

ANTIBIOTIC USE AMONG FOREIGN TRAVELERS IN THAILAND

Sarocha Nganwiwattavorn, Borimas Hanboonkunupakarn, Watcharapong Piyaphanee, Kesinee Chotivanich, Thundon Ngamprasertchai, and Chayasin Mansanguan

Department of Clinical Tropical Medicine, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand

Abstract. Inappropriate antibiotic use can result in drug resistance. In this study, we aimed to determine the incidence of self-treatment with antibiotics among international travelers to Thailand in order to understand how common this practice is in this population. Study subjects were international travelers aged ≥ 18 years who were fluent in English. The study instrument was an online questionnaire developed and pilot tested asking about demographics and antibiotic use during travel in Thailand. Subjects were recruited at popular tourist destinations and asked to complete the study instrument. The study was conducted during March - September 2019. A total of 503 subjects participated in the study, 57.8% male and the mean (\pm standard deviation) age of study subjects was 33.5 (± 12.2) years. Nationalities of study subjects included Asian (26.0%), European (42.1%), North American (23.5%), Oceania (3.4%), African (2.8%), and South American (2.2%). Of these 503 study subjects, 79 (15.7%) had standby antibiotics. During their trip in Thailand, 57 subjects (11.3% of the study subjects) used antibiotics; 15 subjects were those who had standby antibiotics while 42 did not. Of the 42 subjects who did not have standby antibiotics, 24 (57.1%) got antibiotics from doctor's prescription, 12 (28.6%) sought their self-treatment without seeing a healthcare professional and 6 (14.3%) got antibiotics from unknown source (14.3%). Among those who took antibiotics during the trip, 39 (68.4%) finished the antibiotic course while 18 (31.6%) did not. Length of stay ($p < 0.01$) and access to standby antibiotics ($p = 0.020$) were significantly associated with antibiotic use among travelers. In our study, the incidence of antibiotic use among travelers was high and the proportion of those who did take antibiotics but did not finish the course of treatment was high. Those who brought standby antibiotics with them were more likely to take them. These activities increase the risk of developing antibiotic resistance. Pre-travel health consultations should include educating the travelers about this subject in order to reduce the risk of antibiotic resistance in this group of population.

Keywords: antibiotics use, antibiotic resistance, foreign traveler, travel medicine

Correspondence: Borimas Hanboonkunupakarn, Department of Clinical Tropical Medicine, Faculty of Tropical Medicine, Mahidol University, 420/6 Ratchawithi Road, Bangkok 10400, Thailand
Tel: +66 (0) 2354 9168, Fax: +66 (0) 2354 9168
E-mail: borimas.han@mahidol.edu; borimas.han@mahidol.ac.th

INTRODUCTION

Antibiotic resistance is a growing problem worldwide (WHO, 2014). This leads to bacterial infection treatment failure and increased mortality (Van Puyvelde *et al*, 2018; Costelloe *et al*, 2010). Southeast Asia has a problem with antibiotic resistance because antibiotics are relatively inexpensive and easily available. Patients do not require a doctor's prescription to purchase antibiotics in Thailand (Apisarnthanarak *et al*, 2008; Morgan *et al*, 2011). Thailand is a common travel destination (Monti, 2018; US News, 2017). Some travelers coming to Thailand carry standby medications, including antibiotics (Brunette and Nemhauser, 2020; CDC, 2018). Carrying standby antibiotics is associated with increased antibiotic use (Vilkman *et al*, 2018). Lack of knowledge and poor attitudes may contribute to inappropriate use of drugs (Costelloe *et al*, 2010; Keystone and Connor, 2017; Michael *et al*, 2014; Väänänen *et al*, 2006; You *et al*, 2008). Few studies have determined the incidence of antibiotic use among travelers to Thailand (Kittitrakul *et al*, 2015; Bodhidatta *et al*, 2019). In this study, we aimed to determine the incidence of self-treatment with antibiotics among international travelers to Thailand in order to understand how common this practice is in this population.

