



Risk Perception and Incidence of Travel Diarrhea among Spanish Travelers: A Cohort Study

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ABSTRACT

Background: Traveler's diarrhea is the most common infectious disease among travelers and it has been widely studied, but its incidence and risk perception yielded inconsistent findings. Therefore, this study assessed risk perception and incidence of travel diarrhea (TD) among Spanish travelers.

Method: A cohort study (n=7,471) was conducted between 2012 and 2016 in Barcelona. A self-report questionnaire about risk perception and appearance of TD in previous travels was filled in by travelers. A descriptive, bivariate analysis and a binary logistic regression were performed.

Results: The global incidence of TD was 16.2% (95%CI 15.1-17.3), without differences according to socio-demographic characteristics either comorbidities. However, TD incidence was higher among travelers who received a pre-travel vaccination, were younger than 50 years of age travelling to South-East Asia, Africa, Central or South America; independently of gender and education level. A high risk perception of TD was present in 29.1% of travelers, basically among women of high education level, who travel to South-East Asia, Africa, Central or South America, independently of age and pre-travel vaccination.

Conclusions: The global incidence of TD as well as risk perception were quite low, so, much more education on food borne diseases should be done during a pre-travel assessment, basically in young travelers.

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INTRODUCTION:

Traveler's diarrhea (TD) previous years is the most common infectious disease among travelers, but its incidence and risk perception need to be more consistently studied. Between January and August 2017, destinations worldwide welcomed 901 million international tourist arrivals; it means a 7% increase compared with previous years.[1]. More than 80 million persons from industrialized countries travel to developing destination countries each year [2]. In Spain from the total 11 million of travelers in 2007 more than 10% were to the tropics and/or subtropics[3].

The most common health problem among travelers from industrialized regions to developing countries is traveler's diarrhea [4-6]. Because of the high rates of international travel, TD will be a very important problem. There are several reports with different figures of TD incidence due to the wide variety of travels (geographic areas, type of travel, age of travelers, etc). In the past several studies of TD in travelers has been carried out with very few number of people and going to only one destination [5]. According to some reports, TD affects between 20-60% of travelers, this broad range of incidences could be explained by the variety of travelers and places of destination evaluated in these reports [5,7]. In another report more than 60% of individuals visiting tropical or subtropical regions will develop traveler's diarrhea [8].

Regarding risk perception of TD we found evidence of association of high risk of TD perception with an increased likelihood of compliance with daily chemoprophylaxis but there is a lack of evidence published [9]. A report from Canada evidence the underestimation of the risk of water borne diseases related to travel and the need of reinforcement of education of travelers about the modes of transmission of infectious diseases [10]. The aim of this study was to describe risk perception and travel diarrhea among a Spanish travelers cohort.

MATERIALS AND METHODS:

A prospective cohort study was performed in a travel clinic among individuals who

consecutively attended to the clinic and were travelling to tropical or subtropical areas and willing to be questioned regarding their experience with travel diarrhea. The study was conducted at the Travel Health Clinic at the Hospital Universitari de Bellvitge, in Barcelona, Spain.

The information was gathered through a self-reported questionnaire fill in previously to the medical advice. Questionnaire was initially tested in several travelers and amended for clarity. To estimate the consistency of the responses, some probe questions were used. The questionnaire was based on three areas: demographic (age and gender) and medical history (comorbidities, current pharmacological treatments); previous travel/s done in the last 12 months information (country, itinerary); and risk perception of travel diarrhea. Adults seeking medical advice at the travel clinic, between March 2012 and January 2016, before travelling to tropical and subtropical areas, who agreed to participate in the study and reported to have done a travel to tropical areas in the last 12 months and provided travel information (country, previous experience on travel diarrhea) and personal experience on travel diarrhea and risk perception were included. Individuals who met the following criteria were excluded: younger than 18 years old, travelers that reported to be the first time they travel to tropical areas, travelers taking antimicrobial prophylaxis, prebiotics, probiotics or loperamide. The participation was voluntary, participants were not offered any financial incentive and they were informed about their right to withdraw at any time, without penalty. The institutional ethical review board (University Hospital of Bellvitge) approved the study protocol and informed consent. All participants provided written informed consent.

