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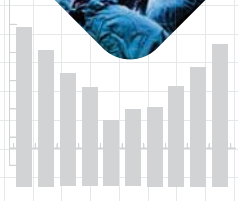
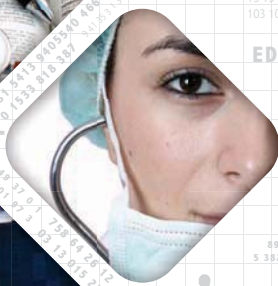
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Working Paper: Physician Mobility During and Following Medical Training

Introduction

The Canadian Post-M.D. Education Registry (CAPER) is the definitive source of national longitudinal information on trainees within the Canadian postgraduate medical education system. CAPER has been collecting data on postgraduate trainees since 1988 and is a unique source of data on physicians in training.

One area of research in medical education that has received considerable attention in recent years is Health Human Resource (HHR) Planning of physicians^{1,2,3}. The goal of HHR planning is to ensure that the correct distribution of physicians, based on a variety of factors (e.g., geographic, specialists) are available to meet the health needs of the population. One component of HHR planning concerns the mobility of physicians as they progress through their undergraduate medical studies, onto their postgraduate studies, and ultimately into practice.

The goal of this working paper is to utilize the longitudinal data held at CAPER to categorize, enumerate, and analyze physician's geographic mobility within Canada during the different phases of their education and out into practice.

Methods

Data Sources

CAPER maintains record-level data for all postgraduate medical residents and fellows in Canada. Data elements permit analysis across medical faculties and trainee characteristics, such as place of MD graduation, legal status, age, gender and field of training. Data is captured longitudinally, from the time of entry to training, to the year of exit, and out into practice following post-M.D. training using the CMA Masterfile. A long-standing data sharing agreement between the two organizations allows us to track practice settings for physicians who completed postgraduate training in Canada.

Description of Population

The selection of the population for this working paper is summarized in *Figure 1* on the following page. To simplify the interpretation of mobility patterns only Canadian Citizens/Permanent Residents (CC/PR), Canadian Medical Graduates (CMGs), who exited a residency program between 2003-2013 were included in these analyses. Any records with missing practice location data and those identified in another country at five-year follow-up from exit of post-M.D. training were excluded from the population to simplify interpretation of mobility patterns. There were also concerns that physicians missing practice location data may do so because they are located in another country. To avoid these data quality concerns both groups were excluded. Overall, this resulted in a final sample of 16,025 individuals.

¹ Wranik, D. (2008). Health human resource planning in Canada: A typology and its application. *Health Policy, 86*(1), 27-41. doi:10.1016/j.healthpol.2007.08.004

² Kabene, S. M., Orchard, C., Howard, J. M., Soriano, M. A., & Leduc, R. (2006). The importance of human resources management in health care: A global context. *Human Resources for Health, 4*(1). doi:10.1186/1478-4491-4-20

³ Murphy, G. T., Birch, S., Mackenzie, A., Bradish, S., & Rose, A. E. (2016). A synthesis of recent analyses of human resources for health requirements and labour market dynamics in high-income OECD countries. *Human Resources for Health, 14*(1). doi:10.1186/s12960-016-0155-2

