J Infect Chemother 25 (2019) 866–872

Contents lists available at ScienceDirect

Journal of Infection and Chemotherapy

journal homepage: http://www.elsevier.com/locate/jic

Original Article

Health risk management behaviors and related factors among Japanese university students participating in short-term study abroad programs☆

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ARTICLE INFO

Article history:
Received 29 December 2018
Received in revised form
17 April 2019
Accepted 19 April 2019
Available online 16 May 2019

Keywords:
Vaccines
Risk reduction behavior
Travel
Students
Universities

ABSTRACT

Background: Overseas travelers should prepare for health problems at their destinations prior to travel. No prospective studies have evaluated factors related to health risk management behaviors among overseas travelers, specifically young travelers.

Methods: We prospectively collected data from pre- and post-travel questionnaire surveys, targeting students of a university in Japan who participated in short-term study abroad programs (n = 532, 6 to 38 travel days and 11 countries). We examined health information collection, receipt of travel vaccinations for the programs and medical kit preparation as health risk management behavior outcomes and their related factors among the participants (82.7% follow-up rate).

Results: In total, 17.5%, 8.0% (28.6% in Southeast Asia) and 68.9% of participants, respectively, collected travel health information via the Japanese or foreign official websites, received travel vaccinations and carried commonly used medicines. Female, travel experience to study destination, parental medical occupation and presence of illness in treatment were positively associated with the health risk management behaviors after adjusting for the covariates including study destination. For example, the adjusted odds ratio (OR) (95% confidence interval [CI]) of receiving travel vaccinations was 4.16 (1.70–10.2) for parental medical occupation relative to non-medical occupation. The adjusted OR (95% CI) of collecting travel health information was 2.54 (1.04–6.21) for travel experience to study destination relative to no overseas travel experience.

Conclusions: Personal characteristics including overseas travel experience and parental occupation provide a useful insight into approaches to promoting health risk management among university students traveling abroad.

1. Introduction

Climate, endemic diseases and health situations differ by country or region, which leads to an elevated health risk in overseas travel. Specifically, most travelers from industrialized countries face worse access to healthcare services while traveling abroad relative to what they can expect in their home countries. Travel health risks vary by itinerary, duration, season, purpose of travel and personal characteristics [1,2]; therefore, overseas travelers should prepare for health problems at their destinations by collecting health information via reliable sources, receiving vaccinations and carrying medical kits for self-treatment.

Japanese people are assumed to have limited attention to preparation while traveling abroad [3]. Lack of precautions against vaccine-preventable diseases among Japanese travelers has gained

Abbreviations: WHO, World Health Organization; CDC, Centers for Disease Control and Prevention; OR, odds ratio; ORS, oral rehydration salt; CI, confidence interval; MR, measles and rubella.

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https://doi.org/10.1016/j.jiac.2019.04.015
1341-321X/

global concern [4] and the proportion of Japanese travelers receiving travel vaccinations has been reported as being lower than that of Western travelers [3,5–8]. Collecting reliable health information prior to travel is also presumed to be suboptimal among Japanese travelers. Furthermore, travelers from any country often need to manage the condition when they become ill or injured overseas [9]; however, medical kits travelers carry have not been fully investigated in Japan and overseas. Because the number of Japanese people traveling abroad has been increasing (17.9 million in 2017) [10], there is concern that more Japanese travelers will visit local clinics or hospitals for potentially preventable health problems.

In recent years, the Japanese government has strongly promoted overseas study for university students [11]. We thus prospectively followed Japanese university students participating in short-term study abroad programs to examine their health risk management behaviors and related factors. In doing so, we focused on three health management behaviors (i.e., health information collection, receipt of travel vaccination for the programs and medical kit preparation) as the outcomes because any overseas traveler should practice these behaviors prior to travel.

