

ORIGINAL RESEARCH

Frequency and determinants of technical procedures in French general practice: a cross-sectional study

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ABSTRACT:

Introduction: Technical skills have many areas of application in general practice and are a dimension of medical competence. Several studies have attempted to describe the technical procedures performed in general practice but most had limitations in the data collection process, the scope of the procedures

addressed, or the healthcare actors involved. No French comparable data have been published. The aim of the present study was therefore to describe the frequency and type of technical procedures in French general practice, and to assess their determinants, in particular rurality.

Methods: The present study was ancillary to the ECOGEN (*Eléments de la COnsultation en médecine GENérale*) study, which was an observational cross-sectional, multicentre, nationwide study conducted in 128 French general practices. Data were collected on 20 613 patient–GP encounters, including the characteristics of GPs and encounters, as well as the health problems managed during the encounter and their associated processes of care; the latter two variables were coded according to the International Classification of Primary Care classification. The GPs' practice location was first classified as rural area, urban cluster, or urban area; the former two categories were combined for analysis. The various technical procedures were classified according to the framework of the International Classification of Process in Primary Care. The frequency of each technical procedure was compared according to GP practice location. The dependent variable analysed was the performance of at least one technical procedure per each health problem managed. Bivariate analysis was performed for all independent variables followed by multivariate analysis for key variables, using a hierarchical model including three levels: the physician, the encounter, the health problem managed.

Results: The data included 2202 technical procedures performed.

Keywords:

clinical laboratory, France, general practice, injections, rurality, skills, technical procedures.

At least one technical procedure was performed in 9.9% of encounters and for 4.6% of health problems managed. The two most frequent groups of technical procedures performed were injections (44.2% of all procedures) and clinical laboratory procedures (17.0%). The following procedures were more often performed by GPs practicing in a rural area or an urban cluster than those practicing in an urban area: injection of joints, bursae, tendons and tendon sheaths (4.1% v 1.2% of all procedures), manipulation and osteopathy (10.3% v 0.4%), excision/biopsy of superficial lesions (1.7% v 0.5%), and cryotherapy (1.7% v 0.3%). Conversely, the following procedures were more often performed by GPs practicing in urban areas: vaccine injection (46.6% v 32.1%), point-of-care testing for group A streptococci (11.8% v 7.6%), and ECG (7.6% v 4.3%). GPs practicing in a rural area or an urban cluster performed more often technical procedures than those practising in an urban area (odds ratio=1.31, 95% confidence interval 1.04–1.65), according to the multivariate model.

Conclusion: Technical procedures were more frequently performed and more complex when they were performed in French rural and urban cluster areas. More studies are required to assess patients' needs regarding technical procedures.

FULL ARTICLE:

Introduction

In general practice, technical procedures have many areas of application, including prevention (eg vaccination or cervical smear), diagnosis (eg group A streptococcus testing), and treatment (eg wound dressing)¹. They require specific skills that are based on both knowledge and manual abilities^{2–4}. Along with communication, knowledge, clinical reasoning, emotions, values and reflection, technical skills are a dimension of medical competence⁵ and a part of the general practice curriculum in many countries^{6,7}. Lists of core technical procedures have been developed in Canada, the US and Australia to serve as bases for training general practice students, but none are currently available in France^{2–4}.

Several studies have attempted to describe the technical procedures performed in general practice, especially in the above-cited countries^{8–21}, and it is of note that many found that rural GPs perform more technical procedures than urban GPs^{10–15,18}. However, most studies had limitations in the data collection process (declarative data)^{10–12,19–21}, the scope of the procedures addressed (in the absence of standard classification)^{13,14,16–18}, or the healthcare actors involved (including students or specialists other than GPs)^{9,15}. In particular, they were performed in at least 18.4% of encounters in Australian general practice in 2015–16⁸. However, no comparable French data have been published.

The aim of the present study was therefore to describe the frequency and type of technical procedures performed in French general practice, and to assess the procedure determinants, in particular rurality.

Methods

Study design

This study was ancillary to the ECOGEN (*Eléments de la*

COnsultation en médecine GENérale) study, an observational, cross-sectional, multicentre, nationwide study conducted in French general practice from November 2011 to April 2012²². Its aim was to describe the clinical activity of French GPs. It involved a representative sample of 128 centres (offices of GPs who were also interns' trainers) attached to one of the 27 collaborating French medical universities. All encounters at the office and home visits were included during 20 working days distributed across the study period. Patient refusal to participate was the only non-inclusion criterion.

Data collection

Data were collected by 54 interns in general practice, acting as observers of their GP trainers. They had been trained to collect and code encounter data according to the International Classification of Primary Care (ICPC-2)¹. They collected the data of each encounter and entered these daily into a secured central database using a dedicated server.

Data about GP characteristics included age, sex, fee agreement (fixed or free), mode of practice (solo practice, group practice, practice in a multi-professional centre), annual number of encounters, and practice location. Three categories for GP practice location (rural area, urban cluster, urban area) were derived from the classification of the French National Institute of Statistics and Economic Studies (*Institut national de la statistique et des études économiques*, INSEE), based on 2007 census data and using both the name of the commune and the postcode²³. These categories were defined according to the number of inhabitants in each territory unit (Appendix I).

