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Rosa Katia Bellomo , Maria Assunta Donato , Vito Cerabona * , Teresa Esposito , Alessia Perna , Giuliana Federico , Carmine Guarino , Anna Odone , Michele Sparano , Romina Sezzatini , Erika Alessandra Strangi , Eleonora Tassone , Paolo Villari , Corrado De Vito

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Exploring the World, Minimizing Risks: Travellers' Awareness and Risk Perception of Infectious Diseases in the Post-Pandemic Era

Rosa Katia Bellomo [1], Maria Assunta Donato [1], Vito Cerabona [1,*], Teresa Esposito [2], Alessia Perna [2], Giuliana Federico [1], Carmine Guarino [2], Anna Odone [3], Michele Sparano [1], Michele Sparano [2], Erika Alessandra Strangi [4], Eleonora Tassone [3], Paolo Villari [1] and Corrado De Vito [1]

[1] Department of Public Health and Infectious Diseases – Sapienza University of Rome, Rome, Italy
[2] Italian Ministry of Health – USMAF/SASN – Lazio, Marche, Umbria, Abruzzo and Molise Regions, Rome, Italy
[3] Department of Public Health, Experimental and Forensic Medicine, University of Pavia, Pavia, Italy
[4] Department of Prevention, ASL Roma 1, Rome, Italy
* Correspondence: vito.cerabona@uniroma1.it

Abstract

Background: The epidemiological alert about the possible spread of different pathogens has highlighted the risk of international travelers contracting infectious diseases when visiting endemic areas. The role of travelers in disease transmission underscores the importance of pre-travel consultations, which provide critical information on health risks, vaccinations, and preventive measures. Understanding travelers' risk perceptions and behaviors is essential for enhancing global health security in the post-pandemic era. **Methods:** A cross-sectional study (June 2023 – January 2024) was conducted by administering an anonymous questionnaire at the Rome-Fiumicino Airport International Prophylaxis Clinic (USMAF-SASN). The questionnaire explored demographics, travel patterns, risk perceptions, vaccination behaviors, and sources of health information. Descriptive statistics, and a multivariable logistic regression analysis were performed to identify low-risk perception predictors. **Results:** Among 217 participants, 89.8% were Italian, with a balanced representation of genders. The primary purpose of travel was tourism (61.6%), followed by work-related trip (23.1%). While 77.1% rated preventive measures as effective, 23.2% evaluated infection risk as low. In particular, these last were in the majority male (OR 3.68, p=0.009), teacher (OR 9.85, p=0.025), and hotels users (OR 5.96, p<0.001). As expected, healthcare professionals and individuals using institutional health sources showed a higher risk awareness. Vaccination uptake at the Airport Clinic was motivated by self-protection, vaccine confidence, and poor time flexibility to access local vaccination services, and last-minute plans, making the airport a more convenient option. **Conclusions:** Travelers' risk perception is influenced by gender, profession, accommodation type, and information sources. Public health strategies should enhance health literacy, promote pre-travel consultations, and improve access to preventive services. Strengthening collaborations between health authorities, educational institutions, and the travel sector is key to mitigating health risks and ensuring global health security. Future interventions should address structural vaccination barriers and improve outreach to under-informed travelers.

Keywords: travel medicine; risk perception; vaccine uptake; international travelers; pre-travel consultation

1. Introduction

International travelers who do not take proper precautions before visiting areas with endemic infectious diseases may face serious health risks and could transmit them across borders. The COVID-

