



Has the diffusion of primary care teams in France improved attraction and retention of general practitioners in rural areas?



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ABSTRACT

Many countries, including France, are facing the old and persistent problem of geographical inequalities of their health human resources, in particular general practitioners (GPs). This situation leads, among other things, to underserved areas, which could result in a lower level of primary health care accessibility. Since the mid-2000s in France, several policies were implemented to provide financial as well as other incentives to support the development of multi-professional group practices, Primary Care Teams (PCTs), in order to attract and retain GPs in underserved areas. This study aims to measure the impact of PCTs settlement on the evolution of GP density in rural areas. To this end, we compare the evolution of GP density between rural areas with PCTs and similar rural areas without PCTs, before (2004–2008) and after (2008–2012) the development of PCTs facilities. The results show that PCTs are mainly located in underserved areas and suggest that they could attract and retain GPs there. Those results should be of interest to countries facing relatively similar geographical inequalities issues and that are also experimenting with multi-professional group practices.

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1. Introduction

Accessibility of care, through its geographical, financial, and social dimensions is a major concern for health care efficiency [1]. Primary care contributes to this accessibility and is considered as the most important level of care to maintain population health [2]. The primary care concept covers several dimensions related to accessibility, continuity, comprehensiveness, coordination, and orientation, and is ensured by different health care professionals such as general practitioners (GPs), nurses, pharmacists, physiotherapists, and dentists [3].

Ensuring the supply and delivery of primary care services in underserved areas is the corner stone for improving equity in access to health care. Facing a global geographical inequalities in health human resource (HHR) distribution, particularly for GPs, many countries have implemented policies and programs to tackle this issue [1,4–8]. The programs target the main factors determining the attraction and retention of HHRs in underserved areas and are built on four main drivers: initial medical education, market entry or licensure regulation, financial incentives, and health care deliv-

ery organizational innovation and professional support to improve both working conditions and work-life balance [6].

At the same time, health policies focus on primary care reinforcement to increase health care performance while reducing costs [8,9]. Among these policies, we observe a trend that promotes group practice in primary care, notably towards new advanced models such as primary care teams (PCTs) where GPs are working with other HHRs such as midwives, dentists, paramedics, nurses, or administrative staff. Structure and organization of these PCTs vary a lot across countries and respond to different kind of challenges [10–13]. In France, multi-professional group practices (*Maisons de santé pluriprofessionnelles*, MSP) belong to this advanced model, and we will refer to these as PCTs [14]. French public authorities, who financially support PCTs, expect that they will attract and retain GPs in underserved areas, knowing that nine out of ten young GPs want to settle in a group practice and 45% in a PCT [15].

Many articles question the respective effectiveness of programs aimed at improving the geographical distribution of HHRs [5,6,16–18], but none has specifically examined the potential effect of PCTs on this point due to their attractiveness as a choice for practicing.

This work aims to describe PCT's location in French rural areas and to measure their impact on attraction and retention of GPs in primary health care underserved areas. We assume that practicing within a PCT is able to attract and retain GPs in such areas, by

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improving both working conditions and work-life balance through various mechanisms observed in other qualitative studies [19–21]: reduction of professional isolation, increased opportunity for locum doctors', employment arrangements, and better management of heavy workload. This contribution fills the gap in the literature on the effect of group practice and teamwork on the reduction of geographical inequalities in the distribution of GPs. This work complements previous and exploratory work designed for a franco-phone audience [22]. In this instance, the study timeframe is larger and provides new results.

2. Background

2.1. Geographical distribution inequalities of primary care physicians and related policies

The unequal HHRs geographical distribution is a global problem [23] which implies localized deficits of HHRs in both rural and deprived urban areas [6,24]. To address this issue, several measures have been implemented in different countries to improve the spatial distribution of HHRs [1,4,5,7] by targeting the determinants of attraction and retention of HHRs. Although both factors call for specific action, few studies distinguish the determinants of attraction from those of retention [25]. It seems that HHRs are first sensitive to family life conditions (e.g. education, working spouse and leisure) and second to professional practices, working conditions (e.g. moderate workload, equipment, team and staff) and expected income. The ability, for a given practitioner, to adapt to a particular geographical context such as remote rural areas appears to be another intrinsic factor.