The main outcome was the development of moderate to severe TD, which was defined according to the International Society of Travel Medicine definition. Travel diarrhea is defined by the level of functional impact in the traveler's life, divided in three categories: mild

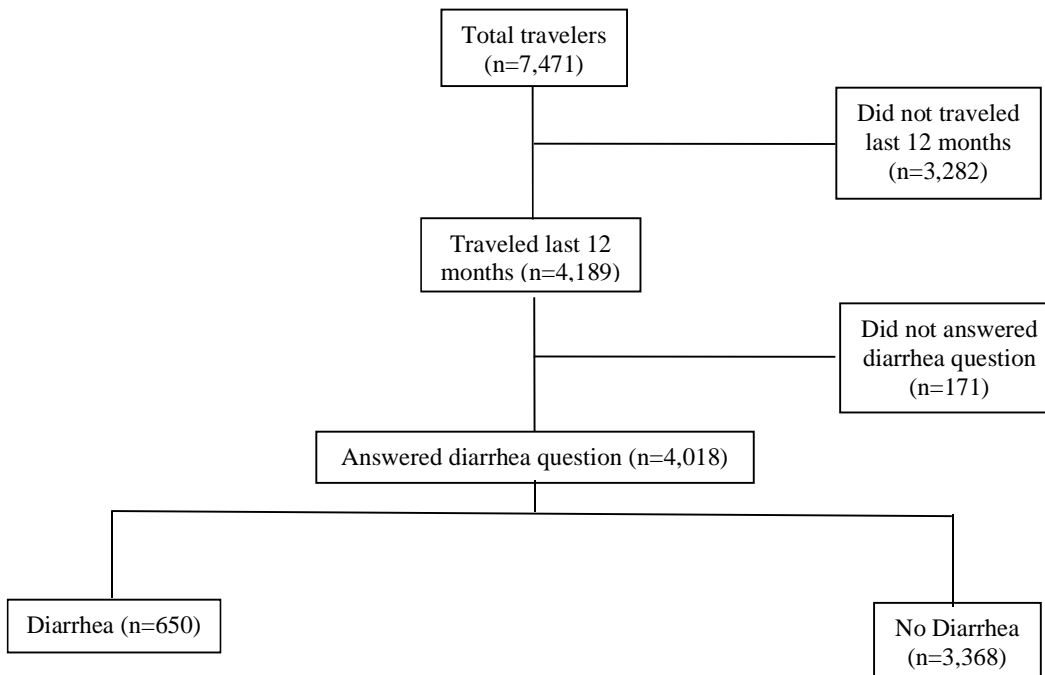
diarrhea (tolerable, not distressing, and does not interfere with planned activities), moderate (is distressing or interferes with planned activities) and severe (diarrhea incapacitating or completely prevents planned activities; all dysentery (bloody stools) is considered severe) [11]. Diarrhea is considered the passage of three or more liquid stools per day (or more frequent passage than is normal for the individual) with, at least, one accompanying symptom (nausea, vomiting, abdominal cramps or pain, fever, blood stools) and this definition is used in most of the articles about diarrhea [12]. The other main outcome was TD risk perception which was defined by an EVA score answering the question: “During your travel do you think you are going to have diarrhea?”. Those who answered “yes” or “maybe yes” were considered to have a high risk perception of travel diarrhea and those who answered “no”, “maybe not” or “I don’t know” were considered to have low perception of risk. A descriptive analysis was conducted to evaluate the sociodemographic characteristics, medical history, travel diarrhea and risk perception.

For description of categorical variables, tables of frequencies and percentages were made, while for quantitative variables that had a normal distribution (Kolmogorov-Smirnov test, $p > 0.05$) were expressed as mean and SD. The overall cumulative incidence and stratification by presence of TD were estimated with their corresponding 95% CI. The χ^2 test, or Fisher’s test (when required), was used for qualitative comparisons. Finally, a multivariate analysis with a logistic regression model was performed to adjust for potential confounders and estimate the crude and adjusted OR of TD. In all cases, a p value < 0.05 was accepted as statistically significant, and a proper interpretation of the results in context with potential confounders was considered. Statistical analysis was performed with the statistical software STATA v13.

