Does attachment to a family physician reduce emergency department visits? A difference-in-differences analysis of Quebec's centralized waiting lists for unattached patients

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Abstract

Background

Patients without a regular primary care provider – unattached patients – are more likely to visit hospital emergency departments (ED), leading to poor patient and health system outcomes. In many Canadian provinces, policy responses to improve primary care access and reduce ED utilization of unattached patients have included centralized waiting lists to help find a primary care provider and formal attachment (rostering, empanelment, enrollment, registration) to a family physician. While previous work suggests attachment improves access and continuity of primary care (1), it is unknown whether this translates into fewer ED visits. The aim of this study was to determine whether the rate of emergency department visits significantly decreases in patients attached to a family physician through Quebec's centralized waiting lists for unattached patients.

Methods

We used a quasi-experimental difference-in-differences approach, studying patients attached through Quebec's centralized waiting lists in 2012–2014. We used administrative medical services physicians' billing data from the *Régie de l'Assurance Maladie du Québec* (RAMQ). Attachment was determined based on fee codes used to formalize attachment. We compared the change in the rate of emergency department visits over two 12-month periods, for 'exposed' patients who became attached (n = 207,669) and 'control' patients who remained unattached during the study period (n = 90,637). To balance baseline patient characteristics in the exposed and control cohorts, we calculated a propensity score including age, sex, Charlson-co-morbidity index, medical vulnerability, and region remoteness and performed inverse probability of treatment weighting. We used descriptive statistics and estimated negative binomial regression models, fitted with generalized estimating equations.

Results

After weighting, cohorts had similar characteristics (standardized differences < 10%). Attached (exposed) patients' mean annual ED visits decreased from 0.60 to 0.49 (18.3%) following attachment, while unattached (control) patients' increased from 0.54 to 0.69 (27.8%). The difference-in-differences estimate (Time period*exposure) showed a significant 36% relative reduction (IRR = 0.64, p < 0.001) in the rate of ED visits for patients who were attached, compared to patients who remained unattached on the centralized waiting lists during the study period.

Conclusion

Our findings suggest that attachment to a family physician through centralized waiting lists for unattached patients significantly reduces the rate of ED utilization.

INTRODUCTION

Canada has both a large proportion of patients unattached to a regular primary care provider and high rates of emergency department visits compared to other OECD countries (2). Quebec has the highest prevalence of unattached patients in the country – over 20% of the population- commonly identified as a root cause of the dire situation in the province's EDs (2–6). Patients without a regular primary care provider – unattached patients – are more likely to visit hospital emergency departments (ED), particularly for non-urgent conditions (7–20). This leads to suboptimal care, increased system costs, ED overcrowding, and poorer health outcomes (6, 12, 13, 21–27).

Across Canada, it has become a policy priority to connect unattached patients to a regular primary care provider, most often a family physician. The policy response in Ontario, Quebec, Manitoba, Nova Scotia, New Brunswick, British-Columbia, and Prince-Edward-Island (28) has been to streamline the process of finding a primary care provider via centralized waiting lists for unattached patients.

The largest centralized waiting lists are in Quebec: as of July 2022 over 1 million patients were waiting for attachment, and 1.5 million patients had been attached to a family physician through these centralized waiting lists, out of 8.6 million Quebecers (29). Average wait times on Quebec's centralized waiting lists exceed 500 days (30). Many family physicians focus on delivering services to their attached patients, leaving few options for unattached patients other than walk-in clinics or EDs (31). Beyond meeting the policy goal of decreasing the number of unattached patients, the effectiveness of these lists to reduce ED utilization has not been evaluated.

Formal attachment (also known as empanelment, rostering, patient registration, or enrollment) is a traceable administrative agreement that formalizes the patient-provider relationship and officially enrolls the patient as part of the provider's panel. Internationally, formal attachment has become a major policy feature of primary care and universal health coverage reforms including in Denmark, France, Germany, Ireland, Israel, Norway, Canada, Sweden, Switzerland and the United Kingdom (32). In Canada, the provinces of Quebec and Ontario introduced formal attachment in the early 2000s as part of new team-based models of primary care. In Ontario, specific patient enrolment models (e.g., family health networks, family health organizations, family health groups) have adopted formal attachment (33). In Quebec, attachment initially targeted medically vulnerable patients (i.e., elderly patients or patients with at least one medical condition) in Family Medicine Groups (team-based interdisciplinary group practices). Since 2009, Quebec's attachment policy has been extended to the general population across all primary care models (34).

The effects of enrollment have been largely understudied (32). Several studies in Quebec and Ontario examined whether there was a reduction in ED use following patient enrollment in specific team-based primary care models (e.g., family health networks, family health organizations, family health groups, *groupes de médecine de famille*). Generally, these studies report no change or a small decrease in ED utilization (32, 35–40). However, in these studies, the effect of enrollment or attachment on ED utilization is difficult to disentangle from the other features of the models, such as team-based care, after-hours coverage, and changes in physicians' remuneration. In addition, they provide little information on the specific effects of attaching patients previously without a primary care provider.

Quebec's formal attachment policy and centralized waiting lists provide an opportunity to trace changes in ED utilization in a cohort of unattached patients who become attached across all primary care models. This provides a unique opportunity to examine the effects of formal attachment in unattached patients, which can inform other Canadian jurisdictions. The aim of this study is to determine whether the rate of ED visits significantly decreases after unattached patients become attached to a family physician through Quebec's centralized waiting lists, compared to a similar group of patients.

METHODS

Study setting: Centralized waiting lists for unattached patients in Quebec

Centralized waiting lists for unattached patients (*guichets d'accès à la clientèle orpheline*) were implemented across Quebec, Canada in 2008 (41). Unattached patients can register on a centralized waiting list, or someone can complete the registration on their behalf. Based on self-reported medical needs and a telephone evaluation by a nurse, patients are prioritized and assessed for medical vulnerability (at least one of 19 health conditions such as cancer, diabetes, hypertension, mental health problems or being 70 years old and over).

