Effects of extending residencies on the supply of family medicine practitioners; difference-in-differences evidence from the implementation of mandatory family medicine residencies in Canada.

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Abstract

Background: There is currently interest in extending medical residency training in several countries including the United States and Canada. There is little evidence on what impacts extending medical residency has on supply of independent practitioners.

Methods: I leverage the province-by-province roll-out of mandatory family medicine residencies in Canada from 1976 to 1994. This mandated that practitioners had to complete a two year residency instead of a one year internship. I use annual Canadian Institute of Health Information data on supply of physicians by specialty and province. I employ a difference-in-differences estimation strategy comparing specialities impacted by the legislation to those that had no change in their residency length (first difference). I compare before and after legislation by province (second difference).

Results: I find reductions in the supply of family medicine practitioners in the range of 3-5% of overall supply after implementation of a longer residency. This reduction is statistically significant lasting five years after mandate and point estimates of supply do not return to baseline until eight years after mandates. I find increases in the number of graduates of other programs that might plausibly substitute for family medicine suggestive that the policy drove medical students towards other residencies.

Conclusion: Extending residency length has the potential to cause declines in physician supply over the short to medium run. There are both direct effects on physician supply through delays in cohorts as well as indirect effects through substitution away from family medicine residencies.

1 Introduction

There is renewed policy interest in extending the length of primary care medical residencies by an additional year to increase the quality of candidates graduating into independent medical practice. In Canada, policy makers want to extend family medicine residencies to three years which would make these programs comparable to the length of family medicine residencies in other countries (Fowler et al., 2022). Debate on the length of American family medicine residencies suggests that these programs be extended by an additional year to a total of four years of training (Carek, 2013; Douglass, 2021; Woolever, 2021).

The goal of this is to improve quality of graduates. However, little attention has been paid to the effects that residency extensions might have on number of graduating physicians. If physicians need to spend an additional year in residency this could impact the supply of family physicians. Extending the length of family medicine may also have other perverse effects like driving individuals out of family medicine into other programs. Given the current concerns with primary care access this is of policy importance (noa, 2020; Dall et al., 2019). What impact would increasing the length of residency have on the supply of family physicians?

I am unaware of any evidence on what residency extensions might do to the supply of physicians (Fowler and Nasmith, 2022). Most of the current debate revolves around how residents and directors view impacts to their well-being (Duane et al., 2002; Smits et al., 2006; Gopal et al., 2007; Sabey and Hardy, 2015) or opinion on how such changes might impact quality (Raîche, 2009; Carek, 2013; Douglass, 2021; Woolever, 2021; Glauser, 2022). The best evidence suggests that they do not positively or negatively impact resident knowledge or quality. (Hopson et al., 2016; Waller et al., 2017; Eiff et al., 2019).

However, over the period of 20 years, Canadian provincial governments mandated two year family medicine residencies in lieu of one year internships where physicians graduated as a general practitioner (GP). I examine the impact of effectively lengthening primary care residencies using a difference in differences identification strategy. I compare the supply of total family medicine practitioners (ie. GPs and family medicine specialists) relative to graduates of other specialty programs, like internal medicine, who did not have changes made to their residency lengths (first difference). I use the province-by-province roll out to assess pre-post differences across these groups (second difference). I examine effects on substitute programs to see if there were changes in choice of residency.

I find a 5-10% overall decline in overall numbers of family medicine practitioners after family medicine residencies become mandatory. This is a function of the mechanical effects of the policy extending training by one year as well as medical students changing residency preference to those outside of primary care. This change occurs over 5-10

years suggesting that residency extensions may exacerbate supply issues over this period absent other policy interventions.

2 Methods

2.1 Policy Context

Canadian medical students apply to residency programs through a centralized matching service which allows them to rank their location and specialty preferences (Lim and Khondker, 2020). Prior to 1994, physicians interested in pursuing a primary care practice had two routes to become independent practitioners. The first was matching to a rotating general internship of one year and then entering into practice. Alternately, a physician could match to a family medicine residency lasting two years. Both routes allowed physicians to practice independently with the former route creating a general practitioner and the latter route creating a family medicine specialist (FMD).

