Do French GPs disproportionately focus on P4P perimeter?

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Introduction

Payment for Performance (P4P) schemes by which physicians get a financial reward as long as they reach quality and efficiency targets provided by regulator have become increasingly popular in recent years in OECD countries (1) : in 2012, P4P program for primary care physicians were implemented in about 15 OECD countries. In the US, the number of P4P schemes has grown spectacularly, from 39 in 2003 to 160 in 2009 (2). The reasons for this success are to be sought in the economic characteristics of P4P schemes : P4P schemes make possible for the regulator to observe medical practices and quality provided by physicians so that the traditional asymmetry of information between the payer and the provider is strongly decreased within the P4P perimeter (2). P4P is also seen as a way to reduce heterogeneity of performance between GPs, as adherence to recommended care may significantly vary across providers (1, 3).

However, the wide dissemination of P4P schemes in many countries sharply contrasts with the very few studies which aim at evaluating their impact on quality or efficiency. When existing, these rare studies tend to show a modest impact of the P4P (4-10) while others remain inconclusive (11). At the same time, P4P may be associated with unintended and undesired effects (12-17). Theoretical analysis tends to predict that rewarding GPs on a limited set of quality and/or efficiency indicators may incite them to disproportionally focus their effort on this P4P perimeter, while neglecting aspects of quality or efficiency that are unrewarded(2), leading to a decrease both in quality and efficiency outside the P4P perimeter. Theoretically, this effect is more likely to happen when the number of performance measures included in the P4P perimeter is low(3).

Beyond these theoretical analyses, very few studies have been conducted so far to investigate empirically the correlation between quality or efficiency performances in the scope of P4P and those achieved out of this perimeter. Fernandez Urrusuno et al. (2014) (18) analyzed whether GPs complying with quality prescribing indicators linked to financial incentives showed a similar level of compliance with non-incentivized indicators, from an Andalusian database. Compliance with P4P perimeter was measured according to 6 quality indicators included in the Andalusian P4P. A consensus group identified 14 indicators not included in the Andalusian P4P perimeter that make possible to measure compliance with non-incentivized indicators. Results show that compliant GPs – identified as those reaching a synthetic score of at least 70%- obtain higher scores on P4P indicators than non-compliant ones but this is no longer the case for non-incentivized indicators, except for two of them (selection of second/ third line antibiotics and selection of antihistamines). Doran et al (2011) (19) analyzed whether the UK P4P (Quality and Outcomes Framework [QOF]) led GPs to neglect activities not included in the scheme. A longitudinal analysis was conducted between January 2000 and December 2007 in order to examine changes in performance for 42 activities (23 included

in the P4P perimeter, 19 excluded) before and after QOF was introduced (in 2004). For each type of indicator, a comparison was established between achievement predicted from the trend in the pre-incentive period (2000-2003) and actual achievement in the period after QOF was implemented (2004-2007). In the first period of the financial incentives, results showed that achievement rates for most incentivized indicators were significantly higher than projected rates from pre-incentive trends. Achievement above predicted rates were higher for incentivized indicators than non-incentivized indicators. In the second and third years of financial incentives, the overall achievement rate for non-incentivized indicators was significantly lower than expected.

To our knowledge, there is no French published study analyzing the risk that P4P may incite GPs to disproportionately focus on P4P perimeter at the expense of quality of non-incentivized care. However, this question is even more relevant in France where the P4P system lies on a smaller set of indicators than the English QOF (142 indicators in 2012)(1). In France, a voluntary Payment for Performance (P4P) scheme was introduced in 2009. This P4P scheme does not replace fee-for-service which remains the main payment scheme for physicians but it acts as an additional payment which aims at improving both quality and efficiency. The P4P was then extended to all French GPs in 2012 – named Payment for Public Health Objectives, Rémunération sur Objectifs de Santé Publique [ROSP] in French)- and may also apply to other medical specialties(20). Physicians are automatically enrolled in the program but remain free to opt out(1). As other P4P schemes, it offers GPs additional payments based on their performance in exchange for a list of clinical targets. Out of a total of 29 indicators, 12 are linked to drug prescription quality or efficiency.

The objective of this study is to evaluate if French top-ranked GPs in the P4P perimeter according to pharmaceutical prescribing quality and efficiency indicators also comply with quality and efficiency indicators outside P4P perimeter.

Data and methodology

Data were extracted from the French 2012 IMS-Health Disease Analyzer database. This survey contains information provided by 693 volunteer GPs in France in 2012. Even if the French P4P was extended to all GPs only in 2012, it had been already implemented for voluntary GPs in 2009 on the basis of the same indicators in such a way that all French GPs knew P4P indicators before 2012. IMS-Health Disease Analyzer database is a database of longitudinal electronic medical records. Anonymous data are collected continuously via medical software, allowing longitudinal follow-up of all the visits of any given patient consulting the same GP in the panel. This database, which is collected in various European countries, has been used in a great number of studies (21-29). It was used to calculate for each of 693 French GPS both incentivized indicators of P4P (called In-P4P indicators) as well as non-incentivized indicators (called Out-P4P indicators).

In P4P quality or efficiency indicators and aggregated indicators

The French P4P scheme lies on 29 indicators which cover various areas such as prevention and screening, quality of the management of chronic conditions, practice organization, and quality or efficiency of drug prescription. Our analysis focus on this latter category which includes 12 indicators(1). In the French P4P, efficiency targets aimed at increasing the prescribing of generics have been implemented in five therapeutic classes (antibiotics, Proton-Pump Inhibitors, statins, antihypertensive drugs, antidepressants). Prescribing targets for generics versus originators products are already widely disseminated in a large number of European countries (30, 31). Even not included

in the “prescribing of generics category”, “share of angiotensin converting enzyme among ACE and sartans” and “proportion of patients treated with antiplatelet drugs who are treated with aspirin” indicators also reflect an efficiency target (table 1).