2. Materials and methods

2.1. Study participants

We targeted students of a university in Japan who participated in short-term study abroad programs in the 2016 and 2017 academic years (n = 576). The university is in Okayama city located in the western part of Japan with a population of 0.7 million people and 0.3 million households. There are six travel clinics registered by two Japanese academic societies on travel medicine in the city (as of October 4, 2017). The programs were conducted in different countries during vacations in summer (August to September) and spring (February to March). The countries for the programs were Australia, Canada, China, France, Ireland, Malaysia, Singapore, UK, South Korea, Thailand and USA (mainland and Guam). The travel duration was 6 (Singapore) to 38 days (Australia), depending on the programs. In the present study, we restricted study participants to Japanese students and conducted a pre-travel survey two months before the students' departure when the university gave all the participants a lecture on health problems related to overseas travel and precautions. The pre-travel lecture lasted about 1 h and presented such information as general and up-to-date health risks and vaccinations by country or region, medical kits, travel medicine websites and nearby travel clinics. At baseline, 532 students were eligible. Among the eligible population, 92 were lost to follow-up when we conducted a post-travel survey one to two months after the students returned home, leaving 440 participants for analysis (82.7% follow-up rate).

2.2. Data collection

We collected data from two surveys using self-administered questionnaires (pre- and post-travel surveys). The pre-travel survey contained questions about personal characteristics including sex, age, academic year, study major, parental occupation, monthly allowance (continuous), presence of illness in treatment (no or yes), experiences of overseas travel and pre-travel vaccinations, and study destination. Age and academic year were dichotomized as follows: 18–19 or ≥20 years old and 1st or ≥2nd year, respectively. Study major was dichotomized as medical or nonmedical. The category of “medical” included participants in faculties of medicine (including nursing and other allied health professions), dentistry and pharmacy. Father and mother's occupation was originally categorized into six for each parent (physician, dentist, pharmacist, nurse, veterinarian and others). Considering the small number of parents engaged in these occupations, we reorganized the original six categories into two: medical or nonmedical. If a participant's father or mother engaged in any of the originally selected medical occupations, parental occupation was categorized as “medical”. Monthly allowance was dichotomized as <3rd quartile or ≥3rd quartile. Overseas travel experience was categorized into three categories: never, yes but no travel experience to the planned study destination, or yes and travel experience to the planned study destination. The study destination was categorized into four, based on countries for studying abroad, industrial development level and geographical location as follows: Western countries (Australia, Canada, France, Ireland, UK and USA including Guam), Singapore, Southeast Asia (Malaysia and Thailand) and East Asia (China and South Korea).

The post-travel survey contained questions about health information collection, travel vaccination and medical kit preparation. Health information collection was queried as follows: “Did you collect health information prior to travel?” If participants answered yes, they selected one or more information sources from the following list: friends or acquaintances; travelers except friends or acquaintances (e.g., via blog or social networking site); travel agency; travel guidebooks; the official Japanese travel safety website maintained by the Ministry of Foreign Affairs, Japan; the official Japanese travel health website maintained by the Quarantine Information Office, Ministry of Health, Labour, and Welfare, Japan; foreign official travel health websites (e.g., International Travel and Health maintained by the World Health Organization [WHO] and Travelers' Health maintained by the Centers for Disease Control and Prevention [CDC], USA); and others. Information about receipt of travel vaccinations for the programs was similarly queried and if applicable, one or more vaccines were selected from the following list: e.g., hepatitis A, hepatitis B, tetanus, rabies, Japanese encephalitis, typhoid and polio. If the vaccines participants received were not on the list, they were asked to select “others” and enter the vaccine name. Participants were also asked about medical kit preparation and if applicable, one or more contents of the medical kit were selected from the following list: e.g., cough or cold medicine, analgesic, antibiotics, antidiarrheal, stomach, intestinal regulation medicine, prescription drug for existing illness, digital thermometer, insect repellent, cold compress, vitamin or dietary supplement, oral rehydration salt (ORS) and adhesive bandage.