Patients are matched with a family physician accepting new patients based on geographic area, needs-based priority, and registration date on the waiting list. Attachment is confirmed at the first visit with the family physician when the patient signs a written agreement. Billing for this first visit includes a fee code that entitles the family physicians to receive a small one-time premium for attaching a new patient, ranging from CAD $19 to $300, depending on the patient's medical vulnerability.

Conceptual Framework

The study was informed by Aday and Andersen's framework (42, 43), widely used to study healthcare access and utilization. This framework views "realized" access as the actual and observable utilization of services resulting from successful entry into the health system. It identifies three types of individual-level determinants of healthcare utilization: predisposing (e.g., age, sex), enabling (e.g., usual source of care, region) and of need (e.g., chronic disease, comorbidity).

ED utilization requires a slight adaptation of Aday and Andersen's framework: ED visits may be partly due to "unrealized" access, resulting from unsuccessful entry into primary care (7). If attachment, as an enabling determinant, has the intended effect of improving "realized" access to primary care, we expect a concomitant decrease in ED utilization, all else being equal (7).

Study design

We used a quasi-experimental difference-in-differences approach in a population-based cohort of patients attached through Quebec's centralized waiting lists. Difference-in-differences models estimate the causal effect of exposure (i.e., becoming attached) by comparing pre/post changes in the outcome of interest (i.e., rate of ED visits) in an exposed group, relative to a control group (who remained unattached) (44). The assumption is that, in the absence of exposure (attachment), we would observe similar changes in the rate of ED visits from one year (pre) to the next (post) in both groups. Therefore, differences between changes in the exposed group and the control group can be attributed specifically to the exposure. This approach helps reduce the risk of bias due to other health system changes which may affect the outcome of interest (i.e., other policies or interventions affecting ED utilization) and is well-suited to evaluate the causal effect of policies, such as attachment to a family physician through centralized waiting lists.

Data source

We used administrative medical services billing data from the *Régie de l'Assurance Maladie du Québec* (RAMQ), Quebec's provincial health insurance board. This data contains patient-level data for medical services delivered by physicians, including in primary care practices, EDs and hospitals, as well as patient demographic information and diagnoses coded according to the International Classification of Diseases 9 (ICD-9).

Ethics

This study received ethics approval from the *Comité d'éthique de la recherche du CIUSSS de l'Estrie – CHUS* (#MP-31-2015-819,14–091). Permission to access RAMQ data was granted by the *Commission d'accès à l'information* (#100 91 88). We did not obtain consent from patients individually. However, we used anonymized and de-identified administrative medical services billing data. The waiver for informed consent to participate was given by Quebec's *Commission d'accès à l'information* (#100 91 88) and the research ethics board *Comité d'éthique de la recherche du CIUSSS de l'Estrie – CHUS* (#MP-31-2015-819,14–091). All methods were performed in accordance with Canada's *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans as well as* Quebec's laws: *Loi sur l'accès aux documents des organismes publiques et sur la protection des renseignements personnels* and *Loi sur l'assurance maladie.*

Study population and period

The study population consisted of patients with a RAMQ fee code indicating attachment to a family physician through the centralized waiting lists (RAMQ codes: 19951, 19952, 19956) between 2012 and 2014. The exposed cohort included all patients attached in 2012–2013, while the control cohort included all patients unattached during the 2012–2013 study period and only became attached in the subsequent year (2013–2014).

The pre/post periods are illustrated in Fig. 1. T0 represents the date of attachment. For the exposed cohort, the pre-period corresponded to the year before attachment (T0-365 days to T0-1 day) and the post-period the year after attachment (T0 to T0 + 365 days). For the control cohort, the pre-period was T0-730 days to T0-366 days, and the post-period T0-365 days to T0-1 day. This allowed us to create both cohorts' pre- and post-periods with similar date ranges.

We excluded patients with more than one attachment fee code during the study period, given that attachment periods were difficult to establish. We also removed patients under one year old at the time of attachment, as they lack sufficient data in the pre-period.

Variables

The main outcome was the number of ED visits per year. Using methods developed in previous studies (45–47), a visit was defined as one or more ED billing codes within two consecutive days.

The main independent variables were exposure to attachment (exposed/control) and period (pre/ post), based on attachment fee codes.

We included predisposing, enabling and need determinants of ED utilization based on Aday and Andersen's framework (42, 43) and data availability. Predisposing determinants were sex and age. Region remoteness was included as an enabling determinant to account for geographical variations in access (48). Needs determinants were the Charlson Comorbidity Index (49, 50) and medical vulnerability. Attachment billing codes identify medical vulnerability (non-vulnerable: 19952; vulnerable: 19951 and 19956) based on the presence of at least one of 19 conditions (e.g., cancer, diabetes, mental health problem, hypertension, or 70 years old and over) (51).

Data analysis

A fundamental assumption of difference-in-differences analysis is that the control and exposed cohort do not differ in a way that could bias the outcome change. We compare the characteristics of the exposed and control cohorts using standardized differences: less than 10% indicates negligible difference between groups (52, 53). We found standardized differences greater than 10% for age, medical vulnerability, and region remoteness, indicating substantial differences between cohorts.

To reduce potential bias due to these differences, we statistically balanced the observed characteristics in the two cohorts, using a propensity score – a method increasingly used in observational studies (52). We calculated a propensity score using a logistic regression model predicting likelihood of exposure (attachment in 2012–2013 vs. 2013–2014). The best predictive model included age, sex, Charlson-co-morbidity index, medical vulnerability, and region remoteness. We then performed inverse probability of treatment weighting: a propensity score method that is most appropriate when all patients in the sample could plausibly be exposed and that allows analysis on all patients in the sample (52, 54).

