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Short Communication

The prevalence of SARS-CoV-2 antibodies in quarantine workers and high-risk communities in Vietnam

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A B S T R A C T

Objective: The aim of this study was to determine the seroprevalence of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) antibodies in high-risk communities and quarantine workers in Vietnam.

Methods: The prevalence of SARS-CoV-2 antibodies was measured in household contacts, close contacts, community members, and migrant workers from two sub-communes in which COVID-19 outbreaks occurred in early 2021: Bac Ma 1 and Tien. The prevalence of SARS-CoV-2 antibodies was also evaluated among quarantine workers at two facilities responsible for quarantining of contacts of COVID-19 cases.

Results: Among 2069 participants from the two sub-communes, six individuals (0.3%) had detectable SARS-CoV-2 antibodies despite no history of COVID-19. This included one Vietnamese migrant worker, two community members, two household contacts, and one close contact of known COVID-19 cases. Among 50 workers at two COVID-19 quarantine facilities, including 15 health care workers (HCWs), one of the HCWs tested positive for SARS-CoV-2 antibodies (1/50, 2.0%) despite no known disease.

Conclusion: The prevalence of SARS-CoV-2 antibodies was low in Vietnamese 'hotspots', suggesting limited community transmission.

Introduction

Vietnam, a populous nation in Southeast Asia, had detected a small number of cases of COVID-19 compared with many other global settings prior to April 2021. Community transmission was prevented using strict public health strategies, including mandatory quarantine for returned travellers, isolation of all community members in domestic epidemic areas, and isolation of contacts of confirmed COVID-19 cases (Nguyen et al., 2021). Quarantine for all close contacts of people with confirmed COVID-19 was delivered by staff who worked and lived in the facilities, in order to minimize community exposure. These staff were provided with accommodation and personal protective equipment (PPE). Furthermore, the staff were required to undergo mandatory 2-week quarantine and negative polymerase chain reaction (PCR) testing

for severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) before returning to the community. These interventions were associated with a low case notification rate. However, notifications may underestimate the true community incidence of COVID-19. This seroprevalence study aimed to measure the prevalence of unrecognized infection in the general community and among quarantine workers at high risk of exposure to SARS-CoV-2.

Methods

A cross-sectional survey was undertaken to measure the prevalence of SARS-CoV-2 antibodies in two northern provinces. Vietnam is a middle-income country with a population of 96 million. Each of its 63 provinces can be subdivided into districts, communes, and sub-

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Table 1
Characteristics of participants and sero-positivity for SARS-CoV-2 antibodies in two sub-communes affected by COVID-19

Characteristics	Bac Ma 1 sub-commune N (%)	Tien sub-commune N (%)
Total participants	897	1172
Age, years (median, interquartile range)	42 (19–57)	37 (20–53)
Female gender	479 (53.4)	501 (42.7)
Number of PCR-confirmed COVID-19 cases in community	7	18
Period of outbreak (time between diagnosis of first and last case)	Jan 27 to Feb 6, 2021	Feb 7–27, 2021
Time from the last case diagnosed to serological testing (weeks)	11.9	8.9
Sero-positivity for SARS-CoV-2		
Total	1/897 (0.1)	5/1172 (0.4)
Household contacts	0/7 (0.0)	2/22 (9.1)
Close contacts	0/14 (0.0)	1/18 (5.6)
Community members	1/876 (0.1)	1/920 (0.1)
Migrant worker	0/0 (0.0)	1/212 (0.4)
Occupation		
Student*	223 (24.9)	217 (18.5)
Office worker	20 (2.2)	22 (1.9)
Factory worker	100 (11.1)	318 (27.1)
Farmer	318 (35.5)	89 (7.6)
Self-employed	107 (11.9)	156 (13.3)
Retired	58 (6.5)	43 (36.7)
Unemployed	2 (0.2)	4 (0.3)
Healthcare worker	3 (0.3)	4 (0.3)
Tourist	0 (0.0)	1 (0.1)
Overseas students, returning home	0 (0.0)	0 (0.0)
People returning home	1 (0.1)	0 (0.0)
Service workers	14 (1.6)	13 (1.1)
Other	52 (6.8)	54 (4.6)
Comorbidities		
Diabetes	31 (3.5)	26 (2.2)
Hypertension	88 (22.2)	75 (6.4)
Renal disease	25 (2.8)	8 (0.7)
Heart disease	33 (3.7)	22 (1.9)
Pulmonary disease	10 (1.1)	8 (0.7)
Immunological disease	2 (0.2)	1 (0.1)
Smoker	111 (12.4)	100 (8.5)
Symptoms during period of outbreak		
Fever	3 (0.3)	4 (0.3)
Cough	6 (0.7)	15 (12.8)
Sputum production	7 (0.8)	5 (0.4)
Hemoptysis	0 (0.0)	0 (0.0)
Dyspnea	7 (0.8)	3 (0.3)
Sore throat	11 (12.3)	28 (2.4)
Nasal discharge	13 (14.5)	31 (2.6)
Headache	21 (23.4)	33 (2.8)
Anosmia	0 (0.0)	0 (0.0)
Diarrhea	3 (3.3)	1 (0.1)
Fatigue	8 (8.9)	21 (1.8)
Myalgia	5 (5.6)	10 (0.8)
Chills	0 (0.0)	1 (0.1)
Conjunctivitis	3 (3.3)	1 (0.1)
Other	8 (8.9)	14 (1.2)