Table 1: P4P prescribing efficiency indicators

	Indicator	P4P threshold
In1	Proportion of multiple sourced antibiotics among all antibiotic prescriptions	>=90%
In2	Proportion of multiple sourced Proton-Pump Inhibitors (PPI) among all PPI prescriptions	>=85%
In3	Proportion of multiple sourced statins among all statins prescriptions	>=70%
In4	Proportion of multiple sourced antihypertensive among all antihypertensive prescriptions	>=65%
In5	Proportion of multiple sourced antidepressants among all antidepressants prescriptions	>=80%
In6	Proportion of Angiotensin Converting Enzyme (ACE) inhibitor among ACE + sartans	>=65%
In7	Proportion of patients treated with antiplatelet drugs who are treated with aspirin	>=85%

Six indicators are linked to pharmaceutical prescribing quality. Among these, two of them are about management of diabetes: [1] Proportion of diabetic patients over 50 (men) or 60 (women) treated with antihypertensives who receive statins, [2] Proportion of diabetic patients over 50 (men) or 60 (woman) treated with antihypertensives and statins, who receive low-dose aspirin or other anticoagulant. As these two indicators are intricately linked, only the first one was retained in the analysis. All P4P prescribing quality indicators are in line with French good-practice recommendations (table 2).

Table 2: P4P prescribing quality indicators

	Indicator	Rationale	P4P threshold
In8	Proportion of diabetic patients over 50 (men) or 60 (women) treated with antihypertensives who receive statins	Prevention of cardiovascular disease for high risk patient	>=75%
In9	Proportion of patients older than 65 treated with vasodilators during the year	Vasodilators may cause falls for older patients	=<5%
In10	Proportion of patients older than 65 treated with long half-life benzodiazepines	Benzodiazepines may cause falls for older patients	=<5%
In11	Proportion of patients treated with long half-life benzodiazepines for 12 weeks or more	Benzodiazepines present a risk of addiction in case of prolonged use	=<12%
In12	Number of antibiotic prescriptions for patients aged 16-65 per 100 patients	To reduce the inappropriate prescription of antibiotics and antimicrobial resistances	=<37%

As these 12 indicators correspond to various areas of quality or efficiency areas, it was useful to build a global indicator that sums-up GPs global performance within the P4P perimeter. Before building this indicator, some indicators –those which have to be minimized in order to be in line with good practice recommendation- were transformed in order to be combined with other indicators which have to be as high as possible. For example, indicator In9 “Proportion of patients older than 65

treated with vasodilators during the year" for which P4P threshold is lower or equal to 5% was transformed in 9"Proportion of patients older than 65 not treated with vasodilators during the year" so that all indicators have finally to be maximized in order to be in line with good-practice recommendation. The global indicator that is built from all individual indicators is used to determine a set of top-ranked GPs according to this P4P perimeter. There are different ways of calculating this global indicator from the 12 indicators. In this article, two aggregated indicators were considered:

- The first indicator –**average indicator**- is the average of 12 In-P4P indicators. It provides a measure of average quality across each opportunity of care. This method gives equal value to all indicators, irrespective of how frequently each was triggered. This makes this indicator more suitable for comparing GPs with heterogeneous populations (32). However, this method has a number of drawbacks. Rarely triggered indicators have as much influence on the composite score as do more common indicators. This can justify to also consider a weighted indicator that gives more weight to frequent indicators and less to rare ones.
- The second indicator –**weighted indicator**- assigns different weight to each indicator in relation to their relative frequencies. Weights for each of the 12 InP4P indicators were calculated at the GP level, considering the ratio of the number of patients of the GP concerned by the indicator divided by the total number of patients concerned by In-P4P indicators of that GP. This second indicator ("weighted indicator") does not reflect the same picture of quality or efficiency prescribing as the final score can be influenced by an opportunistic behavior from the GP tempted to maximize it while concentrating its efforts on the most frequent indicators, to the detriment of the less usual ones.

Aggregating quality and efficiency indicators enable to rank GPs, from those who comply the most with P4P schemes to the GPs who are furthest from achieving them. In this article, it was chosen to distinguish top-ranked GPs in the P4P perimeter from aggregated indicators (average and weighted) according to three thresholds, 30%, 20% and 10%. Consequently, six different aggregated indicators are considered in this paper: Mean 30%, Mean 20%, Mean 10%, Weighted 30%, Weighted 20% and Weighted 10% (table 3).

Table 3: Thresholds defining top-ranked GPs and others

	Top-ranked GPs	Number of top-ranked GPs
Mean 30%	Average indicator >0.714	208
Mean 20%	Average indicator >0.727	139
Mean 10%	Average indicator >0.751	70
Weighted 30%	Weighted indicator >0.732	208
Weighted 20%	Weighted indicator >0.749	139
Weighted 10%	Weighted indicator>0.772	70

Note for the reader: A top ranked-GP according to the mean 30% indicator is defined as a GP who obtains a higher average score than 0.714 (calculated considering the 12 In P4P indicators). A top-ranked GP according to the weighted 30% indicator is a GP who obtains a higher weighted score than 0.732 (calculated considering the 12 In P4P indicators).
Data: IMS-Health Disease Analyzer 2012

Out P4P quality or efficiency indicators

In a second step, 9 new indicators (called **Out P4P**) were chosen by two French physicians' authors of this study from an international literature review on P4P schemes. None of these indicators are currently included in the French P4P scheme but some of them apply in other countries.

