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The primary care performance of alternatively licensed physicians: A multivariate regression analysis using administrative data

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Complete List of Authors:	Hodwitz, Kathryn; College of Physicians and Surgeons of Ontario, Research and Evaluation Department Thakkar, Niels; College of Physicians and Surgeons of Ontario, Research and Evaluation Department Shultz, Susan; The Institute for Clinical Evaluative Sciences Jaakkimainen, R. Liisa; Institute for Clinical Evaluative Sciences; the Institute of Health Policy, Management and Evaluation, University of Toronto, Department of Family and Community Medicine Faulkner, Daniel; College of Physicians and Surgeons of Ontario, Research and Evaluation Department Yen, Wendy; College of Physicians and Surgeons of Ontario
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Title: The primary care performance of alternatively licensed physicians: A multivariate regression analysis using administrative data

Authors:

Kathryn Hodwitz[1], Niels Thakkar[1], Susan E. Schultz[2], Liisa Jaakkimainen[2,3], Daniel Faulkner[1], Wendy Yen[1]

[1]The College of Physicians and Surgeons of Ontario; [2]The Institute for Clinical Evaluative Sciences; [3]The Department of Family and Community Medicine and the Institute of Health Policy, Management and Evaluation, University of Toronto

Contact Information:

Kathryn Hodwitz
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
80 College Street, Toronto, ON M5G 2E2
khodwitz@cpso.on.ca
1-416-967-2600 x522
**Corresponding author*

Niels Thakkar
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
nthakkar@cpso.on.ca

Susan E. Schultz
The Institute for Clinical Evaluative Sciences
Toronto, Ontario, Canada
sue.schultz@ices.on.ca

Liisa Jaakkimainen
The Institute for Clinical Evaluative Sciences
Toronto, Ontario, Canada
liisa.jaakkimainen@ices.on.ca

Daniel Faulkner
Executive Office,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
dfaulkner@cpso.on.ca

Wendy Yen
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
wyen@cpso.on.ca

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Abstract

Objectives: Medical Regulatory Authorities provide licenses to physicians and monitor those physicians once in practice to support their continued competence. In response to physician shortages, many Canadian MRAs developed alternative licensure routes to allow physicians who do not meet traditional licensure criteria to obtain licenses to practice. Many physicians have gained licensure through alternative routes, but the performance of these physicians in practice has not been previously examined. This study compared the performance of traditionally and alternatively licensed physicians in Ontario using quality indicators of primary care. The purpose of this study was to examine the practice performance of alternatively licensed physicians and provide evaluative evidence for alternative licensure policies.

Design: A retrospective examination of Ontario health administrative data was conducted using Poisson regression analyses to compare the performance of traditionally and alternatively licensed physicians.

Setting: Primary care in Ontario, Canada.

Participants: All family physicians who were licensed in Ontario between 2000 and 2012 and who had complete medical billing data in 2014 were included (N=11,419).

Outcome Measures: Primary care quality indicators were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates using Ontario health administrative data.

Results: Alternatively licensed physicians performed similarly to traditionally licensed physicians in many primary care performance measures. Minimal differences were seen across groups in indicators of diabetic care, congestive heart failure care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years

of age, particularly for alternatively licensed physicians who entered Ontario from another Canadian province.

Conclusions: Our findings provide initial support for alternative licensure policies and suggest potential educational content for certain newly licensed physicians. Our study also demonstrates the utility of administrative data for examining physician performance and evaluating medical regulatory policies and programs.

Article Summary:

Strengths and limitations of this study:

- This is the first study to examine the primary care performance of alternatively and traditionally licensed family physicians in Ontario.
- Using population-level data across multiple indicators of primary care allowed for a comprehensive comparison of physicians and using multivariate analysis enabled statistical adjustment of factors associated with primary care performance.
- A limitation of this study is that ALPs and TLPs were compared to each other, not to a gold standard; thus, findings do not indicate whether physicians are meeting performance benchmarks, only whether ALP performance is comparable to TLP performance.
- Secondly, results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care; other important aspects of primary care are not accounted for.

- Lastly, quality indicators are proxies for delivery of care; therefore, some of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.

Key Words: medical regulation, physician performance, licensure, quality of care, primary care, family medicine

The primary care performance of alternatively licensed physicians:

A multivariate regression analysis using administrative data

A safe and effective healthcare system relies on high quality physician performance. Medical Regulatory Authorities (MRAs) support such performance by issuing licenses to qualified physician applicants and monitoring those physicians once in practice to ensure their continued competence. In the recent past, there has been discussion about the efficacy of regulatory processes for serving professional and public interests (1–3) and calls for evidence-informed regulation through the evaluation of regulatory processes and programs.(3–6) This study heeds such a call by examining the primary care performance of family physicians in Ontario as a way of evaluating regulatory licensure policies and providing information about the care delivered by these physicians.

In Canada, physicians traditionally complete a Canadian residency program and the Canadian qualifying and certification examinations to be granted a license to practice. However, in response to projected physician shortages in the early 2000s, many Canadian MRAs developed alternative licensing criteria to facilitate the licensure of physicians who do not meet the traditional criteria.(7,8) Alternative licensure routes were developed, primarily for International Medical Graduates (IMGs), based on previous experience or licensure, postgraduate training, and/or eligibility to write the Canadian certification exams.(7) Often, these physicians were recruited to work in specific underserviced areas and given provisional licenses to practice despite not meeting the traditional qualifications.(9) Smaller Canadian provinces, such as Newfoundland and Saskatchewan, have been prominent issuers of provisional licenses due to their longstanding health human resource needs;(10,11) however, provisionally licensed physicians often move to other parts of the country after completing their service terms, as most

are able to practice anywhere in Canada once licensed.(8–12) As such, it is thought that smaller provinces may serve as entry points to larger provinces such as Ontario.(9,10)

In addition to the migration of provisionally licensed physicians across Canada, alternative licensure routes also allow entry of physicians from the US into Canada and the licensure of physicians who completed Canadian residency but did not immediately write or pass the national certification exams. In these cases, provisional licenses are given with the stipulation of successful exam completion within three years. Although these routes were initially developed to increase access for IMGs, they are now also utilized by Domestic Medical Graduates (DMGs) who have not successfully completed exams at the time of licensure.

Collectively, Alternatively Licensed Physicians (ALPs) represent physicians who did not meet the licensure criteria at the time of entering independent practice in a given province but who were considered to have comparable qualifications to Traditionally Licensed Physicians (TLPs). The performance of ALPs in practice, however, has not been previously examined. Given that many ALPs are IMGs, a review of IMG literature may offer insight into ALP practice performance; however, research comparing IMGs and DMGs has been equivocal. Some studies show IMGs perform less well than DMGs on certification and licensing examinations,(13–16) and that such performance is associated with practice performance. (17,18) Yet, IMGs and DMGs have been shown to be comparable on practice outcomes such as patient mortality,(19,20) readmission rates,(20) surgical outcomes,(21) and cardiac care.(22)

While these conflicting findings may reflect the different outcomes being measured, they may also stem from the limited definition of IMG being employed. IMGs are typically defined by and compared on the location of their undergraduate medical training, but this only represents one

step in an often long and diverse path of training and experience to independent practice.(7) Examining physicians as defined by later steps in this process, such as point of licensure, may shed light on why performance differences may or may not exist and how these physicians may be better supported at different stages of their career.

In this study, we compare the performance of alternatively and traditionally licensed family physicians in Ontario using primary care quality indicators derived from health administrative data. These indicators were developed and validated by health services researchers to examine physician performance in areas such as chronic disease management, screening rates, and hospital readmissions using accepted practice guidelines.(23,24) We focus on the performance of family physicians licensed through three main alternative routes: those licensed in another Canadian province, those licensed in the US, and those who trained in Canada but did not complete certifying examinations at the time of licensure. The research question guiding this study is: How does the primary care performance of alternatively licensed family physicians compare to traditionally licensed family physicians in Ontario?

METHODS

Study Cohorts

The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014. This population included Traditionally Licensed Physicians (TLPs) and Alternatively Licensed Physicians (ALPs). TLPs are physicians who obtained a license to practice by meeting the traditional criteria, namely the completion of postgraduate training in Canada and successful completion of the national qualifying and

certification examinations (the Medical Council of Canada Qualifying Examinations part 1 and 2, and either the College of Family Physicians of Canada (CFPC) or the Royal College of Physicians and Surgeons of Canada (RCPSC) exams). ALPs are those physicians who were missing one or more of the traditional requirements but met an alternative set of criteria at the time of licensure. There are many alternative licensure routes; in this study, we have focused on the three most commonly used by family physicians, described in Table 1. A more comprehensive description of these routes has been described previously.(7)

Table 1. Description of Alternatively Licensed Physician (ALP) subgroups

Out-of-Province ALPs	Physicians who obtained a license in another Canadian province and thus were given an equivalent license in Ontario despite missing one or more traditional licensing requirements[1] or who gained eligibility to write the CFPC examinations by gaining two years of practice experience in another Canadian province and were thus eligible for a provisional license in Ontario[2]
US-Trained ALPs	Physicians who completed postgraduate training in the US but had not successfully completed the Canadian certification examinations at the time of licensure[2,3]
Canadian-Trained ALPs	Physicians who completed postgraduate training in Canada but had not successfully completed the Canadian certification examinations at the time of licensure[2]

[1] *The Agreement on Internal Trade is an interprovincial agreement that was incorporated into Ontario legislation enabling physicians migrating from other Canadian provinces be granted equivalent licenses to practice without assessment or examination*

[2] *Physicians are granted restricted (provisional) licenses and have up to three years to write the Canadian certification examinations*

[3] *Physicians may be granted restricted (provisional) licences due to successful completion of a practice assessment*

Data Sources

Ontario health administrative datasets held at the Institute for Clinical Evaluative Sciences (ICES) were used in this study. These datasets were linked using unique encoded identifiers and

analyzed at ICES under data security and privacy policies and procedures that are approved by the Office of the Information and Privacy Commissioner of Ontario.(25) The following administrative databases were used: Canadian Institute for Health Information hospital Discharge Abstract Database (CIHI-DAD, providing diagnostic information regarding hospital admissions), OHIP physician claims database (containing physician billings and diagnoses from 1991), the National Ambulatory Care Reporting System (NACRS) database (providing information on hospital- and community-based ambulatory care, including emergency department visits, from 2000 and same-day surgery from 1991) , and the Ontario Drug Benefit (ODB) program database (containing information on all drug therapies dispensed to eligible individuals 65 years of age and older).

Variables

Physician demographic characteristics included age, sex, medical school region, and the Human Development Index (HDI) associated with the physician's country of medical school, which is a composite score based on life expectancy, education, and per capita income that rank orders all countries.(26) Physician practice characteristics included practice type (comprehensive or not), group type (Family Health Team (FHT), non-FHT, no group), scope of practice (percent providing any of the following: postnatal visits, obstetrical deliveries, postnatal visits, emergency department (ED) visits, long term care (LTC) visits), and practice location (urban, suburban/rural). Comprehensive family physicians are those who met specific criteria regarding the type and scope of services they provide.(27) FHTs are group practices which include comprehensive family physicians working alongside primary providers such as nurses, social workers, pharmacists and nutritionists. A detailed description of the physician demographic and practice characteristics is included in Appendix A.

Primary care quality indicators based on health administrative data were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates. Chronic disease management indicators included measures for diabetes care (HbA1C testing, cholesterol testing, ophthalmology examinations, the receipt of prescriptions for angiotension converting enzyme inhibitors (ACE) and angiotensin II receptor blockers (ARBs)), congestive heart failure (CHF; echocardiogram testing within 12 months of diagnosis, emergency department (ED) visits), asthma (spirometry testing within 12 months of diagnoses, ED visits) and Chronic Obstructive Pulmonary Disease (COPD; spirometry testing within 12 months of diagnoses, ED visits). Pediatric care indicators include well-baby visits, the 18-month enhanced developmental assessment, and the absence of pediatric vaccinations (defined as no billing for any immunization in OHIP). Cancer screening indicators included cervical, breast, and colorectal cancer screening. Hospital readmission rates were calculated at 30 days and one year for patients with a hospital admission. These primary care quality indicators are described in Appendix B.

For each family physician, patients who were either rostered (enrolled) or virtually rostered to them (attributed to the physician based on the majority of their billings) were included. All outcomes denote whether a patient received a given type of care, rather than whether the physician they were rostered to provided it. Therefore, patients who received care from a physician other than their family physician (e.g., a walk-in clinic physician or another family physician in their practice) would appear in the data as having received that care and this would be attributed to the family physician they are rostered to.

Statistical Analysis

Demographic and practice characteristics are presented as proportions, means, percentage with any, and mean percentages (Table 2). Absolute rates for the primary care quality indicators are presented as means and mean percentages unless otherwise noted (Table 3). Confidence limits (CL) are presented where applicable. To help with interpretation of results, statistically significant differences less than 5% were considered small and statistically significant differences greater than 5% were considered larger.

The relationship between the physician clinical practice characteristics and the outcomes was modelled using Poisson regression with a log offset. Covariates were entered into the model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income and the median age of their patients. The relative rates estimated by the model indicate the difference in outcome between each ALP group and the TLPs (reference group). All analyses were conducted using SAS version 9.3. Ethical approval for this study was received from the Sunnybrook Health Sciences Ethics Review Board.

RESULTS

Demographic and Practice Characteristics

A total of 292 ALPs and 11,127 TLPs were included in the study (Table 2). The largest group of ALPs were the Canadian Trained (n=114), followed by the American Trained (n=91) and the Out-of-Province (n=78). The majority of TLPs were men (56.6%) and were older (50.6 years) than all three groups of ALPs. TLPs had fewer IMGs (22.2%) and overwhelmingly came from countries with very high HDI (90.5%). All ALPs were slightly more likely than TLPs to be in

comprehensive practice and were less likely to be working in a FHT. Patient age and income distributions were similar across all groups.

The ALP groups' average ages ranged from 42.1 to 50.6 years. The Out-of-Province ALPs had the highest proportion of men (69%) compared to the other ALP groups. In the Out-of-Province ALP group, the majority were IMGs (89.7%) and completed medical school in countries considered medium/low on the HDI (63.2%). Seventy percent (70.1 %) practised in urban environments and they had the largest proportion in solo practice (32.2%). Similar to Out-of-Province, the American Trained ALPs were mostly IMGs (85.7%); however, they graduated primarily from medical schools from countries with a very high/high HDI (68.1%). They had the largest proportion practising in non-FHT groups (65.9%) and were the most urban group (78%). Contrary to the other ALPs, almost half (47.4%) of the Canadian Trained ALPs were non-IMGs and 72.9% came from countries with very high/high HDI. Seventy percent were in comprehensive practice and they had the lowest percentage in solo practice. They also had the lowest proportion practising in urban areas compared to all other groups (67.5%).

Table 2. Demographic and Practice Characteristics of TLPs and ALPs

Characteristic	All TLPs	Out-of-Province ALPs	US-Trained ALPs	Canadian-Trained ALPs
Total (n)	11127	87	91	114
Sex				
Male	6303 (56.6%)	60 (69%)	38 (41.8%)	62 (54.4%)
Female	4824 (43.4%)	27 (31%)	53 (58.2%)	52 (45.6%)
Age (yrs, mean)	50.6	49.5	42.1	45.3
Medical school region				
Canada/USA	8656 (77.8%)	9 (10.3%)	13 (14.3%)	54 (47.4%)
All others	2471 (22.2%)	78 (89.7%)	78 (85.7%)	60 (52.7%)
HDI Group				
Very high/High	10065 (90.5%)	32 (36.8%)	62 (68.1%)	83 (72.9%)
Medium/Low	1062 (9.5%)	55 (63.2%)	29 (31.9%)	31 (27.2%)
Practice type				
Comprehensive	7355 (66.1%)	60 (69%)	64 (70.3%)	80 (70.2%)
Not comprehensive	3772 (33.9%)	27 (31%)	27 (29.7%)	34 (29.8%)
Group type				
FHT	2273 (20.4%)	12 (13.8%)	16 (17.6%)	20 (17.5%)
non-FHT	5635 (50.6%)	47 (54%)	60 (65.9%)	70 (61.4%)
No group	3219 (28.9%)	28 (32.2%)	15 (16.5%)	24 (21.1%)
Rurality				
Urban	8596 (77.3%)	61 (70.1%)	71 (78%)	77 (67.5%)
Suburban/Rural	2531 (22.7%)	26 (29.9%)	20 (22%)	37 (32.5%)
Scope of practice (N, % with any)				
Prenatal visits	6131 (55.1%)	46 (52.9%)	52 (57.1%)	77 (67.5%)
Obstetrical delivery	1224 (11%)	6 (6.9%)	7 (7.7%)	21 (18.4%)
Postnatal visits	3093 (27.8%)	24 (27.6%)	17 (18.7%)	33 (28.9%)
ED visits	2292 (20.6%)	17 (19.5%)	8 (8.8%)	27 (23.7%)
LTC visits	2181 (19.6%)	7 (8%)	13 (14.3%)	27 (23.7%)
Patient age distribution				
< 18 years	18.5	23.0	21.0	20.4
18-64 years	63.8	63.4	63.1	62.5
65+ years	17.7	13.6	15.9	17.1
Patient SES				
% low income	38.0	42.6	42.2	38.9

CL: Confidence Limit | HDI: Human Development Index (2013) | FHT: Family Health Team | ED: Emergency Department | LTC: Long-Term Care

Primary Care Quality Indicators

Table 3 shows the results of the unadjusted and adjusted comparisons between each ALP group and the TLPs (unadjusted mean numbers are included in Appendix C). Each ALP group had a unique profile of primary care quality indicators. Patients of the Out-of-Province ALPs had the most substantial statistically significant differences in the quality care indicators compared to patients of TLPs after multivariate adjustments. These family physicians' diabetic patients were 4% less likely to have received HbA1C testing and their COPD patients were 18% less likely to have received spirometry testing. Their patients with CHF, COPD or asthma were 7% more likely to visit an ED for any reason (i.e., all-cause) than those of TLPs. Additionally, their female patients aged 50-69 were 4% less likely to have received a mammogram in previous two years and their pediatric patients had 14% fewer well-baby visits, were 24% less likely to have had an 18-month enhanced well-baby visit, and were 38% more likely to have received no immunizations. However, their patients were 4% more likely to receive colon cancer screening and their hospitalized patients were 9% less likely to be readmitted in one year.

In contrast, American Trained ALPs were comparable to their TLP counterparts, with some statistically significant differences. Their diabetic care was similar, although American Trained ALP patients were 8% more likely to have received HbA1c and lipids testing than TLPs' patients. Their pediatric patients were also 27% less likely to have not received any immunizations; however, they were 7% less likely to receive well-baby visits. Canadian Trained ALPs were also similar to their TLP counterparts across most indicators; however, some statistically significant differences were seen: their pediatric patients were 3% less likely to have received well-baby visit but were 34% less likely to have not received any childhood immunizations; their COPD patients were 11% less likely to have had spirometry testing within

12 months of diagnosis; and their patients with CHF, COPD or asthma were 9% more likely to visit an ED (all-cause) than those of TLPs.

