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General practitioner gender and use of diagnostic procedures: a French cross-sectional study in training practices

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ABSTRACT

Objectives The acceleration in the number of female doctors has led to questions about differences in how men and women practice medicine. The aim of this study was to assess the influence of general practitioner (GP) gender on the use of the three main categories of diagnostic procedures—clinical examinations, laboratory tests and imaging investigations.

Design Cross-sectional nationwide multicentre study.

Setting French training general practices.

Participants The patient sample included all the voluntary patients over a cumulative period of 5 days per office between November 2011 and April 2012. The GP sample included 85 males and 43 females.

Methods 54 interns in general practice, observing their GP supervisors, collected data about the characteristics of GPs and consultations, as well as the health problems managed during the visit and the processes of care associated with them. Using hierarchical multilevel mixed-effect logistic regression models, we performed multivariable analyses to assess differences in each of the three main categories of diagnostic procedures, and two specific multivariable analyses for each category, distinguishing screening from diagnostic or follow-up procedures. We searched for interactions between GP gender and patient gender or type of health problem managed.

Results This analysis of 45 582 health problems managed in 20 613 consultations showed that female GPs performed more clinical examinations than male GPs, both for screening (OR 1.75; 95% CI 1.19 to 2.58) and for diagnostic or follow-up purposes (OR 1.41; 95% CI 1.08 to 1.84). Female GPs also ordered laboratory tests for diagnostic or follow-up purposes more frequently (OR 1.21; 95% CI 1.03 to 1.43). Female GPs performed even more clinical examinations than male GPs to diagnose or follow-up injuries (OR 1.69; 95% CI 1.19 to 2.40).

Conclusion Further research on the appropriateness of diagnostic procedures is required to determine to what extent these differences are related to underuse or overuse.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study was a large multicentre national study.
⇒ It was based on a detailed and comprehensive practice-based collection of health problems and associated processes of care.
⇒ Data were collected in training practices, which may entail a selection bias.
⇒ Multivariable, multilevel analyses were adjusted for confounding factors such as the number of health problems managed during the consultation, but not for a possible influence of the interns who collected the data.
⇒ General practitioners diagnostic practices may have evolved since the time of data collection.

INTRODUCTION

As the number of female doctors rose during the 20th century in industrialised countries, questions have arisen about differences in how men and women practice medicine.[1] Some patterns of their practices, including content and style, have previously been compared. Female primary care physicians (PCPs) usually have a lower workload than their male counterparts and see more female patients.[2] According to an Australian study, female general practitioners (GPs) provide more clinical treatments while male GPs prescribe more medications.[3] Many studies report that female doctors provide more preventive care than males, especially cardiovascular risk assessments[4 5] and gynaecological cancer screening.[4 6] These findings have not, however, been consistently confirmed.[7] Female doctors are recognised to have a more patient-centred communication pattern than males.[8] Studies from Canada[9] and Hungary[10] report that female GPs provided a high quality of care, assessed by compliance with guidelines (higher)[9 10] and hospitalisation rates (lower).[9]

Few studies, however, have examined the influence of doctors' gender on the routine use of diagnostic procedures. The appropriateness of their use affects the quality and cost of medical care.[11] The main diagnostic procedures used in primary care are clinical examinations, laboratory tests and imaging.[12] According to one study in the USA, female

PCPs perform more basic clinical measurements such as blood pressure and more specific procedures, such as rectal or gynaecological examinations.[13] To our knowledge, no comprehensive data on clinical examinations by doctors' gender are available. Studies from Australia, Israel and Canada suggest that female GPs prescribe more laboratory tests than their male counterparts,[3 14 15] and two studies from Australia and the USA report that female primary care doctors may order more imaging investigations per visit.[3 16]

The aim of this study was therefore to assess the influence of doctors' gender on the use of diagnostic procedures in French general practices.

METHODS

Study design

This study is an ancillary analysis of the ECOGEN (Eléments de la COnsultation en médecine GENérale) study, an observational cross-sectional nationwide multicentre study investigation in French general practices from 28 November 2011 to 30 April 2012. The ECOGEN study aimed to describe the clinical activity of French GPs, especially the health problems managed and the associated processes of care.[17] It included 128 centres or GPs' offices. These doctors supervised general practice interns and were attached to one of the 27 participating French medical schools. Each intern was placed in two or three different practices and no practice had more than one intern.

The study included all home and office visits of the participating GPs, in predetermined half-day blocks per week distributed across the study period, for a total of 20 consultation-days per GP. GP participants provided consent to participate in the study, after being informed by their intern. Verbal consent was obtained from the patients or the parents of minor participants. Only visits for which patients refused participation were excluded.

Data collection

Data were collected by 54 interns in general practice, observing their GP supervisors. They were trained for this data collection, including in the use of the International Classification of Primary Care (ICPC-2).[18] They collected the data on paper forms at the end of each encounter and entered them daily in a secure central database via a dedicated website.

Data concerning the GPs' characteristics included age, gender, fees authorised (set by the government or the GP), mode of practice (solo, group, private multiprofessional, or public health centre), practice location, number of visits by medical sales representatives, by public healthcare insurance delegates and by or to patients. The data concerning the consultations included the patient's age, gender, socioprofessional category, health insurance status (specifically, exemption from fees due to low income, serious chronic disease, or a workplace accident or occupational disease), visit site (office or home), number of health problems managed and consultation length. The health problems managed and the associated processes of care performed as well as subsequent procedures prescribed or ordered during the visit were coded according to the ICPC-2 classification, with the support of a coding engine system.[19] The care processes included various preventive, diagnostic, curative, administrative and coordinative procedures. The ICPC-2 is organised in 17 chapters: 15 based on body systems for somatic health problems, one for psychological problems (P) and one for social problems (Z). It also includes the following six components: symptoms and complaints, infections, neoplasms, injuries, congenital anomalies and other diagnoses. We recoded the ICPC-2 components in five categories by merging 'congenital anomalies' and 'other diagnoses'.

Statistical analyses

The study sample of GPs was compared with the French GP population (Source: CNAM TS (Caisse Nationale d'Assurance Maladie des Travailleurs Salariés), 2012) using t-test for numerical data and χ^2 test for categorical data.

The dependent variables analysed were the performance of a clinical examination (yes/no), an order for a laboratory test (yes/no), and the order of an imaging investigation (yes/no) for each health problem managed. The clinical examination variable included the following ICPC-2 codes: complete medical examination/health evaluation (−30), partial medical examination/health evaluation (−31). The laboratory test variable included the following ICPC-2 codes: sensitivity test (−32), microbiological/immunological test (−33), blood test (−34), urine test (−35), stool test (−36), histological/exfoliative cytology (−37), other laboratory test (−38). Imaging investigations corresponded to the ICPC-2 diagnostic radiology/imaging code (−41).