Table 4: Non-incentivized quality or efficiency indicators

	Indicator	Rationale	Max/ min	References
Out1	Proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids	Inhaled corticosteroids are considered as the first line treatment for asthma	Min	(33-42)
Out2	Proportion of patients diagnosed with a urinary tract infection treated by fosfomycin as first-line treatment	Fosfomycin is recommended as first line treatment for urinary tract infections	Max	(43)
Out3	Proportion of patients aged 65+ treated with NSAIDs, ACE inhibitors and a diuretic	The association of NSAIDs, ACE inhibitors and diuretics increases the risk of renal insufficiency	Min	(38, 44)
Out4	Proportion of multiple-sourced NSAIDs among all NSAIDs	Prescribing a greater share of multiple-sourced NSAIDs is supposed to increase prescribing efficiency	Max	(45)
Out5	Prescription rate of amoxicillin as first line treatment among antibiotics for patients with a respiratory infection	Amoxicillin is recommended as first line treatment for patients with a respiratory infection	Max	(46-50)
Out6	Proportion of diabetic patients being treated with metformin as first line treatment	Metformin is considered as the main option for first-line glucose lowering therapy	Max	(51-57)
Out7	Proportion of patients being treated for COPD without corticosteroids	Inhaled corticosteroids taken alone are not recommended	Min	(58-60)
Out8	Proportion of patients over 65 treated with 4 antihypertensives treatments and more	Prescription of more than four antihypertensives treatments for older people is associated with a higher iatrogenic risk	Min	(61)
Out9	Proportion of patients over 65 treated with 2 diuretics and more	Prescription of more than two diuretics for older people is associated with a higher iatrogenic risk	Min	(62)

Note for the reader: Out1 "Proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids" is a min indicator, which means that it has to be minimized in order to be in line with good-practice recommendations. On the contrary, Out2 "Proportion of patients diagnosed with a urinary tract infection treated by fosfomycin as first-line treatment" is a max indicator, which means that it has to be maximized in order to be in line with good-practice recommendations.

As it was done for In-P4P, indicators which have to be minimized in order to be in line with good practice recommendation were transformed in order to be associated with other indicators which have to be as high as possible.

Two aggregated **Out P4P** indicators were calculated from the 9 Out P4P indicators, one "**average OutP4P indicator**" and one "**weighted OutP4P indicator**".

In a final step, annual mean values of each score (average In P4P indicator (aggregated), In P4P indicators, average Out P4P indicator (aggregated), Out P4P indicators, weighted In P4P indicator (aggregated), weighted In P4P indicators, weighted Out P4P indicator (aggregated), weighted Out P4P indicators) were compared for the two types of GPs, top-ranked GPs and other GPs. Student's *t* test and the analysis of variance test were used to determine mean differences. Statistical significance for all analyses in this study was defined as $p < 0.05$ unless explicitly noted.

It was possible to calculate all 12 In-P4P indicators for 592 GPs (85.4%) among 693, and 11 out of 12 In-P4P indicators for 87 GPs more. For one GP, we were not able to calculate more than 4 indicators out of 12. Frequencies of the In-P4P may vary widely across GPs, reflecting differences in clinical situations. On average, indicator [In6] accounts for 16.3% of all patients concerned by In-P4P indicators (table 5). In-P4P efficiency indicators (In1-In7) are far more frequent on average than In-P4P quality indicators (In8-In12).

Table 5: Average frequencies of In-P4P and Out-P4P indicators

	Mean	Standard-deviation	Min	Max
In1.Proportion of multiple sourced antibiotics among all antibiotic prescriptions	0,1379	0,0660	0,0191	0,4441
In2.Proportion of multiple sourced Proton-Pump Inhibitors (PPI) among all PPI prescriptions	0,1313	0,0503	0,0305	0,4146
In3. Proportion of multiple sourced statins among all statins prescriptions	0,1283	0,0377	0,0076	0,2538
In4.Proportion of multiple sourced antihypertensive among all antihypertensive prescriptions	0,1499	0,0451	0,0328	0,3155
In5.Proportion of multiple sourced antidepressants among all antidepressants prescriptions	0,0935	0,0430	0,0073	0,3262
In6.Proportion of Angiotensin Converting Enzyme (ACE) inhibitor among ACE + sartans	0,1627	0,0414	0,0258	0,2892
In7. Proportion of patients treated with antiplatelet drugs also treated with aspirin	0,0107	0,0039	0,0026	0,0315
In8.Proportion of diabetes patients over 50 (M) or 60 (F) treated with antihypertensives who receive statins	0,0041	0,0018	0,0012	0,0181
In9.Proportion of patients older than 65 not treated with vasodilators during the year	0,0333	0,0206	0,0055	0,2529
In10.Proportion of patients older than 65 not treated with long half-life benzodiazepines	0,0333	0,0206	0,0055	0,2529
In11.Proportion of patients treated with long half-life benzodiazepines for less than 12 weeks	0,0165	0,0072	0,0033	0,0738
In12.Number of prescriptions out of antibiotics for patients aged 16-65 per 100 patients	0,1063	0,0685	0,0150	0,5848
Out1.Proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids	0,0124	0,0091	0,0013	0,0680
Out2.Proportion of patients diagnosed with a urinary tract infection treated by fosfomycin as first-line treatment	0,0208	0,0099	0,0048	0,0600
Out3. Proportion of patients aged 65+ with a risk of renal insufficiency not treated with association of NSAID, ACE inhibitors and a diuretic	0,1470	0,0846	0,0189	0,9221
Out4.Proportion of multiple-sourced NSAIDs among all NSAIDs	0,6214	0,1342	0,0704	0,9021
Out5.prescription rate of amoxicillin as first line treatment among antibiotics for patients with a respiratory infection	0,0756	0,0423	0,0081	0,2601
Out6.Proportion of diabetic patients being treated with metformin as first line treatment	0,0285	0,0129	0,0040	0,0915
Out7.Proportion of patients being treated for COPD without corticosteroids	0,0117	0,0103	0,0012	0,1088
Out8.Proportion of patients over 65 treated with less than 4 antihypertensive treatments	0,0575	0,0288	0,0078	0,2043
Out9. Proportion of patients over 65 treated with less than 2 diuretics	0,0575	0,0288	0,0078	0,2043