RESULTS:

A total of 7471 travelers between March 2012 and January 2016 were included in the study. The reasons for participation refusal were non-previous travel in the last 12 months ($n=3,282$) or did not respond the travel question ($n=171$) see Figure 1.

Figure 1. Flowchart of participants for the Incidence study



The baseline characteristics were a mean age of 35.7 years (SD = +/- 10.2), of which 1,911 (48%) were women, 91% were of Spanish nationality and 74% were university students.

They did not have previous comorbidities 82% and 72% did not take any medication. At the time of the survey, 80% of the travelers were working (Table 1).

Table 1: Incidence of TD among travelers by demographic characteristics (n=4,018)

	Incidence TD, % (95%CI)	n	p-value
Gender			0.174
Women	17.1 (15.7-18.5)	325/1,911	
Men	15.4 (13.9-16.9)	325/2,107	
Marital status			0.734
Single	15.9 (14.3-17.4)	336/2,105	
Couple	16.4 (14.7-18.1)	309/1,889	
Previous comorbidity			0.631
Yes	16.7 (13.8-19.6)	106/634	
No	15.9 (14.6-17.2)	646/2,910	
Concomitant drugs			0.748
Yes	15.8 (13.6-17.9)	170/1,073	
No	16.3 (14.9-17.7)	455/2,797	
Age groups			0.098
<30	16.7 (14.7-18.7)	231/1,382	
31-40	17.3 (15.4-19.2)	253/1,463	
41-50	15.1 (12.4-14.8)	100/660	
>50	12.9 (9.9-15.8)	66/513	
Continent			<0.001
Low risk	2.8 (1.9-3.7)	38/1,361	
SE Asia and India	20.3 (17.8-22.8)	194/957	
Central America	23.6 (20.2-26.9)	145/614	
Africa	23.9 (19.9-27.9)	127/531	
South America	28.1 (23.9-32.3)	125/445	
Education level			0.150
Basic	14.7 (12.5-16.9)	152/1,031	
University Medium	18.0 (15.5-20.5)	165/918	
University Superior	13.3 (11.8-14.8)	324/2,023	
Pretravel vaccination			<0.001
Yes	31.4 (28.8-34.1)	191/1,190	
No	9.6 (8.6-10.7)	451/2,797	

The total number of respondents to the incidence question was 7,471 travelers, of whom 4,189 reported having traveled in the last 12 months and 96% of them had answered the question of having suffered from diarrhea or not, therefore it was the population for the incidence analysis. The cumulative incidence

of global TD in our study was 16.2 cases per 100 travelers at risk.

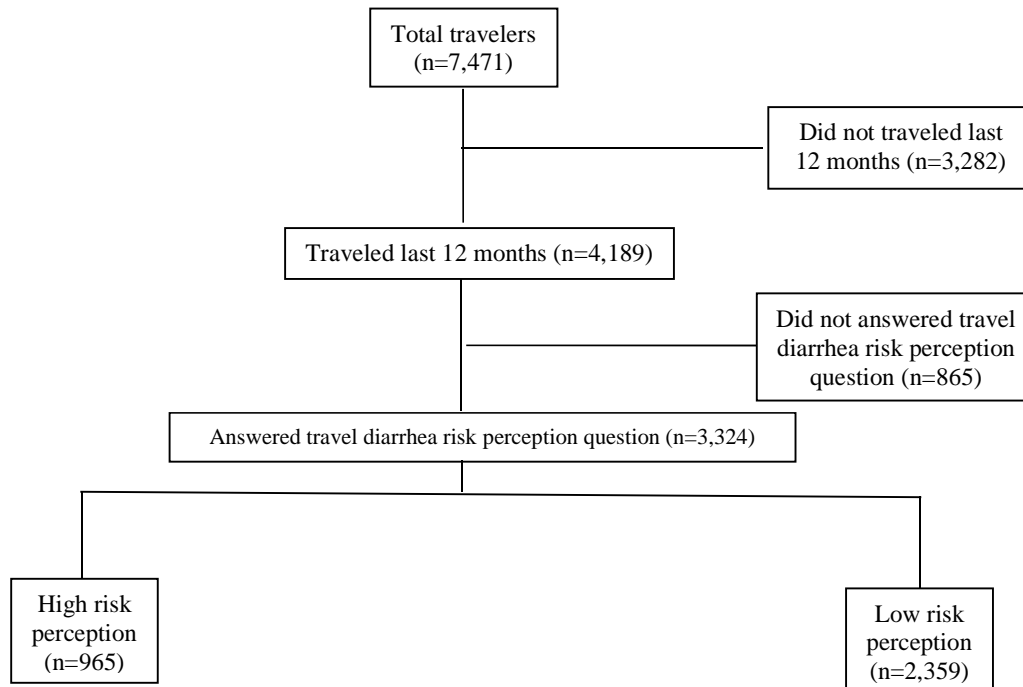
The incidence of TD is higher in women (17%), couples (16%), travelers with previous comorbidities (17%), those without any previous medications (16%), in those with university education (18%), and and by age groups among those <50 years old with higher