In this study, we defined three outcomes (i.e., travel health information collection, receipt of travel vaccination for the programs and medical kit preparation) as follows: whether the participants collected travel health information via the official Japanese travel health website or foreign official travel health websites (official Japanese or foreign travel health websites); whether the participants received travel vaccinations for the programs; and whether the participants carried any of commonly used medicines in the following list: cough or cold medicine, analgesic, antibiotics, antidiarrheal medicine, stomach and intestinal regulation medications [9,12]. Regarding travel health information collection, we focused on the official Japanese or foreign travel health websites because accurate, up-to-date and official information would be provided to the public in Japanese or English.

2.3. Analysis

We examined the distribution of health information collection, receipt of travel vaccinations for the programs and medical kit preparation according to study destination. We then estimated crude odds ratios (ORs) and 95% confidence intervals (95% CIs) for the associations with the three outcomes (i.e., travel health

information collection, receipt of travel vaccination for the programs and medical kit preparation) according to study destination and personal characteristics. Finally, we estimated ORs and 95% CIs after simultaneously adjusting for study destination and other factors that were independently significant (two-sided P value < 0.25) in each crude model [13]. Stata SE, version 14, statistical software (StataCorp., College Station, TX, USA) was used for all analyses.

3. Results

Table 1 shows the baseline characteristics of Japanese university students who participated in short-term study abroad programs. Among the participants (n = 440), 64.3% were women and 72.5% were 18–19 years old. Approximately 10% were majoring in the medical sciences and had parents engaged in medical occupations, respectively. In addition, 59.6% had overseas travel experience, 15.3% of whom ever traveled to their study destinations, and 49.6% studied abroad in Western countries.

Table 2 shows the distribution of health information collection, receipt of travel vaccination and medical kit preparation among total participants and participants stratified by study destination. Approximately 80% of total participants collected health information mainly via the official Japanese travel safety website (44.1%) and travel guidebooks (31.1%), but the official Japanese or foreign travel health websites were less accessible (17.5%). None of the participants collected health information from health professionals (data not shown). Participants going to East Asia collected health information less frequently (63.0%) than those going to the other destinations, although the official Japanese travel safety website was more accessible than the other sources (48.1%).

Table 1
Baseline characteristics of Japanese university students who participated in short-term study abroad programs.

	Study participants (n = 440)	
Sex, n (%)		
Male	157	(35.7)
Female	283	(64.3)
Age group, n (%)		
18–19 years	319	(72.5)
≥20 years	121	(27.5)
Academic year, n (%)		
1st	246	(55.9)
2nd or higher	194	(44.1)
Study major, n (%)		
Non-medical	395	(89.8)
Medical	45	(10.2)
Parental occupation, n (%)		
Non-medical	386	(87.7)
Medical	54	(12.3)
Allowance per month[*1], n (%)		
<45,000 JPY	332	(75.5)
≥45,000 JPY	101	(23.0)
Missing	7	(1.6)
Travel season (in Japan), n (%)		
Summer	223	(50.7)
Spring	217	(49.3)
Presence of illness in treatment, n (%)		
No	374	(85.0)
Yes	66	(15.0)
Overseas travel experience, n (%)		
Never or missing	178	(40.5)
Yes	262	(59.6)
Ever traveled to study destination[*2]	40	(15.3)
Study destination[*3], n (%)		
Western countries	218	(49.6)
Singapore	132	(30.0)
Southeast Asia	63	(14.3)
East Asia	27	(6.1)

Abbreviations: n, number.
*1 1 US dollar = 113.26 JPY (as of Nov. 6, 2018). 45,000 JPY was equivalent to 397.3 US dollars.
*2 The percentage was calculated by the number of those who ever traveled to study destination divided by those who had overseas travel experience.
*3 Europe (Ireland, France, and UK), North America (Canada and USA) and Oceania (Australia and Guam) were included in the category of Western countries; Malaysia and Thailand were included in the category of Southeast Asia; and China and Korea were included in the category of East Asia.

