Research Article

Factors Influencing Willingness to Comply with Public Health Measures for COVID-19 among Incoming air Travelers into Nigeria from high-risk Countries: A Cross-Sectional Analysis

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Abstract

Background: Complying with guidelines established to control COVID-19 pandemic is critical to the successful outcome of the response. We assessed the willingness of non-symptomatic incoming international air travelers into Nigeria to comply with COVID-19 public health measures upon arrival and identified the factors influencing them- March 2020.

Materials and Methods: We conducted a cross-sectional study among 500 incoming international air travelers involving 17 nationals across four major international airports in Nigeria using a pre-tested self-administered electronic questionnaire. We estimated the proportions and determined predictors of participants' willingness to comply with the COVID-19 preventive measures. Predictors were examined using multiple logistic regression at 5% level of significance.

Results: Majority (83%) were extremely/very willing to comply with public health guidelines. Perception of severity was a significant predictor of their willingness to stay at home for 14 days upon arrival (AOR: 6.82, 95 CI%: 1.19-24.45). Self -efficacy towards observing self for COVID-19 symptoms was a significant predictor of willingness to stay at home for 14 days (AOR: 9.37, 95% CI: 3.38-25.97), willingness to observe self for symptoms (AOR: 5.16, 95% CI 1.77-14.93), and willingness to call of national COVID-19 numbers if symptoms develop (AOR: 4.47, 95% CI: 1.19-16.81). Good pre-arrival COVID-19 preventive practices was a significant predictor of willingness to avoid contact with others within the first 14 days on arrival.

Conclusion: There is a need to improve risk communication interventions against COVID-19 for international air travelers particularly enhancing self-efficacy to improve their compliance towards public health measures

Keywords: International Air travel, COVID-19 Prevention, Risk communication, High-risk countries, Risk Perception

Introduction

International travel is a known driver of COVID-19 pandemic across the globe [1-3]. Though it was first reported in Wuhan China, it was no surprise that the outbreak rapidly spread to other cities and countries around the world as Wuhan Airport had non-stop passenger flights scheduled to 113 destinations

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in 22 countries across the world as well as 78 domestic flights in addition to other high air traffic airports in nearby cities [2, 4-6]. Although the World Health Organization (WHO) declared the novel corona virus a Public Health Emergency of International Concern (PHEIC) in January 2020, no trade or travel restrictions were recommended [7-9]. However, WHO recommended that countries put in place strong measures to detect the disease early, isolate and treat cases, trace contacts and promote social distancing measures commensurate with the risk [7, 9]. To limit the international spread of COVID-19, several countries set up point of entry surveillance mechanisms to limit the spread of COVID-19 in line with WHO's recommendations, most of which required the cooperation of the international traveler to comply with the public health measure as major outbreaks have been known to occur as a result of the late identification by the surveillance system [3]. Therefore, the willingness of international travellers to comply with public health measures against the international spread of COVID-19 is of great global public health importance as international travellers could be potential carriers of the infection resulting in a propagation of the ongoing pandemic [9]. As with other behaviours, in-coming air passengers' willingness to comply to these public health measures can be influenced by several factors such as their knowledge of the disease, attitude as well as perceptions [10-12].

Previous research has shown that willingness of the general public to comply with public health prevention measures is essential for success in disease response and containment [13]. Estimation of population compliance with such measures is valuable in assessing the effectiveness of pandemic control decisions and policies in terms of disease containment and cost [13]. A systematic review of physical interventions to reduce the spread of respiratory illnesses showed a clear significant benefit of using low-cost interventions such as hand washing and wearing face masks [14]. Willingness to adopt protective behaviors, have been found to be influenced by several factors including risk perception [15], anxiety [15], concern for family/children/self, [16] greater knowledge concerning transmission [17], perceived effectiveness of the protective measures [16], perceived susceptibility [18], as well as socio-demographic characteristics [15, 16]. As part of the Nigeria's coordinated efforts to contain the spread of the pandemic, the Federal Ministry of Health, through its Port Health Services Division, which is responsible for Border Health security at Points of Entry (Airports, Seaports and Ground crossings), put up measures to prevent importation and spread of the disease into the country [7]. This was because of Nigeria's high turn-over of international travel [19, 20]. In addition to Port Health officers who are primarily stationed at these Points of Entry (POE), surge capacity health personnel were trained and deployed to POEs for international air travelers at the four major international airports in the country [21].

They were tasked with the responsibility of screening all air travelers coming into the country via these points of entry. From the beginning of the pandemic, all travelers into Nigeria especially from countries with confirmed on-going community transmission of SARS-CoV-2, at POEs (international airports), were screened to detect suspected cases of SARS-CoV-2 [7]. Health declaration forms were used to screen the arriving passengers and information obtained included travel history, history of recent illness (within the past 14 days) including fever, cough, flu-like symptoms, difficulty in breathing, history of contact with a confirmed case of COVID-19, history of visit to a health facility where a confirmed positive case was managed, and non-contact temperature monitoring devices like infrared thermometers and thermal scanners were used to detect fever. Initially, the high-risk countries (from countries with confirmed on-going community transmission of SARS-CoV-2) were China, Iran, Republic of Korea, Italy, and Japan. However, as the infection spread to more regions of the world, more countries were added to the list including France, Germany, Spain, Switzerland, USA, UK, Belgium, Norway and Netherlands. Currently, all travelers into Nigeria irrespective of country of travel origin, are screened on arrival.

All suspected cases of SARS-CoV-2 infections [22] were further evaluated and tested to confirm their status. All in-coming air travelers from countries with confirmed on-going community transmission of SARS-CoV-2 were categorized as persons of interest (POI) by the NCDC. The NCDC recommended that asymptomatic POIs, self-isolate themselves by staying at home and limiting their contact with other people for 14 days, monitor themselves for symptoms of SARS-CoV-2 and report immediately if they observe symptoms by calling specific numbers designated for SARS-CoV-2 surveillance within the first 14 days of their arrival [7]. This was in addition to them practicing basic precautionary measures such as frequent hand washing with soap under running water, covering mouth and nose with handkerchief or tissue paper when sneezing and or coughing (or into the elbow if a handkerchief is not available, avoiding close contact with anyone showing symptoms of respiratory illness (such as coughing and sneezing) as well as avoiding self-medication [7, 8, 23, 24].

Because an understanding of the characteristics of international passengers travelling in the middle of an outbreak can aid in identification of some special risks and strategies required to tackle issues of spread across countries, we assessed the willingness of non-symptomatic incoming international air travelers to comply with preventive public health strategies against SARS-CoV-2 infection in Nigeria and determined factors influencing their willingness to comply.