Data concerning the patient and the encounter included age, sex, socioprofessional category, medical fee exemption status (for low income, for serious chronic disease, for accident or occupational disease), place of encounter (at the office or home visit), number of

health problems managed, and duration of encounter. The health problems managed and the associated processes of care performed or planned were coded according to the ICPC-2 classification¹. For each process of care coded, the intern had to describe it further by recording a specific verbatim.

Inclusion and exclusion criteria

Among processes of care performed, those coded with the ICPC-2 rubrics corresponding to clinical, administrative, or coordinating processes of care were excluded (Appendix II), and among those remaining all non-technical procedures based on the recorded verbatim were also excluded. A technical procedure was considered as a process of care that required both knowledge and manual abilities, excluding the routine clinical examination procedures and purely interpretative tasks (eg interpretation of radiography)²⁻⁴. Routine clinical examination procedures were defined, according to WONCA classifications, as inspection, palpation, percussion and auscultation; visual acuity and fundoscopy; otoscopy; vibration sense; vestibular function; digital rectal and vaginal examination; vaginal speculum examination; blood pressure recording; indirect laryngoscopy; and height/weight measurement¹.

Data management and analysis

The GP practice location variable was categorised as either urban (territory units of 50 000 inhabitants or more) or rural area/urban cluster (territory units of less than 50 000 inhabitants). Health problems managed were regrouped, merging the 17 ICPC-2 chapters into eight categories in order to distinguish psychosocial problems from the main somatic problems concerned by technical procedures. The various technical procedures were classified according to the framework of the International Classification of Process in Primary Care (IC-Process-PC)²⁴.

The frequency of technical procedures was compared according to GP practice location using the χ^2 test. We analysed the determinants of performing technical procedures on the level of the health problems managed, which we considered the most specific level because a technical procedure is usually performed to prevent, diagnose, or treat a particular health problem. The dependent variable analysed was therefore the performance of at least one technical procedure per each health problem managed (yes/no). To study the influence of each variable of interest on the dependent variable, we performed bivariate then multivariate analyses, using logistic regression models. These analyses were based on a hierarchical mixed-effect model with random intercepts on physician and encounter effects, including three levels: the physician, the encounter, and the health problem managed. To compare the multivariate model to the 'null model' (with no fixed effect predictor), we calculated the random effect variances and the intraclass correlations for both physicians and encounters, as well as the Akaike information criterion and Bayesian information criterion fit statistics. We also used the marginal R^2 and the conditional R^2 to express the variance explained by the multivariate model. Statistical significance threshold was set to 5%, and Stata v16 (StataCorp; <http://www.stata.com>) was used to perform analyses.

Ethics approval

The ECOGEN study was approved by the National Data Protection Commission (*Commission nationale de l'informatique et des*

libertés, no. 1549782) and the regional ethics committee (*Comité de Protection des Personnes Sud-Est IV*, No. L11-149).

Results

The study investigators directly observed 20 613 patient-GP encounters, including 45 580 health problems managed and 98 873 associated processes of care (including 41 972 planned and 56 863 performed). There were 2202 technical procedures performed during the study period and included herein (Fig1). At least one technical procedure was performed in 2046/20 613 encounters (9.9%) and for 2114/45 580 health problems managed (4.6%). The characteristics of GPs, encounters and health problems managed are reported in Table 1. In particular, 38.3% of GPs practised in a rural area or an urban cluster and 61.7% in an urban area.

The two most frequent groups of technical procedures performed were injections (44.2% of all technical procedures), and clinical laboratory procedures (17.0%). Physical therapies (15.1% v 3.3%), excision/incision/biopsy/aspiration or removal of tissue or body fluids (3.7% v 2.0%), and destruction or cauterization (1.7% v 0.3%) were more often performed by GPs practising in rural areas or urban clusters than in urban areas. Conversely, injections (50.8% v 38.5%) and electrical tracing (7.6% v 4.3%) were more often performed by GPs practising in urban areas (Table 2).

The two most frequent technical procedures were vaccine injections (38.8% of all technical procedures) and point-of-care testing for group A streptococci (9.9%). The following procedures were more often performed by GPs practising in rural areas or urban clusters: injection of joints, bursae, tendons and tendon sheaths (4.1% v 1.2%), manipulation and osteopathy (10.3% v 0.4%), excision/biopsy of superficial lesions (1.7% v 0.5%), and cryotherapy (1.7% v 0.3%). All of these procedures are billed to the patient (€26.13–68.80 (~A\$42.90–112.96), instead of the visit fee), apart from manipulation and osteopathy. Conversely, the following procedures were more often performed by GPs practising in urban areas: vaccine injection (46.6% v 32.1%), point-of-care testing for group A streptococci (11.8% v 7.6%), and ECG (7.6% v 4.3%). Among these, only ECGs are billed (€14.26 (~A\$23.42), in addition to the visit fee; Table 2).