Note for the reader: Indicator In1 “Proportion of multiple sourced antibiotics among all antibiotic prescriptions” represents on average 13.8% of all patients concerned by In-P4P indicators. For the GP who receives the least proportion of patients concerned by this indicator, indicator In1 only accounts for 1.9% while it accounts for 44.4% for the GP who receives the greatest proportion of patients concerned by it.
Data: IMS-Health Disease Analyzer 2012

Results

As average indicator and weighted indicator reflect different aspects of GPs performance, some GPs may be considered as top-ranked with average indicator and not with weighted indicator (table 6).

Table 6: Number of GPs being top-ranked or not with the average or/and weighted indicator

Mean	Weighted	30%	20%	10%
Others	Others	415	492	588
Top-ranked	Others	70	62	35
Others	Top-ranked	70	62	35
Top-ranked	Top-ranked	138	77	35
		693	693	693

Note for the reader: 138 GPs are considered as top-ranked both for average and weighted indicators when the threshold considered is 30%. 415 GPs are not top-ranked GPs neither for average nor for weighted indicator when the threshold considered is 30%.
Data: IMS-Health Disease Analyzer 2012

Top-ranked GPs are more often younger than others (except when the top-ranked threshold is fixed at 10% level) and are more often women, except when the threshold is based on 20% weighted indicator (table 7). On the contrary, the number of patients does not significantly differ between top-ranked GPs and other GPs, regardless of the threshold chosen. Patient's average age only differs between top-ranked GPs and others for weighted indicators 30% and 20%.

Table 7: comparison of GPs characteristics depending on GPs being top-ranked or not

	Mean30			Mean20			Mean10			Weight30			Weight20			Weight10		
	TR	O	p	TR	O	p	TR	O	p	TR	O	p	TR	O	p	TR	O	p
GPs Age	**52,4**	**53,7**	0,045	**52,0**	**53,6**	0,029	**52,7**	**53,4**	0,492	**52,4**	**53,7**	0,048	**52,0**	**53,6**	0,05	**52,3**	**53,4**	0,239
	7,9	7,6		8,3	7,6		8,6	7,6		8,5	7,4		8,6	7,5		8,4	7,6	
Female GPs %	22,6	14,9		24,5	15,3		24,3	16,4		19,2	16,3		16,6	17,3		22,9	16,5	
Number of patients (average)	1473	1502	0,568	1469	1499	0,609	1462	1497	0,650	1518	1482	0,476	1566	1475	0,11	1586	1482	0,173
	557	625		569	615		543	612		613	602		651	593		662	598	
Patients' age (average)	39,1	39,9	0,073	39,0	39,8	0,095	**39,2**	**39,7**	0,436	**39,0**	**39,9**	0,045	**38,8**	**39,9**	0,04	**38,5**	**39,8**	0,057
	5,3	5,5		5,3	5,5		5,3	5,5		5,3	5,5		5,3	5,5		5,5	5,4	

Note for the reader: 30% Top-ranked GPs (according to the mean indicator30%) are significantly younger (52, 4) than other GPs (53, 7). On the contrary, there is no difference on the basis of age between 10% top-ranked GPs and others, whether GPs ranking lies on average indicator or weighted indicator. TR: top-ranked GPs. O: Other GPs. p=p-value. A test of proportion was implemented to test the difference of female GPs' proportion.
Data: IMS-Health Disease Analyzer 2012

Top-ranked GPs are determined according to the aggregated indicator (average or weighted). We then analyze scores obtained by GPs on individual indicators (In-P4P and Out-P4P), whether they are top-ranked or not. Whatever the threshold considered, top-ranked GPs systematically have higher scores than non-compliant GPs for indicators that belong to the French P4P perimeter (table 8 and

table 9) whether GPs are ranked according to average indicator or weighted indicator. The only exception is indicator In8 “Proportion of diabetic patients over 50 (men) or 60 (women) treated with antihypertensives who receive statins” for which no statistical difference is observed between top-ranked GPs and others according to weighted indicator.

When considering non-incentivized quality or efficiency indicators, results strongly differ according to indicators. Whether GPs are ranked according to average indicator or weighted indicator, top-ranked GPs have higher scores for the aggregated indicators (average or weighted) and each of the following single indicators (average or weighted): [Out3] proportion of patients aged 65+ with a risk of renal insufficiency not treated with NSAID, [Out4] proportion of multiple-sourced NSAIDs among all NSAIDs and [Out5] prescription rate of amoxicillin as first line treatment among antibiotics for patients with a respiratory infection. These results are observed for the three thresholds considered (30%, 20% and 10%).