PCR: polymerase chain reaction

communes. Sub-communes usually have a population of between 500 and 2000 people.

Between January 1 and February 28, 2021, Bac Mac 1 sub-commune in Quang Ninh province and Tien sub-commune in Hai Duong province reported 7 and 18 cases of COVID-19, respectively. These two sub-communes, both in North Vietnam, had the highest number of cases during Vietnam's third epidemic wave.

All household and close contacts of COVID-19 cases and all community members residing in the two selected sub-communes were invited to participate in the study. A list of community members for each sub-commune was obtained from local authorities. An invitation letter and information sheet were sent to each household with details of the study. Community members were invited to a study location. For those who did not attend, the study team visited the house to further extend an invitation to participate voluntarily in the study. Individuals in Bac Mac 1 sub-commune were interviewed over a 1-week period 12 weeks after the local outbreak, and individuals from Tien sub-commune were interviewed 9 weeks after the local outbreak (Table 1).

Additionally, testing was carried out on clinical and non-clinical quarantine workers at two isolation facilities in Quang Ninh province, which housed contacts of COVID-19 cases and had the highest number of reported COVID-19 diagnoses. Only two facilities were included due to time and funding limitations.

Participants completed a baseline demographic survey and gave blood for SARS-CoV-2 antibody testing using the validated *cobas* platform (Roche Diagnostics), with an estimated sensitivity and specificity of 96.8% and 99.8%, respectively, for samples taken at least 14 days after symptom onset (The National SARS-CoV-2 Serology Assay Evaluation Group, 2020). The study was completed prior to the delivery of vaccination against SARS-CoV-2.

Ethical approval was obtained from the University of Sydney (HREC 2020/415) and the National Hospital for Tropical Diseases (Nos. 10/HDDD-NDTU, 18/HDDD-NDTU, and 02/HDDD-NDTU). Data and consent records were stored electronically using a REDCap database. Participants received a small reimbursement to compensate for their time.

Table 2
Characteristics of study participants and sero-positivity for SARS-CoV-2 among workers in two quarantine facilities

Characteristics	Healthcare workers (HCW) N (%)	Logistic and security staff N (%)	Specimen collectors N (%)	Total N (%)
Number of participants	15	11	24	50
Age, years (median, interquartile range)	32 (27–34)	37 (32–50)	30 (26–32)	31 (26–35)
Female gender	13 (86.7)	2 (18.2)	23 (95.8)	38 (76.0)
Number of PCR-confirmed COVID-19 cases diagnosed among quarantined contacts in facilities	16			
Period of quarantine of positive COVID-19 cases at the facilities	Jan 30 to Feb 23			
Stayed onsite at facility	Yes	Yes	No	
Length of stay at facility (median, interquartile range)	44 (22–64) days	46 (30–69) days	NA	44 (23–69) days
Time from the last case diagnosed to serological testing	9.1 weeks			
Sero-positivity	1/15 (6.7)	0/11 (0.0)	0/24 (0.0)	1/50 (2.0)
Comorbidities				
Diabetes	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Hypertension	0/15 (0.0)	1/11 (9.1)	0/24 (0.0)	1/50 (2.0)
Renal disease	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Heart disease	0/15 (0.0)	0/11 (0.0)	1/24 (4.2)	1/50 (2.0)
Pulmonary disease	0/15 (0.0)	1/11 (9.1)	0/24 (0.0)	1/50 (2.0)
Immunological disease	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Symptoms during the period working at the center				
Fever	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Cough	0/15 (0.0)	1/11 (9.1)	0/24 (0.0)	1/50 (2.0)
Sputum production	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Hemoptysis	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Dyspnea	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Sore throat	0/15 (0.0)	1/11 (9.1)	0/24 (0.0)	1/50 (2.0)
Nasal discharge	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Headache	1/15 (6.7)	1/11 (9.1)	1/24 (4.2)	3/50 (6.0)
Anosmia	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Diarrhoea	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Fatigue	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Myalgia	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Chills	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Conjunctivitis	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)
Other	0/15 (0.0)	0/11 (0.0)	0/24 (0.0)	0/50 (0.0)