Table 3. Adjusted and unadjusted relative rates from poisson modelling, primary care quality indicators, ALPs vs. TLPs

Population/Measure	Out-of-Province ALPs				US-Trained ALPs				Canadian-Trained ALPs			
	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.
Total (n)	87				91				114			
Diabetes												
HbA1C	0.95 (0.91, 0.98)	**	0.96 (0.92, 0.99)	*	1.09 (1.06, 1.12)	****	1.08 (1.05, 1.11)	****	1.03 (1.00, 1.06)	*	1.03 (1.01, 1.06)	*
Eye exam	0.97 (0.94, 1.00)	*	0.98 (0.95, 1.01)		0.98 (0.96, 1.01)		0.99 (0.97, 1.01)		1.00 (0.98, 1.03)		1.00 (0.98, 1.02)	
Lipids	1.03 (1.00, 1.06)	*	1.00 (0.97, 1.03)		1.12 (1.09, 1.14)	****	1.08 (1.05, 1.10)	****	1.02 (1.00, 1.05)	*	1.02 (0.99, 1.04)	
ACE/AARB	1.02 (0.95, 1.11)		1.06 (0.97, 1.14)		0.96 (0.90, 1.02)		0.98 (0.92, 1.04)		1.05 (1.00, 1.11)		1.04 (0.98, 1.10)	
Statin	1.00 (0.95, 1.04)		0.98 (0.94, 1.03)		1.03 (1.00, 1.07)		1.01 (0.97, 1.04)		1.01 (0.98, 1.04)		1.00 (0.97, 1.03)	
CHF												
Echo w/in 12 mths of dx	1.00 (0.93, 1.08)		1.00 (0.93, 1.08)		1.03 (0.97, 1.10)		1.02 (0.96, 1.08)		1.01 (0.95, 1.06)		1.00 (0.95, 1.06)	
COPD												
Spiro w/in 12 mths of dx	0.80 (0.69, 0.92)	**	0.82 (0.71, 0.95)	**	1.10 (0.99, 1.22)		1.10 (0.99, 1.23)		0.88 (0.80, 0.97)	*	0.89 (0.80, 0.98)	*
Asthma												
Spirometry (ever)	0.96 (0.93, 0.98)	**	1.03 (1.01, 1.06)	*	0.98 (0.96, 1.00)		1.00 (0.98, 1.02)		1.00 (0.98, 1.02)		1.03 (1.01, 1.06)	**
CHF, COPD or Asthma												
ED visits per person	1.08 (1.06, 1.10)	****	1.07 (1.05, 1.09)	****	1.02 (1.01, 1.04)	**	0.97 (0.95, 0.99)	***	1.18 (1.16, 1.19)	****	1.09 (1.07, 1.10)	****
Pediatric care												
Well-baby visits	0.90 (0.87, 0.92)	****	0.86 (0.83, 0.88)	****	0.93 (0.90, 0.95)	****	0.93 (0.90, 0.95)	****	0.98 (0.96, 1.01)		0.97 (0.95, 0.99)	*
18-month enhanced assessment	0.70 (0.63, 0.78)	****	0.76 (0.68, 0.84)	****	0.99 (0.92, 1.07)		0.99 (0.91, 1.07)		1.03 (0.96, 1.10)		1.06 (0.99, 1.14)	
No Immunization	1.20 (0.99, 1.46)		1.38 (1.13, 1.68)	**	0.65 (0.52, 0.81)	***	0.73 (0.58, 0.92)	**	0.66 (0.54, 0.81)	***	0.66 (0.54, 0.82)	***
Cancer screening												
Mammography	0.92 (0.90,	****	0.96 (0.93,	**	0.98 (0.96,		1.01 (0.99,		0.96 (0.94,	***	0.98 (0.96,	

	0.94)		0.99)		1.01)		1.03)		0.98)		1.00)	
Pap test (3 yr)	0.94 (0.92, 0.96)	****	1.00 (0.98, 1.02)		1.00 (0.98, 1.01)	**	1.02 (1.01, 1.03)	**	0.98 (0.97, 0.99)	**	1.01 (0.99, 1.02)	
Any colon CA screening	0.98 (0.96, 1.00)	****	1.04 (1.02, 1.06)	****	0.99 (0.98, 1.01)	*	1.02 (1.00, 1.03)	*	1.00 (0.99, 1.02)		1.03 (1.02, 1.05)	****
Hospital readmissions												
30 day	0.91 (0.79, 1.03)		0.96 (0.84, 1.09)		0.91 (0.82, 1.01)		0.94 (0.84, 1.05)		1.00 (0.92, 1.10)		1.03 (0.94, 1.13)	
1 yr	0.84 (0.78, 0.91)	****	0.91 (0.84, 0.98)	*	0.91 (0.85, 0.96)	**	0.98 (0.93, 1.05)		0.93 (0.88, 0.99)	*	0.98 (0.93, 1.04)	

Notes: Adjusted for age group, sex, IMG status, urban-rural status, number of years in practice, whether the physician was in a Patient Enrollment model, HDI group, median patient age and percent of patients in low-income neighbourhoods.

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II| CL: Confidence Limit | CHF: Congestive Heart Failure | dx: diagnosis | COPD: Chronic Obstructive Pulmonary Disease | ED: Emergency Department | CA: Cancer

Sig.=significance level. *=p<0.05, **=p<0.01, ***=p<0.001, ****=p<0.0001

DISCUSSION

Our analysis of primary care quality indicators suggest that alternatively licensed physicians (ALPs) perform similarly to traditionally licensed physicians (TLPs) in many areas of primary care practice. Small differences were seen across groups in indicators of diabetic care, CHF care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age and COPD management, particularly in patients of Out-of-Province ALPs. While individual family physician performance is contextual and influenced by many factors,(28,29) health administrative data is useful for gaining a system-level impression of family physicians' quality of care and identifying areas that are meeting practice benchmarks and areas that may need improvement.(30) Our findings therefore provide support for alternative licensure policies and identify potential educational content for certain newly licensed family physicians.

Out-of-Province ALPs

Compared to other subgroups, the primary care performance of Out-of-Province ALPs was the most different from TLPs. Most notably, their patients less than two years of age were significantly less likely to receive well baby visits, enhanced 18-month assessments, or immunizations, highlighting a trend in preventive pediatric care. These differences may reflect provincial differences in care expectations for children, as there is significant variation in how 18-month assessments are approached globally and across Canada.(31) Ontario has supported a longer and more comprehensive enhanced18-month assessment by providing financial incentives through a unique billing code.(31–33) It is possible that Out-of-Province ALPs were unaware of Ontario's enhanced 18-month assessment or of the pediatric care expectations of family

physicians in the province. It is also possible that these physicians provided 18-month assessments but did not bill for it using the Ontario-specific code; however, the trend across all three preventive pediatric care indicators suggests that the issue may be broader than billing for this assessment. Previous research has shown that male IMGs who have been in practice for over 10 years are less likely to provide 18-month assessments in Ontario.(34) In this study, age, gender, and HDI were controlled for, suggesting these factors are not accountable for the differences; thus, entering Ontario from another province through an alternative route may be an independent risk factor.

In addition to differences in preventive pediatric care, Out-of-Province ALPs differed from TLPs in rates of spirometry testing for COPD patients, which is recommended to confirm a diagnosis of COPD.(35–38) Previous research has found that spirometry test ordering among family physicians in Ontario is generally low,(39) and our findings suggest that it is even lower among Out-of-Province ALPs (and Canadian Trained ALPs) compared to TLPs, highlighting potential provincial differences in utilization. Out-of-Province ALPs' patients with CHF, COPD, or asthma also had higher rates of all-cause ED visits, but their hospitalized patients were 9% less likely to have been readmitted within one year. Rates of all-cause ED visits and readmissions are sometimes associated with access to primary care,(40–43) but can be influenced by many factors (43–46) and should thus be interpreted cautiously.

Overall, our findings highlight the subtle differences in how physicians in different provinces provide primary care. This has implications for the migration of physicians across provinces since physicians can typically practice anywhere in Canada once licensed. Given that provisional licenses have been seen as a way for physicians to gain entry to larger provinces through smaller ones,(9) the Federation of Medical Regulatory Authorities of Canada has begun to standardize

provincial licensure requirements and the Medical Council of Canada is facilitating a common approach to practice ready assessments for IMGs across the country. While these efforts will help to mitigate potential performance differences in Canadian physicians, our findings suggest that ALPs entering Ontario from another province may still benefit from information about preventive pediatric care at the time of licensure. Focused knowledge translation for family physicians migrating across provinces may help to educate physicians about province-specific expectations and support their adoption of provincially-supported programs and guidelines, reducing the potential for future performance differences.

US-Trained and Canadian-Trained ALPs

US-Trained and Canadian-Trained ALPs performed similarly to TLPs on most primary care quality indicators, though some differences were noted. For both groups, patients less than two years of age were less likely to receive well baby visits but more likely to receive immunizations. US-Trained ALPs' diabetic patients were more likely to receive HbA1c and lipid testing and their patients with CHF, COPD, or asthma were less likely to visit an ED. Canadian-Trained ALPs' COPD patients were less likely to receive spirometry testing, and their patients with CHF, COPD, or asthma were more likely to visit an ED. These findings may reflect that US-Trained ALPs provide better access to primary care than Canadian-Trained ALPs, but further work is needed to examine factors related to ALP primary care access. Overall, the performance of these ALPs was comparable to TLPs. This is perhaps unsurprising given that these physicians have similar postgraduate training. Our findings provide evidence that their practice performance is in fact similar to traditionally licensed physicians in Ontario.

Conclusions

Our findings illustrate that ALPs perform similarly to TLPs across many indicators of primary care. These findings provide support for alternative licensure policies and demonstrate the utility of health administrative data for examining physician performance and evaluating regulatory processes. As transparency and accountability are increasingly emphasized in healthcare,(47) and as physician migration and the use of alternative licensure routes continues to increase,(7) it is imperative that processes for licensing and monitoring physicians are rigourously evaluated. The ongoing assessment of physician performance is critical for understanding the effects of medical regulatory policies and, ultimately, for ensuring high quality patient care.

Strengths and Limitations

This is the first study to examine the primary care performance of alternatively and traditionally licensed family physicians in Ontario. Our use of population-level data across multiple indicators of primary care allowed for a robust and comprehensive comparison of ALPs and TLPs and our use of multivariate analysis enabled statistical adjustment of physician demographics, practice environments, and patient factors, such as SES, that are associated with primary care performance. While this approach contributes to our understanding of ALP performance, it is not without limitations. First, ALPs and TLPs were compared to each other, not to a gold standard. As such, our findings do not indicate whether physicians are meeting performance benchmarks, but rather whether ALP performance is comparable to TLP performance. Second, our results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care. Other important aspects of primary care such as the doctor-patient relationship or inter-

professional collaboration with other primary health care providers are thus not accounted for. Last, billing data introduces unique interpretation challenges as these quality indicators are proxies for delivery of care; therefore, some of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.

Implications for Future Research

This study offers insight into the primary care performance of alternatively licensed physicians. Primary care is an important area of study given that approximately half of physicians in Ontario specialize in Family Medicine;(7) however, future research is needed to examine the practice performance of ALPs practicing in other specialties. Performance is also multi-faceted and must be studied using a variety of measures. Future studies could include other measures of performance, such as practice assessments or complaints profiles, to gain a comprehensive picture of ALPs' practices.

This study also demonstrates that licensure route is a useful way of stratifying and comparing physicians. IMG studies typically define physicians based on their country of undergraduate medical school, whereas licensure route accounts for the influence of postgraduate training and previous practice experience on performance. Examining the impact of all of a physician's training and experience on future practice performance allows for a more robust understanding of the predictors of performance and may enable more nuanced IMG research in the future.

Finally, this study represents a collaboration between a medical regulator and system partners. Such collaborations are important for linking performance data across the continuum of medical education and practice (48,49) and for providing evaluative evidence for regulatory processes

and policies, such as alternative licensure routes.(4,6) Further collaborations of this nature will allow for robust examinations of the influence of each stage of a physician's training on future practice performance.

Appendix A) Description of Physician Demographic and Practice Characteristic Indicators

Indicator	Description	Definition of indicator
Sex		
Male	Physician sex	Male sex
Female		Female sex
Age	Physician age	Physician age in 2014
HDI Group		
Very high	2013 Human development index associated with the country of undergraduate medical school of physician (26)	HDI rank < 50
High		HDI rank ≥50 and < 103
Medium		HDI rank ≥103 and < 145
Low		HDI rank ≥145
Practice Type		
Comprehensive	Comprehensive practice is if majority of services billed are related to "core primary care" and span multiple practice areas (27)	≥ 44 days worked/yr and > 50% of billing "in core primary care" in at least 7 of 22 practice areas
Other		All other FM physicians
Group type		
FHT	Family Health Team, group practice but not-Family Health Team or solo practice	
non-FHT		
No group		

Rurality		
Urban	Practice location categorized in to urban or suburban/rural based on 2008 Rurality Index for Ontario (RIO) score (50)	RIO < 10
Suburban/Rural		RIO ≥ 10
Scope of practice		
Prenatal visits	If the physician submitted billing for care related to: prenatal visits, obstetrical delivery, postnatal visits, Emergency Department, or Long-Term Care	% with any billing
Obstetrical Delivery		% with any billing
Postnatal visits		% with any billing
ED visits		% with any billing
LTC visits		% with any billing
Patient age distribution		
< 18 years	Pts age categories in 2014	< 18 years
18-64 years		18-64 years
65+ years		65+ years
Patient SES		
% low income	Number of pts in the bottom 40% of neighborhood income	< 3rd quintile of neighborhood income

HDI: Human Development Index | FM: Family Medicine | FHT: Family Health Team |RIO: Rurality Index of Ontario| ED: Emergency Department | LTC: Long-Term Care | Pts: patients | SES: Socio-Economic Status

Appendix B) Description of Primary Care Quality Indicators

Indicator	Population	Description/guideline	Definition of indicator
Diabetes			
HbA1c	Pts with Diabetes Mellitus	Every 3-6 months, depending on control (51)	2+ HbA1c in previous 12 months
Eye exam		Examination every 1-2 years, depending on severity (51)	Eye exam in previous 24 months
Lipids		Total cholesterol, HDL-C, LDL-C, and TGs annually (51)	1+ cholesterol test in previous 12 months
ACE/ARB		Indicated for pts with high cardiovascular risk (51)	Prescribed ACE/ARB in previous 12 months (pts 65 years of age or older)
Statin		Indicated for pts with elevated lipids (51)	Prescribed statin in previous 12 months (pts 65 years of age or older)
CHF			
Echocardiogram w/in 12 mths of diagnosis	Pts with newly diagnosed CHF	Recommended early after CHF diagnosis for assessment and management (52)	Echocardiogram ordered within 12 months of diagnosis
ED visits/person	Pts with CHF		All cause ED visit in 2014/15
COPD			
Spirometry w/in 12 mths of diagnosis	Pts with newly diagnosed COPD	Recommended for diagnosis (37)	Spirometry within 12 months of diagnosis
ED visits/person	Pts with COPD	All COPD pts, number of ED	All cause ED visit in 2014/15

		visits/year	
Asthma			
Spirometry	Pts with asthma	Recommended to be reassessed regularly and used for diagnosis (53)	Ever had spirometry
ED visits/person		All asthma pts number of ED visits/year	All cause ED visit in 2014/15
Preventive Pediatric Care			
Well-baby visits	Pts < 2yrs		Number of visits in first 24 months
18-month enhanced well baby visit	Pts 18 months	Recommended for every child in Ontario (32)	Submitted 18 month billing code
No Immunization	Pts < 2yrs	Publicly funded routine immunizations for children in first 2 yrs (54)	Submitted no billing codes for DTAP, Pneumococcal, MenCC, MMR, Varicella
Cancer Screening			
Mammogram	Female pts 52-69 yrs (excluding breast cancer pts)	Recommended every 2-3 years for pts 50-69 (55)	Mammogram in previous 24 months
Pap test	Female pts 23-69 yrs (excluding cervical and endometrial cancer pts)		Pap in previous 36 months

All colon cancer screening	Pts 52-74 yrs (excluding colon cancer and IBD pts)	FOBT recommended every 1-2 yrs; Colonoscopy every 10 yrs; Flexible Ssigmoidoscopy and Double Contrast Barium Enema every 5years for pts 50-74	Any FOBT in previous 2 yrs; colonoscopy in previous 10 yrs; other in previous 5 yrs
Hospital Readmissions			
Readmission (30 days)	All hospitalized pts		Hospital readmission within 30 days
Readmission (1 yr)			Hospital readmission within 12 months

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | pts: patients | HDL-C: High-Density Lipoprotein Cholesterol | LDL-C: Low-Density Lipoprotein Cholesterol | TG: Triglycerides | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II Receptor Blockers | CHF: Congestive Heart Failure | ED: Emergency Department | COPD: Chronic Obstructive Pulmonary Disease | DTAP: Diphtheria, Tetanus, Pertussis, Polio | MenCC: Meningococcal Conjugate C | MMR: Measles, Mumps, Rubella | PAP: Papanicolau test | IBD. Inflammatory Bowel Disease | endo: FOBT: Fecal Occult Blood Test

Appendix C) Unadjusted mean numbers or percentages, clinical practice measures

	TLPs		Out-of-Province ALPs		US-Trained ALPs		Canadian-Trained ALPs	
	mean % or #	95% CL	mean % or #	95% CL	mean % or #	95% CL	mean % or #	95% CL
Diabetes								
HbA1C	43.4	(43, 43.9)	41.8	(37.6, 46)	48.0	(44.3, 51.6)	45.4	(41.8, 49)
Eye exam	66.2	(65.9, 66.6)	63.1	(59.3, 66.8)	67.3	(64.2, 70.3)	67.3	(64, 70.7)
Lipids test	62.4	(61.9, 62.9)	67.6	(63.4, 71.9)	72.9	(68.8, 77)	64.1	(59.8, 68.5)
Ace/AARB	70.2	(69.8, 70.6)	71.8	(67.3, 76.2)	74.5	(71.2, 77.7)	70.2	(66.5, 74)
Statin	69.5	(69.2, 69.9)	68.6	(63.5, 73.8)	75.8	(73.5, 78.1)	69.8	(66.5, 73.2)
CHF								
Echo w/in 12 mths of dx	85.3	(84.7, 85.9)	83.1	(74.5, 91.7)	91.5	(87.9, 95.1)	85.6	(79.8, 91.5)
COPD								
Spiro w/in 12 mths of dx	78.1	(77.6, 78.7)	72.9	(65.1, 80.7)	77.3	(71.7, 83)	79.0	(74.1, 83.8)
Asthma								
Any spirometry	51.7	(51.3, 52.1)	49.4	(45.3, 53.5)	52.0	(48.8, 55.3)	50.7	(47.6, 53.8)
CHF, COPD or Asthma								
ED visits/person	0.82	(0.79, 0.85)	0.68	(0.58, 0.77)	0.65	(0.58, 0.72)	0.87	(0.76, 0.99)
Pediatric care								
Well baby visits (mean #)	5.2	(5.2, 5.3)	4.3	(3.8, 4.9)	5.0	(4.5, 5.4)	4.8	(4.4, 5.2)
18 month enhanced assessment	47.9	(47.1, 48.6)	32.8	(25.8, 39.8)	47.7	(41, 54.4)	47.4	(42, 52.8)
No immunization	16.9	(16.2, 17.5)	23.6	(16.3, 30.9)	12.0	(8, 16)	16.4	(11.2, 21.6)
Cancer screening								
Mammogram	58.2	(57.8, 58.7)	51.0	(46.2, 55.8)	59.1	(55.1, 63.1)	55.0	(50.9, 59.1)
Pap test (3 yrs)	56.4	(56, 56.8)	50.7	(46.5, 54.8)	57.5	(53.1, 62)	55.8	(52.6, 59.1)
Any colon ca screening	55.5	(55.1, 56)	48.7	(43.8, 53.6)	54.6	(50.1, 59)	56.8	(53.3, 60.3)
Hospital readmissions								
30 day	0.18	(0.18, 0.18)	0.14	(0.11, 0.18)	0.15	(0.13, 0.17)	0.19	(0.16, 0.23)
1 yr	0.06	(0.06, 0.06)	0.05	(0.03, 0.06)	0.05	(0.04, 0.06)	0.07	(0.05, 0.09)

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II| CL: Confidence Limit | CHF: Congestive Heart Failure | dx: diagnosis | COPD: Chronic Obstructive Pulmonary Disease | ED: Emergency Department | CA: Cancer

Declarations

1. Ethics approval: Ethical approval for this study was obtained from the Sunnybrook Health Sciences Center Ethics Review Board
2. Availability of data and material: The datasets included in this study are housed at the Institute for Clinical Evaluative Sciences. A request to the Data Analytic Services (DAS) at ICES is required in order to obtain access to data or analytic services (www.ices.on.ca/DAS/Data).
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5. Author contributions: KH, NT, DF, and WY conceptualized this study, interpreted the data, and were key contributors to the manuscript. LJ and SS were responsible for selecting and operationalizing the outcome measures. SS analyzed the data and contributed to writing the manuscript. All authors read and approved the final manuscript.
6. Author information: KH is a Research Associate at the College of Physicians and Surgeons of Ontario and has an MSc in Health Services Research from the University of Toronto; NT is a Research Associate at the College of Physicians and Surgeons of Ontario and has an MSc in Kinesiology and Health Science from York University; SS is a Senior Epidemiologist at the Institute for Clinical Evaluative Sciences and has an MA in Regional Planning from the University of Waterloo and an MSc in Community Health and Epidemiology from the University of Toronto; LJ is a Senior Scientist at the Institute for Clinical Evaluative Sciences and has an MSc in Community Health and Epidemiology from Queen's University

and an MD from McMaster University; DF is the Deputy Registrar at the College of Physicians and Surgeons of Ontario and has an MBA in Health Services Management from McMaster University; WY is a Senior Researcher at the College of Physicians and Surgeons of Ontario and has an MA in Measurement and Evaluation from the University of Toronto and is currently pursuing a PhD in Adult Education from the University of Toronto.

