Travel-associated sexually transmitted infections: an observational cross-sectional study of the GeoSentinel surveillance database

Alberto Matteelli, Patricia Schlagenhauf, Anna C C Carvalho, Leisa Weld, Xiaohong M Davis, Annelies Wilder-Smith, Elizabeth D Barnett, Philippe Parola, Prativa Pandey, Pauline Han, Francesco Castelli, for the GeoSentinel Surveillance Network

Summary

Background Travel is thought to be a risk factor for the acquisition of sexually transmitted infections (STIs), but no multicentre analyses have been done. We aimed to describe the range of diseases and the demographic and geographical factors associated with the acquisition of travel-related STIs through analysis of the data gathered by GeoSentinel travel medicine clinics worldwide.

Methods We gathered data from ill travellers visiting GeoSentinel clinics worldwide between June 1, 1996, and Nov 30, 2010, and analysed them to identify STIs in three clinical settings: after travel, during travel, or immigration travel. We calculated proportionate morbidity for each of the three traveller groups and did logistic regression to assess the association between STIs and demographic, geographical, and travel variables.

Findings Our final analysis was of 112 180 ill travellers—64 335 patients seen after travel, 38 287 patients seen during travel, and 9558 immigrant patients. 974 patients (0·9%) had diagnoses of STIs, and 1001 STIs were diagnosed. The proportionate STI morbidities were 6·6, 10·2, and 16·8 per 1000 travellers in the three groups, respectively. STIs varied substantially according to the traveller category. The most common STI diagnoses were non-gonococcal or unspecified urethritis (30·2%) and acute HIV infection (27·6%) in patients seen after travel; non-gonococcal or unspecified urethritis (21·1%), epididymitis (15·2%), and cervicitis (12·3%) in patients seen during travel; and syphilis in immigrant travellers (67·8%). In ill travellers seen after travel, significant associations were noted between diagnosis of STIs and male sex, travelling to visit friends or relatives, travel duration of less than 1 month, and not having pretravel health consultations.

Interpretation The range of STIs varies substantially according to traveller category. STI preventive strategies should be particularly targeted at men and travellers visiting friends or relatives. Our data suggest target groups for pretravel interventions and should assist in post-travel screening and decision making.

Funding US Centers for Disease Control and Prevention, and International Society of Travel Medicine.

Lancet Infect Dis 2013; 13: 205–13

Published Online November 23, 2012 http://dx.doi.org/10.1016/S1473-3099(12)70291-8

See Comment page 184

Institute of Infectious and Tropical Diseases, University of Brescia, Brescia, Italy (A Matteelli MD, A C C Carvalho MD, Prof F Castelli MD); **University of Zurich, WHO Collaborating Centre for Travel Medicine, Zurich, Switzerland** (Prof P Schlagenhauf PhD); **Victoria, BC, Canada** (L Weld PhD); **Division of Global Migration and Quarantine, Centers for Disease Control and Prevention, Atlanta, GA, USA** (X M Davis PhD, P Han MA); **Department of Medicine, National University of Singapore, Singapore** (Prof A Wilder-Smith MD); **Institute of Public Health, University of Heidelberg, Baden-Württemberg, Germany** (Prof A Wilder-Smith); **Maxwell Finland Laboratory for Infectious Diseases, Boston Medical Center, Boston, MA, USA** (E D Barnett PhD); **University Hospital Institute for Infectious and Tropical Diseases, Aix-Marseille University and Assistance Publique Hôpitaux de Marseille, Marseille, France** (Prof P Parola MD); **and CIWEC Clinic Travel Medicine Center, Kathmandu, Nepal** (P Pandey MD)

Correspondence to: Dr Alberto Matteelli, Institute of Infectious and Tropical Diseases, Piazzale Spedali Civili, 1–25123 Brescia, Italy **matteelli@med.unibs.it**

Introduction

Travel is thought to be a risk factor for the acquisition of sexually transmitted infections (STIs) because it disrupts individuals' usual sexual practices through physical separation of partners and removal of social taboos that might inhibit sexual freedom.[1–3] Published reports about travel-associated STIs focus wholly on risk behaviour and small single-clinic analyses, but no multicentre analyses of the clinical range of travel-related STIs have been done. Most reports show that travel increases exposure to STIs, which can be attributed to the high rate of casual sex and low rate of condom use.[1] A systematic review[4] published in 2010 showed a pooled prevalence of travel-associated casual sex of 20·4% (95% CI 14·8–26·7%), and almost 50% of these sexual encounters were unprotected.

Hypothetically, the risk of acquisition of STIs in travellers is a product of the number of sexual partners, use of condoms, and the prevalence of STIs in other travellers and the contact population of the destination country. Prevalence in the destination country is affected by the uneven distribution of STIs worldwide. The estimated incidence of new cases of bacterial and protozoan STIs in 1995 was 330 million worldwide; 150 million cases were in southeast Asia and 69 million in sub-Saharan Africa, compared with 14 million in North America (ie, Canada, Mexico, Puerto Rico, and the USA) and 16 million in Europe.[5] In an earlier proposed model for the interpretation of phase-specific epidemiology of STIs based on the dynamic interplay between pathogens, human behaviours, and control efforts,[6] low-income countries almost invariably were in the hyperendemic phase, implying high incidence and prevalence of STIs in the general population.

Worldwide, international tourist arrivals have increased from 150 million in 1970 to almost 1 billion in 2011 (with an increase of 4% in 2011),[7] potentially enhancing the interaction between travel and the spread of STIs. Examples of the public health effects of such interactions include prognosis, diagnosis, and treatment of HIV infection in developed countries affected by the importation of several viral clades,[8]

syphilis outbreaks in northern Europe introduced from Russia,[9] and quinolone-resistant *Neisseria gonorrhoeae* strains spread to the USA and Europe from southeast Asia, prompting changes in treatment recommendations for gonorrhoea.[10]

Despite these findings, evidence is scarce for the effect of travel on the acquisition of STIs. Prospective data for incidence in travellers are unavailable, and details about the extent of travel-related STI morbidity are sparse. The range of STIs occurring in travellers is poorly documented, with just one report about a small sample of travellers from a single clinical setting in France.[11]

For more on **GeoSentinel** see http://www.istm.org/geosentinel/main.html

See **Online** for appendix

GeoSentinel, a global sentinel surveillance network established in 1995 through a collaborative effort from the International Society for Travel Medicine and the US Centers for Disease Control and Prevention,[12] provides a means to assess the epidemiology of travel-associated illness in travellers and immigrants. We used the GeoSentinel database to describe the range of STIs in ill travellers visiting GeoSentinel sites and to describe geographical and demographic factors in GeoSentinel patients with STIs.