However, both governments and the college of family physicians considered a one year period of training after medical school inadequate. Alberta was the first to implement mandatory two year training in 1976. After this, various provinces implemented similar policies (Table 1) such that by 1994, the rotating internship had ended country-wide (Levitt and Klein, 1991; Banner, 1995; Chan, 2002). As this delays a GPs graduation into independent practice by a year these interventions are coded as occurring the year after implementation.

2.2 Data

Information on the supply of physicians in Canada is collected by the Canadian Institute of Health Information. This data is recorded annually at a provincial level and extends back to 1968. I exclude data prior to 1970 due to documentation changes and data after 2003 because of large increases in residency positions especially for family medicine practitioners. (Turriff et al., 2020). This leaves a sample of 1020 specialty-province observations.

I am interested in the number of physicians that practice family medicine after the implementation of the policy. I am able to distinguish between physicians that are general practitioners who have completed the rotating general internship and family medicine specialists who completed a family medicine residency. I consider the sum of these two categories as the total number of family practitioners.

2.3 Econometric Strategy

I use the improved doubly robust difference-in-differences (DiD) estimator to assess effects of implementation (Callaway and Sant'Anna, 2021). I compare the specialties affected by the change in policy, specifically general practitioners and family medicine specialists, to all other physician specialties where training length did not change (first difference). I make this comparison pre-post based on the province and the year legislation was implemented making family medicine residencies mandatory (second differences). This is specified as:

$$y_{ijt} = \beta_1(D_{ijt} * Post_{ijt}) + G_{ij} + T_t + \epsilon_{ij} \tag{1}$$

where y is the per-capita supply of physicians by specialty i in province j in year t. D is equal to one for specialties that are treated which are total family practitioners, family medicine specialists and general practitioners. $Post$ is equal to one for specialties in provinces after implementation of mandatory family medicine residency legislation. I am interested in the effects of the interacted term which is β_1; this is the overall difference-in-differences effect on physician supply. G is a fixed effect for the province-specialty group. T is a fixed effect for the year. ϵ is an error term clustered at the specialty-province level.

The assumptions of the DiD model are that no other interventions occur simultaneously and that in the absence of an effect, outcomes would have trended similarly. The latter can be tested by examining parallel trends in event analyses. To complement the main DiD results I show event analyses for 10 years before and after implementation of mandate. Event regressions are specified as:

$$y_{ijt} = \alpha \sum_{-10}^{10} (D_{ijt} * Post_{ijt}) + G_{ij} + T_t + \epsilon_{ij} \tag{2}$$

I am interested in α which estimates effects for each individual dummy variable. These take a value of one for specialty group-provinces in years when there was implementation of mandatory family physician training and zero otherwise. All estimates are relative to the year immediately prior to implementation (ie. $t = -1$) and are plotted with 95% confidence intervals. DiDs are implemented by the Rios-Avila et al. estimation package (Rios-Avila et al., 2022).

2.4 Substituting towards other specialties

Debate has assumed that decreases in physician supply result solely from delayed entry into independence practice. However, this ignores substitution effects. A residency that is made one year longer has an increased opportunity cost relative to other specialty residencies that are not lengthened. Two results might suggest that medical students are substituting towards other programs as a result of the policy. First, if changes in primary care physician volumes occur more than two years after implementation (ie. the

length of that residency), it suggests there may be substitution towards other specialties. Second, specialties that attract similar candidates as family medicine should see increases in their graduating residents.

There is little evidence on the alternate preferences for individuals who are admitted to family medicine programs. However there is guidance from medical student groups which suggest specialties that are similar to family medicine in emphasis on diagnosing and medically treating undifferentiated conditions. These are internal medicine, pediatrics, neurology, and psychiatry (Lim and Khondker, 2020). I repeat the above DiD and event exercise with these as the treatment groups.

