0.98]).[31] Another study examining attachment in older US adults reported reduced attachment from 94.2% in 2010 to 91.0% in 2016 ($p<0.0001$).[32] Both studies demonstrated lower attachment in males, people with lower incomes, or whose race/ethnicity was Black or Latino, even after controlling for insurance status. In New Zealand, 93-95% of the population was enrolled in primary care from 2015-2019, with lower attachment among Maori people and those living with higher deprivation.[14]

Nationally, Ontario has the lowest proportion of residents who are unattached to primary care, and may serve as a model for other provinces. Survey data from the Canadian Community Health Survey demonstrate that Quebec and the Western provinces fare considerably more poorly, and nation-wide estimates suggest that over 4.5 million Canadians do not have access to a regular primary care provider.[19] Some provinces have established centralized wait lists to improve attachment.[20] Cross-sectional studies of the effectiveness of centralized wait lists have demonstrated increased attachment; however, people with fewer comorbid conditions appeared to be preferentially enrolled and demand exceeds primary care capacity.[33,34] Longitudinal analyses of centralized waitlists are underway. Additional measures taken across Canada include

payment reforms, implementation of interdisciplinary teams, attachment fee codes including specific fee codes for attachments of complex patients, expansion of nurse practitioner roles, and geographic attachment in some areas.[35] Our work underscores the importance of payment reform and interdisciplinary team models for supporting attachment.[36]

Although the situation is considerably better in Ontario, health human resource trends suggest concerning future trends. About 14.4% of Ontario family physicians are age 65 years and older,[37] and the mean age of retirement is 70.5 years.[38] Increased healthcare provider pressures experienced during the COVID-19 pandemic have accelerated retirement plans of older physicians,[39] and almost one in five Toronto family physicians reports considering closing their practice in the next five years.[40] In addition, comprehensiveness of practice has been decreasing among newly graduated physicians. While maximum patient panel size tends to occur mid-career,[38] overall numbers of patient panel sizes are reduced in all career phases and practice patterns are shifting away from comprehensive community based primary care practices, to practices which include more focused practices, and roles in hospital and emergency departments.[41] These trends suggest upcoming health human resource problems, which could substantially erode the gains observed in our study.

LIMITATIONS

Our study has some limitations. Health administrative databases are unable to track services provided by nurse practitioners, except in Community Health Centres. In Ontario, 25 nurse practitioner-led clinics serve approximately 100,000 patients, largely located in rural and remote settings.[42] While they play an important role in these communities, the volume of service is unlikely to change the overall trends we found. In addition, the attachment algorithm may have misclassified some people. Our group previously validated the algorithm against survey responses. We demonstrated very high sensitivity and positive predictive value of the algorithm, but more modest specificity, meaning that some uncertainly attached individuals may have had access to primary care. In addition, measures of income and residential stability were all determined at a neighbourhood level using census data. Area level measures are economical and widely used to examine population level differences, but are limited by their inability to capture variation within neighbourhoods.[43]

CONCLUSION

Primary care attachment in Ontario increased faster than the overall population growth rate between 2008 and 2014, but was stagnant after 2014. Lack of ongoing progress followed reduced physician entry to alternate funding and interdisciplinary team models. While disparities in attachment narrowed for many groups, persistent gaps remain for immigrants and lower income Ontarians. Targeted interventions are needed to address these persistent gaps. Upcoming health human resource trends may erode the gains seen.

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Table 1 Patient demographic characteristics 2008-2018