Methods

Study sites

GeoSentinel sites are specialised travel or tropical medicine clinics with global distribution at which point-of-care, clinician-based sentinel surveillance data are gathered. They are staffed by clinicians who are recruited on the basis of their knowledge and experience in travel and tropical medicine.[12] The GeoSentinel network is the largest available database of ill travellers. To be included, patients had to have crossed an international border within 10 years before the clinic visit and sought medical advice for a presumed travel-related illness. Only final confirmed and probable diagnoses were deemed eligible, and more than one diagnosis per patient was possible. Physicians assigned final diagnoses. We used a standardised, anonymous questionnaire to gather data, which we then entered in a central database. The questionnaire comprises demographic data (including age, sex, country of birth, country of residence, citizenship), travel history in the past 5 years, inpatient or outpatient status, pretravel encounter for travel health advice, reason for most recent travel, and traveller classification (appendix). All 52 sites that constituted the network at the time of the study contributed data and were included in the analysis. GeoSentinel's data collection protocol was reviewed by the institutional review board officer at the National Center for Emerging and Zoonotic Infectious Diseases at the US Centers for Disease Control and Prevention and classified as public health surveillance rather than human research requiring submission to institutional review boards. However, at some sites human studies approval was obtained if required by local institutional review boards.

Participants

We classified ill travellers into three groups: attended clinic after travel (ie, the trip related to the illness had

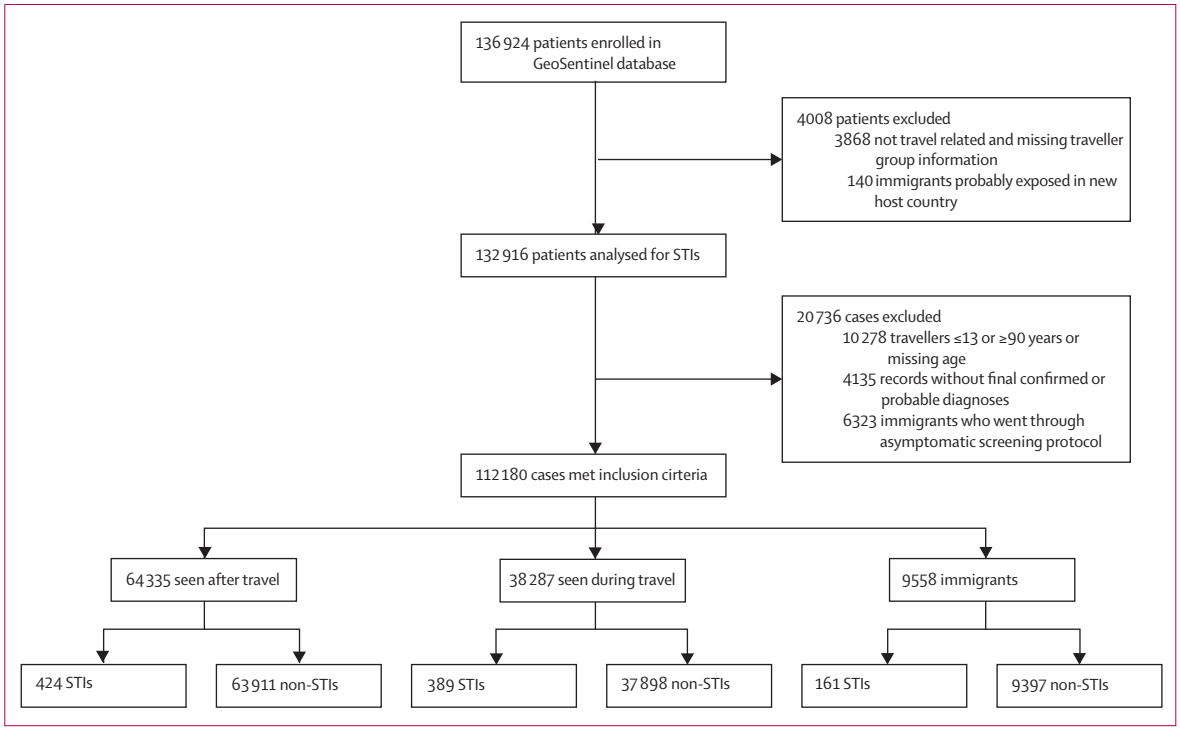

Figure 1: **Flow chart of GeoSentinel database analysis of sexually transmitted infections (STIs)**

been completed); attended during travel (including tourists and short-term business travellers who visit a clinic, migrant workers who visit a clinic in their host country but might move back and forth to their host country many times, and long-term expatriates who are exposed either while at or travelling from their present residence); and immigration travel only (ie, the last travel was the primary immigration trip from the patient's home country to the country of residence). We excluded people in the immigrant group with presumed exposure in the host country because their diseases were not travel related. People for whom the main purpose of travel was to visit friends or relatives were identified as such. All travellers in the immigrants group had immigration as the unique reason for travel.