According to bivariate analyses, performing technical procedures was not associated with GPs' sex, age, fee agreement, mode of practice, practice location or annual number of encounters. Encounters with patients who were male (odds ratio (OR)=1.20, 95% confidence interval (CI) 1.08–1.34), younger (ORs increasing from 1.33 (95%CI 1.13–1.58) in those aged 60–74 years to 7.41 (95%CI 6.05–9.08) in those aged 0–4 years, and with respect to patients aged 75 years or more), unemployed (OR=1.85, 95%CI 1.44–2.38), with respect to executives, or without fee exemption status for a serious chronic disease (OR=2.53, 95%CI 2.20–2.91) more often included a technical procedure. Conversely, retired patients had technical procedures less often than executives (OR=0.48, 95%CI 0.37–0.62). Technical procedures were more often performed when fewer health problems were managed during encounters (ORs from 2.13 (95%CI 1.28–3.55) for five health problems to 16.29 (95%CI 10.25–25.89) for one health problem; with respect to seven or more health problems), and less often performed if encounters took place at patients' homes rather than at GPs' offices (OR=0.38, 95%CI 0.28–0.51). A technical procedure was more often performed to manage a health problem classified

as general/unspecified (OR=64.94, 95%CI 37.82–111.51) or concerning the skin (OR=41.75, 95%CI 23.9–72.69), the ear (OR=33.82, 95%CI 18.72–61.11), the musculoskeletal system (OR=18.02, 95%CI 10.45–31.06), female health/family planning (OR=16.61, 95%CI 9.17–30.08), the respiratory system (OR=14.22, 95%CI 8.22–24.61), or another ICPC-2 body chapter (OR=3.88, 95%CI 2.24–6.72) other than psychological or social chapters

(Table 3).

In the multivariate analysis, GPs practising in a rural area or an urban cluster performed technical procedures more often than those practising in an urban area (OR=1.31, 95%CI 1.04–1.65). No association was found with patient sex or with medical exemption status for a serious chronic disease (Table 3).

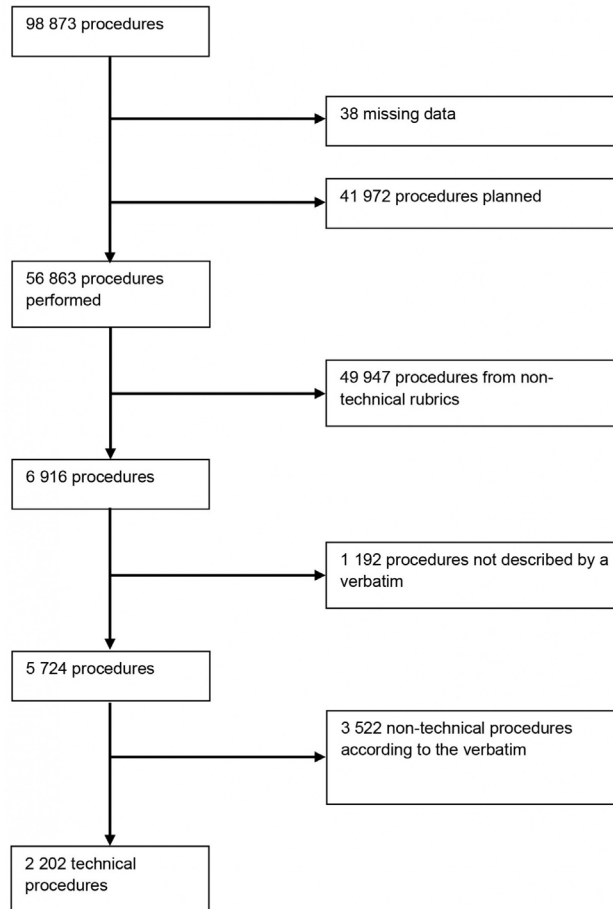


Figure 1: Flowchart of technical procedure selection.

Table 1: Characteristics of GPs, patients, encounters, and health problems managed

