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Physician practices in requesting stool samples for patients with acute gastroenteritis, France, August 2013–July 2014

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SUMMARY

A better understanding of physician practices in requesting stool samples for patients with acute gastroenteritis (AG) is needed to more accurately interpret laboratory-based surveillance data. A survey was conducted in General Practitioners (GPs) between August 2013 and July 2014 to estimate the proportion of stool samples requested for patients with AG and to identify factors associated with GP requests for a stool sample. National health insurance (NHI) data together with surveillance data from a French Sentinel GP network were also used to estimate the proportion of stool samples requested. This proportion was estimated at 4·3% in the GP survey and 9·1% (95% confidence interval 8·7–9·6) using NHI data. Multivariate analysis indicated that the ratio of stool samples requested was almost five times higher in patients with bloody diarrhoea and 10–20 times higher in patients with a long duration of illness before consultation. Laboratory-based surveillance data underestimates the actual burden of disease as fewer than one in 10 AG cases consulting their GP will be requested to submit a stool sample for laboratory testing. This underestimation varies by pathogen as stool samples are more frequently requested for severe illness.

Key words: France, gastroenteritis, General Practitioner, stool sample.

INTRODUCTION

Infectious acute gastroenteritis (AG) causes diarrhoea and vomiting that can be associated with other symptoms such as headache, fever, and abdominal cramps. Public health surveillance for different pathogens causing AG is dependent upon cases consulting for their illness, physicians requesting appropriate tests, identification of pathogens in laboratories and reporting of laboratory-confirmed cases to the public health authorities. Therefore physicians who request stool or other specimens for microbiological testing are essential contributors to the surveillance [1, 2]. A better understanding of the factors that influence General Practitioner (GP) diagnostic practices is needed to more accurately interpret laboratory-based surveillance data and the extent to which it underestimates the actual burden of disease.

In France, a population-based survey conducted between May 2009 and April 2010 estimated that a stool sample was requested for 7·7% [95% confidence interval (CI) 3–18] of AG cases that consulted a physician

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[3]. However, the small sample size (91 cases consulting, of whom five had a stool sample requested) did not allow for a precise estimate of this proportion, nor the identification of the factors associated with a GP requesting laboratory tests in AG cases consulting for their illness in France.

The current study was conducted to estimate the proportion of AG cases consulting their GP for which a stool sample was requested in mainland France (overseas French territories not included) and to identify the factors associated with requesting a stool sample. We compared the results with estimates derived from national health insurance (NHI) data and AG surveillance data from a French Sentinel GP network.

MATERIAL AND METHODS

Sentinel GP surveillance data

The French Sentinel network is a nationwide network of about 1300 GPs (2% of the total GPs in France). GPs participate on a voluntary basis and transmit data on a weekly basis from their patient consultations via secure Internet connections on eight health indicators, including AG [4]. In this network a case of AG is defined as $\geqslant 3$ watery or loose stools in 24 h, with onset of symptoms within 14 days before the GP consultation. Age, gender and whether hospitalization was requested, are reported for each case of AG. To estimate the weekly (or yearly) number of GP consultations for AG in mainland France, the mean number of cases per sentinel GP (standardized according to their participation and their geographical distribution) is multiplied by the total number of GPs in France [5].

Sentinel GP survey data

In addition to routine AG surveillance data collected by the French Sentinel network, a survey was conducted between August 2013 and July 2014 in the sentinel GPs. For each case of AG, additional items had to be completed about the duration of illness before consultation, the presence or not of bloody diarrhoea, whether or not a stool sample had been prescribed and the result of stool culture.

NHI data

The National Health Insurance Information System (SNIIRAM: Système national d'information inter régimes de l'Assurance maladie) aims at evaluating beneficiaries' healthcare consumption and associated expenditures. This system records all reimbursements of medical costs to patients and covers more than 98% of the French population [6]. We extracted NHI data about reimbursement for stool samples requested by GPs in mainland France between August 2013 and July 2014 from the SNIIRAM database. Age of the patient and date of care are reported for each reimbursement.