3 Results

Figure 1 demonstrates the time-series of selected types of physicians over the period of 1970 to 2020. Around 1994 when rotating internships are phased out in the majority of Canada, the number of GPs begins to decline from 75 per 100,000 population. The number off FMDs increases and in 1994 is approximately 26 per 100,000 population. The overall number of family medicine practitioners in 1994 is approximately 100 per 100,000 population.

Table 1 demonstrates the DiD effects estimated by all family medicine practitioners, FMDs, and GPs. Relative to the ten years prior to implementation, the 10 years after demonstrate an increase in the overall supply of family medicine practitioners but at statistically insignificant levels. This comes through an almost 1 to 1 increase in family medicine specialists that are offset by declines in general practitioners as one would expect from a policy that mandated family medicine specialty training.

Figures 2 demonstrates the estimates from event analyses by type of physician. Pretrends in all graphs are noisy but relatively flat and stable suggesting that the parallel trends assumption holds well. In the period after mandating training there are large declines in the number of GPs and large increases in the number of FMDs. However, there is a transient period, with a trough about five years after policy implementation, when the net effect is negative and statistically significant. That trough demonstrates a reduction in the number of total family practitioners of 5-6 per 100,000 population.

Figure 3 demonstrates the effects of the policy on substitute residencies. Both psychiatry and neurology demonstrate statistically significant increases after implementation of the policy. These effects peak about five years after the policy change which is the usual length of a specialist residency in Canada. Pediatrics has similar increases which are not statistically significant. The only outlier are internal medicine graduates which decline in number.

4 Discussion

I demonstrate the effects of mandating a change in length of residency by leveraging cessation of the rotating internship in Canada. The impact on physician supply is in line with the mandate to increase the number of family medicine specialists and decrease the number of GPs. There are declines in GPs that are nearly perfectly offset by increases in family medicine specialists.

The impact of the mandate as measured by event analyses is initially negative as one would expect by delaying a cohort of physicians. This effect is a reduction in the supply of family medicine practitioners by 5-10% of the overall number of practitioners. This decline is statistically significant and negative for five years after mandates and the point estimates remain negative for 8 years after mandates. Current projections suggest that supply of primary care specialists will need to increase by 7 to 20% by 2034 to keep up with demand. These results suggest that extending family medicine residencies will cause an additional decline in supply of physicians by the lower bound of these estimates. Policy makers should expect access issues for patients for an extended period of time after residency length is extended.

However, these results do not just occur because of a delayed cohort effect which would likely impact physician supply over the first two or three years after implementation. There is also substitution towards other specialties outside of primary care. There is some suggestive evidence that this is occurring in historical CaRMS reports from 1995. Prior to the transition, medical school graduates could expect to match to one of their top 3 programs 80% of the time; in 1993 and 1994, this dropped to 70% and 76% suggesting that there was poorer matching success around the time when the majority of provinces discontinued the rotating internship (Banner, 1995). I find further evidence for this by demonstrating increases in the number of practitioners in fields that might be considered substitutes for family medicine.

These results have several limitations. First, they say nothing about the impact on changes in quality of care. The intention of the switch was to improve the ability of physicians and it is possible that improvements in quality may have made up for any possible effects of reduced access to family physicians. Second, this result says nothing about access; it is possible that primary care practices were able to absorb patients who could not access new family practitioners negating any negative supply effects. Third, from an estimation strategy standpoint it is possible there are contaminated effects especially from treated provinces in the 1990s when investments were made to boost family physician supply. It is possible other interventions coinciding with legislation are driving the DiD results.

These results show that extending the length of a family residency program in Canada led to supply reductions in the number of primary care physicians. Policy makers should

consider patient access as well as the quality implications of proposed extensions to family medicine training that are currently being debated.