Taking these into account, decision-makers have several options to improve HHRs geographical distribution that intervene at different stages in the career path.

First options target the training of HHRs through different measures such as increasing the number of students trained, developing training in rural areas, adapting the medical curricula for rural HHRs, and decentralizing educational institutions or programs [25]. Second options concern the regulation of market entry or licensure through compulsory community service, immigration regulations, or waivers for foreign medical graduates who are willing to work in underserved areas [6]. Third options are related to financial incentives: scholarships conditional on future location, allowances, tax exemption and increased wages or fees. The final set of policy concerns professional and/or personal or family support. The former aims to reduce practice isolation by developing, for instance: e-health and telemedicine, online and distance continuing medical education, professional networks and team work. The latter is related to HHRs' family or personal life, and implies the availability of flexible or part-time hours and/or on-duty exemptions. Group practices and PCTs are part of these drivers since it is in favor of team working and facilitate part time working hours.

The literature shows a mixed effectiveness of these measures [5,16,18,26] but identifies several factors which are positively influencing the attraction and retention of HHRs. Regarding initial education, taking into account of the rural origin of students as well as remote or rural medicine training seems to be positively associated with the choice to settle in rural areas later [27–32]. The effectiveness of financial incentives varies considerably from one country to another, and there is a short-term effect on the attraction of professionals to rural areas [17], with a rather positive impact observed in Australia, a partially satisfactory effect in Canada and the United States, and a somewhat undetermined effect in the United Kingdom [26,27,33]. The measures concerning the conditions of practice, and more generally, which aim to improve the work–life balance, appear to be effective. Some policies

aimed at overcoming isolation had positive results, such as continuing education [31], administrative support and assistance [34], facilitating locum work arrangement [35], and improving professional autonomy and career paths [17]. The organization of practice also seems to be crucial as HHRs working in group practice appear to be more satisfied [36,37] and more able to balance work and leisure [38]. Furthermore, the living environment and amenities (education for children, working spouse, nature, and infrastructure) remain an important determinant of the installation [39,40]. Finally, many studies agree on the importance of mobilizing different measures due to various geographical contexts (remote rural areas or deprived urban areas) and the evolution of HHRs' expectations during their careers [5,26].

The literature does not point out the effects of multi-professional groups on the attraction and retention of professionals in underserved areas. Indeed, group practices and PCTs can offer attraction and retention factors for HHRs: overcoming isolation, duties and burdens, and organizing healthcare delivery for a better work-life balance. Structure and organization of group practices are very heterogeneous from one country to another [12,41–44] and therefore need further exploration of their possible effects to improve HHRs spatial distribution.

2.2. The French context: recent measures to attract and retain GPs in underserved areas in primary care

French primary health care has been ranked in the medium to low on scales of primary care orientation in international benchmarking research [45,46]. This ranking could be partially explained by the regulation of French ambulatory health care delivery, which focuses mainly on the level of care supplies and prices [47,48] and could be qualified as incomplete [49]. Ambulatory health care system is mainly based on private practice, mostly run by self-employed professionals and practitioners, including specialists, with a mix of public and private funding. The main characteristics of this system are, as follows: first, an absence of a formal hierarchical organization of ambulatory care system that clearly identifies first-level care and services to deliver; second, a remuneration of HHRs mainly based on a fee-for-services system; third, a strong segmentation of disciplines and/or HHRs, both in terms of practice and patient information; and finally, which is of most interest here, a regulation of HHRs that is mainly based on fluctuant quantitative regulation [50,51], from more to less restrictive, and without selective contract between the National health insurance (NHI) and the physicians. These factors give great freedom to physicians but lead to inequalities in geographical distribution.

Compared to other countries, France has a medium density of doctors [52] and lower regional disparities. That being said, greater differences appear between departments and/or between urban and rural areas. More specifically, GPs are more numerous in departments with medical schools or close to the South and West coasts, and in urban areas, particularly in the centers rather than in the suburbs [53]. Furthermore, the number of GPs decreased since 2007 [54], and sociological changes in the organization of practice type and location preferences of young GPs tend to reinforce existing inequalities. Less attraction for self-employed status, a growing expectation for work-time reduction and an increasing role of living environment [55] favor the attractiveness of large cities for [56].