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The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data

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Authors:

Kathryn Hodwitz[1], Niels Thakkar[1], Susan E. Schultz[2], Liisa Jaakkimainen[2,3], Daniel Faulkner[1], Wendy Yen[1]

[1]The College of Physicians and Surgeons of Ontario; [2]The Institute for Clinical Evaluative Sciences; [3]The Department of Family and Community Medicine and the Institute of Health Policy, Management and Evaluation, University of Toronto

Contact Information:

Kathryn Hodwitz
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
80 College Street, Toronto, ON M5G 2E2
khodwitz@cpso.on.ca
1-416-967-2600 x522
**Corresponding author*

Niels Thakkar
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
nthakkar@cpso.on.ca

Susan E. Schultz
The Institute for Clinical Evaluative Sciences
Toronto, Ontario, Canada
sue.schultz@ices.on.ca

Liisa Jaakkimainen
The Institute for Clinical Evaluative Sciences
Toronto, Ontario, Canada
liisa.jaakkimainen@ices.on.ca

Daniel Faulkner
Executive Office,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
dfaulkner@cpso.on.ca

Wendy Yen
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
wyen@cpso.on.ca

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Abstract

Objectives: Medical Regulatory Authorities provide licenses to physicians and monitor those physicians once in practice to support their continued competence. In response to physician shortages, many Canadian MRAs developed alternative licensure routes to allow physicians who do not meet traditional licensure criteria to obtain licenses to practice. Many physicians have gained licensure through alternative routes, but the performance of these physicians in practice has not been previously examined. This study compared the performance of traditionally and alternatively licensed physicians in Ontario using quality indicators of primary care. The purpose of this study was to examine the practice performance of alternatively licensed physicians and provide evaluative evidence for alternative licensure policies.

Design: A cross-sectional retrospective examination of Ontario health administrative data was conducted using Poisson regression analyses to compare the performance of traditionally and alternatively licensed physicians.

Setting: Primary care in Ontario, Canada.

Participants: All family physicians who were licensed in Ontario between 2000 and 2012 and who had complete medical billing data in 2014 were included (N=11,419).

Outcome Measures: Primary care quality indicators were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates using Ontario health administrative data.

Results: Alternatively licensed physicians performed similarly to traditionally licensed physicians in many primary care performance measures. Minimal differences were seen across groups in indicators of diabetic care, congestive heart failure care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years

of age, particularly for alternatively licensed physicians who entered Ontario from another Canadian province.

Conclusions: Our findings demonstrate that alternatively licensed physicians perform similarly to traditionally licensed physicians across many indicators of primary care. Our study also demonstrates the utility of administrative data for examining physician performance and evaluating medical regulatory policies and programs.

Article Summary:

Strengths and limitations of this study:

- This is the first study to examine the primary care performance of alternatively and traditionally licensed family physicians in Ontario.
- Using population-level data across multiple indicators of primary care allowed for a comprehensive comparison of physicians; using multivariate analysis enabled statistical adjustment of factors associated with primary care performance.
- A limitation of this study is that ALPs and TLPs were compared to each other, not to a gold standard; thus, findings do not indicate whether physicians are meeting performance benchmarks, only whether ALP performance is comparable to TLP performance.
- Secondly, results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care; other important aspects of primary care are not accounted for.

- Lastly, quality indicators are proxies for delivery of care; therefore, some of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.

Key Words: medical regulation, physician performance, licensure, quality of care, primary care, family medicine

The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data

A safe and effective healthcare system relies on high quality physician performance. Medical Regulatory Authorities (MRAs) support such performance by issuing licenses to qualified physician applicants and monitoring those physicians once in practice to ensure their continued competence. MRAs also play a role in examining factors that influence physician performance as a way of identifying physician subgroups that may benefit from educational support.(1–8) Additionally, there has been discussion about the efficacy of regulatory processes for serving professional and public interests (9–11) and calls for evidence-informed regulation through the evaluation of regulatory processes and programs.(11–14) This study heeds such a call by examining the primary care performance of family physicians in Ontario as a way of evaluating regulatory licensure policies and exploring the influence of licensure route on physician performance.

In Canada, physicians traditionally complete a Canadian residency program and the Canadian qualifying and certification examinations to be granted a license to practice. However, in response to projected physician shortages in the early 2000s, many Canadian MRAs developed alternative licensing criteria to facilitate the licensure of physicians who do not meet the traditional criteria.(15,16) Alternative licensure routes were developed, primarily for International Medical Graduates (IMGs), based on previous experience or licensure, postgraduate training, and/or eligibility to write the Canadian certification exams.(15) Often, these physicians were recruited to work in specific underserviced areas and given provisional licenses to practice despite not meeting the traditional qualifications.(17) Smaller Canadian provinces, such as Newfoundland and Saskatchewan, have been prominent issuers of provisional

licenses due to their longstanding health human resource needs;(18,19) however, provisionally licensed physicians often move to other parts of the country after completing their service terms, as most are able to practice anywhere in Canada once licensed.(16–20) As such, it is thought that smaller provinces may serve as entry points to larger provinces such as Ontario.(17,18)

In addition to the migration of provisionally licensed physicians across Canada, alternative licensure routes also allow entry of physicians from the US into Canada and the licensure of physicians who completed Canadian residency but did not immediately write or pass the national certification exams. In these cases, provisional licenses are given with the stipulation of successful exam completion within three years. Although these routes were initially developed to increase access for IMGs, they are now also utilized by Domestic Medical Graduates (DMGs) who have not successfully completed exams at the time of licensure.

Collectively, Alternatively Licensed Physicians (ALPs) represent physicians who did not meet the licensure criteria at the time of entering independent practice in a given province but who were considered to have comparable qualifications to Traditionally Licensed Physicians (TLPs), based on their postgraduate training and/or professional experience. The performance of ALPs in practice, however, has not been previously examined. Given that many ALPs are IMGs, a review of IMG literature may offer insight into ALP practice performance; however, research comparing IMGs and DMGs has been equivocal. Some studies show IMGs perform less well than DMGs on certification and licensing examinations,(21–24) and that such performance is associated with practice performance. (5,25) Yet, IMGs and DMGs have been shown to be comparable on practice outcomes such as patient mortality,(26,27) readmission rates,(27) surgical outcomes,(28) and cardiac care.(29)

While these conflicting findings may reflect the different outcomes being measured, they may also stem from the limited definition of IMG being employed. IMGs are typically defined by and compared on the location of their undergraduate medical training, but this only represents one step in an often long and diverse path of training and experience to independent practice.(15) Examining physicians as defined by later steps in this process, such as point of licensure, may shed light on the impact of postgraduate medical training and early career practice experiences on subsequent performance and how physicians entering practice through alternative licensure routes may be better supported at different stages of their career.

In this study, we sought to understand the impact of alternative licensure routes on the delivery of primary care in Ontario. We used primary care quality indicators derived from health administrative data that were developed and validated by health services researchers to examine physician performance in areas such as chronic disease management, screening rates, and hospital readmissions using accepted practice guidelines.(30,31) We focused on the performance of a cohort of family physicians licensed through three main alternative routes: those licensed in another Canadian province, those licensed in the US, and those who trained in Canada but did not complete certifying examinations at the time of licensure. The research question guiding this study was: Does licensure route influence the primary care performance of physicians in Ontario?

METHODS

Approach

The objective of this study was to examine the independent contribution of being licensed through various alternative routes on primary care performance. In order to isolate the effect of licensure route, we chose to compare each ALP group to TLPs on a variety of quality care indicators while adjusting for a number of covariates. We do not address the independent impact of the other variables that were adjusted for, as, practically, we could either focus on a small number of outcomes and explore the full multivariable models, or examine a broad spectrum of indicators representative of general family practice and narrow our focus to licensure route. We chose the latter, as we were interested in primary care performance as a whole rather than performance on any individual quality indicators. Additionally, the indicators do not have validated thresholds or gold standard rates at the individual- or population-level, thus performance is better assessed globally as opposed to focusing on individual tests, screens, or prescriptions.

Study Cohorts

The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014. All publicly-funded health services provided by physicians are submitted to OHIP. This population included Traditionally Licensed Physicians (TLPs) and Alternatively Licensed Physicians (ALPs). TLPs are physicians who obtained a license to practice by meeting the traditional criteria, namely the completion of postgraduate training in Canada and successful completion of the national qualifying and certification examinations (the Medical Council of Canada Qualifying Examinations part 1 and 2, and either the College of Family Physicians of Canada (CFPC) or the Royal College of Physicians and Surgeons of Canada (RCPSC) exams). ALPs are those physicians who were

missing one or more of the traditional requirements but met an alternative set of criteria at the time of licensure. There are many alternative licensure routes; in this study, we have focused on the three most commonly used by family physicians, described in Table 1. A more comprehensive description of these routes has been described previously.(15)

Table 1. Description of Alternatively Licensed Physician (ALP) subgroups

Out-of-Province ALPs	Physicians who obtained a license in another Canadian province and thus were given an equivalent license in Ontario despite missing one or more traditional licensing requirements[1] or who gained eligibility to write the CFPC examinations by gaining two years of practice experience in another Canadian province and were thus eligible for a provisional license in Ontario[2]
US-Trained ALPs	Physicians who completed postgraduate training in the US but had not successfully completed the Canadian certification examinations at the time of licensure[2,3]
Canadian-Trained ALPs	Physicians who completed postgraduate training in Canada but had not successfully completed the Canadian certification examinations at the time of licensure[2]

[1] The Agreement on Internal Trade is an interprovincial agreement that was incorporated into Ontario legislation enabling physicians migrating from other Canadian provinces be granted equivalent licenses to practice without assessment or examination

[2] Physicians are granted restricted (provisional) licenses and have up to three years to write the Canadian certification examinations

[3] Physicians may be granted restricted (provisional) licences due to successful completion of a practice assessment

Data Sources

Ontario health administrative datasets held at the Institute for Clinical Evaluative Sciences (ICES) were used in this study. These datasets were linked using unique encoded identifiers and analyzed at ICES under data security and privacy policies and procedures that are approved by the Office of the Information and Privacy Commissioner of Ontario.(32) The following administrative databases were used: Canadian Institute for Health Information hospital Discharge

Abstract Database (CIHI-DAD, providing diagnostic information regarding hospital admissions), OHIP physician claims database (containing physician billings and diagnoses from 1991), the National Ambulatory Care Reporting System (NACRS) database (providing information on hospital- and community-based ambulatory care, including emergency department visits, from 2000 and same-day surgery from 1991) , and the Ontario Drug Benefit (ODB) program database (containing information on all drug therapies dispensed to eligible individuals 65 years of age and older).

Variables

Physician demographic characteristics included age, sex, medical school region, and the Human Development Index (HDI) associated with the physician's country of medical school, which is a composite score based on life expectancy, education, and per capita income that rank orders all countries.(33) Physician practice characteristics included practice type (comprehensive or not), group type (Family Health Team (FHT), non-FHT, no group), scope of practice (percent providing any of the following: postnatal visits, obstetrical deliveries, postnatal visits, emergency department (ED) visits, long term care (LTC) visits), and practice location (urban, suburban/rural). Comprehensive family physicians are those who met specific criteria regarding the type and scope of services they provide.(34) FHTs are group practices which include comprehensive family physicians working alongside primary providers such as nurses, social workers, pharmacists and nutritionists. A detailed description of the physician demographic and practice characteristics is included in Appendix A.

Primary care quality indicators based on health administrative data were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates.

Chronic disease management indicators included measures for diabetes care (HbA1C testing, cholesterol testing, ophthalmology examinations, the receipt of prescriptions for angiotension converting enzyme inhibitors (ACE) and angiotensin II receptor blockers (ARBs)), congestive heart failure (CHF; echocardiogram testing within 12 months of diagnosis, emergency department (ED) visits), asthma (spirometry testing within 12 months of diagnoses, ED visits) and Chronic Obstructive Pulmonary Disease (COPD; spirometry testing within 12 months of diagnoses, ED visits). Pediatric care indicators include well-baby visits, the 18-month enhanced developmental assessment, and the absence of pediatric vaccinations (defined as no billing for any immunization in OHIP). Cancer screening indicators included cervical, breast, and colorectal cancer screening. Hospital readmission rates were calculated at 30 days and one year for patients with a hospital admission. These primary care quality indicators are described in Appendix B.

For each family physician, patients who were either rostered (enrolled) or virtually rostered to them (attributed to the physician based on the majority of their billings) were included. All outcomes denote whether a patient received a given type of care, rather than whether the physician they were rostered to provided it. Therefore, patients who received care from a physician other than their family physician (e.g., a walk-in clinic physician or another family physician in their practice) would appear in the data as having received that care and this would be attributed to the family physician they are rostered to.

Statistical Analysis

Demographic and practice characteristics are presented as proportions, means, percentage with any, and mean percentages (Table 2). Absolute rates for the primary care quality indicators are presented as means and mean percentages unless otherwise noted (Table 3). Unadjusted rates are

included for comprehensiveness but only the adjusted rates are discussed to answer our research question. Confidence limits (CL) are presented where applicable. To help with interpretation of results, statistically significant differences less than 5% were considered small and statistically significant differences greater than 5% were considered larger.

Our multivariate analysis modelled the relationship between physician licensure cohort (ALP group or TLP) and clinical practice outcomes. Before carrying out the modelling, we tested the outcome measures for normality and found that many, such as the proportion of a physician's diabetic patients who received an eye exam within the previous year, were not normally distributed, but became so after being log transformed. Based on this, we chose to use proc genmod in SAS to model the number with each characteristic (rather than the proportion) based on the Poisson distribution and including a log offset. Exponentiating the resulting parameter estimate gave us the relative rate for each outcome.

Each outcome was modeled individually. Covariates were entered into each model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income and the median age of their patients. The relative rates estimated by the models indicate the difference in outcome between each ALP group and the TLPs (reference group). All analyses were conducted using SAS version 9.3. Ethical approval for this study was received from the Sunnybrook Health Sciences Ethics Review Board.

Patient and Public Involvement

There was no patient or public involvement in this study.

RESULTS

Demographic and Practice Characteristics

A total of 292 ALPs and 11,127 TLPs were included in the study (Table 2). The largest group of ALPs were the Canadian Trained (n=114), followed by the US-Trained (n=91) and the Out-of-Province (n=78). The majority of TLPs were men (56.6%) and were older (50.6 years) than all three groups of ALPs. TLPs had fewer IMGs (22.2%) and overwhelmingly came from countries with very high HDI (90.5%). All ALPs were slightly more likely than TLPs to be in comprehensive practice and were less likely to be working in a FHT. Patient age and income distributions were similar across all groups.

The ALP groups' average ages ranged from 42.1 to 50.6 years. The Out-of-Province ALPs had the highest proportion of men (69%) compared to the other ALP groups. In the Out-of-Province ALP group, the majority were IMGs (89.7%) and completed medical school in countries considered medium/low on the HDI (63.2%). Seventy percent (70.1 %) practised in urban environments and they had the largest proportion in solo practice (32.2%). Similar to Out-of-Province, the US-Trained ALPs were mostly IMGs (85.7%); however, they graduated primarily from medical schools from countries with a very high/high HDI (68.1%). They had the largest proportion practising in non-FHT groups (65.9%) and were the most urban group (78%). Contrary to the other ALPs, almost half (47.4%) of the Canadian Trained ALPs were non-IMGs and 72.9% came from countries with very high/high HDI. Seventy percent were in comprehensive practice and they had the lowest percentage in solo practice. They also had the lowest proportion practising in urban areas compared to all other groups (67.5%).

Table 2. Demographic and Practice Characteristics of TLPs and ALPs

Characteristic	All TLPs	Out-of-Province ALPs	US-Trained ALPs	Canadian-Trained ALPs
Total (n)	11127	87	91	114
Sex				
Male	6303 (56.6%)	60 (69%)	38 (41.8%)	62 (54.4%)
Female	4824 (43.4%)	27 (31%)	53 (58.2%)	52 (45.6%)
Age (yrs, mean)	50.6	49.5	42.1	45.3
Medical school region				
Canada/USA	8656 (77.8%)	9 (10.3%)	13 (14.3%)	54 (47.4%)
All others	2471 (22.2%)	78 (89.7%)	78 (85.7%)	60 (52.7%)
HDI Group				
Very high/High	10065 (90.5%)	32 (36.8%)	62 (68.1%)	83 (72.9%)
Medium/Low	1062 (9.5%)	55 (63.2%)	29 (31.9%)	31 (27.2%)
Practice type				
Comprehensive	7355 (66.1%)	60 (69%)	64 (70.3%)	80 (70.2%)
Not comprehensive	3772 (33.9%)	27 (31%)	27 (29.7%)	34 (29.8%)
Group type				
FHT	2273 (20.4%)	12 (13.8%)	16 (17.6%)	20 (17.5%)
non-FHT	5635 (50.6%)	47 (54%)	60 (65.9%)	70 (61.4%)
No group	3219 (28.9%)	28 (32.2%)	15 (16.5%)	24 (21.1%)
Rurality				
Urban	8596 (77.3%)	61 (70.1%)	71 (78%)	77 (67.5%)
Suburban/Rural	2531 (22.7%)	26 (29.9%)	20 (22%)	37 (32.5%)
Scope of practice (N, % with any)				
Prenatal visits	6131 (55.1%)	46 (52.9%)	52 (57.1%)	77 (67.5%)
Obstetrical delivery	1224 (11%)	6 (6.9%)	7 (7.7%)	21 (18.4%)
Postnatal visits	3093 (27.8%)	24 (27.6%)	17 (18.7%)	33 (28.9%)
ED visits	2292 (20.6%)	17 (19.5%)	8 (8.8%)	27 (23.7%)
LTC visits	2181 (19.6%)	7 (8%)	13 (14.3%)	27 (23.7%)
Patient age distribution				
< 18 years	18.5	23.0	21.0	20.4
18-64 years	63.8	63.4	63.1	62.5
65+ years	17.7	13.6	15.9	17.1
Patient SES				
% low income	38.0	42.6	42.2	38.9

CL: Confidence Limit | HDI: Human Development Index (2013) | FHT: Family Health Team | ED: Emergency Department | LTC: Long-Term Care

Primary Care Quality Indicators

Table 3 shows the results of the unadjusted and adjusted comparisons between each ALP group and the TLPs (unadjusted mean numbers are included in Appendix C). Each ALP group had a unique profile of primary care quality indicators. Patients of the Out-of-Province ALPs had the most substantial statistically significant differences in the quality care indicators compared to patients of TLPs after multivariate adjustments. These family physicians' diabetic patients were 4% less likely to have received HbA1C testing and their COPD patients were 18% less likely to have received spirometry testing. Their patients with CHF, COPD or asthma were 7% more likely to visit an ED for any reason (i.e., all-cause) than those of TLPs. Additionally, their female patients aged 50-69 were 4% less likely to have received a mammogram in previous two years and their pediatric patients had 14% fewer well-baby visits, were 24% less likely to have had an 18-month enhanced well-baby visit, and were 38% more likely to have received no immunizations. However, their patients were 3% more likely to have received spirometry testing, 4% more likely to receive colon cancer screening, and their hospitalized patients were 9% less likely to be readmitted in one year.

