Epidemiology, Etiology, and Impact of Traveler’s Diarrhea in Jamaica

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Traveler’s diarrhea (TD) is a self-limited illness that usually resolves spontaneously within a few days, but it has the potential for wrecking a meticulously planned business or pleasure trip. Annually 35 million people travel from industrialized countries to a developing country. Among them, TD had an incidence rate of 20% to 50% per 2 weeks’ stay in 1979 to 1981, but has not been assessed on a global scale since. The increase in travel has resulted in dramatic changes in the tourism industry and put pressure on local infrastructure that might influence the epidemiology of TD. Therefore, we decided to assess the epidemiology and etiology of TD in various tourist destinations on different continents, such as Jamaica, later also in Brazil, India, and Kenya.

There is also growing evidence indicating that conventional clinical indices of illness correlate weakly with how patients actually feel and how they are able to function in their daily lives. Therefore, we wanted to assess the quality of life, which reflects the dimensions of physical, emotional, and social impact of disease and the effect of prophylaxis and/or treatment on disease. It is widely recommended that measuring the latter should be completed prior to introducing new technologies and treatments into the marketplace. Furthermore, there is a lack of data on the impact of TD in the developing world. Since oral vaccines against enterotoxigenic *Escherichia coli* (ETEC), Rotavirus, and various other pathogenic agents associated with TD may soon be marketed, it needs to be determined who might benefit from such vaccines.

Here we report on the results from Jamaica where the number of tourists increased from 0.4 to 1.2 million per year during the 1980-1996 period. The Jamaican ministries of health and tourism are to be commended for stimulating participation of International Medicine and Public Health, University of Munich, Munich, Germany (Drs Tornieporth and von Sonnenburg); Western Area Health Administration, Ministry of Health of Jamaica (Dr Campbell-Forrester and Ashley), Department of Microbiology, Cornwall Regional Hospital (Ms Thompson), Montego Bay, Jamaica; Center for Infectious Diseases, University of Texas, Houston (Dr Mathewson); The Lewin Group, Mechelen, Belgium (Mrs Maes); Department of Clinical Epidemiology and Biostatistics, McMaster University, Health Science Centre, Hamilton, Ontario (Dr Stephenson); and St Luke’s Episcopal Hospital, Houston (Dr DuPont).

Financial Disclosure: Mrs Collard and Dr Tornieporth are currently employed by SmithKline Beecham Biologicals, Rixensart, Belgium, which supported the survey with an unrestricted grant. SmithKline Beecham Biologicals in collaboration with SBL Vaccin, Stockholm, Sweden, is in phase 3 clinical trials of a prophylactic vaccine against enterotoxigenic *Escherichia coli*. Corresponding Author and Reprints: Robert Steffen, MD, Institute of Social and Preventive Medicine, Sumerstrasse 30, CH-8006 Zurich, Switzerland (e-mail: travelclin@ifspm.unizh.ch).

**Context** Traveler’s diarrhea (TD) can incapacitate travelers. Characteristics of TD could be helpful in identifying individuals who might benefit from a vaccine against TD.

**Objective** To determine epidemiology, etiology, and impact of TD in Jamaica.

**Design** Two-armed, cross-sectional survey conducted between March 1996 and May 1997.

**Setting** Sangster International Airport and 10 hotels in Montego Bay area, Jamaica.

**Subjects** To investigate epidemiology and impact, 30 369 short-term visitors completed a questionnaire just before boarding their homebound aircrafts. To investigate etiology, 322 patients (hotel guests) with TD provided stool samples.

**Main Outcome Measures** Attack and incidence rates of reported diarrhea and of classically defined TD (≥3 unformed stool samples in 24 hours and ≥1 accompanying symptom), incapacity, risk factors, and etiology.

**Results** The attack rate for diarrhea was 23.6% overall, with 11.7% having classically defined TD. For a mean duration of stay of 4 to 7 days, the incidence rate was 20.9% (all TD) and 10.0% (classic TD). Among airport respondents, the incapacity lasted a mean of 11.6 hours. Less than 3% of all travelers avoided potentially high-risk food and beverages. The most frequently detected pathogens were enterotoxigenic *Escherichia coli*, Rotavirus, and *Salmonella* species.