These different processes lead to the reinforcement of spatial inequalities of GPs and to an increase of underserved areas. It is estimated that these areas concern 18.4% of the population, which represents approximately 12 million inhabitants [57]. Several measures to attract and retain GPs, detailed below, are being implemented in underserved areas.

First, the number of students trained through the *numerus clausus* increased considerably in the early 2000s, and is adjusted,

since 2016, to provide new positions in medical school for underserved regions. Then, public authorities implemented since 2005 financial incentives to attract and retain GPs in underserved areas (scholarships, loan facilities, tax exemptions, increase of fees and contracts with guaranteed incomes). Alongside the financial incentives, the state and the NHI have gradually supported multi-professional group practices that involve several categories of primary care HHRs (medical, paramedics or pharmacists) in a Primary Care Team (PCT). In addition to primary care, PCTs deliver public health, prevention and education to patients, and training or supervision to students. They differ from traditional practices by their multi-professional emphasis, their fee schedule without any over-billing and health strategic plan to address the specific needs of their community-based population.

Three main categories of financial incentives from the state and the NHI are intended for PCTs: co-funding of costs associated with project engineering (e.g. territorial analysis or shared information systems), co-funding of the new multi-professional group practice's building, if required, and some of the operating costs when new practices open (e.g. secretary or administrative staff). Since 2005, the state and local authorities have implemented various programs to finance the creation of PCTs. The location of the PCTs conditions financial support: the PCT should be in an underserved area but it is not mandatory, and each Regional Health Authority (RHA) can set her own criteria. Additionally, the NHI provides since 2009 financial incentives that co-fund operating costs for volunteer PCTs. This contribution represents approximately 5% of practice turnover in family medicine. The contract provides various incentive packages, depending on a set of criteria, regarding accessibility of health care, intensity of the teamwork and multi-professional shared information systems [58]. These policies have contributed to an exponential increase in the number of PCTs. According to the Ministry of Health, there were 10 PCTs in 2008 and nearly 800 in 2016, with approximately half of which receiving operating aid. The average size of a PCT is estimated at 2.2 GPs and 2.6 nurses, without any information regarding full-time equivalents or other staff members.

3. Data and methods

3.1. Data

In order to characterize the French areas, and in particular those that are underserved and deprived, we have identified in the literature the most commonly used dimensions to describe the supply of health care and the needs for health care delivery [59,60]: population socio-economic characteristics, primary care supply, spatial structure (urban or rural), and distance to health care and services. We then defined 18 indicators (Table 1) verifying that they are not highly correlated. The data come from multiple sources: census data (National Institute of Statistics and Economic Studies, INSEE), morbidity-mortality data (French National Institute of Health and Medical Research, CépiDc-INSERM), accessibility of GP (Institute for Research and Information in Health Economics, IRDES), and ambulatory HHRs supply data from the NHI (Caisse Nationale d'Assurance maladie, CNAMTS). The French overseas territories are not included, due to the unavailability of key indicators.

Based on the NHI data on HHRs, we estimate the number of GPs practicing family medicine and effectively delivering visits and services, between January 1, 2004 and December 31, 2012; the sample consists, respectively, of 55 443 GPs and 52 751 GPs. The data regarding PCTs come from a registry of the Ministry of Health (DGOS). In January 2013, France counted 287 PCTs (Fig. 1), of which 207 were located in rural areas.

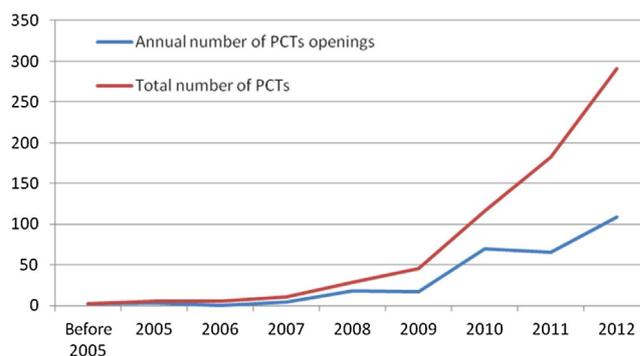
Table 1
Indicators used for characterising rural areas.