Materials and Methods

Study Setting

The study was conducted at four major international airports in Nigeria: Nnamdi Azikiwe International Airport (NAIA), Abuja; Mallam Aminu Kano International Airport (MAKIA), Kano State; Murtala Muhammed International Airport (MMIA), Lagos State and Port Harcourt International Airport (PHIA), Rivers State from Epi-week 11 to 14. These airports were studied because they were designated to be the only points of international air entry into the country as part of the country's heightened surveillance against SARS-CoV2 before the country closed all international airports to non-emergency and non-essential international air travel in Epi-week 14. MMIA and PHIA are located in Southern Nigeria, MAKIA in Northern Nigeria, while NAIA is located in the nation's capital, in the heart of the country. (Figure 1). All four airports received flights from China in addition to other countries around the world. The Port Health Services (PHS) Officers supported by residents and graduates of the Nigeria Field Epidemiology and Laboratory Training Program (NFELTP), staff of the NCDC and surge staff from state governments, screened all in-coming international air passengers especially those from countries with on-going community transmission of SARS-CoV-2 for symptoms of COVID-19 and history of contact. Non-symptomatic travellers from high-risk countries were categorized as persons of interest (POI). These POIs were advised to self-isolate for 14 days in addition to practising COVID-19 preventive measures.[7] Symptomatic POIs were further evaluated to assess if they met the suspected case definition of SARS-CoV-2 and if they did, were tested to confirm their status. Persons of interest who did not meet the suspect case definition of COVID-19 were advised to self-isolate for 14 days as well as adhere to other recommendations by the NCDC [7, 8, 23, 24]. These POIs were monitored through calls by the NCDC for COVID-19 symptoms.

Study design, study population, and sampling technique

This was a cross-sectional study in which participants were recruited prospectively. We included all adult passengers aged 18 years and above who had been categorised as POIs in the ongoing COVID-19 airport surveillance (all in-coming air travellers from countries with confirmed ongoing community transmission of SARS-CoV-2, all in-coming air travellers who have symptoms suggestive of SARS-CoV-2 and all in-coming air travellers who are febrile upon arrival) arriving by air through one of the designated airports. All symptomatic POIs were excluded from the study. The sample size was estimated using the using the Kish's formula [25].

$$n = \frac{Z_\alpha^2 pq}{d^2}$$

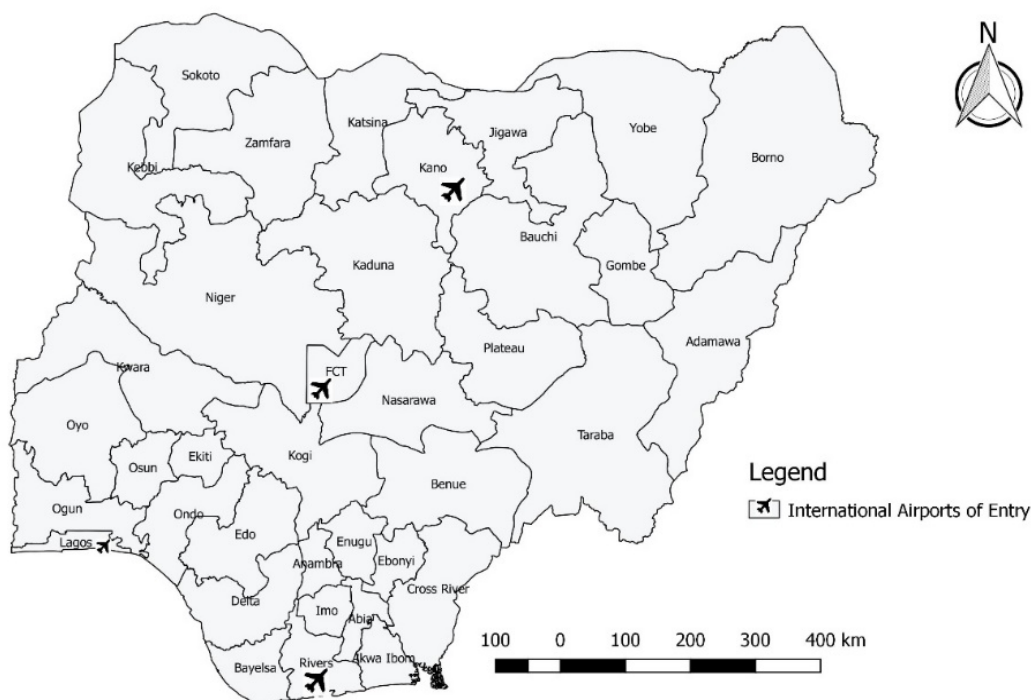Where n = minimum sample size, Zα = The standard normal deviate set at 1.96 which corresponds to 95% confidence

Figure 1: Locations of the designated international Airports of entry in Nigeria (This image was created using a free QGIS 2.18.5 software)

interval, p = The prevalence of willingness to adhere to public health preventive measure in incoming travellers from literature is 48%,[13] q= 1 – p, d= Precision which at 95% Confidence interval is 5 %, with n approximately 384 respondents. After adjusting for a non-response rate of 35%, [13] sample size was adjusted to 591. This was proportionately allocated to the four airports based on the relative volume of international passengers per airport.[19] Each airport was allocated as follows: PHIA international wing: 17, MAIKA international wing: 23, NAIA international wing: 130, MMIA international wing: 421 respondents.

Study tool

A pre-tested semi-structured, self-administered electronic questionnaire created by the authors based on available literature on COVID-19 was used to collect information from the study participants. This questionnaire was created using the google form platform and hyperlinks shared to respondents through short message services (SMS), WhatsApp, or emails based on the preference of the POIs. Asymptomatic POIs were consecutively recruited, and hyperlinks sent until required number of responses was attained. The questionnaire consisted of sections on socio-demographic characteristics, recent travel itinerary, previous history of contact, knowledge of novel coronavirus symptoms and preventive practises, previous practise of COVID-19 preventive health measures, risk perception towards COVID-19 (perceived severity of COVID-19, perceived susceptibility to COVID-19,and perceived self-efficacy towards these preventive measures), self-rated health status and their willingness to practise certain public health preventive health measures within 14 days of arrival (self-observation for COVID-19 symptoms, early reporting of COVID-19 symptoms if observed by calling the NCDC national emergency numbers on COVID-19, staying at home, avoidance of contact with others, covering of nose and mouth if symptomatic) as well as perceived concerns regarding the preventive measures.