**Conclusions** A realistic plan for reducing TD is needed. Preventive measures such as the improvement of hygienic conditions at the destination, and/or the development of vaccines against the most frequent pathogens associated with TD may contribute toward achieving this goal.
ing scientific efforts over the last decade to reduce health risk to visitors.

**METHODS**

This study was conducted between March 1996 and May 1997 and consisted of 2 parts, each lasting 12 months. First, a cross-sectional survey of travelers leaving from Montego Bay's Sangster International Airport was used to analyze TD epidemiology, economic features, and the subjective and objective impact of TD on the tourists' well-being. Second, stool samples were collected at selected hotels from patients with diarrhea who volunteered for evaluation of the etiology of TD. Institutional review boards from the University of Zurich Institute of Social and Preventive Medicine, the Jamaica Ministry of Health (for both study arms), and the University of Texas, Houston, Health Science Center reviewed the protocol of the study. In the hotel study, written informed consent was obtained from each volunteer, while in the airport study voluntary acceptance to complete the anonymous questionnaire was considered consent.

**Airport Study**

Sangster International Airport in Montego Bay is used by more than 90% of the foreign tourists visiting Jamaica. Pretrained interviewers of the Jamaica Tourism Board invited departing travelers of both sexes, 16 years or older, to fill in a self-administered questionnaire while waiting in the departure area. The questionnaire was provided in 6 languages: English, French, German, Spanish, Italian, and Japanese, reflecting the composition of the tourists. Jamaican residents and long-term residents staying more than 100 days were excluded. The questionnaires were actively collected by trained interviewers of the Jamaica Tourism Board, who invited departing travelers of the foreign tourists visiting Jamaica. Predeparture prophylaxis, TD therapy, and cost of stay. Type B investigated food and beverage consumption and quality of life. After a pilot study, 8 questionnaires were distributed during 1 week every month for a 12-month period. Type A was distributed 6 days a week, type B on the randomly selected remaining day.

**Hotel Study**

At 10 large hotels of varying standards willing to collaborate in the Montego Bay area, guests were encouraged to visit the nurse's station, should TD occur. Those reporting TD within 48 hours of onset and who had not used antimicrobial agents in the previous 7 days were invited to sign an informed consent form, provide a stool sample, and complete a questionnaire containing all questions of type A and B. Thereafter, the study resident stationed in the Montego Bay area or the hotel nurse offered free state-of-the-art treatment. The patient was given an address to inquire about laboratory results, if needed. In case of relevant diagnosis (eg, *Salmonella* species) the patient was to be contacted by the study physician.

**Laboratory Evaluation of Stool Samples**

The initial laboratory analysis of stool samples for bacterial and parasitic enteropathogens was conducted at the Department of Microbiology, Cornwall Regional Hospital in Montego Bay. The University of Texas Medical School Enteric Laboratory in Houston was responsible for *E coli* toxin, colonization factor antigen (CFA) testing, virologic assays, and microbiology quality assurance, including confirmation of enteropathogens. On workdays, native stool samples were transferred at 4°C to the local laboratory to be processed within 24 hours. On weekends, we used a transport medium (Enteric Plus, Meridian Diagnostics, Cincinnati, Ohio) and a plastic vial for frozen stool samples, which were processed the next working day. In the local laboratory, stool samples were tested for fecal leukocytes and occult blood. The samples were divided in 3 aliquots, of which 2 were frozen and analyzed later (protozoa enzyme-linked immunosorbent assay [ELISA] at the local laboratory and virology studies in Houston). The third aliquot was processed for the following bacterial enteropathogens: *E coli* (for later detection of ETEC), *Salmonella* species, *Shigella* species, *Campylobacter jejuni*, *Yersinia enterocolitica*, *Vibrio* species, *Aeromonas* species, and *Plesiomonas shigelloides* by previously described methods. Using commercial ELISAs (Alexon Inc, Ramsey, Minn) *Guardia lambia*, *Entamoeba histolytica*, and *Cryptosporidium parvum* were also assessed. The Houston laboratory also tested for *Microsporidia* by using a modified trichrome stain (Trichrome blue, Meridian Diagnostics Inc) and for *Cyclospora* using a modified acid-fast stain that was used for *Cryptosporidium*. Rotavirus and adenovirus were also assessed, except for 38 samples for which there was insufficient material. Per patient, 5 samples of *E coli* isolates and 1 frozen stool sample were transferred to Houston where the *E coli* isolates were analyzed with a hybridization method for heat-labile enterotoxin, human heat-stable enterotoxin, and porcine heat-stable enterotoxin. All strains shown to produce an enterotoxin were then tested for CFAs using a dot blot procedure; CFA1, C2, C3, C4, C5, C6, C7, CFA/VIII, CS17, putative colonization factor (PCF) 0159, and PCF 0166 were investigated.