Dimension	Indicator
Primary health care delivery	
	GP density in 2012 (per 100 000 inhabitants)
	GP density evolution 2004–2012 (%)
	Rate of GPs older than 55 years old in 2012 (%)
	Nurse density in 2008 (per 100 000 inhabitants)
	Physiotherapist density in 2008 (per 100 000 inhabitants)
	Pharmacist density in 2008 (per 100 000 inhabitants)
Population	
Demographics	Annual population growth rate 1999–2009 (%)
	Rate of elderly person (>65 years old, % inhabitants)
	Avoidable mortality (per 100 000 inhabitants)
Health status	Life expectancy (years)
	Premature mortality (per 100 000 inhabitants)
Household	Household income (median for inhabitants, €)
	Rate of elderly person (>65 years old) living alone (%)
	Unemployment rate (% of working population)
Socioeconomic status	Holder of a <i>Baccalauréat</i> * (% of working population)
	Farmers Rate (% of working population)
	Workers rate (% of working population)
Spatial structure	
	Distance to the closest higher services pole (minutes)**

Sources: CépiDc-InsERM, CNAMTS, Irdes, Insee.

* French *baccalauréat* is the french High School diploma.

** Higher services poles are cities with at least half of the higher range services e.g. high school, hospital, and supermarket.



Source: French Ministry of Health

Fig. 1. Evolution of the number of PCTs.

3.2. Method

We estimated the effect of PCTs on GP density evolution based on a mixed-method framework [61] that combines a spatial analysis using a taxonomy of rural areas with a quasi-experimental design for public policy evaluation [62]. We assumed that the treatment effect, i.e. the settlement of a PCT within a rural area, is measured by the difference between GP density with and without the treatment [63].

We focused here only on the French rural areas where most of PCTs are located, knowing that difficulties to access primary care also exist in several urban areas. The unit of analysis is the “living area” i.e. the smallest territory in which inhabitants have access to the most common facilities and services or amenities [64]. Rural “living areas” differ from urban “living areas” by the absence of a major city with more of 10,000 employments. Thus, our sample of rural areas covers 1416 (of the 1677) “living areas” and one-third of the population in metropolitan France. A rural “living area” has on average 14,767 inhabitants, the most populated 137,382 and the least 1823.

In order to characterize rural areas we built a taxonomy of French rural areas based on the 28 indicators identified previously. The taxonomy has two main objectives: describing the spatial dis-

tribution of PCTs and providing the most similar “living areas” as possible to compare those with and without PCTs. We carried out a principal component analysis (PCA) and retain the first 10 factorial axes in order to retain 80% of the inertia. The PCA describes the link between indicators and resumes this information on synthetic factorial’s axes. Then we made a hierarchical ascendant classification (HAC) grouping two-by-two spaces until we get consistent clusters. We used the Ward method in order to minimize intra-class inertia and maximize inter-class inertia.

Thus, we had to group clusters according to the density of general practitioners, in order to constitute sufficiently large and homogeneous samples. Finally, we used difference-in-differences (DiD) models based on longitudinal data for two consecutive periods (2004–2008 and 2008–2012) [65]. That allows us to compare the evolution of GP density for both treated (with PCTs) and control rural areas (without PCTs, but endowed with GPs) by taking into account unobserved heterogeneity constant over time, under the assumptions of parallel trends. Our estimation strategy is then specified as follows based on linear regression formula:

$$Y_i = \beta_0 + \beta_1\text{-BEFORE} + \beta_2\text{-CASE} + \beta_3\text{-AFTER-TREATED} + \varepsilon_i$$

With Y_i , the density or its evolution, AFTER a variable taking the value 0 before and 1 after, TREATED a variable taking the value 0 for the control and 1 for the treated. The coefficient of interest here is β_3 that measures the impact of the treatment on Y_i controlling for initial differences between treated and control areas.

The year 2008 is chosen as a milestone, which marks the period before and after the “PCT policy”, as it represents the beginning of the acceleration of the political support for these practices [44]. The analysis sample is composed of 1416 rural “living areas”: 1 232 control and 184 cases.