For each dependent variable, we performed univariate and then multivariable analyses, using a logistic regression model. The multivariable analyses used hierarchical mixed-effect models with random intercepts for physician effect and including three levels: the physician, consultation and health problem.[20 21] For each of these dependent variables, we secondarily performed two specific multivariable analyses separating diagnostic procedures used for screening purposes and those for diagnostic or follow-up purposes. We identified the screening procedures in the database as the diagnostic processes of care associated with health problems coded with either no disease (A97) or health maintenance/preventive medicine (A98). The diagnostic or follow-up procedures were the diagnostic processes of care associated with health problems coded with any other ICPC-2 rubric. We built the multivariable models by selecting the independent variables with a $p \leq 0.20$ in the univariate analyses.[22] We forced the patient age variable in all the multivariable models, in order to adjust for this potential confounding factor. We searched for interactions between GP gender and patient gender or ICPC-2 components in each multivariable model. Finally, we searched for interactions between each of the 20 most frequent health problems managed and GP gender using dedicated multivariable, multilevel models, whenever the dependent variable was associated with GP gender. The

statistical significance threshold was set at 5%. We used Stata software (release V.16) to perform all these analyses.[23]

Patient and public involvement

Patients were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

The participating GPs were mostly men (66.4%), aged 53 years on average (SD=7.9), with 5188 (SD=1708) consultations per year on average, and practising mainly in urban areas (61.7%) and group practices (61.7%). The GP sample did not differ from the French GP population for gender, mean age, mean annual number of consultations, practice location and type of fees authorised; however, the age class distribution differed (table 1). In the course of 20 613 consultations, they managed 45 582 health problems. A clinical examination was performed for 29 220 of these health problems (64.1%), a laboratory test ordered for 5766 (12.7%) and an imaging investigation ordered for 2282 (5.0%). These three types of procedures accounted for 98.7% of the 42 650 diagnostic procedures used; the main remaining 1.3% were electrical tracings (0.5%), physical function tests (0.3%) and endoscopies (0.2%).

The univariate analyses (table 2) showed that female GPs ordered more laboratory tests than their male counterparts (OR 1.17; 95% CI 1.01 to 1.35), while clinical examinations and imaging did not differ by gender. GP age had no influence on any of these procedures. In the multivariable analyses of all diagnostic procedures (table 3), however, female GPs performed more clinical examinations than males (OR 1.40; 95% CI 1.10 to 1.77) and ordered more laboratory tests (OR 1.20; 95% CI 1.03 to 1.41), with no differences for imaging. Clinical examinations were also performed more frequently by GPs who were older than 60 years or practised in semirural areas and for patients younger than 14 years or older than 75 years. Clinical examinations were less frequently performed by GPs authorised to set their own fees, for female patients, and for patients with a workplace accident or occupational disease or those unemployed. Laboratory tests were more frequently ordered for patients aged from 15 to 29 years and from 60 to 74 years, and for those with serious chronic diseases. They were ordered less often for patients younger than 14 years, those from lower socioprofessional categories (manual workers, office workers, intermediate professions), the unemployed and the retired, those with a workplace accident or occupational disease, and during home visits. Imaging investigations were ordered more frequently for female patients and less frequently for those younger than 29 years or older than 75, working as office workers or unemployed, with serious chronic diseases or during home visits.

In the multivariable analyses restricted to screening procedures (table 4), female GPs performed more clinical examinations than males (OR 1.75; 95% CI 1.19 to 2.58); no differences were seen for laboratory tests or imaging investigations. Clinical examinations were performed more frequently for patients younger than 4 years and less frequently by GPs authorised to set their own fees, for patients aged between 15 and 29 years and between 60 and 74 years, and those with serious chronic diseases. Laboratory tests were ordered more frequently for patients older than 60 years and less frequently for those younger than 14. Imaging investigations were more frequently ordered for female patients and for those aged between 60 and 74 years; they were less frequent for children under 4.

In the multivariable analyses restricted to diagnostic and follow-up procedures (table 5), female GPs performed more clinical examinations than males (OR 1.41; 95% CI 1.08 to 1.84) and ordered more laboratory tests (OR 1.21; 95% CI 1.03 to 1.43); no gender differences were observed for imaging investigations. Clinical examinations were more frequently performed by GPs who practised in semirural areas and for patients younger than 29 years; they were less frequent for patients with workplace accidents or occupational diseases. Clinical examination was more frequently performed for infections, injuries and other diagnoses and less frequently for neoplasms, as compared with symptoms and complaints. Laboratory tests were ordered more frequently for patients aged 15–29 years or with serious chronic diseases. Inversely, they were ordered less frequently for patients younger than 14 years, for those from lower socioprofessional categories or unemployed, with workplace accidents or occupational diseases, and during home visits. Imaging investigations were less frequently ordered for patients younger than 29 years and older than 75, classified as office workers or retired, with serious chronic diseases and during home visits.

No interaction was found between GP gender and patient gender in any of the multivariable models. We found a single interaction between GP gender and health problem components, in the model restricted to procedures used for diagnostic or follow-up purposes, indicating that female GPs performed even more clinical examinations than male GPs to manage injuries, as compared with symptoms and complaints (OR 1.69; 95% CI 1.19 to 2.40) (table 5). Among the 20 most frequent health problems managed, we found positive interactions for clinical examinations between female GP gender and health maintenance/preventive medicine (OR 2.62; 95% CI 2.02 to 3.41), back syndrome without radiating pain (OR 2.70; 95% CI 1.55 to 4.70) and constipation (OR 2.15; 95% CI 1.34 to 3.45), indicating that female GPs performed even more clinical examinations than male GPs to manage these health problems, as compared with all other health problems. We also found positive interactions for laboratory tests between female GP gender and lipid disorder (OR 1.67; 95% CI 1.26 to 2.21) or osteoporosis (OR 5.79; 95% CI 2.15 to 15.58) (table 6).

Table 1 Participating GPs' characteristics by gender (n=128) and comparisons with the French population of GPs (n=54 050, source: CNAM Ts) (France, 2011–2012)

	Study sample			French population	
	Male GP N=85 n (%)	Female GP N=43 n (%)	Total N=128 n (%)	Total N=54 050 n (%)	P value
GP gender					0.40
Male			85 (66.4)	37 699 (69.8)	
Female			43 (33.6)	16 349 (30.2)	
Missing data				2	
GP age (years)					<0.001
32–49	19 (22.4)	18 (41.9)	37 (28.9)	17 465 (32.4)	
50–54	25 (29.4)	13 (30.2)	38 (29.7)	10 808 (20.0)	
55–59	28 (32.9)	10 (23.3)	38 (29.7)	11 195 (20.8)	
≥60	13 (15.3)	2 (4.7)	15 (11.7)	14 473 (26.8)	
Mean age (SD) (years)	53.9 (7.5)	50.1 (8.0)	52.64 (7.88)	52.73	0.90
Missing data				109	
Annual no of consultations (SD)					
0–4999	43 (50.6)	31 (72.1)	74 (57.8)		
5000–10 500	42 (49.4)	12 (27.9)	54 (42.2)		
Mean annual number of consultation (SD)	5525.4 (1724.9)	4519.7 (1478.2)	5187.5 (1708.2)	4960	0.13
Practice location					0.20
Rural areas	12 (14.1)	4 (9.3)	16 (12.5)	7 696 (15.7)	
Urban clusters	24 (28.2)	9 (20.9)	33 (25.8)	14 947 (30.4)	
Urban areas	49 (57.7)	30 (69.8)	79 (61.7)	26 438 (53.9)	
Missing data				4 969	
Mode of practice					
Solo practice	21 (24.7)	6 (14.0)	27 (21.1)		
Group practice	49 (57.6)	30 (69.8)	79 (61.7)		
Private multiprofessional practice	14 (16.5)	6 (14.0)	20 (15.6)		
Public health centre	1 (1.2)	1 (2.3)	2 (1.6)		
Fees					0.75
Set by the health authorities	79 (92.9)	39 (90.7)	118 (92.2)	50 216 (92.9)	
Set by the GP	6 (7.1)	4 (9.3)	10 (7.8)	3 834 (7.1)	
Visits by medical sales representatives					
No	40 (47.1)	18 (41.9)	58 (45.3)		
Yes	45 (52.9)	25 (58.1)	70 (54.7)		
Visits by public healthcare insurance delegates					
No	17 (20.0)	9 (20.9)	26 (20.3)		
Yes	68 (80.0)	34 (79.1)	102 (79.7)		

CNAM TS, Caisse Nationale d'Assurance Maladie des Travailleurs Salariés; GP, general practitioner.