Thirty-five participants (8.0%) received at least one vaccination before their study abroad programs, over half of whom were those who went to Southeast Asia (n = 18) and East Asia (n = 2). Fifteen participants (5.7%) had previously received vaccinations for past overseas travel, and vaccinations participants commonly received were hepatitis A, hepatitis B and influenza, although 206 (46.8%) had received influenza vaccination within one year of departure (data not shown). Among those going to Southeast Asia, 28.6% received at least one vaccination, which included hepatitis A, hepatitis B, Japanese encephalitis and rabies.

Over 80% of total participants prepared a medical kit. Medical kit contents the participants commonly carried were cough or cold medication and adhesive bandage and 68.9% carried any of the commonly used medicines. Participants going to Southeast Asia and East Asia carried stomach, antidiarrheal and intestinal regulation medications more frequently than those going to the other destinations. In addition, those going to Singapore and Southeast Asia carried insect repellent and ORS more frequently than those in the other destinations.

Table 3 shows associations with the health risk behaviors according to personal characteristics. Even after simultaneously adjusting for the covariates, those with illness in treatment were associated with an elevated likelihood for collecting travel health information (OR: 2.02, 95% CI: 1.07–3.80). Compared with those who had never traveled abroad, those with overseas travel experience were also associated with an elevated likelihood for collecting travel health information and the OR (95% CI) for those who had previously traveled to the study destination was 2.54 (1.04–6.21). In addition, those going to Singapore were associated with an elevated likelihood for collecting travel health information (OR: 0.50, 95% CI: 0.26–0.96), compared with those going to Western countries. Similarly, those whose father or mother engaged in medical care and those going to Southeast Asia were associated with an elevated likelihood for receiving travel vaccinations for the programs. The ORs (95% CIs) were 4.16 (1.70–10.2) for the category of “medical” in parental occupation relative to the category of “nonmedical” and 7.45 (3.12–17.8) for the category of “Southeast Asia” relative to the category of “Western countries”. In addition, female participants were associated with an elevated likelihood for carrying commonly used medicines, compared with male participants (OR: 1.99, 95% CI: 1.31–3.02).

4. Discussion

In this study, we evaluated the health risk management behaviors (i.e., travel health information collection, receipt of travel vaccinations for the programs and medical kit preparation) and related factors among Japanese university students participating in short-term study abroad programs. To our knowledge, no prospective study has examined factors related to health risk management behaviors among university students studying abroad. We found that the participants performed health risk management less frequently than expected, although all of the participants had an opportunity to learn about official travel health websites, travel vaccinations and medical kits in the pre-travel lecture. Among those in Southeast Asia and East Asia, the proportion of those receiving travel vaccinations was suboptimal. Sex, overseas travel

Table 2
Distribution of health information collection, receipt of travel vaccinations for the programs and medical kit preparation among total participants and participants stratified by study destination.