		2008			2014			2018			Difference 2018- 2008	
		Attached		Total	Attached		Total	Attached		Total	Absolute percent difference	Relative difference
Variable	**Label**	**N**	**Percent**	**N**	**N**	**Percent**	**N**	**N**	**Percent**	**N**		
OVERALL		10,352,385	80.5	12,863,036	11,972,070	88.1	13,371,946	12,537,172	88.9	14,096,100	8.4	10.4
Sex	Male	4,902,611	77.4	6,336,768	5,731,257	86.3	6,641,622	6,021,636	86.9	6,928,191	9.5	12.3
	Female	5,449,774	83.5	6,526,268	6,240,813	90.6	6,886,323	6,515,536	90.9	7,167,909	7.4	8.9
Age category	<19	2,731,580	91.6	2,983,281	2,707,855	93.7	2,889,839	2,688,182	93.6	2,872,967	2	2.2
	19-34	1,941,613	71.5	2,713,735	2,387,721	82.8	2,883,509	2,491,779	83.6	2,979,286	12.1	16.9
	35-49	2,345,430	76.3	3,073,175	2,468,965	86.4	2,856,163	2,471,632	86.7	2,850,490	10.4	13.6
	50-64	1,947,237	80.2	2,429,426	2,536,267	89.0	2,849,501	2,708,959	89.6	3,024,685	9.4	11.7
	65-79	1,038,837	83.3	1,246,586	1,402,343	91.3	1,536,482	1,646,130	91.9	1,791,552	8.6	10.3
	80+	347,688	83.4	416,833	468,919	91.5	512,451	530,490	91.9	577,120	8.5	10.2
RIO index	Urban (0-9)	7,397,897	79.8	9,275,239	8,692,101	88.2	9,855,613	9,144,956	88.8	10,302,737	9	11.3
	Small town (10-39)	2,116,215	84.8	2,496,232	2,345,182	90.9	2,579,570	2,434,140	90.9	2,676,741	6.1	7.2
	Rural (40+)	765,279	78.2	978,283	857,518	87.4	980,713	874,527	87.9	994,441	9.7	12.4
	Missing	72,994	64.4	113,282	77,269	69.0	112,049	83,549	68.4	122,181	4	6.2
Comorbidity (ADG)	No/low comorbidity (0-4)	4,977,558	73.3	6,791,348	6,068,182	83.8	7,245,411	6,237,180	84	7,427,923	10.7	14.6
	Moderate comorbidity (5-9)	4,272,094	88.7	4,816,930	4,625,684	94.0	4,920,446	4,859,500	94.5	5,142,000	5.8	6.5

	High comorbidity (10+)	1,102,733	87.9	1,254,758	1,278,204	93.8	1,362,088	1,440,492	94.4	1,526,177	6.5	7.4
Morbidity (RUB)	Non-user/healthy user (0-1)	1,026,238	48.4	2,118,830	1,472,205	67.5	2,182,561	1,539,471	67.3	2,286,918	18.9	39.1
	Low morbidity (2)	2,218,280	84.8	2,616,422	2,457,443	90.6	2,711,249	2,454,723	91	2,696,051	6.2	7.3
	Moderate morbidity (3)	5,248,159	87.5	5,999,986	5,818,534	93.0	6,254,661	6,042,110	93.6	6,452,615	6.1	7.0
	High morbidity (4+)	1,859,708	87.4	2,127,798	2,223,888	93.5	2,379,474	2,500,868	94	2,660,516	6.6	7.6
Recent immigrant	No	7,920,620	80.1	9,882,644	9,466,538	88.6	10,682,618	10,045,967	89	11,287,661	8.9	11.1
	Yes	924,122	67.8	1,363,337	970,576	79.8	1,216,706	975,069	81.4	1,198,483	13.6	20.1
Marginalization: Residential Instability quintile	a. Lowest instability (1)	2,245,592	83.8	2,678,771	2,746,156	90.9	3,019,913	2,858,167	91.3	3,130,363	7.5	9.0
	b. 2	2,091,120	83.3	2,511,738	2,311,451	90.4	2,556,842	2,412,349	90.6	2,661,479	7.3	8.8
	c. 3	1,917,243	82.1	2,335,277	2,142,267	89.5	2,393,882	2,280,527	89.9	2,535,978	7.8	9.5
	d. 4	1,893,272	79.6	2,377,687	2,136,073	88.1	2,425,107	2,213,598	88.5	2,500,126	8.9	11.2
	e. Highest instability (5)	2,087,599	75.1	2,780,816	2,524,839	84.9	2,972,369	2,671,039	85.5	3,123,843	10.4	13.9