The questionnaire was translated into simple Chinese using a professional translator as Chinese nationals constituted the majority of foreign nationals into Nigeria from high-risk countries. The Chinese version of the questionnaire was subsequently back translated to English by a postgraduate Chinese student to confirm its authenticity. The questionnaire was pretested among 33 incoming international air travellers into Nnamdi Azikiwe International Airport (NAIA), Abuja before commencement of the study. The reliability of the tool was determined using Cronbach's alpha. A Cronbach's alpha of 0.75 was obtained for the willingness assessment scale while a Cronbach alpha of 0.72 was obtained for previous COVID-19 preventive practise scale. Those who participated in the pre-test did not participate in the main study.

Data quality Assurance

Skip logics and compulsory questions were employed to limit incomplete entries. In addition, a test question to screen out symptomatic incoming travellers was added to ensure data quality.

Data management and Analysis

Data was extracted from the google drive database into Microsoft Excel 2016 where it was cleaned including the removal of duplicate entries. Data analysis was performed using Microsoft Excel 2016 and Epi Info version 7.2

Willingness to comply with the recommended public health measures based on the prevailing recommendation by NCDC and WHO was assessed using a five-point Likert scale response which included 'not at all willing,' 'a little willing,' 'moderately willing,' 'very willing,' and 'extremely willing'. In addition to 'don't know' and 'refused' responses. The willingness to practise SARS-CoV-2 public health preventive measures recommended for asymptomatic POIs were assessed across five domains: Willingness to observe for symptoms of COVID-19 infection for 14 days after arrival; willingness to stay at home for 14 days after arrival, willingness to avoid contact with other people for 14 days after arrival, willingness to always properly cover nose and mouth if symptoms of SARS-CoV-2 develop within 14 days of arrival and their willingness to call approved national emergency numbers for COVID-19 if symptoms develop (NCDC's national COVID-19 hot-line).

A respondent was categorised as willing to practise any of COVID-19 public health measures if he/she was very willing or extremely willing to practise any of COVID-19 public health measures within 14 days of arrival. Knowledge of COVID-19 was assessed using 6 questions with a minimum score of 0 and a maximum score of 6. Those who scored 5 and above, out of 6, were categorised as knowledgeable of SARS-CoV-2 infection and preventive practices. Their pre-arrival practise of recommended preventive measures against SARS-CoV-2 was assessed using 3 questions (frequent hand washing with soap and water/ use of hand sanitizers, avoiding persons with symptoms suggestive of acute respiratory tract infections and avoiding of face touching) on a 5-level Likert scale ranging from 'never' to 'always'. The scores were assigned as follows: 'Never' =1, 'Rarely' = 2, 'Sometimes' = 3, 'frequently' = 4 and 'always' = 5 for the past 2 weeks. Self-rated health status was assessed using a ten-point scale from poor to excellent.[26] Those who indicated 7 to 10 as their perceived health status were categorised as having a good self-rated health status [26].

Univariate, bivariate (chi-square) and multivariable analysis of data was carried out. Odds ratios (ORs), confidence intervals and *P*-values were computed. Willingness to adhere

to the individual public health measures within 14 days of arrival were the dependent variables while sociodemographic characteristics, knowledge of novel coronavirus symptoms and preventive practises, previous practise of COVID-19 preventive health measures, self-rated health status, perceived self-efficacy, perceived severity, perceived susceptibility and concern for self/family were the independent variables. For multivariable analysis, variables with a *P*-value of less than 0.2 in the bivariate analysis were entered into the multivariable logistic regression model using the backward approach. The level of significance was put at 5% for the adjusted OR.

Ethical consideration

Ethical approval was obtained from the National Health Research Ethics Committee, Abuja with approval number: NHREC/01/01/2007-10-/3/2020. Written informed consent was obtained from all respondents and confidentiality was maintained at all times. To ensure data security, access to the database was limited to only those involved in data analysis. At the end of the questionnaire, respondents were given links to NCDC, WHO and CDC websites on COVID-19 preventive measures and what to do if symptoms developed. Government approved national emergency numbers to call on development of symptoms suggestive of the novel coronavirus was also attached at the end of the questionnaire.

Results

Following data cleaning and removal of respondents who answered affirmative to having symptoms suggestive of COVID-19 based on the check question, only 500 respondents out of 591 respondents who participated in this study were analyzed. The mean age ± standard deviation of the participants was 39.9 ±13.4 years with the highest proportion of the respondents – 137 (27.4%) being in the 35-44-year age group. Two hundred and eighty (56.0%) were males and 463 (92.6%) had tertiary education. Nationals belonging to 17 countries participated in this study with most being Nigerian nationals – 415 (83.0%) – followed by the Chinese – 45 (9.0%). A majority of the study participants – 427 (85.4%) – were resident in Nigeria (See table 1).

A total of 481 (96.2%) incoming air travelers had an overall good knowledge of the novel coronavirus. However, concerning the mode of transmission of COVID-19, 43 (8.6%) of the air travelers thought that it was not spread by sneeze/cough droplets while 25 (5.0%) did not know the role of sneeze/cough in its spread. Concerning COVID-19 preventive practices in the last 4 weeks prior to arrival, 188 (37.6%) had a good overall prior preventive practice (frequent handwashing/use of alcohol-based sanitizers, social distancing, avoidance of face touching and avoidance of crowded areas). Of all the in-coming travelers, 258 (51.6%) admitted to sometimes/frequently/always of touching their face especially eyes, nose and mouth (See supplementary table S1).

Within 14 days prior to arrival into Nigeria, only 1 (0.2%) traveler admitted having been in contact with a confirmed case and only 3 (0.6%) admitted to have been to a health care facility where COVID-19 outbreak had been reported.

A majority of the travelers [497 (99.4%)], self-rated their health status as good. Concerning their risk perception towards COVID-19, 474 (94.8 %) thought that it was a very severe/severe disease. Majority of the travelers [426 (85.2%)], were extremely concerned/very concerned/concerned about themselves/family members contracting the disease. However, 337 (67.4%) thought that they had a small chance/ no chance at all of contracting the disease (See supplementary table S2).

