Physician Diagnostic and Reporting Practices for Gastrointestinal Illnesses in Three Health Regions of British Columbia

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ABSTRACT

Objectives: To estimate seasonal proportions of patient visits due to acute gastrointestinal illness (GI), assess factors influencing physicians' stool sample requests, their understanding of laboratory testing protocols and adherence to provincial stool request guidelines in three British Columbia (BC) health regions.

Methods: During a one-year period, eligible physicians were mailed four self-administered questionnaires used to estimate proportions of patients diagnosed with GI, related stool sample requests in the preceding month, and to assess factors prompting stool sample requests.

Results: The response rate overall for the initial comprehensive questionnaire was 18.6%; 7.4% responded to all four questionnaires. An estimated 2.5% of patient visits had a GI diagnosis; of these, 24.8% were asked to submit stool samples. Significant ($p<0.05$) regional and seasonal variations were found in rates of GI and stool sample requests. Top-ranked factors prompting stool sample requests were: bloody diarrhoea, recent overseas travel, immunocompromised status, and duration of illness >7 days; "non-patient" factors included: laboratory availability, time to receive laboratory results, and cost. Physicians' perceptions of which organisms were tested for in a 'routine' stool culture varied.

Interpretation: BC physicians appear to adhere to existing standardized guidelines for sample requests. This may result in systematic under-representation of certain diseases in reportable communicable disease statistics.

MeSH terms: Gastrointestinal diseases; physician practices; gastroenteritis; infectious disease reporting; surveillance

La traduction du résumé se trouve à la fin de l'article.

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Infectious gastrointestinal illness is increasingly recognized as a public health concern.[1-3] However, public health surveillance data generally underestimate the true magnitude and specific causal agents of acute gastrointestinal illness (GI) for several reasons: not all persons with GI seek care, physicians may not request laboratory tests, patients may not submit stool samples upon request, diagnostic tests establish aetiology in only a small proportion of specimens, and confirmed cases may not be reported to the public health surveillance system.[4-6] Established protocols also influence reporting. In British Columbia (BC), laboratory tests are not recommended for mild or moderate cases of GI.[7]

The extent to which surveillance data underestimate the actual burden of disease can be considerable, and can vary by region, pathogen, and expression of symptoms. Moreover, minor changes in physician practices can dramatically alter the number of reported cases.[8,9] A British report states that for every case of infectious gastroenteritis detected by their surveillance system, 136 go undetected.[10] Studies show that less than 30% of patients with gastroenteritis seek care, with 12% in the US,[11] 23% in Ontario, Canada,[12] and 29% in Ireland.[13] In Ontario, for every case of verocytotoxigenic *Escherichia coli*[14,15] the public health surveillance system detects, 4-9 cases are unreported.

Identification and reporting of specific pathogens in patients with GI can improve the effectiveness of public health surveillance,[16] more accurately reflect the true burden of illness, and thus help guide intervention and control measures.

The objectives of this study were to produce estimates of seasonal proportions of primary care patients diagnosed with GI and physicians' rationales for requisitioning stool samples from these patients in three health regions of BC. As well, we sought to gain a better understanding of physicians' perceptions regarding laboratory testing protocols and adherence to provincial stool request guidelines.

METHODS

Data collection

The BC College of Physicians and Surgeons directory was used to identify all

potentially eligible physicians practicing in three of BC's health regions. These geographically distinct regions were: Vancouver (VAN), East Kootenay (EK) and Northern Interior (NI), representing urban, mixed urban/rural, and predominantly rural areas, respectively. Physicians were considered eligible for inclusion if they reported that: i) they provided primary care services (including paediatrics and geriatrics); ii) at least 50% of their patients resided within their health region; and iii) they saw patients at least 8 hours per week during the study period.

