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Preventive Behaviors and Seroprevalence of SARS-CoV-2 Antibodies from Natural Infection among Immigration Police Working at Don Mueang International Airport, Thailand, before the COVID-19 Vaccination Era

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Abstract

After the first wave of the COVID-19 pandemic in Thailand in 2020, there was no data related to preventive behaviors against COVID-19 infection and prevalence of previous infections among frontline immigration police, which could be used to implement health promotion and adapt preventive methods in the organization. All frontline immigration police officers working at Don Mueang International Airport, Bangkok, were invited to participate in this cross-sectional study in May 2020. The objectives were to describe their preventive behaviors and determine the prevalence of antibodies against SARS-CoV-2 using conventional neutralization assays and ELISA tests. There were 201 eligible participants. All were asked to fill in a questionnaire, which asked them to disclose their preventive behaviors against COVID-19 infection. All were tested for antibodies against SARS-CoV-2 from natural infection as vaccines were not available at that time. The most practiced preventive behaviors were wearing a mask at work and wearing a mask in daily life, while taking sick leave when suffering from respiratory symptoms was the least practiced behavior. No SARS-CoV-2 antibodies were present in any participant. Reasons for not taking sick leave, when necessary, should be investigated in further qualitative studies.

Keywords: COVID-19, SARS-CoV-2, antibody, preventive behavior, seroprevalence, immigration police

Introduction

Before the COVID-19 pandemic was declared by World Health Organization on 11 Mar 2020, Thailand was the most popular country for Chinese tourists.[1] During the period between the first reported COVID-19 case in China and the World Health Organization declaration, there were numerous direct flights between Thailand and China and the majority of COVID-19 cases were imported from China. After two outbreak events in Bangkok, March 2020, local transmission became the primary source of infection in Thailand.[2] However, infected international tourists were a major concern for further outbreaks. Don Mueang International Airport is one of the two international airports in Bangkok. The airport has many direct flights from many countries including China, and immigration officers have been the frontline workers facing a high risk of contracting COVID-19 and potentially spreading it to others. This study aimed to describe and compare preventive behaviors, and determine the seroprevalence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibodies among frontline immigration police officers at Don Mueang

International Airport after the first wave of the COVID-19 epidemic in Thailand. Assessment of preventive behaviors among these essential workers was undertaken to identify potential gaps in occupational safety when interacting with travelers who could be infected with SARS-CoV-2. This information would provide crucial implications not only for safeguarding the immigration police but also for ensuring safe immigration control at the airport during the COVID-19 pandemic and beyond.

Materials and Methods

Study Population and Setting

All immigration police officers working within two meters of international travelers at Don Mueang International Airport from January to May 2020 were asked to participate in this study in May 2020. The participants were informed about the research objectives and related procedures. Written informed consent was obtained before enrolment. Participants were excluded if they reported immunocompromised conditions such as active cancer, HIV-AIDS, and the current use of steroids due to the low response for neutralization assay, and the possibility of false negative results.

Outcome Measurement

Preventive behaviors

All consenting immigration officers were asked to fill in a questionnaire, which consisted of two parts, namely demographic data and preventive behaviors. The preventive behaviors were divided into personal hygiene and work-related preventive behaviors. Personal hygiene consisted of seven questions, while work-related preventive behaviors consisted of three questions. Because the risk of working during the first period of the COVID-19 pandemic was considered to be the most possible mode of viral transmission, participants were categorized as having good work-related preventive behaviors if their answers to all three sub-questions were "always" and poor otherwise.

Seroprevalence of SARS-CoV-2 antibodies

Blood was drawn from all participants in a designated area at the Department of Disease Control Unit on the first floor of Terminal 1, Don Mueang International Airport in May 2020. Samples were stored and transported at a proper temperature of around four degrees Celsius to the Faculty of Medical Technology, Mahidol University. The serum was tested for SARS-CoV-2 antibodies by Conventional Neutralization Assay and WANTAI enzyme-linked immunosorbent assay (ELISA) (Beijing Wantai Biological Pharmacy Enterprise Co., Ltd.).