	Total (n = 440, 6–38 d)	Study destination			
		Western countries (n = 218, 10–38 d)	Singapore (n = 132, 6–15 d)	Southeast Asia (n = 63, 14–21 d)	East Asia (n = 27, 8–17 d)
	n (%)	n (%)	n (%)	n (%)	n (%)
Health information collection					
No	95 (21.6)	48 (22.0)	24 (18.2)	13 (20.6)	10 (37.0)
Yes	345 (78.4)	170 (78.0)	108 (81.8)	50 (79.4)	17 (63.0)
Information sources					
Official Japanese travel safety website*1	194 (44.1)	104 (47.7)	47 (35.6)	30 (47.6)	13 (48.1)
Travel guidebooks	137 (31.1)	62 (28.4)	48 (36.4)	19 (30.2)	8 (29.6)
Friends or acquaintances	106 (24.1)	53 (24.3)	34 (25.8)	12 (19.0)	7 (25.9)
Travelers except friends	95 (21.6)	47 (21.6)	27 (20.5)	16 (25.4)	5 (18.5)
Official Japanese travel health website*2	67 (15.2)	39 (17.9)	17 (12.9)	9 (14.3)	2 (7.4)
Foreign official travel health websites*3	19 (4.3)	12 (5.5)	2 (1.5)	5 (7.9)	0
Official Japanese or foreign travel health websites*4	77 (17.5)	46 (21.1)	17 (12.9)	12 (19.0)	2 (7.4)
Travel agencies	39 (8.9)	23 (10.6)	11 (8.3)	3 (4.8)	2 (7.4)
Others	14 (4.1)	6 (3.5)	5 (4.6)	2 (4.0)	1 (5.9)
Receipt of travel vaccinations for the programs					
No	405 (92.1)	206 (94.5)	129 (97.7)	45 (71.4)	25 (92.6)
Yes	35 (8.0)	12 (5.5)	3 (2.3)	18 (28.6)	2 (7.4)
Vaccine					
Hepatitis A	13 (3.0)	1 (0.5)	0	11 (17.5)	1 (3.7)
Hepatitis B	10 (2.3)	3 (1.4)	2 (1.5)	5 (7.9)	0
Japanese encephalitis	5 (1.1)	0	0	4 (6.3)	1 (3.7)
Tetanus	4 (0.9)	1 (0.5)	0	3 (4.8)	0
Rabies	3 (0.7)	0	0	3 (4.8)	0
Others*5	11 (2.5)	8 (3.7)	1 (0.8)	1 (1.6)	1 (3.7)
Medical kit preparation					
No	69 (15.7)	35 (16.1)	26 (19.7)	6 (9.5)	2 (7.4)
Yes	371 (84.3)	183 (83.9)	106 (80.3)	57 (90.5)	25 (92.6)
Medicines					
Cough or cold	219 (49.8)	122 (56.0)	46 (34.8)	33 (52.4)	18 (66.7)
Analgesic	146 (33.2)	80 (36.7)	36 (27.3)	22 (34.9)	8 (29.6)
Stomach	137 (31.1)	66 (30.3)	33 (25.0)	24 (38.1)	14 (51.9)
Antidiarrheal	115 (26.1)	47 (21.6)	34 (25.8)	23 (36.5)	11 (40.7)
Intestinal regulation	104 (23.6)	47 (21.6)	24 (18.2)	26 (41.3)	7 (25.9)
Motion sickness	99 (22.5)	51 (23.4)	32 (24.2)	11 (17.5)	5 (18.5)
Antibiotics	44 (10.0)	27 (12.4)	8 (6.1)	7 (11.1)	2 (7.4)
Prescription drug for existing illness	29 (6.6)	19 (8.7)	7 (5.3)	2 (3.2)	1 (3.7)
Sedatives	5 (1.1)	4 (1.8)	0	0	1 (3.7)
Any of commonly used medicines*6	303 (68.9)	155 (71.1)	81 (61.4)	45 (71.4)	22 (81.5)
Items					
Adhesive bandage	238 (54.1)	114 (52.3)	69 (52.3)	38 (60.3)	17 (63.0)
Insect repellent	161 (36.6)	37 (17.0)	75 (56.8)	43 (68.3)	6 (22.2)
Digital thermometer	29 (6.6)	21 (9.6)	3 (2.3)	3 (4.8)	2 (7.4)
Oral rehydration salt (ORS)	27 (6.1)	6 (2.8)	11 (8.3)	9 (14.3)	1 (3.7)
Cold compress	24 (5.5)	13 (6.0)	6 (4.5)	4 (6.3)	1 (3.7)
Vitamin or dietary supplement	23 (5.2)	12 (5.5)	6 (4.5)	3 (4.8)	2 (7.4)

Abbreviations: n, number; d, travel days.
*1 Japanese Ministry of Foreign Affairs.
*2 Quarantine Information Office, Japanese Ministry of Health, Labour, and Welfare.
*3 Foreign official travel health websites including WHO and CDC.
*4 This category included those who collected health information via the official Japanese travel health website*2 or foreign official travel health websites*3.
*5 Those going to Western countries received influenza (n = 7) and measles (n = 1) vaccines, those going to Singapore received chickenpox vaccine (n = 1), those going to Southeast Asia received influenza (n = 1), and those going to East Asia received MR vaccine (n = 1).
*6 Commonly used medicines including cough or cold medicine, analgesic, stomach, antidiarrheal, or intestinal regulation medicines.

experience, parental medical occupation and presence of illness in treatment were positively associated with health risk management behaviors after simultaneously adjusting for the covariates.