Characteristic	n (%)
<i>GP characteristic (n=128)</i>	
GP sex	
Male	85 (66.4)
Female	43 (33.6)
GP age range (years)	
32–49	35 (27.3)
50–54	33 (25.8)
55–59	38 (29.7)
≥60	22 (17.2)
Fee agreement	
Fixed	118 (92.2)
Free	10 (7.8)
Mode of practice	
Solo practice	27 (21.1)
Group practice	99 (77.3)
Multi-professional centre	2 (1.6)
Practice location	
Urban area	79 (61.7)
Rural area or urban cluster	49 (38.3)
Annual number of encounters	
0–4999	63 (49.2)
5000–10 500	65 (50.8)
<i>Characteristic of encounters (n=20 613)</i>	
Patient sex	
Female	8506 (41.2)
Male	12 107 (58.8)
Patient age range (years)	
0–4	1760 (8.5)
5–14	1485 (7.2)
15–30	2428 (11.8)
31–45	3511 (17.0)
46–59	4093 (19.9)
60–74	4090 (19.8)
≥75	3246 (15.7)
Patient socioprofessional category	
Executive, intellectual profession	1042 (5.1)
Farmer, craftsman, shopkeeper, business owner	639 (3.1)
Intermediate profession	1229 (6.0)
Office worker	3972 (19.3)
Manual worker	815 (4.0)
Retired	6766 (32.8)
Unemployed	6150 (29.8)
Medical fees exemption status for low income	
No	19 757 (95.8)
Yes	856 (4.2)
Medical fees exemption status for a serious chronic disease	
Yes	4785 (23.2)
No	15 828 (76.8)
Medical fee exemption status for an occupational accident or disease	
Yes	519 (2.5)
No	20 094 (97.5)
Encounter place	
GP's office	19 344 (93.8)
Home visit	1269 (6.2)
Number of health problems managed	
1	3831 (18.6)
2	5044 (24.5)
3	4492 (21.8)
4	2999 (14.5)
5	1847 (9.0)
6	1121 (5.4)
≥7	1279 (6.2)
Encounter duration range (min.)	
1–10	5028 (24.4)
11–15	6102 (29.6)
16–20	4334 (21.0)
21–30	3801 (18.4)
>30	1348 (6.5)
<i>Characteristic(s) of health problems managed (n=45 580)</i>	
ICPC-2 chapter	
Psychological/social	4332 (9.5)
Skin	2169 (4.8)
Female genital/pregnancy, childbearing, family planning	1356 (3.0)
Respiratory	5628 (12.3)
General and unspecified	7570 (16.8)

General and unspecified	7 970 (19.0)
Ear (hearing, audition)	840 (1.8)
Musculoskeletal	5 755 (12.6)
Other	17 930 (39.3)

ICPC, International Classification of Process in Primary Care.

Table 2: Distribution of technical procedures according to GP practice location

Technical procedure	Billing	Practice location			p-value
		All areas n (%) (n=2202)	Urban areas n (%) (n=1020)	Rural areas and urban clusters n (%) (n=1182)	
Injection		973 (44.2)	518 (50.8)	455 (38.5)	<0.05
Vaccine injection	No	855 (38.8)	475 (46.6)	380 (32.1)	<0.05
Injection of joints, bursae, tendons, and tendon sheaths	Yes†	60 (2.7)	12 (1.2)	48 (4.1)	<0.05
Subcutaneous injection (no vaccine)	No	33 (1.5)	20 (2.0)	13 (1.0)	NS
Intramuscular injection (no vaccine)	No	21 (1.0)	10 (1.0)	11 (0.9)	NS
Intravenous injection	No	4 (0.2)	1 (0.1)	3 (0.3)	NS
Clinical laboratory		375 (17.0)	160 (15.7)	215 (18.2)	NS
Point-of-care testing for group A streptococci	No	217 (9.9)	139 (11.8)	78 (7.6)	<0.05
Cervical smear	Yes¶	97 (4.4)	52 (5.1)	45 (3.8)	NS
Capillary blood glucose	No	42 (1.9)	21 (2.1)	21 (1.8)	NS
Venipuncture	No	10 (0.5)	4 (0.4)	6 (0.5)	NS
Nasopharyngeal swab	Yes¶	4 (0.2)	3 (0.3)	1 (0.1)	NS
Reproductive or urologic system sampling	No	3 (0.1)	1 (0.1)	2 (0.2)	NS
Skin or other teguments sampling	No	2 (0.1)	1 (0.1)	1 (0.1)	NS
Physical therapy		213 (9.7)	34 (3.3)	179 (15.1)	<0.05
Manipulation or osteopathy	No	126 (5.7)	4 (0.4)	122 (10.3)	<0.05
Mesotherapy	No	52 (2.4)	25 (2.5)	27 (2.3)	NS
Acupuncture	Yes§	13 (0.6)	0 (0)	13 (1.1)	NS
Massage	No	11 (0.5)	0 (0)	11 (0.9)	NS
Vertigo manoeuvres	No	2 (0.1)	2 (0.2)	0 (0)	NS
Other physical therapy	No	9 (0.4)	3 (0.3)	6 (0.5)	NS
Pressure, compression, dilatation, tamponade, or dressing		155 (7.0)	71 (7.0)	84 (7.1)	NS
Bandages or dressings	No	124 (5.6)	57 (5.6)	67 (5.7)	NS
Medical care of wounds and lesions	No	29 (1.3)	13 (1.3)	16 (1.4)	NS
Compression for bleeding	Yes†‡	1 (0.0)	0 (0)	1 (0.1)	NS
Compression/support of varicose veins or lymphoedema	No	1 (0.0)	1 (0.1)	0 (0)	NS
Electrical tracing		129 (5.9)	78 (7.6)	51 (4.3)	<0.05
ECG – standard tracings	Yes¶	129 (5.9)	78 (7.6)	51 (4.3)	<0.05
Miscellaneous procedure		93 (4.2)	47 (4.6)	46 (3.9)	NS
Removal of ear wax or foreign body	Yes§	74 (3.4)	38 (3.7)	36 (3.0)	NS
Removal of foreign body other than cutaneous, subcutaneous and ear	Yes†	10 (0.5)	6 (0.6)	4 (0.3)	NS
Removal hyperkeratosis or distal extremity of the nail plate	No	6 (0.3)	3 (0.3)	3 (0.3)	NS
Nasopharyngeal suction or clearance with saline solution	No	3 (0.1)	0 (0)	3 (0.3)	NS
Repair or immobilisation		91 (4.1)	40 (3.9)	51 (4.3)	NS
Removal of suture material	No	43 (2.0)	21 (2.1)	22 (1.9)	NS
Suture of skin laceration with non-absorbable suture material	Yes†	21 (1.0)	8 (0.8)	13 (1.1)	NS
Immobilisation with manufactured splint	Yes†	13 (0.6)	4 (0.4)	9 (0.8)	NS
Immobilisation with strapping tape	Yes†	6 (0.3)	4 (0.4)	2 (0.2)	NS
Suture of skin laceration with adhesives stitches	Yes†	3 (0.1)	2 (0.2)	1 (0.1)	NS
Debridement/parage of skin laceration	Yes†	2 (0.1)	0 (0)	2 (0.2)	NS
Suture with biological glue	Yes†	1 (0.0)	0 (0)	1 (0.1)	NS
Immobilisation with cast (plastered splint)	Yes†	1 (0.0)	1 (0.1)	0	NS
Reduction of fracture or dislocation	Yes†	1 (0.0)	0 (0)	1 (0.1)	NS
Excision, incision, biopsy, aspiration or removal of tissue or body fluids		64 (2.9)	20 (2.0)	44 (3.7)	<0.05
Excision/biopsy of superficial lesions	Yes¶‡	25 (1.1)	5 (0.5)	20 (1.7)	<0.05
Incision/drainage	Yes†	19 (0.9)	8 (0.8)	11 (0.9)	NS
Aspiration of joints	NR	10 (0.5)	5 (0.5)	5 (0.4)	NS
Removal of cutaneous or subcutaneous foreign body	Yes†	8 (0.4)	2 (0.2)	6 (0.5)	NS
Surgical treatment for ingrowing toenail	Yes†	2 (0.1)	0 (0)	2 (0.2)	NS
Diagnostic ultrasound		39 (1.8)	24 (2.4)	15 (1.3)	NS
Obstetrical	Yes†	21 (1.0)	14 (1.4)	7 (0.6)	NS
Gallbladder and other abdominal organs	Yes†	5 (0.2)	4 (0.4)	1 (0.1)	NS
Pelvic organs (excluding obstetrical)	Yes†	2 (0.1)	1 (0.1)	1 (0.1)	NS
Echodoppler NEC (including vascular ultrasound, breasts and thyroid)	Yes†‡	11 (0.5)	5 (0.5)	6 (0.5)	NS