On the contrary, top-ranked GPs do not reach significantly higher scores for four indicators out of nine when GPs ranking lies on average indicator (table 8): [Out2] proportion of patients diagnosed with urinary tract infection treated by fosfomycin as first-line treatment, [Out7] proportion of patients being treated for COPD without corticosteroids, [Out8] proportion of patients over 65 treated with less than four antihypertensive treatments and [Out9] proportion of patients over 65 treated with less than two diuretics.

When GPs are ranked according to the weighted indicator (table 9), there is no statistical difference between GPs for three indicators: [Out2] proportion of patients diagnosed with urinary tract infection treated by fosfomycin as first-line treatment, [Out6] proportion of diabetic patients being treated with metformin as first line treatment and [Out7] proportion of patients being treated for COPD without corticosteroids.

Table 8 : Annual mean values of quality and efficiency prescribing indicators depending on GPs being top-ranked or not (top-ranked GPs being defined according to the mean indicator)

	Mean30			Mean20			Mean10		
	TR	O	p	TR	O	p	TR	O	p
Quality and efficiency indicator in the P4P perimeter (aggregated indicator)	**0,743** (0,0287)	**0,674** (0,0259)	**<.0001**	**0,7538** (0,0254)	**0,6797** (0,0311)	**<.0001**	**0,7709** (0,0253)	**0,686** (0,0343)	**<.0001**
In1.Proportion of multiple sourced antibiotics among all antibiotic prescriptions	**0,880** (0,071)	**0,8328** (0,0912)	**<.0001**	**0,8855** (0,0718)	**0,8373** (0,0895)	**<.0001**	**0,8899** (0,0734)	**0,8422** (0,0886)	**<.0001**
In2.Proportion of multiple sourced Proton-Pump Inhibitors (PPI) among all PPI prescriptions	**0,998** (0,00691)	**0,9885** (0,0368)	**<.0001**	**0,9981** (0,00772)	**0,9897** (0,0346)	**<.0001**	**0,9985** (0,0051)	**0,9905** (0,0329)	**<.0001**
In3. Proportion of multiple sourced statins among all statins prescriptions	**0,7569** (0,1171)	**0,5911** (0,1413)	**<.0001**	**0,7935** (0,1066)	**0,6029** (0,1406)	**<.0001**	**0,8147** (0,0981)	**0,6212** (0,1473)	**<.0001**
In4.Proportion of multiple sourced antihypertensive among all antihypertensive prescriptions	**0,7288** (0,0927)	**0,6422** (0,1069)	**<.0001**	**0,7461** (0,0871)	**0,649** (0,1068)	**<.0001**	**0,7593** (0,0846)	**0,6578** (0,1081)	**<.0001**
In5.Proportion of multiple sourced antidepressants among all antidepressants prescriptions	**0,6736** (0,1388)	**0,5543** (0,1579)	**<.0001**	**0,6768** (0,1385)	**0,5682** (0,1601)	**<.0001**	**0,709** (0,1239)	**0,5768** (0,1603)	**<.0001**
In6.Proportion of Angiotensin Converting Enzyme (ACE) inhibitor among ACE + sartans	**0,4598** (0,1125)	**0,3728** (0,1038)	**<.0001**	**0,4708** (0,1087)	**0,381** (0,1077)	**<.0001**	**0,4929** (0,1095)	**0,3883** (0,1093)	**<.0001**
In7.Proportion of patients treated with antiplatelet drugs also treated with aspirin	**0,8282** (0,0768)	**0,771** (0,0893)	**<.0001**	**0,8387** (0,0748)	**0,7756** (0,0886)	**<.0001**	**0,8495** (0,0634)	**0,7813** (0,0895)	**<.0001**
In8.Proportion of diabetic patients over 50 (men) or 60 (women) treated with antihypertensives who receive statins	**0,6567** (0,1431)	**0,5341** (0,1732)	**<.0001**	**0,6729** (0,1309)	**0,5461** (0,1742)	**<.0001**	**0,7249** (0,106)	**0,5539** (0,1717)	**<.0001**
In9.Proportion of patients older than 65 not treated with vasodilators during the year	**0,9659** (0,0298)	**0,947** (0,0387)	**<.0001**	**0,967** (0,0301)	**0,9491** (0,038)	**<.0001**	**0,9743** (0,0297)	**0,9502** (0,0372)	**<.0001**
In10.Proportion of patients older than 65 not treated with long half-life benzodiazepines	**0,9408** (0,0311)	**0,924** (0,0422)	**<.0001**	**0,9407** (0,0325)	**0,9261** (0,0411)	**<.0001**	**0,9491** (0,0301)	**0,9268** (0,0403)	**<.0001**
In11.Proportion of patients treated with long half-life benzodiazepines for less than 12 weeks	**0,2369** (0,1367)	**0,191** (0,1213)	**<.0001**	**0,2471** (0,1409)	**0,1942** (0,1221)	**<.0001**	**0,2572** (0,1332)	**0,1989** (0,1259)	**0,0003**
In12.Number of prescriptions out of antibiotics for patients aged 16-65 per 100 patients	**0,7641** (0,0882)	**0,7175** (0,087)	**<.0001**	**0,7794** (0,086)	**0,7194** (0,0868)	**<.0001**	**0,7971** (0,0846)	**0,7241** (0,0875)	**<.0001**
Quality and efficiency indicator outside the P4P perimeter (aggregated indicator)	**0,727** (0,073)	**0,698** (0,063)	**<.0001**	**0,731** (0,077)	**0,701** (0,063)	**<.0001**	**0,835** (0,117)	**0,7415** (0,115)	**<.0001**

