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How general practitioners in France are coping with increased healthcare demand and physician shortages. A panel data survey and hierarchical clustering

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ABSTRACT

Background: General practitioners (GPs) face quantitative and qualitative changes in patient demand and doctor shortages.
Objectives: To investigate how GPs cope with doctor shortage issues.
Materials and methods: Two cross-sectional surveys of a representative panel of 1530 GPs in 2019 and 2022 about their perceptions of physician shortages, working hours worked (WHW), and adaptive behaviors. Hierarchical clustering enabled identification of profiles with different adaptation patterns. Multiple Poisson or logistic regression models studied associations between GPs' profiles and professional characteristics.
Results: 87.4 % of GPs applied at least one adaptation to control patients' healthcare demand. 24 % adopted task-shifting while their average WHW decreased by 3.6 h between 2019 and 2022. Four GP profiles were identified. "Low adapters/low workload" and "Low adapters/high workload" (25 % of the sample each) reported 2.4 adaptive measures: 75.5 % refused to be new patients' preferred doctor in the former group (vs 5.1 %). "High adapters/unchanged consultations" (30.7 %) and "High adapters/shortened consultations" (18.9 %) reported 4.8 and 6.1 adaptations, respectively. They were more likely to practice in medically underserved areas.
Conclusion: These results call into question GPs' gatekeeper role in the French healthcare system. Moreover, the marked reduction in WHW in underserved areas is likely to exacerbate their uneven distribution nationwide. Encouraging vertical integration between HCPs while enhancing cooperation and task-shifting is probably a pathway toward improving the relative GP shortage.

1. Introduction

The qualitative and quantitative changes in healthcare needs and demand, mainly driven by population aging and medical progress [1], has translated into an imbalance in the market of primary care services that raises issues about adequate levels and organization of the healthcare workforce. Population aging inevitably increases the burdens of chronic diseases, multimorbidity, and multiple treatments [2,3], making care more complex and expanding healthcare professionals' (HCPs) workload [4,5]. The relative HCP shortage is a growing problem, especially in Europe [6], and now critical in many countries [7-10], especially for general practitioners (GPs), but also for nurses and other medical specialties [11]. In some countries, including France, the shortage in primary care services is amplified by supply-side factors: mainly the massive wave of retirements among physicians from the baby-boom generation and the increasing share of specialists among physicians (extensive margin). Another important factor is the increase in part-time jobs (intensive margin) [12] – notably explained by the increased share of women among GPs and the aspirations of new generations of GPs to reduce their working time [13,14]. Moreover, in some countries where newly arrived HCPs are free to set up wherever they want, the number of medically underserved areas, mainly rural and deprived, has risen [15].

The question of healthcare workforce optimization to attain universal health coverage can be answered through policies producing qualified HCPs, influencing their mobility, addressing their unequal

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distribution, improving their productivity and skill-mix composition, and ensuring quality of care and the range of services delivered [16]. In many countries, decision-makers have fostered integrated care, multiprofessional teamwork, and task shifting to raise primary care supply while expecting cost-containment effects, with more or less success. Yet, the efficacy of these policies relies on the development of both advanced practices for non-physicians (especially nurses) to deliver people-centered care and skills such as interprofessional cooperation. It necessitates a participatory framework in a bottom-up approach to involve primary HCPs and patients in the transformations of the HCP workforce and organization that changing healthcare needs require [17, 18]. Finally, HCPs' behaviors largely depend on the institutional framework, especially national health insurance systems and HCP payment schemes. In France and elsewhere, where fee-for-service is the dominant mode of payment, induced demand is more likely and willingness to delegate tasks and cooperate with other HCPs less so.

This paper focuses on GPs because of their central role in meeting the population's healthcare needs in many countries and their particular relation to the doctor shortage [19]. A better understanding of both GPs' perceptions of the current trends in healthcare supply and demand and their adaptive behaviors (henceforth adaptations for brevity) is essential to enable policymakers to provide better tailored interventions to recruit and retain physicians in underserved areas. To escape the detrimental effects of GP shortages in their area on them personally (quality of life, mental health), GPs might choose an "exit" strategy: moving towards well-staffed medical areas, changing type of practice from self-employed to salaried status, retiring early, or leaving the medical profession). Past studies show, however, that, once settled, GPs' interregional mobility is quite low, while their intraregional mobility depends on many factors (amenities, local characteristics of healthcare supply and demand, and financial incentives [20]. Few studies have focused on GPs' adaptations for coping with GP shortage issues. To our knowledge, only one article, from Denmark, examined GPs' preferences for organizing their general practice to mitigate such issues: these preferences depended on their current practice type (solo/group) [21].

Using data from a national representative panel of GPs, we sought to study how French GPs cope with the combination of high demand and low supply for doctors and to compare changes in their responses between 2019 and 2022. Our main contributions are to: 1) examine whether GPs' perceptions of doctors' accessibility to patients in their practice area are related to an objective measure of underserved areas (the French "local potential accessibility" indicator); 2) understand how GPs are adapting to the current doctor shortage and the growing demand for healthcare; and 3) analyze factors associated with these perceptions and coping methods.

2. Materials and methods

2.1. Setting

In France, the State and the National Health Insurance Fund (NHIF) are responsible for organizing the primary healthcare system. Most primary care is provided by GPs who are largely free to choose where they settle and decide what services they provide. Regulation mainly focuses on consultation fees, the number of available training places (and thus future graduates) and incentive contracts [22]. GPs, the French healthcare system's gatekeepers, are most often self-employed and remunerated through a fee-for-service (FFS) system (26.5 euros/consultation in 2023). A complementary P4P program ("Payment for Public Health Objectives" – ROSP in French) rewards GPs for performance based on indicators related to prevention, chronic disease management, and appropriate prescribing [23]. In 2019, 40 % of self-employed GPs had chosen to work in multiprofessional group practices (MGPs) [24] that combine at least two GPs and one paramedical professional [25].

2.2. Study population

We used data from the fourth French national representative panel of self-employed GPs, set up in 2018, with 3,304 participants at inclusion. Participating GPs had to be in private practice (as 65.5 % of GPs are, whereas salaried GPs (34.5 %) do not always provide direct care to patients), do not practice any complementary or alternative medicine exclusively (e.g. homeopathy, acupuncture, etc.) and must be the preferred doctor (hereafter PD) (*médecin traitant*) for at least 200 patients. Patients are supposed to choose a PD with whom they register [26] and are penalized by a lower NHIF reimbursement rate if they access secondary care without being referred by their PD [27].

GPs were randomly selected from an exhaustive French database of state-certified physicians as of January 1, 2018, with stratification for gender, age, 2017 annual number of office and home visits, obtained from the NHIF (workload), and practice location. We intentionally oversampled GPs in municipalities with a low GP density [28]. After the inclusion wave (September 2018), six cross-sectional survey waves took place from October 2018 through April 2022. Among the 3,304 initial acceptors, 3,076 GPs (93.0 %) participated in the first wave (October 2018–April 2019). Then, from January 2022 to April 2022, among the 3,153 GPs still eligible (retired GPs were excluded and not replaced), 1,562 participated (49.5 %). For this study, we selected the GPs who took part in the first and last survey waves (1,530 GPs).

This panel received the French "public statistics" label of the National Authority for Statistical Information (*Conseil National de l'Information Statistique n° 114/H030*), after experts reviewed its methodology, questionnaires, compliance with regulations, and governance, and attested its quality.