4. Results

4.1. Six types of rural areas

The defined taxonomy results in six distinct clusters of rural areas (Fig. 2; Table 2). In order to constitute sufficiently large subsamples of observations, we aggregated together the clusters according to the following criteria: underserved areas in primary health care supply, but with average health care needs (clusters 1 and 2); deprived areas in terms of health care needs (manual workers and low health status) with low accessibility of primary care (clusters 3 and 4); and well-served areas in terms of primary health care supply but with higher health care needs (older people, high rate of unemployment) [clusters 5 and 6].

The description that follows emphasizes the key features of each cluster. The variables of each cluster are compared with the average overall level in rural areas and Table 2 summarizes for each variable its average value in each class of rural areas as well as in all rural areas.

Cluster 1 groups together attractive suburban areas that are underserved by GPs and nurses, i.e. with a lower density and accessibility of these HHRs than the average. The population is relatively younger, and with good socio-economic (education, occupation and income) and health status. Cluster 2 comprises privileged areas regarding health and socio-economic status, with an average level of accessibility of primary health care professionals. Cluster 3 is composed of industrial and agricultural areas with a lower accessibility of primary health care professionals. Workers and farmers are overrepresented, and the health status is close to the average. Cluster 4 groups together areas with deprived populations regarding health and socio-economic status as well as a lower accessibility of primary health care professionals. Furthermore, in this instance, the evolution of GP density is one of the worst for rural areas. Cluster 5 groups together tourist and attractive areas regarding migration.

The population is growing but is older and has a higher rate of unemployment. Accessibility of primary health care professionals is the highest, but the distance to services and facilities is higher on average. Cluster 6 groups remote areas with an older population. Farmers are overrepresented, the distance to services is higher, and accessibility of primary care is close to the average, but the GPs are older and the evolution of density is the worst.

A major interest of this taxonomy is that it synthesizes the interaction between primary care accessibility and health needs through health and demographic status. Thus, by comparing health care supply dynamics with demographic dynamics, we observe areas (e.g. cluster 6) where accessibility of primary care seems good i.e. close to the average but with negative trends (important decrease of GP density) suggesting future problems. We also observe areas with a similar supply of GPs, but distinct, in terms of health care needs, such as “deprived” rural areas (cluster 4), where needs appear higher than those in suburban or privileged areas (clusters 1 and 2).

4.2. The majority of rural PCTs are located in underserved areas

Three-quarters of PCTs are located in rural areas and especially in GPs underserved areas, thus meeting the necessity to attract or retain GPs (Fig. 2). Specifically, PCTs are mainly in deprived areas regarding both socio-economic and health status, with a lower primary care accessibility (cluster 4; 25% of PCTs), as well as in industrial and agricultural areas (cluster 3; 25%), and second in remote areas with older population (cluster 6; 22%), as well as in suburbs (cluster 1; 20%). By contrast, PCTs are rarely located in privileged areas (cluster 2; 2%), and in attractive and tourist areas (cluster 5; 6%).

4.3. A slowdown in decrease in GP density in rural areas with PCTs

Table 3 shows the results of the DID models estimating the impact of PCTs by analyzing the evolution of GP density before and after the establishment of PCTs in both treated and control areas. The last column shows the result of the DID. Thus, differences emerge between treated and control areas, and it appears that PCT’s impact is only significant in disadvantaged deprived areas. In such areas (clusters 3 and 4), there was a negative and comparable trend over the period 2004–2008. This trend persists during the following period 2008–2012, but with a significant slowdown, at the 5% level, in treated areas. Overall, treated areas gained an average of 3.5 GPs per 100,000 inhabitants between the two periods compared with those of control areas.

In deprived areas in terms of care needs but with a satisfactory primary health care supply (clusters 5 and 6), the negative trends over the two consecutive periods are relatively comparable between the treated and control areas.

For healthy but underserved areas (clusters 1–2), the GP density increases in areas with PCTs over the period 2004–2008 and decreases for controls. During 2008–2012, the trends are negative in both areas and greater for areas with PCTs in comparison with those of controlled areas. Overall, areas with PCTs lost on average 2 GPs between the two periods compared with those of areas without PCTs, the results being nevertheless non-significant.