**Quality of Life**

A 25-item questionnaire was designed to assess quality of life in relation to contracting TD (type B questionnaire). The questionnaire included demographic and diarrhea-related questions (ie, type of diarrhea, severity of symptoms) and 10 questions specifically assessing various dimensions of quality of life, scored along a 7-point Likert scale. The questions were adapted from a previously validated instrument assessing quality of life in patients with inflammatory bowel disease. The maximum score for the best quality of life a traveler could experience was 70 (10 × 7) while the poorest one was 10 (10 × 1). Those travelers not completing all 10 quality-of-life questions were excluded from the analysis.

**Economics**

A decision outcome model was designed based on the logical sequence of medical
decisions in chemoprophylaxis and treatment of TD to calculate both the medical and economic burden of disease. The analysis was carried out from a societal perspective for travelers originating predominantly from the United States, United Kingdom, and Germany. This viewpoint identifies all costs and benefits regardless of who incurs the cost or receives the benefits. Cost data were calculated in terms of direct medical costs and indirect costs related to incapacitation as a result of disease. Data on incidence of TD, clinical features (symptoms, duration of episode of diarrhea, duration of impairment), consumption of medication and health services, if any, and loss of business/tourism opportunities was obtained from the type A questionnaire. Only questionnaires that complied with the criteria described in the “Airport Study” subsection were retained. Data were incorporated in the model to obtain a preview of the cost per person per stay in Jamaica. Medical service fees were calculated based on fee-for-service rates, and medication costs were taken from listings of pharmaceutical specialties in the respective home countries. The burden of TD related only to ETEC pathogens.

Definitions

As in previous studies classic TD was defined as passage of 3 or more unformed stools per 24 hours with at least 1 accompanying symptom (nausea, vomiting, abdominal cramps or pain, fever, blood in stools). Moderate TD was passage of 1 to 2 unformed stools with at least 1 additional symptom or more unformed stools without additional symptoms. Mild TD was passage of 1 to 2 unformed stools without additional symptoms. Severity of accompanying symptoms was graded 1 to 4 by the patient. Summer was defined as the months from May to October, winter was from November to April. Incapacitation was defined as inability to pursue planned activities. High-risk food items did not fully comply with the old British colonial rule “cook it, boil it, peel it—or forget it.” Twelve risky food items consumed occasionally or daily resulted in a maximum score of 24.

Statistical Analysis

Data management and tabulations were performed with Epi Info software (version 6.04b, Centers for Disease Control and Prevention, Atlanta, Ga). To supplement this program, SAS software (version 6, SAS Inc, Cary, NC) was used for the statistical analysis. The attack rates of diarrhea are presented as simple proportions with 95% confidence limits (CLs). Kruskal-Wallis and x2 tests were applied to compare continuous and discrete predictor variables. The stratified Mantel-Haenszel method was used to test for confounding variables. The analysis of the airport study was supplemented by a logistic regression model with the potential predictor variables of age, season, type of hotel, sex, purpose of stay, duration of stay, health advice, and country of origin. The reference population for the calculation of the odds ratios (ORs) was the 27 948 people for whom the above-mentioned variables were completely known.