We estimated negative binomial regression models with a logit link function appropriate for continuous count variables like the number of ED visits (55). Negative binomial regression models extend the Poisson model to account for over-dispersion of data, allowing for extra variance (56). We used generalized estimating equations (GEEs) to fit the regression, which account for the correlation between repeated measures and provide population-average regression coefficients (55). An unstructured covariance matrix was used. Robust (Huber-White sandwich) estimators were employed, given our non-normal distribution, large sample size and use of inverse probability of treatment weighting (55, 57). We included a "time period*exposure" interaction term to estimate the difference-in-differences. Negative binomial regression models estimate the logs of the expected counts; when exponentiated, these represent incidence rate ratios (IRR). If attachment significantly reduces the number of ED visits per year, we expect an IRR for the Time period*exposure interaction term smaller than 1 and is statistically significant.

To show the impact of inverse probability of treatment weighting, we also estimated a multivariate negative binomial regression model in the unweighted cohort, including potential confounders of age, sex, region remoteness, Charlson co-morbidity index and medical vulnerability (see supplementary file 1).

Given our large sample size, statistical significance was assessed at a p-value < 0.01 to decrease the risk of type 1 error. Analyses were performed in SPSS 26, with R 3.5 extension. With less than 1% missing data for region remoteness, listwise deletion was applied.

RESULTS

Patient characteristics

Table 1 compares patient characteristics in both cohorts before and after weighting. Before weighting, we found substantial differences between the two cohorts with standardized differences exceeding the 10% threshold for age, medical vulnerability, and region remoteness. Exposed patients were younger, a larger proportion were non-vulnerable (59.9% vs. 47.0%), and a larger proportion were from university regions (36.7% vs. 28.9%). The cohorts had similar proportions of males and females.

After the inverse probability of treatment weighting, previously meaningful standardized differences were reduced to under 10%, indicating weighting statistically balanced characteristics between the exposed and control cohorts for all included variables.

Table 1
Characteristics of exposed and control cohorts

	Unweighted					Weighted by the inverse probability of treatment		
Variables	Exposed cohort (n = 207 669)		Control cohort (n = 90 637)		Standardized difference	Exposed cohort (n = 297 691)	Control cohort (n = 297 702)	Standardized difference
Age	N	%	N	%	%	%	%	%
1–5	10 546	5.1	3 846	4.2	3.4	4.5	6.1	-6.0
6–17	20 611	9.9	7 200	7.9	5.6	9.2	9.7	-1.4
18–34	43 614	21.0	14 236	15.7	11.0	19.9	17.8	4.4
35–54	60 369	29.1	24 183	26.7	4.4	28.7	27.3	2.5
55–69	43 968	21.2	22 892	25.3	-8.0	22.1	23.0	-1.8
70+	28 561	13.8	18 280	20.2	-14.3	15.5	16.2	-1.6
Sex								
Male	99 155	47.7	43 462	48.0		47.8	47.8	
Female	108 514	52.3	47 175	52.0	0.5	52.2	52.2	0.0
Medical vulnerability								
Non-vulnerable	123 078	59.3	42 581	47.0		55.5	55.4	
Vulnerable	84 591	40.7	48 056	53.0	-20.3	44.5	44.6	-0.2
Charlson Comorbidity Index								
Low (0)	134 959	65.0	54 495	60.2	8.1	63.4	63.7	-0.5
Medium (1–3)	60 726	29.2	29 043	32.0	-5.0	30.3	29.6	1.3
High (4+)	11 984	5.8	7 099	7.8	-6.6	6.2	6.7	-1.7

	Unweighted					Weighted by the inverse probability of treatment		
Region remoteness								
Remote	27 890	13.4	18 901	20.9	-16.8	15.0	17.0	-4.5
Intermediary	51 032	24.6	22 329	24.6	0.0	25.9	22.3	6.8
Peripheral	52 159	25.1	23 025	25.4	-0.6	24.8	26.2	-2.6
University	76 133	36.7	26 204	28.9	13.5	34.3	34.6	-0.5
Missing	455	0.2	178	0.2				

Number of ED visits per year

As presented in Table 2, during the pre-period, both the unweighted exposed and control cohorts had an average of 0.58 ED visits, indicating similar levels of ED utilization. During the post period, exposed patients' average number of ED visits decreased to 0.47 ED visits: an 18.9% decrease. In contrast, during the same post-period, the control cohort's average increased from 0.58 to 0.75: a 29.3% increase. Once weighted, we observed similar results: the exposed cohort's average decreased from 0.60 to 0.49 (18.3%), while the control cohort's average increased from 0.54 to 0.69 (27.8%).

Table 2
Descriptive statistics for number of emergency department visits per patient per year, during pre- and post-periods, in the unweighted and weighted cohorts

	Unweighted						Weighted by the inverse probability of treatment					
	Exposed cohort (attached) (n = 207 669)			Control cohort (n = 90 637)			Exposed cohort (n = 297 691)			Control cohort (n = 297 702)		
Time period	Mean	s.d.	99% CI	Mean	s.d.	99% CI	Mean	s.d.	99% CI	Mean	s.d.	99% CI
Pre	0.58	1.31	0.57–0.59	0.58	1.30	0.56–0.59	0.60	1.35	0.60–0.61	0.54	1.25	0.53–0.54
Post	0.47	1.16	0.47–0.48	0.75	1.51	0.73-76	0.49	1.19	0.45–0.50	0.69	1.44	0.68–0.69

Initially, during the pre-period, exposed patients had 12% more ED visits than control patients (IRR = 1.12, $p < 0.001$). This is similar to the weighted results shown in Table 2: a mean of 0.60 for the exposed cohort, compared to 0.54 for the control cohort (11.1% difference).

