

Prevalence of gastrointestinal infection among international travellers returning to Canada

MARGARET L RUSSELL, MD, PHD, EDGAR J LOVE, MD, PHD, LARISSA KF TEMPLE, BSC(H)

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OBJECTIVE: To describe the prevalence of parasitic and bacterial gastrointestinal infection (excluding enterotoxigenic *Escherichia coli*) among international travellers attending the International Travel Clinic at The University of Calgary. **METHODS:** Data were abstracted from the records of the first visit after travel of all persons making a post travel visit between January 1, 1986 and March 31, 1990. **RESULTS:** Data were available for 886 first visits (840 persons). Stools were submitted by 692 travellers. The frequency of stool submission varied by the duration of travel abroad, and the frequency of diarrhea either during or after the trip was greater among those who had submitted a stool specimen. The prevalence of stools positive for ova, parasites or pathogenic bacteria was 41.2%. When only pathogenic organisms were considered, the prevalence of infection was 19.4%. The most commonly isolated pathogenic parasites were *Dientamoeba fragilis*, *Giardia lamblia*, and *Entamoeba histolytica*. The most commonly isolated bacteria were *Campylobacter* species and *Salmonella* species. **CONCLUSIONS:** Although the prevalence of positive stool screens among returned travellers in this population was high, only about one-fifth of persons tested were positive for pathogens.

Key Words: Diarrhea, Diarrhea prevention and control, Epidemiology, Retrospective studies, Travel

Prévalence de l'infection gastro-intestinale chez les voyageurs qui reviennent au Canada

OBJECTIF: Décrire la prévalence des infections gastro-intestinales parasitaires et bactériennes (à l'exclusion de *Escherichia coli* entérotoxigène) chez les voyageurs en provenance de l'étranger, qui fréquentent l'*International Travel Clinic* de l'Université de Calgary. **MÉTHODE:** Les données ont été extraites des dossiers de première consultation suivant le retour de voyage de toutes les personnes qui ont visité la clinique entre le 1er janvier 1986 et le 31 mars 1990. **RÉSULTATS:** Des données ont été disponibles pour les 886 premières consultations (840 personnes); 692 voyageurs ont soumis un spécimen de selles. La fréquence de l'échantillonnage de selles variait selon la durée du séjour à l'étranger, et la fréquence de la diarrhée durant ou après le voyage était plus grande parmi ceux qui avaient soumis un spécimen de selles. La prévalence de positivité des selles à l'égard d'oeufs, de parasites ou de bactéries pathogènes était de 41,2%. Lorsque seulement des organismes pathogènes étaient considérés, la prévalence de l'infection était de 19,4%. Les parasites pathogènes les plus fréquemment isolés étaient *Dientamoeba fragilis*, *Giardia lamblia* et *Entamoeba histolytica*. Les bactéries les plus fréquemment isolées ont été *Campylobacter* et *Salmonella*. **CONCLUSIONS:** Bien que la prévalence de positivité du dépistage au niveau des selles parmi ces voyageurs ait été élevée, seulement un cinquième des personnes soumises aux épreuves se sont révélées positives à l'égard des pathogènes.

Department of Community Health Sciences, Faculty of Medicine, University of Calgary

Correspondence and reprints: Dr Margaret L Russell, Department of Community Health Sciences, Faculty of Medicine, University of Calgary, 3330 Hospital Drive NW, Calgary, Alberta T2N 4N1. Telephone (403) 220-4286, Fax (403) 283-4740

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IN 1988, 14.5 MILLION UNITED STATES CITIZENS TRAVELLED to countries other than Canada and Mexico (1). Travel to more exotic destinations including the Caribbean, Central and South America, Japan, Africa and Oceania between 1986 and 1988 increased by 15.7%. Similarly, Canadians took 2.8 million trips to countries outside the United States in 1988; and travel to Africa, Asia, Central and South America increased by 28% between 1986 and 1988 (2).

The most common health problem experienced by international travellers while abroad, particularly those to developing countries, is travellers' diarrhea (3). However, symptoms may persist or primarily manifest themselves after the traveller returns home. Among short term visitors to developing countries, about 30% suffer severe diarrhea abroad and at home, and 12% have severe diarrhea which begins only upon return home (4). As diarrhea is so extremely common among travellers, stool examinations are often ordered as part of the workup of the returned traveller, particularly the individual who was ill while abroad. However, such testing may result in substantial health care costs, particularly if the prevalence of infection is low. For example, among North Americans, the use of routine stool cultures for detection of salmonella and shigella may yield positive results in only 1.5 to 2.5% of cases, resulting in costs per positive as high as \$900 to \$1200 (5). Thus, a determination of organism prevalence will aid in the improved selection of patients for laboratory tests, in this instance, for post travel stool screening. Although many studies of acute travellers' diarrhea have been published, only a few studies report the prevalence of infections among returned travellers (6,7), and no published data exist regarding travellers returning to North American destinations.