The mail-out process involved sending four self-administered questionnaires, Q1-Q4. The first (Q1) was mailed in October 2002, followed by Q2-Q4 in January, May and July of 2003 respectively. Q1 was more comprehensive with both open-ended questions and tick-box lists to determine: 1) practice type; 2) estimated number of patients seen, number diagnosed with acute GI, and number requested to submit a stool sample in the preceding month; and 3) details regarding general factors influencing stool requests and perceptions of laboratory testing procedures. In order to assess seasonal changes in rates, Q2-Q4 addressed only item 2 above, and were sent only to eligible physicians who had completed Q1. An incentive draw prize was offered to encourage returning all four questionnaires. For anonymity, all physicians were identified by a numerical code.

A case definition for acute GI was included with the questionnaire and chosen to be similar to that used in a related population-based study of self-reported GI in the population of the same health regions:[17] a) three or more loose stools in 24 hours; or b) diarrhoea with two other symptoms; or c) vomiting with two other symptoms. Symptoms should have been preceded by a seven-day symptom-free period; "other" symptoms included vomiting, nausea, fever, abdominal cramps and bloody stools.

Data analysis

Data were compiled and stored in Excel;[18] STATA[19] was used for statistical analysis. Binomial exact confidence intervals were computed for estimates of proportions. Regional, seasonal and practice type comparisons were performed using Fisher's two-tailed exact test to assess associations for variables of interest. Analyses of data subsequent to Q1 included only those physicians who had completed all four questionnaires. Significant results were defined by $p \leq 0.05$.

TABLE I

Total Number of Eligible Physician Respondents and Estimated Total Number of Patients Seen, by Health Region and Time of Year (British Columbia, 2002-2003)

Questionnaire (Month, Year)	Health Region	# Eligible Physician Respondents	Response Rate (#Eligible Returns/ #Eligible)	Estimated Total Patients Seen by Physician Respondents (in prior month)
Q1 (October, 2002)	EK *	22	22.0% (22/100)	7756
	VAN†	157	18.71% (157/839)	74,150
	NI‡	15	14.56% (15/103)	8747
	All Regions	194	18.62% (194/1042)	90,653
Q2 (January, 2003)	EK	13		3430
	VAN	108		41,530
	NI	6		2950
	All Regions	127		47,910
Q3 (May, 2003)	EK	15		4028
	VAN	102		44,195
	NI	10		5728
	All Regions	127		53,951
Q4 (July, 2003)	EK	17		4483
	VAN	85		35,123
	NI	9		3580
	All Regions	111		43,186
Completed All 4 Questionnaires	EK	11	11.0% (11/100)	
	VAN	62	7.39% (62/839)	
	NI	4	3.88% (4/103)	
	All Regions	77	7.39% (77/1042)	

* = East Kootenay
† = Vancouver
‡ = Northern Interior

RESULTS

Questionnaire participation

The initial mailout of Q1 to 1,042 eligible physicians resulted in an overall response rate of 18.62% (n=194). Regional response rates were 22%, 18.7% and 14.6% for EK, VAN and NI, respectively (Table I). Seventy-seven responded to all four questionnaires for a response rate of 7.4%. Details on total respondents and visits, by health region and time of year, are found in Table I. Most respondents (174/194) were general practitioners; no significant regional differences in practice type were found.

Proportion of patients with gastrointestinal illnesses

Based on physicians' estimates, 2.5% of all patients seen were diagnosed with GI. Notable regional and seasonal variations were observed (Table II). All three health regions showed the highest proportion of patients with GI in winter (3.5% overall). During winter and spring, NI had a significantly higher proportion of patients diagnosed with GI than VAN and EK combined (Table II).

Diagnostic practices criteria

Overall, physicians' estimates indicated that 24.8% of patients diagnosed with GI were requested to submit stool samples for diagnostic testing (Table II). The highest proportion of stool sample requests (34.9%) was in summer. NI had a significantly smaller proportion of stool sample requests during all seasons except summer (Table II).

