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Severe Acute Respiratory Syndrome Coronavirus 2 among Asymptomatic Workers Screened for Work Resumption, China

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After the outbreak in Wuhan, China, we assessed 29,299 workers screened for severe acute respiratory syndrome coronavirus 2 by reverse transcription PCR. We noted 18 (0.061%) cases of asymptomatic infection; 13 turned negative within 8.0 days, and 41 close contacts tested negative. Among 6 contacts who had serologic tests, none were positive.

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As the population of Wuhan, China, returns to work, asymptomatic cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are being discovered among workers receiving health checkups for work resumption. Previous studies have shown that asymptomatic cases can be a public health threat and might lead to another outbreak (1,2). However, little is known about the clinical characteristics of asymptomatic infections. We report on cases of asymptomatic SARS-CoV-2 infection among persons during work resumption screening in Wuhan.

At Wuhan Pingan Healthcare Diagnostic Center, we reviewed 29,299 asymptomatic persons who were screened for SARS-CoV-2 by reverse transcription PCR (RT-PCR) and 22,633 asymptomatic persons tested for SARS-CoV-2 antibodies during March 13–April 25, 2020. Throat swab specimens were tested for SARS-CoV-2 by using Real-Time Fluorescent-PCR Kits (DAAN GENE Co., LTD, <https://www.en.daangene.com>; Appendix, <https://wwwnc.cdc.gov/EID/article/28/9/20-1848-App1.pdf>). We used colloidal gold-based immunochromatographic strip assay, Novel Coronavirus (SARS-CoV-2) IgM/IgG Antibody Detection Assay (Vazyme Biotech Co. Ltd., <http://vazyme.bioon.com.cn>) to perform antibody testing (Appendix). We recorded the demographic features, exposure history, RT-PCR and serology results, and imaging reports at the time of testing. We obtained follow-up data from persons screened by telephone.

Among 29,299 persons screened by RT-PCR, we confirmed 18 (0.061%) cases of SARS-CoV-2 infection. Of 22,633 persons tested for SARS-CoV-2 antibodies, 617 (2.7%) cases had positive IgG but negative IgM; 196 (0.87%) cases had positive IgG and IgM; and 40 (0.18%) cases had negative IgG but positive IgM.

The median age of 18 asymptomatic case-patients (10 male, 8 female) was 30.5 years (Table). Six (33.3%) cases had clear contact history with a confirmed case of SARS-CoV-2 infection. The median cycle threshold (C_t) values on the day of first positive RT-PCR were 38.2 (C_t range 37.2–39.3) for ORF1b gene and 38.1 (C_t range 36.81–38.5) for N gene (Table). All antibody tests were obtained on the day of first positive RT-PCR except in 1 case (obtained 6 days later). Half (7/14) the cases had negative IgM and IgG; the other half had positive IgG but negative IgM results (Table). Among 8 case-patients who had computed tomography imaging of the chest, none had remarkable findings. We closely observed the cases for 3–41 (median 16.5) days; 13 cases had negative RT-PCR within a median of 8 (range 3–14) days (Table), and none had symptoms. Among 41 close contacts, all had 2 consecutive negative RT-PCR tests ≥ 24 hours apart.

Among 6 contacts who had serologic tests, none had positive results.

According to Wuhan Municipal Health Commission (3), 275,400 RT-PCR tests were performed for universal screening during April 9–15, 2020. Among those, 182 (0.066%) asymptomatic persons were identified as SARS-CoV-2-positive, which is consistent with our study. Half the cases in our study showed negative IgM and IgG at the time of positive RT-PCR, suggesting recent infections (≤ 14 days). Seven (50%) cases in our study had positive IgG but negative IgM, indicating a late stage infection, 4 of which had a long interval of exposure (30–75 days). In addition, 13 cases had negative RT-PCR assays ≤ 8 (range 3–14) days, suggesting a favorable prognosis for persons with asymptomatic infections.

Epidemiologic, virologic, and modeling evidence support the possibility of SARS-CoV-2 transmission from persons who are presymptomatic (SARS-CoV-2 detected before symptoms onset) or asymptomatic (never develop symptoms) (4). None of the 18 asymptomatic persons in our study developed symptoms.

Recent reports showed that the viral load of SARS-CoV-2 infections in persons with no or mild symptoms was similar to the viral load of symptomatic patients (5,6), which could contribute to rapid transmissions (5). However, other studies demonstrated that asymptomatic patients had a lower viral load than symptomatic and presymptomatic patients (7,8,9), which might indicate less transmissibility from asymptomatic persons. The median cycle threshold values for the 18 cases were 38.2 for ORFa1b gene and 38.1 for the N gene, indicating a relatively low viral load. In addition, all 41 close contacts of the asymptomatic case-patients tested negative by RT-PCR. Possible explanations for this finding include that: the asymptomatic infected persons had relatively low viral load and were less infectious; that asymptomatic persons did not have clinical symptoms, such as sneezing or coughing, that could cause virus spread; and that, due to the strict isolation and preventive measures taken in Wuhan for ≥ 3 months, the population was generally protected from the spread of infection by mask-wearing and self-quarantine.