Data collection and definition of STIs

Sites contributed to data collection by the reporting system described elsewhere.[13] We assigned diagnostic codes from a standardised list of more than 500 causative or syndromic diagnoses on the basis of final diagnoses reported by physicians. Case definitions of STIs were not systematically based on microbiological criteria only, but also included clinical judgment. We identified

	Seen after travel (n=424)	Seen during travel (n=389)	Immigration travel (n=161)
Mean age (SD), years	40·2 (12·9)	34·7 (11·3)	37·7 (14·1)
Sex ratio (M:F)	2·45:1	1·92:1	1·39:1
Five most common regions of exposure	Southeast Asia (106; 25·0%) Sub-Saharan Africa (103; 24·3%) Unknown* (53; 12·5%) South America (39; 9·2%) Western Europe (30; 7·1%)	South central Asia (130; 33·4%) Unknown* (125; 32·1%) Northeast Asia (72; 18·5%) Southeast Asia (30; 7·7%) South America (8; 2·1%)	Sub-Saharan Africa (79; 49·1%) North Africa (18; 11·2%) South America (16; 9·9%) Southeast Asia (14; 8·7%) Eastern Europe (10; 6·2%)
Patients' setting	Inpatient (80; 18·9%) Outpatient (337; 79·5%) Missing (7; 1·7%)	Inpatient (17; 4·4%) Outpatient (372; 95·6%)	Inpatient (37; 23·0%) Outpatient (123;76·4%) Missing (1; 0·6%)
Reason for travel	Tourism (213; 50·2%) Visiting friends or relatives (93; 22·0%) Business (74; 17·5%) Missionary or volunteer (38; 9·0%) Other (5; 1·2%)	Business (243; 62·5%) Tourism (107; 27·5%) Missionary or volunteer (25; 6·4%) Student (10; 2·6%) Other (4; 1·0%)	NA

Data are n (%) unless otherwise stated. *Includes travellers whose itinerary was too complex to assign a region of likely exposure.

Table 1: **Demographic and trip characteristics of ill travellers with sexually transmitted infections, by traveller category**

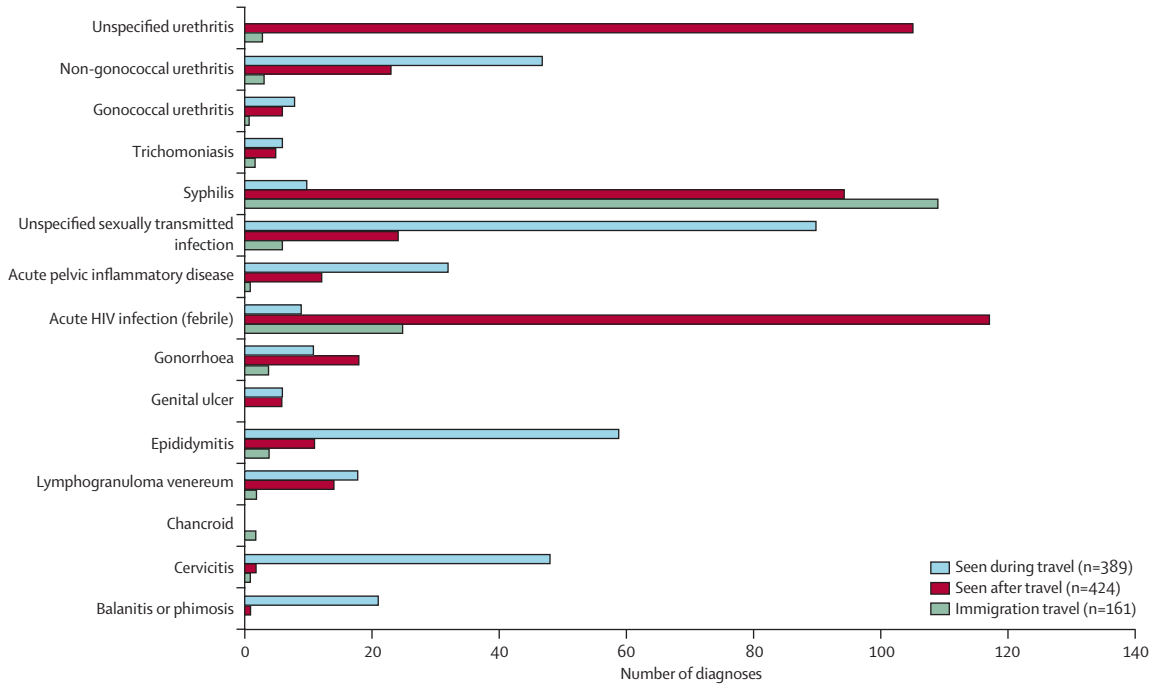

Figure 2: **Distribution of specific diagnoses of sexually transmitted infections in ill travellers according to clinical setting in GeoSentinel**

23 codes for potential STI diagnoses. Patients with seven of these codes were not included in the group of patients with STIs. One code (violence exposure) was not a morbidity disorder, one (vaginitis) was judged not to be a true STI, and six (specifically AIDS, asymptomatic HIV infection, hepatitis B virus infection, herpes simplex virus infection, chronic pelvic inflammatory disease, and genital warts) are only tenuously associated with travel because the time between infection and diagnosis can vary tremendously. In particular, we excluded cases of hepatitis B virus infection from the total cases of STIs (and included such diagnoses as non-STI cases instead) because we were unable to differentiate acute infection from chronic infection not associated with travel or other forms of non-sexual acquisition of the illness.

We used the remaining 15 codes to define ill travellers with STIs—namely, gonococcal, non-gonococcal, and unspecified urethritis; gonorrhoea; syphilis; trichomoniasis; lymphogranuloma venereum; genital ulcers; chancroid; acute HIV infection; acute pelvic inflammatory disease; epididymitis; cervicitis; balanitis; and unspecified STI. Syphilis cases included primary, secondary, and latent infections; we relied on the clinician's judgment that syphilis was related to travel.

	Number of diagnoses (%)
Female travellers	
Seen after travel (122 patients, 127 diagnoses)	
Urethritis*	48 (37·8%)
HIV†	27 (21·3%)
Syphilis	18 (14·2%)
Acute pelvic inflammatory disease	12 (9·4%)
Trichomoniasis	5 (3·9%)
Seen during travel (133 patients, 134 diagnoses)	
Cervicitis	48 (35·8%)
Acute pelvic inflammatory disease	31 (23·1%)
Unspecified STIs	25 (18·7%)
Urethritis*	9 (6·7%)
Trichomoniasis	6 (4·5%)
Immigration travel (67 patients, 68 diagnoses)	
Syphilis	49 (72·1%)
HIV†	11 (16·2%)
Gonorrhoea‡	2 (2·9%)
Cervicitis	1 (1·5%)
Acute pelvic inflammatory disease	1 (1·5%)
Male travellers	
Seen after travel (299 patients, 308 diagnoses)	
HIV†	89 (28·9%)
Urethritis*	79 (25·6%)
Syphilis	76 (24·7%)
Gonorrhoea‡	20 (6·5%)
Unspecified STIs	20 (6·5%)
Seen during travel (256 patients, 266 diagnoses)	
Urethritis*	73 (27·4%)
Unspecified STIs	65 (24·4%)
Epididymitis	59 (22·2%)
Balanitis or phimosis	21 (7·9%)
Gonorrhoea‡	18 (6·8%)
Immigration travel (93 patients, 94 diagnoses)	
Syphilis	60 (63·8%)
HIV†	14 (14·9%)
Unspecified STIs	5 (5·3%)
Epididymitis	4 (4·3%)
Urethritis*	4 (4·3%)