2.3. Data collection procedure and questionnaires

To compare responses, we used questions included in the first and last survey waves. Data collected covered GPs' age, gender, and professional characteristics (workload and practice — solo or in either an MGP or a different group setting). The number of self-reported weekly hours worked (WHW) during an ordinary week — to neutralize any seasonal effect and the effect of events such as epidemics — was initially collected in 2018 during the inclusion wave.

The standardized questionnaires also collected GPs' perceptions and opinions regarding current and future healthcare supply, difficulties in referring their patients to nurses and paramedical professionals, and GPs' adaptations (8 items, Fig. 1) to stay in their practice area despite the GP shortage. We synthesized these behaviors into three categories: trying to meet patients' needs (e.g., task-shifting), controlling demand (e.g., refusing to be the PD for new patients, i.e., to register them), and adaptations that could potentially impair quality of care (e.g., reducing time spent on continuing medical education or shortening consultation length).

We used the French "local potential accessibility" (LPA) indicator as a proxy for GP accessibility. This indicator, calculated at the municipality level and expressed in quartiles, was obtained in 2019 and 2022 from the Ministry of Health and matched with the participants' municipalities of practice. This indicator is age-standardized to consider different age-specific population health needs and considers the accessibility of GPs in neighboring municipalities. Underserved areas are frequently defined by an LPA below the 25th percentile (2.5 consultations per year per inhabitant [29]).

2.4. Statistical analysis

Participants in this study (46 % of the panel) were younger, more often women, had lower workloads, and worked more often in group practices than the other GPs (Appendix Table A1). Data were, however, weighted for age, gender, workload, and GP accessibility in the practice area in two steps. The first weighting ensured that these variables'

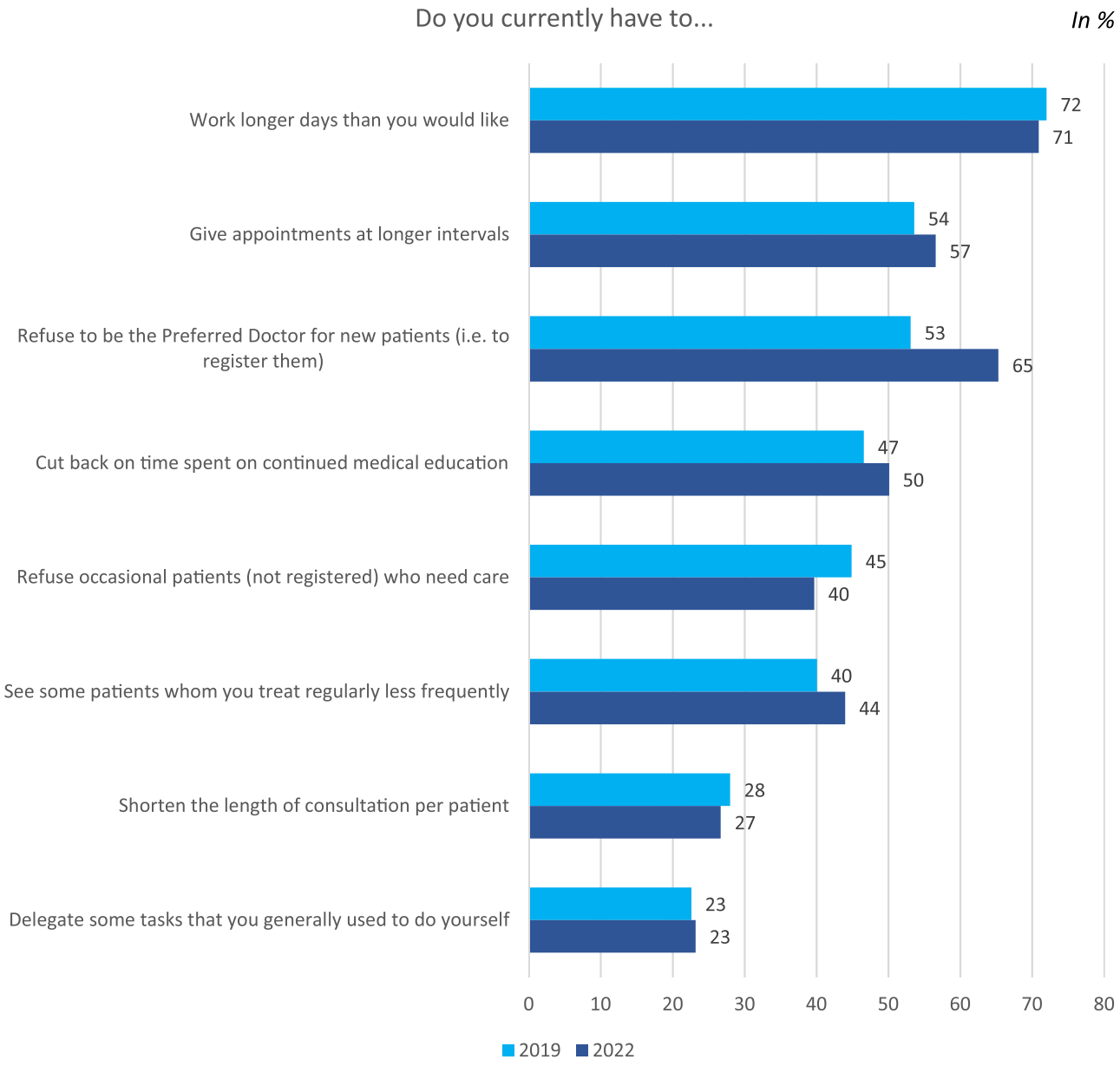

Fig. 1. Trends from 2018–2019 to 2022 of GPs' adaptation measures for coping with a physician shortage and/or with health-care demand in their practice area (National panel of self-employed GPs, France, $N = 1{,}530$[1])
Data were weighted for age, gender, workload, and GP accessibility in their practice area.
[1] Only respondents who answered in both 2018-2019 and 2022. As such, population totals may differ slightly from other tables.
"Give appointments at longer intervals" concerns all patients (both patients on the active list (all patients) and registered patients (those with a preferred doctor)), whereas "See some patients whom you treat regularly less frequently" is limited to patients with chronic diseases who regularly see their GP (mostly registered patients). It is crucial to differentiate these two actions because, in terms of patient follow-up, increasing waiting time for occasional patients is not equivalent to doing so for regular patients.

distribution in the 2022 sample was the same as at panel inclusion, and then a second aligned the sample with their distribution in the population of self-employed GPs [30].

We used univariate analyses to compare the changes in responses from 2018/2019 to 2022 and studied the associations between GPs' perceptions and their demographic and professional characteristics with Chi-square tests and the Rao-Scott correction. We built a count variable of the number of adaptations applied by GPs, based on the eight corresponding items (range=0-8) and assessed pairwise correlations between them with the Matthews correlation coefficient. Because these correlations were low, we built three composite variables to measure GPs' propensities: 1) to control healthcare demand; 2) to meet healthcare demand (e.g. task-shifting); and 3) to adopt behaviors potentially able to impair healthcare quality.

To study GPs' profiles according to their adaptations, we performed a factor analysis of mixed data (FAMD) of the eight corresponding items, self-reported WHW in the 2018/2019 survey and in 2022 and then an agglomerative hierarchical clustering (AHC) [31] with Ward's linkage to group individuals while minimizing within-cluster variability. To choose the number of clusters, we used the NbClust package in R. The most recommended partitioning was 2 clusters (by 8 indicators out of 30), but we opted for the second most recommended number of clusters, 4 (by 5 indicators), because it yielded more interpretable and pertinent results [32].