DISCUSSION

Female compared with male GPs performed more clinical examinations for both screening and diagnostic/follow-up purposes. They also ordered more laboratory tests for the latter purpose. Imaging investigations for screening were ordered most frequently for female patients.

Comparison with existing literature

To our knowledge, a finding that female GPs perform more frequently clinical examinations than male GPs has not been reported before. It is consistent with

Table 2 Characteristics of GPs, consultations and health problems associated with the three types of diagnostic procedures used (clinical examinations, laboratory tests, imaging) per health problem managed in univariate analyses (France, 2011–2012)

	Clinical examination 29 220/45 582 (64.1%)		Laboratory test 5766/45 582 (12.7%)		Imaging 2282/45 582 (5.0%)	
	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
GPs' characteristics						
Gender						
Male	18300/28 580 (64.0%)	Ref	3388/28 580 (11.8%)	Ref	1357/28 580 (4.8%)	Ref
Female	10920/17 002 (64.2%)	1.12 (0.88 to 1.43)	2378/17 002 (14.0%)	1.17 (1.01 to 1.35)	925/17 002 (5.4%)	1.15 (0.96 to 1.37)
Age (years)						
32–49	7168/11 389 (62.9%)	Ref	1463/11 389 (12.8%)	Ref	686/11 389 (6.0%)	Ref
50–54	8578/13 205 (65.0%)	0.92 (0.67 to 1.25)	1696/13 205 (12.8%)	1.05 (0.87 to 1.28)	632/13 205 (4.8%)	0.87 (0.69 to 1.09)
55–59	7942/12 395 (64.1%)	0.88 (0.65 to 1.20)	1454/12 395 (11.7%)	0.93 (0.77 to 1.12)	564/12 395 (4.5%)	0.80 (0.63 to 1.00)
≥60	5532/8593 (64.4%)	0.98 (0.69 to 1.39)	1153/8593 (13.4%)	1.09 (0.88 to 1.36)	400/8593 (4.7%)	0.82 (0.63 to 1.06)
Annual no of consultations						
0–4999	16528/25 982 (63.6%)	Ref	3279/25 982 (12.6%)	Ref	1307/25 982 (5.0%)	Ref
5000–10 500	2692/19 600 (64.8%)	1.35 (1.08 to 1.70)	2487/19 600 (12.7%)	1.06 (0.92 to 1.22)	975/19 600 (5.0%)	0.92 (0.77 to 1.10)
Practice location						
Rural	3501/5187 (67.5%)	1.27 (0.89 to 1.80)	604/5187 (11.6%)	1.00 (0.80 to 1.24)	241/5187 (4.7%)	0.91 (0.70 to 1.19)
Semirural	8637/13 402 (64.5%)	1.36 (1.04 to 1.77)	1727/13 402 (12.9%)	1.02 (0.87 to 1.21)	632/13 402 (4.7%)	0.82 (0.67 to 1.00)
Urban	17082/26 993 (63.3%)	Ref	3435/26 993 (12.7%)	Ref	1409/26 993 (5.2%)	Ref
Mode of practice						
Solo practice	5652/9096 (62.1%)	0.73 (0.55 to 0.97)	999/9096 (11.0%)	0.86 (0.72 to 1.03)	425/9096 (4.7%)	1.01 (0.81 to 1.25)
Group practice	17990/27 104 (66.4%)	Ref	3497/27 104 (12.9%)	Ref	1272/27 104 (4.7%)	Ref
Private multiprofessional practice	5257/8924 (58.9%)	0.96 (0.70 to 1.31)	1205/8924 (13.5%)	1.02 (0.84 to 1.25)	564/8924 (6.3%)	1.21 (0.96 to 1.54)
Public health centre	321/458 (70.1%)	1.07 (0.43 to 2.65)	65/458 (14.2%)	1.17 (0.66 to 2.06)	21/458 (4.6%)	0.95 (0.46 to 1.95)
Fees						
Set by the health authorities	27384/42 274 (64.8%)	Ref	5350/42 274 (12.7%)	Ref	2071/42 274 (4.9%)	Ref
Set by the GP	1836/3308 (55.5%)	0.65 (0.43 to 0.99)	416/3308 (12.6%)	1.06 (0.82 to 1.38)	211/3308 (6.4%)	1.26 (0.92 to 1.72)
Visits by medical sales representatives						
No	12311/19 726 (62.4%)	Ref	2484/19 726 (12.6%)	Ref	1034/19 726 (5.2%)	Ref
Yes	16909/25 856 (65.4%)	1.28 (1.02 to 1.61)	3282/25 856 (12.7%)	0.99 (0.86 to 1.14)	1248/25 856 (4.8%)	0.86 (0.72 to 1.02)
Visits by public healthcare insurance delegates						
No	4671/7374 (63.3%)	Ref	1025/7374 (13.9%)	Ref	418/7374 (5.7%)	Ref
Yes	24549/38 208 (64.3%)	1.15 (0.86 to 1.53)	4741/38 208 (12.4%)	0.89 (0.75 to 1.06)	1864/38 208 (4.9%)	0.85 (0.68 to 1.05)
Characteristics of consultations						