In contrast, US-Trained ALPs were comparable to their TLP counterparts, with some statistically significant differences. Their diabetic care and cancer screening rates were similar, although US-Trained ALP patients were 8% more likely to have received HbA1c and lipids testing than TLPs' patients and 2% more likely to have received a pap test or any colon cancer screening. Their CHF, COPD and asthma patients were also 3% less likely to visit the ED and their pediatric patients were 27% less likely to have not received any immunizations; however, they were 7% less likely to receive well-baby visits. Canadian Trained ALPs were also similar to their TLP counterparts across most indicators; however, some statistically significant differences were

seen: their pediatric patients were 3% less likely to have received a well-baby visit but were 34% less likely to have not received any childhood immunizations; their COPD patients were 11% less likely to have had spirometry testing within 12 months of diagnosis; and their patients with CHF, COPD or asthma were 9% more likely to visit an ED (all-cause) than those of TLPs. Minor differences were seen also seen with HbA1c testing, spriometry testing for asthma patients, and colon cancer screening, with Canadian-Trained ALP's patients being 3% more likely to have received testing or screening.

Table 3. Adjusted and unadjusted relative rates from poisson modelling, primary care quality indicators, ALPs vs. TLPs

Population/Measure	Out-of-Province ALPs				US-Trained ALPs				Canadian-Trained ALPs			
	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.
Total (n)	87				91				114			
Diabetes												
HbA1C	0.95 (0.91, 0.98)	**	0.96 (0.92, 0.99)	*	1.09 (1.06, 1.12)	****	1.08 (1.05, 1.11)	****	1.03 (1.00, 1.06)	*	1.03 (1.01, 1.06)	*
Eye exam	0.97 (0.94, 1.00)	*	0.98 (0.95, 1.01)		0.98 (0.96, 1.01)		0.99 (0.97, 1.01)		1.00 (0.98, 1.03)		1.00 (0.98, 1.02)	
Lipids	1.03 (1.00, 1.06)	*	1.00 (0.97, 1.03)		1.12 (1.09, 1.14)	****	1.08 (1.05, 1.10)	****	1.02 (1.00, 1.05)	*	1.02 (0.99, 1.04)	
ACE/AARB	1.02 (0.95, 1.11)		1.06 (0.97, 1.14)		0.96 (0.90, 1.02)		0.98 (0.92, 1.04)		1.05 (1.00, 1.11)		1.04 (0.98, 1.10)	
Statin	1.00 (0.95, 1.04)		0.98 (0.94, 1.03)		1.03 (1.00, 1.07)		1.01 (0.97, 1.04)		1.01 (0.98, 1.04)		1.00 (0.97, 1.03)	
CHF												
Echo w/in 12 mths of dx	1.00 (0.93, 1.08)		1.00 (0.93, 1.08)		1.03 (0.97, 1.10)		1.02 (0.96, 1.08)		1.01 (0.95, 1.06)		1.00 (0.95, 1.06)	
COPD												
Spiro w/in 12 mths of dx	0.80 (0.69, 0.92)	**	0.82 (0.71, 0.95)	**	1.10 (0.99, 1.22)		1.10 (0.99, 1.23)		0.88 (0.80, 0.97)	*	0.89 (0.80, 0.98)	*
Asthma												
Spirometry (ever)	0.96 (0.93, 0.98)	**	1.03 (1.01, 1.06)	*	0.98 (0.96, 1.00)		1.00 (0.98, 1.02)		1.00 (0.98, 1.02)		1.03 (1.01, 1.06)	**
CHF, COPD or Asthma												
ED visits per person	1.08 (1.06, 1.10)	*** *	1.07 (1.05, 1.09)	****	1.02 (1.01, 1.04)	**	0.97 (0.95, 0.99)	***	1.18 (1.16, 1.19)	****	1.09 (1.07, 1.10)	****
Pediatric care												
Well-baby visits	0.90 (0.87, 0.92)	*** *	0.86 (0.83, 0.88)	****	0.93 (0.90, 0.95)	****	0.93 (0.90, 0.95)	****	0.98 (0.96, 1.01)		0.97 (0.95, 0.99)	*
18-month enhanced assessment	0.70 (0.63, 0.78)	*** *	0.76 (0.68, 0.84)	****	0.99 (0.92, 1.07)		0.99 (0.91, 1.07)		1.03 (0.96, 1.10)		1.06 (0.99, 1.14)	
No Immunization	1.20 (0.99, 1.46)		1.38 (1.13, 1.68)	**	0.65 (0.52, 0.81)	***	0.73 (0.58, 0.92)	**	0.66 (0.54, 0.81)	***	0.66 (0.54, 0.82)	***
Cancer screening												
Mammography	0.92 (0.90,	***	0.96 (0.93,	**	0.98 (0.96,		1.01 (0.99,		0.96 (0.94,	***	0.98 (0.96,	

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	0.94)	*	0.99)		1.01)		1.03)		0.98)		1.00)	
Pap test (3 yr)	0.94 (0.92, 0.96)	*** *	1.00 (0.98, 1.02)		1.00 (0.98, 1.01)		1.02 (1.01, 1.03)	**	0.98 (0.97, 0.99)	**	1.01 (0.99, 1.02)	
Any colon CA screening	0.98 (0.96, 1.00)	*** *	1.04 (1.02, 1.06)	****	0.99 (0.98, 1.01)	*	1.02 (1.00, 1.03)	*	1.00 (0.99, 1.02)		1.03 (1.02, 1.05)	****
Hospital readmissions												
30 day	0.91 (0.79, 1.03)		0.96 (0.84, 1.09)		0.91 (0.82, 1.01)		0.94 (0.84, 1.05)		1.00 (0.92, 1.10)		1.03 (0.94, 1.13)	
1 yr	0.84 (0.78, 0.91)	*** *	0.91 (0.84, 0.98)	*	0.91 (0.85, 0.96)	**	0.98 (0.93, 1.05)		0.93 (0.88, 0.99)	*	0.98 (0.93, 1.04)	

Notes: Adjusted for age group, sex, IMG status, urban-rural status, number of years in practice, whether the physician was in a Patient Enrollment model, HDI group, median patient age and percent of patients in low-income neighbourhoods.

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II| CL: Confidence Limit | CHF: Congestive Heart Failure | dx: diagnosis | COPD: Chronic Obstructive Pulmonary Disease | ED: Emergency Department | Pap test: Papanicolau test | CA: Cancer

Sig.=significance level. *=p<0.05, **=p<0.01, ***=p<0.001, ****=p<0.0001

DISCUSSION

Our analysis of primary care quality indicators suggest that alternatively licensed physicians (ALPs) perform similarly to traditionally licensed physicians (TLPs) in many areas of primary care practice when controlling for a number of covariates. Small differences were seen across groups in indicators of diabetic care, CHF care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age and COPD management, particularly in patients of Out-of-Province ALPs. While individual family physician performance is contextual and influenced by many factors,(6,35) health administrative data is useful for gaining a system-level impression of family physicians' quality of care and broadly identifying areas that may need improvement.(36) Over all, our findings suggest that alternative licensure route is not a strong independent predictor of family medicine performance on the majority quality indicators examined. For a small number of newly licensed family physicians, educational content pertaining to Ontario-specific guidelines and expectations may be of benefit.

Out-of-Province ALPs

Compared to other subgroups, the primary care performance of Out-of-Province ALPs was the most different from TLPs after adjustments. Most notably, their patients less than two years of age were significantly less likely to receive well baby visits, enhanced 18-month assessments, or immunizations, highlighting a trend in preventive pediatric care. These differences may reflect provincial differences in guidelines and schedules for pediatric care. For example, there is significant variation in how 18-month assessments are approached globally and across Canada.(37) Ontario has supported a longer and more comprehensive enhanced18-month

assessment by providing financial incentives through a unique billing code.(37–39) It is possible that Out-of-Province ALPs were unaware of Ontario's enhanced 18-month assessment or of the pediatric care expectations of family physicians in the province. It is also possible that these physicians provided 18-month assessments but did not bill for it using the Ontario-specific code. Previous research has shown that male IMGs who have been in practice for over 10 years are less likely to provide 18-month assessments in Ontario.(40) In this study, age, gender, and HDI were controlled for, suggesting these factors are not accountable for the differences; thus, entering Ontario from another province through an alternative route appears to be an independent risk factor.

Similar to the differences seen in 18-month assessments, the lower childhood immunization rates in the Out-of-Province ALPs may be in part due to inter-provincial variation in policies. For example, childhood vaccine schedules differ across provinces (41) which may have implications for how physicians bill. Further, in Ontario, immunizations for children under two years of age are predominantly done in physician offices,(42) while they may be administered by nurses or other allied health professionals in other provinces. Thus, the norms and conventions from their prior jurisdictions may be reflected in the billing practices of these ALPs once in Ontario.

In addition to differences in preventive pediatric care, Out-of-Province ALPs differed from TLPs in rates of spirometry testing for COPD patients, which is recommended to confirm a diagnosis of COPD.(43–46) Previous research has found that spirometry test ordering among family physicians in Ontario is generally low,(47) and our findings suggest that it is even lower among Out-of-Province ALPs (and Canadian Trained ALPs) compared to TLPs, highlighting potential provincial differences in utilization. Out-of-Province ALPs' patients with CHF, COPD, or asthma also had higher rates of all-cause ED visits, but their hospitalized patients were 9% less

likely to have been readmitted within one year. Rates of all-cause ED visits and readmissions are sometimes associated with access to primary care,(48–51) but can be influenced by many factors (51–54) and should thus be interpreted cautiously.

Overall, our findings highlight that ALPs entering Ontario from another Canadian province perform differently than TLPs in certain indicators of primary care. However, the performance differences noted in this study may be due to provincial differences in care expectations and reflect the context of their recent work environments. Such provincial differences in how physicians provide primary care have implications for the migration of physicians across provinces since physicians can typically practice anywhere in Canada once licensed. Given that provisional licenses have been seen as a way for physicians to gain entry to larger provinces through smaller ones,(17) the Federation of Medical Regulatory Authorities of Canada has begun to standardize provincial licensure requirements and the Medical Council of Canada is facilitating a common approach to practice ready assessments for IMGs across the country. While these efforts will help to mitigate potential performance differences in Canadian physicians, our findings suggest that ALPs entering Ontario from another province may still benefit from information about Ontario care expectations at the time of licensure. Focused knowledge translation for family physicians migrating across provinces may help to educate physicians about province-specific expectations and support their adoption of provincially-supported programs and guidelines, reducing the potential for future performance differences.

US-Trained and Canadian-Trained ALPs

US-Trained and Canadian-Trained ALPs performed similarly to TLPs on most primary care quality indicators after adjustments, though some notable differences were seen. For both groups,

patients less than two years of age were less likely to receive well baby visits but more likely to receive immunizations. In contrast to the Out-of province ALPs, whose patients were more likely to have not received any early childhood immunizations, US- and Canadian-Trained ALP patients were much more likely to receive them compared to the rest of the province: this 27-34% difference was the largest difference seen between these groups and the TLPs. US-Trained ALPs' patients were also more likely to receive pap tests and colon cancer screenings, their diabetic patients were more likely to receive HbA1c and lipid testing, and their patients with CHF, COPD, or asthma were less likely to visit an ED. The higher rates of testing and screening may be reflective of their American training, as previous research has found American physicians tend to have lower thresholds for diagnostic and therapeutic interventions.(55) Similar to Out-of-Province ALPs, Canadian-Trained ALPs' COPD patients were less likely to receive spirometry testing, and their patients with CHF, COPD, or asthma were more likely to visit an ED. Overall, the performance of both of these ALP groups was comparable to TLPs. This is perhaps unsurprising given that these physicians have similar postgraduate training, and that postgraduate training has been found to be predictive of patient outcomes.(56) Our findings provide evidence that their practice performance is in fact similar to traditionally licensed physicians in Ontario.

Conclusions

Our findings illustrate that ALPs perform similarly to TLPs across many indicators of primary care, suggesting that route of licensure is not a strong predictor of family physician performance in Ontario. These findings provide support for alternative licensure policies and also demonstrate the utility of health administrative data for examining physician performance and evaluating regulatory processes. As transparency and accountability are increasingly emphasized in

healthcare,(57) and as physician migration and the use of alternative licensure routes continues to increase,(15) it is imperative that processes for licensing and monitoring physicians are rigourously evaluated. The ongoing assessment of physician performance is critical for understanding the effects of medical regulatory policies and, ultimately, for ensuring high quality patient care.

Strengths and Limitations

This is the first study to examine the primary care performance of alternatively and traditionally licensed family physicians in Ontario. Our use of population-level data across multiple indicators of primary care allowed for a robust and comprehensive comparison of ALPs and TLPs and our use of multivariate analysis enabled statistical adjustment of physician demographics, practice environments, and patient factors, such as SES, that are associated with primary care performance. While this approach contributes to our understanding of ALP performance, it is not without limitations. First, ALPs and TLPs were compared to each other, not to a gold standard. As such, our findings do not indicate whether physicians are meeting performance benchmarks, but rather whether ALP performance is comparable to TLP performance. Second, our results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care. Other important aspects of primary care such as the doctor-patient relationship or inter-professional collaboration with other primary health care providers are thus not accounted for. Last, billing data introduces unique interpretation challenges as these quality indicators are proxies for delivery of care; therefore, some of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.

Implications for Future Research

This study offers insight into the primary care performance of alternatively licensed physicians. Primary care is an important area of study given that approximately half of physicians in Ontario specialize in Family Medicine;(15) however, future research is needed to examine the practice performance of ALPs practicing in other specialties. Performance is also multi-faceted and must be studied using a variety of measures. Future studies could include other measures of performance, such as practice assessments or complaints profiles, to gain a comprehensive picture of ALPs' practices.

This study also demonstrates that licensure route is a useful way of stratifying and comparing physicians. IMG studies typically define physicians based on their country of undergraduate medical school, whereas licensure route accounts for the influence of postgraduate training and previous practice experience on performance. Examining the impact of all of a physician's training and experience on future practice performance allows for a more robust understanding of the predictors of performance and may enable more nuanced IMG research in the future.

Finally, this study represents a collaboration between a medical regulator and system partners. Such collaborations are important for linking performance data across the continuum of medical education and practice (58,59) and for providing evaluative evidence for regulatory processes and policies, such as alternative licensure routes.(12,14) Further collaborations of this nature will allow for robust examinations of the influence of each stage of a physician's training on future practice performance.

Declarations

1. Ethics approval: Ethical approval for this study was obtained from the Sunnybrook Health Sciences Center Ethics Review Board
2. Availability of data and material: The datasets included in this study are housed at the Institute for Clinical Evaluative Sciences. A request to the Data Analytic Services (DAS) at ICES is required in order to obtain access to data or analytic services (www.ices.on.ca/DAS/Data).
3. Conflicts of interests: The authors declare that they have no conflicts of interests
4. Funding: The analysis for this study was funded by an annual grant to the Institute for Clinical Evaluative Sciences from the Ontario Ministry of Health and Long-Term Care (MOHLTC)
5. Author contributions: KH, NT, DF, and WY conceptualized this study, interpreted the data, and were key contributors to the manuscript. LJ and SS were responsible for selecting and operationalizing the outcome measures. SS analyzed the data and contributed to writing the manuscript. All authors read and approved the final manuscript.
6. Author information: KH is a Research Associate at the College of Physicians and Surgeons of Ontario and has an MSc in Health Services Research from the University of Toronto; NT is a Research Associate at the College of Physicians and Surgeons of Ontario and has an MSc in Kinesiology and Health Science from York University; SS is a Senior Epidemiologist at the Institute for Clinical Evaluative Sciences and has an MA in Regional Planning from the University of Waterloo and an MSc in Community Health and Epidemiology from the University of Toronto; LJ is a Senior Scientist at the Institute for Clinical Evaluative Sciences and has an MSc in Community Health and Epidemiology from Queen's University

and an MD from McMaster University; DF is the Deputy Registrar at the College of Physicians and Surgeons of Ontario and has an MBA in Health Services Management from McMaster University; WY is a Senior Researcher at the College of Physicians and Surgeons of Ontario and has an MA in Measurement and Evaluation from the University of Toronto and is currently pursuing a PhD in Adult Education from the University of Toronto.

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Appendix A) Description of Physician Demographic and Practice Characteristic Indicators

Indicator	Description	Definition of indicator
Sex		
Male	Physician sex	Male sex
Female		Female sex
Age	Physician age	Physician age in 2014
HDI Group		
Very high	2013 Human development index associated with the country of undergraduate medical school of physician (26)	HDI rank < 50
High		HDI rank ≥50 and < 103
Medium		HDI rank ≥103 and < 145
Low		HDI rank ≥145
Practice Type		
Comprehensive	Comprehensive practice is if majority of services billed are related to "core primary care" and span multiple practice areas (27)	≥ 44 days worked/yr and > 50% of billing "in core primary care" in at least 7 of 22 practice areas
Other		All other FM physicians
Group type		
FHT	Family Health Team, group practice but not-Family Health Team or solo practice	
non-FHT		
No group		
Rurality		
Urban	Practice location categorized in to urban or suburban/rural based on 2008 Rurality Index for Ontario (RIO) score (50)	RIO < 10
Suburban/Rural		RIO ≥ 10
Scope of practice		
Prenatal visits	If the physician submitted billing for care related to: prenatal	% with any billing

Obstetrical Delivery	visits, obstetrical delivery, postnatal visits, Emergency Department, or Long-Term Care	% with any billing
Postnatal visits		% with any billing
ED visits		% with any billing
LTC visits		% with any billing
Patient age distribution		
< 18 years	Pts age categories in 2014	< 18 years
18-64 years		18-64 years
65+ years		65+ years
Patient SES		
% low income	Number of pts in the bottom 40% of neighborhood income	< 3rd quintile of neighborhood income

HDI: Human Development Index | FM: Family Medicine | FHT: Family Health Team |RIO: Rurality Index of Ontario| ED: Emergency Department | LTC: Long-Term Care | Pts: patients | SES: Socio-Economic Status

Appendix B) Description of Primary Care Quality Indicators

Indicator	Population	Description/guideline	Definition of indicator
Diabetes			
HbA1c	Pts with Diabetes Mellitus	Every 3-6 months, depending on control (51)	2+ HbA1c in previous 12 months
Eye exam		Examination every 1-2 years, depending on severity (51)	Eye exam in previous 24 months
Lipids		Total cholesterol, HDL-C, LDL-C, and TGs annually (51)	1+ cholesterol test in previous 12 months
ACE/ARB		Indicated for pts with high cardiovascular risk (51)	Prescribed ACE/ARB in previous 12 months (pts ≥65 years of age or older)
Statin		Indicated for pts with elevated lipids (51)	Prescribed statin in previous 12 months (pts ≥65 years of age or older)
CHF			
Echocardiogram w/in 12 mths of diagnosis	Pts with newly diagnosed CHF	Recommended early after CHF diagnosis for assessment and management (52)	Echocardiogram ordered within 12 months of diagnosis
ED visits/person	Pts with CHF		All cause ED visit in 2014/15
COPD			
Spirometry w/in 12 mths of diagnosis	Pts with newly diagnosed COPD	Recommended for diagnosis (37)	Spirometry within 12 months of diagnosis
ED visits/person	Pts with COPD	All COPD pts, number of ED visits/year	All cause ED visit in 2014/15