A multiple robust Poisson regression of the 2022 sample studied the associations between GPs' sociodemographic and professional characteristics with the dependent variable: "perceived current healthcare supply".

The current supply was dichotomized as "very insufficient" *vs* "somewhat insufficient/sufficient". We chose to group GPs with moderately negative responses and GPs with positive responses because they shared similar characteristics in terms of GP accessibility. A final model performed a multinomial multiple regression on data collected in 2022 to study the characteristics of GPs associated with their adaptation profiles.

All analyses used two-sided *p*-values, defined statistical significance as $p<0.05$, and were conducted with R 4.2.1 [33] and its *survey* 4.1-1 [34] and *FactoMineR* 2.7 [35] packages.

3. Results

3.1. Sample description

The study sample included more male GPs (59.7 %, Table 1). Between 2019 and 2022, the share of GPs over 60 years old increased from 22.0 % to 42.2 % and the share of GPs in group practice (including MGPs) rose by 5 percentage points (pp.) to reach 70 % in 2022. The average number of WHW decreased from 54.7 h in 2018 to 51.1 in 2022, a decline observed among 58 % of GPs. The higher their 2018 volume, the greater the 2022 decline (Appendix Table A2).

3.2. GPs' perceptions of the current and future healthcare supply in their practice area

In 2022, 34.5 % of GPs estimated that the current healthcare supply in their area was very insufficient (19.8 % in 2019, $p<0.001$; Table 1). GPs with the highest workloads ($p=0.003$) and those practicing in areas with low GP accessibility ($p<0.001$, Appendix Table A3) also ranked this perception highest most frequently.

Table 1
GPs' perceptions of the current healthcare supply in their area in 2018–2019 and in 2022 (National panel of self-employed GPs, France, $N = 1{,}530$[1])

		GPs' perception of the current healthcare supply in their area[2]								
		In 2018-2019					In 2022			
	Total sample (%)	Very insufficient supply (%)	Somewhat insufficient supply (%)	Sufficient supply (%)	*p*-value (chi-sq.)[3]	Total sample (%)	Very insufficient supply (%)	Somewhat insufficient supply (%)	Sufficient supply (%)	*p*-value (chi-sq.)[3]
Total	100	19.8	46.1	34.1		100	34.5	44.2	21.4	
Gender					0.88					0.84
Men	59.7	19.6	45.6	34.8		59.7	33.6	44.5	21.9	
Women	40.3	20.2	46.9	32.9		40.3	35.8	43.6	20.6	
Age					0.06					0.62
< 50	36.3	23.3	47.9	28.8		29.1	33.8	41.9	24.3	
50-59	41.7	15.7	44.5	39.8		28.7	36.4	46.2	17.4	
≥ 60	22.0	21.9	46.1	32.0		42.2	33.7	44.3	22.0	
Workload					0.06					**0.003**
1st quartile	23.0	14.7	46.6	38.7		23.0	25.4	54.6	20.0	
Q2-Q3	51.0	20.1	43.4	36.5		51.0	33.0	45.2	21.8	
4th quartile	26.0	23.8	50.8	25.4		26.0	45.4	33.0	21.6	
GP accessibility in the practice area[4]					**< 0.001**					**<0.001**
1st quartile (lowest accessibility)	19.7	31.8	48.8	19.4		18.5	52.2	36.8	11.0	
2nd quartile	23.6	25.0	41.8	33.1		22.5	44.2	40.7	15.1	
3rd quartile	27.4	19.0	48.1	32.9		27.9	31.3	47.1	21.6	
4th quartile (highest accessibility)	29.3	8.2	45.9	45.9		31.1	19.6	48.4	32.0	
Group practice					0.09					0.10
In a multi-professional group practice[5]	6.0	28.66	44.18	27.16		16.9	43.90	40.48	15.62	
In another group setting[6]	59.0	19.95	48.51	31.54		53.1	32.96	46.36	20.68	
Solo practice	35.0	18.09	42.34	39.57		30.0	31.84	42.31	25.85	
Mean weekly working hours[7]		**(at inclusion, in 2018)**					**(in the 2022 survey)**			
In hours	54.7	58.1	54.3	53.2		51.1	50.9	51.6	50.8	
p-value (lin. reg.)[8]	-	Ref	**0.02**	**0.006**		-	Ref.	0.60	0.95	

Data were weighted for age, gender, workload, and GP accessibility in their practice area. Differences in responses between 2019 and 2022 for perception of the current healthcare supply in the area are statistically significant at $p < 0.001$ (Rao-Scott Chi-square test).

[1] Only respondents who answered in both 2018-2019 and 2022. As such, population totals may differ slightly from those in the other tables.

[2] The question was: "Do you consider that the supply of general practitioners in your practice area is currently very insufficient/somewhat insufficient/sufficient?" Seventeen respondents were removed: 9 answered "don't know" in 2018-2019, 5 in 2022, along with 3 non-responses in 2022.

[3] Rao-Scott Chi-square test of independence between GPs' perception of the current healthcare supply in their area and the row variables. Bold *p*-values denote statistical significance at the 0.05 level.

[4] Quartiles of number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with higher GP accessibility. Quartile 1: 0-2.56; Quartiles 2-3: 2.57-4.11; Quartile 4: 4.12-20.85.

[5] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

[6] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not have such a health project

[7] Fifty-seven observations were excluded due to missing weekly hours worked data.

[8] Test of significance of the coefficient obtained in a weighted linear regression with the weekly hours worked as a dependent variable and GPs' perception of the current healthcare supply in their area as an explanatory variable.

In 2022, 74.0 % of GPs expected the future healthcare supply in their area to deteriorate (74.5 % in 2019), and 48.2 % that this deterioration would be severe (42.8 % in 2019). Although this opinion was more frequent in areas with low GP accessibility (58.3 %), the expectation of declining supply increased from 22.6 % in 2019 to 33.5 % in 2022 even where GP accessibility was high (Appendix Table A4).

3.3. GPs' difficulties and adaptive behaviors

In 2022, 63 % of GPs reported difficulties in referring their patients to nurses and paramedical professionals (38 % in 2019) (Appendix Table A5). Between 2019 and 2022, refusing to register new patients (to be their PD) rose most, from 53.0 % to 65.2 % (+12 pp. Fig. 1). The share of GPs seeing patients with chronic illnesses less frequently increased from 40 % to 44 % over this period. In all, 87.4 % of the participating GPs applied at least one adaptation to control patients' healthcare

Table 2
Typology of GPs according to the adaptation measures they applied in 2022 (National panel of self-employed GPs, France, $N = 1{,}501$[1])