This study describes the prevalence of parasites and pathogenic bacteria found on routine laboratory stool assessment among returned travellers attending The University of Calgary International Travel Clinic (ITC), and explores correlates of stool positivity such as trip duration.

METHODS

The University of Calgary ITC provides both pre and post travel health assessment, diagnosis and treatment for international travellers. Patients are referred by themselves, by community health nurses and by physicians. Pre and post travel patients routinely complete a self-administered questionnaire including socio-demographic data, dates of travel and countries visited. Post travel patients also complete a checklist of environmental exposures. Between January 1, 1986 and March 31, 1990, one stool culture and two examinations for ova and parasites were ordered for all returned travellers making a first post travel visit who attended the ITC; however, further stool examinations were car-

ried out as clinically indicated. Persons who visited the clinic because of immigration to Canada were excluded from the study.

Stool specimens submitted for culture were routinely screened for salmonella, shigella, yersinia, campylobacter, aeromonas, pleisomonas, vibrio and verotoxin producing *Escherichia coli*. Specific testing for enterotoxigenic *E coli* (ETEC) was not carried out, as this procedure is not part of routine microbiological testing.

Specimens to be examined for ova and parasites were submitted to gauze filtration and gross inspection, concentrated, and wet and iron hematoxylin stained specimens were examined.

The following data were abstracted from the charts: dates of clinic visits; dates of travel; exposures to untreated water, milk and raw or poorly cooked meat and fish; use of medication; and results of stool examinations. Destinations outside of the United States and Canada, where the largest amount of time was spent, were coded up to a maximum of six destinations giving priority to destinations in developing countries. The number of visits exceeds the number of persons, because the first post travel clinic visit for each trip was used for persons who travelled more than once during the study period.

Data were coded and entered using the SPSS-DE statistical analysis computer programs. Frequencies, cross tabulations and stratified tables were performed using the MINITAB statistical package and P values are reported for descriptive purposes only. Odds ratios and 95% confidence intervals were calculated using the Epi Info Software Package.

RESULTS

Clinic population characteristics: During the study period, the ITC saw 840 persons for post travel assessment. Because some of these had travelled on more than one occasion during the study period, there were 886 'first' post travel visits. In the discussion of results which follows, those rates based on persons versus visits will be so identified.

The majority of the visits were self-referred (81.6%); however, 10.3% were referred by other physicians and 4.1% by the patient's employer. Five hundred and sixteen of the visits (59.2%) were made by males and 356 (40.8%) by females. The purpose of travel (846 trips) was: holiday/tour (47.4%); business/employment (40.8%); visiting family (2.8%); or other (9.0%).

Most persons (64.5%) had visited more than one destination: 17.6% visited six or more; 46.9% visited between two and five destinations; and 35.4% visited one destination. As shown in Table 1, 70.7% had visited Asia, 37.6% Africa, and 28.9% Central/South America and the Caribbean. The duration of absence from Canada ranged from one day to six years: 39.4% lasted one month or less; 19.8% one to three months; 17.3% four

to eight months; and 23.5% nine months or longer. Patients visited the clinic a median of 20 days after returning to Canada.

The median age of the patients was 31.7 years (range four months to 75.2 years), and did not differ between males and females.

Only 29.4% of the patients had been seen by an ITC physician for a pre-travel assessment.

Diarrhea: Eight persons had had diarrhea prior to departure. Excluding these eight, diarrhea was experienced during or after the trip by 641 of 747 persons (85.8%) for whom data were available. Of the 589 where the onset of diarrhea occurred during the trip, 238 (40.4%) had symptoms persisting after returning to Canada.

Medications: The majority of travellers (82.6%) used some form of medication while abroad. Types of medication taken included: antimotility (6.1%); antibiotic/anthelmintic (37.8%); both antimotility and antibiotic/anthelmintic (4.9%); and other medications (33.7%).

Stool submission: Stools were submitted for examination by 692 persons. Patients submitting specimens had been abroad for longer periods than those who did not. Of persons who had been abroad for one month or less, 71.4% submitted stools for examination compared to 89.1% of those who had been abroad for nine months or longer ($P < 0.001$). Persons who submitted stool specimens were also more likely to have experienced diarrhea than those who did not (88.8% versus 65.1%).