Table 3 shows estimates for the regression model in the weighted cohorts (exposed and control groups balanced for age, sex, medical vulnerability, comorbidity index and region remoteness). The regression model in the unweighted cohorts is provided in the supplementary materials and show similar results, indicating that adjusting for the covariates had little influence on the estimates.

During the post-period, the estimate indicates that the rate of ED visits increased significantly by 27% for control patients who remained unattached (IRR = 1.27, $p < 0.001$), compared to the pre-period. This is similar to the observed increase in the mean number of annual ED visits from 0.54 to 0.69 (27.7% increase) (Table 2).

In contrast, the difference-in-differences estimate (Time period*exposure IRR = 0.64, $p < 0.001$) indicates that exposed patients (attached during the study) had a significant 36% relative reduction in ED visits per year in the post-period, compared to patients in the control cohort. This shows that attachment caused a significant decrease in the number of ED visits per year.

Table 3
Results of the weighted negative binomial regression model (GEE). Effect of attachment to a family physician through Quebec's centralized waiting lists on the number emergency department visits per year

	Weighted with inverse probability of treatment		
	IRR	99% CI	p-value
Time period			
Pre	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Post	1.27	1.25–1.30	< 0.001
Exposure: attachment during study period			
Control	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Exposed	1.12	1.09–1.14	< 0.001
Period*exposure	0.64	0.63–0.66	< 0.001
Constant	0.54	0.53–0.55	< 0.001

DISCUSSION

In Canada, policy responses to improve primary care access and reduce ED utilization have included centralized waiting lists for unattached patients and formal attachment to a primary care provider (58, 59). While previous work suggests attachment improves access and continuity of primary care (1), it was unknown whether this translates into fewer ED visits. Our difference-in-difference analysis shows ED utilization decreased by 36% amongst unattached patients who became attached to a family physician, relative to unattached patients still on the centralized waiting lists during the same period (IRR = 0.64, $p<0.001$). This finding is significant both statistically and from a policy perspective: it confirms that Quebec's policy of formal attachment through centralized waiting lists reduces ED utilization.

Attachment significantly reduced ED utilization among unattached patients from Quebec's centralized waiting lists.

This significant 36% decrease in ED visits is coherent with previous evidence that having a regular primary care provider is associated with lower ED utilization (9, 11, 60–65). For example, a study conducted in Quebec showed

11% fewer annual ED visits for adult patients with a regular family physician than patients without (65). These previous studies generally compare ED utilization between patients with and without a regular primary care provider, two groups with inherently different characteristics and utilization behaviours.

Our study is the first to estimate changes in ED utilization among previously unattached patients who become attached, limiting the risk of bias due to underlying differences. It suggests unattached patients can benefit from attachment to a family physician through less “unrealized” access to primary care. This aligns with our findings from another recent analysis in Quebec that showed improvements in “realized” access to primary care (number of primary care visits) and continuity of care (concentration of care) in the two years following attachment to a family physician via the centralized waiting lists (66). Together, these results support formal attachment to a family physician and centralized waiting lists as effective solutions to improve access to primary care and reduce ED use amongst unattached patients.

In our study, the observed 36% decrease is larger than reported in other studies on formal attachment. In Quebec and Ontario, evaluations of primary care models that introduced formal attachment in the early 2000s generally show small reductions in ED visits (38, 39, 67). For instance, in Ontario, a difference-in-differences analysis found that patient enrolment models led to a 3.5% reduction in the rate of non-urgent ED visits (36). Similarly, another Quebec study in reported that Family Medicine Groups reduce ED visits by 3% (67). In these studies, it is difficult to disentangle the specific effect of attachment from other organizational effects. Our study adds valuable policy insight to this literature by showing the considerable impact of attaching patients without a regular primary care provider (i.e., from centralized waiting lists).

In our study, we roughly estimate that this attachment policy helps avoid about 4.1% of all ED visits in the province per year ((0.11 fewer ED visits X 1,382,388 patients attached through Quebec’s centralized waiting list)/3,694,126 ED visits per year in 2019–2020). Of course, this is an imperfect estimate that assumes patients attached to family physicians maintain lower ED utilization beyond the first post-attachment year, which cannot be inferred from this study. Nonetheless, it illustrates the potential system-level impact of attaching unattached patients via a centralized waiting list.

Policy implication #1

Our finding confirms Quebec’s attachment policy through centralized waiting lists achieved its objective of reducing ED use among previously unattached patients. This provides compelling evidence in favour of attachment as an effective solution to reduce unattached patients’ ED utilization.

Attachment led to a reduction in ED utilization, although patients were relatively healthy

In our study, attached patients were relatively healthy (59% non-vulnerable, 65% low comorbidity), yet we observed a considerable decrease in ED utilization. Patients in our cohorts being relatively healthy fits with previous reports of cherry-picking and challenges prioritizing patients with more complex needs when implementing centralized waiting lists and attachment policies (41, 68–70). Unattached patients with chronic diseases are more likely to use the ED (9). This suggests our estimates are conservative and policies may be even more effective at reducing ED utilization by prioritizing attachment of patients with more health needs.

Improvements require closely monitoring attachment patterns to identify and modify processes conducive to cherry-picking. For instance, in Quebec, regulations introduced in 2013 made it more difficult for family physicians to select patients they wanted to attach (i.e. whom they meet at a walk-in clinic) and “self-refer” them to centralized wait lists to bill for the attachment fee (68). Self-referrals tended to be for younger and healthier patients (68), explaining the observed differences between our exposed and control cohorts. However, these policies should be carefully designed by engaging patients, physicians, nurses, centralized waiting list staff, regional decision-makers, and researchers to improve equitable attachment without stifling physician participation (71).

Policy implication #2

By reducing cherry-picking and prioritizing patients with health conditions, attachment policies may be even more effective at reducing unattached patients’ ED utilization.