MATERIALS AND METHODS

Study population

The study population was international travelers to Thailand aged ≥ 18 years fluent in English, who were willing to participate in this study. Subjects were recruited in various sites: commonly frequent by tourists: in Bangkok (Khao San Road, the Hospital for Tropical Diseases, Mahidol University), in Phuket (Ratsada

Pier, Patong Beach, an elephant camp), Prachuap Khiri Khan (Hua Hin), Surat Thani (Koh Tao) and Chonburi (Pattaya). The study was conducted during March-September 2019.

Study instrument

We developed our own study instrument which was an online questionnaire that asked about demographics, travel history, pre-travel physician consultation and antibiotic use during travel in this trip. The questions in the instrument were created after a literature review (Al-Shibani *et al*, 2017; Awad and Aboud, 2015; Chinnasami *et al*, 2016; Huang *et al*, 2013; McNulty *et al*, 2007a; McNulty *et al*, 2007b). The instrument was then reviewed by 7 healthcare workers and then pilot tested on 12 international travelers to Thailand who presented to the Travel Clinic of the Hospital for Tropical Diseases, Bangkok. The instrument was then completed online.

This study was approved by the Ethics Committee, Faculty of Tropical Medicine, Mahidol University (MUTM-EXMPT 2019-003). Potential subjects were informed about the study and voluntariness to join the study. At the beginning of the questionnaire, there were "YES" and "NO" buttons available for subjects to choose to join or not to join the study, respectively. The study subjects gave consent to participate in the study by clicking the "YES" button. All responses were anonymously recorded.

Statistical analysis

We analyzed the study instrument data using Statistical Package for the Social Sciences (SPSS), version 18 (SPSS Inc, Chicago, IL). Descriptive statistics were used to present numbers, frequencies, percentages and means with

standard deviations (SD) or medians with interquartile ranges (IQR). Chi square and odds ratio (OR) were used to analyze categorical data. Logistic regression analysis was employed to identify factors associated with antibiotic use by study subjects. Statistical significance of univariate and multivariate analysis was set at $p < 0.05$.

RESULTS

Demographic data

A total of 503 subjects were included in the study, 57.8% male. The mean (\pm SD) age of study subjects was 33.5 (\pm 12.2) years; with 63.6% of subjects were aged 21-40 years. Thirty- nine subjects (7.7%) had a history of a chronic medical condition (asthma and lung diseases, hypertension, diabetes mellitus, and gastrointestinal problems). Subjects were from Europe (42.1%), Asia (26.0%), North America (23.5%), Oceania (3.4%), Africa (2.8%), and South America (2.2%). Up to 77.8% of the subjects had a bachelor's degree higher; 12.5% had medical training. The three most commonly reasons for traveling were tourism (67.8%), research/education (16.9%) and business (8.5%). Among these study subjects, 64.0% traveled for less than a month (Table 1).

Practices regarding standby medications and antibiotics

Of 503 study subjects, 207 subjects (41.2%) brought standby medications with them. Several subjects brought more than one type of medication. These standby medications were anti-diarrheal drugs (53.6%, 111/207), antibiotics (38.2%, 79/207), anti-malarial drugs (27.5%, 57/207) and other medications (33.3%, 69/207) (Fig 1). Focusing on the antibiotics, the three most common antibiotics that subjects brought with

Table 1
Demographic characteristics of study subjects.

Characteristics	Number (%) (n=503)
Gender	
Female	212 (42.1)
Male	291 (57.8)
Age group in years	
\leq 20	44 (8.7)
21-30	189 (37.6)
31-40	131 (26.0)
41-50	61 (12.1)
51-60	26 (5.2)
\geq 61	21 (4.2)
Missing	31 (6.2)
Education level	
High school	64 (12.7)
Bachelor's degree	266 (52.9)
Master's degree	125 (24.9)
Others	48 (9.5)
Nationality	
European	212 (42.1)
North American	118 (23.5)
South American	11 (2.2)
Asian	131 (26.0)
African	14 (2.8)
Oceania	17 (3.4)
Study site	
Bangkok	333 (66.2)
Phuket	151 (30.0)
Others	19 (3.7)
History of underlying disease	
Yes	39 (7.8)
No	464 (92.2)
Occupation	
Medical related	63 (12.5)
Non-medical related	279 (55.5)
Student	114 (22.6)
Unemployed	24 (4.7)
Retired	23 (4.6)
Duration of travel in Thailand	
\leq 7 days	223 (44.3)
8 days - 1 month	99 (19.7)
>1 month - 6 months	44 (8.7)
> 6 months	50 (9.9)
Missing	87 (17.3)
Purpose of travel	
Tourism	341 (67.8)
Business	43 (8.5)
Research and education	85 (16.9)
Visit friends and relatives	19 (3.8)
Resident	9 (1.8)
Others	6 (1.1)