Analysis of the data

We estimated the proportion of stool samples requested by GPs between August 2013 and July 2014 in France via two methods. The first method is based on the results of the Sentinel GP survey (number of stool samples requested in the documented AG consultations). The second method used the number of reimbursements for stool samples requested by GPs (NHI data) together with the estimates of the total number of GP consultations for AG in France (sentinel GP surveillance data). Both methods allow the estimation of the proportion of AG cases with stool samples requested (Sentinel GP survey) or requested and reimbursed (NHI data) by month and by age group (0–4, 5–14, 15–29, 30–64, $\geqslant 65$ years).

We analysed the data of the Sentinel GP survey using a Poisson regression model with robust variance to identify factors that influence the likelihood of physicians to request a stool sample. The choice of this type of regression was based on our objective to assess ratios of requested stool samples rather than approximate them (e.g. odds ratio from logistic regression) [7]. The multivariate analysis was adjusted on the following potentially associated variables: age, gender, presence of bloody diarrhoea, hospitalization, season, and delay before consultation. Age was the only continuous variable, and was tested and modelled using fractional polynomials [8]. The final multivariate model was built using backward elimination and variables with $P < 0{\cdot}05$ were kept in the final model. Interactions between season and presence of bloody diarrhoea, age and presence of bloody diarrhoea and between age and delay before consultation were tested. Data analyses were performed using Stata v. 12·1 (StataCorp, USA).

RESULTS

Proportion of stool samples prescribed

Between August 2013 and July 2014, 293 sentinel GPs enrolled 10 152 patients consulting for AG in the GP

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Table 1. *Characteristics of the cases of acute gastroenteritis included by sentinel General Practitioners, France, August 2013–July 2014*

	Number	Proportion
Age group (years)		
0–4	1689	17%
5–14	1739	17%
15–29	2477	24%
30–64	3539	35%
⩾65	708	7%
Month		
August	424	4%
September	619	6%
October	814	8%
November	865	9%
December	1235	12%
January	1780	18%
February	1379	14%
March	883	9%
April	734	7%
May	489	5%
June	497	5%
July	433	4%
Stool sample requested		
Yes	435	4%
No	9617	96%
Missing	100	
Gender		
Male	5027	50%
Female	4968	50%
Missing	157	
Duration before consultation		
⩽3 days	8584	89%
4–6 days	825	9%
7–14 days	228	2%
Missing	515	
Bloody diarrhoea		
Yes	124	1%
No	9733	99%
Missing	295	
Hospitalization		
Yes	49	0·5%
No	9882	99·5%
Missing	221	

survey. The main characteristics of the cases are summarized in Table 1. Information about stool sample request was available for 10 052 cases and 435 (4·3%) had a stool sample requested.

Over the same period, NHI data indicated that 399 986 stool samples requested by GPs were reimbursed and the Sentinel GP network estimated the total number of consultations for AG in France at 4374766 (95% CI 4171386–4578146). Using both data sources, the proportion of stool samples requested by GPs and reimbursed to consulting AG cases was estimated at 9·1% (95% CI 8·7–9·6).

Seasonal and age-specific trends

Seasonal trends over time are similar for both methods with the greatest proportion of stool samples requested during the summer period: 10% compared to 2% during the winter period in the Sentinel GP survey and 15% (95% CI 13·9–16·9) compared to 5% (95% CI 4·9–5·3) using NHI/Sentinel GP surveillance data (Fig. 1).

In all age groups estimates using the NHI/GP Sentinel surveillance data were higher than the estimates derived from the Sentinel GP survey. This difference was most marked in the elderly with 30% (95% CI 28–33) of cases aged ⩾65 years having a stool sample requested using NHI/Sentinel GP surveillance data *vs.* 9% in the Sentinel GP survey (Fig. 2).