Most of the POIs [415, (83.0%)], were willing to comply with all 5 recommendations to prevent COVID-19. Of all the recommendations, the POIs were most willing to practice covering of nose and mouth if symptoms of cough/sneeze develop within 14 days of arrival [492 (98.4%)] while avoiding contact with others was the practice that they were least willing to practice [278 (55.6%)]. See Table 2. As regards the concerns of the international air-travelers to practice the NCDC's recommendations for recent incoming air travelers for COVID-19, majority had no concerns as regards adhering to them (See Figure 2). However, calling the national emergency numbers to notify the NCDC of development of symptoms suggestive of the novel coronavirus was the recommended behavior with the most concerns [134 (26.8%)] while having to always properly cover their nose and mouth if they develop symptoms of coughing and sneezing [90 (18.0%)] had the least concerns (Figure 2).

Among travelers concerned about staying at home for 14 days after arrival, the need for food and drink [71 (53.4%)] was their major concern about staying at home. Fear of what might be found was the major concern regarding self-observance for symptoms suggestive of COVID-19 [62 (46.3%)]. See supplementary table S3. The possibility of separation from loved ones was the most concern as regards calling the national emergency numbers to notify them of development of symptoms suggestive of COVID-19 [62 (46.3%)]. While stigmatization/discrimination from others was the most concern as regards avoiding contact with others for 14 days following arrival [47 (42.3%)]. In addition, forgetting to do so always was the most concern as regards always properly covering nose and mouth if symptoms suggestive of COVID-19 develop within 14 days of arrival [61 (67.7%)]. See supplementary table S3.

POIs who perceived COVID-19 as very severe/severe were more likely to be extremely/very willing to stay at home compared with those who perceived it as less severe and this

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Table 1: Characteristics of International In-coming Air travelers into Nigeria from countries with on-going Community Transmission of COVID-19, March 2020.

Variable	Frequency (Percentage) n=500
Age group (years)	
18-24	76 (15.2)
25-34	103 (20.0)
35-44	137 (27.4)
45-54	110 (22.0)
55-64	53 (10.6)
≥65	21 (4.2)
Sex	
Male	280 (56.0)
Female	217 (43.4)
Prefer not to say	3 (0.6)
Marital Status	
Married	305 (61.0)
Never married	166 (33.2)
Divorced	16 (3.2)
Separated	12 (2.4)
Widowed	1 (0.2)
Nationality	
Nigerian	415 (83.0)
Chinese	45 (9.0)
Others	9 (1.8)
Italian	7 (1.4)
British	6 (1.2)
American	5 (1.0)
German	4 (0.8)
Indian	4 (0.8)
South African	3 (0.6)
French	2 (0.4)
Education	
Tertiary	463 (92.6)
Secondary	35 (7.0)
Primary	2 (0.4)
Employment Status	
Employed	340 (68.0)
Not Employed	160 (32.0)
Purpose of Stay in originating country	
That is where I live/reside	154 (30.8)
Business	140 (28.0)
Social visit	118 (23.6)
Conference	44 (8.8)

Nigeria as Place of Residence	
Yes	427 (85.4)
No, came for a visit	73 (14.6)
Reason for visit to Nigeria if not place of residence	
(n=73)	
Business	24 (32.9)
Pleasure	23 (31.5)
Both	20 (27.4)
No response	6 (8.2)
Airport of Entry	
Murtala Muhammed International Airport, Lagos state	378 (75.6)
Nnamdi Azikiwe International Airport, Abuja	89 (17.8)
Mallam Aminu Kano International Airport, Kano state	19 (3.8)
Port Harcourt International Airport, Rivers state	14 (2.8)
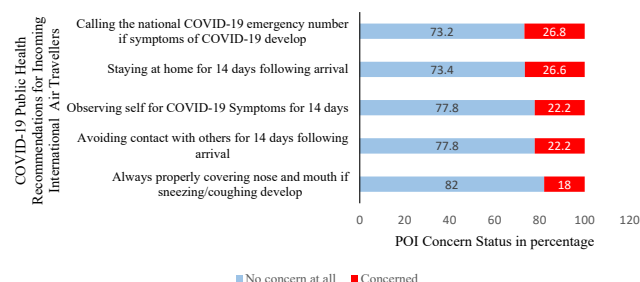
Figure 2: Concerns of International In-coming Air travellers into Nigeria regarding NCDC's COVID-19 Public Health Preventive measures recommendation, March 2020

was statistically significant (AOR: 6.82, 95% CI: 1.90-24.45, see table 3). Those who came through MMIA and NAIA were more likely to be extremely/very willing stay at home for 14 days compared to those who came through MAKIA and PHIA (AOR: 5.35, 95% CI: 1.82 -15.73, see table 3). POIs who were extremely/highly confident in their ability to observe themselves for symptoms suggestive of COVID-19 were more likely to be to be extremely/very willing to stay at home compared to those who were not (AOR: 9.37, 95% CI: 3.38-25.97, See table 3). POIs who were planning to stay beyond 2 weeks in Nigeria were extremely/highly willing to observe themselves for symptoms compared to those who were not (AOR: 5.85, 95% CI: 1.05-32.63, See table 3). Those who were confident in their ability to observe themselves for symptoms suggestive of COVID-19 were more likely to be to be extremely/very willing to observe self for symptoms compared to those who were not (AOR: 5.16, 95% CI 1.77-14.93, See table 3).

Concerning, willingness to avoid contact with others for

14 days following arrival into Nigeria, those with good prior preventive practice against COVID-19 were more likely to be extremely/very willing to avoid contact with others compared to those with poor prior preventive practice against COVID-19 (AOR: 3.40, 95% CI: 1.45-7.93, See table 4).

Those who were confident in their ability to observe themselves for symptoms suggestive of COVID-19 were more likely to be to be extremely/very willing to avoid contact with others compared to those who were not (AOR: 4.69, 95% CI: 1.97-11.15, See table 4). Concerning their willingness to call the national approved numbers for COVID-19 if symptoms develop within 14 days of arrival, those who were confident in their ability to observe themselves for symptoms suggestive of COVID-19 were more likely to be to be extremely/very willing to call the national approved numbers compared to those who were not (AOR: 4.47, 95% CI: 1.19-16.81, See table 5).