Asthma			
Spirometry	Pts with asthma	Recommended to be reassessed regularly and used for diagnosis (53)	Ever had spirometry
ED visits/person		All asthma pts number of ED visits/year	All cause ED visit in 2014/15
Preventive Pediatric Care			
Well-baby visits	Pts < 2yrs		Number of visits in first 24 months
18-month enhanced well baby visit	Pts 18 months	Recommended for every child in Ontario (32)	Submitted 18 month billing code
No Immunization	Pts < 2yrs	Publicly funded routine immunizations for children in first 2 yrs (54)	Submitted no billing codes for DTAP, Pneumococcal, MenCC, MMR, Varicella
Cancer Screening			
Mammogram	Female pts 52-69 yrs (excluding breast cancer pts)	Recommended every 2-3 years for pts 50-69 (55)	Mammogram in previous 24 months
Pap test	Female pts 23-69 yrs (excluding cervical and endometrial cancer pts)		Pap in previous 36 months
All colon cancer screening	Pts 52-74 yrs (excluding colon cancer and IBD pts)	FOBT recommended every 1-2 yrs; Colonoscopy every 10 yrs; Flexible Ssigmoidoscopy and Double Contrast Barium Enema every 5years for pts 50-74	Any FOBT in previous 2 yrs; colonoscopy in previous 10 yrs; other in previous 5 yrs

Hospital Readmissions		
Readmission (30 days)	All hospitalized pts	Hospital readmission within 30 days
Readmission (1 yr)		Hospital readmission within 12 months

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | pts: patients | HDL-C: High-Density Lipoprotein Cholesterol | LDL-C: Low-Density Lipoprotein Cholesterol | TG: Triglycerides | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II Receptor Blockers | CHF: Congestive Heart Failure | ED: Emergency Department | COPD: Chronic Obstructive Pulmonary Disease | DTAP: Diphtheria, Tetanus, Pertussis, Polio | MenCC: Meningococcal Conjugate C | MMR: Measles, Mumps, Rubella | Pap test: Papanicolau test | IBD. Inflammatory Bowel Disease | endo: FOBT: Fecal Occult Blood Test

Appendix C) Unadjusted mean numbers or percentages, clinical practice measures

	TLPs		Out-of-Province ALPs		US-Trained ALPs		Canadian-Trained ALPs	
	mean % or #	95% CL	mean % or #	95% CL	mean % or #	95% CL	mean % or #	95% CL
Diabetes								
HbA1C	43.4	(43, 43.9)	41.8	(37.6, 46)	48.0	(44.3, 51.6)	45.4	(41.8, 49)
Eye exam	66.2	(65.9, 66.6)	63.1	(59.3, 66.8)	67.3	(64.2, 70.3)	67.3	(64, 70.7)
Lipids test	62.4	(61.9, 62.9)	67.6	(63.4, 71.9)	72.9	(68.8, 77)	64.1	(59.8, 68.5)
Ace/AARB	70.2	(69.8, 70.6)	71.8	(67.3, 76.2)	74.5	(71.2, 77.7)	70.2	(66.5, 74)
Statin	69.5	(69.2, 69.9)	68.6	(63.5, 73.8)	75.8	(73.5, 78.1)	69.8	(66.5, 73.2)
CHF								
Echo w/in 12 mths of dx	85.3	(84.7, 85.9)	83.1	(74.5, 91.7)	91.5	(87.9, 95.1)	85.6	(79.8, 91.5)
COPD								
Spiro w/in 12 mths of dx	78.1	(77.6, 78.7)	72.9	(65.1, 80.7)	77.3	(71.7, 83)	79.0	(74.1, 83.8)
Asthma								
Any spirometry	51.7	(51.3, 52.1)	49.4	(45.3, 53.5)	52.0	(48.8, 55.3)	50.7	(47.6, 53.8)
CHF, COPD or Asthma								
ED visits/person	0.82	(0.79, 0.85)	0.68	(0.58, 0.77)	0.65	(0.58, 0.72)	0.87	(0.76, 0.99)
Pediatric care								
Well baby visits (mean #)	5.2	(5.2, 5.3)	4.3	(3.8, 4.9)	5.0	(4.5, 5.4)	4.8	(4.4, 5.2)
18 month enhanced assessment	47.9	(47.1, 48.6)	32.8	(25.8, 39.8)	47.7	(41, 54.4)	47.4	(42, 52.8)
No immunization	16.9	(16.2, 17.5)	23.6	(16.3, 30.9)	12.0	(8, 16)	16.4	(11.2, 21.6)
Cancer screening								

Mammogram	58.2	(57.8, 58.7)	51.0	(46.2, 55.8)	59.1	(55.1, 63.1)	55.0	(50.9, 59.1)
Pap test (3 yrs)	56.4	(56, 56.8)	50.7	(46.5, 54.8)	57.5	(53.1, 62)	56.8	(52.6, 59.1)
Any colon cancer screening	55.5	(55.1, 56)	48.7	(43.8, 53.6)	54.6	(50.1, 59)	56.8	(53.3, 60.3)
Hospital readmissions								
30 day	0.18	(0.18, 0.18)	0.14	(0.11, 0.18)	0.15	(0.13, 0.17)	0.19	(0.16, 0.23)
1 yr	0.06	(0.06, 0.06)	0.05	(0.03, 0.06)	0.05	(0.04, 0.06)	0.07	(0.05, 0.09)

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II| CL: Confidence Limit | CHF: Congestive Heart Failure | dx: diagnosis | COPD: Chronic Obstructive Pulmonary Disease | ED: Emergency Department | Pap test: Papanicolau test | CA: Cancer

STROBE Statement—checklist of items that should be included in reports of observational studies
NOTE: Page Numbers refer to "clean" (i.e. unmarked) version of manuscript

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4	A cross-sectional retrospective examination of Ontario health administrative data was conducted using Poisson regression analyses to compare the performance of traditionally and alternatively licensed physicians. Minimal differences were seen across groups in indicators of diabetic care, congestive heart failure care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age, particularly for alternatively licensed physicians who entered Ontario from another Canadian province.
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7-8	Collectively, Alternatively Licensed Physicians (ALPs) represent physicians who did not meet the licensure criteria at the time of entering independent practice in a given province but who were considered to have comparable qualifications to Traditionally Licensed Physicians (TLPs), based on their postgraduate training and/or professional experience. The performance of ALPs in practice, however, has not been previously examined. Given that many ALPs are IMGs, a review of IMG literature may offer insight into ALP practice performance; however, research comparing IMGs and DMGs has been equivocal. IMGs are typically defined by and compared on the location of their undergraduate medical training, but this only represents one step in an often long and diverse path of training and experience to independent practice. Examining physicians as defined by later steps in this process, such as point of licensure, may shed light on the impact of postgraduate medical training and early career practice experiences on subsequent performance and how physicians entering practice through alternative licensure routes may be better supported at different

				stages of their career
Objectives	3	State specific objectives, including any prespecified hypotheses	8	The research question guiding this study was: Does licensure route influence the primary care performance of physicians in Ontario?
Methods				
Study design	4	Present key elements of study design early in the paper	9	In order to isolate the effect of licensure route, we chose to compare each ALP group to TLPs while adjusting for a number of covariates. We do not address the independent impact of the other variables that were adjusted for, as we felt we could either focus on a small number of outcomes and explore the full multivariable models, or examine a broad spectrum of indicators representative of general family practice and narrow our focus to licensure route. We chose the latter, as we were interested in primary care performance as a whole rather than performance on any individual quality indicators.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9	The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014.
Participants	6	*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	9	The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014.
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11-12 and supplementary file	Physician demographic characteristics included age, sex, medical school region, and the Human Development Index (HDI) associated with the physician's country of medical school, which is a composite score based on life expectancy, education, and per capita income that rank orders all countries.[33] Physician practice characteristics included practice type (comprehensive or not), group type (Family Health Team (FHT), non-FHT, no group), scope of practice (percent providing any of the following: postnatal visits, obstetrical deliveries, postnatal visits, emergency department (ED) visits, long term care (LTC) visits), and practice location (urban, suburban/rural). Comprehensive family physicians are

				those who met specific criteria regarding the type and scope of services they provide.(34) FHTs are group practices which include comprehensive family physicians working alongside primary providers such as nurses, social workers, pharmacists and nutritionists. A detailed description of the physician demographic and practice characteristics is included in Appendix A. Primary care quality indicators based on health administrative data were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates. Chronic disease management indicators included measures for diabetes care (HbA1C testing, cholesterol testing, ophthalmology examinations, the receipt of prescriptions for angiotension converting enzyme inhibitors (ACE) and angiotensin II receptor blockers (ARBs)), congestive heart failure (CHF; echocardiogram testing within 12 months of diagnosis, emergency department (ED) visits), asthma (spirometry testing within 12 months of diagnoses, ED visits) and Chronic Obstructive Pulmonary Disease (COPD; spirometry testing within 12 months of diagnoses, ED visits). Pediatric care indicators include well-baby visits, the 18-month enhanced developmental assessment, and the absence of pediatric vaccinations (defined as no billing for any immunization in OHIP). Cancer screening indicators included cervical, breast, and colorectal cancer screening. Hospital readmission rates were calculated at 30 days and one year for patients with a hospital admission. These primary care quality indicators are described in Appendix B.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10-11	Ontario health administrative datasets held at the Institute for Clinical Evaluative Sciences (ICES) were used in this study. These datasets were linked using unique encoded identifiers and analyzed at ICES under data security and privacy policies and procedures that are approved by the Office of the Information and Privacy Commissioner of Ontario.(32) The following administrative databases were used: Canadian Institute for Health Information hospital Discharge Abstract Database (CIHI-DAD, providing diagnostic information regarding hospital admissions), OHIP physician claims database (containing physician billings and diagnoses from 1991), the National Ambulatory Care Reporting System (NACRS) database (providing information on hospital- and

				community-based ambulatory care, including emergency department visits, from 2000 and same-day surgery from 1991), and the Ontario Drug Benefit (ODB) program database (containing information on all drug therapies dispensed to eligible individuals 65 years of age and older)
Bias	9	Describe any efforts to address potential sources of bias	13	Covariates were entered into the model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income and the median age of their patients.
Study size	10	Explain how the study size was arrived at	9	The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11-12 and supplementary file	See item 7.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	13	Our multivariate analysis modelled the relationship between physician licensure cohort (ALP group or TLP) and clinical practice outcomes. Before carrying out the modelling, we tested the outcome measures for normality and found that many, such as the proportion of a physician's diabetic patients who received an eye exam within the previous year, were not normally distributed, but became so after being log transformed. Based on this, we chose to use proc genmod in SAS to model the number with each characteristic (rather than the proportion) based on the Poisson distribution and including a log offset. Exponentiating the resulting parameter estimate gave us the relative rate for each outcome. Each outcome was modeled individually. Covariates were entered into the model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income and the median age of their patients. The relative rates estimated by the model indicate the difference in outcome between each ALP group and the TLPs (reference group).
		(*b*) Describe any methods used to examine		NA

		subgroups and interactions		
		(*c*) Explain how missing data were addressed	9	The study population included **all practising family physicians** in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 **and billed the Ontario Health Insurance Plan (OHIP) in 2014**. **All publicly funded health services provided by physicians are submitted to OHIP**.
		(*d*) *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy		NA
		(*e*) Describe any sensitivity analyses		NA
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	14 9	A total of 292 ALPs and 11,127 TLPs were included in the study The study population included **all practising family physicians** in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014
		(b) Give reasons for non-participation at each stage		NA
		(c) Consider use of a flow diagram		NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	14-16	A total of 292 ALPs and 11,127 TLPs were included in the study (Table 2). The largest group of ALPs were the Canadian Trained (n=114), followed by the US-Trained (n=91) and the Out-of-Province (n=78). The majority of TLPs were men (56.6%) and were older (50.6 years) than all three groups of ALPs. TLPs had fewer IMGs (22.7%) and overwhelmingly came from countries with very high HDI (90.5%). All ALPs were slightly more likely than TLPs to be in comprehensive practice and were less likely to be working in a FHT. Patient age and income distributions were similar across all groups. The ALP groups' average ages ranged from 42.1 to 50.6 years. The Out-of-Province ALPs had the highest proportion of men (69%) compared to the other ALP groups. In the Out-of-Province ALP group, the majority were IMGs (89.7%) and completed medical school in countries considered medium/low on the HDI (63.2%). Seventy percent (70.1 %) practised in urban environments and they

				had the largest proportion in solo practice (32.2%). Similar to Out-of-Province, the US-Trained ALPs were mostly IMGs (85.7%); however, they graduated primarily from medical schools from countries with a very high/high HDI (68.1%). They had the largest proportion practising in non-FHT groups (65.9%) and were the most urban group (78%). Contrary to the other ALPs, almost half (47.4%) of the Canadian Trained ALPs were non-IMGs and 72.9% came from countries with very high/high HDI. Seventy percent were in comprehensive practice and they had the lowest percentage in solo practice. They also had the lowest proportion practising in urban areas compared to all other groups (67.5%).
		(b) Indicate number of participants with missing data for each variable of interest	9	The study population included **all practising family physicians** in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 **and billed the Ontario Health Insurance Plan (OHIP) in 2014**. **All publicly funded health services provided by physicians are submitted to OHIP**.
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		NA
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		NA
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		NA
		Cross-sectional study—Report numbers of outcome events or summary measures	Supplementary file	Appendix 4
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	20-21	Table 3
		(*b*) Report category boundaries when continuous variables were categorized	Supplementary file	Appendix A-B
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful		NA

		time period		
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses		NA
Discussion				
Key results	18	Summarise key results with reference to study objectives	21	Our analysis of primary care quality indicators suggest that alternatively licensed physicians (ALPs) perform similarly to traditionally licensed physicians (TLPs) in many areas of primary care practice when controlling for a number of covariates. Small differences were seen across groups in indicators of diabetic care, CHF care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age and COPD management, particularly in patients of Out-of-Province ALPs. While individual family physician performance is contextual and influenced by many factors,(6,35) health administrative data is useful for gaining a system-level impression of family physicians' quality of care and identifying areas that are meeting practice benchmarks and areas that may need improvement.(36) Over all, our findings suggest that alternative licensure route is not a strong independent predictor of family medicine performance on the majority quality indicators examined. For a small number of newly licensed family physicians, educational content pertaining to Ontario-specific guidelines and expectations may be of benefit.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	26-27	First, ALPs and TLPs were compared to each other, not to a gold standard. As such, our findings do not indicate whether physicians are meeting performance benchmarks, but rather whether ALP performance is comparable to TLP performance. Second, our results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care. Other important aspects of primary care such as the doctor-patient relationship or inter-professional collaboration with other primary health care providers are thus not accounted for. Last, billing data introduces unique interpretation challenges as these quality indicators are proxies for delivery of care; therefore, some

				of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-24	Compared to other subgroups, the primary care performance of Out-of-Province ALPs was the most different from TLPs after adjustments. Most notably, their patients less than two years of age were significantly less likely to receive well baby visits, enhanced 18-month assessments, or immunizations, highlighting a trend in preventive pediatric care. These differences may reflect provincial differences in guidelines and schedules for pediatric care. For example, there is significant variation in how 18-month assessments are approached globally and across Canada. Ontario has supported a longer and more comprehensive enhanced18-month assessment by providing financial incentives through a unique billing code. It is possible that Out-of-Province ALPs were unaware of Ontario's enhanced 18-month assessment or of the pediatric care expectations of family physicians in the province. It is also possible that these physicians provided 18-month assessments but did not bill for it using the Ontario-specific code. Previous research has shown that male IMGs who have been in practice for over 10 years are less likely to provide 18-month assessments in Ontario.40) In this study, age, gender, and HDI were controlled for, suggesting these factors are not accountable for the differences; thus, entering Ontario from another province through an alternative route appears to be an independent risk factor. Similar to the differences seen in 18-month assessments, the lower childhood immunization rates in the Out-of-Province ALPs may be in part due to inter-provincial variation in policies. For example, childhood vaccine schedules differ across provinces which may have implications for how physicians bill. Further, in Ontario, immunizations for children under two years of age are predominantly done in physician offices, while they may be administered by nurses or other allied health professionals in other provinces. Thus, the norms and conventions from their prior jurisdictions may be reflected in the billing practices of these ALPs once in

Ontario.

In addition to differences in preventive pediatric care, Out-of-Province ALPs differed from TLPs in rates of spirometry testing for COPD patients, which is recommended to confirm a diagnosis of COPD. Previous research has found that spirometry test ordering among family physicians in Ontario is generally low, and our findings suggest that it is even lower among Out-of-Province ALPs (and Canadian Trained ALPs) compared to TLPs, highlighting potential provincial differences in utilization. Out-of-Province ALPs' patients with CHF, COPD, or asthma also had higher rates of all-cause ED visits, but their hospitalized patients were 9% less likely to have been readmitted within one year. Rates of all-cause ED visits and readmissions are sometimes associated with access to primary care, but can be influenced by many factors and should thus be interpreted cautiously.

Overall, our findings highlight that ALPs entering Ontario from another Canadian province perform differently than TLPs in certain indicators of primary care. However, the performance differences noted in this study may be due to provincial differences in care expectations and reflect the context of their recent work environments. Such provincial differences in how physicians provide primary care have implications for the migration of physicians across provinces since physicians can typically practice anywhere in Canada once licensed. Given that provisional licenses have been seen as a way for physicians to gain entry to larger provinces through smaller ones, the Federation of Medical Regulatory Authorities of Canada has begun to standardize provincial licensure requirements and the Medical Council of Canada is facilitating a common approach to practice ready assessments for IMGs across the country. While these efforts will help to mitigate potential performance differences in Canadian physicians, our findings suggest that ALPs entering Ontario from another province may still benefit from information about Ontario care expectations at the time of licensure. Focused knowledge translation for family physicians migrating across

provinces may help to educate physicians about province-specific expectations and support their adoption of provincially-supported programs and guidelines, reducing the potential for future performance differences. US-Trained and Canadian-Trained ALPs performed similarly to TLPs on most primary care quality indicators after adjustments, though some notable differences were seen. For both groups, patients less than two years of age were less likely to receive well baby visits but more likely to receive immunizations. In contrast to the Out-of province ALPs, whose patients were more likely to have not received any early childhood immunizations, US- and Canadian-trained ALP patients were much more likely to receive them compared to the rest of the province: this 27-34% difference was the largest difference seen between these groups and the TLPs. US-Trained ALPs' patients were also more likely to receive pap tests and colon cancer screenings, their diabetic patients were more likely to receive HbA1c and lipid testing, and their patients with CHF, COPD, or asthma were less likely to visit an ED. The higher rates of testing and screening may be reflective of their American training, as previous research has found American physicians tend to have lower thresholds for diagnostic and therapeutic interventions. Similar to Out-of-Province ALPs, Canadian-Trained ALPs' COPD patients were less likely to receive spirometry testing, and their patients with CHF, COPD, or asthma were more likely to visit an ED. Overall, the performance of both of these ALP groups was comparable to TLPs. This is perhaps unsurprising given that these physicians have similar postgraduate training, and that postgraduate training has been found to be predictive of patient outcomes. Our findings provide evidence that their practice performance is in fact similar to traditionally licensed physicians in Ontario.