For the process and procedures of ELISA, laboratories followed every procedure from the brand and provided positive and negative control for the test. Based on previous studies, the sensitivity of WANTAI ELISA for SARS-CoV-2 ranged from 86–100%, depending on the time that patients were tested after their first debut, and the specificity was 96.9–99.2%.[3–5]

For the neutralization assay, which measured total immunoglobulin that can neutralize the virus, the antibodies will increase after the person is infected for around three to four weeks. In this study, we used a microneutralization test in Vero cell, which originated from a monkey's kidney, incubated into a cell monolayer one day before the test, and used SARS-CoV-2 at fifty-percent tissue culture infective dose. In the test, neutralizing antibody titers could be detected at a level as low as 1:10. The microneutralization assay was considered to be the most sensitive and specific test and can be used as a gold standard.[6]

We defined a case as SARS-CoV-2 infection from our positive laboratory results, in which SARS-CoV-2 infection was identified as positive once conventional Neutralization Assay (cNA) was positive regardless of the ELISA test result due to its high specificity.[7,8] If only ELISA was positive, an additional test of immunofluorescent assay would be applied due to ELISA's lower specificity and the possibility of cross-reactivity from other diseases, and the positive result was confirmed when both ELISA and immunofluorescent assay were positive.[9] Since there were no vaccines available at the time of this study, a positive antibody was interpreted as evidence of prior SARS-CoV-2 infection.

The study was approved by Mahidol University Central Institutional Review Board (protocol number MU-COVID2020.001/2503).

Statistical Analysis

Participants' characteristics were summarized using descriptive statistics. Independent samples t-test and the two-sample Wilcoxon rank-sum test were applied to compare the difference in means and distributions of continuous variables between participants who were deemed to have good and poor work-related preventive behaviors. The equality of variance between groups was assessed before applying the independent samples t-test. Exact probability was applied to compare proportions between groups.

All preventive behaviors were measured regarding the frequency of doing that behavior using a 4-point Likert scale ranging from rarely (<20%), sometimes (20–50%), often (51–95%), and always (>95%), and were described using the median and interquartile range.

Results

Demographic Characteristics

Of 201 eligible immigration police officers, all agreed to participate in the study and none were excluded. The majority of participants were female, younger than 35 years, and had no history of upper respiratory tract infection from January to May 2020. The median duration of employment was 9 months and the range was 2 months to 32 years. Most participants spent 8 hours and confronted approximately 200 international passengers per day from January to May 2020. RT-PCR testing for SARS-CoV-2 was performed on nearly 60% of all participants, with 22% experiencing some respiratory symptoms, and all results were negative (Table 1).

Table 1. Demographic characteristics of Thai immigration police officers working against COVID-19 at Don Mueang International Airport, disaggregated by level of the work-related preventive behaviors on preventing COVID-19

Demographic characteristics	Total	Good*	Poor
	n (%)†	n (%)‡	n (%)‡
Overall‡	201	30 (14.9)	171 (85.1)
Gender			
Male	51 (25.4)	4 (7.8)	47 (92.2)
Female	150 (74.6)	26 (17.3)	124 (82.7)
Age (years)			
Mean (SD)	33.4 (9.6)	34.3 (10.4)	33.2 (9.4)
Range	19–58	20–56	19–58
Age group (years)			
≤35	131 (65.2)	19 (14.5)	112 (85.5)
36–45	41 (20.4)	7 (17.1)	34 (82.9)
>45	29 (14.4)	4 (13.8)	25 (86.2)
Duration of work experience (months)			
Median (IQR)	9 (34)	9.0 (60)	9.0 (25)
Range	2–392	7–392	2–292
≤12	116 (57.7)	17 (14.7)	99 (85.3)
>12	85 (42.3)	13 (15.3)	72 (84.7)
Number of passengers contacted (per day)			
Median (IQR)	200 (400)	225 (400)	200 (400)
Range	5–12000	10–12000	5–12000
≤100	65 (32.3)	9 (13.8)	56 (86.2)
>100	136 (67.7)	21 (15.4)	115 (84.6)
Duration of contact with passengers (minutes)			
Median (IQR)	480 (300)	450 (240)	480 (360)
Range	2–1440	60–600	2–1440
≤60	39 (19.4)	3 (7.7)	36 (92.3)
>60	162 (80.6)	27 (16.7)	135 (83.3)
History of upper respiratory tract illness			
No	156 (77.6)	23 (14.7)	133 (85.3)
Yes	45 (22.4)	7 (15.6)	38 (84.4)
History of nasopharyngeal swab screening (RT-PCR)			
No	84 (41.8)	16 (19.0)	68 (81.0)
Yes	117 (58.2)	14 (12.0)	103 (88.0)

Note: SD: standard deviation, IQR: interquartile range. †Percentage by column, ‡Percentage by row

**Good work-related preventive behaviors; replied 'always' in all three work-related preventive behaviors shown in Table 2.*

Preventive Behaviors

The most common preventive behaviors were wearing masks in daily life and wearing masks at work. Not using share belonging, cleaning hands in daily life and during work, were always done consecutively after wearing masks. The least common behavior was taking sick leave after a respiratory tract ailment, followed by cleaning personal or shared belongings and use of cashless payment systems, consecutively (Table 2).