academic level, but all these findings were not statistically significant. Analyzing by destination, travelers to South America had the highest rates of TD with 28%, followed by 24% in Africa and Central America, Southeast Asia and India 20% ($p < 0.001$)

When we analyze the pretravel vaccination status, it determines the highest TD rate (31%) ($p < 0.001$) (Table 1).

From the total number of respondents to the survey ($n = 7,417$) 3,324 answered the question about risk perception of TD, from these only 965 travelers declared to have a high risk perception of TD for the next travel (Figure 2).

Figure 2. Flowchart of participants for travel diarrhea risk perception study



The mean of age among travelers with high risk perception of TD for the next travel was 32.1 (SD=8.2), and in those with low risk perception it was 38.1 (SD=12.1). The perception of risk was not different according to comorbidities, previous medication taken neither pre-travel vaccination ($p > 0.05$). The perception of risk was higher in women 34% ($p < 0.001$) and among single travelers (33%) ($p < 0.001$). By age groups the perception of risk was higher among younger travelers of 40% in < 30 ($p < 0.001$). The risk perception was higher in

South East Asia and India (33%), followed by South America (30%), Central America (26%), Africa (24%) and low risk countries (15%) ($p < 0.001$) and by education level the risk perception of TD was higher among those travelers with superior university studies (36%) ($p < 0.001$). Among those travelers vaccinated the perception of risk of TD was higher (27%) than among those vaccinated pretravel, but this difference was not statistically significant (Table 2).

Table 2: Low and high TD risk perception among travelers by demographic characteristics ($n = 3,324$)

	High TD risk perception, n(%)	Low TD risk perception, n(%)	n	p-value
Gender				
Women	1,043 (65.8)	543 (34.2)	1,586	<0.001
Men	1,316 (75.7)	422 (24.3)	1,738	
Marital status				
Single	1,172 (67.2)	572 (32.8)	1,744	<0.001
Couple	1,171 (75.3)	384 (24.7)	1,555	
Age groups				
<30	702 (60.1)	467 (39.9)	1,169	<0.001
31-40	794 (69.1)	355 (30.9)	1,149	
41-50	411 (82.2)	89 (17.8)	500	
>50	403 (91.2)	39 (8.8)	442	
Continent				
Low risk	123 (84.8)	22 (15.2)	145	<0.001
SE Asia and India	1,037 (66.7)	517 (33.3)	1,554	
Central America	164 (73.9)	58 (26.1)	222	
Africa	622 (75.8)	199 (24.2)	821	
South America	380 (69.9)	164 (30.1)	544	
Education level				
Basic	815 (80.9)	193 (19.1)	1,008	<0.001
University Medium	540 (71.3)	217 (28.7)	757	
University Superior	966 (63.8)	548 (36.2)	1,514	
Pretravel vaccination				
Yes	561 (73.4)	201 (26.6)	764	0.641
No	786 (72.6)	296 (27.4)	1,082	

Two separate multivariate analyses were performed, one for the incidence and another one for risk perception variables. In both cases were included in the model those variables considered relevant, and those with a p value <0.05. In a multivariate analysis we found that the incidence of TD in our population depends on pretravel vaccination status (OR=2.7; 95%CI: 2.3-3.3), the age of travelers (OR<30= 2.2; 95%CI:1.6-3.1) and continent of destination (OR South América= 10.4; 95%CI:6.9-15.6) independently of gender (OR women= 1.1; 95%CI:0.9-1.3) and education level (OR=1.3; 95%CI:0.9-1.6).