Continued

Table 2 Continued

	Clinical examination 29 220/45 582 (64.1%)		Laboratory test 5766/45 582 (12.7%)		Imaging 2282/45 582 (5.0%)	
	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Patient gender						
Male	11957/18 220 (65.6%)	Ref	2342/18 220 (12.8%)	Ref	856/18 220 (4.7%)	Ref
Female	17263/27 362 (63.1%)	0.90 (0.87 to 0.94)	3424/27 362 (12.5%)	0.95 (0.90 to 1.01)	1426/27 362 (5.2%)	1.12 (1.02 to 1.22)
Patient age (years)						
0–4	2101/2548 (82.5%)	2.37 (2.10 to 2.66)	78/2548 (3.1%)	0.21 (0.17 to 0.27)	29/2548 (1.1%)	0.15 (0.10 to 0.22)
5–14	1783/2136 (83.5%)	2.55 (2.24 to 2.90)	163/2136 (7.6%)	0.59 (0.50 to 0.71)	105/2136 (4.9%)	0.68 (0.55 to 0.85)
15–29	3080/4426 (69.6%)	1.18 (1.08 to 1.28)	630/4426 (14.2%)	1.19 (1.06 to 1.34)	246/4426 (5.6%)	0.78 (0.66 to 0.92)
30–44	4205/6332 (66.4%)	Ref	783/6332 (12.4%)	Ref	441/6332 (7.0%)	Ref
45–59	1210/1867 (64.8%)	0.90 (0.80 to 1.00)	230/1867 (12.3%)	1.02 (0.87 to 1.19)	123/1867 (6.6%)	0.97 (0.79 to 1.19)
60–74	10922/18 297 (59.7%)	0.74 (0.69 to 0.79)	2662/18 297 (14.6%)	1.22 (1.11 to 1.33)	1023/18 297 (5.6%)	0.79 (0.71 to 0.89)
≥75	5919/9976 (59.3%)	0.74 (0.69 to 0.79)	1220/9976 (12.2%)	1.03 (0.93 to 1.14)	315/9976 (3.2%)	0.45 (0.39 to 0.53)
Socioprofessional category						
Farmer, craftsman, shopkeeper, business owner	898/1364 (65.8%)	0.94 (0.81 to 1.09)	230/1364 (16.9%)	1.04 (0.86 to 1.26)	93/1364 (6.8%)	0.91 (0.70 to 1.19)
Executive, intellectual profession	1255/2079 (60.4%)	Ref	336/2079 (16.2%)	Ref	170/2079 (8.2%)	Ref
Intermediate profession	1549/2298 (67.4%)	1.15 (1.01 to 1.30)	317/2298 (13.8%)	0.80 (0.68 to 0.95)	164/2298 (7.1%)	0.88 (0.70 to 1.11)
Office worker	5140/7739 (66.4%)	1.05 (0.94 to 1.17)	1011/7739 (13.1%)	0.77 (0.67 to 0.89)	476/7739 (6.2%)	0.80 (0.66 to 0.97)
Manual worker	992/1508 (65.8%)	1.03 (0.89 to 1.19)	172/1508 (11.4%)	0.70 (0.57 to 0.86)	94/1508 (6.2%)	0.86 (0.65 to 1.12)
Retired	11836/19 944 (59.4%)	0.79 (0.71 to 0.87)	2697/19 944 (13.5%)	0.83 (0.73 to 0.94)	828/19 944 (4.2%)	0.54 (0.45 to 0.65)
Unemployed	7550/10 650 (70.9%)	1.32 (1.19 to 1.46)	1003/10 650 (9.4%)	0.53 (0.46 to 0.61)	457/10 650 (4.3%)	0.55 (0.45 to 0.66)
Exemption from medical fees for low income						
No	28128/43 873 (64.1%)	Ref	5572/43 873 (12.7%)	Ref	2183/43 873 (5.0%)	Ref
Yes	1092/1709 (63.9%)	1.01 (0.91 to 1.13)	194/1709 (11.3%)	0.86 (0.73 to 1.00)	99/1709 (5.8%)	1.17 (0.95 to 1.45)
Exemption from medical fees for a serious chronic disease						
No	20874/31 322 (66.6%)	Ref	3680/31 322 (11.8%)	Ref	1755/31 322 (5.6%)	Ref
Yes	8346/14 260 (58.5%)	0.72 (0.69 to 0.75)	2086/14 260 (14.6%)	1.28 (1.21 to 1.36)	527/14 260 (3.7%)	0.63 (0.57 to 0.70)
Exemption from medical fees for a workplace accident or occupational disease						
No	28681/44 653 (64.2%)	Ref	5717/44 653 (12.8%)	Ref	2219/44 653 (5.0%)	Ref
Yes	539/929 (58.0%)	0.75 (0.66 to 0.86)	49/929 (5.3%)	0.39 (0.29 to 0.52)	63/929 (6.8%)	1.44 (1.10 to 1.87)
Consultation length (min.)						
1–10	5672/8621 (65.8%)	Ref	789/8621 (9.2%)	Ref	286/8621 (3.3%)	Ref
11–15	8420/12 683 (66.4%)	0.99 (0.94 to 1.06)	1504/12 683 (11.9%)	1.34 (1.22 to 1.47)	594/12 683 (4.7%)	1.43 (1.24 to 1.66)

Continued

Table 2 Continued

	Clinical examination 29 220/45 582 (64.1%)		Laboratory test 5766/45 582 (12.7%)		Imaging 2282/45 582 (5.0%)	
	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
16–20	6584/10 344 (63.6%)	0.87 (0.82 to 0.93)	1383/10 344 (13.4%)	1.57 (1.42 to 1.73)	528/10 344 (5.1%)	1.62 (1.39 to 1.88)
21–30	6192/10 092 (61.4%)	0.78 (0.72 to 0.83)	1512/10 092 (15.0%)	1.81 (1.64 to 2.00)	628/10 092 (6.2%)	2.03 (1.74 to 2.36)
>30	2352/3842 (61.2%)	0.74 (0.67 to 0.81)	578/3842 (15.0%)	1.94 (1.70 to 2.20)	246/3842 (6.4%)	2.15 (1.77 to 2.60)
No of health problems managed						
1	7240/8472 (85.5%)	9.43 (8.44 to 10.54)	1127/8472 (13.3%)	1.23 (1.06 to 1.42)	763/8472 (9.0%)	4.78 (3.71 to 6.16)
2	7831/11 154 (70.2%)	3.52 (3.19 to 3.88)	1374/11 154 (12.3%)	1.11 (0.96 to 1.28)	563/11 154 (5.0%)	2.49 (1.93 to 3.21)
3	6139/9933 (61.8%)	2.39 (2.16 to 2.63)	1230/9933 (12.4%)	1.12 (0.98 to 1.29)	394/9933 (4.0%)	1.90 (1.47 to 2.46)
4	3653/6632 (55.1%)	1.75 (1.58 to 1.94)	852/6632 (12.8%)	1.19 (1.03 to 1.38)	263/6632 (4.0%)	1.95 (1.49 to 2.55)
5	2077/4085 (50.8%)	1.42 (1.28 to 1.58)	471/4085 (11.5%)	1.02 (0.88 to 1.20)	138/4085 (3.4%)	1.60 (1.20 to 2.13)
6	1187/2478 (47.9%)	1.30 (1.15 to 1.46)	354/2478 (14.3%)	1.33 (1.12 to 1.57)	70/2478 (2.8%)	1.29 (0.92 to 1.79)
≥7	1093/2828 (38.6%)	Ref	358/2828 (12.7%)	Ref	91/2828 (3.2%)	Ref
Consultation site						
GP's office	27119/42 199 (64.3%)	Ref	5410/42 199 (12.8%)	Ref	2209/42 199 (5.2%)	Ref
Patient's home	2101/3383 (62.1%)	0.90 (0.84 to 0.98)	356/3383 (10.5%)	0.79 (0.70 to 0.89)	73/3383 (2.2%)	0.42 (0.33 to 0.53)
Characteristics of health problems managed (components)						
Symptoms and complaints	5052/9092 (55.6%)	Ref	1085/9092 (11.9%)	Ref	902/9092 (9.9%)	Ref
Infections	6273/6780 (92.5%)	10.64 (9.61 to 11.78)	603/6780 (8.9%)	0.72 (0.65 to 0.80)	203/6780 (3.0%)	0.27 (0.23 to 0.32)
Neoplasms	404/780 (51.8%)	0.84 (0.72 to 0.98)	106/780 (13.6%)	1.17 (0.94 to 1.46)	67/780 (8.6%)	0.87 (0.67 to 1.14)
Injuries	806/1060 (76.0%)	2.61 (2.24 to 3.04)	27/1060 (2.6%)	0.19 (0.13 to 0.28)	138/1060 (13.0%)	1.33 (1.09 to 1.61)
Other diagnoses	16685/27 870 (59.9%)	1.21 (1.15 to 1.27)	3945/27 870 (14.2%)	1.21 (1.13 to 1.31)	972/27 870 (3.5%)	0.32 (0.29 to 0.36)

The numerators and denominators can be read as follows: 28 580 out of 45 582 health problems were managed by male GPs and 17 002 by female GPs; among the 28 580 health problems managed by male GPs, 18 300 were associated with a clinical examination.
GPs, general practitioners.