Generally, most participants practice all preventive behaviors in "personal hygiene care" at the level of "often" and "always", with the median score of the preventive behavior's frequency of at least three. However, taking sick leave when having respiratory symptoms had the lowest median score of two. Most (85.1%) participants had poor work-related preventive behaviors. There were no significant differences between participants' characteristics and their level of work-related preventive behaviors (Table 1).

Table 2. Frequency of preventive behaviors against contracting and being exposed to COVID-19 among Thai immigration police officers working at Don Mueang International Airport

Questions	Rarely (1)	Sometimes (2)	Often (3)	Always (4)	Median (IQR)
	n (%)	n (%)	n (%)	n (%)	
Overall					
Personal hygiene care					
1. How often did you clean your hands with alcohol gel or hand sanitizer after going to the restroom, before having food, or touching any share belonging? (cleaning hands in daily life)	0 (0)	4 (2.0)	73 (36.3)	124 (61.7)	4 (3–4)
2. How often did you pay for items via cashless system, such as credit card, or QR code? (use of cashless payment systems)	16 (8.0)	53 (26.4)	96 (47.8)	36 (17.8)	3 (2–3)
3. How often did you touch your face (including mouth, nose, eyes)?† (touching face)	3 (1.5)	35 (17.4)	82 (40.8)	81 (40.3)	3 (3–4)
4. How often did you use shared belongings, such as dish, spoon, or glass?† (not using share belonging)	2 (1.0)	18 (9.0)	44 (21.9)	137 (68.1)	4 (3–4)
5. How often did you clean your belonging/ sharing parts of your residence (such as cleaning door knob, mobile phone at least once daily)? (cleaning personal or shared belongings)	16 (8.0)	77 (38.3)	80 (39.8)	28 (13.9)	3 (2–3)
6. How often did you practice physical distancing (being at least 1 meter away from others)? (physical distancing)	1 (0.5)	23 (11.4)	123 (61.2)	54 (26.9)	3 (3–4)
7. How often did you wear a mask before going out? (wearing masks in daily life)	0 (0)	2 (1.0)	12 (6.0)	187 (93.0)	4 (4)
Work-related preventive behaviors					
1. How often did you wear a mask at work? (wearing masks at work)	0 (0)	1 (0.5)	12 (6.0)	188 (93.5)	4 (4)
2. How often did you take sick leave if you had respiratory symptoms? (taking sick leave)	61 (30.3)	47 (23.4)	44 (21.9)	49 (24.4)	2 (1–3)
3. How often did you clean your hands with alcohol gel or hand sanitizer after receiving a document from passengers? (cleaning hands during work)	3 (1.5)	14 (7.0)	82 (40.8)	102 (50.7)	4 (3–4)

Note: SD: standard deviation, IQR: interquartile range. †Score has been reversed for mean calculation.

Prevalence of SARS-CoV-2 Antibodies

Participants' antibody results for ELISA and neutralizing assay were all negative for SARS-CoV-2, resulting in a prevalence of SARS-CoV-2 antibodies of zero.

Discussion

According to the results of the behavior survey, wearing a mask at work and in everyday life was the most common preventive behavior, with more than 90% of participants always wearing a mask. This could be a

result of the Thai government's COVID-19 policy, which includes strict social regulations. Since the COVID-19 pandemic, almost every business, grocery store, shopping center, shop and market must prohibit anyone without masks from entering. In the period before COVID-19 occurred, people normally did not wear masks at all.