Annual ED visits increased among patients who remained unattached

We observed a significant increase in annual ED visits among patients who remained unattached on the centralized waiting lists during the post-period (27.7%, $p<0.001$). This may reflect that there were fewer options for unattached patients to access primary care, as medical appointments were increasingly dedicated to attached patients. An alternative explanation is that patients experienced a health shock in the post-period, increasing their use of the ED, which then accelerated their attachment in the subsequent year. However, given that nearly half of the control cohort was considered healthy (non-vulnerable), we believe this explanation to be less plausible.

This finding suggests a potential unintended consequence of formal attachment policies: creating additional barriers to accessing primary care for unattached patients. Policy measures to mitigate these risks may include creating transition clinics, negotiating quotas of appointments for unattached patients in primary care clinics, increasing scope of practice for more accessible primary care providers such as nurses and community pharmacists, and offering navigation for centralized waiting lists patients to help them access primary care while they await attachment (as are currently being implemented in Quebec with the *guichets d’accès à la première ligne*) (72).

Policy implication #3

Attachment policies should be accompanied by interventions to provide temporary primary care alternatives to the ED for patients awaiting attachment.

Strengths and limitations

We used a robust difference-in-differences approach, which allows us to interpret the results causally. While having a single pre- and post-time period is a limitation of this study, our pre/post design makes a novel contribution to the literature, as most previous research used cross-sectional designs to compare ED utilization between attached and unattached patients.

The physician billing data provides a large cohort of all patients attached through centralized waiting lists across the province, strengthening the external validity of our study. However, the context of Quebec – a high proportion of unattached patients, centralized waiting lists that attach relatively healthy patients, and few primary care alternatives to the ED for unattached patients – should be carefully considered when generalizing these findings to other contexts. For instance, in jurisdictions with more options for unattached patients to access primary care, attachment may have a more modest impact on ED use.

The database also contains data on most medical services delivered by physicians in Quebec, conferring good internal validity to our ED utilization, time, and attachment measures. However, our measure of ED visits includes non-urgent visits and urgent visits and visits leading to hospitalizations that may be less sensitive to shifts in primary care access. Therefore, our estimates should be considered conservative.

Despite initial differences in age, medical vulnerability, and region remoteness between exposed and control cohorts, both had similar average annual ED visits in the pre-period. In a pre/post design like ours, this should provide some reassurance as to the initial "equivalence" of the cohorts (73). We also employed a propensity score method to balance cohort characteristics, reducing all standardized differences under the 10% threshold. However, variables were limited by their availability in the billing data. We did not include potentially relevant individual determinants such as immigrant status, ethnicity, or socioeconomic status. Therefore, it is possible that there is unmeasured and residual confounding in our study. However, using a control group reduced the risk of confounding due to both observed and unobserved variables.

CONCLUSION

Our study suggests that attachment to a family physician through centralized waiting lists for unattached patients significantly reduced the rate of ED utilization in Quebec, Canada. This provides evidence that attachment policies, which are now present in a growing number of health systems, can considerably reduce ED visits by shifting care to the most appropriate level: a primary care provider who assumes principal responsibility for a patient. Future research should also look at the impacts of attaching patients collectively to a primary care team instead of an individual family physician.

Abbreviations

CI	Confidence interval
ED	Emergency department
GEE	Generalized estimating equations
IRR	Incidence rate ratio
RAMQ	Régie de l'assurance maladie du Québec
Ref.	Reference
S.d.	Standard deviation

Declarations

Ethics approval and consent to participate

This study received ethics approval from the *Comité d'éthique de la recherche du CIUSSS de l'Estrie – CHUS* (#MP-31-2015-819,14-091). Permission to access RAMQ data was granted by the *Commission d'accès à l'information* (#100 91 88). We did not obtain consent from patients individually. However, we used anonymized and de-identified administrative medical services billing data. The waiver for informed consent to participate was given by Quebec's *Commission d'accès à l'information* (#100 91 88) and the research ethics board *Comité d'éthique de la recherche du CIUSSS de l'Estrie – CHUS* (#MP-31-2015-819,14-091). All methods were performed in accordance with Canada's *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans as well as* Quebec's laws: *Loi sur l'accès aux documents des organismes publiques et sur la protection des renseignements personnels* and *Loi sur l'assurance maladie.*

Consent for publication

Not applicable.

Availability of data and materials

The dataset analyzed during the current study is not publicly available, as per the agreement with the *Commission d'accès à l'information*, which regulates access to administrative billing data in the province of Quebec. The corresponding author, Mylaine Breton, should be contacted for data enquiries.

Competing interests

The authors declare that they have no completing interests.

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Authors' contribution

MAS, MB and JH conceptualized and designed the study. MB led the process of acquiring the data. MAS conducted the data analyses and led the interpretation. JH provided guidance for the analysis, reported and interpretation. MAS drafted the manuscript and JH, and MB critically revised it. All authors approved the final version of the manuscript.

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References

1. Smithman MA, Haggerty J, Gaboury I, Breton M. Improved access to and continuity of primary care after attachment to a family physician: longitudinal cohort study on centralized waiting lists for unattached patients in Quebec, Canada. BMC Primary Care. 2022;23(1):1-17.