974 travellers had 1001 diagnoses of STIs. Three diagnoses (epididymitis, HIV†, and urethritis*) were recorded in travellers seen after travel whose sex was unknown. One case of urethritis* was diagosed in a patient of unknown sex in the immigration travel group. STIs=sexually transmitted infections. *Non-gonococcal and unspecified. †Acute infection (febrile). ‡Gonococcal urethritis and other forms of gonorrhoea.

Table 2: **Five most commonly diagnosed STIs in ill travellers, by clinical setting and sex**

Statistical analysis

We analysed data for each group separately. Our primary strategy was to compare sociodemographic and travel-related variables of cases with and without diagnoses of STIs. We excluded non-travel-related cases; travellers younger than 13 years, older than 90 years, or with missing age information; and immigrants who were seen for a systematic asymptomatic medical screening after arrival. The clinician defined the country of exposure if he or she was confident that the infection was acquired there, in view of the duration of the incubation period, known endemicity patterns, or if the region was the only one visited.

We classified pretravel consultation into three categories—"yes", "no", and "don't know"—and merged "no" and "don't know" into a single group. We described the distribution of the most common diagnoses. We calculated the proportionate morbidity of STIs (per 1000 travellers) for each traveller category by dividing the number of travellers with an STI by the total number of ill travellers visiting a GeoSentinel site in that category. We also established the most common specific STIs by sex.

For each traveller category, we examined the association of a diagnosis of an STI in ill travellers with demographic and travel-related characteristics with logistic regressions and Student's *t* test for continuous variables. We did multivariable logistic regressions for the group seen after travel. We deemed p values less than 0·05 to be clinically significant. We used SPSS software (version 12.0) to analyse our data.

Role of the funding source

Staff from the US Centers for Disease Control and Prevention who are responsible for administration of funding had roles in study design; data collection, analysis, and interpretation; writing of the report; and the decision to submit the paper for publication. The International Society of Travel Medicine did not have

such roles. The corresponding author had full access to all data and final responsibility for the decision to submit the report for publication.

Results

We included data gathered between June 1, 1996, and Nov 30, 2010. 112 180 ill travellers met our inclusion criteria (figure 1). 974 of these people (0·9%) had an STI, and 1001 STIs were diagnosed. The probable country of exposure could not be established for all travellers. Table 1 shows the demographic characteristics of travellers with STIs, stratified by traveller group. A trip duration of less than 1 month was reported by 70% of travellers seen after travel and by 44% of those seen during travel. Figure 2 shows the most common STIs diagnosed in travellers according to traveller category, and table 2 the five most common diagnoses by sex and travel category.

The proportionate STI morbidity for ill travellers seen after travel was 6·6 per 1000 travellers. Non-gonococcal or unspecified urethritis (n=128; 30·2%), acute HIV infection (117; 27·6%), and syphilis (94; 22·2%) were the most common diagnoses (figure 2, table 2). 80 (1·1%) of the 7324 patients seen in an inpatient setting after travel were diagnosed with an STI compared with 337 (0·6%) of 56 022 outpatients. Information about inpatient or outpatient care was missing for 989 patients seen after travel.

Male sex, travelling to visit friends or relatives, not having a pretravel consultation, and duration of travel less than 30 days were independently significantly associated with diagnosis of an STI in multivariate analysis (table 3). Ill travellers who had been to south central Asia were the least likely to receive an STI diagnosis.

Most (34 327; 90%) patients seen during travel visited GeoSentinel clinics in only six centres—namely, Kathmandu (24 372; 64%), Singapore (2477; 7%), Beijing (2347; 6%), Hong Kong (1959; 5%), Ho Chi Minh City (1723; 5%), and Peekshill, NY (1449; 4%). We did not do a multivariate analysis because the patients presenting differ greatly between clinics.

The proportionate STI morbidity was 10·2 per 1000 travellers in patients who attended clinics while travelling. The most common specific diagnoses were non-gonococcal or unspecified urethritis (n=73; 27·4%) and epididymitis (59; 22·2%) in men and cervicitis (48; 35·8%) in women (figure 2, table 2). Of the travellers who had an STI, 91 travelled for less than 1 month. Male travellers were more likely to have a diagnosis of an STI than were women, and younger travellers were more likely than other ill travellers to have a diagnosis of an STI (table 4). Business travellers were more likely than tourists to have an STI (table 4).

Most patients (8804; 92%) in the immigrant category visited GeoSentinel clinics in western Europe (3063; 32%), Canada (3005; 31%), the USA (1564; 18%), and Australia (1172; 12%). The proportionate STI morbidity for immigrants was 16·8 per 1000 travellers. Syphilis was the most common diagnosis in both men and women (table 2). 37 (1·9%) of 1898 inpatients and 123 (1·6%) of 7560 outpatients were diagnosed with STIs (100 people had missing data for inpatient or outpatient care). Immigrant patients seen during the first 6 months after arrival were significantly more likely to have an STI diagnosis than were those seen after being in the country for longer (table 5). Compared with immigrants from southeast Asia, those from north Africa, eastern Europe, and sub-Saharan Africa were most likely to have an STI diagnosis (table 5). No multivariate analysis is shown because only two variables had a significant relation with diagnoses of STIs in the crude analysis; these variables did not show any interaction.