	Profiles of French GPs[2]				
	Profile 1	Profile 2	Profile 3	Profile 4	Total
Total (in %)	25.0	25.5	30.7	18.9	100.0
Mean number of adaptation measures applied (max.8)	2.4	2.4	4.8	6.1	3.8
Average weekly hours worked	42.6	55.2	53.4	53.0	51.1
Average change in weekly hours worked, compared to previous survey	-7.7	-0.9	-2.9	-3.2	-3.6
Do you currently have to…	(column %)	(column %)	(column %)	(column %)	
GPs considered to "control" healthcare demand[3]***	94.8	56.5	100.0	100.0	87.6
- Refuse to be the Preferred Doctor for new patients (i.e. to register them)***	75.5	5.1	96.4	84.2	65.6
- Refuse occasional patients (not registered) who need care***	39.3	12.9	53.3	58.0	40.4
- See some patients whom you treat regularly less frequently***	28.8	28.0	58.0	69.9	45.3
- Give appointments at longer intervals***[4]	35.0	31.3	82.1	81.2	57.2
GPs considered to make adjustments to meet demand for health care[5]***	27.0	87.3	95.0	96.7	76.4
- Work longer days than you would like***	19.4	83.6	93.2	93.9	72.4
- Delegate some tasks that you generally used to do yourself***	9.3	18.9	29.2	42.7	24.1
GPs considered to apply measures with potential to impair health-care quality[6]***	1.8	6.1	-	82.5	17.6
- Shorten the length of consultation per patient***	14.9	17.0	-	100.0	26.9
- Cut back on time spent on continued medical education***	19.7	38.0	68.7	82.5	51.2
Gender**					
Men	56.3	70.7	53.0	62.8	60.2
Women	43.7	29.3	47.0	37.2	39.8
Age***					
< 50	25.6	17.8	35.7	36.8	28.8
50-59	20.9	33.5	32.8	29.3	29.4
≥ 60	53.6	48.7	31.5	33.8	41.8
Workload***					
1st quartile	27.5	26.3	19.2	13.6	22.0
Q2-Q3	53.1	46.9	56.6	43.9	50.9
4th quartile	19.4	26.8	24.2	42.5	27.1
GP accessibility in the practice area[7]*					
1st quartile (lowest accessibility)	20.9	14.4	20.6	20.9	19.2
2nd quartile	20.2	17.0	26.9	24.7	22.3
3rd quartile	30.0	25.1	26.8	30.2	27.8
4th quartile (highest accessibility)	28.9	43.5	25.7	24.2	30.8
Group practice**					
In a multiprofessional group practice[8]	13.0	16.1	18.8	21.0	17.1
In another group setting[9]	53.6	43.5	60.9	52.6	53.1
Solo practice	33.4	40.3	20.3	26.4	29.8

Data were weighted for age, gender, workload, and GP accessibility in the practice area.

[1] 2022 respondents only. 61 observations were excluded due to missing weekly working hours data.

[2] Profile 1: GPs who applied few adaptation measures, with the fewest weekly hours worked and who often refused to be the Preferred Doctor for new patients (i.e., to register them); profile 2: GPs who applied few adaptation measures, with the most weekly hours worked and who seldom refused to be the Preferred Doctor for new patients; profile 3: GPs who applied many adaptation measures, but did not shorten the length of consultations; profile 4: GPs who applied many adaptation measures, including the shortening of the length of consultations.

[3] Composite variable: GPs refusing to be the Preferred Doctor for new patients OR refusing occasional patients (not on primary care list) who need care OR seeing some patients whom they treat regularly less frequently OR giving appointments at longer intervals.

[4] "Give appointments at longer intervals" concerns all patients (both patients on the active list (all patients) and registered patients (those with a preferred doctor)), whereas "See some patients whom you treat regularly less frequently" is limited to patients with chronic diseases who regularly see their GP (mostly registered patients). It is crucial to differentiate these two actions because, in terms of patient follow-up, increasing waiting time for occasional patients is not equivalent to doing so for regular patients.

[5] Composite variable: GPs working longer days than they would like OR delegating some tasks that they generally used to do themselves.

[6] Composite variable: GPs shortened the length of consultation per patient AND cut back on time devoted to continuing medical education.

[7] Quartiles of the number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with greater GP accessibility.

[8] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

[9] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not have such a health project.

p-values: *** <0.001, ** <0.01, * <0.05 (Chi-squared test of independence between the profile of French GPs and the row variables with Rao-Scott correction)

demand; 75 % attempted to meet it, and 17.1 % applied adaptations that could worsen healthcare quality (Table 2).

3.4. Four profiles of GPs' adaptations to the current context

We found four different GP profiles based on their adaptations in 2022 and the number of WHW they reported for an ordinary working week (Table 2).

"Low adapters/low workload" (profile 1, 25 %) they reported 2.4 adaptations on average and 42.6 WHW; 75.5 % refused to be new patients' PD.

"Low adapters/high workload" (profile 2, 25.5 %): they reported 2.4 adaptations, and 55.2 WHW; only 5.1 % refused to be new patients' PD.

"High adapters/unchanged consultations (profile 3, 30.7 %) and 'High adapters/shortened consultations' (profile 4, 18.9 %): they reported 4.8 and 6.1 adaptations and 53.4 and 53.0 WHW, respectively; 96.4 % (profile 3) and 84.2 % (profile 4) refused to be the PD for new patients; GPs with profile 3 did not shorten consultation length, unlike those with profile 4.

Over 2019-2022, GPs' self-reported WHW in profiles 1 through 4 fell by 7.7, 0.9, 2.9 and 3.2 h respectively. All GPs with profiles 3 or 4 and almost all with profile 1 applied at least one adaptation to control healthcare demand (*vs.* 56.5 % with profile 2). Most GPs with profile 2, 3, or 4 (respectively 87.3 %, 95.0 %, and 96.7 %) adapted their practices to meet patients' demand (27.0 % in profile 1). Finally, very few GPs with profile 1 or 2 (respectively 1.8 % and 6.1 %), and none with profile 3 simultaneously applied adaptations potentially decreasing the quality of their care, whereas 82.5 % with profile 4 did.

GPs with profile 1 were more often older (53.6 % were 60 years-old and over), 27.5 % had low workloads and 33.4 % were in solo practices (Table 2). Those with profile 2 were mostly men (70.7 %) and older (48.7 % $\geq$ 60 years old); 43.5 % were in high GP-accessibility areas and 40.3 % in solo practices. In profile 3, 47.0 % of GPs were women, 35.7 % under 50, and 60.9 % working in a non-MGP group practice. Finally, GPs with profile 4 were similar in age to profile 3, included fewer women (37.2 %), and had the highest workload.

The multivariate polytomous logistic regression confirmed the above results (Table 3): compared to GPs with profile 2 (few adaptations, high relatively constant WHW), those with profiles 1 and 3 were more likely to be women, profiles 1, 3 and 4 were younger, and profile 4 had a higher workload. All profiles except 2 practiced in underserved areas more often.

3.5. GPs' adaptive behaviors even in areas with the highest GP accessibility

Given that GPs' location choice might also be considered an adaptation (*e.g.* leaving an underserved area for one with better accessibility), we studied characteristics of the sample by GP accessibility in their practice area (Appendix Table A6). The proportion of GPs who applied adaptations was always higher among those in areas with the lowest accessibility, with, for example, 71 % refusing to become PD for new patients, but 56.3 % of GPs in areas with the highest accessibility index also refused; 70 % worked longer days than they wanted; and 47 % had reduced the time spent on continued medical education. GPs' WHW did not significantly differ by GP accessibility in their practice area (51.1 h on average in 2022; Appendix Table A2), but WHW decrease was stronger in areas with low accessibility (-5.8 h) compared with medium (-3.8 h) or high accessibility (-2.0 h).