Table 3 Characteristics of GPs, consultations and health problems associated with the three types of diagnostic procedures used (clinical examinations, laboratory tests, imaging) per health problem managed in the multivariable analyses (France, 2011–2012)

	Clinical examination 29 220/45 582 (64.1%) OR (95% CI)	Laboratory test 5766/45 582 (12.7%) OR (95% CI)	Imaging 2282/45 582 (5.0%) OR (95% CI)
GPs' characteristics			
Gender			
Male	Ref	Ref	Ref
Female	1.40 (1.10 to 1.77)	1.20 (1.03 to 1.41)	1.13 (0.94 to 1.35)
Age (years)			
32–49	Ref	Ref	Ref
50–54	1.05 (0.78 to 1.41)	1.01 (0.83 to 1.23)	0.89 (0.71 to 1.11)
55–59	1.12 (0.83 to 1.51)	0.92 (0.75 to 1.12)	0.83 (0.66 to 1.04)
≥60	1.42 (1.00 to 2.01)	1.06 (0.85 to 1.34)	0.84 (0.64 to 1.09)
Practice location			
Rural	1.29 (0.92 to 1.81)	1.01 (0.81 to 1.26)	0.96 (0.74 to 1.24)
Semi-rural	1.46 (1.13 to 1.89)	1.05 (0.89 to 1.24)	0.91 (0.75 to 1.11)
Urban	Ref	Ref	Ref
Fees			
Set by health authorities	Ref	Ref	Ref
Set by GPs	0.57 (0.37 to 0.87)	0.96 (0.73 to 1.26)	1.07 (0.78 to 1.47)
Characteristics of consultations			
Patient gender			
Male	Ref	Ref	Ref
Female	0.95 (0.91 to 0.99)	0.97 (0.91 to 1.03)	1.14 (1.04 to 1.26)
Patient age (years)			
0–4	1.51 (1.31 to 1.74)	0.24 (0.19 to 0.31)	0.18 (0.12 to 0.27)
5–14	1.69 (1.46 to 1.97)	0.69 (0.56 to 0.84)	0.69 (0.53 to 0.89)
15–29	1.09 (0.99 to 1.19)	1.27 (1.13 to 1.43)	0.72 (0.61 to 0.85)
30–44	Ref	Ref	Ref
45–59	1.05 (0.93 to 1.18)	1.02 (0.87 to 1.20)	1.08 (0.87 to 1.33)
60–74	1.06 (0.98 to 1.15)	1.18 (1.07 to 1.31)	1.17 (1.02 to 1.34)
≥75	1.20 (1.09 to 1.33)	1.01 (0.89 to 1.16)	0.86 (0.70 to 1.06)
Socioprofessional category			
Farmer, craftsman, shopkeeper, business owner	1.00 (0.85 to 1.17)	1.01 (0.83 to 1.22)	0.94 (0.71 to 1.24)
Executive, intellectual profession	Ref	Ref	Ref
Intermediate profession	1.07 (0.93 to 1.22)	0.78 (0.66 to 0.93)	0.83 (0.65 to 1.05)
Office worker	1.04 (0.93 to 1.16)	0.77 (0.67 to 0.89)	0.78 (0.64 to 0.94)
Manual worker	1.01 (0.86 to 1.19)	0.73 (0.59 to 0.90)	0.82 (0.62 to 1.09)
Retired	1.04 (0.93 to 1.17)	0.80 (0.69 to 0.93)	0.85 (0.69 to 1.05)
Unemployed	0.87 (0.77 to 0.98)	0.69 (0.59 to 0.80)	0.78 (0.63 to 0.97)
Exemption from medical fees for a serious chronic disease			
No	Ref	Ref	Ref
Yes	1.07 (1.02 to 1.13)	1.25 (1.17 to 1.34)	0.80 (0.71 to 0.90)
Exemption from medical fees for a workplace accident or occupational disease			
No	Ref	Ref	Ref
Yes	0.66 (0.57 to 0.77)	0.39 (0.29 to 0.52)	0.81 (0.61 to 1.07)

Continued

Table 3 Continued

	Clinical examination 29 220/45 582 (64.1%) OR (95% CI)	Laboratory test 5766/45 582 (12.7%) OR (95% CI)	Imaging 2282/45 582 (5.0%) OR (95% CI)
No of health problems managed			
1	7.10 (6.29 to 8.01)	2.02 (1.73 to 2.36)	5.57 (4.26 to 7.28)
2	3.20 (2.88 to 3.56)	1.45 (1.25 to 1.68)	2.51 (1.92 to 3.27)
3	2.36 (2.13 to 2.62)	1.29 (1.12 to 1.49)	1.77 (1.36 to 2.31)
4	1.80 (1.62 to 2.00)	1.27 (1.10 to 1.48)	1.77 (1.35 to 2.32)
5	1.44 (1.29 to 1.61)	1.06 (0.90 to 1.24)	1.52 (1.14 to 2.04)
6	1.33 (1.18 to 1.50)	1.33 (1.13 to 1.58)	1.18 (0.85 to 1.64)
≥7	Ref	Ref	Ref
Consultation place			
GP's office	Ref	Ref	Ref
Patient's home	0.96 (0.88 to 1.05)	0.75 (0.66 to 0.85)	0.50 (0.39 to 0.65)
Characteristics of health problems managed (components)			
Symptoms and complaints	Ref	Ref	Ref
Infections	7.78 (7.00 to 8.64)	0.78 (0.70 to 0.87)	0.23 (0.20 to 0.27)
Neoplasms	0.74 (0.63 to 0.87)	1.18 (0.95 to 1.47)	1.09 (0.83 to 1.42)
Injuries	2.11 (1.80 to 2.47)	0.18 (0.12 to 0.26)	1.00 (0.82 to 1.24)
Congenital anomalies/Other diagnoses	1.29 (1.22 to 1.36)	1.23 (1.14 to 1.32)	0.35 (0.32 to 0.39)
GPs' variance	0.362	0.128	0.141
Marginal explained variance coefficient	0.226	0.088	0.168
Conditional explained variance coefficient	0.303	0.122	0.203

GPs, general practitioners.

earlier studies of a few basic clinical measurements reporting that female GPs checked blood pressure, height and weight more often than males.[5 13] The even higher difference observed for clinical examination for screening purposes is also consistent with the greater level of prevention and screening usually provided by female GPs.[4] Conversely, KL Bertakis reported that male doctors in the USA spent more time on technical practice behaviours, such as medical history tacking and physical examination; but this result was presumably not adjusted for potential confounding factors such as patient gender and health problem number and type.[24] The particularly high frequency of clinical examination by female GPs in injured patients is an original finding. A number of studies have explored patient gender issues in the management of traumatic injuries in emergency settings, but none explored the influence of physician gender.[25] Our finding may be explained by a different practice style related to physician gender, as suggested in a Canadian study which found that female physicians better managed pain in emergency departments than male physicians.[26] Studies of various designs, based on frequency per health problem,[3] per encounter[3] or per patient[14] have previously reported that female GPs order more laboratory tests than male doctors. In our study, however, female GPs ordered more laboratory tests for diagnostic and follow-up but not for screening. This result is consistent with studies showing that female GPs see more patients with endocrine and female genital health problems, which are usually monitored by laboratory tests.[3 27]

Beyond their overall higher frequency of clinical examination and laboratory tests, female GPs performed even more clinical examinations or ordered even more laboratory tests than male GPs in some of the most frequent health problems managed, as compared with all other health problems. In particular, female GPs performed much more clinical examinations than male GPs for preventive purposes, which is consistent with the observation that female PCPs performed pap smear tests[28] and skin examination for melanoma detection[29] more frequently than male PCPs in the USA. Regarding back syndrome, according to a systematic review, low back pain initial management is not exposed to doctor's gender effect; however, no data were available on patient clinical examination.[30] Our finding regarding laboratory testing to monitor lipid disorders is consistent with Hungarian data that showed that female GP gender was associated with regular lipid profile measurement in patients with diabetes or hypertension.[31] The finding regarding laboratory testing to monitor osteoporosis is consistent with a study in the USA, which found much more frequent ordering of 25-OH vitamin D by female than male

Table 4 Characteristics of GPs, consultations and health problems associated with the three types of diagnostic procedures considered (clinical examinations, laboratory tests, imaging) per health problem managed, restricted to those for screening, in the multivariable analyses (France, 2011–2012)