Destruction or cauterisation		23 (1.2)	3 (0.3)	20 (1.7)	<0.05
Cryotherapy	Yes ^{††} or Yes ^{§‡}	23 (1.2)	3 (0.3)	20 (1.7)	<0.05
Reproductive and urologic system procedure		25 (1.1)	11 (1.1)	14 (1.2)	NS
Insertion of subcutaneous contraceptive device	Yes [†]	6 (0.3)	1 (0.1)	5 (0.4)	NS
Removal of subcutaneous contraceptive device	Yes [†]	7 (0.3)	2 (0.2)	5 (0.4)	NS
Insertion of IUD	Yes [†]	5 (0.2)	3 (0.3)	2 (0.2)	NS
Removal of IUD	No	1 (0.0)	1 (0.1)	0 (0)	NS
Manual liberation of the foreskin	No	3 (0.1)	1 (0.1)	2 (0.2)	NS
Reproductive and urologic system procedures NEC (including prostatic massage, urinary catheter procedures)	No	3 (0.1)	3 (0.3)	0 (0)	NS
Diagnostic skin testing and allergy testing		21 (1.0)	14 (1.4)	7 (0.6)	NS
Tuberculosis skin tests	No	20 (0.9)	14 (1.4)	6 (0.5)	NS
Allergy testing (including skin testing)	Yes [†]	1 (0.0)	0 (0)	1 (0.1)	NS
Endoscopy		1 (0.0)	0 (0)	1 (0.1)	NS
Anoscopy	No	1 (0.0)	0 (0)	1 (0.1)	NS

[†] More than, and not in addition to, visit fee;

^{††} In addition to visit fee.

[§] Less than, and not in addition to, visit fee.

[‡] Under conditions.

IUD, intrauterine device. NEC, not elsewhere classified. NS, not significant.