Out1.Proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids	**0,899** (0,136)	**0,873** (0,148)	**0,040**	0,901 (0,141)	0,876 (0,146)	0,096	**0,918** (0,097)	**0,877** (0,149)	0,003
Out2.Proportion of patients diagnosed with a urinary tract infection treated by fosfomycin as first-line treatment	0,326 (0,222)	0,290 (0,200)	0,073	0,323 (0,221)	0,295 (0,203)	0,224	0,347 (0,227)	0,295 (0,204)	0,080
Out3. Proportion of patients aged 65+ with a risk of renal insufficiency not treated with association of NSAID, ACE inhibitors and a diuretic	**0,942** (0,036)	**0,929** (0,044)	**<.0001**	**0,943** (0,036)	**0,931** (0,043)	0,001	**0,944** (0,033)	**0,932** (0,043)	0,005
Out4.Proportion of multiple-sourced NSAIDs among all NSAIDs	**0,781** (0,145)	**0,692** (0,151)	**<.0001**	**0,805** (0,137)	**0,697** (0,151)	**<.0001**	**0,826** (0,143)	**0,707** (0,151)	**<.0001**
Out5.prescription rate of amoxicillin as first line treatment among antibiotics for patients with a respiratory infection	**0,447** (0,219)	**0,386** (0,222)	**0,001**	**0,476** (0,213)	**0,386** (0,221)	**<.0001**	**0,500** (0,195)	**0,393** (0,223)	0,000
Out6.Proportion of diabetic patients being treated with metformin as first line treatment	**0,795** (0,098)	**0,769** (0,113)	**0,003**	**0,795** (0,099)	**0,773** (0,111)	**0,038**	**0,802** (0,093)	**0,774** (0,111)	**0,049**
Out7.Proportion of patients being treated for COPD without corticosteroids	0,488 (0,257)	0,510 (0,240)	0,324	0,464 (0,248)	0,513 (0,244)	0,058	0,502 (0,260)	0,503 (0,244)	0,961
Out8.Proportion of patients over 65 treated with less than 4 antihypertensive treatments	0,909 (0,050)	0,916 (0,053)	0,092	**0,906** (0,052)	**0,916** (0,052)	**0,042**	**0,899** (0,051)	**0,916** (0,052)	**0,011**
Out9. Proportion of patients over 65 treated with less than 2 diuretics	0,780 (0,074)	0,781 (0,086)	0,860	0,779 (0,077)	0,781 (0,084)	0,809	0,779 (0,084)	0,781 (0,082)	0,861

Note for the reader: GPs considered as top-ranked with indicator mean 30% have a significantly higher aggregated score (0,743) than other GPs (0,674). On the contrary, there is no statistical difference between the proportion of patients over 65 treated with less than 2 diuretics depending on GPs being top-ranked or not whatever the threshold considered. TR: Top-ranked GPs. O: Other GPs. The shaded areas in the table indicate that the difference between top-ranked GPs and others is not statistically significant at a 5% threshold. Number in brackets indicate standard deviations.

Data: IMS-Health Disease Analyzer 2012

Table 9: Annual mean values of quality and efficiency prescribing indicators depending on GPs being top-ranked or not (top-ranked GPs being defined according to the weighted indicator)

	Weight30			Weight20			Weight10		
	TR	O	p	TR	O	p	TR	O	p
Quality and efficiency indicator in the P4P perimeter (aggregated indicator)	**0,770** (0,038)	**0,669** (0,045)	**<.0001**	**0,785** (0,039)	**0,678** (0,048)	**<.0001**	**0,809** (0,043)	**0,687** (0,052)	**<.0001**
In1.Proportion of multiple sourced antibiotics among all antibiotic prescriptions	**0,881** (0,080)	**0,833** (0,088)	**<.0001**	**0,886** (0,078)	**0,837** (0,088)	**<.0001**	**0,894** (0,090)	**0,842** (0,087)	**<.0001**
In2.Proportion of multiple sourced Proton-Pump Inhibitors (PPI) among all PPI prescriptions	**0,995** (0,018)	**0,990** (0,035)	**0,0197**	**0,995** (0,014)	**0,990** (0,034)	**0,0139**	**0,997** (0,008)	**0,991** (0,033)	**0,0004**
In3. Proportion of multiple sourced statins among all statins prescriptions	**0,745** (0,131)	**0,597)** (0,142)	**<.0001**	**0,760** (0,125)	**0,611** (0,147)	**<.0001**	**0,788** (0,127)	**0,625** (0,149)	**<.0001**
In4.Proportion of multiple sourced antihypertensive among all antihypertensive prescriptions	**0,733** (0,096)	**0,641** (0,104)	**<.0001**	**0,737** (0,096)	**0,652** (0,107)	**<.0001**	**0,770** (0,100)	**0,658** (0,106)	**<.0001**
In5.Proportion of multiple sourced antidepressants among all antidepressants prescriptions	**0,668** (0,145)	**0,557** (0,157)	**<.0001**	**0,673** (0,130)	**0,569** (0,162)	**<.0001**	**0,685** (0,140)	**0,579** (0,161)	**<.0001**
In6.Proportion of Angiotensin Converting Enzyme (ACE) inhibitor among ACE + sartans	**0,462** (0,113)	**0,372** (0,103)	**<.0001**	**0,477** (0,115)	**0,380** (0,105)	**<.0001**	**0,506** (0,119)	**0,387** (0,107)	**<.0001**
In7. Proportion of patients treated with antiplatelet drugs also treated with aspirin	**0,821** (0,084)	**0,775** (0,088)	**<.0001**	**0,824** (0,086)	**0,779** (0,088)	**<.0001**	**0,834** (0,082)	**0,783** (0,089)	**<.0001**
In8.Proportion of diabetes patients over 50 (men) or 60 (women) treated with antihypertensives who receive statins	0,550 (0,201)	0,579 (0,162)	0,1029	0,557 (0,209)	0,574 (0,165)	0,4468	0,582 (0,215)	0,570 (0,170)	0,6749
In9.Proportion of patients older than 65 not treated with vasodilators during the year	**0,965** (0,032)	**0,947** (0,038)	**<.0001**	**0,967** (0,031)	**0,949** (0,038)	**<.0001**	**0,970** (0,032)	**0,951** (0,037)	**<.0001**
In10.Proportion of patients older than 65 not treated with long half-life benzodiazepines	**0,938** (0,049)	**0,925** (0,035)	**0,0011**	**0,943** (0,035)	**0,926** (0,040)	**<.0001**	**0,946** (0,037)	**0,927** (0,040)	**0,0001**
In11.Proportion of patients treated with long half-life benzodiazepines for less than 12 weeks	**0,189** (0,129)	**0,211** (0,127)	**0,0341**	**0,172** (0,125)	**0,213** (0,127)	**0,0009**	**0,172** (0,126)	**0,208** (0,128)	**0,0234**
In12.Number of prescriptions out of antibiotics for patients aged 16-65 per 100 patients	**0,753** (0,097)	**0,722** (0,085)	**0,0001**	**0,758** (0,094)	**0,725** (0,088)	**<.0001**	**0,764** (0,101)	**0,728** (0,088)	**0,0016**
Quality and efficiency indicator outside the P4P perimeter (aggregated indicator)	**0,7974** (0,1134)	**0,7311** (0,1156)	**<.0001**	**0,8119** (0,1108)	**0,7356** (0,1159)	**<.0001**	**0,8381** (0,1068)	**0,7411** (0,1161)	**<.0001**