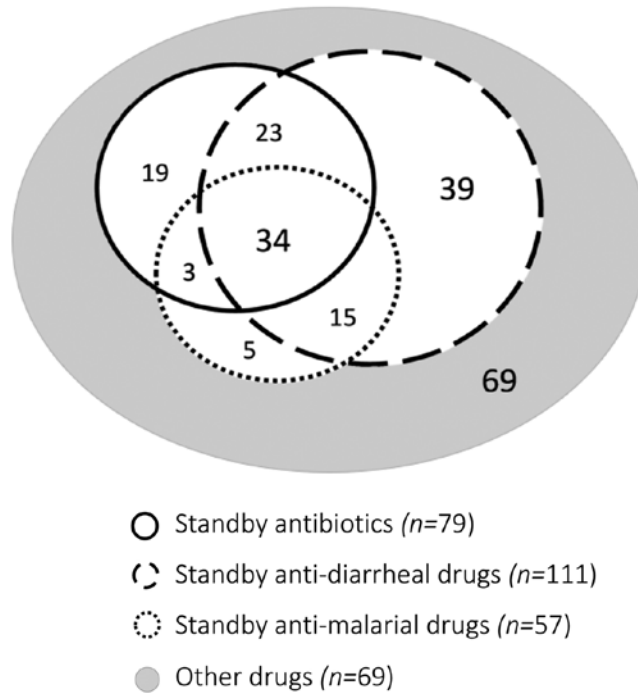


Fig 1-Numbers of subjects and details of standby medications reported in this study (n=207).

them were macrolide (19.0%), penicillin (16.5%), and fluoroquinolone (6.3%). It was also observed that 37 subjects who brought standby antibiotics (46.8%) could not name them.

A total of 57 subjects took antibiotics during the trip; 15 took their standby antibiotics while 42 subjects who did not have standby antibiotics got antibiotics from doctor's prescription (57.1%), self-treatment without seeing a healthcare professional (28.6%) and unknown source (14.3%) (Table 2). Among 57 antibiotic users, 39 (68.4%) finished the antibiotic course while 18 (31.6%) did not.

When asking for the reason for taking antibiotics, the most common reasons were cold- or flu-like symptoms (17.5%), gastrointestinal symptoms (15.7%), skin infections (12.3%) and urinary-

tract infections (12.3%). There was no significant difference in the incidence of antibiotic use between those with and without underlying disease ($p=0.18$).

Factors associated with antibiotic use

Logistic regression analysis was used to determine the factors associated with antibiotic use during travel to Thailand. On univariate analysis factors significantly associated with antibiotic use were: education level ($p=0.006$), study site ($p=0.006$), length of stay in Thailand ($p<0.001$), purpose of travel ($p=0.004$) and having standby antibiotics ($p=0.022$). Study subjects whose education was higher than high school level were more likely to take antibiotics (OR = 1.352; 95% CI: 0.449-4.072 for bachelor's degree; OR = 2.857; 95% CI: 0.933-8.751 for master's degree). Study subjects who visited Phuket

Table 2
Antibiotic use among study subjects.