Results of the Sentinel GP survey

In the Sentinel GP survey 89% of the cases consulted within 3 days of illness. The proportion of stool samples requested was significantly higher in cases that consulted after 3 days of illness (26% *vs.* 2%, $P < 0{\cdot}001$).

A stool sample result was available for 226 (52%) of the 435 patients with a stool sample request. The result was negative for 155 (69%) patients; *Campylobacter* spp. was most often identified (12%), followed by *Salmonella* spp. (6%) and rotavirus (4%) (Table 2).

Multivariate analysis indicated that the requested stool sample ratio (RSSR) was almost five times higher in patients with bloody diarrhoea and 10–20 times higher in patients with a long duration of illness before consultation (4–6 days and 7–14 days, respectively). The RSSR was also higher in summer than in winter [adjusted RSSR (aRSSR) 2·0] and in males (aRSSR 1·3). The RSSR increased with age (0·6% per year). No interaction was identified (Table 3).

DISCUSSION

The proportion of stool samples requested by GPs in France estimated using NHI data together with Sentinel GP surveillance data (9·1%) was greater than the proportion reported from the Sentinel GP survey (4·3%), but close to the proportion estimated

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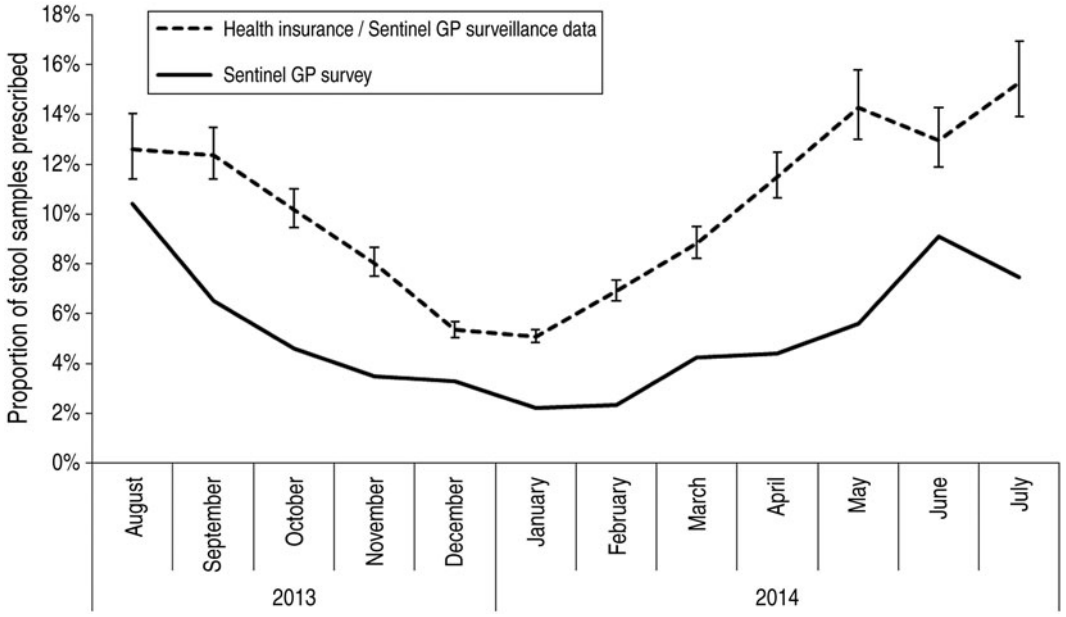

Fig. 1. Proportion of stool samples requested by General Practitioners (GP) for acute gastroenteritis cases by month, France, August 2013–July 2014.