5 Tables and Figures

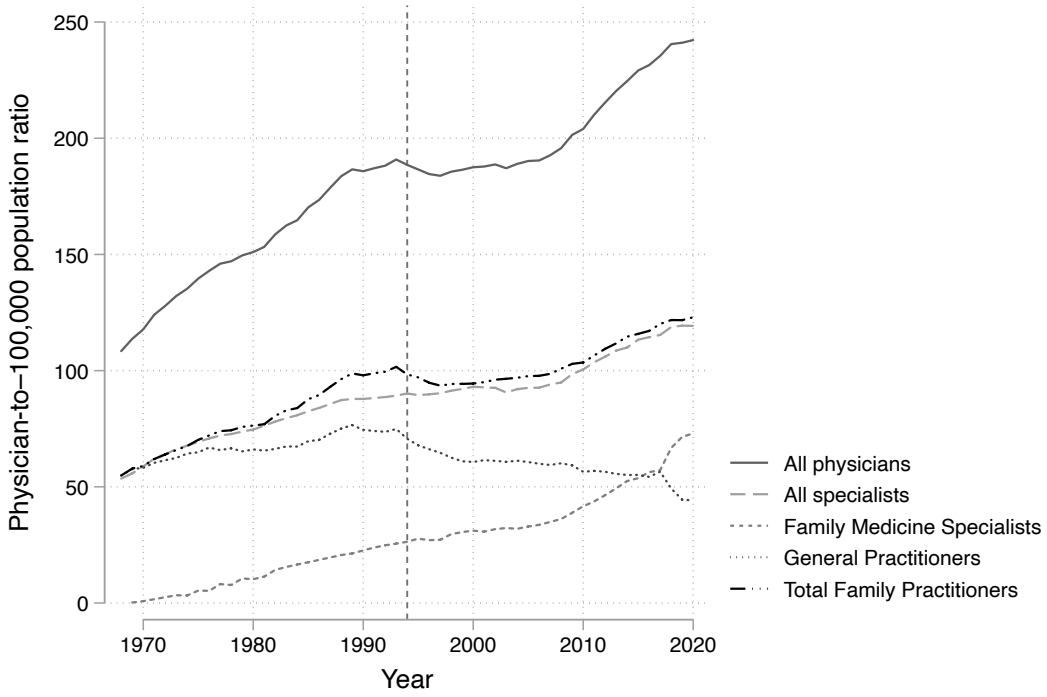

Figure 1: Time series of selected physician categories.

Province	Year of policy	Year of Effect
Alberta	1976	1977
Quebec	1988	1989
Saskatchewan	1989	1990
British Columbia	1993	1994
Ontario	1993	1994
New Brunswick	1993	1994
Prince Edward Island	1993	1994
Nova Scotia	1993	1994
Manitoba	1994	1994
Newfoundland and Labrador	1994	1994

Table 1: Year of policy change by province.

	Family Medicine Practitioners			Family Medicine Specialists			General Practitioners		
	Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural
DiD Estimates	8.637*	8.975*	-0.223	18.76*	15.20*	3.536*	-15.81*	-11.58*	-4.109*
	(2.86)	(3.02)	(-0.30)	(10.18)	(10.26)	(4.85)	(-6.80)	(-5.38)	(-5.21)

t statistics in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$

Table 2: DiD Estimates by type of physician and location.