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19 pandemic exemplifies the role of travelers in the global spread of communicable diseases [1]. Similarly, in recent years, international travel has significantly impacted the geographic spread of health threats such as Ebola virus, Zika virus, and antimicrobial-resistant pathogens [2–4]. Between 6% and 87% of travelers report illness during or after their journeys, with more reliable estimates suggesting that 43% to 79% of those traveling to developing countries experience health issues, primarily traveler's diarrhea [5]. A recent meta-analysis revealed that approximately 36% of travelers experienced diarrhea during trips lasting less than 100 days. Key predictors of this outcome include younger age, longer travel durations, travel to low- and middle-income countries, tourism-related activities, and backpacking [6]. These findings highlight the need for pre-travel medical consultations to inform travelers about potential health risks and preventive behaviors. Pre-travel medical guidance plays a pivotal role in safeguarding the health of international travelers by providing critical information about infectious diseases prevalent in their destinations. This guide equips travelers with information on recommended vaccinations, preventive measures, and necessary medications, thereby reducing the risk of contracting or transmitting diseases across borders [7]. Many studies have just shown that the scarce adherence to public health recommendations is caused by lack of awareness, misinformation, and perceived low risk, which deters individuals from seeking or following pre-travel health advice [8]. Assessing the risk of travel-related infections poses several challenges. One major issue is the limited availability of accurate data concerning disease risk among travelers. This is partly due to difficulties in collecting reliable numerators, such as the number of infections among travelers, and denominators, including the number of individuals susceptible at specific destinations. Moreover, minor illnesses remain unreported; travelers may not seek medical attention, or diagnostic tests might not be performed to confirm the illness. Furthermore, many travelers visit multiple locations, making it hard to pinpoint the exact source of their exposure. Although data on disease incidence in local populations are available, they are not applicable to travelers. Travelers generally engage in different behaviors, eating practices, accommodations, preventive care, and activities compared to residents. The best pre-exposure prophylaxis for international travelers are unquestionably the vaccinations, which provide safe and effective protection against infectious diseases such as yellow fever, typhoid, hepatitis A, and influenza is well-documented, making them essential tools for protecting individual and public health during global travel [7]. Vaccines shield travelers from potentially life-threatening diseases and help prevent the introduction and spread of these pathogens across international borders, thereby contributing to global health security [9]. Vaccines for travelers are categorized according to risk assessment, including those recommended for individual protection, those mandated under the 2005 International Health Regulations [10], and those required by specific countries for entry. Understanding the risk perceptions of infectious diseases among international departing travelers in an increasingly interconnected world is vital for promoting global health safety [11–14]. However, this study was conducted to understand if pre-travel infectious disease risk perception has evolved among international travelers in the post-COVID-19 era, particularly in real-world airport health service settings.

Objectives

The primary objective of this study was to identify predictors of low perceived risk of infectious diseases among international travelers in the post-pandemic era. Secondary objectives were to describe pre-travel health awareness and risk perception, preventive behaviors, drivers/barriers of pre-exposure prophylaxis uptake, vaccination willingness and sources of health information in a real-world airport health service centre.

2. Materials and Methods

Study Population

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This cross-sectional study was conducted between June 2023 and January 2024. An anonymous questionnaire was distributed via Google Forms to travelers departing from or transiting through Rome-Fiumicino "Leonardo da Vinci" International Airport (LIRF), specifically at the Maritime, Air and Border Health Offices (USMAF-SASN) clinic. Medical staff at the USMAF-SASN clinic informed all participants of the survey's methods, objectives, and guarantees of anonymity. Informative posters regarding the study were also displayed at the USMAF-SASN clinic. After obtaining consent to process sensitive data for the research, healthcare personnel facilitated the completion of the online questionnaire. The questionnaires were compiled anonymously to minimize the risk of confidentiality breaches, and no demographic or identifying information was collected. Completed questionnaires were accessible only to the investigators.

Questionnaire

The questionnaire was adapted from a previously validated tool in the Italian context [15] and was presented in Italian, English, Spanish, and French to minimize potential language barriers. It included a demographic assessment to examine the sample's social and personal characteristics, including gender, age, employment status, education level, nationality, religion, and political orientation. Additionally, it collected information on the destination, type of accommodation, trip setting, organization, equipment, and the reasons and frequency of the trips. Furthermore, it assessed travelers' attitudes and perceptions of risk regarding major infectious diseases that could arise at their destination. Finally, the questionnaire explored their knowledge and attitudes toward relevant preventive measures, pre-travel prophylaxis, travel health and well-being.