Marginalization: Material Deprivation quintile	a. Lowest deprivation (1)	2,381,696	83.4	2,857,306	2,623,982	90.2	2,910,272	2,893,438	90.4	3,201,555	7.0	8.4
	b. 2	2,099,290	82.5	2,545,256	2,518,205	90.2	2,791,259	2,663,134	90.5	2,942,539	8	9.7
	c. 3	1,982,173	81	2,447,798	2,297,416	89.1	2,577,049	2,382,518	89.6	2,659,189	8.6	10.6
	d. 4	1,863,131	79.4	2,346,986	2,199,123	87.9	2,503,068	2,244,028	88.3	2,540,744	8.9	11.2
	e. Highest deprivation (5)	1,908,536	76.7	2,486,943	2,222,060	85.9	2,586,465	2,252,562	86.4	2,607,762	9.7	12.7
ED visit in last 2 years	Yes	3,760,038	85.4	4,403,177	4,397,211	91.5	4,805,605	4,708,543	92.1	5,113,652	6.7	7.5
Hospitalization in last 2 years	Yes	2,338,830	88.5	2,642,562	2,551,439	93.8	2,719,265	4,708,543	92.1	2,761,144	3.6	4.1

Table 2. Univariate logistic regression models for association between patient characteristics and patient attachment 2018, stratified by sex

		Male		Female	
Variable	**Label**	**Odds Ratio (95% CI)**	**Prob**	**Odds Ratio (95% CI)**	**Prob**
Age category	<19	1.99 (1.97, 2.01)	<.0001	1.41 (1.40, 1.42)	<.0001
	19-34	0.57 (0.57, 0.57)	<.0001	0.64 (0.63, 0.64)	<.0001
	35-49	0.71 (0.70, 0.71)	<.0001	0.83 (0.82, 0.84)	<.0001
	50-64 (ref)	*1.00*	--	*1.00*	--
	65-79	1.45 (1.44, 1.47)	<.0001	1.16 (1.15, 1.17)	<.0001
	80+	1.54 (1.52, 1.57)	<.0001	1.10 (1.08, 1.11)	<.0001
RIO index	Urban (0-9)	1.08 (1.07, 1.09)	<.0001	1.07 (1.06, 1.08)	<.0001
	Small town (10-39)	1.33 (1.32, 1.34)	<.0001	1.44 (1.42, 1.45)	<.0001
	Rural (40+) (ref)	*1.00*	--	*1.00*	--
Comorbidity (ADG)	*No/low comorbidity (0-4) (ref)*	*1.00*	--	*1.00*	--
	Moderate comorbidity (5-9)	3.33 (3.31, 3.35)	<.0001	3.03 (3.01, 3.05)	<.0001
	High comorbidity (10+)	3.28 (3.24, 3.32)	<.0001	2.89 (2.86, 2.92)	<.0001
Morbidity (RUB)	*Non-user/healthy user (0-1) (ref)*	*1.00*	--	*1.00*	--
	Low comorbidity (2)	4.38 (4.36, 4.41)	<.0001	5.85 (5.80, 5.89)	<.0001
	Moderate morbidity (3)	6.51 (6.47, 6.54)	<.0001	7.67 (7.62, 7.71)	<.0001
	High morbidity (4+)	7.13 (7.07, 7.19)	<.0001	7.64 (7.58, 7.71)	<.0001
Recent immigrant	*No (ref)*	*1.00*	--	*1.00*	--
	Yes	0.56 (0.56, 0.56)	<.0001	0.50 (0.50, 0.51)	<.0001
Marginalization: Instability quintile	*[1] Lowest instability (ref)*	*1.00*	--	*1.00*	--