RESULTS

Airport Survey Population

At the airport, 30 532 questionnaires (26 957 [88.3%] type A and 3575 [11.7%] type B) were collected, of which 30 369 (99.5%) could be evaluated according to study inclusion criteria. In type A (25 questions) there were no missing answers in 78.5%, and 1 missing question in 18.0% of the responders; in type B these rates were 50.2% and 31.4%, respectively. The main demographics for type A and type B questionnaires were similar. Overall 52.6% were women, with a mean (SD) age of 33.5 (10.5) years (35.3 [10.9] years for men); the mean duration of stay was 7.7 (4.3) days (median, 7 days). This value varied by country of residence from 5.3 (2.0) days (Japan) to 15.2 (6.5) days (Germany). The purpose of travel was a vacation for 69.9%, marriage and/or honeymoon for 23.6%, business for 2.0%, other for 4.5%. Visitors from the United States accounted for 71.4% of the study population.

Epidemiology of Traveler’s Diarrhea

According to the airport survey, the total TD attack rate over the 12-month period was 23.6%, with 11.7% of the total population having classic TD, 8.3% moderate TD, and 3.6% mild TD. As shown in TABLE 1, TD attack rates significantly decreased with age, whereas there was no significant sex-related difference. All TD attack rates increased with duration of stay until day 14 but then decreased. Persons residing in northern countries and honeymooners showed significantly higher classic and moderate TD attack rates (Table 1).

The vast majority of tourists (74.1%) chose an all-inclusive package (all meals and beverages at the hotel included, which does not preclude occasional consumption outside the hotel) and had significantly higher TD rates compared with those with various other meal plans. Of all visitors to Jamaica, 2 out of 5 had no meals and beverages outside their hotel and there were no relevant differences in TD rates with those eating outside. There were 916 visitors who stayed with friends and/or family, and they had a significantly lower total TD rate (95% confidence interval [CI], 12.8%-2.2%). In total, 95% of travelers had ice cubes in their drinks and 90% ate salads, both usually on a daily basis, approximately 80% consumed dairy products and tap water, and more than 55% ate ice cream, hamburgers, and incompletely cooked chicken, lobster, or shrimp. Less than 3% reported to have avoided all potentially contaminated food and beverage items. People aged 36 to 55 years were slightly more negligent with respect to potentially contaminated food and beverage items compared with younger and older age groups. Those with TD scored 11.2 (maximum, 24) in the risky food score compared with 10.9 in those who did not have TD (P<.012). For classic TD there was no significant difference. Among the 24% of the population who bought food and/or beverages from street vendors, 25.6% had TD compared with 24.7% who did not. There was minimal variation in the score of risky food items regardless of seeking health advice. Only 2% of all travelers used prophylactic medication against TD; most often these were Americans using bismuth subsalicylate.

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try in the week prior to arrival to Jamaica and experienced a TD total incidence of 18.9 (95% CL: 16.2, 21.9); 5.2% had done so in the 6 months preceding their visit to Jamaica and had an attack rate of 16.7 (95% CL: 14.9, 18.7). The attack rate in the rest of the study population was significantly higher (24.1% ± 0.5%). Patients with underlying medical conditions had no increased severity of disease.

Multiple logistic regression, controlling for duration and month of stay, country of residence, and purpose of trip for all TD forms, gave ORs and 95% CLs differing significantly according to the country of residence: United Kingdom, 3.4 (95% CL: 2.9, 4.0), Canada, 3.1 (95% CL: 2.6, 3.8), United States, 2.6 (95% CL: 2.2, 3.0), and various European countries, 1.3 (95% CL: 1.0, 1.7). Those who gave marriage and/or honeymoon as the reason for their visit had an OR of 1.7 (95% CL: 1.5, 1.9) compared with vacation, 1.2 (95% CL: 1.0, 1.3). The OR increased per day of stay by 1.06, while it diminished by 0.98 for each year of age. Similar values were obtained for classic TD. The second logistic regression model revealed that tourists with full board (3 meals included) had a higher probability of diarrhea (OR, 1.58; 95% CL: 1.26, 1.96; P<.001).