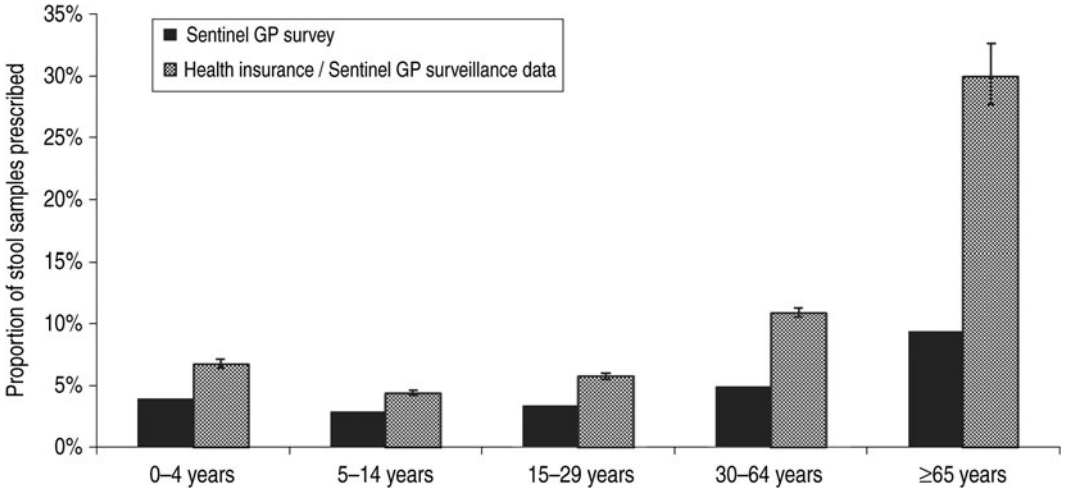

Fig. 2. Proportion of stool samples requested by General Practitioners (GP) for acute gastroenteritis cases by age group, France, August 2013–July 2014.

by the population-based survey conducted in 2009–2010 (7·7%) [3]. These proportions are similar to those estimated by population-based surveys in Poland (5·5%) [9] and Italy (6%) [10], but lower than in Ireland (15%) [11], The Netherlands (15%) [12], Denmark (45%) [13] and Norway (45%) [14]. However, the proportion of cases consulting for AG in France (33%) [3], Poland (30%) [9] and Italy (37%) [10] are higher than in the other European countries (8–20%) [11–14]. More AG cases consulting may lead to an increased proportion of consultations for less severe AG illness, for which a laboratory test is less likely to be requested. In the Sentinel GP survey 9/10 cases consulted within 3 days of illness, which was similar to the proportion estimated in the population survey (92%) [3]. These observations support the hypothesis that in France a large proportion of mild cases seek care rapidly after onset of illness, resulting in a smaller proportion of patients having a stool sample analysis requested. In France sentinel GPs are similar to all GPs in age, but they are more often male, not equally distributed over

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Table 2. *Results of stool samples analyses precribed by sentinel General Practitioners for acute gastroenteritis cases, France, August 2013–July 2014*

	Number	Proportion
Test result available*	226	
Negative	155	68·6%
Campylobacter spp.	28	12·4%
Salmonella spp.	14	6·2%
Rotavirus	9	4·0%
E. coli	3	1·3%
Shigella spp.	2	0·9%
Adenovirus	1	0·4%
Cryptosporidium	1	0·4%
Other†	14	6·2%

* One stool sample was positive for *Campylobacter* spp. and *Cryptosporidium.*
† One *Pseudomonas aeruginosa*, one *Giardia intestinalis*, one *Clostridium* and 11 unspecified.

the territory and see more patients each week [5]. Practice style or habits may be different between the 293 GPs that voluntarily participated in the Sentinel GP survey and GPs that did not, leading to differences in the likelihood of requesting a stool sample. The number of stool samples requested by GPs and reimbursed in the SNIIRAM database includes stool samples prescribed for AG cases not responding to the case definition of the Sentinel network (e.g. cases with chronic gastrointestinal conditions). The prevalence of several chronic diseases with symptoms of diarrhoea or vomiting is higher in the elderly than the rest of the population. Stool samples are requested in elderly patients with chronic gastrointestinal conditions and may explain the higher difference observed between both methods in cases aged $\geqslant 65$ years. Despite the difference in the estimates of the overall proportion of requested stool samples, trends over time were similar using both methods with a greater proportion of stool samples requested in the summer period, when incidence of AG is at its lowest [3]. A similar seasonal trend was also reported in other northern developed countries [15, 16]. This may reflect physicians' increased concerns about a possible bacterial aetiology as the incidence of AG of bacterial origin is greatest in summer in France [17, 18]. The absolute number of stool samples requested for analysis was roughly the same every month, which could also indicate that GPs ration the number of stool samples they order to be tested every month.