4. Discussion

4.1. GPs' gatekeeper role called into question

Most GPs sought to control their patient demand, mainly those in low-to-medium GP accessibility areas, but also those in high-accessibility areas. The adaptation with the most important impact on meeting patients' needs — refusing to accept new patients as their PD — was present in most profiles (except profile 2). The lump-sum payment granted by the NHIF to GPs acting as PD seems to have failed to stem this phenomenon. This calls into question GPs' ability to fulfill this role that has structured access to secondary health care in France since 2005 [36]. Doctors, nonetheless, need not accept all patients who wish to register with them. Although GPs' decision not to register new patients is understandable as the simplest way to control their workload/WHW, not being registered with a GP in the French institutional system induces out-of-pocket payments for patients, potentially causes care renunciation, and increases social health inequalities that are costly from a collective perspective. In 2021 in France, the NHIF estimated that 6 million patients aged 17 or over (11 %) did not have a registered PD [37]; in 2023, 700,000 people with a chronic illness requiring regular health monitoring had no PD [38]. The same year, the Ministry of Health announced a plan requiring the NHIF to contact these patients and put them in touch with doctors. This was organized in each "département" (French district), based on voluntary participation by doctors and with local health professional coordination communities responsible for improving care coordination. To prevent the aggravation of social inequalities in health, the NHIF may also need to consider abolishing the existing penalties for patients unable to find a PD who will accept them and/or increase the amount of the lump-sum payment to PDs as the evidence suggests that it inadequately incentivizes GPs to register every patient.

4.2. Attempt to adjust to healthcare demand while reducing working hours

Attempts to adjust to healthcare demand by working longer days than desired was reported mainly by GPs with profiles 2 to 4, who had the highest WHW in 2022. In France, this volume was stable (54 h) from 2014 through 2019 [39]. Its fall in 2022 contrasts with the high share (around 70 %) of GPs reporting working longer days than desired. This may reflect a social change in GPs' perceptions of an acceptable workload and a structural tendency of this profession to reduce their working hours, amplified by the arrival of a new generation of GPs, the oldest generation's departure, and possibly consequences of the COVID-19 pandemic [40,41]. Ever more GPs, especially those who are younger and/or female, want to maintain a balance between their professional and personal lives [42,43] and avoid professional burnout [44]. This syndrome is common among GPs [45,46] especially in areas of low medical density. The marked reduction in GP WHW in underserved areas and the simultaneous expression of dissatisfaction with working hours suggest that the downward trend in GP full-time equivalents may persist. It is likely to exacerbate inequalities in the distribution of GPs across the country and finally lead French health authorities, who have thus far rejected a constraining policy targeting young doctors setting up in practice, to intervene. They are already allocating more interns in medicine to underserved areas, which appears to be raising the GP densities there [47].

Under these circumstances, one solution would be to implement vertical integration between HCPs while developing teamwork through enhanced cooperation and task-shifting. Nonetheless, although task-shifting was adopted mostly by doctors with profiles 3 or 4, who practiced in underserved areas more often than the others, the average share of GPs reporting this adaptation in our study is lower (24 %) than reported elsewhere [48]. To free up GPs' medical time, policymakers in France have encouraged task-shifting from GPs to nurses and paramedics (mainly physiotherapists) and medical assistants (who perform administrative tasks, prepare consultations, and coordinate care with other HCPs). Some GPs (and GP unions) nevertheless remain skeptical about this policy, questioning its actual impact on healthcare quality [49], despite the relative consensus in the international literature on its positive impacts [50,51]. In addition, the fee-for-service payment

Table 3
Factors associated with GPs' adaptation profiles in 2022 (National panel of self-employed GPs, France, $N = 1{,}501$[1])

	Profile 1[2] (ref. Profile 2[3])		Profile 3 (ref. Profile 2)		Profile 4 (ref. Profile 2)	
	aOR[4]	95 % CI[4]	aOR	95 % CI	aOR	95 % CI
Gender						
Men	Ref.	-	Ref.	-	Ref.	-
Women	**1.62****	**[1.16; 2.25]**	**1.93*****	**[1.41; 2.64]**	1.32	[0.94; 1.87]
Age						
< 50	Ref.	-	Ref.	-	Ref.	-
50-59	**0.56****	**[0.37; 0.86]**	**0.53****	**[0.36; 0.78]**	**0.44*****	**[0.28; 0.67]**
≥ 60	0.72	[0.49; 1.07]	**0.41*****	**[0.28; 0.59]**	**0.39*****	**[0.26; 0.59]**
Workload						
1st quartile	Ref.	-	Ref.	-	Ref.	-
Q2-Q3	0.92	[0.64; 1.31]	**1.68****	**[1.17; 2.41]**	1.23	[0.82; 1.82]
4th quartile	0.72	[0.45; 1.17]	1.52	[0.96; 2.41]	**2.15****	**[1.33; 3.48]**
GP accessibility in the practice area[5]						
1st quartile (lowest accessibility)	**1.64***	**[1.07; 2.52]**	**2.81*****	**[1.86; 4.26]**	**2.15****	**[1.36; 3.39]**
2nd quartile	1.45	[0.94; 2.26]	**2.27*****	**[1.49; 3.47]**	**2.10****	**[1.33; 3.33]**
3rd quartile	1.19	[0.79; 1.78]	1.46	[0.98; 2.19]	1.46	[0.94; 2.26]
4th quartile (highest accessibility)	Ref.	-	Ref.	-	Ref.	-
Group practice						
Solo practice	Ref.	-	Ref.	-	Ref.	-
In another group setting[6]	1.17	[0.79; 1.72]	1.41	[0.96; 2.08]	1.40	[0.91; 2.14]
In a multiprofessional group practice[7]	0.66	[0.42; 1.04]	1.04	[0.68; 1.60]	1.03	[0.65; 1.65]

Multinomial logistic regression

[1] 2022 respondents only. 61 observations were excluded due to missing weekly hours worked data.

[2] Profile 1: GPs who applied few adaptation measures, with the fewest weekly hours worked, and who often refused to be the Preferred Doctor for new patients (i.e. to register them); profile 3: GPs who applied many adaptation measures, but did not shorten the length of consultations; profile 4: GPs who applied many adaptation measures, including the shortening of the length of consultations.

[3] Profile 2: GPs who applied few adaptation measures, with the most weekly hours worked and who seldom refused to be the Preferred Doctor for new patients.

[4] Adjusted odds ratios and confidence interval.

[5] Quartiles of the number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with greater GP accessibility. Quartile 1: 0-2.56; Quartiles 2-3: 2.57-4.11; Quartile 4: 4.12-20.85.

[6] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not, unlike MGPs, have a health project (see note 7 below).

[7] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

***: p-value < 0.001; **: p-value < 0.01; *: p-value < 0.05.

system for self-employed GPs in France increases the opportunity costs of both task shifting and cooperation between HCWs, a problem that also applies to MGPs [52]. However, the number of medical assistants has risen sharply since they were introduced in 2020, with 6,000 contracts signed over the last three years, 75 % of them with GPs. According to the NHIF, medical assistants may enable GPs to see almost 10 % more patients (of patients seen at least once) and to boost the number of medical acts by 8 % compared to GPs without medical assistants [53]. Task shifting is not limited to MGPs: it can also exist in solo practices. In particular, the Asalée scheme (*Action de santé libérale en équipe*) set up in 2004 enabled GPs to delegate tasks to nurses to improve screening and monitoring of chronic diseases [54]. However, less than 1 % of self-employed nurses nationwide currently participate.

Encouraging the vertical integration of GPs and nurses and effective teamwork between them is probably a pathway toward improving the relative GP shortage, as already shown [55]. It requires training nurses, authorizing the transfer of certain tasks to them (advanced practice nursing), and new remuneration policies.