Based on checklists and free-text options, physicians reported the most common patient-related factors prompting stool sample requests as: bloody diarrhoea, recent travel overseas, an immunocompromised patient, illness lasting more than 7 days, and illness associated with an outbreak (Table III). "Non-patient"-related factors were: laboratory availability, collection kit availability, time to get results, cost, concerns with antibiotic resistance, confidence in laboratory results, and laboratory pressure to restrict the number of samples (Table IV). No significant differences were found between regions or practice types for factors influencing stool sample requests. Physicians reported "very good" patient compliance for stool sample requests; only 4.3% stated "very poor to

TABLE II

Proportions (with 95% confidence intervals) of Patients Diagnosed with Gastrointestinal Illness (GI) and Requested to Submit Stool Samples One Month Prior to Receipt of Questionnaire, Based on Returns from Physicians Who Completed All Four in the Series of Study Questionnaires: by Health Region and Overall (British Columbia, 2002-2003)

Mail-out (Season)	East Kootenay		Vancouver		Northern Interior		All Health Regions	
	% of all visits diagnosed with GI* (#GI/#visits)	% of stool samples requested from GI patients (#requests/#GI)	% of all visits diagnosed with GI (#GI/#visits)	% of stool samples requested from GI patients (#requests/#GI)	% of all visits diagnosed with GI (#GI/#visits)	% of stool samples requested from GI patients (#requests/#GI)	% of all visits diagnosed with GI (#GI/#visits)	% of stool samples requested from GI patients (#requests/#GI)
Q1	1.9%	**46.7%**‡	2.2%	21.5%	3.1%	**8.0%**§	2.3%	22%
(Fall)	(60/3166)	(28/60)	(792/3552)	(170/ 792)	(75/2450)	(6/75)	(927/41168)	(204/927)
CI† (on %)	(1.4 - 2.4)	(33.7 - 60.0)	(2.1 - 2.3)	(18.7 - 24.5)	(2.4 - 3.8)	(2.0 - 16.6)	(2.1 - 2.4)	(19.4 - 24.8)
Q2	4.4%	24.2%	3.2%	22.5%	**5.9%**‡	**8.9%**§	3.5%	21%
(Winter)	(124/2832)	(30/124)	(877/27087)	(197/877)	(135/2300)	(12/135)	(1136/32219)	(239/1136)
CI (on %)	(3.7 - 5.2)	(16.7 - 32.7)	(3.0 - 3.5)	(19.7 - 25.4)	(4.9 - 6.9)	(4.7 - 15.0)	(3.3 - 3.7)	(18.7 - 23.5)
Q3	1.8%	25.5%	1.9%	29.4%	**4.5%**‡	**13.4%**§	2.2%	26.4%
(Spring)	(47/2583)	(12/47)	(562/28843)	(165/562)	(127/2806)	(17/127)	(736/34232)	(194/736)
CI (on %)	(1.3 - 2.4)	(13.9 - 40.3)	(1.8 - 2.1)	(25.6 - 33.3)	(3.9 - 5.4)	(8.0 - 20.6)	(2.0 - 2.3)	(23.2 - 29.7)
Q4	1.9%	47.4%	2.0%	34.9%	2.9%	23.3	2.0%	34.9
(Summer)	(38/1978)	(18/38)	(481/24106)	(168/481)	(43/1460)	(10/43)	(562/27544)	(196/562)
CI (on %)	(1.4 - 2.6)	(31.0 - 64.2)	(1.8 - 2.2)	(30.7 - 39.4)	(2.1 - 3.9)	(11.8 - 38.6)	(1.9 - 2.2)	(30.9 - 39.0)
All 4	2.5%	32.7%	3.2	25.8	**4.2**‡	**11.8**§	2.5	24.8
Mail-outs	(269/10559)	(88/269)	(2712/83588)	(700/2712)	(380/9016)	45/380		
	(2.3 - 2.9)	(27.1 - 38.7)	(3.1 - 3.4)	(24.2 - 27.5)	(3.8 - 4.7)	(8.8 - 15.5)	(2.4 - 2.6)	(23.3 - 26.2)