	n/N (%)	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
Sex					
Female	122/31 574 (0·4%)	1	..	1	..
Male	299/32 344 (0·9%)	2·41 (1·95–2·97)	<0·0001	2·22 (1·79–2·75)	<0·0001
Reason for travel					
Tourism	213/37 394 (0·6%)	1	..	1	..
Business	74/9204 (0·8%)	1·42 (1·085–1·85)	0·01	1·22 (0·92–1·62)	0·159
Missionary or volunteer	38/8557 (0·4%)	0·78 (0·55–1·10)	0·156	0·91 (0·63–1·32)	0·625
Student	3/1331 (0·2%)	0·39 (0·13–1·23)	0·111	0·54 (0·17–1·71)	0·297
Health-care seeking	0/46 (0·0%)	..	0·998	..	0·998
Visiting friends or relatives	93/7371 (1·3%)	2·23 (1·75–2·85)	<0·0001	2·12 (1·62–2·78)	<0·001
Military	2/302 (0·7%)	1·17 (0·29–4·71)	0·832	1·31 (0·32–5·37)	0·706
Travel duration					
≥30 days	125/22 359 (0·6%)	1	..	1	..
1–29 days	290/40 822 (0·7%)	1·27 (1·03–1·56)	0·025	1·25 (1·01–1·56)	0·049
Pretravel consultation					
Yes	136/29 883 (0·5%)	1	..	1	..
No or don't know	288/34 452 (0·8%)	1·84 (1·50–2·26)	<0·0001	1·50 (1·20–1·87)	<0·0001
Region of travel					
South central Asia	21/8565 (0·3%)	1	..	1	..
Southeast Asia	106/9883 (1·1%)	4·41 (2·76–7·05)	<0·0001	4·34 (2·71–6·96)	<0·001
Northeast Asia	11/1690 (0·7%)	2·67 (1·28–5·54)	0·009	2·33 (1·12–4·86)	0·024
Sub-Saharan Africa	103/16 520 (0·6%)	2·55 (1·60–4·08)	<0·0001	2·32 (1·45–3·73)	<0·0001
North Africa	9/2548 (0·4%)	1·44 (0·66–3·15)	0·359	1·38 (0·63–3·03)	0·417
South America	39/5388 (0·7%)	2·97 (1·74–5·05)	<0·0001	3·07 (1·80–5·25)	<0·0001
Central America	11/4233 (0·3%)	1·06 (0·51–2·20)	0·876	1·16 (0·56–2·42)	0·686
The Caribbean	23/3656 (0·6%)	2·58 (1·42–4·66)	0·002	2·38 (1·30–4·38)	0·010
North America	3/802 (0·4%)	1·58 (0·46–5·13)	0·493	1·47 (·44–4·98)	0·533
Eastern Europe	8/691 (1·2%)	4·77 (2·10–10·80)	<0·0001	3·44 (1·51–7·82)	0·003
Western Europe	30/2293 (1·3%)	5·39 (3·08–9·44)	<0·0001	4·87 (2·74–8·67)	<0·0001
Middle East	6/1250 (0·5%)	1·96 (0·79–4·87)	0·146	1·74 (0·70–4·32)	0·235
Oceania	0/674 (0·0%)	..	0·992	..	0·992
Australia or New Zealand	1/355 (0·3%)	1·15 (0·15–8·57)	0·892	1·27 (0·17–9·46)	0·818
Region undetermined	53/5784 (0·9%)	3·76 (2·27–6·24)	<0·0001	3·88 (2·32–6·48)	<0·0001

424 of 64 335 travellers had STIs. Mean age was 38·1 years (95% CI 37·9–38·2) in people without STIs and 40·2 years (38·9–41·4) in those with STIs (p=0·02; adjusted OR not significant). STIs=sexually transmitted infections. OR=odds ratio.

Table 3: **Univariate and multivariate analyses of variables associated with STIs in travellers seen after travel**

	n/N (%)	Crude OR (95% CI)	p
Sex			
Female	133/19 624 (0·7%)	1	..
Male	256/18 614 (1·4%)	2·04 (1·66–2·52)	<0·0001
Reason for travel			
Tourism	107/15 930 (0·7%)	1	..
Business	243/17 113 (1·4%)	2·13 (1·70–2·68)	<0·0001
Missionary or volunteer	25/3723 (0·7%)	1·00 (0·65–1·55)	0·999
Student	10/1064 (0·9%)	1·40 (0·73–2·69)	0·308
Health-care seeking	2/122 (1·6%)	2·47 (0·60–10·10)	0·210
Visiting friends or relatives	2/264 (0·8%)	1·13 (0·28–4·60)	0·866
Military	0/14 (0·0%)	..	0·999
Travel duration			
1–29 days	91/12 782 (0·7%)	1	..
≥30 days	117/12 606 (0·9%)	1·31 (0·99–1·72)	0·056
Region of travel			
South central Asia	130/19 372 (0·7%)	1	..
Southeast Asia	30/4255 (0·7%)	1·05 (0·71–1·56)	0·807
Northeast Asia	72/4227 (1·7%)	2·57 (1·92–3·42)	<0·0001
Sub-Saharan Africa	3/829 (0·4%)	0·54 (0·17–1·69)	0·289
North Africa	0/85 (0·0%)	..	0·997
South America	8/672 (1·2%)	1·78 (0·87–3·67)	0·114
Central America	8/679 (1·2%)	1·78 (0·86–3·62)	0·121
The Caribbean	1/70 (1·4%)	2·15 (0·30–15·56)	0·450
North America	5/271 (1·8%)	2·78 (1·13–6·85)	0·026
Eastern Europe	1/43 (2·3%)	3·52 (0·48–25·80)	0·215
Western Europe	4/284 (1·4%)	2·11 (0·78–5·76)	0·143
Middle East	1/89 (1·1%)	1·68 (0·23–12·17)	0·606
Oceania	0/23 (0·0%)	..	0·998
Australia or New Zealand	1/84 (1·2%)	1·78 (0·25–12·91)	0·567
Region undetermined	125/7304 (1·7%)	2·58 (2·01–3·30)	<0·0001

389 infections in 38 287 travellers. Mean age was 37·1 years (95% CI 36·9–37·2) in people without STIs and 34·7 years (33·6–35·8) in those with STIs (p=0·001). STIs=sexually transmitted infections. OR=odds ratio.