Statistical Analysis

The data were collected anonymously, entered into a database, and analyzed exclusively in an aggregated form without any identifying information. The statistical analysis aimed to provide a descriptive overview of the study population, focusing on socio-demographic and occupational variables. Absolute and relative frequencies were calculated for categorical variables. Univariate analysis was conducted using the χ^2 and Fisher's exact tests for categorical variables. A multiple logistic regression model was developed to identify predictors of low perception of risk contagion. Model selection was performed using the Akaike Information Criterion (AIC). Variables with a p-value < 0.25 in the univariate analysis were included in the multivariate models. The odds ratio (OR) and the corresponding 95% confidence interval were calculated for each variable. Statistical significance was set at $p<0.05$. The covariates included in the models were as follows: sex (0=female, 1=male), age (continuous, in years), employment status (0=other, unemployed=1, teacher=2, law enforcement/armed forces=3, airport worker=4, seafarer=5, healthcare professional=6, student=7), sources of information on preventive measures (0 = non-institutional sources, 1 = institutional sources), travel frequency (0=other, 1=less than once a year), accommodation type (0=other, 1=hotel and resort), and the preventive measures awareness (equal to 1 if the person has stated that they are aware of the recommended preventive measures against infectious diseases for their destination, and 0 in all other cases). The statistical analysis was performed using the statistical software STATA 18.0 (StataCorp LLC, Texas, USA).

3. Results

Among the 217 participants, the majority were Italians, representing 89.8% of the sample. Europeans accounted for 4.2%, while participants of African, Asian, and Central/South American origins represented globally 6% of respondents. The study observed a relatively balanced gender distribution, with males comprising 53.5% and females 46.5%. Regarding marital status, 51.4% were unmarried, 21.8% were cohabitating, and 19.9% were married. Employment status varied significantly, with 51.9% classified as 'other,' followed by healthcare professionals (15.3%) and students (12.0%). Regarding educational attainment, 45.4% of respondents held an undergraduate

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degree, while 25.9% had completed postgraduate education. The age distribution spanned various age groups, with the 25–30 age group being the most represented (Table 1).

Table 1. Demographic and professional characteristics of respondents (217 respondents).

VARIABLES	N	%
Nationality		
Italian	192	89.8%
European	9	4.2%
African	5	2.3%
Asian	5	2.3%
Central/South American	3	1.4%
Gender		
Male	116	53.5%
Female	101	46.5%
Marital Status		
Single	111	51.4%
Living together	47	21.8%
Married	43	19.9%
Divorced/Separated	14	6.4%
Widowed	1	0.5%
Employment Status		
Healthcare professionals	33	15.3%
Students	26	12.0%
Currently unemployed	13	6.0%
Maritime and airport workers	20	9.3%
Teachers	7	3.2%
Law enforcement/Armed forces	5	2.3%
Other	112	51.9%
Education Level		
Postgraduate	56	25.9%
Graduate	98	45.4%
Upper Secondary Education	50	23.1%
Lower secondary education	9	4.2%
Primary education	3	1.4%
Age Group		
<25	19	8.7%
25-30	57	26.3%
30-35	44	20.3%
36-45	38	17.5%
46-50	13	6.0%
>50	46	21.2%

The primary reason for travel was tourism (61.6%), followed by work-related travel (23.1%). Most participants traveled with organized groups or friends (40.2%) or with family (39.2%). Popular destinations included Africa (45.2%), Central/South America (27.1%), and Asia (22.9%). Most respondents stayed abroad for one to four weeks, with hotels or resorts being the preferred accommodation choice (48.8%). Additionally, 32.4% of participants had visited high-risk infectious disease areas in the previous five years, and 38.3% reported traveling abroad more than twice yearly (Table 2).

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Table 2. Travel information (217 respondents).