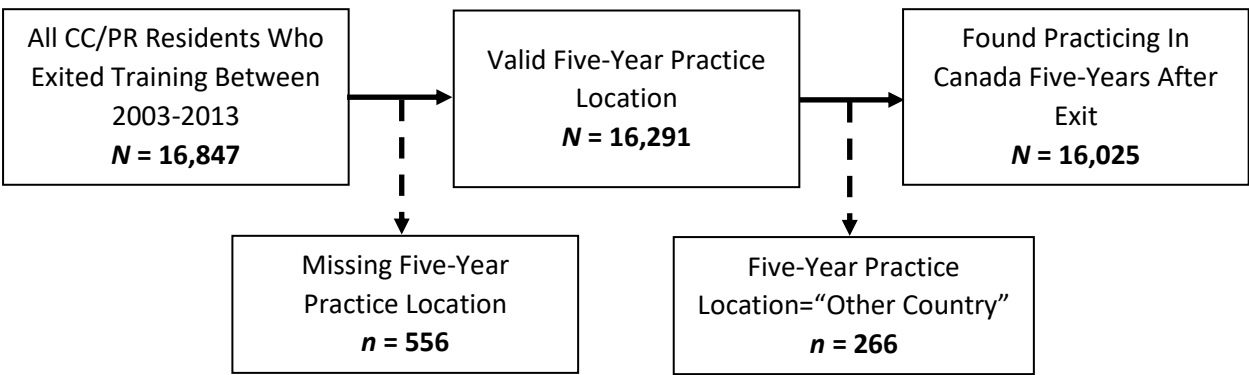


Figure 1: Selection of population to examine physician mobility

Division of Canada into Regions

There are currently seventeen faculties of medicine in Canada that are not equally geographically distributed across the provinces and territories. To facilitate interpretation of mobility patterns (described in the following section) the country was divided into several regions (see Figure 2 below). Each region has at least one medical faculty with the exception of the northern territories (i.e., Yukon Territory, Northwest Territories, and Nunavut).

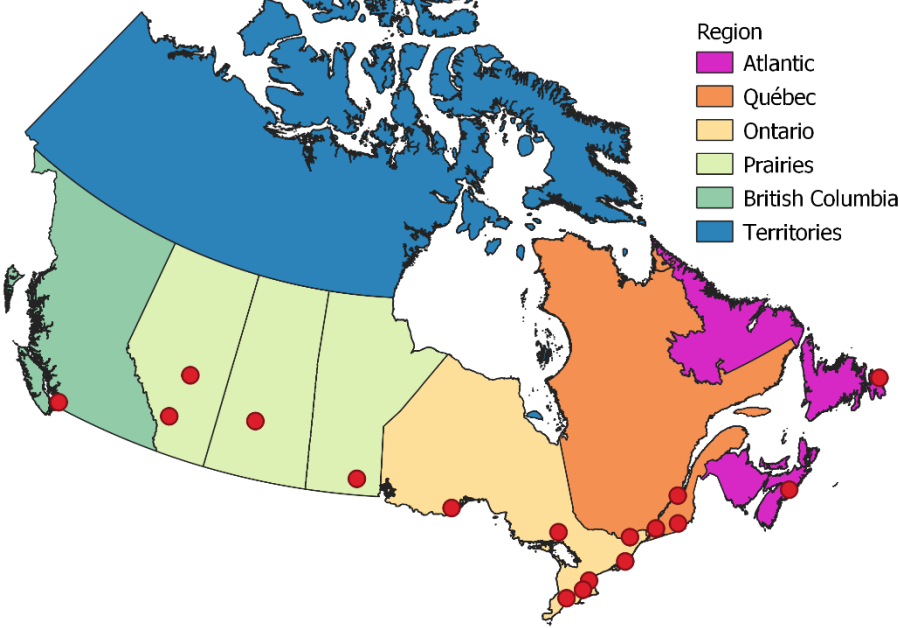


Figure 2: Division of Canada into six regions and locations of medical faculties.

Mobility Patterns

The CAPER database contains location information on where physicians completed their MD degree, where they completed their postgraduate training, and their practice location five years after exiting postgraduate training.⁴ There are over 100 possible combinations of the five regions containing medical faculties. As this would make interpretation of the mobility data challenging five patterns which cover all combinations were considered. A sixth mobility pattern was added for all physicians who were identified as practicing in the Territories five years after exiting postgraduate training. *Table 1* summarizes the mobility patterns and provides exemplar movement patterns.

Table 1: Mobility patterns with exemplar movement between regions.