In the survey, the GPs transmitted the results of the stool samples for only 52% of the patients with a stool sample request. This may be because the patient did not submit the requested stool sample or because the GP did not complete this information when he received the stool sample result from the laboratory (the GP has to return manually to the file of the patient for which he received the result). Of the patients with a documented stool sample result *Campylobacter* spp. (12%) and *Salmonella* spp. (6%) were the microorganisms most commonly identified, but for 69% of the patients no microorganism was identified. These results may not accurately reflect the real situation as the proportion of stool samples tested varies between pathogens and laboratories. Whereas testing for *Salmonella* spp. is performed on all stool samples, this is not the case for *Campylobacter* spp. nor for viral agents or parasites, impacting negatively the probability of identification of these pathogens.

Bloody diarrhoea and a long duration of illness were the most important factors that influence the decision of a GP to request a stool sample for culture. Similar results have also been reported in other countries [15, 19, 20]. A long duration of illness was also associated with a higher consultation rate [3]. Therefore pathogens more likely to cause severe illness, such as the bacterial agents *Salmonella* spp., *Campylobacter* spp., *Yersinia* spp. or *E. coli* will be better ascertained in laboratory-based surveillance data as patients suffering from these infections are more likely to consult and more likely to have a stool sample requested.

CONCLUSION

This study illustrates the importance of stool sample request practices for the interpretation of laboratory-based surveillance data of pathogens causing AG as a marker of disease incidence in France. Surveillance data underestimate the community incidence of AG as fewer than one in 10 AG cases consulting their GP will be requested to submit a stool sample for laboratory testing. The degree of underestimation depends of the severity of illness (duration of illness, bloody diarrhoea). Therefore pathogens causing more severe illness such as *Salmonella* spp. and *Campylobacter* spp. will be better ascertained than agents causing less severe illness such as viral agents.

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Table 3. *Requested stool sample ratios by General Practitioners for acute gastroenteritis cases, France, August 2013–July 2014*

	Univariate		Multivariate	
	RSSR	95% CI	aRSSR	95% CI
Age, years* (ref. point)			1·006	
0–4 (2)	1	–	1	–
5–14 (8)	0·8	0·7–1·0	1·0	1·0–1·1
15–29 (22)	0·9	0·7–1·1	1·1	1·1–1·2
30–64 (45)	1·3	1·1–1·7	1·3	1·1–1·5
⩾65 (70)	2·3	1·8–2·9	1·5	1·2–1·9
Gender				
Male	1·3	1·1–1·5	1·3	1·1–1·5
Female	1	–	1	–
Duration before consultation				
⩽3 days	1	–	1	–
4–6 days	10·7	8·7–13·2	9·0	7·1–11·3
>6 days	30·2	24·7–36·8	22·4	17·6–28·4
Bloody diarrhoea				
No	1	–	1	–
Yes	13·1	10·7–16·1	4·8	3·6–6·5
Hospitalization				
No	1	–		
Yes	3·9	2·1–7·4		
Season				
Winter	1	–	1	–
Spring	2·1	1·6–2·7	1·7	1·3–2·2
Summer	3·2	2·5–4·2	2·0	1·6–2·6
Autumn	1·3	1·0–1·7	1·2	0·9–1·5

aRSSR, Adjusted requested stool sample ratio; CI, confidence interval.
* For age the ratios estimated from the model were presented at convenient values (i.e. 2, 8, 22, 45, 70 years).

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DECLARATION OF INTEREST

None.

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