Table 3: Characteristics of GPs, encounters and health problems associated with technical procedures per health problem managed in bivariate and multivariate analyses

Characteristic	n/N (%) n=2114 technical procedures N=45 850 health problems	OR (95%CI) in bivariate analyses†	OR (95%CI) in multivariate analysis
GP characteristic			
GP sex			
Male	1386/28 578 (4.8)	Ref.	Ref.
Female	728/17 002 (4.3)	1.00 (0.76–1.32)	1.05 (0.83–1.34)
GP age range (years)			
32–49	594/11 389 (5.2)	1.40 (0.99–1.99)	1.22 (0.90–1.66)
50–54	524/13 204 (4.0)	Ref.	Ref.
55–59	625/12 394 (5.0)	1.31 (0.93–1.84)	1.48 (1.10–2.00)
≥60	371/859 (4.3)	1.20 (0.81–1.77)	1.36 (0.96–1.91)
Fee agreement			
Fixed	1963/42 272 (4.6)	Ref.	
Free	151/3308 (4.6)	1.05 (0.65–1.68)	
Mode of practice			
Solo practice	375/9096 (4.1)	Ref.	Ref.
Group practice	1325/13 400 (4.9)	1.25 (0.90–1.73)	1.21 (0.91–1.61)
Multiprofessional centre	414/9381 (4.4)	1.31 (0.89, 1.99)	1.12 (0.78–1.61)
Practice location			
Urban area	1181/26 993 (4.4)	Ref.	Ref.
Rural area and urban cluster	933/18 587 (5.9)	1.13 (0.87–1.47)	1.31 (1.04–1.65)
Annual number of encounters			
0–4999	1237/25 982 (4.8)	Ref.	
5000–10 500	877/19 598 (4.5)	1.00 (0.77–1.29)	
Characteristic of encounters			
Patient sex			
Female	1184/27 361 (4.3)	Ref.	Ref.
Male	930/18219 (5.1)	1.20 (1.08–1.34)	1.08 (0.98–1.19)
Patient age range (years)			
0–4	343/2548 (13.5)	7.41 (6.05–9.08)	1.53 (1.23–1.90)
5–14	229/2136 (10.7)	5.37 (4.32–6.67)	1.40 (1.11–1.75)
15–30	348/4425 (7.9)	3.86 (3.18–4.68)	1.29 (1.05–1.58)
31–45	341/6332 (5.4)	2.46 (2.03–2.97)	1.02 (0.84–1.25)
46–59	78/1867 (4.2)	1.89 (1.42–2.51)	0.93 (0.69–1.24)
60–74	547/18 297 (3.0)	1.33 (1.13–1.58)	0.91 (0.76–1.08)
≥75	228/9975 (2.3)	Ref.	Ref.
Socioprofessional category			
Executive, intellectual profession	99/2079 (4.8)	Ref.	
Farmer, craftsman, shopkeeper, business owner	62/1364 (4.6)	0.79 (0.54–1.15)	
Intermediate profession	96/2298 (4.2)	0.80 (0.57–1.11)	
Office worker	364/7739 (4.7)	0.92 (0.71–1.20)	
Manual worker	90/1508 (6.0)	1.07 (0.75–1.51)	
Retired	514/19 943 (2.6)	0.48 (0.37–0.62)	
Unemployed	889/10 649 (8.3)	1.85 (1.44–2.38)	
Medical fees exemption status for low income			
No	2019/43 871 (4.6)	Ref.	
Yes	95/1709 (5.6)	1.26 (0.97–1.64)	
Medical fees exemption status for a serious chronic disease			
Yes	339/14 259 (2.4)	Ref.	
No	1775/31 321 (5.7)	2.53 (2.20–2.91)	
Medical fee exemption status for an occupational accident or disease			
Yes	38/929 (4.1)	Ref.	
No	2076/44 651 (4.6)	1.25 (0.84–1.84)	
Encounter place			
GP office	2046/42 197 (4.8)	Ref.	Ref.
Home visit	68/3383 (2.0)	0.38 (0.28–0.51)	0.70 (0.53–0.93)
Number of health problems managed			
1	900/8472 (10.6)	16.29 (10.25–25.89)	10.00 (6.26–15.99)
2	597/11 153 (5.4)	7.26 (4.57–11.53)	4.13 (2.59–6.57)
3	329/9933 (3.3)	4.30 (2.70–6.87)	2.96 (1.85–4.72)
4	164/6631 (2.5)	3.12 (1.93–5.05)	2.54 (1.57–4.10)
5	72/4085 (1.8)	2.13 (1.28–3.55)	1.92 (1.16–3.20)
6	31/2478 (1.3)	1.51 (0.85–2.70)	1.49 (0.84–2.65)
≥7	21/2828 (0.7)	Ref.	Ref.
Encounter duration range (min.)			
1–10	403/8620 (4.7)	Ref.	
11–15	528/12 682 (4.2)	0.88 (0.75–1.04)	
16–20	497/10 344 (4.8)	1.09 (0.92–1.29)	

21–30	489/10 092 (4.8)	1.10 (0.92–1.32)	
>30	197/3842 (5.1)	1.27 (1.00–1.62)	
Characteristic of health problems managed			
ICPC-2 chapter			
Psychological /social	14/4332 (0.3)	Ref.	Ref.
Skin	228/2169 (10.5)	41.75 (23.98–72.69)	32.92 (18.98–57.10)
Female genital/pregnancy, childbearing, family planning	64/1356 (4.7)	16.61 (9.17–30.08)	13.26 (7.33–23.97)
Respiratory	234/5628 (4.2)	14.22 (8.22–24.61)	8.06 (4.66–13.93)
General/unspecified	992/7570 (13.1)	64.94 (37.82–111.51)	49.99 (29.19–85.62)
Ear (hearing, audition)	76/840 (9.0)	33.82 (18.72–61.11)	19.84 (11.00–35.78)
Musculoskeletal	301/5755 (5.2)	18.02 (10.45–31.06)	14.59 (8.57–25.36)
Other	205/17 930 (1.1)	3.88 (2.24–6.72)	4.10 (2.39–7.13)
Random effect variance			
Physician		0.429	0.302
Encounter		1.822	0.140
Intraclass correlation			
Physician		0.077	0.081
Encounter		0.406	0.119
Fit statistic			
AIC		16 542	13 823
BIC		16 568	14 094
Marginal R^2			35.80%
Conditional R^2			43.41%

[†] Random effect variances, intraclass correlations and fit statistics in the third column are given from the 'null model' (with no fixed effect predictor).