* = Gastrointestinal illness
† = Binomial exact 95% confidence intervals on percent
‡ = Significantly higher than the estimate for all health regions combined
§ = Significantly lower than the estimate for all health regions combined

TABLE III

Patient-related Factors That Influence the Likelihood of a Physician Requesting a Stool Sample from Patients with Symptoms of Gastrointestinal Illness (British Columbia, 2002-2003)

Patient-related Factor		Percent of Respondents Indicating How Factor Influences Request (95% exact confidence interval)			
	n	Always or Often (80% or more)	Sometimes (≥20% & <80%)	Rarely or Never (0 - <20%)	Not Relevant*
Bloody diarrhoea	192	92.7 (88.1 - 96.0)	5.2 (2.5 - 9.4)	2.1 (0.6 - 5.2)	–
Recent travel overseas	191	87.6 (82.0 - 91.8)	10.4 (6.5 - 15.6)	1.5 (0.3 - 4.4)	0.5 (0.01 - 2.9)
Immunocompromised patient	194	87.3 (81.8 - 91.7)	9.5 (5.7 - 14.6)	1.6 (0.3 - 4.5)	1.6 (0.3 - 4.5)
Duration of illness >7 days	191	82.9 (76.8 - 87.9)	14.0 (9.4 - 19.7)	3.1 (1.1 - 6.6)	–
Outbreak-associated	193	82.8 (75.6 - 87.0)	12.5 (8.2 - 18.0)	4.2 (1.8 - 8.0)	0.5 (0.01 - 2.9)
Occupational situation	191	74.7 (67.8 - 80.6)	16.9 (11.9 - 23.0)	7.9 (4.5 - 12.8)	0.5 (0.01 - 2.9)
Recent camping trip	191	69.6 (62.6 - 76.1)	23.6 (17.7 - 30.2)	6.3 (3.3 - 10.7)	0.5 (0.01 - 2.9)
Recent antibiotic use	193	63.7 (56.4 - 70.5)	21.6 (16.0 - 28.1)	14.2 (9.6 - 20.0)	0.5 (0.01 - 2.9)
Household outbreak	192	48.2 (40.8 - 55.5)	37.4 (30.5 - 44.8)	13.9 (9.3 - 19.7)	0.5 (0.01 - 2.9)
Fever ≥38°C	193	42.6 (35.5 - 50.0)	36.3 (29.5 - 43.6)	17.9 (12.7 - 24.1)	3.2 (1.2 - 6.7)
Clinical dehydration	191	40.6 (33.5 - 47.9)	38.9 (32.0 - 46.3)	16.3 (11.4 - 22.4)	4.2 (1.8 - 8.1)
Duration of illness 5-7 days	184	36.0 (29.1 - 43.3)	39.1 (32.2 - 46.5)	24.9 (18.9 - 31.7)	–
Patient request	191	29.7 (23.3 - 36.7)	37.5 (30.6 - 44.8)	28.6 (22.4 - 35.6)	4.2 (1.8 - 8.1)
Age of patient	191	28.0 (21.6 - 35.0)	46.7 (38.4 - 53.1)	16.1 (11.2 - 22.2)	10.2 (6.3 - 15.5)
Abdominal pain	190	11.6 (7.4 - 17.0)	48.4 (41.1 - 55.8)	34.7 (28.0 - 42.0)	5.3 (2.6 - 9.5)
Duration of illness 2-4 days	188	5.3 (2.6 - 9.5)	17.8 (12.7 - 24.1)	75.3 (68.5 - 81.2)	1.6 (0.3 - 4.5)

* Not considered as a deciding factor.

poor compliance". Thirty-seven percent of physicians indicated that non-compliance was generally due to improvement of symptoms, inconvenience (28%), disgust with collection (12%), difficulty of collection (10%), ignorance of sample usefulness (7%) and other reasons (6%).