Out1.Proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids	**0,8994** (0,1371)	**0,8729** (0,1478)	**0,037**	**0,8988** (0,1189)	**0,8764** (0,1505)	**0,0791**	**0,9119** (0,1197)	**0,8773** (0,1473)	**0,0384**
Out2.Proportion of patients diagnosed with a urinary tract infection treated by fosfomycin as first-line treatment	0,3077 (0,2196)	0,2971 (0,2013)	0,5966	0,3156 (0,2102)	0,2963 (0,2059)	0,3961	0,3387 (0,2148)	0,2959 (0,2056)	0,157
Out3. Proportion of patients aged 65+ with a risk of renal insufficiency not treated with association of NSAID, ACE inhibitors and a diuretic	**0,9477** (0,0378)	**0,9267** (0,0425)	**<.0001**	**0,956** (0,033)	**0,9272** (0,0424)	**<.0001**	**0,9298** (0,9607)	**0,0422** (0,031)	**<.0001**
Out4.Proportion of multiple-sourced NSAIDs among all NSAIDs	**0,7778** (0,1485)	**0,6938** (0,1496)	**<.0001**	**0,7936** (0,1515)	**0,7001** (0,149)	**<.0001**	**0,8285** (0,1504)	**0,7066** (0,1496)	**<.0001**
Out5.prescription rate of amoxicillin as first line treatment among antibiotics for patients with a respiratory infection	**0,4704** (0,223)	**0,3762** (0,2164)	**<.0001**	**0,4792** (0,215)	**0,3855** (0,2204)	**<.0001**	**0,491** (0,2123)	**0,3946** (0,2216)	**0,0009**
Out6.Proportion of diabetic patients being treated with metformin as first line treatment	0,7834 (0,1136)	0,7741 (0,1075)	0,3416	0,779 (0,1101)	0,7763 (0,1092)	0,8051	0,7747 (0,1161)	0,777 (0,1087)	0,8699
Out7.Proportion of patients being treated for COPD without corticosteroids	0,5031 (0,2504)	0,5034 (0,2431)	0,9904	0,5288 (0,2433)	0,4975 (0,2452)	0,2379	0,5157 (0,2389)	0,502 (0,2457)	0,6991
Out8.Proportion of patients over 65 treated with less than 4 antihypertensive treatments	**0,9232** (0,0514)	**0,9101** (0,0523)	**0,0029**	**0,9249** (0,0525)	**0,9113** (0,052)	**0,0067**	**0,9258** (0,0521)	**0,9127** (0,0523)	**0.0511**
Out9. Proportion of patients over 65 treated with less than 2 diuretics	**0,8034** (0,0849)	**0,7713** (0,0793)	**<.0001**	**0,8167** (0,0797)	**0,7719** (0,0805)	**<.0001**	**0,8161** (0,0857)	**0,7769** (0,081)	**0,0002**

Note for the reader: GPs considered as top-ranked with indicator mean 30% have a significantly higher aggregated score (0,770) than other GPs (0,669). On the contrary, there is no statistical difference between the proportion of patients over 65 treated with less than 2 diuretics depending on GPs being top-ranked or not whatever the threshold considered. TR: Top-ranked GPs. O: Other GPs. The shaded areas in the table indicate that the difference between top-ranked GPs and others is not statistically significant at a 5% threshold. Number in brackets indicate standard deviations.

Data: IMS-Health Disease Analyzer 2012

For indicator [Out2] proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids, there is a statistical difference between top-ranked GPs and others for two thresholds (30% and 10%) but not 20%, whether the ranking lies on average or weighted indicator.