Only 17.5% of the participants collected travel health information via the official Japanese or foreign travel health websites, although the websites had been introduced at the time of pre-travel lecture. Furthermore, nobody seemed to seek health information from travel medicine specialists. The present finding is consistent with a past study reporting that 0.3% of Japanese travelers [36.4 years of age (mean), tourism purpose (87.7%), <7 travel days (72.1%), travel to Asia (87.7%)] sought health information from general or occupational health physicians [5]. Studies conducted in 2004 reported that the proportions of those who sought health information from general practitioners or family physicians and from travel clinics were far higher among European travelers (57.4% and 35.3%) and South African travelers (23% and 25%) [8,14]. This gap might be because the number of travel medicine specialists or travel clinics is still relatively small in Japan [3] and Japanese people do not seem to accept the extra cost of visiting a hospital or clinic for purposes other than medical treatment, e.g., pre-travel consultation.

We found that personal characteristics (e.g., presence of illness in treatment and overseas travel experience) were associated with an elevated likelihood for collecting travel health information. Whether the participants can imagine illness onset and living conditions while

Table 3
Associations with collecting official travel health information, receiving travel vaccination for the programs and carrying commonly used medicines according to study destination and personal characteristics.

	Collecting travel health information*1			Receiving travel vaccinations for the programs			Carrying commonly used medicines*2		
	Crude		Adjusted*3	Crude		Adjusted*3	Crude		Adjusted*3
	OR (95% CI)	*P*	OR (95% CI)	OR (95% CI)	*P*	OR (95% CI)	OR (95% CI)	*P*	OR (95% CI)
Sex									
Male	1 (ref.)			1 (ref.)			1 (ref.)		1 (ref.)
Female	1.19 (0.70, 2.00)	0.52		1.42 (0.67, 3.05)	0.36		1.98 (1.31, 3.00)	<0.01	1.99 (1.31, 3.02)
Age									
18–19 years	1 (ref.)			1 (ref.)		1 (ref.)	1 (ref.)		
≥20 years	0.99 (0.57, 1.71)	0.96		0.42 (0.16, 1.10)	0.08	0.49 (0.16, 1.46)	0.93 (0.59, 1.46)	0.76	
Academic year									
1st	1 (ref.)		1 (ref.)	1 (ref.)		1 (ref.)	1 (ref.)		
2nd or higher	0.73 (0.44, 1.20)	0.21	0.66 (0.38, 1.14)	0.56 (0.27, 1.17)	0.12	1.18 (0.49, 2.85)	1.26 (0.84, 1.90)	0.26	
Study major									
Non-medical	1 (ref.)		1 (ref.)	1 (ref.)			1 (ref.)		
Medical	1.85 (0.91, 3.76)	0.09	1.54 (0.72, 3.26)	0.81 (0.24, 2.76)	0.74		1.13 (0.57, 2.22)	0.73	
Parental occupation									
Non-medical	1 (ref.)			1 (ref.)		1 (ref.)	1 (ref.)		
Medical	1.24 (0.61, 2.53)	0.55		3.28 (1.48, 7.28)	<0.01	4.16 (1.70, 10.2)	0.81 (0.45, 1.48)	0.49	
Monthly allowance									
<45,000 JPY	1 (ref.)			1 (ref.)			1 (ref.)		
≥45,000 JPY	0.87 (0.48, 1.59)	0.65		1.26 (0.56, 2.80)	0.58		1.11 (0.68, 1.80)	0.67	
Travel season									
Summer	1 (ref.)			1 (ref.)			1 (ref.)		
Spring	0.68 (0.42, 1.13)	0.14		1.41 (0.70, 2.83)	0.34		0.90 (0.60, 1.35)	0.62	
Presence of illness in treatment									
No	1 (ref.)		1 (ref.)	1 (ref.)			1 (ref.)		
Yes	2.00 (1.09, 3.68)	0.03	2.02 (1.07, 3.80)	0.94 (0.35, 2.52)	0.90		0.89 (0.51, 1.55)	0.68	
Overseas travel/study destination experiences									
Never or missing	1 (ref.)		1 (ref.)	1 (ref.)			1 (ref.)		
Yes/never	1.67 (0.96, 2.88)	0.07	1.57 (0.88, 2.78)	1.37 (0.65, 2.88)	0.41		1.18 (0.77, 1.80)	0.45	
Yes/ever	2.25 (0.97, 5.20)	0.06	2.54 (1.04, 6.21)	1.12 (0.30, 4.18)	0.86		1.53 (0.70, 3.33)	0.29	
Study destination									
Western countries	1 (ref.)		1 (ref.)	1 (ref.)		1 (ref.)	1 (ref.)		1 (ref.)
Singapore	0.55 (0.30, 1.01)	0.06	0.50 (0.26, 0.96)	0.40 (0.11, 1.44)	0.16	0.43 (0.12, 1.56)	0.65 (0.41, 1.02)	0.06	0.64 (0.40, 1.02)
Southeast Asia	0.88 (0.43, 1.79)	0.72	0.74 (0.34, 1.58)	6.87 (3.09, 15.3)	<0.01	7.45 (3.12, 17.8)	1.02 (0.55, 1.89)	0.96	1.03 (0.55, 1.92)
East Asia	0.30 (0.07, 1.31)	0.11	0.26 (0.06, 1.20)	1.37 (0.29, 6.49)	0.69	1.31 (0.27, 6.40)	1.79 (0.65, 4.93)	0.26	1.78 (0.64, 4.97)