5. Discussion

Geographical inequalities in GP distribution remain a concern in many countries despite the implementation of several measures to attract and retain GPs in underserved areas [1,5,6]. Thus, the evaluation of the specific impact of these measures on GP distribution is crucial for strengthening evidence-based health policy decisions. It

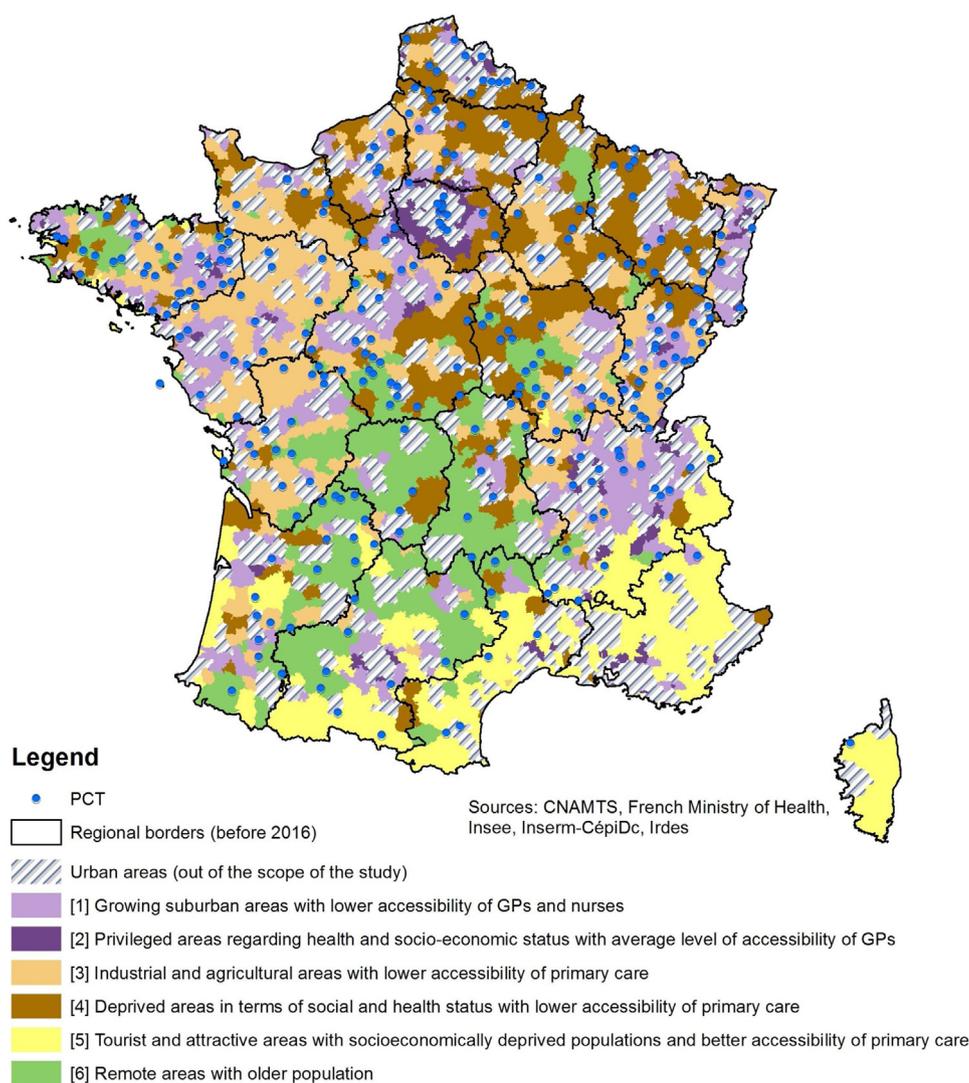


Fig. 2. Location of PCTs depending on the six clusters of the spatial taxonomy.

Table 2
Description of the rural “living areas” cluster with main indicators.