The percentage of physicians who perceived routine stool cultures to include *Salmonella*, *Campylobacter*, *Shigella* and *E.coli* O157 were 93.8%, 93.7%, 93.2%, and 77.9%, respectively. A large proportion did not know whether *Vibrio* (28.9%) and non-O157 *E.coli* (37.2%) were included in routine tests. When ordering a stool culture, 6% of physicians requested specific tests for viruses; in contrast, 56% and 39% "always or often" requested tests for parasites and bacteria, respectively.

DISCUSSION

We found significant differences in both regional and seasonal proportions of GI cases diagnosed by physicians. Stool sample requests were more likely when patients presented with: duration of illness >7 days, bloody diarrhoea, recent travel overseas, outbreak-associated illness, or were immunocompromised. These findings show that physicians adhere to standardized BC guidelines for sample requests.[7]

Regional differences, such as the higher proportion of GI observed in NI, may be due to rural versus urban locations. A US study attributes similar findings to a higher frequency of contact with environmental sources of infection in rural areas.[20] The socio-economic situation might also be a contributing factor. Expensive water treatment systems (e.g., filtration equipment) effective on chlorine-resistant pathogens

like *Cryptosporidium parvum*[21,22] might simply be beyond small community budgets. Moreover, most rural communities use water from private wells that may not be tested regularly. Our finding that GI cases were proportionately higher in winter is similar to an Australian study;[23] this pattern is likely associated with Rotavirus[24] and Norovirus[25,26] cycles that peak during cold months.

Higher stool sample request rates during summer (despite lower proportions of GI) may reflect physicians' concerns with the suspected causal agent and severity of illness. Enteric illnesses of bacterial origin last longer and are generally more severe, hence physicians' choice of "duration of illness lasting >7 days" as a top criteria for stool requests. Also, summertime outdoor activities (e.g., barbequing, swimming) increase the risk of bacterial infections.[27] Stool sample request rates in our study (25%) were similar to one US study (21%)[9] and a Canadian study in Hamilton, Ontario (22%),[28] but lower than in another US study (44%).[29] Similar to our findings, the latter US study[29] described significant regional differences in request rates. However, in our study, this difference could not be explained by factors that physicians *reported* influenced their stool request behaviour since no significant regional differences in these factors were found. This apparent disconnect between the regions, with regards to the actual numbers of requests versus factors identified as influencing sample requests, could indicate that our questionnaire did not capture the factors responsible for this effect, or perhaps physicians are subconsciously more influenced by some of these factors than they believe.

This might explain NI's low rate of stool sample requests despite high proportions of GI. Since most laboratories are in urban centres, the distance from these facilities might effectively reduce numbers of requests from physicians in more rural locations. Other factors, such as concerns with local drinking water quality, might explain the significantly higher sample request rates in EK despite lower proportions of GI-diagnosed patients. The EK region accounts for 21% of all recognized water-borne outbreaks in BC, but has only 2% of the total population.[30]

The fact that physicians were more likely to request stool samples based on certain diagnostic factors such as those outlined in the guidelines (e.g., bloody diarrhoea) implies systematic lack of ascertainment of the true incidence of some diseases. Low stool sample request rates result in unknown aetiology,[29] which could result in under- or over-reporting of specific pathogens in public health surveillance.

TABLE IV

Non-patient-related Factors That Influence the Likelihood of a Physician Requesting a Stool Sample from Patients with Symptoms of Gastrointestinal Illness (British Columbia, 2002-2003)

Factor	% of Respondents Stating Factor Influences Request (#Yes / #Respondents)	95% Exact Confidence Interval
Laboratory availability	25.4 (46/181)	(19.2 - 32.4)
Collection kit availability	20.2 (35/173)	(14.5 - 27.0)
Confidence in laboratory results	14.1 (25/177)	(9.4 - 20.1)
Laboratory pressure to restrict the number of samples	11.9 (21/177)	(7.5 - 17.6)
Length of time to get lab results	24.7 (45/182)	(18.6 - 31.7)
Cost of lab analysis	23.6 (42/178)	(17.6 - 30.5)
Concerns with antibiotic resistance	23.5 (42/179)	(17.5 - 30.4)