*1 An outcome of collecting official travel health information was defined based on whether participants collected health information via official Japanese or foreign travel health websites.
*2 An outcome of carrying commonly used medicines was defined based on whether participants carried at least one of the following medicines: cough or cold, analgesic, stomach, antidiarrheal, or intestinal regulation medicines.
*3 Simultaneously adjusting for valuables with $P < 0.25$ in the crude model.

staying overseas, especially in study destinations, may influence heath risk management through collecting health information.

In the present study, the participants going to Southeast Asia received vaccinations for at least one disease (28.6%) prior to travel. This is a higher proportion than that of general university students (5.2% in 2006) [15] and Japanese travelers (<10% in 2007–2008) [5], most of whom traveled to Asian countries to do sightseeing for less than two weeks. The reasons may partly derive from a different purpose of travel and participants' knowledge of travel health because the university gave the lecture to all students participating in the study abroad programs. However, the proportion in our study was still lower than that of university students in the USA (42% for at least one disease) [16] and Canada (34.4% for hepatitis A) [17] probably because Japanese people tend to disregard disease prevention during overseas travel and there are few travel clinics in Japanese cities [3]. Because Japanese universities and the government have strongly promoted overseas study as an educational policy [11], approaches to promoting travel vaccinations other than pre-travel lectures need to be considered. For example, health management approaches that Japanese companies conducted for employees could be helpful (e.g., 55.8% received travel vaccinations among Japanese expatriates [18]).

Caution is needed when considering the childhood routine vaccination status of Japanese university students because this population could miss opportunities to receive required doses of several vaccines, including those for measles, rubella and Japanese encephalitis. This is because the Japanese governmental vaccination policy changed during their childhood [19,20]. In the present study, few participants received an additional dose of measles and/or rubella-containing vaccine (n = 2) or Japanese encephalitis vaccine (n = 5). Clinicians in Japan and abroad thus need to be cautious about the routine childhood vaccination status of Japanese university students.