Mobility Pattern	Notes	Region of MD	Region of Post-M.D.	Region of Practice (Five Year Follow-Up)
Consistent	Physician was found in the same region at all three timepoints.	Atlantic	Atlantic	Atlantic
Mobile	Physician was found in different regions at all three timepoints	Atlantic	Ontario	Prairies
Return to MD	Physician left region of MD for postgraduate training and returned to practice in region of MD.	Atlantic	Québec	Atlantic
Remain in Post-M.D.	Physician left region of MD and practiced in the same region as postgraduate training occurred.	Atlantic	Ontario	Ontario
Leave Education	Physician completed MD and postgraduate training in one region but practiced in another region.	British Columbia	British Columbia	Prairies
Territories	Physician was found practicing in the northern territories.	Ontario	Ontario	Nunavut

⁴ CAPER has reliable data concerning the medical faculty in which a student was enrolled for their post-M.D. residency training. Although some faculties do offer a small number of residency training positions in regions outside their main faculty location only the region a medical faculties primary campus is located within was considered for these analyses. For example, Memorial University of Newfoundland has a Family Medicine program residency training program based in Nunavut. The residents enrolled in this program would be classified as receiving their residency training in the Atlantic region as that is the location of the primary Memorial University of Newfoundland campus.

A separate category was created for those practicing in the Territories five years after exiting postgraduate training as those physicians could only ever be categorized as “Leave Education” or “Mobile” as there are no medical faculties in the Territories.

Analyses

The number of physicians who were classified into each mobility category was determined. A deeper investigation of the data in terms of demographic differences between groups was conducted to determine if any patterns emerged.

Results

Descriptive Statistics of Mobility Patterns

The basic counts of the regions each physician completed their MD, their postgraduate training, and practice location five years after exiting training are summarized in *Table 2*, below.

Table 2: Number of physicians at each time point.

MD Region	Post-M.D. Region	Five Year Practice Region					
		Atlantic	Québec	Ontario	Prairies	British Columbia	Territories
Atlantic	Atlantic	523	4	47	24	16	3
	Québec	13	16	8	1	0	0
	Ontario	108	1	219	15	18	1
	Prairies	28	0	9	65	17	0
	British Columbia	12	0	7	7	50	1
Québec	Atlantic	10	7	5	2	3	0
	Québec	207	4,293	114	29	38	0
	Ontario	5	43	172	7	5	1
	Prairies	1	11	3	26	7	0
	British Columbia	1	10	9	7	47	0
Ontario	Atlantic	82	1	54	8	11	5
	Québec	8	83	99	8	15	0
	Ontario	52	30	3,902	110	130	11
	Prairies	7	2	96	270	54	2
	British Columbia	3	4	91	25	255	4
Prairies	Atlantic	43	0	10	59	13	2
	Québec	3	31	18	32	12	0
	Ontario	6	1	286	146	39	1
	Prairies	19	0	76	1,716	175	10
	British Columbia	3	6	20	91	240	7
British Columbia	Atlantic	23	0	1	5	36	2
	Québec	0	17	3	2	24	1
	Ontario	2	1	99	15	91	1
	Prairies	2	0	14	122	107	2
	British Columbia	1	0	17	26	640	8

As noted in the methods section one of the rationales for developing mobility patterns was the large number of combinations of locations possible in this paper. The large number of cells in *Table 2* reinforce this point. Therefore, physicians were classified into the six mobility patterns described in the methods section.

Mobility Categories

The number of physicians who fell into each category are summarized in *Table 3*, below.

Table 3: Number of physicians by mobility category

Mobility Category	<i>n</i>	%
Consistent	11,074	69.1
Mobile	460	2.9
Return to MD	1,158	7.2
Remain in Post-M.D.	2,156	13.5
Leave Education	1,115	7.0
Territories	62	0.4
Total	16,025	100.0

The largest mobility category by far was consistent with almost 7 in 10 physicians (69.1%) falling into this category. The least common mobility categories were those practicing in the territories (0.4%) and those who switched regions (i.e., Mobile) at each time point (2.9%). There was roughly the same proportion of physicians who fell into the remaining categories.

Interregional Variance in Physician Mobility

Most physicians earn their MD degree in the same region they lived in prior to entry to medical school due to MD seat allocation requirements for admission. Generally, there are no seat allocation requirements at the post-M.D. level. Differences in mobility categories by MD region are summarized in *Figure 3*, below.