Physicians in our study had similar perceptions of a "routine" stool culture as physicians in a US study,[29] wherein 99% believed that tests for *Salmonella* and *Shigella* would be included, 95% for *Campylobacter* and 70% for *E.coli* O157:H7. However, more than 40% of physicians in the US study, compared to 29% in ours, did not know whether tests for *Vibrio* were included in routine stool cultures. Uncertainty over whether less common pathogens like *Vibrio* are included in regular screening has public health significance because physicians may assume pathogens are tested for when in fact they are not, leading to an under-reporting of GI events. A survey of Canadian laboratories reports intra- and inter-provincial variations in the organisms tested for during routine stool cultures;[31] testing was consistent for common enteric pathogens, but quite variable for other pathogens. Thus, physician education clarifying the variability in laboratory testing methodologies is recommended.

Since our analyses depended on physician self-reporting without consulting their actual records, recall and misclassification biases may have influenced findings of both GI rates and stool sample requests. These approximations could have either over- or under-reported the numbers. Studies that depend on self-reporting also tend to select for those who are interested in the subject and thus might also select for those who are more inclined to request stool samples.

Our study is indicative of general trends; a review of actual physician records would provide more accurate information. Additionally, small regional sample sizes resulted in low power for detecting potentially significant differences. Nationwide studies are still needed for interpolation beyond this single-province study.

The results of this physician-level investigation and two concurrent studies at the population[17] and laboratory[31] levels will contribute to a better understanding of reasons for under-reporting and estimate the degree to which it occurs at each of these levels. More specific information on true pathogen loads in the community could be determined through a targeted study of representative physicians with increased sampling over a period of time. This would estimate the prevalence of a broader range of enteric pathogens, which could in turn be used to create adjustment factors for data that are currently collected. Such information is critical for helping public health to better interpret available surveillance data and to better understand the epidemiology of enteric diseases in the population.

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RÉSUMÉ

Objectifs : Estimer, dans trois régions sanitaires de la Colombie-Britannique (C.-B.), les pourcentages saisonniers de visites médicales en raison de maladies gastrointestinales (MGI) aiguës, et déterminer les facteurs incitant les médecins à demander des échantillons de selles, leurs connaissances des protocoles d'essai des laboratoires et leur respect des lignes directrices relatives aux demandes d'échantillons de selles.

Méthode : Sur une période d'un an, les médecins admissibles ont reçu par la poste quatre questionnaires à remplir soi-même, qui ont servi à estimer le pourcentage de patients chez qui une MGI avait été diagnostiquée et le nombre connexe d'échantillons de selles demandés le mois précédent, et à évaluer les facteurs incitant les médecins à demander un échantillon de selles.

Résultats : Le taux global de réponse au premier questionnaire général s'est élevé à 18,6 %, et 7,4 % des médecins ont répondu aux quatre questionnaires. Un taux estimatif de 2,5 % des patients avaient reçu un diagnostic de MGI, et les médecins avaient demandé à 24,8 % d'entre eux de fournir des échantillons de selles. Des variations régionales et saisonnières importantes ($p<0,05$) ont été observées dans les taux de MGI et de demandes d'échantillons de selles. Les principaux facteurs incitant les médecins à demander un échantillon de selles étaient : la présence de sang dans les selles, un voyage récent à l'étranger, un déficit immunitaire et une maladie qui dure plus de sept jours; les facteurs « extérieurs aux patients » étaient, entre autres, la disponibilité du laboratoire, le temps nécessaire pour recevoir les résultats et les coûts. Les perceptions des médecins au sujet des organismes visés par une culture de selles « de routine » étaient variables.

Interprétation : Les médecins de la C.-B. semblent s'en tenir aux lignes directrices normalisées en vigueur relativement aux demandes d'échantillons de selles, ce qui peut se solder par une sous-représentation systématique de certaines maladies dans les statistiques sur les maladies transmissibles à déclaration obligatoire.