Indicator	Overall average	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Living areasrate (%)	–	22	8	23	19	15	14
French populations rate (%)	–	7	3	8	6	5	5
Rural populations rate (%)	–	24	8	21	23	14	10
Population size (average)	14767	16491	15 694	13 764	17 727	14 109	9 952
Persons per km ² (average)	83.0	95.1	216.7	51.9	77.9	96.9	32.7
Primary health care delivery							
GP density (per 100 000 inhabitants)	80.7	77.6	82.6	68.5	73.6	103.3	90.1
GP density evolution 2004–2012 (%)	–7.7	–1.3	0.0	–10.9	–11.1	–7.8	–12.1
Rate of GPs older than 55 years old (%)	50.7	42.5	41.4	54.8	54.6	51.1	56.8
Population							
Demographic							
Annual population growth rate 1999–2009 (%)	0.9	1.6	1.2	0.8	0.3	1.3	0.2
Rate of elderly person (>65 years old, % inhabitants)	19.7	15.6	13.6	20.1	19.3	22.1	27.1
Avoidable mortality (per 100 000 inhabitants)	77.1	71.2	66.8	73.7	91.8	76.0	79.0
Health status							
Life expectancy (years)	80.1	80.6	81.5	80.2	78.7	80.2	79.8
Premature mortality (per 100 000 inhabitants)	205.4	181.7	154.5	203.5	244.5	207.7	218.7
Household							
Household income (median for inhabitants, €)	21 054.5	22 576.9	30 115.5	19 987.4	19 567.6	20 507.6	17 939.7
Rate of elderly person (>65 years old) living alone (%)	28.5	27.3	25.6	28.7	30.9	28.4	28.3
Unemployment rate (% of working population)	9.5	7.8	7.2	8.7	11.6	12.1	9.2
Holder of a <i>Baccalauréat</i> (% of working population)	28.8	31.6	40.6	24.9	24.7	32.5	25.7
Socio-economic							
Farmers Rate (% of working population)	5.4	3.3	1.3	6.4	4.0	4.4	12.2
Workers rate (% of working population)	28.4	27.4	17.1	34.7	32.5	22.0	27.3
Spatial structure							
Distance to higher services poles (minutes)	22.6	20.7	17.4	21.2	20.3	26.8	29.0

Sources: CépiDc-Inserm, CNAMTS, Irdes, Insee.

Table 3
Impact of PCTs on the evolution of GP density in rural areas.

Difference in GP density	Before (2004–2008)			After (2008–2012)			DID
	Control	Treated	Diff. before	Control	Treated	Diff. after	
Clusters 1 and 2							
Mean	−0.639	3.170	3.809	−1.893	−0.156	1.737	−2.072
Standard deviation	0.584	1.733	1.829	0.584	1.733	1.829	2.586
t	−1.09	1.56	2.08	−2.79	0.72	2.68	−0.80
P> t	0.274	0.068	0.038**	0.001	0.928	0.342	0.423
Number	379	43		379	43		
R-2							0.01031
Clusters 3 and 4							
Mean	−3.896	−4.327	−0.431	−6.030	−2.968	3.062	3.494
Standard deviation	0.467	1.104	1.199	0.467	1.104	1.199	1.695
t	−8.34	−4.29	−0.36	−8.46	−3.30	2.48	2.06
P> t	0.000	0.000	0.719	0.000	0.007	0.011**	0.040**
Number	497	89		497	89		
R-2							0.01151
Clusters 5 and 6							
Mean	−4.913	−3.557	1.356	−7.460	−5.935	1.525	0.169
Standard deviation	0.839	2.196	2.351	0.839	2.196	2.351	3.325
t	−5.85	−4.30	0.58	−7.95	−6.03	1.43	0.05
P> t	0.000	0.106	0.564	0.000	0.007	0.517	0.960
Number	356	52		356	52		
R-2							0.00727

Sources: CNAMTS, French Ministry of Health, Insee, Inserm-CépiDc, Irdes.

The mean and standard deviation estimated by Ordinary Least Square (OLS) without covariables.

DID: Difference-in-differences.

***p < 0.01.

*p < 0.1.

** p < 0.05.

appears that the literature is mixed about the effectiveness of these measures [18]. The literature generally explores four main policy tools: initial training, regulation of HHRs, financial incentives and health care delivery organizational innovation with professional and personal support. Among these tools, rural training/practice and improved working conditions appear to emerge as effective tools against the traditional policies that consist of increasing the number of future physicians or by using “carrots or sticks”, including financial incentives, to influence the location choice of current physicians.