Prevalence of infection: The proportion of persons infected with one or more organisms was 41.2%. Mixed infections were common. Although the median number of organisms isolated was one, up to six organisms were isolated from some persons. Table 2 displays the prevalence of infection by organism. Overall, 5.9% of patients were infected with potentially pathogenic bacteria, and 39.7% with protozoa and/or helminths. In contrast to the 41.2% overall prevalence of infection with one or more organisms, only 19.4% of persons were infected with pathogens (ascaris, campylobacter, *Dientamoeba fragilis*, giardia, salmonella, hookworm, trichuris, *Entamoeba histolytica*, cryptosporidium, tapeworms, or schistosomes).

Correlates of infection: The isolation of organisms in one or more stools was not associated with the patient's age, gender, use of any medications, use of antibiotics/anthelmintics, or use of antimotility medications. Organism isolation was also not associated with ever having had diarrhea.

Organism isolation was negatively associated with the time elapsed between the trip and visit to ITC (42% of trips lasting less than one month versus 38.7% of longer trips), and positively associated with the duration of travel (45.1% for trips longer than one month versus 28.6% for trips lasting less than one month). There was no association at the 0.05 probability level

TABLE 1
Destinations of travellers

Destination	Number	Percentage*
Asia	601	70.7
Africa	320	37.6
Central/South America and Caribbean	246	28.9
Oceania/Australia/New Zealand	120	14.1
North America	49	5.8
Middle East	38	4.5

* Totals exceed 100% because most persons visited multiple destinations

TABLE 2
Organism prevalence

Organism	Prevalence (%) (Calgary)	Prevalence (%) (Finland)
<i>Campylobacter jejuni</i>	3.2	1.1
<i>Salmonella</i> species	2.2	4.1
<i>Aeromonas</i> species	1.5	-
<i>Shigella</i> species	1.2	1.1
<i>Pleisomonas shigelloides</i>	0.2	-
<i>Pseudomonas</i> species	0.2	-
<i>Enteromonas</i> species	0.3	-
<i>Endolimax nana</i>	34.1	-
<i>Blastocystis hominis</i>	15.2	-
<i>Entamoeba coli</i>	9.0	-
<i>Dientamoeba fragilis</i>	4.9	-
<i>Giardia lamblia</i>	4.8	4.4
<i>Entamoeba hartmanii</i>	4.2	-
<i>Entamoeba histolytica</i>	3.3	2.3
<i>Iodamoeba buetschlii</i>	2.3	-
<i>Chilomastix mesnili</i>	1.6	-
<i>Entamoeba</i> (unspecified)	0.9	-
<i>Cryptosporidium</i> species	0.3	0.1
<i>Trichuris trichuria</i>	2.0	1.8
<i>Ascaris</i> species	1.2	1.3
Hookworm	0.4	0.3
<i>Hymenolepis nana</i>	0.1	-
<i>Schistosoma</i> species	0.1	-
<i>Geotrichum</i> species	0.1	-

between the isolation of classes of organisms (protozoa, bacteria or helminths) and the occurrence of diarrhea, after controlling for trip duration. In contrast, pathogens were significantly less likely to be isolated in persons whose diarrhea persisted after returning to Canada or had onset after returning to Canada, than in persons who had experienced diarrhea only while abroad. Pathogens were isolated from 30.6% of persons who experienced diarrhea only while abroad compared with 18.5% of persons whose diarrhea persisted or began after returning to Canada. Among persons abroad for less than three months, those having onset of diarrhea during the trip were slightly more likely than those with onset after their return to have patho-

genic bacteria isolated (odds ratio = 3.0, 95% confidence interval 1.02-9.39).

Organisms were isolated from 40% of persons who had ever visited Africa compared with 31% of those who had not. Similarly, pathogens were isolated from 38% of persons who had visited Africa versus 30% of persons who had not. No other destination was associated with isolation of pathogenic or nonpathogenic organisms.

No association was observed between pathogen or organism isolation and the following environmental exposures: eating in local homes; eating poorly cooked or raw fresh fruit, fresh vegetables, pork, beef or fish; eating or drinking unpasteurized dairy products; drinking untreated or unboiled water; wading, bathing or swimming in fresh water; and walking barefoot or having close contact with wild or domestic animals. Organisms were isolated from 44% of persons who had eaten food obtained from street vendors compared with 30% of persons who had not; for pathogens, the proportions were 29% and 21%, respectively.

DISCUSSION

It is recognized that the prevalence of parasites and pathogenic bacteria reported in this paper may be biased because the submission of stool specimens for examination was associated both with patients having had diarrhea and with the duration of the trip abroad. Generalizations from these data must bear this caution in mind.