AIC, Akaike information criterion. BIC, Bayesian information criterion. CI, confidence interval. OR, odds ratio. Ref., reference value.

Discussion

This study provides insight on the performance of technical procedures by French GPs and the influence of rurality. It showed that at least one technical procedure was performed in 9.9% of encounters and for 4.6% of health problems managed. Injections were the most frequent group of procedures performed, followed by clinical laboratory tests, and vaccine injection was the most frequent procedure, far ahead of point-of-care testing for group A streptococci. GPs practising in rural areas or in urban clusters performed more technical procedures than those practising in urban areas. Some complex technical procedures more frequently performed by GPs practising in rural areas and in urban clusters are not billed above the visit fee.

Comparison with existing literature

Among the published studies⁸⁻²¹, only the one conducted by Britt et al in Australia was based on frequency estimators and a procedure classification similar to that used herein⁸; therefore comparisons were only made with this report. The overall frequency of technical procedures in France was around half of that reported in Australia (18.4%, including vaccine injections). We found that injections were the most frequent group of procedures performed in France, as also observed in Australia (30.1%); however, the proportion of vaccine injections among these was greater in France as compared to Australia (18.3%). The high frequency of vaccine injections in the present study is consistent with the strong association between technical procedures performed and health issues classified in the ICPC-2 'general/unspecified' chapter, which includes the 'preventive medicine' rubric. The second most frequent group of procedures corresponded to clinical laboratory procedures, mainly point-of-care testing for group A streptococci. The frequency of all clinical laboratory procedures was not reported in the Australian study, and point-of-care testing for group A streptococci is not routinely done in Australia²⁵. It is of note that in the Australian study procedures were grouped into 'excision, removal tissue, biopsy, destruction, debridement, cauterization' and 'incision, drainage,

flushing, aspiration, removal body fluid', whereas in the present study approximately the same procedures were included but not in the same groups ('excision, incision, biopsy, aspiration or removal of tissue or body fluids' and 'destruction or cauterization'); combining these arrives at a similar content, and this was more frequent in Australia (18.9%) than in France (3.9% of all technical procedures; data not shown). Taken together, technical procedures are less frequent in France than in Australia and a lower proportion of these are complex.

According to the present study, French GPs practising in rural areas or in urban clusters performed more technical procedures than those practising in urban areas; this may explain at least in part the higher frequency of technical procedures performed in Australia that did not formally investigate this aspect⁸. Several studies conducted in Australia, the USA, Israel, and various European countries have also found that rural GPs performed more technical procedures than urban GPs^{10-15,18}. In particular, complex procedures such as infiltrations of joints¹¹ and minor surgery¹³⁻¹⁵ were more often performed by rural GPs, which is consistent with the findings presented herein, considering that the group 'excision, incision, biopsy, aspiration or removal of tissue or body fluids' roughly corresponded to minor surgery procedures. This, as well as the more frequent performance of complex technical procedures in general by rural GPs, may be due to the rarity of specialists (such as surgeons or dermatologists) in such areas²⁶. To our knowledge, the more frequent performance of cryotherapy and manipulation/osteopathy by French GPs in rural areas or urban clusters had not been identified previously.

Three procedures were more often performed by French GPs practising in urban areas: vaccine injections, point-of-care testing for group A streptococci, and ECGs. These findings are consistent with previous data from Ontario and Iowa regarding vaccine injections, ECG, and laboratory procedures as a whole^{15,17}. Lack of GPs in French rural areas may have increased the proportion of vaccine injections and point-of-care testing performed by other healthcare professionals such as nurses or pharmacists²⁷. In addition, the higher workload of rural GPs²⁸ may push them to

delay time-consuming and non-urgent procedures required for routine monitoring, such as ECGs.

Strengths and limitations

To our knowledge, this is the first published study providing data on the performance of technical procedures by French GPs. It was a large multicentre national study, based on a detailed and comprehensive practice-based collection of health problems managed along with the associated processes of care, including the technical procedures. In addition, both health problems and technical procedures were classified consistently.

GPs involved in the ECOGEN study were all trainers, which may entail differences with other GPs. However, they proved to be representative of French GPs for age, sex, and practice location²². In addition, according to another study conducted in France, patients of GP trainers can be considered to be similar to those of non-trainer GPs; however, among technical procedures, GP trainers performed slightly more seasonal flu vaccination than non-trainers, although it is not known whether this applies to other vaccinations²⁹.