	[2]	0.90 (0.89, 0.91)	<.0001	0.95 (0.94, 0.96)	<.0001
	[3]	0.82 (0.82, 0.83)	<.0001	0.89 (0.88, 0.89)	<.0001
	[4]	0.70 (0.70, 0.71)	<.0001	0.77 (0.77, 0.78)	<.0001
	[5] Highest instability	0.53 (0.53, 0.54)	<.0001	0.59 (0.58, 0.59)	<.0001
Marginalization: Deprivation quintile	*[1] Lowest deprivation (ref)*	*1.00*	--	*1.00*	--
	[2]	1.01 (1.00, 1.01)	0.0377	1.03 (1.02, 1.03)	<.0001
	[3]	0.90 (0.90, 0.91)	<.0001	0.94 (0.93, 0.94)	<.0001
	[4]	0.78 (0.78, 0.79)	<.0001	0.83 (0.82, 0.84)	<.0001
	[5] Highest deprivation	0.65 (0.64, 0.65)	<.0001	0.71 (0.71, 0.72)	<.0001

Table 3. Multivariate logistic regression for association between patient characteristics and patient attachment, 2018

Variable	Label	Male: Odds Ratio (95% CI)	Male: Prob	Female: Odds Ratio (95% CI)	Female: Prob
INTERCEPT		2.23 (2.20, 2.26)	<.0001	2.39 (2.35, 2.43)	<.0001
Age category	a. <19 vs 50-64	2.70 (2.67, 2.73)	<.0001	2.40 (2.37, 2.43)	<.0001
	b. 19-34 vs 50-64	0.86 (0.86, 0.87)	<.0001	0.83 (0.83, 0.84)	<.0001
	c. 35-49 vs 50-64	0.92 (0.91, 0.92)	<.0001	1.01 (1.00, 1.02)	0.0027
	d. 65-79 vs 50-64	1.13 (1.12, 1.14)	<.0001	1.00 (0.99, 1.01)	0.4717
	e. 80+ vs 50-64	1.14 (1.13, 1.16)	<.0001	0.91 (0.90, 0.92)	<.0001
RIO index	a. Urban vs Rural	1.11 (1.10, 1.12)	<.0001	1.11 (1.09, 1.12)	<.0001
	b. Small town vs Rural	1.28 (1.27, 1.30)	<.0001	1.35 (1.33, 1.37)	<.0001
Comorbidity (ADG)	a. Moderate vs Low comorbidity	1.41 (1.40, 1.42)	<.0001	1.33 (1.31, 1.34)	<.0001
	b. High vs Low comorbidity	1.58 (1.56, 1.61)	<.0001	1.36 (1.34, 1.38)	<.0001
Resource user band (RUB)	a. Low user vs Non-user	3.90 (3.87, 3.93)	<.0001	5.43 (5.38, 5.48)	<.0001
	b. Moderate user vs Non-user	5.32 (5.28, 5.36)	<.0001	6.95 (6.89, 7.01)	<.0001
	c. High user vs Non-user	4.82 (4.76, 4.89)	<.0001	7.07 (6.98, 7.16)	<.0001
Recent immigrant	a. Immigrant vs non-immigrant	0.63 (0.63, 0.64)	<.0001	0.60 (0.59, 0.60)	<.0001
Marginalization: Instability quintile	a. [2] vs Lowest instability [1]	0.93 (0.92, 0.94)	<.0001	0.94 (0.93, 0.95)	<.0001
	b. [3 vs Lowest instability [1]	0.88 (0.88, 0.89)	<.0001	0.91 (0.90, 0.92)	<.0001
	c. [4] vs Lowest instability [1]	0.81 (0.81, 0.82)	<.0001	0.84 (0.83, 0.85)	<.0001
	d. Highest [5] vs Lowest instability [1]	0.67 (0.67, 0.68)	<.0001	0.72 (0.71, 0.73)	<.0001

Marginalization: Deprivation quintile	a. [2] vs Lowest deprivation [1]	0.98 (0.97, 0.99)	<.0001	0.98 (0.98, 0.99)	0.0007
	b. [3] vs Lowest deprivation [1]	0.92 (0.91, 0.93)	<.0001	0.93 (0.92, 0.94)	<.0001
	c. [4] vs Lowest deprivation [1]	0.85 (0.84, 0.86)	<.0001	0.87 (0.86, 0.88)	<.0001
	d. Highest [5] vs Lowest deprivation [1]	0.75 (0.75, 0.76)	<.0001	0.80 (0.79, 0.80)	<.0001