Table 4: **Univariate analysis of variables associated with STIs in travellers seen during travel**

	n/N (%)	Crude OR (95% CI)	p
Sex			
Female	67/4393 (1·5%)	1	..
Male	93/5102 (1·8%)	1·20 (0·87–1·65)	0·26
Time from migration			
≤6 months	68/2715 (2·5%)	1	..
>6 months to ≤12 months	12/984 (1·2%)	0·48 (0·26–0·89)	0·020
>12 months to ≤5 years	43/2791 (1·5%)	0·61 (0·41–0·90)	0·012
>5 years	29/2755 (1·1%)	0·41 (0·27–0·64)	<0·0001
Region of origin			
Southeast Asia	14/1421 (1·0%)	1	..
South central Asia	4/1170 (0·3%)	0·35 (0·11–1·05)	0·061
Northeast Asia	5/458 (1·1%)	1·11 (0·40–3·10)	0·843
Sub-Saharan Africa	79/3276 (2·4%)	2·48 (1·40–4·40)	0·002
North Africa	18/573 (3·1%)	3·26 (1·61–6·60)	0·001
South America	16/1140 (1·4%)	1·43 (0·70–2·94)	0·331
Central America	7/397 (1·8%)	1·80 (0·72–4·50)	0·206
The Caribbean	4/343 (1·2%)	1·19 (0·39–3·63)	0·765
Eastern Europe	10/369 (2·7%)	2·80 (1·23–6·35)	0·014
Middle East	3/263 (1·1%)	1·16 (0·33–4·06)	0·817
Oceania	1/15 (6·7%)	7·18 (0·88–58·4)	0·065
North America, western Europe, Australia, New Zealand	0/130 (0·0%)	..	0·996
Region undetermined	0/3 (0·0%)	..	..

161 infections in 9558 travellers. Mean age was 35·8 years (95% CI 35·5–36·0) in people without STIs and 37·7 years (35·5–39·9) in those with STIs (p=0·082). STIs=sexually transmitted infections. OR=odds ratio.

Table 5: **Univariate analysis of variables associated with STIs in immigrants**

Discussion

Our study is the first large, multicentre analysis of the clinical range of travel-related STIs (panel). Despite the many studies about the risk-taking behaviours of travellers, information about the range and risk factors for STIs in travellers is scarce. Most published reports[11,14] are small case series from single centres. Strengths of our study include the large number of STIs analysed, the global multicentre perspective with standardised data, and the demographic and geographical diversity of the cases.

Although data for proportionate morbidity cannot be compared with those for incidence, our results support the findings of previous studies and show a low but worrying burden of STIs in travellers.[14,15,18,19] In a study[15] done at a genitourinary medicine clinic in London, UK, the incidence of STIs in people who had travelled in the previous 3 months was not significantly different from that in people who had not travelled at all (19% *vs* 23%), and the maximum attributable fraction of new STIs that could have resulted from a new sexual partnership abroad was 12%. In other small, prospective studies[16,17,20] about health problems in travellers, no STIs were reported. However, perhaps travellers with genital symptoms are likely to seek care at venues other than travel medicine clinics (eg, STI clinics, primary care providers), and thus our findings and those of others probably underestimate the true burden of STIs in international travellers.

In previous analyses of the GeoSentinel database[18] and a single-site analysis[19] of people seen after travel, the highest STI proportionate morbidity was noted in patients born in low-income countries and living in high-income countries (ie, immigrants) who travelled to their region of birth to visit friends or relatives. However, further direct comparison between the immigrant and traveller groups is difficult; travellers and immigrants probably consult GeoSentinel sites for different reasons, and comparisons are likely to be biased.

Our findings show that STIs are diagnosed in people seen during travel at least as often as in those who have returned home before seeking help. In diseases such as gonorrhoea, which have a very short incubation period, symptoms probably happen before the end of the travel period. Information given to departing travellers at risk for STIs should include details about how to recognise signs and symptoms of infection and recommendations to seek health care early during travel and have a repeat thorough screening after returning home.

The type of STIs noted differed between traveller groups (figure 2, table 2). The high frequency of epididymitis, cervicitis, and acute pelvic inflammatory disease in travellers seen during travel suggests that STI-related acute complications in the higher genital tract might be an underestimated risk in travellers. Findings about frequency of STIs might guide practitioners' advice about risk reduction and the need for screening or diagnostic procedures.

Non-gonococcal or unspecific urethritis was the most common diagnosis overall. Urethritis is the most reliable marker of STI epidemiology because it is caused only by true STI agents, is symptomatic in a substantial proportion of infected men and boys, and is easy to recognise (at least in its syndromic form).

The high frequency of acute HIV infections registered through the GeoSentinel database is of great concern. We did no tests to establish whether the cases of HIV detected were recent infections, and could not completely exclude domestic exposure. Median time between return from travel and diagnosis of HIV infection was 28 days (IQR 10–59) for the 63% of all travellers with acute HIV infection who had travelled during the past 6 months. Travel can contribute substantially to the spread of HIV infection, and, in developed countries, travellers and those visiting friends or relatives are at increased risk of HIV infection compared with non-travellers.[14,21,22] However, in our sample, the largest single group of patients with acute HIV infection of those seen after travel were born in western Europe and had travelled as tourists mainly in Europe itself (data not shown). The transmission coefficient of HIV is at the lower edge of the range of STI agents; therefore this finding might be an indicator of the high risk of STIs in travellers.

Syphilis was a common diagnosis in travellers and immigrants—a result that accords with evidence of a worldwide re-emergence of the disease.[23] Exotic STIs were uncommon (eg, lymphogranuloma venereum, chancroid) or not detected at all (donovanosis), which might be because of restricted diagnostic capacities at GeoSentinel sites or referral of patients with these infections to different clinics, but probably also suggests a worldwide reduction in the frequency of these infections.

We investigated factors associated with increased odds of STI diagnosis. Male sex corresponded to about a doubling in the odds of an STI diagnosis in all groups of ill travellers. This predominance of STIs in men was also reported by Schlagenhauf and colleagues,[24] who examined the distribution of infectious disease by sex. Variations in sexual behaviour determined by the patients' sex might contribute to this finding, but we cannot exclude the effect of easier diagnosis of STI pathogens in men and boys because they represent a higher proportion of symptomatic cases than do female patients. Age affects the odds of STI diagnosis relative to any other diagnosis only in patients seen during travel, perhaps because of the restricted type and number of clinics that see many patients during travel.