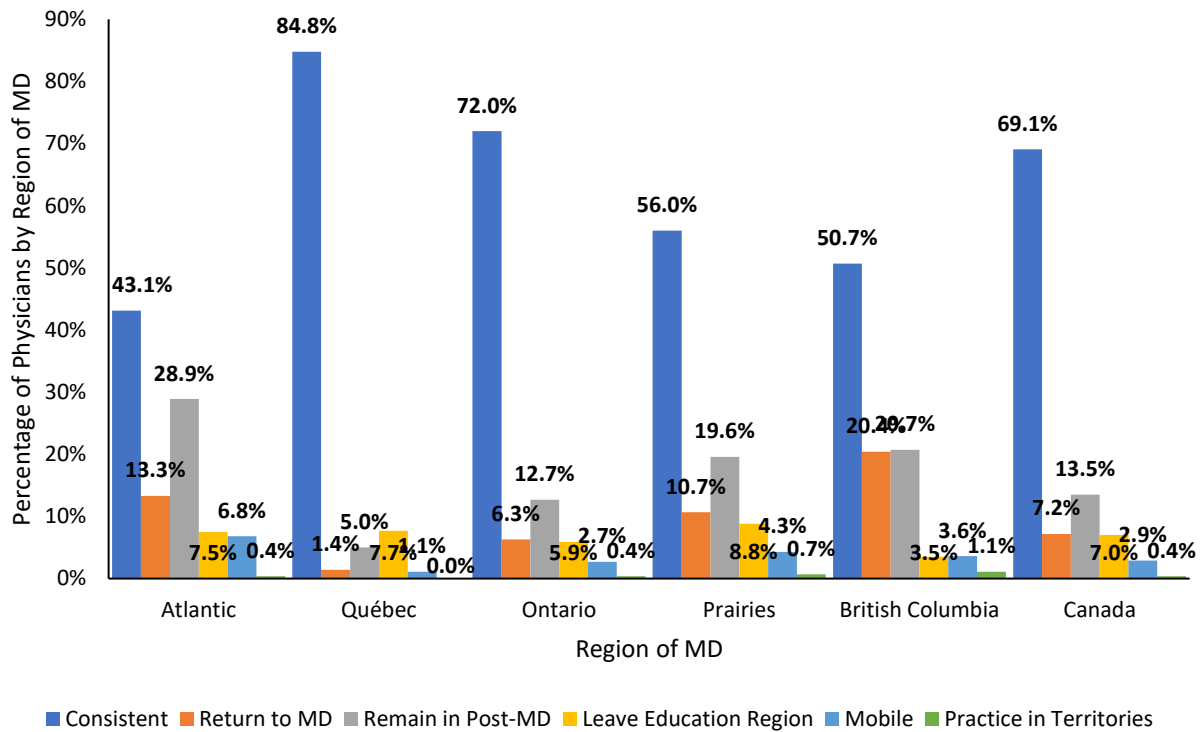


Figure 3: Proportion of physicians by mobility category based on region of MD.

As expected, based on the total percentages, the most common mobility category was consistent. However, there were substantial regional variations.

Of particular note was the large percentage of physicians (~85%) who earned their MD in Québec who remained in Québec for both postgraduate and later chose to practice in the province. This is not necessarily surprising due to the fact that 3 of the 4 medical faculties in Québec provide instruction in French only. It is reasonable to expect that residents of Québec, where the majority of the population speaks French, to apply to schools where French is the primary language of instruction. They would then go to practice in primarily French speaking regions.

Another group of students who tended to remain consistent during their medical education and entry to practice were those who completed their MD in Ontario (~72%). This result is also unsurprising due to the fact that Ontario has the largest number of medical faculties in Canada. Therefore, it is not necessarily surprising that a larger proportion of students from Ontario stay in that province for both their education and practice due to the large number of choices in faculties and opportunities following graduation.

To examine the impact of having single province regions and the fact that these regions have four or more medical faculties the mobility categories were computed for the remaining regions (see Table 4).