2. Institut canadien d’information sur la santé. Résultats du Canada : Enquête internationale de 2020 du Fonds du Commonwealth sur les politiques de santé réalisée auprès de la population générale de 11 pays — tableaux de données. Ottawa, ON: ICIS; 2021.
3. Commissaire à la santé et au bien être. Apprendre des meilleurs : étude comparative des urgences du Québec. Gouvernement du Québec; 2016.
4. Commissaire à la santé et au bien-être. Les urgences au Québec : Évolution de 2003-2004 à 2012-2013. Québec; 2014.
5. Roberge D, Larouche D, Pineault R, Levesque J, Hamel M, Simard B. Hospital emergency departments: substitutes for primary care? : Direction de santé publique de Montréal; 2007.
6. Roberge D, Pineault R, Larouche D, Poirier LR. The continuing saga of emergency room overcrowding: are we aiming at the right target? Healthc Policy. 2010;5(3):27-39.
7. McCusker J, Karp I, Cardin S, Durand P, Morin J. Determinants of emergency department visits by older adults: a systematic review. Academic Emergency Medicine. 2003;10(12):1362-70.
8. McCusker J, Tousignant P, Borges Da Silva R, Ciampi A, Levesque JF, Vadeboncoeur A, et al. Factors predicting patient use of the emergency department: a retrospective cohort study. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2012;184(6):21.
9. Glazier RH. The Impact of not Having a Primary Care Physician Among People with Chronic Conditions. Toronto: Institute for Clinical Evaluative Sciences; 2008.
10. Haggerty J, Pineault R, Beaulieu MD, Brunelle Y, Goulet F, Rodrigue J, et al. Accessibility and continuity of primary care in Québec. Ottawa: Canadian Health services research Foundation; 2004. Contract No.: Report.
11. Sung N-J, Choi Y-J, Lee J-H. Primary Care Comprehensiveness Can Reduce Emergency Department Visits and Hospitalization in People with Hypertension in South Korea. International journal of environmental research and public health. 2018;15(2):272.
12. Ionescu-Ittu R, McCusker J, Ciampi A, Vadeboncoeur A-M, Roberge D, Larouche D, et al. Continuity of primary care and emergency department utilization among elderly people. Canadian Medical Association Journal. 2007;177(11):1362-8.
13. McCusker J, Roberge D, Levesque JF, Ciampi A, Vadeboncoeur A, Larouche D, et al. Emergency department visits and primary care among adults with chronic conditions. Med Care. 2010;48(11):972-80.
14. Fung CS, Wong CK, Fong DY, Lee A, Lam CL. Having a family doctor was associated with lower utilization of hospital-based health services. BMC Health Services Research. 2015;15(1):42.
15. Lam C, Leung G, Mercer S, Fong D, Lee A, Lam T, et al., editors. Utilisation pattern of primary health care services in Hong Kong: does having a family doctor make any difference? Health Research Symposium; 2011: Food and Health Bureau.
16. Moineddin R, Meaney C, Agha M, Zagorski B, Glazier RH. Modeling factors influencing the demand for emergency department services in Ontario: a comparison of methods. BMC Emergency Medicine. 2011;11(1):13.
17. Rosenblatt RA, Wright GE, Baldwin L-M, Chan L, Clitherow P, Chen FM, et al. The effect of the doctor-patient relationship on emergency department use among the elderly. American Journal of Public Health. 2000;90(1):97.
18. Schoen C, Osborn R, Huynh PT, Doty M. Primary care and health system performance: adults' experiences in five countries. Health Affairs. 2004;23:W4.

19. Lambrew JM, Defriese GH, Carey TS, Ricketts TC, Biddle AK. The effects of having a regular doctor on access to primary care. Medical care. 1996;34(2):138-51.
20. Sox CM, Swartz K, Burstin HR, Brennan TA. Insurance or a regular physician: which is the most powerful predictor of health care? American Journal of Public Health. 1998;88(3):364-70.
21. Roberge D, Larouche D, Pineault R, Levesque JF, Hamel M, Simard B. L'urgence hospitalière : un substitut à la première ligne - Résultats d'une enquête auprès de la population de Montréal et de la Montérégie. Montreal: Direction de santé publique de Montréal; 2007.
22. Stiell A, Forster AJ, Stiell IG, van Walraven C. Prevalence of information gaps in the emergency department and the effect on patient outcomes. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2003;169(10):1023-8.
23. Carret MLV, Fassa ACG, Domingues MR. Inappropriate use of emergency services: a systematic review of prevalence and associated factors. Cadernos de Saúde Pública. 2009;25(1):7-28.
24. Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Deciding to Visit the Emergency Department for Non-Urgent Conditions: A Systematic Review of the Literature. The American journal of managed care. 2013;19(1):47-59.
25. Mehrotra A, Liu H, Adams JL, Wang MC, Lave JR, Thygeson NM, et al. Comparing costs and quality of care at retail clinics with that of other medical settings for 3 common illnesses. Annals of internal medicine. 2009;151(5):321-8.
26. Hollander MJ, Kadlec H. Financial implications of the continuity of primary care. The Permanente Journal. 2015;19(1):4.
27. Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. Health affairs (Project Hope). 2010;29(9):1630-6.
28. Breton M, Wong ST, Smithman MA, Kreindler S, Jbilou J, Marshall EG, et al. Centralized Waiting Lists for Unattached Patients in Primary Care: Learning from an Intervention Implemented in Seven Canadian Provinces. Healthcare Policy. 2018;13(4):65-82.
29. Régie de l'assurance maladie du Québec. Évolution du nombre de personnes inscrites auGuichet d'accès à un médecin de famille (GAMF) selon leur statut en 2021. 2021.
30. Ministère de la Santé et des Services sociaux. Rapport annuel de gestion 2020-2021. Québec: Gouvernement du Québec; 2021.
31. Breton M, Pineault R, Levesque J-F, Roberge D, Da Silva RB, Prud'homme A. Reforming healthcare systems on a locally integrated basis: is there a potential for increasing collaborations in primary healthcare? BMC health services research. 2013;13(1):262.
32. Marchildon GP, Brammli-Greenberg S, Dayan M, De Belvis AG, Gandré C, Isaksson D, et al. Achieving higher performing primary care through patient registration: A review of twelve high-income countries. Health Policy. 2021.
33. Tiagi R. Access to and utilization of health care services among Canada's immigrants. International Journal of Migration, Health and Social Care. 2016;12(2):146-56.
34. Roy A, Breton M, Loslier J. Providing continuity of care to a specific population: Attracting new family physicians. Canadian Family Physician. 2016;62(5):e256-e62.
35. Singh J, Dahrouge S, Green M. The impact of the adoption of a patient rostering model on primary care access and continuity of care in urban family practices in Ontario, Canada. BMC Family Practice. 2019;20(52).