VARIABLES	N	%
Reason for Travel		
Tourism	133	61.6%
Work	50	23.1%
Visit friends/family	9	4.2%
Other	12	5.6%
Religion	7	3.2%
Return to home country	1	0.5%
Study vacation	4	1.8%
Accompaniment		
Organized group/Friends	86	40.2%
Family	84	39.2%
None/Other	44	20.6%
Destination		
Africa	85	45.2%
Central/South America	51	27.1%
Asia	43	22.9%
Italy	4	2.1%
Other European countries	2	1.1%
No travel planned	3	1.6%
Length of stay		
Less than 1 week	17	8.4%
1 week	9	4.4%
1-2 weeks	85	41.9%
2-4 weeks	67	33.0%
More than 4 weeks	12	5.9%
More than 6 months	10	4.9%
More than 1 year	3	1.5%
Accommodation type		
Hotel/Resort	106	48.8%
Private house	40	18.4%
Not specified	36	16.6%
Camping	15	6.9%
Hostel	11	5.2%
More than one type	7	3.2%
Other	2	0.9%
Travel to high risk infectious countries in the past 5 years		
No	146	67.6%
Yes	70	32.4%
Frequency of travels abroad		
More than twice a year	82	38.3%
Once or twice a year	74	34.6%
Less than once a year	47	22.0%
Never	11	5.1%

As shown in Table 3, nearly half of the participants (49.3%) received vaccinations primarily to protect themselves against infections. In comparison, 18.9% were vaccinated based on their general trust in vaccine safety and efficacy before traveling to high-risk regions. The most frequently administered vaccines were for yellow fever (47%), Hepatitis A (16%), and Typhoid fever (16%). The primary reasons for receiving vaccinations at the USMAF Clinic were difficulties booking vaccinations through the Local Health Authority (LHA) (63.9%) and last-minute travel plans (21.2%).

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Table 3. Information about vaccinations and knowledge of infectious diseases in the destination country (217 respondents).

VARIABLES	N	%
Reason for Vaccination		
Other	1	0.4%
Otherwise, I will lose my travel document	4	1.8%
To protect those around me	7	3.1%
It is mandatory in the destination country	8	3.5%
Advice of a doctor	13	5.7%
Work obligation	16	7.0%
I am afraid of contracting infectious diseases	23	10.1%
I believe in the usefulness of vaccination before traveling to a high-risk country	43	18.9%
To protect myself from infections	112	49.3%
Type of Vaccine		
Polio	6	1.8%
Hepatitis B	9	2.7%
Meningococcus	9	2.7%
Diphtheria	11	3.4%
Tetanus	34	10.2%
Hepatitis A	52	15.6%
Typhoid fever	55	16.5%
Yellow fever	157	47.1%
Main Reason for Getting Vaccinated at USMAF-SASN Clinic		
I did not go to the clinic for vaccinations	15	7.2%
I was unaware of the vaccinations required for this destination	16	7.7%
I booked the trip unexpectedly due to work	22	10.6%
I booked the trip last minute	22	10.6%
I was unable to book with my LHA	133	63.9%
Most Common Infectious Diseases in the destination country		
West Nile	11	1.4%
Mumps	13	1.8%
Zika	16	2.1%
Polio	22	2.8%
Rabies	27	3.5%
Meningococcus	28	3.6%
Dengue	33	4.3%
Hepatitis B	61	7.9%
Malaria	86	11.1%
Diarrhea	90	11.7%
Typhus	110	14.2%
Hepatitis A	123	15.9%
Yellow fever	152	19.7%

As shown in Table 4, a significant proportion of respondents (77.1%) evaluated highly the effectiveness of preventive measures. However, when assessing the risk of contracting illnesses at their travel destinations, 23.2% perceived the risk as low. Information about infectious diseases prevention, geographic distribution and prevalence was primarily obtained from non-institutional sources (63.0% and 80.2%, respectively).

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Table 4. Risk perception and sources of information.