Table 4: Number of physicians by mobility category excluding MD graduates from Ontario and Québec

Mobility Category	n	%
Consistent	2,879	52.0
Mobile	259	4.7
Return to MD	747	13.5
Remain in Post-M.D.	1,211	21.9
Leave Education	405	7.3
Territories	39	0.7
Total	5,540	100.0

A substantially smaller proportion of physicians remained consistent when MD graduates from Ontario and Québec were excluded from the analyses. When only examining the Atlantic, Prairies, and British Columbia regions the “Remain in Post-M.D.” group had the greatest percentage increase. A little over 1 in 5 physicians end up leaving their MD region to pursue postgraduate studies and remain in that region five-years after exiting training.

Variation in Broad Specialty of Training

CAPER typically groups trainees into four broad specialties of training. This section will examine differences in broad specialty of training as a function of mobility pattern. The proportion of physicians in each broad specialty are summarized in Table 5, below.

Table 5: Number and proportion of physicians by broad specialty of training and mobility category

	Broad Specialty of Training									
	Family Medicine		Medical Specialties		Lab Medicine Specialties		Surgical Specialties		Total	
	n	% (col)	n	% (col)	n	% (col)	n	% (col)	n	% (col)
Consistent	5,270	71.4	4,167	67.9	200	67.1	1,437	65.1	11,074	69.1
Return to MD	452	6.1	455	7.4	27	9.1	224	10.1	1,158	7.2
Remain in Post-M.D.	884	12.0	953	15.5	38	12.8	281	12.7	2,156	13.5
Leave Education	541	7.3	370	6.0	26	8.7	178	8.1	1,115	7.0
Mobile	183	2.5	185	3.0	7	2.3	85	3.9	460	2.9
Territories	56	0.8	4	0.1	0	0.0	2	0.1	62	0.4
Total	7,386	100	6,134	100	298	100	2,207	100	16,025	100

Overall, the distribution of mobility categories across broad specialties did not vary substantially (Table 5). A few minor deviations in mobility category by broad specialty were noted. Physicians who studied Family Medicine tended to be more consistent (71.4% vs. 69.1%). Physicians in the Medical Specialties tended to leave the region they completed their MD in and remain in the region they completed their post-M.D. training in (15.5% vs. 13.5%). Physicians who trained in the Lab Medicine Specialties tended to complete their MD and post-M.D. studies in one region but practiced in another region (8.7% vs. 7.0%).

Finally, physicians who studied Family Medicine tended to be more likely to practice in the Territories than those in other specialties (0.8% vs. 0.4%). Although interesting these differences were relatively small.

Variations in Demographics Across Mobility Patterns

As detailed in the methodology section CAPER collects a variety of basic demographic data on post-M.D. students. The following section examines if there are any differences in demographics across the physician mobility categories. *Figure 4*, shows the breakdown of reported gender by physician mobility category.