In the multivariate analysis of risk perception we found that in our population it depends on gender

“(OR women=1.3; 95%CI:1.1-1.6), the age of travelers (OR<30=5.6; 95%CI:3.6-8.4), the continent of destination (OR South East Asia/India=2.7; 95%CI:1.5-4.9) and the academic level (OR University level=1.9; CI%:1.5-2.4) independently of vaccination status previous to travel (OR=1.1; 95%CI:0.9-1.3) (Table 3). When we compare a multivariate analysis of incidence with risk perception found that both were higher among younger travelers (<40 years old). Incidence was higher among those travelers vaccinated pre travel. Risk perception was higher among women. We didn't find coincidence by continent of destination (Table 3).

Table 3: Comparative multivariate analysis of incidence/risk perception of TD

	TD Incidence, OR (95%CI)	High TD risk perception, OR (95%CI)
Gender		
Women	1.08 (0.9-1.3)	1.35 (1.1-1.6)
Men	1	1
Age groups		
<30	2.23 (1.6-3.1)	5.57 (2.6-8.4)
31-40	1.87 (1.4-2.6)	4.10 (2.7-6.2)
41-50	1.42 (1.0-2.1)	2.17 (1.4-3.5)
>50	1	1
Continent		
Low risk	1	1
SE Asia and India	6.20 (4.2-9.1)	2.72 (1.5-4.9)
Central America	8.57 (5.8-12.6)	1.98 (1.1-3.9)
Africa	8.2 (5.5-12.2)	2.18 (1.2-3.9)
South America	10.4 (6.9-15.6)	2.45 (1.3-4.5)
Education level		
Basic	1	1
University Medium	1.26 (0.9-1.6)	1.50 (1.1-2.0)
University Superior	1.05 (0.8-1.6)	1.93 (1.5-2.4)
Pretravel vaccination		
Yes	2.7 (2.3-3.3)	1.08 (0.9-1.3)
No	1	1

DISCUSSION:

In the present study, the incidence of severe diarrhea among travelers was 16.2 cases per 100 travelers at risk, which could be considered relatively low compared with the results of similar published studies. In a study conducted in European travelers, the incidence of TD was 40% [2]. In another study carried out on Dutch travelers the global attack rate of TD was 50% [4]. A study conducted in Connecticut by clinical survey showed an incidence of TD in American travelers of 46% [5]. All these studies were carried out in traveler's diarrhea without differentiating severity.

In a multicenter study comparing incidences in different cities of developing countries a variable incidence was found, ranging from 55% in Mombasa, Kenya to 14% in Fortaleza, Brazil. The incidence found in Brasil in this study was similar to that we found in our study [13]. The results in our study differ from those described by Zamarrón Fuertes et al in another Spanish cohort, where 24.9% incidence of TD was found [3]. The range of TD's

incidence in travelers to developing countries is quite variable, ranging from 14 to 60% according to the place in different studies [2-8,13]. One explanation for that could be we categorized traveler diarrhea according to the International Society of Travel Medicine definition, including in our study only those diarrheas defined as moderate and severe, leaving aside all the mild diarrheas [11]. Another explanation could be that most of the travelers registered as tourists traveling to South América are travelers born abroad, who visit family and relatives (VFR's) having a different incidence and level of exposure to risk.

In our cohort we found that the pretravel vaccination is significantly linked to an increase of TD incidence, this could be explained because those previously vaccinated travelers have had a lower risk perception than those not vaccinated, having a false perception of safety and taking more risks. Besides we don't have the information or registration of what vaccines they received and this information could be influenced by recall bias and

we don't know if they were covered for water borne diseases. In a Finnish cohort was described the correct vaccination of 22% of the travelers for hepatitis A (199/895), and 59% for typhoid fever (87/148) but this coverage was correlated with 54% of travelers diagnosed with TD (250/460), being TD the most common cause for seeking health care [14]. We found that the incidence of TD was lower in older travelers, in coincidence with the findings described by Hill in a cohort of US travelers where the highest frequency of traveler's diarrhea was found in the youngest people, suggesting that the older age is a protection factor for developing traveler's diarrhea [5]. This can be explained because older travelers tend to avoid unnecessary risks and they have, in average, a bigger budget, therefore they can afford better accommodation and quality of food and services. A study of travelers behavior found that younger people tend to sleep more in guest houses and less in hotels, eat uncooked meat/fish often, tend to consume more alcohol, not always use utensils, not always wash their hands, have more contact with fresh water, walk barefoot often and had insect stings than older travelers [14].