VARIABLES	N	%
Perceived usefulness of preventive measures (0-10)		
Low risk (0-3)	3	1.4%
Medium risk (4-7)	44	21.5%
High risk (8-10)	162	77.1%
Perception of risk of contracting infectious diseases at destination (0-10)		
Low risk (0-3)	48	23.2 %
Medium risk (4-7)	128	61.8%
High risk (8-10)	31	15.0%
Source of information: measures to prevent disease risk		
Institutional health sources	131	63.0%
Non institutional health sources	77	37.0%
Source of information: most common infectious diseases at destination		
Non institutional health sources	105	80.2%
Institutional health sources	26	19.8%

The multivariable analysis (Table 5) showed that males were significantly more likely to underestimate the pre-travel risk than females (OR 3.68, 95% CI 1.38–9.84, p=0.009). Teachers demonstrated an even stronger inclination to perceive low risk, with an OR of 9.85 (95% CI 1.33–72.80, p=0.025), indicating they were nearly ten times more likely to see a lower risk of contracting infectious diseases. In contrast, healthcare professionals were less likely to view low risk (OR 0.12, 95% CI 0.01–0.99, p=0.049). Accommodation type also played a significant role, as travelers staying in hotels or resorts were approximately six times more likely to perceive low risk than those choosing other accommodation types (p=0.001). Furthermore, access to preventive health information from reliable sources was associated with a significantly lower likelihood of perceiving low risk (OR 0.19, 0.07–0.53, p=0.001). Conversely, travel frequency, awareness of preventive measures, and age did not significantly influence risk perception.

Table 5. Results of the multivariable logistic regression to identify predictors of low-risk perception.

VARIABLES	OR	95% CI	p-Value
Male	3.68	1.38 – 9.84	0.009
Age (continous)	1.00	0.96 – 1.04	0.941
Employment status			
Other	1.00	--	--
Unemployed	1.19	0.19 – 7.65	0.852
Teacher	9.85	1.33 – 72.80	0.025
Law enforcement/Armed forces	4.73	0.54 – 42.42	0.165
Airport worker	1.88	0.35 – 10.15	0.465
Seafarer	0.50	0.04 – 5.71	0.574
Healthcare professional	0.12	0.01 – 0.99	0.049
Student	0.64	0.13 – 3.10	0.579
Information on preventive measures: institutional sources	0.19	0.07 – 0.53	0.001
Travel frequency: less than once a year	0.65	0.20 – 2.10	0.474
Accomodation: Hotel/Resort	5.96	2.31 – 15.35	<0.001
Preventive measures awareness	0.98	0.32 – 2.96	0.966

4. Discussion

This study, conducted at Rome-Fiumicino Leonardo da Vinci International Airport, provides post-pandemic evidence on infectious disease risk perception and preventive behaviors among international travelers in a real-world airport health service centre. Many travelers reported relying