Table 2: Willingness of International In-coming Air-travelers into Nigeria to comply with COVID-19 Preventive Measures, March 2020

Variable	Frequency (Percentage)
	n=500
Willingness to observe self for symptoms of COVID-19 for 14 days following arrival into Nigeria	
Extremely Willing	338 (67.6)
Very Willing	136 (27.2)
Moderately Willing	14 (2.8)
A little Willing	8 (1.6)
Not Willing at all	4 (0.8)
Willingness to avoid contact with others for 14 days following arrival into Nigeria	
Extremely Willing	278 (55.6)
Very Willing	174 (34.8)
Moderately Willing	37 (7.4)
A little Willing	6 (1.2)
Not Willing at all	5 (1.0)
Willingness to stay at home for 14 days following arrival into Nigeria	
Extremely Willing	330 (66.0)
Very Willing	140 (28.0)
Moderately Willing	23 (4.6)
A little Willing	6 (1.2)
Not Willing at all	1 (0.2)
Willingness to always properly cover nose and mouth if symptoms of coughing/sneezing develop within 14 days of arrival	
Extremely Willing	375 (75.0)
Very Willing	117 (23.4)
Moderately Willing	5 (1.0)
A little Willing	3 (0.6)
Not Willing at all	0 (0.0)
Willingness to call national emergency numbers if symptoms of COVID-19 develop within 14 days of arrival	
Extremely Willing	353 (70.6)
Very Willing	132 (26.4)
Moderately Willing	13 (2.6)
A little Willing	2 (0.4)
Not Willing at all	0 (0.0)

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Table 3: Predictors of willingness to comply with COVID-19 Preventive Measures by international air-travelers, Nigeria, March 2020

Independent Variable	Extremely/ Very willing to Stay at home for 14 days						Extremely/ Very willing to observe self for COVID-19 symptoms					
	Unadjusted Odds			Adjusted Odds			Unadjusted Odds			Adjusted Odds		
	COR (95%CI)		P-value	AOR (95%CI)			COR (95% CI)		P-value	AOR (95% CI)		
Age group (years)												
< 40	1			-	-	-	1			-	-	-
≥40	1.54 (0.73- 3.23)		0.259				1.39 (0.63 -3.13)		0.420	-	-	-
Gender												
Female	1	-	-	-	-	-	1	-	-	-	-	-
Male	0.85 (0.40 - 1.81)		0.677	-	-	-	0.80 (0.35 - 1.79)		0.583	-	-	-
Nationality												
Nigerian	1	-	-	-	-	-	1	-	-	-	-	-
Non- Nigerian	1.35 (0.46 - 3.98)		0.581	-	-	-	1.13 (0.38 - 3.38)		0.822	-	-	-
Educational Status												
Secondary and below	1	-	-	-	-	-	1	-	-	-	-	-
Tertiary	0.89 (0.20 - 3.88)		0.874	-	-	-	1.05 (0.24 - 4.61)		0.953	-	-	-
Marital Status												
Not Married	1	-	-	-	-	-	1	-	-	1	-	-
Married	1.21 (0.57 - 2.55)		0.616				2.23 (1.00 - 4.96)		0.045	2.1 (0.85 - 5.32)		
Employed												
No	1	-	-	1	-	-	1	-	-	1	-	
Yes	1.68 (0.80 - 3.55)		0.170	0.83 (0.35 - 1.94)			2.62 (1.18 - 5.81)		0.014	1.70 (0.70 - 4.12)		
Airport of Entry												
MAKIA/PHIA	1	-	-	1	-	-	1	-	-	-	-	
MMIA/NAIA	5.20 (2.04 - 13.23)		<0.001	**5.35 (1.82 - 15.73)**			1.19 (0.27 - 5.27)		0.818	-	-	
Nigeria as place of Residence												
No, came for a visit	1	-	-	-	-	-	1	-	-	1	-	
Yes	1.5 (0.59 - 3.82)		0.388	-	-	-	2.28 (0.92 - 5.63)		0.068	1.31 (0.44 - 3.89)		
Duration of Stay												
2 weeks and below	1	-	-	-	-	-	1.00	-	-	1	-	
Beyond 2 weeks	2.51 (0.54 - 11.68)		0.225	-	-	-	5.02 (1.33 - 19.04)		0.009	**5.85 (1.05 - 32.63)**		
Living/ Staying alone												
No	1	-	-	1	-	-	1	-	-	-	-	

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	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Yes	3.39 (1.16 - 9.87)	0.018	**4.07 (1.18 - 14.01)**		1.36 (0.56 - 3.30)	0.499	-	-
Knowledge of COVID-19								
Poor	1	-	-	-	1	-	-	-
Good	1.90 (0.42 - 8.65)	0.397	-	-	1.01 (0.13 - 7.90)	0.990	-	-
Perceived Severity of COVID-19								
Not Sure/ Not Severe/ Not Severe at all	1	-	1	-	1	-	1	-
Very Severe/ Severe	4.28 (1.49 - 12.28)	0.004	**6.82 (1.90 - 24.45)**		2.56 (0.72 - 9.14)	0.135	2.43 (0.62 - 9.61)	
Perceived chance of contracting COVID-19								
Not Sure/ Small chance/ No chance at all	1	-	-		1	-	-	-
Very Large/ Large Chance	0.46 (0.10 - 2.12)	0.309	-	-	Un-defined	0.326	-	-
Pre-arrival COVID-19 Preventive Practice								
Poor	1	-	1	-	1	-	1	-
Good	3.19 (1.20 - 8.48)	0.015	2.60 (0.91 - 7.46)		2.08 (0.82 - 5.27)	0.116	1.86 (0.68 - 5.09)	
Concern for Family/ Self								
Concerned/ Slightly Concerned/ Not concerned at all	1	-	1	-	1	-	1	-
Extremely/ Very Concerned	2.31 (1.10 - 4.87)	0.024	2.22 (0.97 - 5.05)		1.90 (0.85 - 4.24)	0.112	1.57 (0.67 - 3.70)	
Confidence to observe self-for symptoms								
Moderately/ Slightly/ Not at all confident	1	-	1	-	1	-	1	-
Extremely/ Highly Confident	9.16 (3.74 - 22.43)	<0.001	**9.37 (3.38 - 25.97)**		7.22 (2.76 - 18.92)	<0.001	**5.16 (1.77 - 14.93)**	

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Table 4: Predictors of willingness to comply with COVID-19 Preventive Measures by international air-travelers, Nigeria, March 2020