4.3. Adaptation potentially decreasing care quality and safety

Finally, some of the measures GPs have adopted (reducing the length of consultations and the time devoted to continuing medical education) were overrepresented in profile 4 and present the risk of impairing the quality and safety of care [56]. The fee-for-service payment system fosters the reduction in consultation length. Although the subject is debated, some theoretical and empirical texts in health economics acknowledge that consultation length can be regarded as a proxy for health care quality to patients [57-61], especially for time-consuming tasks such as education, prevention, and complex consultations (e.g. with socially vulnerable patients). These represent a significant portion of GPs' workload [62,63]. A shorter consultation length is likely to adversely affect patient health care and physician workload and stress [64,65]. Although many factors contribute to the quality of care, studies suggest that countries with longer consultation times also tend to show higher care quality and better health outcomes [66]. Numerous studies also indicate a substitution effect between consultation time and drug prescriptions in private practice. These prescriptions compensate for reduced consultation time, which often comes at the expense of patient education and explanation and contributes to polypharmacy, a risk factor for avoidable morbidity and mortality [4,26,64].

4.4. Are GPs' concerns in tune with reality?

GPs' worsening perceptions of their present and future situation from 2019 to 2022 may be partly a backlash from the COVID-19 pandemic. It is, however, consistent with the decreased GP density (-8 %) nationally between 2012 and 2022 [67] and the French Ministry of Health's

projections (2021) predicting a reduction in the supply of GPs — and most medical professionals — until the end of the 2020s [68]. This trend contrasts with the decreased volume of hours worked over our study period. This observation suggests that the GP shortage may be amplified by a reduction in full-time equivalents that lessens GPs' capacity to absorb the health demand, especially in underserved areas.

4.5. Measures proposed to address the shortage of doctors and their evaluation

Several types of measures are proposed to attract and retain doctors in underserved areas [69]: 1) *Financial interventions: either* direct (e.g. increased/guaranteed salary or bonus, in exchange for working several years in underserved areas) or indirect (e.g., building new MGPs, changing remuneration schemes); 2) *Regulation*: e.g., expanding medical training places to increase the GP supply; regulating authorizations to practice in certain regions to ensure a fairer geographical distribution of GPs; 3) *Educational interventions*: e.g. rotations or internships in underserved areas to medical students; rural fellowships or training programs; 4) *Professional and personal support* (e.g. advising or mentoring rural GPs (with practice setup), improving communication resources (telehealth), task delegation, and offering possibilities for family housing. Multifactorial approaches are in fact often adopted. However, due to the design and methodology of the studies that evaluated these measures, it is hard to conclude to what extent they have actually affected recruitment and retention of doctors in underserved areas, and to propose a "best practice" approach [69]. Moreover, most of these measures are difficult to implement, mainly for financial and technical reasons; they often reach a limited proportion of primary care HCPs and take time to produce effects [70]. Some of them (task-shifting, MGPs) have allowed reductions of doctors' working hours and thus further depleted the system's capacity to absorb healthcare demand [71].

4.6. Limitations

Our study has some limitations. Because GPs' answers were self-reported, we cannot exclude either reporting or desirability biases; some participants might have underreported some of their adaptations, or overreported other aspects (e.g., working hours). This does not, however, call into question our results, which are consistent and alarming. Moreover, GPs' perceptions were highly correlated with objective indicators of GP accessibility (Appendix Table A3). We could not have access to practice quality indicators that would have enabled us to assess in greater depth the behavioral differences between the GP adaptation profiles. Finally, endogeneity biases (especially omitted variables and reverse causality) prevent us from drawing causal inferences. Although the use of the panel dimension of our data might have enabled us to control for time-invariant unobserved heterogeneity, the absence of strong and valid instruments in the database forbids valid causal inferences.

5. Conclusion

This study sheds new light on the physician shortage by studying, to our knowledge for the first time, their perceptions of this situation and the ways in which they adapt in real life to alleviate it. By drawing up a typology of these adaptations (found in most countries), incorporating the change in the volume of hours worked per week over the study period, and comparing it with healthcare supply, this article raises questions about the organizational approaches and public policy responses to this shortage so far.

Efforts should concentrate on assessing the effectiveness (and efficiency) of public interventions and policies in this field. Pending more robust evidence, however, some avenues can be advocated, as they seem promising. The first is to rebalance the number of doctors by measures to avoid exacerbating geographical disparities in distribution, although we note that such measures can meet strong resistance from doctors if they are perceived as coercive. Better coordination is also required between HCPs and between primary and secondary care providers, in each geographical area; the French experience of local health professional coordination communities highlights the value of bottom-up approaches for achieving this objective. To encourage and enable task shifting and interprofessional cooperation in various forms, interprofessional training must be developed in initial and continued professional training. Similarly, MGP development should continue, particularly in underserved areas [25,72,73], as these structures are an effective way of combating medical isolation in these areas and appear to be associated with a better quality of life for their professionals. Finally, where fee-for-service payment predominates in GPs' income, combining other forms of payment — performance-based, lump-sum based on the number of patients registered, grouped, coordination-based, etc. — could encourage cooperation, coordination, and task delegation.

CRediT authorship contribution statement

Bérengère Davin-Casalena: Writing – original draft. **Dimitri Scronias:** Writing – original draft, Methodology, Formal analysis. **Yann Videau:** Writing – original draft, Supervision. **Pierre Verger:** Writing – original draft, Supervision, Conceptualization.

Conflict of interest statement

The authors have no conflict of interest to declare.

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Appendix

Table A1
Comparisons between respondents to both questionnaires (2018-2019 and 2022) and to the inclusion questionnaire only (2018-2019) (National panel of self-employed GPs, France, N = 3,304)

	GPs who responded to:			
	Both questionnaires		Inclusion questionnaire only	
	N	% (column)	N	% (column)
Total	1530	46.3	1774	53.7
Gender				
Men	810	52.9	1099	62.0
Women	720	47.1	675	38.0
p-value	**< 0.001**			
Age (in 2018-2019)				
< 50	770	50.3	552	31.1
50-59	478	31.2	593	33.4
≥ 60	282	18.4	629	35.5
p-value	**< 0.001**			
Workload (in 2018-2019)				
1st quartile	400	26.1	503	28.3
Q2-Q3	847	55.4	824	46.5
4th quartile	283	18.5	447	25.2
p-value	**< 0.001**			
GP accessibility in the practice area[1] (in 2018-2019)				
Quartile 1	414	27.1	470	26.49
Quartile 2	351	22.9	374	21.08
Quartile 3	387	25.3	454	25.59
Quartile 4	378	24.7	476	26.83
p-value	0.41			
Group practice (in 2018-2019)				
In a multiprofessional group practice[2]	240	15.7	181	10.2
In another group setting[3]	881	57.6	887	50.0
Solo practice	409	26.7	706	39.8
p-value	**< 0.001**			

Unweighted data.
P-value: chi-squared test of independence between the column and row variable.
[1] Quartiles of number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with higher GP accessibility. Quartile 1: 0-2.56; Quartiles 2-3: 2.57-4.11; Quartile 4: 4.12-20.85.
[2] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).
[3] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not have such a health project.