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on airport health hubs rather than LHUs because of perceived worse quality and more timely access to care. This trend underscores the need to improve appointment modality and enhanced service availability at local health centers [16,17]. Strengthening partnerships between LHUs and travel-related health services is crucial to reducing reliance on last-minute vaccinations and ensuring broader access to essential health services. Almost a quarter of respondents underestimate the risk of contracting diseases at their travel destinations. Our logistic regression analysis identified key predictors of risk perception among travelers. Gender played a significant role, with males perceiving lower health risks than females, consistent with broader research on risk behaviors [18]. Furthermore, previous studies on the influence of gender on tourists' risk perceptions reveal that gender moderates the effect of risk perception on destination and behavioral intentions [19]. In particular, it turned out that women practice better hygiene, such as frequent handwashing, which reduces foodborne illness transmission [20,21]. These findings align with disparities observed during the COVID-19 pandemic, where men displayed lower risk perceptions and were less responsive to health warnings [22,23]. This reinforces the need for gender-sensitive risk communication strategies in travel medicine. Accommodation type also affects risk perception, as travelers staying in hotels or resorts tend to feel a lower risk due to the hygiene standards and safety protocols in place. However, this perception may lead to complacency regarding preventive behaviors. Research on business travelers shows that staying in high-standard accommodations does not always mean better risk preparedness [24]. Additionally, the presence of visible health and hygiene protocols in hotels may contribute to a perceived sense of safety, potentially influencing travelers' risk appraisal [25]. Professional background significantly shaped risk perception. Healthcare professionals demonstrated greater awareness, likely due to their medical knowledge, even if – unexpectedly - teachers exhibited a lower concern for travel-related health risks. Although based on a small subgroup, the finding regarding teachers suggests a potential gap in infectious disease risk awareness within a professional group that plays a key role in health education [26]. The impact of travel frequency on risk perception and experience was less pronounced than anticipated. Frequent travelers (those who travel more than twice a year) did not demonstrate greater risk awareness than infrequent travelers. In this regard, a study of Greek business travelers found that frequent travel did not improve pre-travel health preparation, suggesting that experience alone may not enhance preventive behaviors [24]. The source of health information was a crucial factor in risk communication and perception. Access to credible health sources notably decreased the likelihood of perceiving low risk, underscoring the significance of trustworthy health information. Many travelers relied on non-healthcare sources, such as travel agencies, which may not consistently provide accurate guidance. To date, an Italian study found that travelers who received direct advice from healthcare professionals were better prepared [15]. These findings align with vaccine hesitancy research, which shows that reliance on alternative sources is associated with lower adherence to preventive behaviors [27]. This underscores the importance of strengthening institutional communication channels within pre-travel health services, at least in the airport health centre.

5. Conclusions

This study explores key determinants of infectious disease risk perception among international travelers, including gender, type of accommodation, professional background, and access to reliable health information. Public health strategies should strengthen health literacy and promote evidence-based risk communication, with particular attention to groups showing lower risk awareness, such as male travelers and specific professional categories. Enhancing access to pre-travel consultations and improving the integration between LHU and airport-based services may help reduce structural barriers to vaccination and preventive care, ultimately improving traveler preparedness and mitigating travel-related health risks. In this context, airport-based travel medicine services may represent a strategic yet underutilized point of contact for intercepting travelers with low-risk perception and limited access to traditional healthcare pathways, in way to ameliorate awareness, perceived benefits, and structural factors shaping vaccine uptake.

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Future research should evaluate targeted health literacy interventions and communication strategies across diverse traveler populations and settings to further enhance vaccination adherence and global travel health security. While this study provides valuable insights, it has limitations. A selection bias consists of the fact that participants were recruited from a clinic setting, likely reflecting individuals with higher health awareness. In addition, some occupational categories included a limited number of observations; therefore, estimates should be interpreted with caution. Self-reported data may also introduce bias, potentially underreporting health risk perceptions or overreporting preventive behaviors.

Furthermore, the study's focus on primarily Italian travelers may limit the applicability of findings to more diverse populations using the airport. Additionally, conducting research at a single major airport may restrict generalizability to other travel environments. Future studies should include broader samples across multiple settings to enhance the understanding of health risk perceptions among international travelers.

Author Contributions: De Vito C, Villari P and Odone A contributed to the conception and design of the study. Bellomo RK, Donato MA, Cerabona V, Federico G, Esposito T, Guarino C, Perna A, Sparano M, Sezzatini R, Strangi EA and Tassone E performed data collection and contributed to data curation. Federico G conducted the analyses. Bellomo RK, Donato MA, Cerabona V, Federico G, Sparano M and Strangi EA wrote the first draft of the manuscript. De Vito C, Villari P, Odone A, Perna A and Esposito T critically revised the manuscript and contributed to supervision. All authors contributed to manuscript revision and read and approved the submitted version.

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Informed Consent Statement: Informed consent was obtained electronically from all subjects involved in the study before participation in the survey.

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author via email. The data are not publicly available due to privacy and ethical restrictions.

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