In our study, the highest incidence of diarrhea per continent was found in those travelers with destination to South America with 28 cases per 100 travelers, in second place Africa and Central America with 24 cases, South East Asia and India with 20 cases and for low risk countries with only 3 cases. The highest incidence in South America found in our study is not coincident with the results described by Bederlock et al with a higher attack rate in the South West and Central Asia [4]. Our study differs also from what Zamarrón Fuertes et al found in a Spanish cohort in 2010, where was reported a higher incidence of TD whose destination was Central America 29.6%, followed by those who traveled to South East Asia with 28.7% [3]. Another study that differs from ours was done by Gautret et al in France with European travelers, and he found that the most frequent destinations for travelers who suffered TD was Africa in the first place and Asia South Central in the second [2]. The highest incidence of TD in South America could be explained because the most of the travelers visiting this region were young people (58% <40 years old) and 34% were free tourists (backpackers).

Another finding of our study was that the most frequent destination reported to South America were Brasil and Peru 366/456 travelers (80.1%) and a very high incidence rate of TD was found in these two countries with 101/456 (22.2%).

Another explanation if this high incidence could be the historical/cultural links between Spain and South America making this destination less exotic than others, leading to a lower perception of risk.

Regarding risk perception data our findings are similar to those described in the literature, the risk perception of TD in different cohorts of travelers tend to be low. In one study the perceived risk of watery diarrhea in a military population deployed in Iraq, Afghanistan and surroundings regions, the most of the respondents indicated no perceived risk to dysentery or watery diarrhea even when the estimated rates of travelers diarrhea among deployed military personnel is estimated to be approximately 30 cases per 100 persons-months [9,15]. This is coincident with our finding with a very high rate of travelers indicating a low perception of TD in the questionnaire. Another study coincident with ours reports that travelers who did had TD, when they were asked, tended to consider it a smaller problem than they had thought it would be prior departure. Even those travelers who were forced to alter their planned activities and those who were forced to stay indoors tender to consider less of a problem when asked the question upon return than they had thought it would be before departure [16]. In another study made in Canada, the perception of risk severity of TD among travelers going to Mexico and Dominican Republic was not severe in the most of them (77%) [16]. Our finding are similar to several studies proving that perception of risk of TD among travelers [9,10,16]

Regarding risk perception by gender we found that women tend to be more aware of the risk of TD, that finding is coincident with the findings of one study who reports that women are less likely to eat at a restaurant and try to eat in their own household during travel [14].

We found that the risk perception in young travelers was higher than in older travelers this could be explained by the fact that the younger travelers were the group with the higher incidence in the previous travel, these fact could lead to have a higher perception in the next one. But an already cited study of behavior in travelers found that younger travelers tend to have a higher risky behavior than older travelers [17].

Regarding to the continent of destination we found that the risk perception for TD was higher among travelers to SE Asia and India and South America. In all the cases the differences found were statistically significative. Our findings show that the risk perception of TD is higher in travelers with higher education levels, may be due to a better

access to information. Another findings of this study regarding the purpose of the travel, we found the risk perception of TD is higher in tourists than in other groups (business, VFR, cooperators), a finding that coincides with that described by Hill in a American cohort and for Leder et al. described in a French cohort of travelers [17].

One of the strengths of this study is the high number of participants (n=7,471) comparing with other studies published. The main limitation of this study is the recall bias of the travelers during the fulfilling of the questionnaire. As every a survey there is an important risk of recall bias due to fact that the time passed from the travel until the filling of the questionnaire could be one year.

CONCLUSIONS:

This study found a low incidence of severe TD mainly because of the classification of diarrhea used and a high number of VFR's travelers registered in as tourists. The risk perception of TD was higher in certain groups, such as women, young travelers, traveling to SE Asia and India, and with higher education. We confirmed that the experience of a TD in a previous travel increases the risk perception of TD for the next travel. More studies are needed in order to confirm and validate our results.

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