Generalisability	21	Discuss the generalisability (external validity) of the study results	26	This study offers insight into the primary care performance of alternatively licensed physicians. Primary care is an important area of study given that approximately half of physicians in Ontario specialize in Family Medicine;(15) however, future research is needed to examine the practice performance of ALPs practicing in other specialties. Performance is also multi-faceted and must be studied using a variety of measures. Future studies could include other measures of performance, such as practice assessments or complaints profiles, to gain a comprehensive picture of ALPs' practices.
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	27	The analysis for this study was funded by an annual grant to the Institute for Clinical Evaluative Sciences from the Ontario Ministry of Health and Long-Term Care (MOHLTC)

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data

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Title: The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data

Authors:

Kathryn Hodwitz[1], Niels Thakkar[1], Susan E. Schultz[2], Liisa Jaakkimainen[2,3], Daniel Faulkner[1], Wendy Yen[1]

[1]The College of Physicians and Surgeons of Ontario; [2]The Institute for Clinical Evaluative Sciences; [3]The Department of Family and Community Medicine and the Institute of Health Policy, Management and Evaluation, University of Toronto

Contact Information:

Kathryn Hodwitz
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
80 College Street, Toronto, ON M5G 2E2
khodwitz@cpso.on.ca
1-416-967-2600 x522
**Corresponding author*

Niels Thakkar
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
nthakkar@cpso.on.ca

Susan E. Schultz
The Institute for Clinical Evaluative Sciences
Toronto, Ontario, Canada
sue.schultz@ices.on.ca

Liisa Jaakkimainen
The Institute for Clinical Evaluative Sciences
Toronto, Ontario, Canada
liisa.jaakkimainen@ices.on.ca

Daniel Faulkner
Executive Office,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
dfaulkner@cpso.on.ca

Wendy Yen
Research and Evaluation Department,
The College of Physicians and Surgeons of Ontario
Toronto, Ontario, Canada
wyen@cpso.on.ca

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Abstract

Objectives: Medical Regulatory Authorities provide licenses to physicians and monitor those physicians once in practice to support their continued competence. In response to physician shortages, many Canadian MRAs developed alternative licensure routes to allow physicians who do not meet traditional licensure criteria to obtain licenses to practice. Many physicians have gained licensure through alternative routes, but the performance of these physicians in practice has not been previously examined. This study compared the performance of traditionally and alternatively licensed physicians in Ontario using quality indicators of primary care. The purpose of this study was to examine the practice performance of alternatively licensed physicians and provide evaluative evidence for alternative licensure policies.

Design: A cross-sectional retrospective examination of Ontario health administrative data was conducted using Poisson regression analyses to compare the performance of traditionally and alternatively licensed physicians.

Setting: Primary care in Ontario, Canada.

Participants: All family physicians who were licensed in Ontario between 2000 and 2012 and who had complete medical billing data in 2014 were included (N=11,419).

Outcome Measures: Primary care quality indicators were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates using Ontario health administrative data.

Results: Alternatively licensed physicians performed similarly to traditionally licensed physicians in many primary care performance measures. Minimal differences were seen across groups in indicators of diabetic care, congestive heart failure care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years

of age, particularly for alternatively licensed physicians who entered Ontario from another Canadian province.

Conclusions: Our findings demonstrate that alternatively licensed physicians perform similarly to traditionally licensed physicians across many indicators of primary care. Our study also demonstrates the utility of administrative data for examining physician performance and evaluating medical regulatory policies and programs.

Article Summary:

Strengths and limitations of this study:

- This is the first study to examine the primary care performance of alternatively and traditionally licensed family physicians in Ontario.
- Using population-level data across multiple indicators of primary care allowed for a comprehensive comparison of physicians; using multivariable analysis enabled statistical adjustment of factors associated with primary care performance.
- A limitation of this study is that ALPs and TLPs were compared to each other, not to a gold standard; thus, findings do not indicate whether physicians are meeting performance benchmarks, only whether ALP performance is comparable to TLP performance.
- Secondly, results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care; other important aspects of primary care are not accounted for.

- Lastly, quality indicators are proxies for delivery of care; therefore, some of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.

Key Words: medical regulation, physician performance, licensure, quality of care, primary care, family medicine

The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data

A safe and effective healthcare system relies on high quality physician performance. Medical Regulatory Authorities (MRAs) support such performance by issuing licenses to qualified physician applicants and monitoring those physicians once in practice to ensure their continued competence. MRAs also play a role in examining factors that influence physician performance as a way of identifying physician subgroups that may benefit from educational support.(1–8) Additionally, there has been discussion about the efficacy of regulatory processes for serving professional and public interests (9–11) and calls for evidence-informed regulation through the evaluation of regulatory processes and programs.(11–14) This study heeds such a call by examining the primary care performance of family physicians in Ontario as a way of evaluating regulatory licensure policies and exploring the influence of licensure route on physician performance.

In Canada, physicians traditionally complete a Canadian residency program and the Canadian qualifying and certification examinations to be granted a license to practice. However, in response to projected physician shortages in the early 2000s, many Canadian MRAs developed alternative licensing criteria to facilitate the licensure of physicians who do not meet the traditional criteria.(15,16) Alternative licensure routes were developed, primarily for International Medical Graduates (IMGs), based on previous experience or licensure, postgraduate training, and/or eligibility to write the Canadian certification exams.(15) Often, these physicians were recruited to work in specific underserviced areas and given provisional licenses to practice despite not meeting the traditional qualifications.(17) Smaller Canadian provinces, such as Newfoundland and Saskatchewan, have been prominent issuers of provisional

licenses due to their longstanding health human resource needs;(18,19) however, provisionally licensed physicians often move to other parts of the country after completing their service terms, as most are able to practice anywhere in Canada once licensed.(16–20) As such, it is thought that smaller provinces may serve as entry points to larger provinces such as Ontario.(17,18)

In addition to the migration of provisionally licensed physicians across Canada, alternative licensure routes also allow entry of physicians from the US into Canada and the licensure of physicians who completed Canadian residency but did not immediately write or pass the national certification exams. In these cases, provisional licenses are given with the stipulation of successful exam completion within three years. Although these routes were initially developed to increase access for IMGs, they are now also utilized by Domestic Medical Graduates (DMGs) who have not successfully completed exams at the time of licensure.

Collectively, Alternatively Licensed Physicians (ALPs) represent physicians who did not meet the licensure criteria at the time of entering independent practice in a given province but who were considered to have comparable qualifications to Traditionally Licensed Physicians (TLPs), based on their postgraduate training and/or professional experience. The performance of ALPs in practice, however, has not been previously examined. Given that many ALPs are IMGs, a review of IMG literature may offer insight into ALP practice performance; however, research comparing IMGs and DMGs has been equivocal. Some studies show IMGs perform less well than DMGs on certification and licensing examinations,(21–24) and that such performance is associated with practice performance. (5,25) Yet, IMGs and DMGs have been shown to be comparable on practice outcomes such as patient mortality,(26,27) readmission rates,(27) surgical outcomes,(28) and cardiac care.(29)

While these conflicting findings may reflect the different outcomes being measured, they may also stem from the limited definition of IMG being employed. IMGs are typically defined by and compared on the location of their undergraduate medical training, but this only represents one step in an often long and diverse path of training and experience to independent practice.(15) Examining physicians as defined by later steps in this process, such as point of licensure, may shed light on the impact of postgraduate medical training and early career practice experiences on subsequent performance and how physicians entering practice through alternative licensure routes may be better supported at different stages of their career.

In this study, we sought to understand the impact of alternative licensure routes on the delivery of primary care in Ontario. We used primary care quality indicators derived from health administrative data that were developed and validated by health services researchers to examine physician performance in areas such as chronic disease management, screening rates, and hospital readmissions using accepted practice guidelines.(30,31) We focused on the performance of a cohort of family physicians licensed through three main alternative routes: those licensed in another Canadian province, those licensed in the US, and those who trained in Canada but did not complete certifying examinations at the time of licensure. The research question guiding this study was: Does licensure route influence the primary care performance of physicians in Ontario?

METHODS

Approach

The objective of this study was to examine the independent contribution of being licensed through various alternative routes on primary care performance. Given that licensure route has not been previously studied as a potential factor influencing performance, we were interested in isolating its effect by comparing each ALP group to TLPs on a variety of quality care indicators while adjusting for a number of covariates. We do not address the independent impact of the other variables that were adjusted for, as, practically, we could either focus on a small number of outcomes and explore the full multivariable models, or examine a broad spectrum of indicators representative of general family practice and narrow our focus to licensure route. We chose the latter, as we were interested in primary care performance as a whole rather than performance on any individual quality indicators. Additionally, the indicators do not have validated thresholds or gold standard rates at the individual- or population-level, thus performance is better assessed globally as opposed to focusing on individual tests, screens, or prescriptions. By focusing on the independent contribution of licensure route while adjusting for covariates, we aimed to understand if a physician's licensure route is associated with subsequent performance, irrespective of other demographic or practice characteristics. The goal of this approach was to explore whether regulatory licensure policies independently influence the primary care provided to patients in Ontario, thus offering evaluative evidence for the impact and outcomes of these policies.

Study Cohorts

The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014. All publicly-funded health services provided by physicians are submitted to OHIP. This population included Traditionally Licensed

Physicians (TLPs) and Alternatively Licensed Physicians (ALPs). TLPs are physicians who obtained a license to practice by meeting the traditional criteria, namely the completion of postgraduate training in Canada and successful completion of the national qualifying and certification examinations (the Medical Council of Canada Qualifying Examinations part 1 and 2, and either the College of Family Physicians of Canada (CFPC) or the Royal College of Physicians and Surgeons of Canada (RCPSC) exams). ALPs are those physicians who were missing one or more of the traditional requirements but met an alternative set of criteria at the time of licensure. There are many alternative licensure routes; in this study, we have focused on the three most commonly used by family physicians, described in Table 1. A more comprehensive description of these routes has been described previously.(15)

Table 1. Description of Alternatively Licensed Physician (ALP) subgroups

Out-of-Province ALPs	Physicians who obtained a license in another Canadian province and thus were given an equivalent license in Ontario despite missing one or more traditional licensing requirements[1] or who gained eligibility to write the CFPC examinations by gaining two years of practice experience in another Canadian province and were thus eligible for a provisional license in Ontario[2]
US-Trained ALPs	Physicians who completed postgraduate training in the US but had not successfully completed the Canadian certification examinations at the time of licensure[2,3]
Canadian-Trained ALPs	Physicians who completed postgraduate training in Canada but had not successfully completed the Canadian certification examinations at the time of licensure[2]

[1] The Agreement on Internal Trade is an interprovincial agreement that was incorporated into Ontario legislation enabling physicians migrating from other Canadian provinces be granted equivalent licenses to practice without assessment or examination

[2] Physicians are granted restricted (provisional) licenses and have up to three years to write the Canadian certification examinations

[3] Physicians may be granted restricted (provisional) licences due to successful completion of a practice assessment

Data Sources

Ontario health administrative datasets held at the Institute for Clinical Evaluative Sciences (ICES) were used in this study. These datasets were linked using unique encoded identifiers and analyzed at ICES under data security and privacy policies and procedures that are approved by the Office of the Information and Privacy Commissioner of Ontario.(32) The following administrative databases were used: Canadian Institute for Health Information hospital Discharge Abstract Database (CIHI-DAD, providing diagnostic information regarding hospital admissions), OHIP physician claims database (containing physician billings and diagnoses from 1991), the National Ambulatory Care Reporting System (NACRS) database (providing information on hospital- and community-based ambulatory care, including emergency department visits, from 2000 and same-day surgery from 1991) , and the Ontario Drug Benefit (ODB) program database (containing information on all drug therapies dispensed to eligible individuals 65 years of age and older).

Variables

Physician demographic characteristics included age, sex, medical school region, and the Human Development Index (HDI) associated with the physician's country of medical school, which is a composite score based on life expectancy, education, and per capita income that rank orders all countries.(33) Physician practice characteristics included practice type (comprehensive or not), group type (Family Health Team (FHT), non-FHT, no group), scope of practice (percent providing any of the following: postnatal visits, obstetrical deliveries, postnatal visits, emergency department (ED) visits, long term care (LTC) visits), and practice location (urban, suburban/rural). Comprehensive family physicians are those who met specific criteria regarding

the type and scope of services they provide.(34) FHTs are group practices which include comprehensive family physicians working alongside primary providers such as nurses, social workers, pharmacists and nutritionists. A detailed description of the physician demographic and practice characteristics is included in Appendix A.

Primary care quality indicators based on health administrative data were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates. Chronic disease management indicators included measures for diabetes care (HbA1C testing, cholesterol testing, ophthalmology examinations, the receipt of prescriptions for angiotension converting enzyme inhibitors (ACE) and angiotensin II receptor blockers (ARBs)), congestive heart failure (CHF; echocardiogram testing within 12 months of diagnosis, emergency department (ED) visits), asthma (spirometry testing within 12 months of diagnoses, ED visits) and Chronic Obstructive Pulmonary Disease (COPD; spirometry testing within 12 months of diagnoses, ED visits). Pediatric care indicators include well-baby visits, the 18-month enhanced developmental assessment, and the absence of pediatric vaccinations (defined as no billing for any immunization in OHIP). Cancer screening indicators included cervical, breast, and colorectal cancer screening. Hospital readmission rates were calculated at 30 days and one year for patients with a hospital admission. These primary care quality indicators are described in Appendix B.

For each family physician, patients who were either rostered (enrolled) or virtually rostered to them (attributed to the physician based on the majority of their billings) were included. All outcomes denote whether a patient received a given type of care, rather than whether the physician they were rostered to provided it. Therefore, patients who received care from a physician other than their family physician (e.g., a walk-in clinic physician or another family

physician in their practice) would appear in the data as having received that care and this would be attributed to the family physician they are rostered to.

Statistical Analysis

Demographic and practice characteristics are presented as proportions, means, percentage with any, and mean percentages (Table 2). Absolute rates for the primary care quality indicators are presented as means and mean percentages unless otherwise noted (Table 3). Unadjusted rates are included for comprehensiveness but only the adjusted rates are discussed to answer our research question. Confidence limits (CL) are presented where applicable. To help with interpretation of results, statistically significant differences less than 5% were considered small and statistically significant differences greater than 5% were considered larger.

Our multivariable analysis modelled the relationship between physician licensure cohort (ALP group or TLP) and clinical practice outcomes. Before carrying out the modelling, we tested the outcome measures for normality and found that many, such as the proportion of a physician's diabetic patients who received an eye exam within the previous year, were not normally distributed, but became so after being log transformed. Based on this, we chose to use proc genmod in SAS to model the number with each characteristic (rather than the proportion) based on the Poisson distribution and including a log offset. Exponentiating the resulting parameter estimate gave us the relative rate for each outcome.

Each outcome was modeled individually. Covariates were entered into each model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income

and the median age of their patients. The relative rates estimated by the models indicate the difference in outcome between each ALP group and the TLPs (reference group). All analyses were conducted using SAS version 9.3. Ethical approval for this study was received from the Sunnybrook Health Sciences Ethics Review Board.

Patient and Public Involvement

There was no patient or public involvement in this study.

RESULTS

Demographic and Practice Characteristics

A total of 292 ALPs and 11,127 TLPs were included in the study (Table 2). The largest group of ALPs were the Canadian Trained (n=114), followed by the US-Trained (n=91) and the Out-of-Province (n=78). The majority of TLPs were men (56.6%) and were older (50.6 years) than all three groups of ALPs. TLPs had fewer IMGs (22.2%) and overwhelmingly came from countries with very high HDI (90.5%). All ALPs were slightly more likely than TLPs to be in comprehensive practice and were less likely to be working in a FHT. Patient age and income distributions were similar across all groups.

The ALP groups' average ages ranged from 42.1 to 50.6 years. The Out-of-Province ALPs had the highest proportion of men (69%) compared to the other ALP groups. In the Out-of-Province ALP group, the majority were IMGs (89.7%) and completed medical school in countries considered medium/low on the HDI (63.2%). Seventy percent (70.1 %) practised in urban environments and they had the largest proportion in solo practice (32.2%). Similar to Out-of-Province, the US-Trained ALPs were mostly IMGs (85.7%); however, they graduated primarily

from medical schools from countries with a very high/high HDI (68.1%). They had the largest proportion practising in non-FHT groups (65.9%) and were the most urban group (78%). Contrary to the other ALPs, almost half (47.4%) of the Canadian Trained ALPs were non-IMGs and 72.9% came from countries with very high/high HDI. Seventy percent were in comprehensive practice and they had the lowest percentage in solo practice. They also had the lowest proportion practising in urban areas compared to all other groups (67.5%).

Table 2. Demographic and Practice Characteristics of TLPs and ALPs

Characteristic	All TLPs	Out-of-Province ALPs	US-Trained ALPs	Canadian-Trained ALPs
Total (n)	11127	87	91	114
Sex				
Male	6303 (56.6%)	60 (69%)	38 (41.8%)	62 (54.4%)
Female	4824 (43.4%)	27 (31%)	53 (58.2%)	52 (45.6%)
Age (yrs, mean)	50.6	49.5	42.1	45.3
Medical school region				
Canada/USA	8656 (77.8%)	9 (10.3%)	13 (14.3%)	54 (47.4%)
All others	2471 (22.2%)	78 (89.7%)	78 (85.7%)	60 (52.7%)
HDI Group				
Very high/High	10065 (90.5%)	32 (36.8%)	62 (68.1%)	83 (72.9%)
Medium/Low	1062 (9.5%)	55 (63.2%)	29 (31.9%)	31 (27.2%)
Practice type				
Comprehensive	7355 (66.1%)	60 (69%)	64 (70.3%)	80 (70.2%)
Not comprehensive	3772 (33.9%)	27 (31%)	27 (29.7%)	34 (29.8%)
Group type				
FHT	2273 (20.4%)	12 (13.8%)	16 (17.6%)	20 (17.5%)
non-FHT	5635 (50.6%)	47 (54%)	60 (65.9%)	70 (61.4%)
No group	3219 (28.9%)	28 (32.2%)	15 (16.5%)	24 (21.1%)
Rurality				
Urban	8596 (77.3%)	61 (70.1%)	71 (78%)	77 (67.5%)
Suburban/Rural	2531 (22.7%)	26 (29.9%)	20 (22%)	37 (32.5%)
Scope of practice (N, % with any)				
Prenatal visits	6131 (55.1%)	46 (52.9%)	52 (57.1%)	77 (67.5%)
Obstetrical delivery	1224 (11%)	6 (6.9%)	7 (7.7%)	21 (18.4%)
Postnatal visits	3093 (27.8%)	24 (27.6%)	17 (18.7%)	33 (28.9%)
ED visits	2292 (20.6%)	17 (19.5%)	8 (8.8%)	27 (23.7%)
LTC visits	2181 (19.6%)	7 (8%)	13 (14.3%)	27 (23.7%)
Patient age distribution				
< 18 years	18.5	23.0	21.0	20.4
18-64 years	63.8	63.4	63.1	62.5
65+ years	17.7	13.6	15.9	17.1
Patient SES				
% low income	38.0	42.6	42.2	38.9

CL: Confidence Limit | HDI: Human Development Index (2013) | FHT: Family Health Team | ED: Emergency Department | LTC: Long-Term Care

Primary Care Quality Indicators

Table 3 shows the results of the unadjusted and adjusted comparisons between each ALP group and the TLPs (unadjusted mean numbers are included in Appendix C). Each ALP group had a unique profile of primary care quality indicators. Patients of the Out-of-Province ALPs had the most substantial statistically significant differences in the quality care indicators compared to patients of TLPs after multivariable adjustments. These family physicians' diabetic patients were 4% less likely to have received HbA1C testing and their COPD patients were 18% less likely to have received spirometry testing. Their patients with CHF, COPD or asthma were 7% more likely to visit an ED for any reason (i.e., all-cause) than those of TLPs. Additionally, their female patients aged 50-69 were 4% less likely to have received a mammogram in previous two years and their pediatric patients had 14% fewer well-baby visits, were 24% less likely to have had an 18-month enhanced well-baby visit, and were 38% more likely to have received no immunizations. However, their patients were 3% more likely to have received spirometry testing, 4% more likely to receive colon cancer screening, and their hospitalized patients were 9% less likely to be readmitted in one year.