	Clinical examination 3480/6224 (55.9%) OR (95% CI)	Laboratory test 1011/6224 (16.2%) OR (95% CI)	Imaging 144/6224 (2.3%) OR (95% CI)
GPs' characteristics			
Gender			
Male	Ref	Ref	Ref
Female	1.75 (1.19 to 2.58)	1.22 (0.97 to 1.54)	1.12 (0.71 to 1.76)
Age (years)			
32–49	Ref	Ref	Ref
50–54	1.18 (0.74 to 1.90)	0.87 (0.65 to 1.15)	0.49 (0.28 to 0.85)
55–59	1.13 (0.70 to 1.82)	0.93 (0.68 to 1.25)	0.65 (0.36 to 1.16)
≥60	1.70 (0.97 to 2.98)	1.01 (0.72 to 1.42)	0.50 (0.25 to 0.98)
Annual no of consultations			
0–4999	Ref	Ref	Ref
5000–10 500	1.30 (0.91 to 1.87)	1.05 (0.85 to 1.31)	0.64 (0.41 to 1.02)
Fees			
Set by health authorities	Ref	Ref	Ref
Set by GP	0.44 (0.22 to 0.85)	1.11 (0.75 to 1.64)	1.75 (0.84 to 3.61)
Characteristics of consultations			
Patient gender			
Male	Ref	Ref	Ref
Female	0.95 (0.84 to 1.07)	0.87 (0.75 to 1.01)	3.23 (2.03 to 5.15)
Patient age (years)			
0–4	1.38 (1.05 to 1.82)	0.03 (0.01 to 0.08)	0.21 (0.06 to 0.69)
5–14	0.91 (0.66 to 1.25)	0.12 (0.06 to 0.28)	0.62 (0.21 to 1.85)
15–29	0.67 (0.53 to 0.84)	1.11 (0.84 to 1.47)	0.46 (0.21 to 1.02)
30–44	Ref	Ref	Ref
45–59	1.31 (0.94 to 1.82)	1.19 (0.82 to 1.74)	0.57 (0.17 to 1.96)
60–74	0.76 (0.62 to 0.93)	1.81 (1.43 to 2.29)	1.89 (1.11 to 3.23)
≥75	1.12 (0.83 to 1.52)	1.42 (1.01 to 1.99)	1.01 (0.43 to 2.36)
Socioprofessional category			
Farmer, craftsman, shopkeeper, business owner	0.87 (0.59 to 1.29)	1.12 (0.74 to 1.71)	1.75 (0.67 to 4.58)
Executive, intellectual profession	Ref	Ref	Ref
Intermediate profession	1.33 (0.94 to 1.88)	0.84 (0.57 to 1.23)	0.83 (0.32 to 2.11)
Office worker	1.20 (0.92 to 1.58)	0.87 (0.65 to 1.18)	1.12 (0.56 to 2.25)
Manual worker	1.21 (0.79 to 1.85)	1.07 (0.68 to 1.68)	0.36 (0.05 to 2.91)
Retired	1.00 (0.75 to 1.34)	0.80 (0.58 to 1.10)	0.84 (0.41 to 1.74)
Unemployed	0.92 (0.68 to 1.23)	0.76 (0.55 to 1.05)	0.95 (0.44 to 2.06)
Exemption from medical fees for low income			
No	Ref	Ref	Ref
Yes	0.92 (0.69 to 1.23)	0.65 (0.41 to 1.03)	1.34 (0.55 to 3.26)
Exemption from medical fees for a serious chronic disease			
No	Ref	Ref	Ref
Yes	0.68 (0.57 to 0.81)	0.90 (0.74 to 1.09)	0.78 (0.48 to 1.27)
No of health problems managed			

Continued

Table 4 Continued

	Clinical examination 3480/6224 (55.9%) OR (95% CI)	Laboratory test 1011/6224 (16.2%) OR (95% CI)	Imaging 144/6224 (2.3%) OR (95% CI)
1	4.87 (3.32 to 7.15)	0.92 (0.60 to 1.40)	1.58 (0.63 to 3.95)
2	2.18 (1.55 to 3.07)	0.75 (0.53 to 1.07)	0.68 (0.30 to 1.55)
3	1.60 (1.14 to 2.25)	0.77 (0.55 to 1.10)	0.86 (0.39 to 1.89)
4	1.24 (0.88 to 1.76)	1.22 (0.86 to 1.74)	0.83 (0.37 to 1.88)
5	1.22 (0.84 to 1.76)	0.91 (0.62 to 1.33)	1.36 (0.60 to 3.09)
6	0.98 (0.65 to 1.48)	1.61 (1.07 to 2.40)	0.87 (0.32 to 2.38)
≥7	Ref	Ref	Ref
GPs' variance	0.787	0.124	0.215
Marginal explained variance coefficient	0.096	0.393	0.249
Conditional explained variance coefficient	0.270	0.415	0.295

GPs, general practitioners.

PCPs.[32] No inversed interaction was observed in favour of male GPs for any of the top 20 health problems, which accounted for almost half the health problems managed.

Given concerns about increasing expenditures for medical tests,[11] studies of the appropriateness of diagnostic procedures have focused mainly on their overuse.[33] GPs in the USA and the UK acknowledge that they regularly prescribe unnecessary tests.[11 34] Nonetheless, underuse accounts for a substantial portion of inappropriate test use.[33 35] Both errors expose patients to adverse events: underuse of both clinical examinations and laboratory tests can result in missed or delayed diagnosis,[36] while their inappropriate use in asymptomatic adults can lead to overdiagnosis and overtreatment[37 38] without reducing patient mortality.[39] A few studies have found that female GPs prescribe slightly more recommended tests than males for the follow-up of chronic conditions such as diabetes and hypertension.[9 10] These findings tend to favour the underuse of diagnostic procedures by male GPs, although this conclusion depends on the frequency thresholds used. Since female GPs are more reluctant to deal with uncertainty than male GPs,[40] they might also overuse diagnostic procedures to reassure themselves about the risk of diagnostic oversights.

In this study, GP gender had no influence on the frequency per health problem of imaging investigation orders. This finding is consistent with the results of an Australian study.[3] Previous studies have found, however, that female GPs order more imaging investigations per encounter than male GPs,[3 16] perhaps because their patients report a higher number of health problems per visit.[2] Moreover, screening mammograms ordered for female patients may explain this higher rate of imaging orders. The likelihood of this interpretation is supported by the finding of a US study that patient gender did not influence imaging orders when screening mammograms were excluded.[16]

Implications for research and practice

Given that these analyses were adjusted for various patient and health problem characteristics, it is likely that the differences in clinical examination and laboratory test use observed between male and female GPs are due to their inappropriate use by male and/or female GPs. Further research is required to determine the extent to which these differences may be related to underuse or overuse of these procedures, for few studies have explored their appropriateness by doctors' gender.[9 10]

Recommendations about the use of diagnostic procedures are frequently imprecise, inapplicable or lack evidence, for example, about follow-up intervals.[41 42] Since appraisals of procedure overuse or underuse are usually based on clinical practice guidelines, improving guideline quality should optimise the appropriateness of procedures and reduce their differential use by female and male GPs.