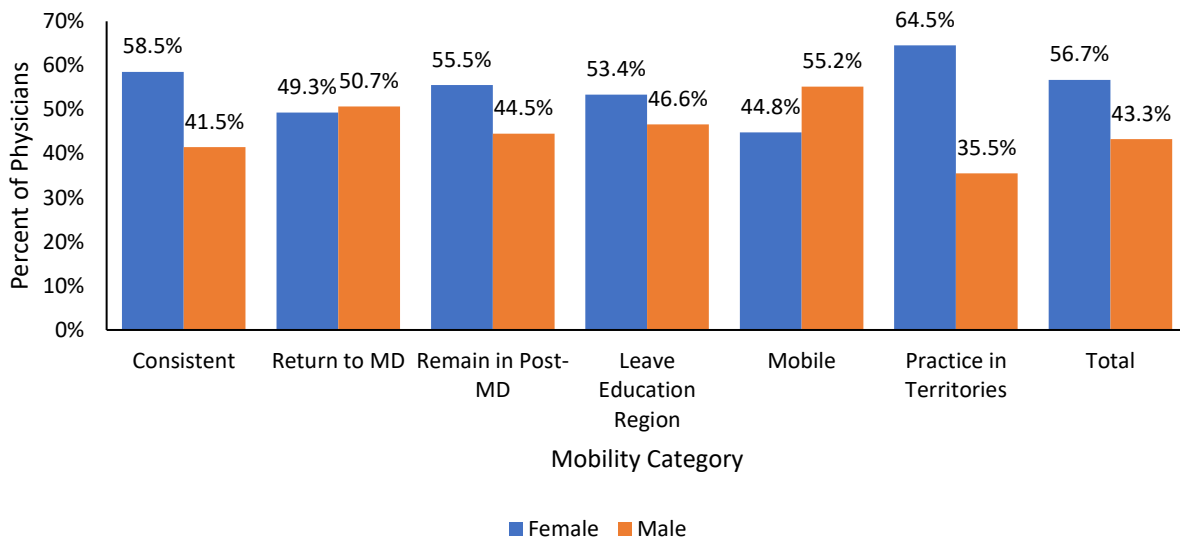


Figure 4: Percentage of trainees by gender and mobility category

For the entire population there was a higher percentage of females (56.7%) to males (43.3%). A chi-square test of independence did indicate there was a significant association between mobility category and gender, $\chi^2(df=5, n=16,025) = 75.22, p < .001$.

Relative to the total proportion of males (43.3%):

- Male physicians tended to be categorized more frequently than females in the “Return to MD” group (50.7% and 49.3%, respectively) and “Mobile” group (55.2% and 44.8%, respectively).
- A smaller proportion of males (35.5%) than females were located practicing in the northern territories five-years after exiting training.

Age at Completion of Training

The CAPER database also contains the age of physicians as they exit training. The following analysis, summarized in *Figure 5*, examines differences in the age of trainees across mobility categories.

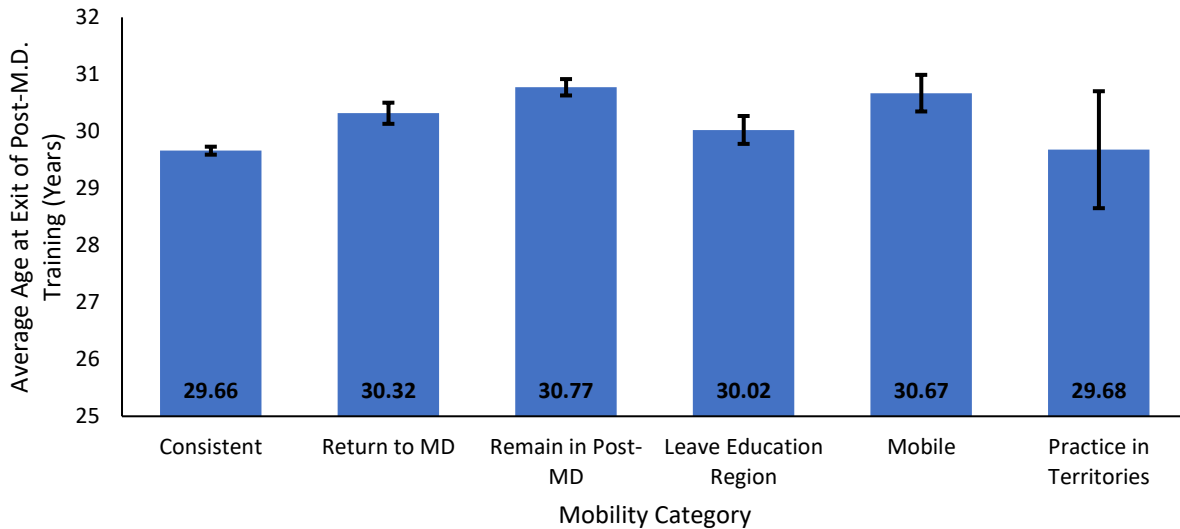


Figure 5: Average age of physicians at exit from post-M.D. training by mobility category (95% CI error bars).