In contrast, US-Trained ALPs were comparable to their TLP counterparts, with some statistically significant differences. Their diabetic care and cancer screening rates were similar, although US-Trained ALP patients were 8% more likely to have received HbA1c and lipids testing than TLPs' patients and 2% more likely to have received a pap test or any colon cancer screening. Their CHF, COPD and asthma patients were also 3% less likely to visit the ED and their pediatric patients were 27% less likely to have not received any immunizations; however, they were 7% less likely to receive well-baby visits. Canadian Trained ALPs were also similar to their TLP counterparts across most indicators; however, some statistically significant differences were

seen: their pediatric patients were 3% less likely to have received a well-baby visit but were 34% less likely to have not received any childhood immunizations; their COPD patients were 11% less likely to have had spirometry testing within 12 months of diagnosis; and their patients with CHF, COPD or asthma were 9% more likely to visit an ED (all-cause) than those of TLPs. Minor differences were seen also seen with HbA1c testing, spriometry testing for asthma patients, and colon cancer screening, with Canadian-Trained ALP's patients being 3% more likely to have received testing or screening.

Table 3. Adjusted and unadjusted relative rates from poisson modelling, primary care quality indicators, ALPs vs. TLPs

Population/Measure	Out-of-Province ALPs				US-Trained ALPs				Canadian-Trained ALPs			
	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.	Unadjusted RR (CL)	Sig.	Adjusted (RR, CL)	Sig.
Total (n)	87				91				114			
Diabetes												
HbA1C	0.95 (0.91, 0.98)	**	0.96 (0.92, 0.99)	*	1.09 (1.06, 1.12)	****	1.08 (1.05, 1.11)	****	1.03 (1.00, 1.06)	*	1.03 (1.01, 1.06)	*
Eye exam	0.97 (0.94, 1.00)	*	0.98 (0.95, 1.01)		0.98 (0.96, 1.01)		0.99 (0.97, 1.01)		1.00 (0.98, 1.03)		1.00 (0.98, 1.02)	
Lipids	1.03 (1.00, 1.06)	*	1.00 (0.97, 1.03)		1.12 (1.09, 1.14)	****	1.08 (1.05, 1.10)	****	1.02 (1.00, 1.05)	*	1.02 (0.99, 1.04)	
ACE/AARB	1.02 (0.95, 1.11)		1.06 (0.97, 1.14)		0.96 (0.90, 1.02)		0.98 (0.92, 1.04)		1.05 (1.00, 1.11)		1.04 (0.98, 1.10)	
Statin	1.00 (0.95, 1.04)		0.98 (0.94, 1.03)		1.03 (1.00, 1.07)		1.01 (0.97, 1.04)		1.01 (0.98, 1.04)		1.00 (0.97, 1.03)	
CHF												
Echo w/in 12 mths of dx	1.00 (0.93, 1.08)		1.00 (0.93, 1.08)		1.03 (0.97, 1.10)		1.02 (0.96, 1.08)		1.01 (0.95, 1.06)		1.00 (0.95, 1.06)	
COPD												
Spiro w/in 12 mths of dx	0.80 (0.69, 0.92)	**	0.82 (0.71, 0.95)	**	1.10 (0.99, 1.22)		1.10 (0.99, 1.23)		0.88 (0.80, 0.97)	*	0.89 (0.80, 0.98)	*
Asthma												
Spirometry (ever)	0.96 (0.93, 0.98)	**	1.03 (1.01, 1.06)	*	0.98 (0.96, 1.00)		1.00 (0.98, 1.02)		1.00 (0.98, 1.02)		1.03 (1.01, 1.06)	**
CHF, COPD or Asthma												
ED visits per person	1.08 (1.06, 1.10)	*** *	1.07 (1.05, 1.09)	****	1.02 (1.01, 1.04)	**	0.97 (0.95, 0.99)	***	1.18 (1.16, 1.19)	****	1.09 (1.07, 1.10)	****
Pediatric care												
Well-baby visits	0.90 (0.87, 0.92)	*** *	0.86 (0.83, 0.88)	****	0.93 (0.90, 0.95)	****	0.93 (0.90, 0.95)	****	0.98 (0.96, 1.01)		0.97 (0.95, 0.99)	*
18-month enhanced assessment	0.70 (0.63, 0.78)	*** *	0.76 (0.68, 0.84)	****	0.99 (0.92, 1.07)		0.99 (0.91, 1.07)		1.03 (0.96, 1.10)		1.06 (0.99, 1.14)	
No Immunization	1.20 (0.99, 1.46)		1.38 (1.13, 1.68)	**	0.65 (0.52, 0.81)	***	0.73 (0.58, 0.92)	**	0.66 (0.54, 0.81)	***	0.66 (0.54, 0.82)	***
Cancer screening												
Mammography	0.92 (0.90,	***	0.96 (0.93,	**	0.98 (0.96,		1.01 (0.99,		0.96 (0.94,	***	0.98 (0.96,	

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	0.94)	*	0.99)		1.01)		1.03)		0.98)		1.00)	
Pap test (3 yr)	0.94 (0.92, 0.96)	*** *	1.00 (0.98, 1.02)		1.00 (0.98, 1.01)		1.02 (1.01, 1.03)	**	0.98 (0.97, 0.99)	**	1.01 (0.99, 1.02)	
Any colon CA screening	0.98 (0.96, 1.00)	*** *	1.04 (1.02, 1.06)	****	0.99 (0.98, 1.01)	*	1.02 (1.00, 1.03)	*	1.00 (0.99, 1.02)		1.03 (1.02, 1.05)	****
Hospital readmissions												
30 day	0.91 (0.79, 1.03)		0.96 (0.84, 1.09)		0.91 (0.82, 1.01)		0.94 (0.84, 1.05)		1.00 (0.92, 1.10)		1.03 (0.94, 1.13)	
1 yr	0.84 (0.78, 0.91)	*** *	0.91 (0.84, 0.98)	*	0.91 (0.85, 0.96)	**	0.98 (0.93, 1.05)		0.93 (0.88, 0.99)	*	0.98 (0.93, 1.04)	

Notes: Adjusted for age group, sex, IMG status, urban-rural status, number of years in practice, whether the physician was in a Patient Enrollment model, HDI group, median patient age and percent of patients in low-income neighbourhoods.

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II| CL: Confidence Limit | CHF: Congestive Heart Failure | dx: diagnosis | COPD: Chronic Obstructive Pulmonary Disease | ED: Emergency Department | Pap test: Papanicolau test | CA: Cancer

Sig.=significance level. *=p<0.05, **=p<0.01, ***=p<0.001, ****=p<0.0001

DISCUSSION

Our analysis of primary care quality indicators suggest that alternatively licensed physicians (ALPs) perform similarly to traditionally licensed physicians (TLPs) in many areas of primary care practice when controlling for a number of covariates. Small differences were seen across groups in indicators of diabetic care, CHF care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age and COPD management, particularly in patients of Out-of-Province ALPs. While individual family physician performance is contextual and influenced by many factors,(6,35) health administrative data is useful for gaining a system-level impression of family physicians' quality of care and broadly identifying areas that may need improvement.(36) Over all, our findings suggest that alternative licensure route is not a strong independent predictor of family medicine performance on the majority quality indicators examined. For a small number of newly licensed family physicians, educational content pertaining to Ontario-specific guidelines and expectations may be of benefit.

Out-of-Province ALPs

Compared to other subgroups, the primary care performance of Out-of-Province ALPs was the most different from TLPs after adjustments. Most notably, their patients less than two years of age were significantly less likely to receive well baby visits, enhanced 18-month assessments, or immunizations, highlighting a trend in preventive pediatric care. These differences may reflect provincial differences in guidelines and schedules for pediatric care. For example, there is significant variation in how 18-month assessments are approached globally and across Canada.(37) Ontario has supported a longer and more comprehensive enhanced18-month

assessment by providing financial incentives through a unique billing code.(37–39) It is possible that Out-of-Province ALPs were unaware of Ontario's enhanced 18-month assessment or of the pediatric care expectations of family physicians in the province. It is also possible that these physicians provided 18-month assessments but did not bill for it using the Ontario-specific code. Previous research has shown that male IMGs who have been in practice for over 10 years are less likely to provide 18-month assessments in Ontario.(40) In this study, age, gender, and HDI were controlled for, suggesting these factors are not accountable for the differences; thus, entering Ontario from another province through an alternative route appears to be an independent risk factor.

Similar to the differences seen in 18-month assessments, the lower childhood immunization rates in the Out-of-Province ALPs may be in part due to inter-provincial variation in policies. For example, childhood vaccine schedules differ across provinces (41) which may have implications for how physicians bill. Further, in Ontario, immunizations for children under two years of age are predominantly done in physician offices,(42) while they may be administered by nurses or other allied health professionals in other provinces. Thus, the norms and conventions from their prior jurisdictions may be reflected in the billing practices of these ALPs once in Ontario.

In addition to differences in preventive pediatric care, Out-of-Province ALPs differed from TLPs in rates of spirometry testing for COPD patients, which is recommended to confirm a diagnosis of COPD.(43–46) Previous research has found that spirometry test ordering among family physicians in Ontario is generally low,(47) and our findings suggest that it is even lower among Out-of-Province ALPs (and Canadian Trained ALPs) compared to TLPs, highlighting potential provincial differences in utilization. Out-of-Province ALPs' patients with CHF, COPD, or asthma also had higher rates of all-cause ED visits, but their hospitalized patients were 9% less

likely to have been readmitted within one year. Rates of all-cause ED visits and readmissions are sometimes associated with access to primary care,(48–51) but can be influenced by many factors (51–54) and should thus be interpreted cautiously.

Overall, our findings highlight that ALPs entering Ontario from another Canadian province perform differently than TLPs in certain indicators of primary care. However, the performance differences noted in this study may be due to provincial differences in care expectations and reflect the context of their recent work environments. Such provincial differences in how physicians provide primary care have implications for the migration of physicians across provinces since physicians can typically practice anywhere in Canada once licensed. Given that provisional licenses have been seen as a way for physicians to gain entry to larger provinces through smaller ones,(17) the Federation of Medical Regulatory Authorities of Canada has begun to standardize provincial licensure requirements and the Medical Council of Canada is facilitating a common approach to practice ready assessments for IMGs across the country. While these efforts will help to mitigate potential performance differences in Canadian physicians, our findings suggest that ALPs entering Ontario from another province may still benefit from information about Ontario care expectations at the time of licensure. Focused knowledge translation for family physicians migrating across provinces may help to educate physicians about province-specific expectations and support their adoption of provincially-supported programs and guidelines, reducing the potential for future performance differences.

US-Trained and Canadian-Trained ALPs

US-Trained and Canadian-Trained ALPs performed similarly to TLPs on most primary care quality indicators after adjustments, though some notable differences were seen. For both groups,

patients less than two years of age were less likely to receive well baby visits but more likely to receive immunizations. In contrast to the Out-of province ALPs, whose patients were more likely to have not received any early childhood immunizations, US- and Canadian-Trained ALP patients were much more likely to receive them compared to the rest of the province: this 27-34% difference was the largest difference seen between these groups and the TLPs. US-Trained ALPs' patients were also more likely to receive pap tests and colon cancer screenings, their diabetic patients were more likely to receive HbA1c and lipid testing, and their patients with CHF, COPD, or asthma were less likely to visit an ED. The higher rates of testing and screening may be reflective of their American training, as previous research has found American physicians tend to have lower thresholds for diagnostic and therapeutic interventions.(55) Similar to Out-of-Province ALPs, Canadian-Trained ALPs' COPD patients were less likely to receive spirometry testing, and their patients with CHF, COPD, or asthma were more likely to visit an ED. Overall, the performance of both of these ALP groups was comparable to TLPs. This is perhaps unsurprising given that these physicians have similar postgraduate training, and that postgraduate training has been found to be predictive of patient outcomes.(56) Our findings provide evidence that their practice performance is in fact similar to traditionally licensed physicians in Ontario.

Conclusions

Our findings illustrate that ALPs perform similarly to TLPs across many indicators of primary care, suggesting that route of licensure is not a strong predictor of family physician performance in Ontario. These findings provide support for alternative licensure policies and also demonstrate the utility of health administrative data for examining physician performance and evaluating regulatory processes. As transparency and accountability are increasingly emphasized in

healthcare,(57) and as physician migration and the use of alternative licensure routes continues to increase,(15) it is imperative that processes for licensing and monitoring physicians are rigourously evaluated. The ongoing assessment of physician performance is critical for understanding the effects of medical regulatory policies and, ultimately, for ensuring high quality patient care.

Strengths and Limitations

This is the first study to examine the primary care performance of alternatively and traditionally licensed family physicians in Ontario. Our use of population-level data across multiple indicators of primary care allowed for a robust and comprehensive comparison of ALPs and TLPs and our use of multivariable analysis enabled statistical adjustment of physician demographics, practice environments, and patient factors, such as SES, that are associated with primary care performance. While this approach contributes to our understanding of ALP performance, it is not without limitations. First, ALPs and TLPs were compared to each other, not to a gold standard. As such, our findings do not indicate whether physicians are meeting performance benchmarks, but rather whether ALP performance is comparable to TLP performance. Second, our results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care. Other important aspects of primary care such as the doctor-patient relationship or inter-professional collaboration with other primary health care providers are thus not accounted for. Last, billing data introduces unique interpretation challenges as these quality indicators are proxies for delivery of care; therefore, some of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.

Implications for Future Research

This study offers insight into the primary care performance of alternatively licensed physicians. Primary care is an important area of study given that approximately half of physicians in Ontario specialize in Family Medicine;(15) however, future research is needed to examine the practice performance of ALPs practicing in other specialties. Performance is also multi-faceted and must be studied using a variety of measures. Future studies could include other measures of performance, such as practice assessments or complaints profiles, to gain a comprehensive picture of ALPs' practices.

This study also demonstrates that licensure route is a useful way of stratifying and comparing physicians. IMG studies typically define physicians based on their country of undergraduate medical school, whereas licensure route accounts for the influence of postgraduate training and previous practice experience on performance. Examining the impact of all of a physician's training and experience on future practice performance allows for a more robust understanding of the predictors of performance and may enable more nuanced IMG research in the future.

Finally, this study represents a collaboration between a medical regulator and system partners. Such collaborations are important for linking performance data across the continuum of medical education and practice (58,59) and for providing evaluative evidence for regulatory processes and policies, such as alternative licensure routes.(12,14) Further collaborations of this nature will allow for robust examinations of the influence of each stage of a physician's training on future practice performance.

Declarations

1. Ethics approval: Ethical approval for this study was obtained from the Sunnybrook Health Sciences Center Ethics Review Board

2. Availability of data and material: The datasets included in this study are housed at the Institute for Clinical Evaluative Sciences. A request to the Data Analytic Services (DAS) at ICES is required in order to obtain access to data or analytic services (www.ices.on.ca/DAS/Data).

3. Conflicts of interests: The authors declare that they have no conflicts of interests

4. Funding: The analysis for this study was funded by an annual grant to the Institute for Clinical Evaluative Sciences from the Ontario Ministry of Health and Long-Term Care (MOHLTC)

5. Author contributions: KH, NT, DF, and WY conceptualized this study, interpreted the data, and were key contributors to the manuscript. LJ and SS were responsible for selecting and operationalizing the outcome measures. SS analyzed the data and contributed to writing the manuscript. All authors read and approved the final manuscript.

6. Author information: KH is a Research Associate at the College of Physicians and Surgeons of Ontario and has an MSc in Health Services Research from the University of Toronto; NT is a Research Associate at the College of Physicians and Surgeons of Ontario and has an MSc in Kinesiology and Health Science from York University; SS is a Senior Epidemiologist at the Institute for Clinical Evaluative Sciences and has an MA in Regional Planning from the University of Waterloo and an MSc in Community Health and Epidemiology from the University of Toronto; LJ is a Senior Scientist at the Institute for Clinical Evaluative Sciences and has an MSc in Community Health and Epidemiology from Queen's University

and an MD from McMaster University; DF is the Deputy Registrar at the College of Physicians and Surgeons of Ontario and has an MBA in Health Services Management from McMaster University; WY is a Senior Researcher at the College of Physicians and Surgeons of Ontario and has an MA in Measurement and Evaluation from the University of Toronto and is currently pursuing a PhD in Adult Education from the University of Toronto.

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Appendix A) Description of Physician Demographic and Practice Characteristic Indicators

Indicator	Description	Definition of indicator
Sex		
Male	Physician sex	Male sex
Female		Female sex
Age	Physician age	Physician age in 2014
HDI Group		
Very high	2013 Human development index associated with the country of undergraduate medical school of physician (26)	HDI rank < 50
High		HDI rank ≥50 and < 103
Medium		HDI rank ≥103 and < 145
Low		HDI rank ≥145
Practice Type		
Comprehensive	Comprehensive practice is if majority of services billed are related to "core primary care" and span multiple practice areas (27)	≥ 44 days worked/yr and > 50% of billing "in core primary care" in at least 7 of 22 practice areas
Other		All other FM physicians
Group type		
FHT	Family Health Team, group practice but not-Family Health Team or solo practice	
non-FHT		
No group		
Rurality		
Urban	Practice location categorized in to urban or suburban/rural based on 2008 Rurality Index for Ontario (RIO) score (50)	RIO < 10
Suburban/Rural		RIO ≥ 10
Scope of practice		
Prenatal visits	If the physician submitted billing for care related to: prenatal	% with any billing

Obstetrical Delivery	visits, obstetrical delivery, postnatal visits, Emergency Department, or Long-Term Care	% with any billing
Postnatal visits		% with any billing
ED visits		% with any billing
LTC visits		% with any billing
Patient age distribution		
< 18 years	Pts age categories in 2014	< 18 years
18-64 years		18-64 years
65+ years		65+ years
Patient SES		
% low income	Number of pts in the bottom 40% of neighborhood income	< 3rd quintile of neighborhood income

HDI: Human Development Index | FM: Family Medicine | FHT: Family Health Team |RIO: Rurality Index of Ontario| ED: Emergency Department | LTC: Long-Term Care | Pts: patients | SES: Socio-Economic Status

Appendix B) Description of Primary Care Quality Indicators

Indicator	Population	Description/guideline	Definition of indicator
Diabetes			
HbA1c	Pts with Diabetes Mellitus	Every 3-6 months, depending on control (51)	2+ HbA1c in previous 12 months
Eye exam		Examination every 1-2 years, depending on severity (51)	Eye exam in previous 24 months
Lipids		Total cholesterol, HDL-C, LDL-C, and TGs annually (51)	1+ cholesterol test in previous 12 months
ACE/ARB		Indicated for pts with high cardiovascular risk (51)	Prescribed ACE/ARB in previous 12 months (pts ≥65 years of age or older)
Statin		Indicated for pts with elevated lipids (51)	Prescribed statin in previous 12 months (pts ≥65 years of age or older)
CHF			
Echocardiogram w/in 12 mths of diagnosis	Pts with newly diagnosed CHF	Recommended early after CHF diagnosis for assessment and management (52)	Echocardiogram ordered within 12 months of diagnosis
ED visits/person	Pts with CHF		All cause ED visit in 2014/15
COPD			
Spirometry w/in 12 mths of diagnosis	Pts with newly diagnosed COPD	Recommended for diagnosis (37)	Spirometry within 12 months of diagnosis
ED visits/person	Pts with COPD	All COPD pts, number of ED visits/year	All cause ED visit in 2014/15

Asthma			
Spirometry	Pts with asthma	Recommended to be reassessed regularly and used for diagnosis (53)	Ever had spirometry
ED visits/person		All asthma pts number of ED visits/year	All cause ED visit in 2014/15
Preventive Pediatric Care			
Well-baby visits	Pts < 2yrs		Number of visits in first 24 months
18-month enhanced well baby visit	Pts 18 months	Recommended for every child in Ontario (32)	Submitted 18 month billing code
No Immunization	Pts < 2yrs	Publicly funded routine immunizations for children in first 2 yrs (54)	Submitted no billing codes for DTAP, Pneumococcal, MenCC, MMR, Varicella
Cancer Screening			
Mammogram	Female pts 52-69 yrs (excluding breast cancer pts)	Recommended every 2-3 years for pts 50-69 (55)	Mammogram in previous 24 months
Pap test	Female pts 23-69 yrs (excluding cervical and endometrial cancer pts)		Pap in previous 36 months
All colon cancer screening	Pts 52-74 yrs (excluding colon cancer and IBD pts)	FOBT recommended every 1-2 yrs; Colonoscopy every 10 yrs; Flexible Ssigmoidoscopy and Double Contrast Barium Enema every 5years for pts 50-74	Any FOBT in previous 2 yrs; colonoscopy in previous 10 yrs; other in previous 5 yrs