As training in test-ordering can lead to long-term improvement in the use and cost of laboratory tests,[43 44] developing programmes for initial and continuing medical education is another way to reduce these differences. Multifaceted interventions aimed at both GPs and patients, including reminders and audit/feedback, may help reduce use of low-value diagnostic procedures.[45]

Strengths and limitations

Because the participating GPs all trained and supervised GP interns, they were likely to be different from other GPs. Nonetheless, they were representative of French GPs for gender, mean age (although not for age class), mean annual number of consultations, practice location and type of fees authorised. Another French study has reported that their patients can be considered globally similar to those of GPs who do not train interns.[46]

Table 5 Characteristics of GPs, consultations and health problems associated with the three types of diagnostic procedures used (clinical examinations, laboratory tests, imaging) per health problem managed, restricted to those of diagnostic or follow-up purposes, in the multivariable analyses (France, 2011–2012)

	Clinical examination 25 740/39 358 (65.4%) OR (95% CI)	Laboratory test 4755/39 358 (12.1%) OR (95% CI)	Imaging 2138/39 358 (5.4%) OR (95% CI)
GPs' characteristics			
Gender			
Male	Ref	Ref	Ref
Female	1.41 (1.08 to 1.84)	1.21 (1.03 to 1.43)	1.13 (0.94 to 1.35)
Age (years)			
32–49	Ref	Ref	Ref
50–54	1.02 (0.73 to 1.41)	1.03 (0.83 to 1.27)	0.92 (0.73 to 1.16)
55–59	1.10 (0.80 to 1.53)	0.92 (0.74 to 1.14)	0.82 (0.65 to 1.04)
60+	1.36 (0.93 to 2.00)	1.07 (0.83 to 1.36)	0.86 (0.65 to 1.13)
Practice location			
Rural	1.33 (0.92 to 1.91)	1.00 (0.79 to 1.27)	0.94 (0.72 to 1.23)
Urban	1.49 (1.12 to 1.96)	1.04 (0.87 to 1.25)	0.91 (0.74 to 1.11)
Urban	Ref	Ref	Ref
Fees			
Set by health authorities	Ref	Ref	Ref
Set by GP	0.60 (0.38 to 0.95)	0.93 (0.69 to 1.25)	1.05 (0.76 to 1.46)
Characteristics of consultations			
Patient gender			
Male	Ref	Ref	Ref
Female	0.95 (0.90 to 1.00)	0.98 (0.91 to 1.04)	1.07 (0.98 to 1.18)
Patient age (years)			
0–4	2.41 (1.96 to 2.96)	0.39 (0.30 to 0.51)	0.21 (0.14 to 0.32)
5–14	2.58 (2.13 to 3.12)	0.86 (0.69 to 1.06)	0.73 (0.56 to 0.95)
15–29	1.27 (1.14 to 1.42)	1.31 (1.15 to 1.49)	0.75 (0.63 to 0.90)
30–44	Ref	Ref	Ref
45–59	1.01 (0.88 to 1.15)	0.97 (0.81 to 1.16)	1.09 (0.87 to 1.35)
60–74	1.10 (1.01 to 1.19)	1.06 (0.95 to 1.19)	1.10 (0.95 to 1.27)
≥75	1.18 (1.06 to 1.31)	0.95 (0.82 to 1.10)	0.82 (0.66 to 1.01)
Socioprofessional category			
Farmer, craftsman, shopkeeper, business owner	1.01 (0.84 to 1.21)	0.98 (0.79 to 1.22)	0.88 (0.65 to 1.17)
Executive, intellectual profession	Ref	Ref	Ref
Intermediate profession	0.98 (0.84 to 1.15)	0.78 (0.64 to 0.95)	0.81 (0.63 to 1.03)
Office worker	0.98 (0.86 to 1.11)	0.76 (0.64 to 0.89)	0.74 (0.60 to 0.90)
Manual worker	0.94 (0.79 to 1.12)	0.68 (0.54 to 0.86)	0.81 (0.61 to 1.08)
Retired	1.00 (0.88 to 1.14)	0.83 (0.70 to 0.98)	0.83 (0.67 to 1.03)
Unemployed	0.84 (0.74 to 0.96)	0.69 (0.58 to 0.81)	0.75 (0.60 to 0.93)
Exemption from medical fees for a serious chronic disease			
No	Ref	Ref	Ref
Yes	1.08 (1.02 to 1.15)	1.38 (1.28 to 1.49)	0.79 (0.70 to 0.89)
Exemption from medical fees for a workplace accident or occupational disease			
No	Ref	Ref	Ref
Yes	0.62 (0.53 to 0.73)	0.36 (0.26 to 0.51)	0.74 (0.55 to 0.99)

Continued

Table 5 Continued

	Clinical examination 25 740/39 358 (65.4%) OR (95% CI)	Laboratory test 4755/39 358 (12.1%) OR (95% CI)	Imaging 2138/39 358 (5.4%) OR (95% CI)
No of health problems managed			
1	7.20 (6.32 to 8.20)	2.25 (1.90 to 2.67)	6.15 (4.63 to 8.16)
2	3.23 (2.88 to 3.62)	1.61 (1.37 to 1.90)	2.89 (2.18 to 3.82)
3	2.33 (2.09 to 2.61)	1.38 (1.17 to 1.62)	1.92 (1.45 to 2.54)
4	1.77 (1.58 to 1.98)	1.23 (1.04 to 1.45)	1.90 (1.43 to 2.54)
5	1.39 (1.23 to 1.56)	1.06 (0.89 to 1.26)	1.52 (1.11 to 2.07)
6	1.30 (1.15 to 1.48)	1.28 (1.06 to 1.54)	1.23 (0.86 to 1.74)
≥7	Ref	Ref	Ref
Consultation place			
GP's office	Ref	Ref	Ref
Patient's home	1.01 (0.92 to 1.11)	0.73 (0.64 to 0.84)	0.54 (0.42 to 0.70)
Characteristics of health problems managed (components)			
Symptoms and complaints	Ref	Ref	Ref
Infections	7.10 (6.24 to 8.09)	0.71 (0.64 to 0.80)	0.22 (0.19 to 0.26)
Neoplasms	0.76 (0.62 to 0.93)	1.18 (0.95 to 1.47)	1.12 (0.86 to 1.46)
Injuries	1.81 (1.49 to 2.19)	0.17 (0.11 to 0.26)	0.99 (0.81 to 1.22)
Other diagnoses	1.51 (1.41 to 1.62)	1.16 (1.07 to 1.25)	0.40 (0.36 to 0.44)
Interactions between GP gender and health problems managed (components)			
Gender × infections	1.13 (0.91 to 1.41)		
Gender × neoplasms	1.06 (0.75 to 1.49)		
Gender × injuries	1.69 (1.19 to 2.40)		
Gender × other diagnoses	0.93 (0.83 to 1.04)		
GPs' variance	0.427	0.148	0.149
Marginal explained variance coefficient	0.252	0.073	0.170
Conditional explained variance coefficient	0.338	0.112	0.206

GPs, general practitioners.

We could not adjust analyses for a possible influence of the interns, as it would have introduced a level of collinearity with GP characteristics into the multivariable models. However, the standardised process used for data collection and the observing role of the interns during the study limited the risk of confounding bias due to this factor.

The study data were collected in 2011–2012. In the recent years, the sex ratio female/male of the GPs practicing in France has still substantially increased (from 0.64 in 2010 to 1.02 in 2020).[47] The diagnostic practices of GPs may have also evolved as observed in Australia (with an increase in the number of pathology tests and of imaging investigations from 6.0 to 7.1 per 100 problems managed between 2006–2007 and 2015–16).[48] However, it is unlikely that the gaps observed between female and male GPs in this study have much changed in the meantime, since the medical education does not differ by gender and no incentive specific to GP gender has been provided in France.

The higher use of diagnostic procedures by female compared with male GPs may be due to a lower frequency of visits for chronic diseases. No such finding has been reported, however, and female GPs tend to ask patients to come back for follow-up visits at shorter intervals than male GPs.[13 49]

We could not include consultation length in our analyses, although it may be a confounding factor, given that consultations with female GPs are usually longer than those of males.[2 50] However, the statistical models were adjusted for the number of health problems managed.