36. Tiagi R, Chechulin Y. The effect of rostering with a patient enrolment model on emergency department utilization. Healthcare Policy. 2014;9(4):105-21.
37. Glazier RH, Klein-Geltink J, Kopp A, Sibley LM. Capitation and enhanced fee-for-service models for primary care reform: a population-based evaluation. Canadian Medical Association Journal. 2009;180(11):E72-E81.
38. Carter R, Lévesque JF, Harper S, Quesnel-Vallée A. Measuring the effect of Family Medicine Group enrolment on avoidable visits to emergency departments by patients with diabetes in Quebec, Canada. Journal of Evaluation in Clinical Practice. 2017;23(2):369-76.
39. Héroux J, Moodie EE, Strumpf E, Coyle N, Tousignant P, Diop M. Marginal structural models for skewed outcomes: identifying causal relationships in health care utilization. Statistics in Medicine. 2014;33(7):1205-21.
40. McAlister FA, Bakal JA, Green L, Bahler B, Lewanczuk R. The effect of provider affiliation with a primary care network on emergency department visits and hospital admissions. Canadian Medical Association Journal. 2018;190(10):E276-E84.
41. Breton M, Wong ST, Smithman MA, Kreindler S, Jbilou J, Sutherland J, et al. Centralized waiting lists for unattached patients in primary care: learning from an intervention implemented in seven Canadian provinces. Healthcare policy. 2018;13(4):65.
42. Aday LA, Andersen R. A framework for the study of access to medical care. Health Services Research. 1974;9(3):208.
43. Aday LA, Andersen RM. Equity of access to medical care: a conceptual and empirical overview. Medical care. 1981;19(12 Suppl):4-27.
44. Strumpf EC, Harper S, Kaufman JS. Fixed effects and difference in differences. Methods in social epidemiology. 2017:341-68.
45. Belzile E, Sanche S, McCusker J, Vadeboncoeur A, Ciampi A, Levesque J. A measure of emergency department use based on quebec's administrative data. Montreal: St-Mary's Research Center; 2011.
46. McCusker J, Roberge D, Levesque JF, Ciampi A, Vadeboncoeur A, Larouche D, et al. Emergency department visits and primary care among adults with chronic conditions. Medical Care. 2010;48(11):972-80.
47. Dendukuri N, McCusker J, Bellavance F, Cardin S, Verdon J, Karp I, et al. Comparing the validity of different sources of information on emergency department visits: a latent class analysis. Medical Care. 2005:266-75.
48. Clavet M, Pelletier G, Saucier A, Martin P. Regards sur le système de santé et des services sociaux du Québec. Quebec: Ministère de la santé et des services sociaux; 2009.
49. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. Journal of clinical epidemiology. 1994;47(11):1245-51.
50. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. Journal of chronic diseases. 1987;40(5):373-83.
51. Régie de l'assurance maladie du Québec. Lettre d'entente no 245 – Nouvelle version remplaçant celle en vigueur depuis le 1er novembre 2011 Québec: RAMQ; 2013.
52. Austin PC. An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. Multivariate Behav Res. 2011;46(3):399-424.
53. Austin PC. Using the standardized difference to compare the prevalence of a binary variable between two groups in observational research. Communications in statistics-simulation and computation. 2009;38(6):1228-34.

54. Allan V, Ramagopalan SV, Mardekian J, Jenkins A, Li X, Pan X, et al. Propensity score matching and inverse probability of treatment weighting to address confounding by indication in comparative effectiveness research of oral anticoagulants. Journal of Comparative Effectiveness Research. 2020;9(9):603-14.
55. Heck RH, Thomas S, Tabata L. Multilevel modeling of categorical outcomes using IBM SPSS: Routledge; 2013.
56. Hox JJ, Moerbeek M, Van de Schoot R. Multilevel analysis: Techniques and applications: Routledge; 2017.
57. Horton NJ, Lipsitz SR. Review of software to fit generalized estimating equation regression models. The American Statistician. 1999;53(2):160-9.
58. Ministère de la santé et des services sociaux. Plan stratégique du Ministère de la santé et des services sociaux 2015-2020. 2017.
59. Ministère de la santé et des services sociaux. Plan stratégique 2019-2023 du Ministère de la santé et des services sociaux. Gouvernement du Québec; 2019.
60. Palmer E, Leblanc-Duchin D, Murray J, Atkinson P. Emergency department use: Is frequent use associated with a lack of primary care provider? Canadian Family Physician. 2014;60(4):e223-e9.
61. Reid GJ, Freeman TR, Thind A, Stewart M, Brown JB, Vingilis ER. Access to family physicians in southwestern Ontario. Healthcare Policy. 2009;5(2):e187.
62. Sanmartin C, Ross N. Experiencing difficulties accessing first-contact health services in Canada. Healthcare Policy. 2006;1(2):103-19.
63. Talbot Y, Fuller-Thomson E, Tudiver F, Habib Y, McIsaac WJ. Canadians without regular medical doctors. Who are they? Canadian Family Physician. 2001;47(1):58-64.
64. Hay C, Pacey M, Bains N, Ardal S. Understanding the unattached population in Ontario: evidence from the Primary Care Access Survey (PCAS). Healthcare Policy. 2010;6(2):33.
65. McCusker J, Tousignant P, Borgès DS, Ciampi A, Lévesque J-F, Vadeboncoeur A, et al. Factors predicting patient use of the emergency department: a retrospective cohort study. Canadian Medical Association Journal. 2012;184(6):E307-E16.
66. Smithman MA, Haggerty J, Gaboury I, Breton M. Improved access to and continuity of primary care after attachment to a family physician: longitudinal cohort study on centralized waiting lists for unattached patients in Quebec, Canada. BMC Primary Care. 2022;23(1):238.
67. Strumpf E, Ammi M, Diop M, Fiset-Laniel J, Tousignant P. The impact of team-based primary care on health care services utilization and costs: Quebec's family medicine groups. Journal of Health Economics. 2017;55:76-94.
68. Breton M, Brousselle A, Boivin A, Roberge D, Pineault R, Berbiche D. Who gets a family physician through centralized waiting lists? BMC Family Practice. 2015;16(1):1-11.
69. Lavergne MR, King C, Peterson S, Simon L, Hudon C, Loignon C, et al. Patient characteristics associated with enrolment under voluntary programs implemented within fee-for-service systems in British Columbia and Quebec: a cross-sectional study. Canadian Medical Association Open Access Journal. 2022;10(1):E64-E73.
70. Smithman MA, Brousselle A, Touati N, Boivin A, Nour K, Dubois C-A, et al. Area deprivation and attachment to a general practitioner through centralized waiting lists: a cross-sectional study in Quebec, Canada. International Journal for Equity in Health. 2018;17(1):1-16.
71. Breton M, Smithman MA, Kreindler SA, Jbilou J, Wong ST, Marshall EG, et al. Designing centralized waiting lists for attachment to a primary care provider: considerations from a logic analysis. Evaluation and Program Planning. 2021;89:101962.