Independent Variable	Extremely/ Very willing to avoid contact with others for 14 days						Extremely/ Very willing to always properly cover mouth and nose if symptoms of Sneezing/Coughing develop within 14 days of arrival						
	Unadjusted Odds			Adjusted Odds			Unadjusted Odds			Adjusted Odds			
	COR (95%CI)		*P*-value	AOR (95%CI)			COR (95% CI)		*P*-value	AOR (95% CI)			
Age group (years)													
< 40	1	-	-		-	-	-	1	-	-		1	-	-
≥40	0.91 (0.50 - 1.65)		0.761	-	-	-	7.17 (0.88 - 58.74)		0.033	2.90 (0.25 - 34.36)			
Gender													
Female	1	-	-		-	-	-	1	-	-		-	-	-
Male	1.46 (0.80 - 2.64)		0.216	-	-	-	0.43 (0.09 - 2.13)		0.283	-	-	-	
Nationality													
Nigerian	1	-	-		-	-	-	1	-	-	-	1	-	-
Non- Nigerian	1.85 (0.71 - 4.82)		0.202	-	-	-	Un-defined		0.197	164533.06 (0.00 - >1.0E12)			
Educational Status													
Secondary and below	1	-	-		-	-	-	1	-	-		1	-	-
Tertiary	1.53 (0.57 - 4.12)		0.401	-	-	-	4.35 (0.85 - 22.37)		0.055	5.06 (0.72 - 35.71)			
Marital Status													
Not Married	1	-	-		-	-	-	1	-	-		1	-	-
Married	1.37 (0.75 - 2.48)		0.307				11.32 (1.38 - 92.73)		0.005	6.38 (0.53 - 76.34)			
Employed													
No	1	-	-	1	-	-	1	-	-		1	-	-
Yes	1.75 (0.96 - 3.21)		0.066	1.28 (0.67 - 2.45)			3.62 (0.86 - 15.36)		0.062	0.56 (0.11 - 4.59)			
Airport of Entry													
MAKIA/ PHIA	1	-	-	1	-	-	1	-	-		1	-	-
MMIA/ NAIA	2.80 (1.14 - 6.84)		0.019	2.47 (0.94 - 6.50)			4.96 (0.96 - 25.58)		**0.035**	6.24 (0.86 - 45.23)			
Nigeria as place of Residence													
No, came for a visit	1	-	-		-	-	-	1	-	-		-	-	-
Yes	1.40 (0.65 - 3.03)		0.392	-	-	-	Un-defined		0.238	-	-	-	
Duration of Stay													
2 weeks and below	1	-	-		-	-	-	1	-	-		-	-	-

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	OR (95% CI)	p-value	OR (95% CI)	OR (95% CI)	p-value	OR (95% CI)
Beyond 2 weeks	2.44 (0.67 - 8.99)	0.165	2.55 (0.58 - 11.31)	Un-defined	0.616	-
Living/ Staying alone						
No	1	-	-	1	-	-
Yes	1.54 (0.78 - 3.04)	0.215	-	1.49 (0.30 - 7.45)	0.628	-
Knowledge of COVID-19						
Poor	1	-	-	1	-	-
Good	1.82 (0.51 - 6.47)	0.350	-	Un-defined	0.571	-
Perceived Severity of COVID-19						
Not Sure/ Not severe/ Not severe at all	1	-	-	1	-	-
Very Severe/ Severe	1.78 (0.59 - 5.39)	0.304	-	Un-defined	0.504	-
Perceived chance of contracting COVID-19						
Not Sure/ Small Chance/ No Chance at all	1	-	-	1	-	-
Very Large/ Large Chance	0.48 (0.13 - 1.73)	0.252	-	Undefined	0.593	-
Pre-arrival COVID-19 Preventive Practice						
Poor	1	-	1	1	-	1
Good	3.91 (1.72 - 8.91)	<0.001	**3.40 (1.45 - 7.93)**	4.29 (0.52 - 35.16)	0.140	4.87 (0.54 - 44.20)
Concern for Family /Self						
Concerned/ Slightly concerned/ Not concerned at all	1	-	1	1	-	1
Extremely/ Very Concerned	1.73 (0.94 - 3.20)	0.077	1.74 (0.91 - 3.34)	2.54 (0.63 - 10.30)	0.177	2.47 (0.54 - 11.42)
Confidence to observe self-for symptoms						
Moderately/ Slightly/ Not at all Confident	1	-	1	1	-	-
Extremely/ Highly Confident	6.78 (3.00 - 15.31)	<0.001	**4.69 (1.97 - 11.15)**	5.52 (1.07 - 28.62)	0.023	

Table 5: Predictors of willingness to comply with COVID-19 Preventive Measures by international air-travelers, Nigeria, March 2020

Independent Variable	Extremely/ Very willing to call national COVID-19 emergency numbers within 14 days of arrival if symptoms develop						
	Unadjusted Odds					Adjusted Odds	
	COR	95%CI		P-value		AOR	95%CI	
Age group (years)								
<40	1	-	-			1	-	-
≥40	4.15	1.16	14.90	**0.018**		3.50	0.87	14.07
Gender								
Female	1	-	-			1	-	-
Male	2.66	0.90	7.89	0.068		1.88	0.59	6.07
Nationality								
Nigerian	1	-	-			-	-	-
Non-Nigerian	1.34	0.30	6.06	0.701		-	-	-
Educational Status								
Secondary and below	1	-	-			-	-	-
Tertiary/Post-secondary	0.89	0.11	6.97	0.912		-	-	-
Marital Status								
Not Married	1	-	-			1	-	-
Married	2.41	0.85	6.88	0.09		1.27	0.35	4.62
Employed								
No	1	-	-			1	-	-
Yes	2.50	0.89	7.03	0.072		1.10	0.33	3.68
Airport of Entry								
MAKIA/PHIA	1	-	-			-	-	-
MMIA/NAIA	2.25	0.49	10.43	0.286		-	-	-
Nigeria as place of Residence								
No, Came for a visit	1	-	-			-	-	-
Yes	1.48	0.41	5.39	0.548		-	-	-
Duration of Stay								
2 weeks and below	1	-	-			-	-	-
Beyond 2 weeks	0.00	Undefined	Undefined	0.489		-	-	-
Living/Staying alone								
No	1	-	-			1	-	-
Yes	3.29	0.73	14.76	0.100		3.37	0.67	16.94
Knowledge of COVID-19								
Poor	1	-	-			-	-	-
Good	0.00	Undefined	Undefined	0.435		-	-	-
Perceived Severity of COVID-19								

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Not Sure/ Not severe/ Not severe at all	1	-	-		-	-	-
Very Severe/ Severe	2.96	0.63	13.84	0.150	3.86	0.72	20.75
Perceived chance of contracting COVID-19							
Not Sure/ Small Chance/ No chance at all	1	-	-	-	-	-	-
Very large/ large chance	0.48	0.06	3.86	0.478	-	-	-
Pre-arrival COVID-19 Preventive Practice							
Poor	1	-	-		1	-	-
Good	4.04	0.90	18.12	0.049	3.48	0.73	16.58
Concern for Family/Self							
Concerned/ Slightly/ Not concerned at all	1	-	-		-	-	-
Extremely/ Very Concerned	0.91	0.28	2.89	0.866	-	-	-
Confidence to observe self-for symptoms							
Moderately/ Slightly/ Not at all	1	-	-		1	-	-
Extremely/ Highly Confident	6.42	1.91	21.54	**<0.001**	**4.47**	**1.19**	**16.81**