Furthermore, there is a significant seasonal variation. Total TD rates were 26.4% ± 1.8% to 30.2% ± 1.7% between May and October but dropped to a minimum of 15.1% ± 1.3% in December, staying below 20% until March (Figure). Among the 8 hotels where more than 1000 interviewees stayed during the 12-month study period, the total TD rates significantly varied between 14.0% ± 1.9% and 29.5% ± 2.7%. Two characteristic examples of hotels, A and B (Figure), show that a low–attack-rate hotel kept a low rate throughout the year—the same applied for a high–attack-rate hotel.

The onset of TD occurred almost at the same time (mean days, 3.8-4.0) in all severity stages, but duration was longer with increasing TD severity (Table 2). The mean number of accompanying symptoms was 1.67 for classic TD and 0.53 for moderate TD. The mean severity score for accompanying symptoms was similar when classic and moderate TD were compared, the greatest differences in their incidence being observed for abdominal pain and fever. Duration of TD increased with severity as shown in Table 2, but it should be noted that in 24.7% of all patients, mainly among people experiencing classic TD, diarrhea persisted at the time of interview and departure.

Almost half the patients with classic TD were incapacitated, while for mild TD this was still 9%, albeit for much shorter duration. In all TD patients the mean duration of incapacitation until departure was 11.6 hours (Table 2). Among the 475 patients who required professional help (6.6%), most consulted a hotel nurse (63.4%), a physician (17.3%), or a pharmacy (11.8%); the rest consulted various other sources. One third of the patients used some form of medication. Two patients were hospitalized.

### Quality of Life

In the airport study, 78.2% of interviewees responded to all 10 questions on the quality of life. There was only 1 question that had a nonresponse rate exceeding 11%. The mean score for quality of life was 64.3 for travelers who did not experience TD. In the airport study this was significantly reduced to 54.9 in patients with classic TD (Kruskal-Wallis, 553.3; P<.001). In the hotel study the score was even lower (43.0). Along with abdominal pain, patients reported loss of quality of life mostly with regard to the ability to participate in leisure activities, sexual activity, and their feeling of general well-being.

While 8.8% of the people indicated a well-defined cause for their illness, only 0.3% and 0.1% of the people surveyed in the airport indicated that they would

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**Table 1. Traveler’s Diarrhea (TD) Attack Rates in Jamaica Based on Airport Survey Data**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of Subjects</th>
<th>Rate of TD Cases, %</th>
<th>Total Incidence (95% Confidence Limit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Classic</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>14347</td>
<td>11.1</td>
<td>8.5</td>
</tr>
<tr>
<td>Women</td>
<td>15961</td>
<td>12.3</td>
<td>8.2</td>
</tr>
<tr>
<td><strong>Age, y</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-55</td>
<td>18862</td>
<td>13.0</td>
<td>9.2</td>
</tr>
<tr>
<td>36-65</td>
<td>10062</td>
<td>10.1</td>
<td>7.1</td>
</tr>
<tr>
<td>&gt;55</td>
<td>1445</td>
<td>5.5</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Duration of stay, d</strong></td>
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<td></td>
</tr>
<tr>
<td>1-3</td>
<td>1203</td>
<td>4.0</td>
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<tr>
<td>4-7</td>
<td>19756</td>
<td>10.0</td>
<td>7.6</td>
</tr>
<tr>
<td>8-11</td>
<td>4896</td>
<td>14.1</td>
<td>9.4</td>
</tr>
<tr>
<td>12-14</td>
<td>3391</td>
<td>20.3</td>
<td>13.1</td>
</tr>
<tr>
<td>&gt;15</td>
<td>1123</td>
<td>14.6</td>
<td>9.0</td>
</tr>
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<td><strong>Country of residence</strong></td>
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<tr>
<td>United Kingdom</td>
<td>2813</td>
<td>24.3</td>
<td>13.8</td>
</tr>
<tr>
<td>Canada</td>
<td>1621</td>
<td>15.2</td>
<td>9.1</td>
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<td>United States</td>
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</tr>
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<td>Germany</td>
<td>907</td>
<td>7.5</td>
<td>8.0</td>
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<tr>
<td>Italy</td>
<td>475</td>
<td>3.8</td>
<td>5.3</td>
</tr>
<tr>
<td>Japan</td>
<td>1393</td>
<td>3.3</td>
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<tr>
<td>Latin America</td>
<td>276</td>
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<td><strong>Purpose of stay</strong></td>
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<td>Marriage and/or honeymoon</td>
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<td>10.3</td>
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<tr>
<td>Business</td>
<td>607</td>
<td>7.2</td>
<td>5.3</td>
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<tr>
<td><strong>Recent travel to other (sub) tropical destinations</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>In previous week</td>
<td>756</td>
<td>9.3</td>
<td>7.1</td>
</tr>
<tr>
<td>In previous 6 mo</td>
<td>1566</td>
<td>7.6</td>
<td>6.1</td>
</tr>
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</table>
not return to a developing country or to Jamaica, respectively, because of health reasons.