Patients seen after travel who had a pretravel health consultation had fewer STIs than did those who did not have such a consultation. We are unsure whether the consultation caused the reduction; possibly people who visit clinics have a-priori lower risk-taking behaviour or fall into groups at a lower risk of STIs than do those who do not visit clinics. Irrespective, this finding suggests an important opportunity to provide useful education.

Panel: Research in context

Systematic review

We searched Medline with the terms "travel" and "adults" under the medical subject heading major topic "sexually transmitted diseases" for articles published between Jan 1, 1990, and July 31, 2012. We screened abstracts and read pertinent articles, and selected other papers from their reference lists. There were no restrictions on language of publication. We searched the websites of the World Tourism Organization, Centers for Disease Control and Prevention, WHO, and GeoSentinel for information about sexually transmitted infections (STIs) in travellers. We identified no prospective and multicentre studies about the range of travel-associated STIs or that assessed the relation between travel and the risk of acquisition of STIs. Most papers investigated the relations between STIs and travel in terms of frequency of casual sex and percentage of condoms use.[1,4] Available data show that the prevalence of STIs is higher in southeast Asia and sub-Saharan Africa than in developed countries. The rising number of international travellers has been noted by the World Tourism Organization,[7] and many papers describe the introduction of sexually transmitted pathogens from different geographical areas because of increased population mobility.[8–10]

Interpretation

This study is the largest so far of travellers with STIs; it describes the range of STIs and identifies associated sociodemographic and behavioural characteristics. Our findings accord with data from previous studies showing a low but alarming burden of STIs in travellers.[14–17] Our results are relevant for clinicians, who should know how STIs vary according to traveller category, will help to identify target groups for pretravel interventions, and will assist in post-travel screening and decision making.

Travel duration was significantly related to frequency of STIs for patients seen after travel but not for patients seen during travel, although measurement of duration of exposure for long-term expatriates and people with very complex travel histories is difficult.

STIs are ubiquitous, but their prevalence varies greatly in different regions.[5,6] Additionally, variations in culture in both travellers and people in destination areas might be apparent in differences in sexual behaviours and therefore in risks when travelling to some locations. The highest proportion of STIs in travellers seen while travelling was in patients in northeast Asia (where two GeoSentinel clinics mostly see expatriates) or North America (where a clinic sees many migrant workers who are originally from Latin America).

Our study has some inherent limitations. The data are only for patients seeking medical care at a GeoSentinel clinic. Hence, in the absence of denominator data for all travellers, incidences cannot be calculated or a numerical risk provided for travel to a particular destination. The passive recruitment of ill travellers affects the capacity to capture (ie, diagnose, report, or measure) travel-associated STIs, because affected travellers might not be aware of their illness or might perceive it as a negligible problem and avoid seeking treatment. Such occurrences have a greater effect on infections that are usually asymptomatic—eg, chlamydial infections. GeoSentinel clinics are known for travel and migration-related health issues rather than for STI management; thus, travellers with suspected STIs might seek care from alternative medical services, which could have biased towards an underestimation of the frequency of STIs. However, GeoSentinel sites usually recognise the need for medical screening on the basis of country of origin or migration, so clinicians there might do additional tests in at-risk travellers.

We cannot separate the diseases diagnosed by screening from those diagnosed because of clinical presentation or referral. However, migrant travellers in whom an STI was diagnosed and who were seen at two sites where protocol-driven systematic screening occurred were excluded from the analysis. Clinics that see many travelling patients are disproportionately located in Asia, and so our dataset provides less information about travelling patients in other parts of the world.

The restricted use of consistent diagnostic algorithms or procedures for STIs is another important weakness to note. The GeoSentinel system is based on the assumption that all diagnoses are made by experienced clinicians who are aware of the importance of definition of a disease as travel related. However, these experts work within the limitations of an imperfect set of diagnostic criteria. For this reason, our finding of many acute HIV infections in ill travellers should be interpreted with caution. Finally, our results were affected by our exclusion of several potential STI diagnoses for which the role of travel was uncertain (such as hepatitis B virus and herpes simplex virus infections). The combined effect of most of these limitations is underestimation of the total frequency of STIs.

In terms of further research, prospective studies with molecular techniques would be useful to establish the true incidence of travel-associated STIs, but such studies are cumbersome and expensive. Networks such as GeoSentinel provide an ideal framework for measurement of the effect of pretravel advice and changes in the uptake of clinic visits before travel. More information is needed about whether travel actually changes sexual behaviour and why roughly 50% of travellers engaging in new sexual relationships abroad inconsistently use condoms.[4] Research about the use of safe-sex promotional information and leaflets has produced conflicting results.[25] Behavioural data from previous Stop AIDS campaigns might be useful to pinpoint successful components of safe sex projects that can be adapted for pretravel health advice.

Contributors

AM and FC conceived and designed the study. AM, PS, and ACCC wrote the first draft of the Article, prepared the final version, and processed the submission. LW, XMD, and PH were responsible for data management and did the analysis in collaboration with ACCC. All authors contributed to data gathering, participated in data interpretation, reviewed and revised the first draft, and approved the final report for submission.

Conflicts of interest

We declare that we have no conflicts of interest.

Acknowledgments

This work was supported by the GeoSentinel Surveillance Network through a cooperative agreement with the US Centers for Disease Control and Prevention (grant 5U50CI000359) and funding from the International Society of Travel Medicine. The findings and conclusions in this Article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