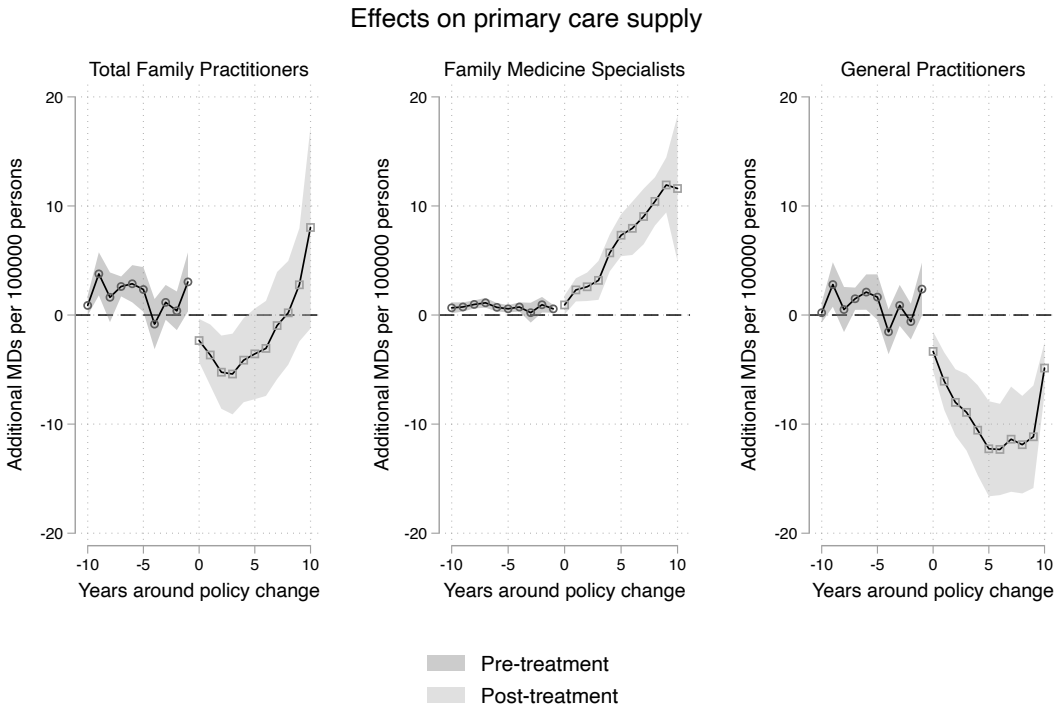

Figure 2: Event analysis for family medicine practitioners. Point estimates are displayed with 95% CI.

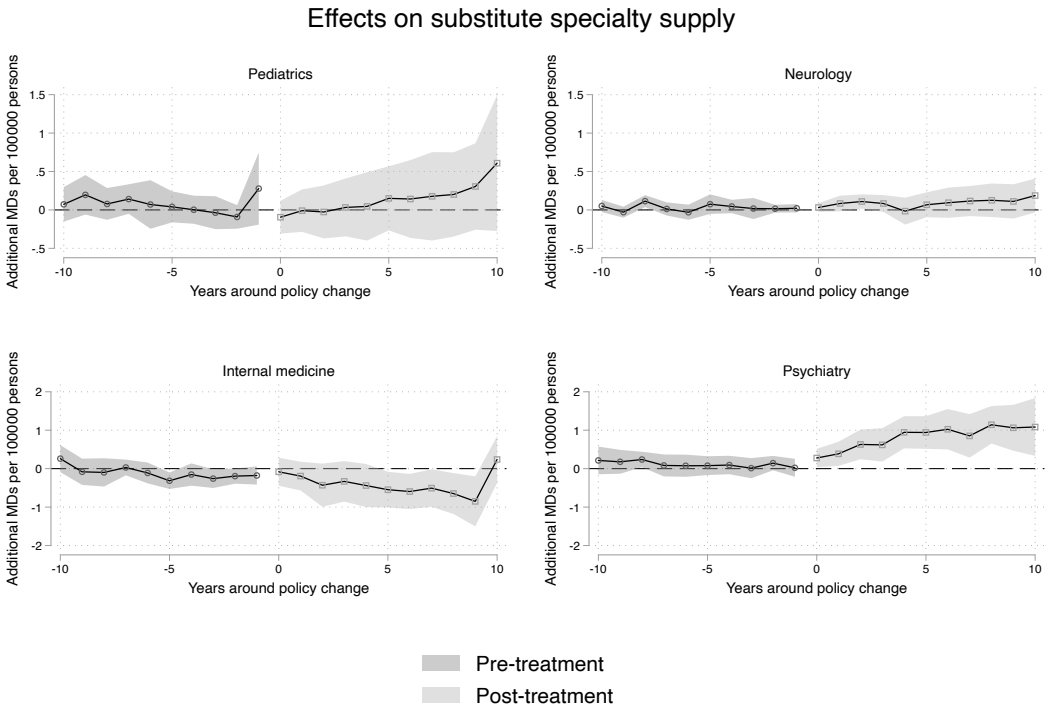

Figure 3: Event analysis for substitute specialties to family medicine. Point estimates are displayed with 95% CI.

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