Hospital Readmissions		
Readmission (30 days)	All hospitalized pts	Hospital readmission within 30 days
Readmission (1 yr)		Hospital readmission within 12 months

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | pts: patients | HDL-C: High-Density Lipoprotein Cholesterol | LDL-C: Low-Density Lipoprotein Cholesterol | TG: Triglycerides | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II Receptor Blockers | CHF: Congestive Heart Failure | ED: Emergency Department | COPD: Chronic Obstructive Pulmonary Disease | DTAP: Diphtheria, Tetanus, Pertussis, Polio | MenCC: Meningococcal Conjugate C | MMR: Measles, Mumps, Rubella | Pap test: Papanicolau test | IBD. Inflammatory Bowel Disease | endo: FOBT: Fecal Occult Blood Test

Appendix C) Unadjusted mean numbers or percentages, clinical practice measures

	TLPs		Out-of-Province ALPs		US-Trained ALPs		Canadian-Trained ALPs	
	mean % or #	**95% CL**	**mean % or #**	**95% CL**	**mean % or #**	**95% CL**	**mean % or #**	**95% CL**
Diabetes								
HbA1C	43.4	(43, 43.9)	41.8	(37.6, 46)	48.0	(44.3, 51.6)	45.4	(41.8, 49)
Eye exam	66.2	(65.9, 66.6)	63.1	(59.3, 66.8)	67.3	(64.2, 70.3)	67.3	(64, 70.7)
Lipids test	62.4	(61.9, 62.9)	67.6	(63.4, 71.9)	72.9	(68.8, 77)	64.1	(59.8, 68.5)
Ace/AARB	70.2	(69.8, 70.6)	71.8	(67.3, 76.2)	74.5	(71.2, 77.7)	70.2	(66.5, 74)
Statin	69.5	(69.2, 69.9)	68.6	(63.5, 73.8)	75.8	(73.5, 78.1)	69.8	(66.5, 73.2)
CHF								
Echo w/in 12 mths of dx	85.3	(84.7, 85.9)	83.1	(74.5, 91.7)	91.5	(87.9, 95.1)	85.6	(79.8, 91.5)
COPD								
Spiro w/in 12 mths of dx	78.1	(77.6, 78.7)	72.9	(65.1, 80.7)	77.3	(71.7, 83)	79.0	(74.1, 83.8)
Asthma								
Any spirometry	51.7	(51.3, 52.1)	49.4	(45.3, 53.5)	52.0	(48.8, 55.3)	50.7	(47.6, 53.8)
CHF, COPD or Asthma								
ED visits/person	0.82	(0.79, 0.85)	0.68	(0.58, 0.77)	0.65	(0.58, 0.72)	0.87	(0.76, 0.99)
Pediatric care								
Well baby visits (mean #)	5.2	(5.2, 5.3)	4.3	(3.8, 4.9)	5.0	(4.5, 5.4)	4.8	(4.4, 5.2)
18 month enhanced assessment	47.9	(47.1, 48.6)	32.8	(25.8, 39.8)	47.7	(41, 54.4)	47.4	(42, 52.8)
No immunization	16.9	(16.2, 17.5)	23.6	(16.3, 30.9)	12.0	(8, 16)	16.4	(11.2, 21.6)
Cancer screening								

Mammogram	58.2	(57.8, 58.7)	51.0	(46.2, 55.8)	59.1	(55.1, 63.1)	55.0	(50.9, 59.1)
Pap test (3 yrs)	56.4	(56, 56.8)	50.7	(46.5, 54.8)	57.5	(53.1, 62)	56.8	(52.6, 59.1)
Any colon cancer screening	55.5	(55.1, 56)	48.7	(43.8, 53.6)	54.6	(50.1, 59)	56.8	(53.3, 60.3)
Hospital readmissions								
30 day	0.18	(0.18, 0.18)	0.14	(0.11, 0.18)	0.15	(0.13, 0.17)	0.19	(0.16, 0.23)
1 yr	0.06	(0.06, 0.06)	0.05	(0.03, 0.06)	0.05	(0.04, 0.06)	0.07	(0.05, 0.09)

HbA1c: Haemoglobin A1c (Glycated Haemoglobin) | ACE/AARB: Angiotensin Converting Enzyme Inhibitors/ Angiotensin II| CL: Confidence Limit | CHF: Congestive Heart Failure | dx: diagnosis | COPD: Chronic Obstructive Pulmonary Disease | ED: Emergency Department | Pap test: Papanicolau test | CA: Cancer

STROBE Statement—checklist of items that should be included in reports of observational studies

NOTE: Page Numbers refer to "clean" (i.e. unmarked) version of manuscript

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	The primary care performance of alternatively licensed physicians in Ontario, Canada: A cross-sectional study using administrative data
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4	A cross-sectional retrospective examination of Ontario health administrative data was conducted using Poisson regression analyses to compare the performance of traditionally and alternatively licensed physicians. Minimal differences were seen across groups in indicators of diabetic care, congestive heart failure care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age, particularly for alternatively licensed physicians who entered Ontario from another Canadian province.
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7-8	Collectively, Alternatively Licensed Physicians (ALPs) represent physicians who did not meet the licensure criteria at the time of entering independent practice in a given province but who were considered to have comparable qualifications to Traditionally Licensed Physicians (TLPs), based on their postgraduate training and/or professional experience. The performance of ALPs in practice, however, has not been previously examined. Given that many ALPs are IMGs, a review of IMG literature may offer insight into ALP practice performance; however, research comparing IMGs and DMGs has been equivocal. IMGs are typically defined by and compared on the location of their undergraduate medical training, but this only represents one step in an often long and diverse path of training and experience to independent practice. Examining physicians as defined by later steps in this process, such as point of licensure, may shed light on the impact of postgraduate medical training and early career practice experiences on subsequent performance and how physicians entering practice through alternative licensure routes may be better supported at different

				stages of their career
Objectives	3	State specific objectives, including any prespecified hypotheses	8	The research question guiding this study was: Does licensure route influence the primary care performance of physicians in Ontario?
Methods				
Study design	4	Present key elements of study design early in the paper	9	In order to isolate the effect of licensure route, we chose to compare each ALP group to TLPs while adjusting for a number of covariates. We do not address the independent impact of the other variables that were adjusted for, as we felt we could either focus on a small number of outcomes and explore the full multivariable models, or examine a broad spectrum of indicators representative of general family practice and narrow our focus to licensure route. We chose the latter, as we were interested in primary care performance as a whole rather than performance on any individual quality indicators.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9	The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014.
Participants	6	*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	9	The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014.
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11-12 and supplementary file	Physician demographic characteristics included age, sex, medical school region, and the Human Development Index (HDI) associated with the physician's country of medical school, which is a composite score based on life expectancy, education, and per capita income that rank orders all countries.[33] Physician practice characteristics included practice type (comprehensive or not), group type (Family Health Team (FHT), non-FHT, no group), scope of practice (percent providing any of the following: postnatal visits, obstetrical deliveries, postnatal visits, emergency department (ED) visits, long term care (LTC) visits), and practice location (urban, suburban/rural). Comprehensive family physicians are

				those who met specific criteria regarding the type and scope of services they provide.(34) FHTs are group practices which include comprehensive family physicians working alongside primary providers such as nurses, social workers, pharmacists and nutritionists. A detailed description of the physician demographic and practice characteristics is included in Appendix A. Primary care quality indicators based on health administrative data were calculated for chronic disease management, preventive pediatric care, cancer screening, and hospital readmission rates. Chronic disease management indicators included measures for diabetes care (HbA1C testing, cholesterol testing, ophthalmology examinations, the receipt of prescriptions for angiotension converting enzyme inhibitors (ACE) and angiotensin II receptor blockers (ARBs)), congestive heart failure (CHF; echocardiogram testing within 12 months of diagnosis, emergency department (ED) visits), asthma (spirometry testing within 12 months of diagnoses, ED visits) and Chronic Obstructive Pulmonary Disease (COPD; spirometry testing within 12 months of diagnoses, ED visits). Pediatric care indicators include well-baby visits, the 18-month enhanced developmental assessment, and the absence of pediatric vaccinations (defined as no billing for any immunization in OHIP). Cancer screening indicators included cervical, breast, and colorectal cancer screening. Hospital readmission rates were calculated at 30 days and one year for patients with a hospital admission. These primary care quality indicators are described in Appendix B.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10-11	Ontario health administrative datasets held at the Institute for Clinical Evaluative Sciences (ICES) were used in this study. These datasets were linked using unique encoded identifiers and analyzed at ICES under data security and privacy policies and procedures that are approved by the Office of the Information and Privacy Commissioner of Ontario.(32) The following administrative databases were used: Canadian Institute for Health Information hospital Discharge Abstract Database (CIHI-DAD, providing diagnostic information regarding hospital admissions), OHIP physician claims database (containing physician billings and diagnoses from 1991), the National Ambulatory Care Reporting System (NACRS) database (providing information on hospital- and

				community-based ambulatory care, including emergency department visits, from 2000 and same-day surgery from 1991), and the Ontario Drug Benefit (ODB) program database (containing information on all drug therapies dispensed to eligible individuals 65 years of age and older)
Bias	9	Describe any efforts to address potential sources of bias	13	Covariates were entered into the model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income and the median age of their patients.
Study size	10	Explain how the study size was arrived at	9	The study population included all practising family physicians in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11-12 and supplementary file	See item 7.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	13	Our multivariate analysis modelled the relationship between physician licensure cohort (ALP group or TLP) and clinical practice outcomes. Before carrying out the modelling, we tested the outcome measures for normality and found that many, such as the proportion of a physician's diabetic patients who received an eye exam within the previous year, were not normally distributed, but became so after being log transformed. Based on this, we chose to use proc genmod in SAS to model the number with each characteristic (rather than the proportion) based on the Poisson distribution and including a log offset. Exponentiating the resulting parameter estimate gave us the relative rate for each outcome. Each outcome was modeled individually. Covariates were entered into the model in a stepwise fashion, with only the significant variables retained in the final model. These included grouped age, sex, number of years in practice, urban-rural status, IMG status, whether the physician was in a patient enrollment model, HDI group, the proportion of their patients who were low income and the median age of their patients. The relative rates estimated by the model indicate the difference in outcome between each ALP group and the TLPs (reference group).
		(*b*) Describe any methods used to examine		NA

		subgroups and interactions		
		(*c*) Explain how missing data were addressed	9	The study population included **all practising family physicians** in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 **and billed the Ontario Health Insurance Plan (OHIP) in 2014**. **All publicly funded health services provided by physicians are submitted to OHIP**.
		(*d*) *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy		NA
		(*e*) Describe any sensitivity analyses		NA
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	14 9	A total of 292 ALPs and 11,127 TLPs were included in the study The study population included **all practising family physicians** in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 and billed the Ontario Health Insurance Plan (OHIP) in 2014
		(b) Give reasons for non-participation at each stage		NA
		(c) Consider use of a flow diagram		NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	14-16	A total of 292 ALPs and 11,127 TLPs were included in the study (Table 2). The largest group of ALPs were the Canadian Trained (n=114), followed by the US-Trained (n=91) and the Out-of-Province (n=78). The majority of TLPs were men (56.6%) and were older (50.6 years) than all three groups of ALPs. TLPs had fewer IMGs (22.7%) and overwhelmingly came from countries with very high HDI (90.5%). All ALPs were slightly more likely than TLPs to be in comprehensive practice and were less likely to be working in a FHT. Patient age and income distributions were similar across all groups. The ALP groups' average ages ranged from 42.1 to 50.6 years. The Out-of-Province ALPs had the highest proportion of men (69%) compared to the other ALP groups. In the Out-of-Province ALP group, the majority were IMGs (89.7%) and completed medical school in countries considered medium/low on the HDI (63.2%). Seventy percent (70.1 %) practised in urban environments and they

				had the largest proportion in solo practice (32.2%). Similar to Out-of-Province, the US-Trained ALPs were mostly IMGs (85.7%); however, they graduated primarily from medical schools from countries with a very high/high HDI (68.1%). They had the largest proportion practising in non-FHT groups (65.9%) and were the most urban group (78%). Contrary to the other ALPs, almost half (47.4%) of the Canadian Trained ALPs were non-IMGs and 72.9% came from countries with very high/high HDI. Seventy percent were in comprehensive practice and they had the lowest percentage in solo practice. They also had the lowest proportion practising in urban areas compared to all other groups (67.5%).
		(b) Indicate number of participants with missing data for each variable of interest	9	The study population included **all practising family physicians** in Ontario who were registered with the College of Physicians and Surgeons of Ontario (CPSO) between 2000 and 2012 **and billed the Ontario Health Insurance Plan (OHIP) in 2014**. **All publicly funded health services provided by physicians are submitted to OHIP**.
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		NA
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		NA
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		NA
		Cross-sectional study—Report numbers of outcome events or summary measures	Supplementary file	Appendix 4
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	20-21	Table 3
		(*b*) Report category boundaries when continuous variables were categorized	Supplementary file	Appendix A-B
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful		NA

		time period		
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses		NA
Discussion				
Key results	18	Summarise key results with reference to study objectives	21	Our analysis of primary care quality indicators suggest that alternatively licensed physicians (ALPs) perform similarly to traditionally licensed physicians (TLPs) in many areas of primary care practice when controlling for a number of covariates. Small differences were seen across groups in indicators of diabetic care, CHF care, asthma care, and cancer screening rates. Larger differences were found in preventive care for children less than two years of age and COPD management, particularly in patients of Out-of-Province ALPs. While individual family physician performance is contextual and influenced by many factors,(6,35) health administrative data is useful for gaining a system-level impression of family physicians' quality of care and identifying areas that are meeting practice benchmarks and areas that may need improvement.(36) Over all, our findings suggest that alternative licensure route is not a strong independent predictor of family medicine performance on the majority quality indicators examined. For a small number of newly licensed family physicians, educational content pertaining to Ontario-specific guidelines and expectations may be of benefit.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	26-27	First, ALPs and TLPs were compared to each other, not to a gold standard. As such, our findings do not indicate whether physicians are meeting performance benchmarks, but rather whether ALP performance is comparable to TLP performance. Second, our results are based on one year of health administrative data which depicts a point in time and also only represents elements of care that are funded by the Ontario Ministry of Health and Long-Term care. Other important aspects of primary care such as the doctor-patient relationship or inter-professional collaboration with other primary health care providers are thus not accounted for. Last, billing data introduces unique interpretation challenges as these quality indicators are proxies for delivery of care; therefore, some

				of the variance in the indicators may be, in part, attributable to differences in billing practices or factors unrelated to the physician, such as patient preference.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-24	Compared to other subgroups, the primary care performance of Out-of-Province ALPs was the most different from TLPs after adjustments. Most notably, their patients less than two years of age were significantly less likely to receive well baby visits, enhanced 18-month assessments, or immunizations, highlighting a trend in preventive pediatric care. These differences may reflect provincial differences in guidelines and schedules for pediatric care. For example, there is significant variation in how 18-month assessments are approached globally and across Canada. Ontario has supported a longer and more comprehensive enhanced18-month assessment by providing financial incentives through a unique billing code. It is possible that Out-of-Province ALPs were unaware of Ontario's enhanced 18-month assessment or of the pediatric care expectations of family physicians in the province. It is also possible that these physicians provided 18-month assessments but did not bill for it using the Ontario-specific code. Previous research has shown that male IMGs who have been in practice for over 10 years are less likely to provide 18-month assessments in Ontario.40) In this study, age, gender, and HDI were controlled for, suggesting these factors are not accountable for the differences; thus, entering Ontario from another province through an alternative route appears to be an independent risk factor. Similar to the differences seen in 18-month assessments, the lower childhood immunization rates in the Out-of-Province ALPs may be in part due to inter-provincial variation in policies. For example, childhood vaccine schedules differ across provinces which may have implications for how physicians bill. Further, in Ontario, immunizations for children under two years of age are predominantly done in physician offices, while they may be administered by nurses or other allied health professionals in other provinces. Thus, the norms and conventions from their prior jurisdictions may be reflected in the billing practices of these ALPs once in

Ontario.

In addition to differences in preventive pediatric care, Out-of-Province ALPs differed from TLPs in rates of spirometry testing for COPD patients, which is recommended to confirm a diagnosis of COPD. Previous research has found that spirometry test ordering among family physicians in Ontario is generally low, and our findings suggest that it is even lower among Out-of-Province ALPs (and Canadian Trained ALPs) compared to TLPs, highlighting potential provincial differences in utilization. Out-of-Province ALPs' patients with CHF, COPD, or asthma also had higher rates of all-cause ED visits, but their hospitalized patients were 9% less likely to have been readmitted within one year. Rates of all-cause ED visits and readmissions are sometimes associated with access to primary care, but can be influenced by many factors and should thus be interpreted cautiously.

Overall, our findings highlight that ALPs entering Ontario from another Canadian province perform differently than TLPs in certain indicators of primary care. However, the performance differences noted in this study may be due to provincial differences in care expectations and reflect the context of their recent work environments. Such provincial differences in how physicians provide primary care have implications for the migration of physicians across provinces since physicians can typically practice anywhere in Canada once licensed. Given that provisional licenses have been seen as a way for physicians to gain entry to larger provinces through smaller ones, the Federation of Medical Regulatory Authorities of Canada has begun to standardize provincial licensure requirements and the Medical Council of Canada is facilitating a common approach to practice ready assessments for IMGs across the country. While these efforts will help to mitigate potential performance differences in Canadian physicians, our findings suggest that ALPs entering Ontario from another province may still benefit from information about Ontario care expectations at the time of licensure. Focused knowledge translation for family physicians migrating across

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provinces may help to educate physicians about province-specific expectations and support their adoption of provincially-supported programs and guidelines, reducing the potential for future performance differences.
US-Trained and Canadian-Trained ALPs performed similarly to TLPs on most primary care quality indicators after adjustments, though some notable differences were seen. For both groups, patients less than two years of age were less likely to receive well baby visits but more likely to receive immunizations. In contrast to the Out-of province ALPs, whose patients were more likely to have not received any early childhood immunizations, US- and Canadian-trained ALP patients were much more likely to receive them compared to the rest of the province: this 27-34% difference was the largest difference seen between these groups and the TLPs. US-Trained ALPs' patients were also more likely to receive pap tests and colon cancer screenings, their diabetic patients were more likely to receive HbA1c and lipid testing, and their patients with CHF, COPD, or asthma were less likely to visit an ED. The higher rates of testing and screening may be reflective of their American training, as previous research has found American physicians tend to have lower thresholds for diagnostic and therapeutic interventions. Similar to Out-of-Province ALPs, Canadian-Trained ALPs' COPD patients were less likely to receive spirometry testing, and their patients with CHF, COPD, or asthma were more likely to visit an ED. Overall, the performance of both of these ALP groups was comparable to TLPs. This is perhaps unsurprising given that these physicians have similar postgraduate training, and that postgraduate training has been found to be predictive of patient outcomes. Our findings provide evidence that their practice performance is in fact similar to traditionally licensed physicians in Ontario.

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Generalisability	21	Discuss the generalisability (external validity) of the study results	26	This study offers insight into the primary care performance of alternatively licensed physicians. Primary care is an important area of study given that approximately half of physicians in Ontario specialize in Family Medicine;(15) however, future research is needed to examine the practice performance of ALPs practicing in other specialties. Performance is also multi-faceted and must be studied using a variety of measures. Future studies could include other measures of performance, such as practice assessments or complaints profiles, to gain a comprehensive picture of ALPs' practices.
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	27	The analysis for this study was funded by an annual grant to the Institute for Clinical Evaluative Sciences from the Ontario Ministry of Health and Long-Term Care (MOHLTC)

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.