Furthermore, participants whose fathers or mothers engaged in medical care were associated with an elevated likelihood for receiving travel vaccinations for the programs even after adjusting for study destination. By contrast, whether participants majored in medical sciences were not associated with an elevated likelihood of receiving the travel vaccinations. It is probable that whether participants received travel vaccinations could be influenced by parental knowledge about vaccines or vaccine-preventable diseases more strongly than the participants' own study majors or economic situations [21].

We also found that participants tended to prepare medical and health-related items in medical kits, e.g., 34.9%, 36.5% and 60.3% of those going Southeast Asia carried analgesic, antidiarrheal medications and adhesive bandage, respectively. This is lower than that of a past study targeting UK backpackers who specialized in pharmacy (pharmacists and pharmacy students), e.g., 86%, 66% and 88%

of those carried analgesic, antidiarrheal medications and adhesive bandage, respectively [12].

In addition, we found that female participants were associated with an elevated likelihood for carrying commonly used medicines, including analgesic and antidiarrheal medicines. Moreover, female participants were also associated with an elevated likelihood for collecting travel health information and receiving travel vaccinations for the programs, respectively, although these associations were not significant. It is plausible that women, compared with men, tend to judge risks as bigger and more problematic [22,23] and thus manage their health risks more thoroughly. Therefore, further studies need to examine the underlying mechanisms of health risk management behaviors and personal characteristics.

A major strength of the present study is that we targeted students of a university participating in short-term study abroad programs, considering that no prospective studies have evaluated their risk management behaviors and related factors. In addition, the high follow-up rate (82.7%) strengthens the validity of our findings. Another strength is that we prospectively followed the participants to collect information on personal characteristics via a pre-travel survey and on three health risk management behavior outcomes via a post-travel survey.

The present study has several limitations. First, we targeted the students of a university in a city with poor resources for travel medicine, which may be a problem when generalizing our findings to Japanese university students in Tokyo and other major cities in Japan. Second, because travel duration depended on the study destinations, we could not analyze the impacts on health risk management behaviors. Finally, we cannot rule out the possibility that other factors (e.g., risk perception [21,23]) could influence the associations of sex, presence of illness in treatment, overseas travel experience and parental occupation with health risk management behaviors among university students. Further studies thus need to examine what factors influence these associations.

5. Conclusions

The present study demonstrated that Japanese university students participating in short-term study abroad programs did not perform sufficient health risk management behaviors, although a pre-travel lecture was provided to all participants. Personal characteristics including sex and prior overseas travel experience were positively associated with health risk management behaviors, independent of the study destination. There is urgent need for intervention approaches to improve health risk management behaviors among university students (e.g., to raise risk awareness, providing data about students' characteristics related to a lower likelihood of health risk management behaviors before a pre-travel lecture).

Source of funding

This work was supported by JSPS KAKENHI Grant Number JP17K02111. The sponsors have no involvement in deciding the study design, the collection, analysis, and interpretation of data, the writing of the report, and the decision to submit the paper for publication.

Ethics

This study was approved by the Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences Institutional Review Board (No. R1606-039).

Acknowledgements

This work was supported by JSPS KAKENHI Grant Number JP17K02111. We would like to thank Dr. Takao Inamori and Dr. Toshihide Tsuda for their valuable support. We also thank Dr. Mayumi Ono for her useful comments.

Conflicts of interest

The authors have no conflicts of interest to disclose.

Author contributions

Michiyo Yamakawa, PhD, designed the study and analytical strategy, performed the data analyses, drafted the initial manuscript, and approved the final manuscript as submitted. Yuko Tanaka, PhD, designed the study and analytical strategy, reviewed and revised the manuscript, and approved the final manuscript as submitted. Megumi Sasai, PhD, designed the study, obtained data, contributed to the interpretation of results, reviewed and revised the manuscript, and approved the final manuscript as submitted.

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