**Hotel Survey Data**

The 322 volunteers were comparable with the total population surveyed at the airport with respect to age, sex, country of residence, proportion with health advice, duration of stay, meal arrangement, food sources outside the hotel, dietary behavior, and day of onset of diarrhea. In the hotel population, TD was markedly more serious as expressed by number of unformed stools, rates and severity of accompanying symptoms, and impact of TD (Table 2). The same degree of TD severity was observed in the subset of airport study subjects who had sought medical attention at the time they experienced TD.

**Etiology of Traveler’s Diarrhea**

The pathogen detection rate was 31.7% (Table 3). A single pathogen was detected in 26.7% of the stool samples, 2 pathogens in 4.3%, and 3 or 4 pathogens in 0.3%. The ETEC was the most frequently diagnosed pathogen. The proportion of heat-labile toxin-producing strains was high (57.9%) and CFA/IV was the most predominant (36.8%), more than double CFA/I and II. The PCF 0159 (2.6%) was predominant (36.8%), more than double CFA/IV in the winter season. Among the 68 patients with more than 10 bowel movements per 24 hours, the pathogen detection rate was 51.5%, with viruses detected in only 1 case. The proportion of ETEC was almost identical in summer (21/175 [12.0%]) and winter (17/144 [11.8%]); C. jejuni was only detected during the winter (16/145 [11.0%]). Viruses were predominant in the winter season. Among the 68 patients with more than 10 bowel movements per 24 hours, the pathogen detection rate was 51.5%, with *Salmonella* species and Rotavirus (12 cases each) and ETEC (9 cases) being the most frequent pathogens.

**Economics**

Overall, based on the airport study, the attack rate of any TD was 23.6% in foreign travelers visiting Jamaica. Per stay (mean duration, 7.7 days) the estimated average cost for medication, medical treatment, and missed activities was US $116.50/patient or US $27.50/traveler to Jamaica. Since 11.8% of infections were caused by ETEC, it may be inferred that

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**Figure. Diarrhea Attack Rates in Tourists Visiting Jamaica**

Rates are based on airport survey data collected from tourists visiting Jamaica from March 1996 to February 1997. TD indicates traveler’s diarrhea.
higher risk seen with honeymooners, irrespective of age, may be associated with more elaborate and less hygienic buffets related to the ceremonies.

Residency in areas with high or intermediate TD risk, such as Latin America, southern Europe, Japan, and recent travel to subtropical countries resulted in significantly lower TD rates probably because immunity to infection develops. The fact that British visitors had considerably higher TD attack rates than the rates observed in Canadian, US, or German visitors is of some surprise, although British studies have previously shown exceptionally high attack rates in their tourists to southern Europe.20,21 This high risk in British tourists cannot be explained by longer duration of stay nor by selecting more high-risk, possibly cheaper, hotels, nor by identified dietary patterns based on the logistic regression analysis. British residents might have a different degree of immunity, a lack of previous exposure, a different genetic background, or so far undetected dietetic differences.