This study estimated the impact of PCTs in France on the recruitment and retention of GPs. We showed that areas with PCTs, compared to similar areas without PCTs, are experiencing a more favorable evolution of GP density in deprived rural areas with an average difference-in-differences of 3.5 GPs per 100,000 inhabitants. This finding suggests that multi-professional group practices, here PCTs, help to attract and retain GPs, probably through the improvement of their working conditions. Thus, PCTs contribute to the improvement of one of the key component of accessibility to health care delivery.

These results should be of interest to countries with relatively similar geographical inequality issues, which are experimenting with multi-professional group practices in Bismarckian (e.g. Germany, Austria), Beveridgian (e.g. Spain, Italy), mixed (e.g. France, Canada), or liberal (e.g. the United States) health care systems. From a French point of view, this work compliments previous evaluations of the impact of individual financial incentives on the attraction and retention of GPs that appear to be expensive and inefficient [66].

From a methodological point of view, this research demonstrates the value of a spatial analysis and taxonomy in order to compare similar areas with a quasi-experimental design for health policy or health services research. Thus, our contribution completes the small number of evaluations of policies to recruit and retain GPs which involve a comparison group [18], and offers a perspective for new evaluations of the impact of other policies aiming at reinforcing the presence of GPs in underserved areas. The taxonomy is also

useful for controlling the environment of practice in studies questioning the efficiency and quality of care in PCTs [44]. Moreover, the taxonomy takes into account several dimensions of both health care needs of the population and primary health care supply and shows inadequacies in some deprived areas. It also allows us to take into account healthcare attraction of a territory such as employment opportunities. This method could improve the definition of underserved areas in primary care, which remains a major issue in many countries [51], and could also be of interest to other disciplines, such as space planning, in order to qualify and understand the spatio-temporal dynamics.

Our study has some methodological limits. It is impossible to analyze changes in GP density for each rural area cluster due to small sample size. Some aggregated clusters induced, for example, greater heterogeneity between treated and controlled areas than expected. This result may explain why some treated and control areas do not have the same trend before the development of PCTs, especially clusters 1 and 2, and to a lesser extent clusters 5 and 6. Thus, these results cannot be generalized for the current state of France knowing the exponential growth of PCTs, and may probably underestimate the current effects of PCTs on GP density. In addition, one of the central attraction and retention dimensions is explored through the attractiveness of practicing in a PCT, but we do not take into account the possible effects of other measures, such as financial incentives, which can also be implemented in areas with PCTs. We assume that most of these measures are implemented in the same underserved areas as are the PCTs, because they serve the same purpose.

Our results call for confirmation of the permanence of the effects over time and more treated areas, and need to be replicated in other countries. Furthermore, the period following the development of PCTs (2008–2012) remains relatively short and can be extended. To do so, we plan to use new registry data of PCTs (2016) matched with corresponding data for GPs in the same period when available. It would be also important to understand the differences in productivity, opening hours and quality between solo and group practices to complete the analysis of how PCTs improve accessibil-

ity of care. Other studies have shown that GPs working in PCTs have higher productivity and longer working hours [44] and works are in progress to estimate again this effects.

6. Conclusion

PCTs are mainly located in rural areas, which are deprived in terms of socio-economic and health status and relatively underserved in primary care. The development of PCTs appears to be effective because we observe a slowdown in the decline of GP density between 2008 and 2012 compared to the previous period 2004–2008, in areas with PCTs compared with similar areas without PCTs. Our results suggest that PCTs contribute to attract and retain more GPs and thus, to reduce geographical inequalities in GPs supply, or at least do not increase them. We therefore bring new evidences in the policy evaluation in the field. We showed that multi-professional group practice with improved working condition could be a good driver to attract and retain GPs in underserved areas. These results should be of interest to countries with relatively similar geographical inequality issues and who are experimenting with multi-professional group practices.

Our results call for studies over a longer period, as well as a larger PCT sample in order to strengthen our analysis and conduct it for urban areas at the finest level possible. It would be also interesting to conduct similar studies to understand the attractiveness of PCTs for other health professionals such as nurses.

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