Table A2
GPs' changes in weekly hours worked between 2018 and 2022, according to GP accessibility in the practice area (National panel of self-employed GPs, France, *N* = 1,501[1])

	GP accessibility in the practice area[2]			
	Low accessibility (Q1)	Medium accessibility (Q2-Q3)	High accessibility (Q4)	Total
Total	19.2 %	50.1 %	30.7 %	100 %
Weekly hours worked in the 2018 inclusion survey				
In hours	55.7	55.6	52.6	54.7
p-value (lin. reg.)[3]	-	0.99	**0.022**	
Weekly working hours in the 2022 survey				
In hours	49.8	51.8	50.6	51.1
p-value (lin. reg.)	-	0.14	0.56	
Difference in weekly hours worked between the 2022 survey and the 2018 inclusion survey				
In hours	-5.8	-3.8	-2.0	-3.6
p-value (lin. reg.)	Ref.	0.08	**< 0.001**	
In percentage	-10.4 %	-6.8 %	-3.8 %	-6.6 %
Difference in weekly hours worked between the 2022 survey and the 2018 inclusion survey				
	(column %)	(column %)	(column %)	(column %)
Decrease	63.3 %	60.3 %	52.9 %	58.6 %
Increase	23.5 %	28.1 %	30.6 %	28.0 %
Stable	13.2 %	11.6 %	16.5 %	13.4 %
p-value (chi-sq.)[4]	0.3			
Mean decrease in weekly hours worked (among those who worked less than in the 2018-2019 inclusion survey)				
In hours	-11.53	-10,1	-8.07	-9.9
P-value (lin. reg.)	-	0.25	**0.003**	
Mean increase in weekly hours worked (among those who work more than in the 2018-2019 inclusion survey)				
In hours	6.35	8.19	7.44	7.7
P-value (lin. reg.)	-	0.15	0.39	

Data were weighted for age, gender, workload, and GP accessibility in the practice area.

[1] 2022 respondents only. 61 observations were excluded due to missing data regarding the weekly hours worked variable.

[2] Quartiles of the number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP worked in an area with greater GP accessibility. Quartile 1: 0-2.56; Quartile 2-3: 2.57-4.11; Quartile 4: 4.12-20.85.

[3] Test of significance of the coefficient obtained from a weighted linear regression with the row variable as a dependent variable and GP accessibility in the practice area as an explanatory variable.

[4] Chi-squared test of independence between GP accessibility in the practice area and the change in the number of weekly hours worked between the 2022 survey and the 2018 inclusion survey.

Table A3

Factors associated with GPs' perceptions of the current health care-supply in their area, 2022 (National panel of self-employed GPs, France, $N = 1{,}562$[1])

	Current supply is very insufficient (ref: current supply is somewhat insufficient or sufficient[2])	
	aRR[3]	95 % CI[3]
Gender		
Male	Ref.	-
Female	1.09	[0.95; 1.24]
Age		
< 50	Ref.	-
50-59	1.15	[0.98; 1.36]
≥ 60	1.05	[0.90; 1.24]
Workload		
< 2nd quartile	Ref.	-
Q1-Q3	**1.23***	**[1.04; 1.47]**
> 3rd quartile	**1.55*****	**[1.28; 1.88]**
GP accessibility in the practice area[4]		
1st quartile (lowest accessibility)	**2.77*****	**[2.22; 3.46]**
2nd quartile	**2.07*****	**[1.63; 2.63]**
3rd quartile	**1.55*****	**[1.20; 2.00]**
4th quartile (highest accessibility)	Ref.	-
Group practice		
Solo practice	Ref.	-
In another group setting[5]	0.99	[0.84; 1.17]
In a multiprofessional group practice[6]	1.12	[0.94; 1.34]

[1] 2022 respondents only.

[2] Nine responses were removed: 2 nonresponses and 7 "don't know" answers.

[3] Adjusted risk ratio obtained from a multiple Poisson regression with robust standard errors; confidence intervals.

[4] Quartiles of the number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with greater GP accessibility. Quartile 1: 0-2.56; Quartiles 2-3: 2.57-4.11; Quartile 4: 4.12-20.85.

[5] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not, unlike MGPs, have a health project (see note 6 below).

[6] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

***: p-value < 0.001; **: p-value < 0.01; *: p-value < 0.05.

Table A4

GPs' perceptions of future healthcare supply in their area in 2018–2019 and in 2022 (National panel of self-employed GPs, France, $N = 1{,}530$[1]).

	GPs' perception of future healthcare supply in their area[2]									
	In 2018-2019					In 2022				
	Stable, or increase (%)	Slight decrease (%)	Strong decrease (%)	Don't know (%)	p-value[3]	Stable, or increase (%)	Slight decrease (%)	Strong decrease (%)	Don't know (%)	p-value[3]
Total	18.1	31.7	42.8	7.4		17.1	25.8	48.2	8.9	
Gender					0.47					<0.001
Men	18.4	32.1	43.6	6.0		18.9	27.8	48.0	5.3	
Women	17.7	31.2	41.8	9.4		14.3	23.0	48.5	14.2	
Age					0.49					0.52
< 50	18.3	30.7	43.6	7.4		15.8	31.3	43.6	9.3	
50-59	18.7	35.4	38.4	7.4		17.8	21.3	51.1	9.8	
≥ 60	16.6	26.2	50.0	7.2		17.4	25.2	49.4	8.0	
Workload					0.29					0.97
1st quartile	20.7	31.0	39.9	8.5		17.2	26.0	48.7	8.1	
Q2-Q3	14.6	33.5	43.7	8.3		16.0	27.0	48.3	8.7	
4th quartile	22.8	28.9	43.7	4.6		19.1	23.5	47.5	10.0	
GP accessibility in the practice area[4]					**<0.001**					**<0.001**
1st quartile (lowest accessibility)	12.0	17.8	67.4	2.8		15.2	23.0	58.3	3.5	

(continued on next page)

Table A4 (*continued*)

	GPs' perception of future healthcare supply in their area[2]									
	In 2018-2019					In 2022				
	Stable, or increase (%)	Slight decrease (%)	Strong decrease (%)	Don't know (%)	*p*-value[3]	Stable, or increase (%)	Slight decrease (%)	Strong decrease (%)	Don't know (%)	*p*-value[3]
2nd quartile	17.2	29.5	46.2	7.1		17.7	23.4	51.0	7.9	
3rd quartile	18.1	31.4	43.9	6.6		13.6	19.8	55.7	10.8	
4th quartile (highest accessibility)	22.9	43.1	22.6	11.4		20.7	34.6	33.5	11.2	
Group practice					0.44					0.33
In a multi-professional group practice[5]	19.0	24.7	49.1	7.1		22.4	25.1	48.8	3.7	
In another group setting[6]	17.3	34.4	42.0	6.3		16.0	26.1	47.7	10.3	
Solo practice	19.1	30.8	40.8	9.4		15.9	25.8	48.8	9.4	
Mean weekly working hours[7]	**(at inclusion, in 2018)**					**(in the 2022 survey)**				
In hours	52.7	53.6	57.1	49.6		49.9	51.7	51.7	49.1	
p-value (lin. reg.)[8]	Ref	0.51	**0.002**	0.23		Ref.	0.22	0.21	0.66	

Data were weighted for age, gender, workload, and GP accessibility in their practice area. Differences in responses between 2019 and 2022 for perception of the future health-care supply in the area were not statistically significant (Rao-Scott Chi-square test).

[1] Only respondents who answered in both 2018-2019 and 2022. As such, population totals may differ slightly from those in the other tables.

[2] The question was: "What are the demographic prospects in healthcare supply in your practice area?".

[3] Rao-Scott Chi-square test of independence between GPs' perception of the future health-care supply in their area and the row variables. Bold *p*-values denote statistical significance at the 0.05 level.

[4] Quartiles of number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with higher GP accessibility. Quartile 1: 0-2.56; Quartiles 2-3: 2.57-4.11; Quartile 4: 4.12-20.85.