The GeoSentinel Surveillance Network

Members of the GeoSentinel Surveillance Network who contributed data are Holly Murphy, Rainer Weber, Robert Steffen, Frank von Sonnenburg, Nancy Piper Jenks, Christine A Kerr, Sarah Borwein, Karin Leder, Joseph Torresi, Graham V Brown, Jay S Keystone, Kevin C Kain, Mogens Jensenius, Andy Wang, Jane Eason, Susan MacDonald, Anne E McCarthy, Nicole L Anderson, Trish Batchelor, Dominique Meisch, Rogelio López-Vélez, Jose A Pérez-Molina, Vanessa Field, Eli Schwartz, Effrossyni Gkrania-Klotsas, Louis Loutan, François Chappuis, Eric Caumes, Alice Pérignon, Poh Lian Lim, Gerd-Dieter Burchard, Michael D Libman, Brian J Ward, J Dick Maclean, William M Stauffer, Patricia F Walker, DeVon C Hale, Rahul Anand, Stephanie S Gelman, Bradley A Connor, Fabrice Simon, Jean Delmont, Luis M Valdez, Hugo Siu, Christina M Coyle, Murray Wittner, Alejandra C Gurtman, N Jean Haulman, David Roesel, Elaine C Jong, Marc T Shaw, Annemarie Hern, John D Cahill, George McKinley, Carmelo Licitra, Antonio Crespo, Christophe Rapp, Olivier Aoun, Robert Kass, Marc Mendelson, Peter Vincent, Noreen A Hynes, R Bradley Sack, Robin McKenzie, Thomas B Nutman, Amy D Klion, Stefan Hagmann, Michael Henry, Andy O Miller, Lin H Chen, Mary E Wilson, Jose Flores-Figueroa, Pablo C Okhuysen, Shuzo Kanagawa, Yasuyuki Kato, Yasutaka Mizunno, Peter J de Vries, Kartini Gadroen, Phyllis E Kozarsky, Jessica Fairley, Carlos Franco-Paredes, Watcharapong Piyaphanee, Udomsak Silachamroon, Cecilia Perret, Francisca Valdivieso, Johnnie A Yates, Vernon E Ansdell, Robert Muller, Edward Benoit, Eunice Chen, Paul D Holtom, Jeff A Goad, Anne Anglim, Patrick W Doyle, Wayne G Ghesquiere, Natsuo Tachikawa, Hanako Kurai, and Hiroko Sagara. Affiliations are listed in the appendix.

References

1 Matteelli A, Carosi G. Sexually transmitted diseases in travellers. *Clin Infect Dis* 2001; **32:** 1063–67.

2 Hynes NA. Sexually transmitted diseases in travellers. *Curr Infect Dis Rep* 2005; **7:** 132–37.

3 Memish ZA, Osoba AO. International travel and sexually transmitted diseases. *Trav Med Infect Dis* 2006; **4:** 86–93.

4 Vivancos R, Abubakar I, Hunter PR. Foreign travel, casual sex, and sexually transmitted infections: systematic review and metanalysis. *Int J Infect Dis* 2010; **14:** e842–51.

5 Gerbase AC, Rowley JT, Mertens TE. Global epidemiology of sexually transmitted diseases. *Lancet* 1998; **351** (suppl 3)**:** 2–4.

6 Wasserheit JN, Aral SO. The dynamic topology of sexually transmitted disease epidemics: implications for prevention strategies. *J Infect Dis* 1996; **174** (suppl 2)**:** 201–13.

7 World Tourism Organization. World tourism barometer. http://dtxtq4w60xqpw.cloudfront.net/sites/all/files/pdf/unwto_barom12_01_january_en_excerpt.pdf (accessed Aug 14, 2012).

8 Perrin L, Kaiser L, Yerly S. Travel and the spread of HIV-1 genetic variants. *Lancet Infect Dis* 2003; **3:** 22–27.

9 Hiltunen-Back E, Haikala O, Koskela P, Vaalasti A, Reunala T. Epidemics due to imported syphilis in Finland. *Sex Transm Dis* 2002; **12:** 746–51.

10 Centers for Diseases Control and Prevention. Increases in fluorquinolone-resistant *Neisseria gonorrhoeae* among men who have sex with men—United States 2003, and revised recommendations for gonorrhea treatment, 2004. *MMWR Morbid Mortal Wkly Rep* 2004; **53:** 335–38.

11 Ansart S, Hochedez P, Perez L, Bricaire F, Caumes E. Sexually transmitted diseases diagnosed among travellers returning from the tropics. *J Trav Med* 2009; **16:** 79–83.

12 Freedman DO, Kozarsky PE, Weld LH, Cetron MS. GeoSentinel: the global emerging infections sentinel network of the International Society of Travel Medicine. *J Travel Med* 1999; **6:** 94–98.

13 Freedman DO, Weld LH, Kozarsky PE, et al. Spectrum of disease and relation to place of exposure among ill returned travellers. *N Engl J Med* 2006; **354:** 119–30.

14 Hawkes S, Hart GJ, Johnson AM, et al. Risk behaviour and HIV prevalence in interregional travellers. *AIDS* 1994; **8:** 247–52.

15 Hawkes S, Hart GJ, Bletsoe E, Shergold C, Johnson AM. Risk behaviour and STI acquisition in genitourinary clinic attendees who have travelled. *Genitourin Med* 1995; **71:** 351–54.

16 Hill DR. Health problems in a large cohort of Americans traveling to developing countries. *J Travel Med* 2000; **7:** 259–66.

17 Winer L, Alkan M. Incidence and precipitating factors of morbidity among Israeli travellers abroad. *J Travel Med* 2002; **9:** 227–32.

18 Leder K, Tong S, Weld L, et al, for the GeoSentinel Surveillance network. Illness in travellers visiting friends and relatives: a review of the GeoSentinel surveillance network. *Clin Infect Dis* 2006; **43:** 1185–93.

19 Fenner L, Weber R, Steffen R, Schlagenhauf P. Imported infectious diseases and purpose of travel, Switzerland. *Emerg Infect Dis* 2007; **13:** 217–21.

20 Hochedez P, Visentini P, Ansart S, Caumes E. Changes in the pattern of health disorders diagnosed among two cohorts of French travellers to Nepal, 17 years apart. *J Trav Med* 2004; **11:** 341–46.

21 Fenton KA, Chinouya M, Davidson O, Copas A. HIV transmission risk among sub-Saharan Africans in London travelling to their countries of origin. *AIDS* 2001; **15:** 1442–45.

22 Kramer MA, van Veen MG, Op de Cul ELM, et al. Migrants travelling to their country of origin: a bridge population for HIV transmission? *Sex Transm Infect* 2008; **84:** 554–55.

23 Hook EW, Peeling J, Dolin R. Syphilis control—a continuing challenge. *N Engl J Med* 2004; **351:** 122–24.

24 Schlagenhauf P, Chen L, Wilson M, et al. Gender and travel associated illness. *Clin Infect Dis* 2010; **50:** 826–32.

25 Gagneux OP, Blochliger CU, Tanner M, Hatz C. Malaria and casual sex: what travelers know. *J Travel Med* 1996; **3:** 14–21.