We excluded 1192 procedures not described by a verbatim (17.2% of those eligible), which could lead to an underestimate of the number of technical procedures performed. However, most of these excluded procedures were associated with health problems classified in ICP-2 chapters not likely compatible with performing technical procedures, such as the 'other' chapters and the respiratory chapter (Appendix III).

It is of note that only 12.5% of the GPs participating in the ECOGEN study practised in a rural area, which precluded the study of this group specifically. We therefore merged the groups of GPs practising in rural areas and in urban clusters in order to increase the statistical power for comparing rural and urban practices, and comparison with other studies in this regard has to be interpreted with caution.

Since the time when the ECOGEN was conducted, some task shifting from GPs to other primary care professionals has emerged in France. The concerned tasks include some technical procedures such as vaccine administration, which is now partially allowed to nurses, pharmacists and midwives and may be less often performed by GPs³⁰.

Implications

The frequency of technical procedures undertaken by GPs in France seems low, and it is of note that most are simple procedures. This suggests that there may be certain barriers to performing technical procedures, and that this may be different in more rural than urban areas; this has previously been reported, and barriers include lack of time, fear of complications, lack of experience and training, as well as inadequate fees for the time, skills, legal protection, and equipment needed^{20,31}. Further studies are therefore required to describe needs of patients and the potential barriers to performing technical procedures, with a special emphasis on the location of patient care.

Conclusion

A technical procedure was performed in approximately 1 in 10 encounters in France, which is approximately half the rate reported in Australia. These procedures were more frequently performed

and more complex when they were performed in rural areas and urban clusters. More studies are required to assess patient needs and potential barriers regarding technical procedures. Such assessment should help to design training of primary care professionals on technical procedures according to countries and eventually to rural and urban areas of practice.

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Appendix I: Classification of the 128 GPs according to the location of their practice

	GPs (n)	Practice location	GPs (n)
Rural commune	16	Rural area	16
Urban unit of less than 5000 inhabitants	12	Urban cluster	33
Urban unit of 5000-9999 inhabitants	9		
Urban unit of 10000-19999 inhabitants	8		
Urban unit of 20000-49999 inhabitants	4		
Urban unit of 50000-99999 inhabitants	9	Urban area	79
Urban unit of 100000-199999 inhabitants	8		
Urban unit of 200000-1999999 inhabitants	40		
Paris agglomeration	22		

Appendix II: Selection of ICPC-2 processes of care including technical procedures or not

Rubrics without technical procedures	Rubrics with technical procedures
-30 Medical Exam/Eval-Complete	-32 Sensitivity Test
-31 Medical Examination/Health Evaluation- Partial/Pre-op check	-33 Microbiological/Immunological Test
-35 Urine Test	-34 Blood Test
-36 Faeces Test	-37 Histological/Exfoliative Cytology
-45 Observe/Educate/Advice/Diet	-38 Other Laboratory Test NEC
-46 Consultation with Primary Care Provider	-39 Physical Function Test
-47 Consultation with Specialist	-40 Diagnostic Endoscopy
-48 Clarification/Discuss Patient's RFE	-41 Diagnostic Radiology/Imaging
-58 Therapeutic Counselling/Listening	-42 Electrical Tracings
-60 Results Tests/Procedures	-43 Other Diagnostic Procedures
-61 Results Exam/Test/Record	-44 Preventive Immunisations/Medications
-62 Administrative Procedure	-49 Other Preventive Procedures
-63 Follow-up Encounter Unspecified	-50 Medicat-Script/Reqst/Renew/Inject
-64 Encounter Initiated by Provider	-51 Incise/Drain/Flush/Aspirate
-65 Encounter Initiated third person	-52 Excise/Remove/Biopsy/Destruction/ Debride
-66 Refer to Other Provider	-53 Instrument/Catheter/Intubate/Dilate
-67 Referral to Physician/Specialist/ Clinic/Hospital	-54 Repair/Fixate-Suture/Cast/Prosthetic
-68 Other Referrals NEC	-55 Local Injection/Infiltration
	-56 Dress/Press/Compress/Tamponade
	-57 Physical Medicine/Rehabilitation
	-59 Other Therapeutic Procedure NEC
	-69 Other Reason for Encounter NEC

NEC, not elsewhere classified.

APPENDIX III:

Appendix III: Distribution of the 1192 procedures excluded because they were not described by a verbatim, by health problem ICPC-2 chapter, with their OR from multivariate analysis

ICPC-2 chapter	n (%)	OR (95%CI)
Other chapters	510 (42.8)	4.10 (2.38–7.08)
Respiratory	251 (21.1)	7.98 (4.62–13.78)
Musculoskeletal	126 (10.6)	14.59 (8.50–25.05)
General and unspecified	98 (8.2)	48.55 (28.48–82.76)
Psychological/social	87 (7.3)	ref
Skin	53 (4.4)	32.14 (18.60–55.54)
Female genital / pregnancy, childbearing, family planning	36 (3.0)	13.11 (7.27–23.64)
Ear (Hearing, audition)	31 (2.6)	19.39 (10.80–34.81)

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