Discussion

The finding that most of the study participants were willing to comply with all the Nigeria Centre for Disease Control's COVID-19 prevention recommendations for incoming travelers is encouraging. The high willingness to comply with COVID-19 preventive measures in this study may largely be due to increase in risk communication and community engagement globally in line with the WHO strategy of risk communication and community engagement (RCCE) which could afford most individuals the opportunity to have some information that would improve their health seeking behavior [27]. This could also be a reflection of the respondents' high education level which on its own could influence the willingness of the individuals to comply with disease preventive measures including COVID-19. However, close to half of the respondents were not willing to avoid contact with others. This may be because socialization is part of all societies as man naturally is a social being [28]. This finding presents additional basis for the relevant authorities to further engage the POIs and the general public on the role of physical contact in COVID-19 transmission and the importance of avoiding contacts not just for the symptomatic individuals but also the apparently healthy individuals.

The good knowledge of COVID-19 demonstrated by the majority of the participants in this study may have been due to increased public awareness campaign on COVID-19 globally especially as the respondents were coming from countries already affected by the pandemic with on-going risk communication activities. This finding is in keeping with that of a cross-sectional study in China which found a good knowledge of COVID-19 among the respondents [29]. Another study done in the United States and the United

Kingdom among the general public showed a good knowledge about COVID-19 [30].

Our finding that only a few respondents had a good overall prior preventive practice against COVID-19 (e.g., frequent hand washing and use of alcohol-based hand sanitizers, social distancing, and avoidance of face touching and crowded areas) has great implication in public health as lack of compliance to preventive measures worsens the pandemic. This is even more worrisome finding this among international traveler who have the potential of exporting the disease. The non-satisfactory proportion for overall prior preventive practice against COVID-19 observed in this study, may be because COVID-19 is a novel disease hence, requiring more health education to influence behavioral change in terms of adhering to good preventive practices for COVID-19. This suggests possible gaps in risk communication on COVID-19 prevention from the originating countries. This is opposed to the finding in an earlier study conducted in China [29] and to a similar study done among health workers in China by M. Zhou et al [31].

The perception of COVID-19 as a severe disease by a majority of the respondents is in keeping with a cross-sectional study that assessed the risk perception of COVID-19 around the world [12]. It is worthy of note that COVID-19 is highly transmissible and has led to so many mortalities globally according to WHO reports. This may explain the finding in this study. The finding that participants who perceived COVID-19 as severe or very severe were more likely to be extremely or very willing to stay at home for 14 days, compared with those who perceived it as less severe is similar to the result of a study in the US where perceived infection risk was associated with protective behaviors [32]. Respondents who came through the Lagos and Abuja airports were observed to be more likely to be willing to practice the preventive measures like staying at home for 14 days, avoiding contact with others, proper covering of nose and mouth which may suggest a difference in the risk communication activities at these international airports compared to the rest in the country.

This is probably as a result of the increased federal attention given to MMIA given that it had the bulk of international air travelers into the country as well as the fact that the recording of the country's index case of COVID-19 came in through it. In addition, the location of NAIA at the country's capital where the FMOH, NCDC offices are located, could have resulted in increased attention to surveillance at NAIA POE. Age not being a significant influencer of willingness was surprising in this study as risky behavior among younger adults is not uncommon [33]. In addition, to the fact that bad outcome, including death, is commoner among older people across the globe [34, 35].

A high confidence in the ability to observe self for symptoms of COVID-19 (self- efficacy) was a prominent predictor of the POIs willingness to comply with COVID-19 preventive measures across four of the five domains assessed (willingness to stay at home, willingness to observe self for symptoms suggestive of COVID-19, avoiding of contact with others and calling of national emergency numbers on COVID-19 within 14 days of arrival). This was not surprising as self-efficacy is a known determinant of health behavior and behavioral change including future health-related behavior [36]. Hence there is a need to build their confidence through intensive public enlightenment and engagement of high risk international travelers upon arrival. This study also calls for the need to intensify monitoring of the POIs during their first 14 days of arrival through calls and home visits because a failure to monitor for symptoms and act promptly could lead to local transmission of the virus and community spread especially for those who may be unwilling to comply with public health measures against COVID-19.

The findings of this study may be limited by desirability bias where respondents may give the response that they think the researcher wants to hear. Hence, an introductory note buttressing the need for sincerity of responses was added to limit that. In addition, findings of this study may have been limited by misclassification bias (symptomatic POIs vs non-symptomatic POIs) as some travellers may not have volunteered correct information about COVID-19 symptoms upon arrival at the airport, hence the addition of certain questions in the instrument to control for that (presence of suggestive symptoms in respondent). Also, the evolution in current public health measures against COVID-19 for international air travellers such as wearing of face masks to cover nose and mouth to prevent COVID-19 spread even when asymptomatic, not just covering of nose and mouth when sneezing and coughing [37, 38], and COVID-19 testing during international travel (pre-departure and upon arrival) may limit the current applicability of our study findings [39]. However, the robust representativeness of the study makes its result worth considering and could help policy-makers design evidenced-based risk communication strategies especially at international airports prior to departure and upon arrival as this also has the potential to prevent in flight transmission of COVID-19 for air travelers [40] In addition, the novel nature of this disease and a lack of similar studies limited a robust comparison of findings with other similar studies.

Conclusion

International air travelers play a significant role in the spread or containment of the COVID-19 pandemic. We found that perceived severity of COVID-19, duration of stay in country of arrival, airport of entry and self-efficacy towards observing self for COVID-19 symptoms were significant factors influencing the willingness of international air travelers to comply to COVID-19 preventive measures. This

study, therefore, reinforces the need for good and sustained risk communication and behavior change interventions on COVID- 19 especially their self-efficacy in all countries particularly among international air travelers (whether entry or exit) as COVID-19 is an ongoing global pandemic.