Had standby antibiotics	Used antibiotics <i>n</i> (%)		Total
	Yes	No	
Yes	15 (19.0%)	64 (81.0%)	79 (15.7%)
No	42 (9.9%)	382 (90.1%)	424 (84.3%)
Total	57 (11.3%)	446 (88.7%)	503 (100.0%)

were less likely to take antibiotics than those who visited Bangkok (OR = 0.240; 95% CI: 0.001-0.573). Subjects who stayed in Thailand for longer duration were more likely to take antibiotics than those who had travel period within a week (OR = 3.916; 95% CI: 1.634-9.388 for 8 days-1 month; OR = 4.498; 95% CI: 1.578-12.824 for >1 month-6 months; OR = 15.852; 95% CI: 6.611-38.011 for >6 months). Subjects with the purpose of travel for business, research/education and resident had higher chance to take antibiotics than tourism (OR = 2.599; 95% CI: 1.29-6.788; OR = 2.395; 95% CI: 1.215-4.721; OR = 8.943; 95% CI: 2.271-3.209, respectively). Subjects with standby antibiotics were more likely to take antibiotics than those without standby antibiotics (OR = 2.132; 95% CI: 1.117-4.068).

On multivariate analysis, using a cutoff *p*-value <0.05, the factors significantly associated with antibiotic use were length of stay in Thailand (*p*<0.001) and having standby antibiotics (*p*=0.020). Subjects who stayed in Thailand longer than a week were more likely to take antibiotics (OR = 4.555; 95% CI: 1.830-11.338 for 8 days-1 month; OR = 3.770; 95% CI: 1.202-11.821 for >1 month-6 months; OR = 12.089, 95% CI: 4.256-34.334 for >6 months). Subjects who brought standby antibiotics had chance to take them twice

higher than subjects who did not (OR = 2.416; 95% CI: 1.147-5.091). The details are shown in Table 3.

DISCUSSION

Incidence of standby antibiotics and antibiotic usage

In our study, 15.7% (79/503) of the study subjects had standby antibiotics and 11.3% (57/503) did use their antibiotics during their trip. This result is similar to a study from Finland that found 20.3% (54/266) of subjects had standby antibiotics (Vilkman *et al*, 2018). This suggests standby antibiotics are commonly given to travelers, regardless of nationality. In our study, 19.0% (15/79) of subjects who had standby antibiotics used them during their trip. This was significantly more common among those who had standby antibiotic than those who did not. Our findings are similar to a previous study (Vilkman *et al*, 2018), that found 34.0% (18/53) of those who had standby antibiotics took them versus 10.8% (23/213) of those who did not took antibiotics during their trip.

In our study, only 68.4% (39/57) of subjects completed their course of antibiotics putting them at risk for developing drug-resistant bacteria (Woerther *et al*, 2017), and being travelers,

Table 3
Binary logistic regression analysis comparing those who used and those who did not use antibiotics during the current trip.

Factors (n)	Univariate analysis		Multivariate analysis	
	Crude OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Gender (503)				
Female (212)	1	-	-	-
Male (291)	1.284 (0.726-2.270)	0.390		
Age group in percentiles (472)		0.670		
<25; ≤ 24 (129)	1	-	-	-
25-75; 25-40 (235)	1.213 (0.590-2.493)	0.600		
>75; ≥ 41 (108)	1.452 (0.641-3.289)	0.371		
Education level (503)		0.006*		0.435
High school (64)	1	-	1	-
Bachelor (266)	1.352 (0.449-4.072)	0.591	1.441 (0.443-4.689)	0.544
Master (125)	2.857 (0.933-8.751)	0.066	1.766 (0.519-6.008)	0.363
Others (48)	4.459 (1.323-15.037)	0.016*	2.779 (0.727-10.624)	0.135
Nationality (503)		0.088		
European (212)	1	-	-	-
North American (118)	1.959 (1.007-3.813)	0.048		
South American (11)	0.960 (0.117-7.891)	0.970		
Asian (131)	0.880 (0.407-1.901)	0.745		
African (14)	3.840 (1.103-13.371)	0.035		
Oceania (17)	0.600 (0.076-4.765)	0.629		
Study site (484)		0.006*		0.065
Bangkok (333)	1	-	1	-
Phuket (151)	0.240 (0.001-0.573)	0.001*	0.206 (0.055-0.781)	0.020*
Others (19)	0.682 (0.153-3.044)	0.616	0.946 (0.190-4.709)	0.946
Underlying disease (503)		0.180		
Yes (39)	1	-	-	-
No (464)	0.552 (0.232-1.316)	0.180		
Occupation (503)		0.063		
Medical related (63)	1	-	-	-
Non-medical related (279)	1.102 (0.437-2.779)	0.837		
Student (114)	1.330 (0.484-3.652)	0.580		
Unemployed (24)	0.413 (0.047-3.624)	0.425		
Retired (23)	4.156 (1.223-14.125)	0.022		