Discussion

By definition, top-ranked GPs according to the French P4P perimeter systematically have better scores than other GPs for the aggregated incentivized indicators. This observation is confirmed for each single indicator, both for average and weighted indicators, and whatever the threshold. The only exception is for the weighted indicators [In8]"Proportion of diabetic patients over 50 (men) or 60 (women) treated with antihypertensives who receive statins" for which differences between top-ranked GPs and others are not statistically different. This may be explained by the fact that frequencies of efficiency indicators (indicators In1 to In7, table 5) are higher than frequencies of quality indicators (indicators In8 to In12, table 5). Consequently, weighted indicators favor GPs showing good performance on efficiency indicators, even if they achieve poorer performance on quality indicators. Indicator In8 is the least frequent quality indicator, which does not penalize GPs that have performed poorly on it.

Our results also show that top-ranked GPs do not necessarily obtain higher scores for non-incentivized indicators than the other GPs. When defined according to the average indicator, top-ranked GPs only obtain better scores than other GPs for 5 non-incentivized indicators out of 9: [Out1] Proportion of patients being treated for asthma with long-acting beta agonists without corticosteroids, [Out3] Proportion of patients aged 65+ with a risk of renal insufficiency not treated with NSAID, [Out4] Proportion of multiple-sourced NSAIDs among all NSAIDs, [Out5] prescription rate of amoxicillin as first line treatment among antibiotics for patients with a respiratory infection and [Out6] Proportion of diabetic patients being treated with metformin as first line treatment. Among these indicators, three of them Out3, Out4 and Out5 are far more common than other non-incentivized indicators, which would indicate that top-ranked GPs may have a greater awareness concerning good practice recommendations but only for widely disseminated non-incentivized indicators. Furthermore, our result on NSAID multiple sourced prescribing questions the existence of a spillover effect by which top-ranked GPs that already obtain high scores for incentivized multiple sourced indicators would also prescribe a greater share of multiple sourced drugs in non-incentivized indicators. This hypothesis would require confirmation while considering a study covering a greater number of non-incentivized multiple sourced indicators.

When top-ranked GPs are defined according to the average indicator, they do not obtain higher scores than other GPs for [Out2] Proportion of patients diagnosed with a urinary tract infection treated by fosfomycin as first-line treatment, [Out7] Proportion of patients being treated for COPD without corticosteroids, [Out8] Proportion of patients over 65 treated with less than 4 antihypertensive treatments and [Out9] Proportion of patients over 65 treated with less than 2 diuretics. When top-ranked GPs are defined according to weighted indicator, indicator [Out6] "Proportion of diabetic patients being treated with metformin as first line treatment" is not statistically different between top-ranked GPs and others while it was different when top-ranked GPs were determined according to average indicator. One may explain this situation considering that weighted indicator "weight30" lies on 208 GPs, 138 being also top-ranked in the "mean30" indicator, while 70 GPs are only considered as top-ranked in the weighted indicator and not in the average

indicator (table 4). Those 70 GPs have low scores for indicator Out6, which then cancels the difference between top-ranked GPs and others for this indicator. Our results slightly vary across aggregated indicators –average versus weighted- which tends to show that we do not obtain exactly the same picture of efficiency and quality prescribing while using one or another, which encourages approaches that lie on several indicators. However, both approaches –average versus weighted- show that top-ranked GPs within the P4P perimeter do not systematically perform better than other GPs on the scope of non-incentivized indicators.

Our results confirm those obtained by other countries (Spain: (18); UK: (63)): they show an imperfect correlation between In P4P compliance and Out P4P compliance. Consequently, they raise questions about the impact of P4P schemes that only lie on a limited set of quality or efficiency indicators because physicians may be tempted to concentrate their efforts on optimizing the scores obtained on incentivized indicators at the expense of quality or efficiency outside the P4P perimeter (3). They also suggest that some P4P schemes, as the French one, are condemned to involve an increasing set of indicators over time in order to disseminate quality of care more widely. At the same time, regulator shall be warned that increasing the number of incentivized indicators in an excessive way may also cause adverse effects since incentives may become unreadable for GPs(1).

There are limitations to our study. Our analysis is based on a database that contains 693 volunteer GPs in France in 2012. Volunteer GPs may bias the results as they may be different from other GPs. However, a comparison established between scores obtained from IMS Disease Analyzer and data from Public Health Insurance showed important similarities for numerous incentivized indicators: there were no differences for indicators In1, In4, In6, In7, In10 and In11. However, volunteer GPs from IMS had better results than GPs from Public Health Insurance for the prescription of multiple sourced PPI and statins (64% versus 54%) but smaller scores for multiple sourced statins (57% versus 66.5%). Volunteer GPs also had better scores for indicator In8, In9 and In12.

Furthermore, our study only concentrates on pharmaceutical prescribing quality and efficiency P4P indicators and not on all P4P indicators, i.e. only 12 indicators out of 29 indicators, which prevents from generalizing our results to the whole perimeter of P4P.

Conclusion

Our study shows an imperfect correlation between In P4P compliance and Out P4P compliance for pharmaceutical prescribing quality and efficiency indicators. French top-ranked GPs according to the P4P perimeter do not systematically obtain higher scores for non-incentivized quality or efficiency indicators, even if they reach better results than other GPs for more common non incentivized indicators.

These first results should be completed by integrating other Out P4P indicators such as polypharmacy indicators. Furthermore, further investigation is needed to better understand the correlation between In P4P indicator and Out P4P indicator while incorporating variables related to GPs (age, gender, number of patients…) in an econometric analysis that was not conducted in this article. Further extensions of the study could be to analyze the evolution of indicators over time, within and outside the P4P perimeter.

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