Figure 1 Proportion primary care patients attached 2008-2018

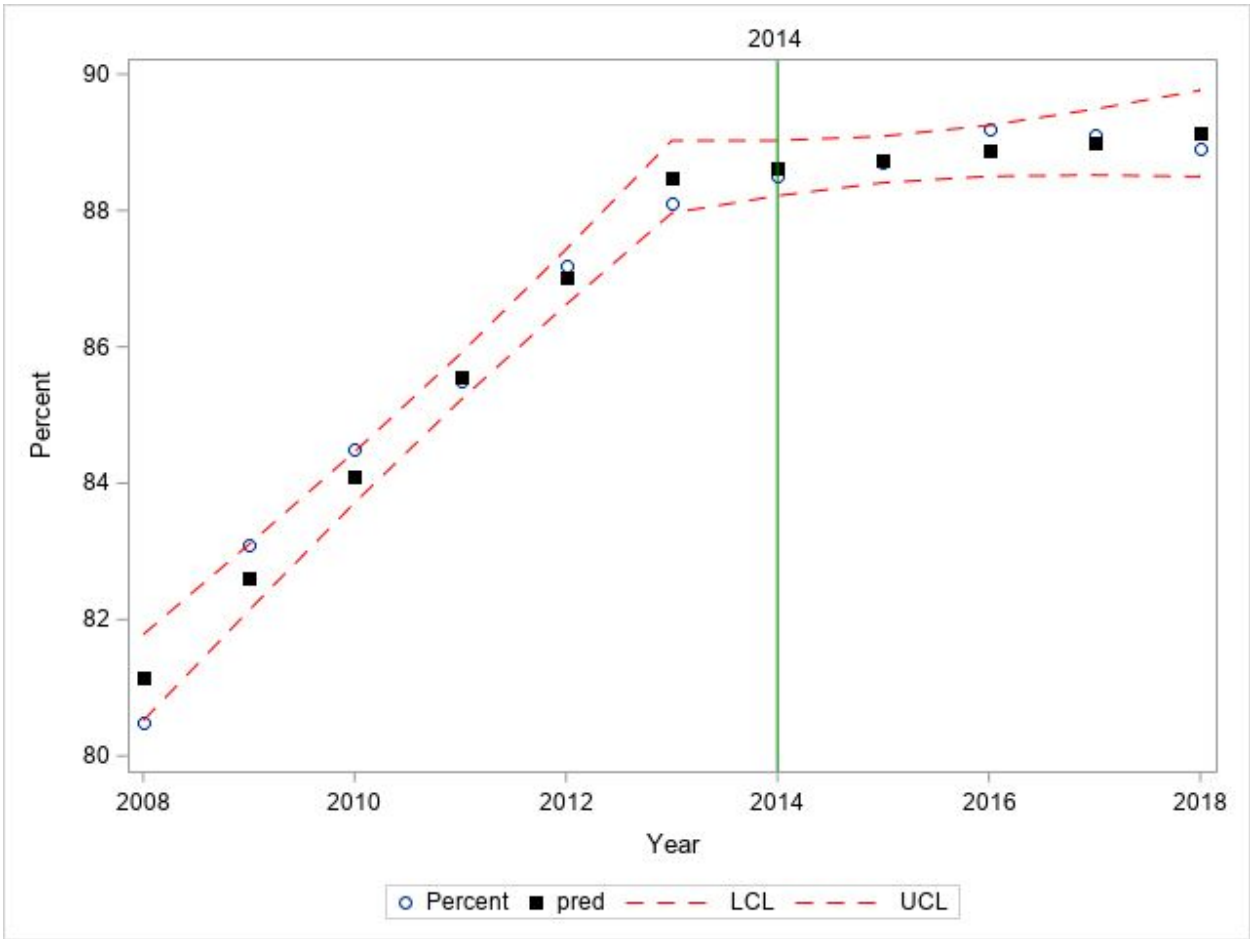

Figure 2. Proportion primary care patients attached 2008-2018 by selected patient characteristics