Table 3 (Continued)

Factors (n)	Univariate analysis		Multivariate analysis	
	Crude OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Duration of travel in Thailand (503)		<0.001*		<0.001*
≤ 7 days (223)	1	-	1	-
8 days - 1 month (99)	3.916 (1.634-9.388)	0.002*	4.555 (1.830-11.338)	0.001*
>1 month - 6 months (44)	4.498 (1.578-12.824)	0.005*	3.770 (1.202-11.821)	0.023*
> 6 months (50)	15.852(6.611-38.011)	<0.001*	12.089(4.256-34.334)	<0.001*
Missing (87)	2.081 (0.750-5.773)	0.159	7.968 (1.912-33.206)	0.004*
Purpose of travel (503)		0.004*		0.961
Tourism (341)	1	-	1	-
Business (43)	2.599 (1.29-6.788)	0.010*	1.203 (0.431-4.689)	0.725
Research and education (85)	2.395 (1.215-4.721)	0.012*	0.839 (0.360-1.954)	0.684
Visit friends and relatives† (19)	-	-	-	-
Resident (9)	8.943 (2.271-3.209)	0.002*	1.642 (0.337-7.993)	0.539
Others (6)	2.236 (0.252-19.809)	0.470	1.335 (0.122-14.664)	0.813
Standby antibiotics (503)				
No (424)	1	-	1	-
Yes (79)	2.132 (2.132-4.068)	0.022*	2.416 (1.147-5.091)	0.020*

OR: odds ratio; CI: confidence interval; *: statistically significant at $p < 0.05$; †: none in this travel purpose category used antibiotics.

they might transmit antibiotic-resistant pathogens worldwide. Our findings are similar to a study from Kuwait that found only 64.9% (208/321) of subjects finished the antibiotic course (Awad and Aboud, 2015), suggesting poor adherence to an antibiotic regimen is not just a traveler problem.

The common reasons given for using antibiotics in our study were cold or flu-like symptoms, gastrointestinal symptoms, skin infection and urinary tract infection. These are similar to the three most common health problem reported by foreign travelers to Thailand: febrile viral infection, dengue infection,

and acute diarrhea (Oo *et al*, 2019). Viral infections, including dengue, and most cases of diarrhea do not require antibiotics. This shows antibiotic misuse among foreign travelers in Thailand and emphasizes the need of antibiotic-related health education for travelers.

The factors significantly associated with self-treatment with antibiotics among study subjects were having standby antibiotics and duration of travel. Having standby antibiotics was also found to be associated with their use in a previous study (Vilkman *et al*, 2018). Longer duration of travel (especially >7 days) was related to 4 times higher chance of

taking medication compared with short travel duration; this increased to 12 times with a travel duration >6 months. Previous studies reported travelers' diarrhea usually occurs by the end of the first week of travel (Kollaritsch, 1989; Steffen, 2005). Travel duration >1 month has also been reported to be associated with increased risk for contracting a respiratory-tract infection (Leder *et al*, 2003; Prajapat *et al*, 2018). Longer duration travelers are at greater risk of contracting an illness than those with short travel durations.

In our study, we considered factors for association with antibiotic use but we only studied associations, not causality due to our study design. Only data regarding antibiotic use during the current trip were collected. Subjects were recruited from only a few select sites and may not represent all travelers to Thailand. We also only recruited those fluent in English excluding other travelers.

In conclusion, we discovered self-treatment with antibiotics was common among international travelers to Thailand and associated with having standby antibiotics and longer duration of travel. Failure to complete the course of antibiotics was also common in our study subjects increasing the risk of developing drug-resistant bacteria and spreading it to other countries. Travelers need to be educated about correct antibiotic use.

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