PCR: polymerase chain reaction

Results

In total, 897 unvaccinated individuals in Bac Ma 1 sub-commune and 1172 individuals in Tien sub-commune (including 212 Vietnamese migrant workers) were enrolled in this study (Table 1). The participation rate was approximately 80% and 31% for community residents and migrant workers, respectively. In the community, six individuals (6/2069, 0.3%), had detectable SARS-CoV-2 antibodies including one migrant worker (1/212, 0.5%), two community members (2/1796, 0.1%), and two household contacts (2/29, 6.9%) and one close contact (1/32, 3.1%) of known COVID-19 cases. The ages of individuals with positive serology ranged from 9 to 67 years; three were female (50.0%). In the quarantine facilities, 50 quarantine workers were screened (participation rate 50/53, 94.3%). Of these, one of 15 healthcare workers (HCWs) (1/50, 2.0%) had detectable SARS-CoV-2 antibodies (Table 2). All seven cases were diagnosed incidentally during the study period and did not report symptoms during the outbreak period or while working at quarantine facilities. None of the positive cases required treatment, admission, or support for COVID-19 during the study period.

Discussion

This population-wide survey in COVID-19 hotspots during Vietnam's third wave demonstrated a low prevalence of SARS-CoV-2 antibodies among members of the general community and quarantine workers. This was among the first studies of seroprevalence of SARS-CoV-2 in workers at dedicated quarantine facilities.

The finding of one HCW with detectable SARS-CoV-2 antibodies was comparable to studies in Vietnam during the previous COVID-19 outbreaks (Hasan et al., 2021; Chau et al., 2021). However, the findings in Vietnam contrasted starkly with other settings in which the risk of

infection among healthcare workers was high. For example, the prevalence of SARS-CoV-2 antibodies was found to be 7.9% among Colombian airport workers (Malagón-Rojas et al., 2021) and 23% among Swedish home-care employees (Lindahl et al., 2020). In both studies, it was not possible to determine whether they were infected at work due to the high rates of community transmission (Lindahl et al., 2020; Malagón-Rojas et al., 2021). In contrast, in Vietnam, the healthcare and other quarantine workers had lived at the facility throughout their assignments, reducing transmission to the community, and vice versa.

Our study demonstrated limited community transmission of SARS-CoV-2 in Vietnamese communities with confirmed COVID-19 cases. Furthermore, only one migrant worker had positive serology. These results show that Vietnam's policy of quarantine for all close contacts of patients with COVID-19 in government facilities was associated with very limited community transmission in settings with known cases. This included vulnerable migrant populations.

Limitations of this study included the involvement of only two quarantine facilities, and the retrospective design. Strengths included the selection of a representative sample of quarantine workers, thus helping to provide an understanding of the transmission of SARS-CoV-2 in this well-controlled environment.

Conclusion

The prevalence of SARS-CoV-2 antibodies in quarantine workers and in communities was low during a community outbreak of COVID-19. Given the low rates of prevalent immunity to the virus, COVID-19 vaccination will be critical to long-term community protection amidst future outbreaks in Vietnam.

Conflicts of interest

None declared

Funding source

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Ethical statement

Ethical approval was obtained from the University of Sydney (HREC 2020/415) and the National Hospital for Tropical Diseases (Nos. 10/HDDD-NDTU, 18/HDDD-NDTU, and 02/HDDD-NDTU). Data and consent records were stored electronically using a REDCap database. Participants received a small reimbursement to compensate for their time.

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Data sharing

The data used for this research, including deidentified participant data and data dictionary, are available from the corresponding author on request.

Author contributions

Tasnim Hasan: manuscript preparation, writing — first draft and editing, data analysis

Pham Ngoc Thach: investigation, project administration, writing — review and editing

Nguyen Thu Anh: supervision, conceptualisation, data curation, writing — review and editing

Le Thi Thu Hien: supervision, data curation, investigation, project administration, writing — review and editing

Nguyen Thi Mai An: investigation, project administration, writing — review and editing

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Brett Toelle: conceptualisation, supervision, data curation, writing — review and editing

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