CONCLUSIONS

The results of this study indicate that female GPs perform clinical examinations and order laboratory

Table 6 Search for interactions between the top 20 health problems managed and GP gender for clinical examinations and laboratory tests in multivariable analyses†

	Clinical examination 29220/45582 (64.1%)	Laboratory test 5766/45582 (12.7%)
	OR (95% CI)	OR (95% CI)
Health maintenance/preventive medicine (n=5000)		
Female vs male (Health maintenance/preventive medicine)	2.62 (2.02 to 3.41)	1.06 (0.86 to 1.31)
Female vs male (All other health problems)	1.28 (1.02 to 1.62)	1.21 (1.04 to 1.42)
Interaction, p value	<0.001	0.11
Hypertension, uncomplicated (n=3189)		
Female vs male (Hypertension, uncomplicated)	1.82 (1.22 to 2.70)	1.33 (1.02 to 1.74)
Female vs male (All other health problems)	1.41 (1.11 to 1.79)	1.19 (1.02 to 1.39)
Interaction, p value	0.13	0.34
Upper respiratory infection, acute (n=1969)		
Female vs male (Upper respiratory infection, acute)	1.69 (0.80 to 3.60)	1.03 (0.59 to 1.80)
Female vs male (All other health problems)	1.38 (1.10 to 1.75)	1.20 (1.03 to 1.40)
Interaction, p value	0.58	0.59
Lipid disorder (n=1691)		
Female vs male (Lipid disorder)	1.38 (1.00 to 1.90)	1.67 (1.26 to 2.21)
Female vs male (All other health problems)	1.37 (1.09 to 1.73)	1.19 (1.02 to 1.39)
Interaction, p value	0.97	0.01
No disease (n=1235)		
Female vs male (No disease)	1.38 (0.98 to 1.93)	1.65 (1.03 to 2.64)
Female vs male (All other health problems)	1.38 (1.09 to 1.73)	1.19 (1.02 to 1.39)
Interaction, p value	1.0	0.16
Depressive disorder (n=1216)		
Female vs male (Depressive disorder)	0.95 (0.67 to 1.35)	0.45 (0.14 to 1.39)
Female vs male (All other health problems)	1.40 (1.11 to 1.77)	1.21 (1.03 to 1.41)
Interaction, p value	0.01	0.08
Diabetes, non-insulin dependent (n=1093)		
Female vs male (Diabetes, non-insulin dependent)	1.44 (0.99 to 2.08)	1.23 (0.91 to 1.66)
Female vs male (All other health problems)	1.38 (1.09 to 1.73)	1.20 (1.02 to 1.41)
Interaction, p value	0.78	0.86
Acute bronchitis/bronchiolitis (n=697)		
Female vs male (Acute bronchitis/bronchiolitis)		1.43 (0.57 to 3.57)
Female vs male (All other health problems)		1.20 (1.03 to 1.40)
Interaction, p value	*	0.70
Sleep disturbance (n=669)		
Female vs male (Sleep disturbance)	0.70 (0.40 to 1.22)	0.61 (0.06 to 5.97)
Female vs male (All other health problems)	1.39 (1.10 to 1.75)	1.20 (1.03 to 1.40)
Interaction, p value	0.01	0.56
Hypothyroidism/thyrotoxicosis (n=647)		
Female vs male (Hypothyroidism/thyrotoxicosis)	2.10 (1.38 to 3.19)	2.02 (1.40 to 2.93)
Female vs male (All other health problems)	1.37 (1.09 to 1.72)	1.19 (1.02 to 1.39)
Interaction, p value	0.02	<0.01
Osteoarthrosis, other (n=576)		
Female vs male (Osteoarthrosis, other)	1.62 (1.06 to 2.49)	0.84 (0.23 to 3.06)

Continued

Table 6 Continued

	Clinical examination 29220/45582 (64.1%)	Laboratory test 5766/45582 (12.7%)
	OR (95% CI)	OR (95% CI)
Female vs male (All other health problems)	1.38 (1.09 to 1.73)	1.20 (1.03 to 1.40)
Interaction, p value	0.38	0.59
Back syndrom without radiating pain (n=482)		
Female vs male (Back syndrom without radiating pain)	2.70 (1.55 to 4.70)	0.63 (0.20 to 2.04)
Female vs male (All other health problems)	1.37 (1.09 to 1.72)	1.20 (1.03 to 1.40)
Interaction, p value	0.01	0.28
Anxiety disorder/anxiety state (n=474)		
Female vs male (Anxiety disorder/anxiety state)	1.16 (0.71 to 1.90)	
Female vs male (All other health problems)	1.38 (1.09 to 1.73)	
Interaction, p value	0.45	*
Constipation (n=451)		
Female vs male (Constipation)	2.15 (1.34 to 3.45)	2.29 (0.71 to 7.44)
Female vs male (All other health problems)	1.37 (1.09 to 1.72)	1.20 (1.03 to 1.40)
Interaction, p value	0.04	0.27
Bursitis/tendinitis/synovitis NOS (n=435)		
Female vs male (Bursitis/tendinitis/synovitis NOS)	1.32 (0.75 to 2.34)	0.46 (0.05 to 4.01)
Female vs male (All other health problems)	1.38 (1.10 to 1.73)	1.20 (1.03 to 1.40)
Interaction, p value	0.87	0.38
Back syndrome with radiating pain (n=429)		
Female vs male (Back syndrome with radiating pain)	1.63 (0.92 to 2.89)	0.73 (0.19 to 2.84)
Female vs male (All other health problems)	1.38 (1.09 to 1.73)	1.20 (1.03 to 1.40)
Interaction, p value	0.52	0.47
Atrial fibrillation/flutter (n=408)		
Female vs male (Atrial fibrillation/flutter)	0.90 (0.50 to 1.61)	1.03 (0.63 to 1.67)
Female vs male (All other health problems)	1.38 (1.10 to 1.74)	1.21 (1.03 to 1.41)
Interaction, p value	0.12	0.50
Oesophagus disease (n=388)		
Female vs male (Oesophagus disease)	2.13 (1.28 to 3.54)	1.60 (0.31 to 8.10)
Female vs male (All other health problems)	1.37 (1.09 to 1.72)	1.20 (1.03 to 1.40)
Interaction, p value	0.06	0.73
Osteoporosis (n=379)		
Female vs male (Osteoporosis)	1.60 (0.85 to 3.04)	5.79 (2.15 to 15.58)
Female vs male (All other health problems)	1.38 (1.10 to 1.74)	1.19 (1.02 to 1.39)
Interaction, p value	0.63	<0.01
Vitamin/nutritional deficiency (n=370)		
Female vs male (Vitamin/nutritional deficiency)	0.81 (0.28 to 2.33)	1.17 (0.59 to 2.33)
Female vs male (All other health problems)	1.39 (1.10 to 1.74)	1.20 (1.03 to 1.40)
Interaction, p value	0.31	0.94

The top 20 health problems accounted for 21 798 (47.8%) out of 45 582 health problems managed.
*The test for interaction could not be processed when the proportion of GPs performing clinical examination or ordering a laboratory test was 0% or 100%.
†These 20 multivariable analyses were performed using multilevel models adjusted for all the variables included in the models presented in table 3.
NOS, not otherwise specified.

tests for diagnostic or follow-up purposes more frequently than male GPs. These differences in practices were observed overall and proved to be even stronger in the management of injuries and of some of the most frequent health problems. Further research on the appropriateness of diagnostic procedures is required to determine to what extent these gender gaps are related to underuse or overuse. Improving guidelines quality and GP education on diagnostic procedures should reduce these gaps.

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