The age of each physician at exit of training was submitted to a one-way Analysis of Variance (ANOVA). Levine’s test for homogeneity of variance was significant ($p < .001$). However, the non-parametric Kruskal-Wallis test was in concordance with the ANOVA ($\chi^2(df=5, n=16,025) = 321.94, p < .001$). Therefore, the results of the parametric analysis were used. The ANOVA revealed a significant effect of mobility category on age, $F(5, 16019) = 40.59, p < .001, \eta^2 = 0.01$. As can be seen by the small eta-squared value the effect of mobility category was very small even though it was significant (Figure 5). Taken together there would appear to be no meaningful difference in average age at exit from post-M.D. training by mobility category.

Area of Five-Year Practice Location

The five-year practice location data has been used in this analysis to categorize physicians into mobility categories. We can also use this data to examine whether physicians within certain mobility categories end up practicing in more rural or urban regions.

To determine the rurality of a physicians practice location CAPER links the postal code of practice to the Postal Code Conversion File (PCCF) where Single Link Indicator (SLI) is equal to one. This file links a postal code to the Statistical Area Classification (SAC) type most representative of the postal code provided. The classification structure summarized in Table 6 was used to classify practice locations.

Table 6: Relationship of Statistical Area Classification Type to area of practice

Statistical Area Classification Type	Area of Practice
1	Large Urban
2	Small City
3	Town
4-8	Rural

SAC type can only be determined if a practice location record has a full postal code as opposed to practice region where only a province is required. There are a number of records in the current population that have practice location province/territory but not a full postal code. Therefore, a number of records ($n = 489$, 3.1% of sample) in the following analyses are missing data on area of practice. The results of the analyses are summarized in *Table 7*, below.

Table 7: Area of practice five-years after exit from post-M.D. training by mobility category

Area of Practice	Mobility Category													
	Consistent		Return to MD		Remain in Post-M.D.		Leave Education		Mobile		Territories		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Large Urban	8,637	80.6	914	80.6	1,764	84.1	754	69.6	354	79.2	0	0.0	12,423	80.0
Small City	344	3.2	47	4.1	108	5.1	60	5.5	22	4.9	0	0.0	581	3.7
Town	900	8.4	112	9.9	100	4.8	161	14.9	49	11.0	40	69.0	1,362	8.8
Rural	835	7.8	61	5.4	126	6.0	108	10.0	22	4.9	18	31.0	1,170	7.5
Missing	358	3.2	24	2.1	58	2.7	32	2.9	13	2.8	4	6.5	489	3.1
Total	11,074	100	1,158	100	2,156	100	1,115	100	460	100	62	100	16,025	100

Note: Percentages were calculated excluding missing data from the denominator (i.e., numerator / [total – missing]).

A chi-square test of independence revealed that mobility category and area of practice are dependent on each other, $\chi^2(df=15, n=15,536) = 498.12, p < .001$. The PCCF file does not classify any region of the territories as “large urban” or “small city”. As expected due to lower population and lack of large urban centers physicians practicing in the territories were found only in town and rural areas.

For most remaining mobility categories, the distribution of area of practice was consistent with the group taken as a whole. One interesting exception to this were individuals who completed their education in one region but were found practicing in another five years later. For these physicians a smaller percentage were in large urban areas and they were more likely to be found in small city and town regions. They also had the highest proportion of physicians working in rural areas. Another interesting deviation from the total were those who remained in their post-M.D. region after moving from another region where they completed their MD. These individuals tended to be more likely to be found in large urban and small city areas.

Concluding Remarks

This working paper has examined the mobility of physicians during their education and five-years into practice utilizing the CAPER database. The majority of physicians remain consistent staying within a single region at all three points in time. This pattern is strongest in the Québec and Ontario regions. A deeper dive revealed some minor differences in broad specialty of training, gender, area of practice, and age at exit from postgraduate training. Granted many of these differences were quite small. Future research in the field of physician mobility should aim to collect more complete data on the demographics of individuals and other factors such as grades to examine if variation in mobility can be explained by other factors.