Table 1. Clinical characteristics of asymptomatic persons with detected severe acute respiratory syndrome coronavirus 2 infection, Wuhan, China*

Age, y/sex	Occupation	Underlying condition	Interval, d†	Exposure source	RT-PCR	C _t ORFa1b	C _t N	Interval, d‡	IgM	IgG	Chest CT	Interval, d§	Follow-up, d
29/M	Office worker	N	70	Family	+, –, –	37	38	5	–	+	Normal	0	41
32/M	Journalist	N	54	Bus passenger	+, +, –	39	38	9	–	+	Normal	0	41
27/M	Journalist	N	NA	Unclear	+, –	35	32	3	–	–	Normal	0	39
31/F	Researcher	N	61	Family	+, –, –, –	36	38	7	–	–	NA	NA	23
27/M	Office worker	N	75	Family	+, –, –, –	33	35	3	–	+	Normal	0	21
32/F	Housewife	N	NA	Unclear	+, –, –	38	37	14	–	–	NA	NA	17
37/F	Office worker	N	22	Family	+, –, –, –	40	39	8	NA	NA	NA	NA	16
57/M	Logistics dispatcher	Asthma	NA	Unclear	+, –, –	39	37	8	NA	NA	Normal	10	16
25/M	Banking	N	NA	Unclear	+, –, –	38	38	8	NA	A	NA	NA	16
26/M	Marketing	N	NA	Unclear	+	39	38	NA	–	–	NA	NA	17
23/M	Marketing	N	NA	Unclear	+, –	38	38	13	–	–	Normal	5	17
26/F	Office worker	N	NA	Unclear	+, –	38	40	14	NA	NA	NA	NA	17
60/F	Cleaner	N	NA	Unclear	+	37	37	NA	–	+	NA	NA	13
65/M	Cleaner	COPD	NA	Unclear	+	39	39	NA	–	–	Normal	0	13
28/F	Office worker	N	NA	Unclear	+	38	39	NA	–	+	NA	NA	8
33/F	Office worker	N	30	Family	+, –	39	37	12	–	+	Normal	0	14
30/F	Office worker	N	NA	Unclear	+, –	39	38	10	–	+	NA	NA	13
62/M	Worker	Hypertension	NA	Unclear	+	39	39	NA	–	–	NA	NA	3

*COPD, chronic obstructive pulmonary disease; CT, computed tomography; C_t ORFa1b, RT-PCR cycle threshold for the ORFa1b gene; C_t N, RT-PCR cycle threshold for the N gene; N, no; NA, not available; +, positive; –, negative.

†Days between last exposure and initial positive RT-PCR.

‡Days between first positive and first negative RT-PCR results

§Days between first positive RT-PCR and CT scan.

Our report has limitations. Our sample size of asymptomatic cases is small, and follow-up was short. Recall bias of exposure history is another limitation; in the absence of clear symptom onset, asymptomatic persons might be less likely to accurately recall exposures than persons with symptoms. Finally, that the study took a place during the post-peak period of the epidemic in Wuhan, so contacts could have been seropositive already; those tested were seronegative, but most contacts did not have serologic testing.

In conclusion, as the population returns to the workplace, asymptomatic SARS-CoV-2-infected persons could be among workers. Although we did not detect transmission among 41 contacts of persons who were SARS-CoV-2-positive, such transmission cannot be excluded. Therefore, continued testing, self-quarantine, and mask-wearing should be encouraged to reduce the risk for additional outbreaks.

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Effects of Proactive Social Distancing on COVID-19 Outbreaks in 58 Cities, China

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Cities across China implemented stringent social distancing measures in early 2020 to curb coronavirus disease outbreaks. We estimated the speed with which these measures contained transmission in cities. A 1-day delay in implementing social distancing resulted in a containment delay of 2.41 (95% CI 0.97–3.86) days.

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Appendix

Reverse Transcription-PCR (RT-PCR) for Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)

We performed real-time fluorescent PCR analysis on ABI 7500 (Thermo Fisher Scientific, <https://www.thermofisher.com>). The throat swab specimens were tested for SARS-CoV-2 by using Real-Time Fluorescent-PCR Kits (DAAN GENE Co., LTD, <https://www.en.daangene.com>). The coincidence rate of negative reference products (−/−) is 10/10 and all are negative; the coincidence rate of positive reference products (+/+) is 5/5.

The coefficient of variation (CV, %) of the precision cycle threshold (C_i) value is $\leq 5.0\%$. The minimum detection amount is $\leq 1 \times 10^3$ copies/mL. We did not detect cross reaction with human coronavirus (HKU1, OC43, NL63 and 229E), SARS coronavirus, MERS coronavirus (HKU1, OC43), other viruses, or human genomic DNA.

Method for SARS-CoV-2 Antibody Assays

We tested for SARS-CoV-2 IgM/IgG antibodies by using colloidal gold-based immunochromatographic strip assay, Novel Coronavirus (SARS-CoV-2) IgM/IgG Antibody Detection Assay (Vazyme Biotech Co. Ltd., <http://vazyme.bioon.com.cn>). The tested specimen (serum/plasma) diffuses upward by capillary force at the loading end and passes

through the marker pad. The SARS-CoV-2 IgM antibody and IgG antibody in the sample combine with the recombinant antigen colloidal gold to form a colloidal gold-labeled antigen-test IgM complex and a colloidal gold-labeled antigen-test IgG complex diffusing into nitrocellulose membrane. The strip includes 3 indicator lines, T1 for IgM, T2 for IgG, and C indicating control.