72. Breton M, Lamoureux-Lamarche C, Deslauriers V, Laberge M, Arsenault J, Gaboury I, et al. Evaluation of the implementation of single points of access for unattached patients in primary care and their effects: a study protocol. BMJ open. 2023;13(3):e070956.
73. Strumpf E, Harper S, Kaufman JS. Fixed effects and difference in differences. Methods in social epidemiology. 2017:341-68.

Figures

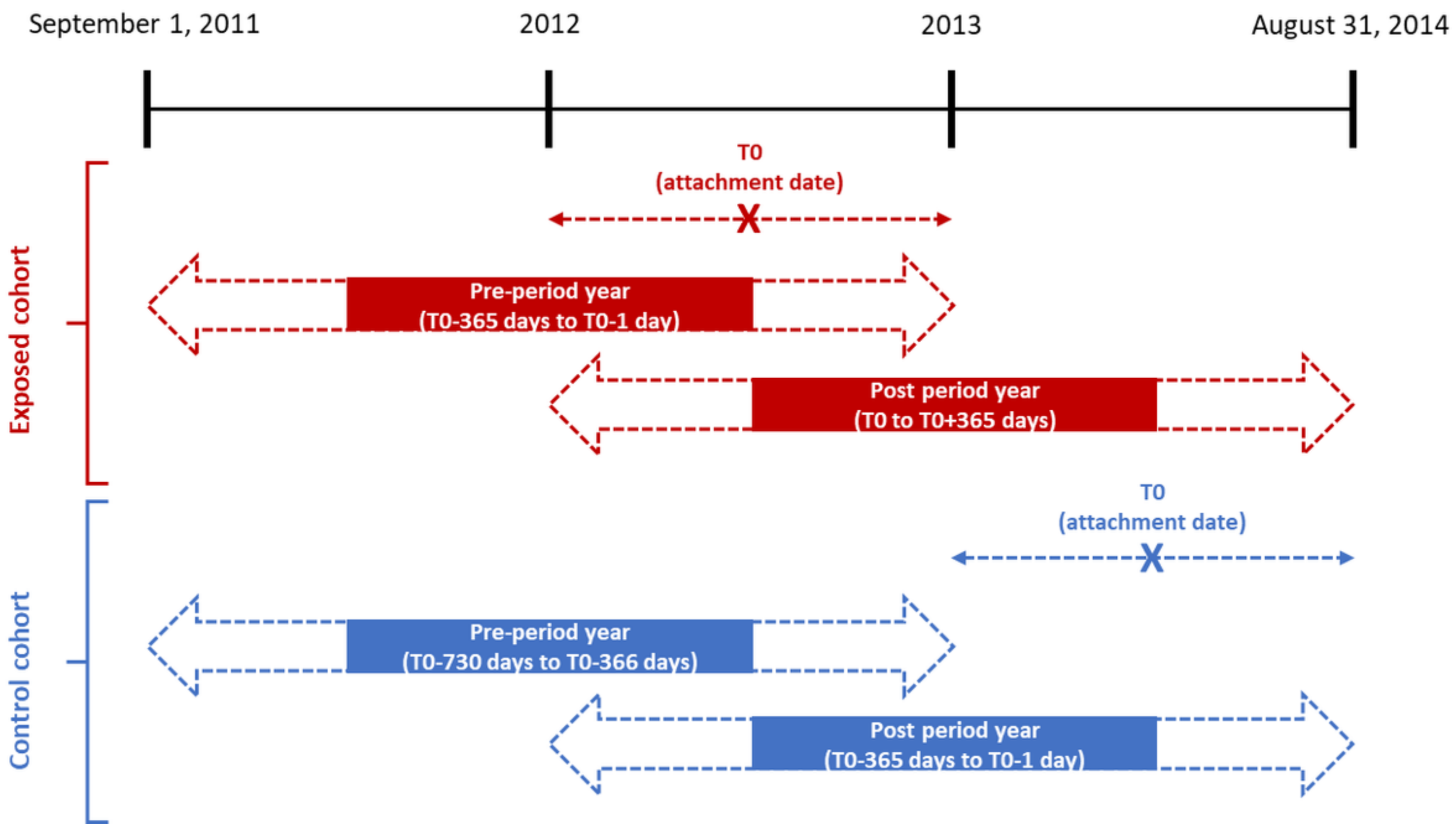

Figure 1

Pre and post periods for the exposed and the control cohorts, with periods determined relative to attachment date (T0).

Supplementary Files

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