Lack of dietary discipline designed to avoid dangerous food and beverages, so far only demonstrated for European travelers,22,23 occurs likewise in North Americans, even in people who had received travel health advice. The higher diarrhea risk seen in full-board customers may tentatively be explained by the fact that lunch may be of a particular high risk, since these buffets are exposed for a longer period to higher ambient temperatures or even to the sun. Consumption of high-risk food was a weak predictor for the incidence of all diarrhea and no predictor for classic TD. The rules of dietary discipline could not be shown to have relevant value in this retrospective survey, while a single prospective study illustrated some benefit.22

The medical impact of TD, not assessed until recently in a military setting,24 is considerable. A mean duration of incapacitation of 17.1 hours in classic TD ruins a full day abroad and such loss during a 1-week stay is considerable. But even the 2.6 hours reported in those with mild TD may result in cancellation of a planned excursion since further evolution of the ailment cannot be foreseen. Overall, among all TD patients, the incapacitation until departure was nearly 12 hours. Taking into account all travelers to Jamaica this is approximately 21⁄2 hours. Frustration, loss of time, and missed opportunities among healthy companions have not been assessed.

Of all people experiencing TD, 6.6% consulted medically trained personnel and a considerable proportion of patients used some form of drug therapy. The quality-of-life score was significantly reduced by TD, especially in the hotel study, where patients had more symptoms. This could be because of the immediate questioning, causing less recall bias.

Regarding quality of life, we found a direct link with the severity of diarrhea: the more severe the diarrhea experienced while traveling abroad, the lower the quality of life.

As shown, TD caused by ETEC, even perceived as a self-limited disease, represents a considerable socioeconomic burden. For travelers under attack, a mean incapacitation of 17.1 hours in classic TD ruins a full day abroad and such loss during a 1-week stay is considerable. But even the 2.6 hours reported in those with mild TD may result in cancellation of a planned excursion since further evolution of the ailment cannot be foreseen. Overall, among all TD patients, the incapacitation until departure was nearly 12 hours. Taking into account all travelers to Jamaica this is approximately 2 1/2 hours. Frustration, loss of time, and missed opportunities among healthy companions have not been assessed.

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Traveler's diarrhea in Jamaica

TRAVELER’S DIARRHEA IN JAMAICA

The exception in a single patient in whom PCF0159 was detected, to those included in the ETEC whole-cell B subunit vaccine currently under development. This demonstrates a likely efficacy of the vaccine in the studied region of Jamaica. There was a marked seasonal variation for the attack rate of TD in Jamaica. Similar to a study conducted in Morocco, diarrhea caused by Campylobacter was more often detected in winter, whereas in Jamaica there was no seasonal variation for diarrhea caused by ETEC.

There is a need for a realistic plan to reduce TD. Neither American nor European visitors follow restrictive dietary rules and avoid potentially contaminated food and beverage items. Travel health advice had no impact on the incidence of TD. Currently, the Ministry of Health in Jamaica is embarking on a program of improved food hygiene on the island of Jamaica. But, if the TD problem in Jamaica persists despite such efforts, should a future ETEC vaccine be recommended to travelers to this and similar destinations? Assuming that ETEC is the origin of a similar proportion of all incidences of TD, an ETEC vaccine be recommended to travelers to this island. Approximately 10% that means that the attack rate of classic TD would be reduced from 11.7% to 10.5% and total TD from 23.6% to 21.2%. The vaccine would thus be useful to 1.2% and 2.4%, respectively, of the total population traveling to Jamaica and thus a greater proportion of travelers would benefit from the ETEC vaccine than from any other vaccine currently recommended for travelers, such as against hepatitis A, hepatitis B, typhoid, or tetanus. The ETEC vaccine will have greater utility in areas where ETEC diarrhea is more common. Future oral cocktail vaccines with multiple enteropathogenic antigens may offer an even greater benefit.

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