Conversely, taking sick leave after a respiratory tract infection was the least practice behavior. Immigration officers are entitled to 60 sick leave days annually, with the requirement that a medical certificate be produced. Immigration officers in Thailand serve in day and night shifts. Taking constant sick leave may have consequences on coworkers, even if they are tolerable, which might be a cause for avoiding taking leave. This happened to other types of workers as well. More than half of healthcare workers and other types of workers continued to work while suffering from influenza-like illnesses, which is comparable to results of this study.[10] Some studies found that there was a phenomenon of sickness presenteeism in which workers did not take sick leave despite illness due to economic and social constraints, and workplace culture.[11,12] Other studies described that sickness absenteeism was explained by the workers' perception, disposition, social and cultural standards, and expectations.[13,14] Because of its critical potential in transmitting infections to others and causing new outbreak clusters, the reasons for this high percentage should be explored further using qualitative studies, in-depth interviews, or other-appropriate methods.[15]

Cleaning personal or shared belongings and use of cashless payment systems were the second and third least common preventive behaviors. Both these behaviors are considered to be related to contact transmission. In Thailand, acronyms such as DMHTTA (Distancing, Mask, Hygiene, Testing, Temperature, Application) and VUCA (Vaccine, Universal Prevention, COVID-Free Setting, Antigen Test Kit) were widely promoted, unlike cleaning of personal and shared belongings. Because contact is one of the mechanisms through which SARS-CoV-2 spreads, keeping the environment clean is critical.[16] According to the United Nations International Children's Emergency Fund, the U.S. Centers for Disease Control, and other knowledge-based resource organizations, commonly-touched surfaces such as door knobs, tables, chairs, kitchen and bathroom surfaces, light switches, remote control devices, phones, tablets, computers, and keyboards should be cleaned daily, or at least frequently, using products containing 70% alcohol or bleach.[17–19] For cashless payment systems, according to a poll, 57% of Thai customers utilize digital payment methods (such as debit/credit cards, smartphone apps, mobile banking, and QR codes), compared to 43% who use cash.[20] Due to the long-term tolerance of SARS-CoV-2 on surfaces, a cashless payment system that does not need the exchange of items such as credit cards, is the best approach to encourage physical distancing and limit the contact, thus lowering the risk of contracting and transmitting infectious diseases.[21–24] Even though there is no evidence and scientific support for viral transmission through fomites, fomite contact is still considered to be a possible mode of SARS-CoV-2 transmission.[25,26]

Public Health Recommendation

We suggest that the Ministry of Public Health, in collaboration with the Government Public Relations Department, publicly inform and promote, via media such as television, infographics, and other social media sites and platforms (such as Facebook, YouTube, and Instagram), that people clean their everyday objects such as mobile phones and door knobs, in order to maintain good hygiene. Cashless payment should be encouraged more for both buyers and sellers by media broadcasting. A campaign promoting a tax deduction system for sellers and a discount for buyers using cashless systems may increase its popularity. This could be done through the collaboration of the Ministry of Public Health, the Government Public Relations Department, the Ministry of Finance, and the Ministry of Digital Economy and Society.

Thailand has instituted several safeguard measures to prevent COVID-19 from spreading. People's behavior is one of the most important factors associated with COVID-19 infection. We observed from this study that no immigration police at Don Mueang International Airport had neutralizing antibodies against SARS-CoV-2 infection in May 2020. With the extremely high sensitivity and specificity of the neutralization assay, together the satisfactory process of sample collection, storage, and internal quality control at the laboratory, we believe that the results are accurate, and the participants had not been infected from SARS-CoV-2 previously, since the neutralizing antibody and ELISA titer is mostly detectable for several months among previously infected persons.[7,8,27] This contradicts our prediction that certain immigration officers would be affected as a result of their job, which requires them to interact with a large number of tourists and locals returning from abroad. Another possible reason was that there was a low number of infected international travelers during that period, only 83 cases from 6,424 arrivals in April 2020, or 1.3%.

Limitations

Due to the zero prevalence of SARS-CoV-2 among immigration police, we did not analyze preventive behaviors related to being infected. However, we found behaviors that participants seemed to practice better and worse, and this is useful for health promotion and the development of guidelines at work in order to prevent the spread of disease. Another limitation was that the self-reported questionnaire may have created a response bias. However, we tried to minimize this bias by clarifying the questionnaire to each participant for their better understanding.

Conclusion

After the first wave of the COVID-19 epidemic in Thailand, which occurred between March and April 2020 and in which cases peaked at 188 on 22 March, with a cumulative number of 2,912 cases in these two months, the seroprevalence of SARS-CoV-2 antibodies among 201 Thai immigration police officers working at Don Mueang International Airport was zero, indicating a high likelihood of no previous infection. Wearing a mask at work and in everyday life was the most common preventive behavior, reported by almost all participants. However, taking sick leave while experiencing respiratory infection symptoms was found to be the least practiced behavior. Identifying the reasons behind the reluctance to take sick leave and promoting the importance of taking sick leave while experiencing respiratory infection symptoms will help prevent the spreading of not only SARS-CoV-2 but other infectious viruses.

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