We recommend that international travelers be willing to adhere to all public health measures against COVID-19 as this will limit international spread of the virus particularly new variants.We also recommend that risk communication activities for COVID-19 for international travellers especially targeting their self-efficacy should be intensified by relevant stakeholders as this plays a crucial role on influencing the willingness of international incoming travellers to follow COVID-19 preventive measures and recommendations on arrival. We also recommend further studies to assess the practice of COVID-19 related preventive measures and outcome among international air travellers as well as studies to determine the relationship between international air travellers' willingness to comply with COVID-19 preventive measure and their actual compliance. We believe that these will better guide policy makers on interventions to help contain the pandemic, especially with the re-opening of international borders and the recommencement of international air travel across the world, Nigeria inclusive.

List of Abbreviation

AOR   Adjusted Odds Ratio

COR   Crude Odds Ratio

COVID-19 Coronavirus Disease 2019

NCDC   Nigeria Centre for Disease Control

PHEIC   Public Health Emergency of International Concern.

POE   Point of Entry

PHS   Port Health Services

POI   Persons of Interest

RCCE   Risk Communication and Community Engagement

WHO   World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the National Health Research Ethics Committee, Abuja with approval number: NHREC/01/01/2007-10-/3/2020. Written informed consent was obtained from all respondents and confidentiality was maintained at all times

Consent for publication

Not applicable_

Availability of data and materials

All the data associated with this work is available from the corresponding author on reasonable request.

Competing Interests

The authors have no competing interest to declare.

Authors Contribution

Conception and Design of the study

ISU, CDU, MSB, COA, UCO, AAO, CSO, EB, KE, ALI, MA, JO, PN, and CI

Acquisition of Data

ISU, CDU, MSB, COA, IHZ, CSO, PIO, AM, and CPE

Analysis and Interpretation of Data

ISU, CDU, AAO, and EB

Drafting the article/revising it critically for important intellectual content

ISU, CDU, MSB, COA, IHZ, UCO, AAO, CSO, PIO, AM, CPE, EB, KE, ALI, MA, JO, PN, and CI

Final approval of the version to be submitted

All authors read and approved the final version for submission.

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SUPPLEMENTARY FILES

Supplementary table S1: Pre-Arrival COVID-19 Preventive Measures Practice of International In-coming Air-travelers into Nigeria, March 2020

Variable	Frequency (Percentage) n=500
Frequent and thorough hand washing with soap and water or use of alcohol-based hand sanitizers	
Always	274 (54.8)
Frequently	184 (36.8)
Sometimes	27 (5.4)
Rarely	12 (2.4)
Never	3 (0.6)
Keeping a distance of at least 1.5 meters or 5 feet from persons coughing or Sneezing	
Always	269 (53.8)
Frequently	154 (30.8)
Sometimes	59 (11.8)
Rarely	15 (3.0)
Never	3 (0.6)
Touching of face especially eyes, nose and mouth	
Always	28 (5.6)
Frequently	53 (10.6)
Sometimes	177 (35.4)
Rarely	169 (33.8)
Never	73 (14.6)
Avoiding crowded places or areas	
Always	282 (56.4)
Frequently	132 (26.4)
Sometimes	52 (10.4)
Rarely	17 (3.4)
Never	17 (3.4)

Supplementary table S2: Risk perceptions of International In-coming Air-travelers into Nigeria towards COVID-19, March 2020

Variable	Frequency (Percentage) n=500
How severe do you think COVID-19 is?	
Very Severe	356 (71.2)
Severe	118 (23.6)
Not Sure	16 (3.2)
Not Severe	8 (1.6)
Not Severe at all	2 (0.4)
How concerned are you about yourself or family members getting COVID-19?	
Extremely Concerned	282 (56.4)
Very Concerned	75 (15.0)
Concerned	69 (13.8)
Slightly concerned	40 (8.0)
Not Concerned at all	34 (6.8)
What do you think are your chances of getting COVID-19 infection	
Very Large chance	8 (1.6)
Large chance	9 (1.8)
Not sure	146 (29.2)
Small chance	150 (30.0)
No Chance at all	187 (37.4)

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Supplementary table S3: Concerns of In-coming Air-travelers regarding adherence to Nigeria's COVID-19 Preventive Measures for international travelers upon arrival, March 2020

Variable	Frequency (Percentage)
Concerns about having to always properly cover my nose and mouth if symptoms of cough and sneezing develop (n = 90) *	
I may forget to do so always	61 (67.7)
It is not convenient	15 (16.7)
Other reasons**	5 (5.6)
No particular reason but highly concerned	9 (10.0)
Concerns about calling the National emergency COVID-19 numbers if symptoms of COVID-19 develop within 14 days of arrival (n = 134) *	
I could be separated from my loved ones	62 (46.3)
I don't have the national emergency numbers	29 (21.6)
I may be discriminated against	31 (23.1)
My routine could be disrupted	12 (9.0)
Concerns about staying at home for 14 days following their arrival (n = 133)	
I would need food and drink	71 (53.4)
I won't be able to care for my family	25 (18.8)
I may lose my job	13 (9.8)
Feelings of isolation	10 (7.5)
I may run out of essentials	8 (6.0)
No particular reason but very concerned	3 (2.3)
Other reasons***	3 (2.3)
Concerns about avoiding contact with others for 14 days following their arrival (n = 111) *	
Stigmatization/Discrimination from others	47 (42.3)
I won't be able to care for my family	41 (39.9)
I may lose my job	8 (7.2)
Isolation	6 (5.4)
No particular reason, just extremely concerned	5 (4.5)
Other reasons ****	4 (3.6)
Concerns about observing Self for COVID-19 for 14 days upon arrival (n = 111) *	
I am afraid of what I may find	62 (55.9)
No particular reason, just extremely concerned	18 (16.2)
Other reason for concern*****	4 (3.6)
Feeling of isolation	4 (3.6)
Loneliness and lack of regular power supply	2 (1.8)

*This was the prevailing NCDC recommendation for in-coming international travelers on COVID-19 as at the time of the study. This was based on the WHO recommendations for COVID-19

**Other concerns about coverage of nose and mouth include: Being reported to NCDC (1), paying attention to carry what is needed (1), running out of tissues (2), stigmatization for using masks (1) and to avoid infecting others (1)

***Other concerns regarding staying at home include: Visa issues (1), Could slow down business (1), Health concerns (1)

****Other concerns for avoiding contact with others include: Hard to avoid people in a hotel (1), Lack of food (1), Could run out of essentials (1), People coming in and out of the house already (1)

***** Other concerns regarding observing self for symptoms include: Being responsible for symptoms due to recent travel (1), Concern for the health of others (1), A family man (1), constant cleaning of areas within the house and hands (1)

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