Additionally, the population of returned travellers studied in Calgary may differ from those observed at other travel clinics and may also differ from those seen in primary care practices with respect to trip duration, destinations and patterns of health care use. For example, only 16% of returned travellers attending a Finnish clinic had been abroad for one month or less (6) in contrast to the 39.4% in this study. The mean trip duration in a sample of returned travellers attending a New York City clinic was 21.3 days (8). While 37% of both the Finnish and the Calgary samples had visited Africa, nearly 50% of the New York sample had done so. The proportion of the Calgary population visiting Asia was about twice that of the New York study and more than three times that of the Finnish. Thus, the findings of this study may not be generalizable to any other site. The trip duration and pattern of health care use on return from travel seen in Calgary is also of importance in that the long median delay (20 days) between return from travel and Clinic visit will have reduced the detectable prevalence of bacterial infection, as the excretion of pathogenic bacteria subsequent to an acute episode of diarrhea has been shown to rapidly decline over time (9).

A further limitation of the present study which restricts comparisons with other studies of travellers' diarrhea is that stool specimens were not routinely screened for the presence of ETEC, which is probably

the most common cause of travellers' diarrhea (10). However, the majority of Canadian hospital out-patient laboratories do not routinely perform this screen; thus, the present study may give some indication of what other Canadian centres with similar populations of travellers might expect to observe. Indeed, it is notable that the proportion of persons in our study from whom fecal pathogens were isolated (19.4%) is quite similar to the 15% found in a study of returned travellers attending a Finnish clinic (6). In particular, the proportions from whom *giardia*, *E histolytica*, trichuris, ascariis, shigella and hookworm were isolated were very similar to the proportions found among the returned Finnish travellers (Table 2). Similarly, the 3.3% of our patients infected with *E histolytica* is very similar to the 3.8% found by Jedlicka *et al* (7) among persons returning from Africa, Latin America and Asia. The similarities are particularly striking because of differences between our population and that of the Finnish study with respect to destinations visited and duration of time abroad, variables which have been associated with both the probability of acquiring travellers' diarrhea and of isolating particular classes of organism (6,9).

It is difficult to make comparisons between studies with respect to the overall proportion of persons infected with one or more organisms because of differences in laboratory procedures and reporting methods. Our laboratory routinely reports the presence of *Blastocystis hominis*, for example, and this alone may be responsible for the discrepancy between our observation of an overall infection rate of 41.2% compared with the 26.7% reported by Kyronseppa and Peltola (6) and 14.1% described by Jedlicka (7).

It is apparent that there are differences between returned travellers and the Canadian population at large, with respect to frequency of isolation of one or more organisms. Parasite prevalences were estimated by Gyorkos (14) based on isolations from Canadian provincial laboratories. An overall parasite prevalence rate (protozoa and worms) of 16.4% was observed, in contrast to the 39.7% observed in the present study (29.6% excluding *B hominis*). While it was unclear if Gyorko's data included *B hominis*, it is evident that a substantially larger proportion of returned travellers than the Canadian population at large show evidence of exposure to a fecally contaminated environment.

It is surprising that we found no association between organism isolation and the use of medications at any time. Possible explanations include poor recall of medications taken, or that organisms likely to be affected by medications had been treated prior to the return to Canada, and/or that organisms had been excreted prior to the ITC visit, or that ETEC, which we did not study, is the organism most likely to be affected by commonly taken medications. Many of the persons who had diarrhea took antibiotics while abroad, and

some of them may have been infected by *Clostridium difficile*. While *C difficile* toxin was not found in any of the persons studied, this test was not routinely ordered on persons with diarrhea for whom a pathogen was not found. Further investigation of the role of *C difficile* in diarrhea among returned travellers would be of interest.

The observation that pathogens were less likely to be isolated from persons whose diarrhea had onset or persisted after returning to Canada than persons who experienced diarrhea only while abroad, is surprising. It is possible, however, that this observation might be confounded by the length of delay between symptom onset and clinic visit. However, controlling for elapsed time between returning to Canada and clinic visit did not affect this relationship. The other possibility is that persons with diarrhea continuing or beginning after returning to Canada may have been suffering from ETEC, which we did not study.

Finally, as only 19.4% of persons were found to be

infected with pathogens, despite the high proportion of persons who had had diarrhea, the data suggest that routine stool screening for international travellers is of limited use. Further studies are needed to establish the best predictors of pathogen isolation so that rational, cost-effective laboratory testing can be facilitated.

CONCLUSION

We have described the prevalence of gastrointestinal infection found by laboratory procedures likely to be routinely performed by hospital and out-patient laboratories. While the findings may not be generalizable due to differences in laboratory procedures and patient travel patterns, there were striking similarities in the organism specific prevalences to those found in a clinic population in Finland. These similarities suggest that concordant rates for at least some organisms might be anticipated to be found among international travellers returning for care elsewhere in the developed world.

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