[5] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

[6] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not have such a health project.

[7] Fifty-seven observations were excluded due to missing weekly hours worked data.

[8] Test of significance of the coefficient obtained in a weighted linear regression with the weekly hours worked as a dependent variable and GPs' perception of the future health-care supply in the area as an explanatory variable.

Table A5

GPs' difficulties in referring their patients to healthcare workers (National panel of self-employed GPs, France, $N = 1{,}530$[1]).

	In your daily practice, do you find it difficult to refer your patients to appropriate healthcare workers who are able to provide them with care?					
	In 2018-2019			In 2022		
	Yes (%)	No/Don't know (%)	*p*-value (chi-sq.)[2]	Yes (%)	No/Don't know (%)	*p*-value (chi-sq.)[2]
Total	37.9	62.1		63.0	37.0	
Gender			0.20			**0.028**
Men	35.8	64.2		59.5	40.5	
Women	40.8	59.2		68.2	31.8	
Age			0.75			0.22
< 50	36.9	63.1		66.6	33.4	
50-59	39.6	60.4		65.4	34.6	
≥ 60	36.2	63.8		59.0	41.0	
Workload			0.96			**0.015**
1st quartile	38.0	62.0		65.1	34.9	
Q2-Q3	38.3	61.7		67.2	32.8	
4th quartile	36.9	63.1		53.2	46.8	
Nurses accessibility in the practice area[3]			**< 0.001**			0.07
1st quartile (lowest accessibility)	52.1	47.9		72.0	28.0	
2nd quartile	41.5	58.5		63.9	36.1	
3rd quartile	34.4	65.6		62.2	37.8	
4th quartile (highest accessibility)	27.7	72.3		56.8	43.2	
Group practice			0.19			**0.014**
In a multi-professional group practice[4]	39.9	60.1		70.9	29.1	
In another group setting[5]	40.9	59.1		65.0	35.0	
Solo practice	33.8	66.2		55.0	45.0	
Mean weekly working hours[6]	**(at inclusion, in 2018)**			**(in the 2022 survey)**		
In hours	51.3	51.0		55.9	54.0	
p-value (lin. reg.)[7]	Ref.	0.11		Ref.	0.81	

Data were weighted for age, gender, workload, and GP accessibility in their practice area. Differences in responses between 2019 and 2022 for difficulties to refer patients to appropriate healthcare workers are statistically significant at $p < 0.001$ (Rao-Scott Chi-square test).

[1] Only respondents who answered in both 2018-2019 and 2022. As such, population totals may differ slightly from those in the other tables.

[2] Rao-Scott Chi-square test of independence between GPs' difficulties to refer patients to appropriate healthcare workers and the row variables. Bold *p*-values denote statistical significance at the 0.05 level.

[3] Quartiles of number of full-time nurses per 100,000 inhabitants (age-standardized) in the practice area. A higher quartile indicates that the GP works in an area with higher nurses accessibility. Quartile 1: 0-92.3; Quartile 2-3: 92.4-199.0; Quartile 4: 199.1-3060.7

[4] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

[5] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not have such a health project.

[6] Fifty-seven observations were excluded due to missing weekly hours worked data.

[7] Test of significance of the coefficient obtained in a weighted linear regression with the weekly hours worked as a dependent variable and GPs' perception of the future health-care supply in the area as an explanatory variable.

Table A6
Profiles of French GPs according to the accessibility of GPs in their practice area in 2022 ($N = 1,562$[1])

	Accessibility of GPs[2]			
	Low accessibility (Q1) (column %)	Medium accessibility (Q2-Q3) (column %)	High accessibility (Q4) (column %)	Total (%)
Total	19.0	50.2	30.8	100.0
Mean number of measures applied (max.8)	4.1	3.9	3.4	3.8
Average weekly hours worked[3]	49.8	51.8	50.6	51.1
Average change in weekly hours worked, compared to previous survey[3]	-5.8	-3,8	-2.0	-3.6
Do you currently have to…				
GPs considered to "control" health care demand[4]	87.2	89.5	84.0	87.4
- Refuse to be the Preferred Doctor for new patients (i.e. to register them)**	71.3	68.5	56.3	65.2
- Refuse occasional patients (not registered) who need care	40.7	43.2	33.4	39.7
- See some patients whom you treat regularly less frequently *	52.5	45.1	36.9	44.0
- Give appointments at longer intervals[5]	60.7	56.8	53.7	56.6
GPs considered to make adjustments to meet the health care demand[6]	77.2	74.6	73.3	74.7
- Work longer days than you would like	72.6	70.8	70.0	70.9
- Delegate some tasks that you generally used to do yourself**	33.3	23.4	16.8	23.3
GPs considered to apply measures at potential to impair health-care quality[7]	20.4	16.9	15.4	17.1
- Shorten the length of consultation per patient	27.7	27.7	24.4	26.7
- Cut back on time spent on continued medical education	52.9	51.1	46.9	50.1
Gender				
Male	61.8	59.5	58.8	59.7
Female	38.2	40.5	41.2	40.3
Age				
< 50	24.7	28.8	31.3	28.8
50-59	25.5	30.0	29.1	28.9
≥ 60	49.9	41.2	39.6	42.4
Workload				
1st quartile	25.2	19.3	27.4	22.9
Q2-Q3	46.6	53.8	48.6	50.9
4th quartile	28.1	26.8	24.0	26.2
Group practice*				
In a multiprofessional group practice[8]	22.0	18.4	11.0	16.8
In another group setting[9]	48.7	50.3	61.0	53.3
Solo practice	29.3	31.3	28.0	29.9

Data were weighted for age, gender, workload, and GP density in the practice area.

[1] 2022 respondents only.

[2] Quartiles of the number of visits to GPs per year per inhabitant (age-standardized) in the practice area. A higher quartile indicates that the GP worked in an area with higher GP accessibility. Low accessibility (quartile 1): 0-2.564; Medium accessibility (quartiles 2-3): 2.565-4.118; High accessibility (quartile 4): 4.119-20.847.

[3] Sixty-one observations were excluded due to missing data for the weekly hours worked variable.

[4] Composite variable: GPs refusing to be Preferred Doctor for new patients (i.e., to register them) OR refusing occasional patients (not registered with them) who need care OR seeing some patients whom they treat regularly less frequently OR giving appointments at longer intervals.

[5] "Give appointments at longer intervals" concerns all patients (both patients on the active list (all patients) and registered patients (those with a preferred doctor)), whereas "See some patients whom you treat regularly less frequently" is limited to patients with chronic diseases who regularly see their GP (mostly registered patients). It is crucial to differentiate these two actions because, in terms of patient follow-up, increasing waiting time for occasional patients is not equivalent to doing so for regular patients.

[6] Composite variable: GPs working longer days than they would like OR delegating some tasks that they generally used to do themselves.

[7] Composite variable: GPs shortening the length of consultation per patient AND cutting back on the time they devote to continued medical education.

[8] Multiprofessional group practices (MGPs) are practices that combine at least two GPs and paramedical professionals and have an administratively validated health project (that defines the MGP's priorities for responding to public health issues in the area it serves).

[9] Another group setting covers practices with different composition profiles (for example, several GPs, or GPs and other specialists, etc.) and do not have such a health project.

p-values: *** <0.001, ** <0.01, * <0.05 (Chi-square test of independence between the profile of French GPs and the row variables with Rao-Scott correction)

Table A1, A2, A3, A4, A5, A6

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