

Letters

RESEARCH LETTER

Positive RT-PCR Test Results in Patients Recovered From COVID-19

Previous studies on coronavirus disease 2019 (COVID-19) mainly focused on epidemiological, clinical, and radiological features of patients with confirmed infection.¹⁻⁴ Little attention has been paid to the follow-up of recovered patients.

Methods | One hospitalized patient and 3 patients (all medical personnel) quarantined at home with COVID-19 were treated at Zhongnan Hospital of Wuhan University,



Viewpoint pages 1439, and 1441



Related articles pages 1488 and 1499



Audio

Wuhan, China, from January 1, 2020, to February 15, 2020, and evaluated with real-time reverse transcriptase-polymerase chain reaction (RT-PCR) tests for COVID-19 nucleic acid to determine if they could return to work. All the following criteria⁵ had to be met for hospital discharge

or discontinuation of quarantine: (1) normal temperature lasting longer than 3 days, (2) resolved respiratory symptoms, (3) substantially improved acute exudative lesions on chest computed tomography (CT) images, and (4) 2 consecutively negative RT-PCR test results separated by at least 1 day.

The RT-PCR tests were performed on throat swabs following a previously described method.¹ The RT-PCR test kits (BioGerm) were recommended by the Chinese Center for Disease Control and Prevention. The same technician and brand of test kit was used for all RT-PCR testing reported; both internal controls and negative controls were routinely performed with each batch of tests.

Demographic information, laboratory findings, and radiological features were collected from electronic medical records. After recovery, patients and their families were contacted directly, and patients were asked to visit the hospital to collect throat swabs for the RT-PCR tests.

This study was approved by the Zhongnan Hospital of Wuhan University institutional review board and the need for informed consent was waived.

Results | All 4 patients were exposed to the novel 2019 coronavirus through work as medical professionals. Two were male and the age range was 30 to 36 years. Among 3 of the patients, fever, cough, or both occurred at onset. One patient was initially asymptomatic and underwent thin-section CT due to exposure to infected patients. All patients had positive RT-PCR test results and CT imaging showed ground-glass opacification or mixed ground-glass opacification and consolidation. The severity of disease was mild to moderate.

Antiviral treatment (75 mg of oseltamivir taken orally every 12 hours) was provided for the 4 patients. For 3 of the patients, all clinical symptoms and CT imaging abnormalities had resolved. The CT imaging for the fourth patient showed delicate patches of ground-glass opacity. All 4 patients had 2 consecutive negative RT-PCR test results. The time from symptom onset to recovery ranged from 12 to 32 days.

After hospital discharge or discontinuation of quarantine, the patients were asked to continue the quarantine protocol at home for 5 days. The RT-PCR tests were repeated 5 to 13 days later and all were positive. All patients had 3 repeat RT-PCR tests performed over the next 4 to 5 days and all were positive. An additional RT-PCR test was performed using a kit from a different manufacturer and the results were also positive for all patients. The patients continued to be asymptomatic by clinician examination and chest CT findings showed no change from previous images. They did not report contact with any person with respiratory symptoms. No family member was infected.

Discussion | Four patients with COVID-19 who met criteria for hospital discharge or discontinuation of quarantine in China (absence of clinical symptoms and radiological abnormalities and 2 negative RT-PCR test results) had positive RT-PCR test results 5 to 13 days later. These findings suggest that at least a proportion of recovered patients still may be virus carriers. Although no family members were infected, all reported patients were medical professionals and took special care during home quarantine. Current criteria for hospital discharge or discontinuation of quarantine and continued patient management may need to be reevaluated. Although false-negative RT-PCR test results could have occurred as suggested by a previous study,⁶ 2 consecutively negative RT-PCR test results plus evidence from clinical characteristics and chest CT findings suggested that the 4 patients qualified for hospital discharge or discontinuation of quarantine.

The study was limited to a small number of patients with mild or moderate infection. Further studies should follow up patients who are not health care professionals and who have more severe infection after hospital discharge or discontinuation of quarantine. Longitudinal studies on a larger cohort would help to understand the prognosis of the disease.

Lan Lan, MD
Dan Xu, MD
Guangming Ye, MD
Chen Xia, MS
Shaokang Wang, MS
Yirong Li, MD, PhD
Haibo Xu, MD, PhD

Author Affiliations: Department of Radiology, Zhongnan Hospital of Wuhan University, Wuhan, China (Lan, D. Xu, H. Xu); Department of Laboratory

Medicine, Zhongnan Hospital of Wuhan University, Wuhan, China (Ye, Li); Beijing Infervision Technology Co Ltd, Beijing, China (Xia, Wang).

Corresponding Authors: Haibo Xu, MD, PhD, Department of Radiology (xuhaibo1120@hotmail.com), and Yirong Li, MD, PhD, Department of Laboratory Medicine (liyirong838@163.com), Zhongnan Hospital of Wuhan University, Donghu Road, Wuchang District, Wuhan City 430071, Hubei Province, China.

Published Online: February 27, 2020. doi:10.1001/jama.2020.2783

Author Contributions: Drs H. Xu and Li had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Drs Lan and D. Xu contributed equally to the study. Drs H. Xu and Li contributed equally as senior authors.

Concept and design: Lan, D. Xu, Xia, Wang, H. Xu.

Acquisition, analysis, or interpretation of data: Lan, Ye, Wang, Li.

Drafting of the manuscript: Lan, D. Xu, Ye, H. Xu.

Critical revision of the manuscript for important intellectual content: Xia, Wang, Li.

Statistical analysis: D. Xu, H. Xu.

Supervision: Li.

Conflict of Interest Disclosures: None reported.

Funding/Support: This study was supported by grant 81771819 from the National Natural Science Foundation of China and grant 2017YFC0108803 from the National Key Research and Development Plan of China.

Role of the Funder/Sponsor: The study funders/sponsors had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

1. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. Published online February 7, 2020. doi:10.1001/jama.2020.1585
2. Chan JF-W, Yuan S, Kok K-H, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*. 2020;395(10223):514-523. doi:10.1016/S0140-6736(20)30154-9
3. Wei M, Yuan J, Liu Y, Fu T, Yu X, Zhang ZJ. Novel coronavirus infection in hospitalized infants under 1 year of age in China. *JAMA*. Published online February 14, 2020. doi:10.1001/jama.2020.2131
4. Pan F, Ye T, Sun P, et al. Time course of lung changes on chest CT during recovery from 2019 novel coronavirus (COVID-19) pneumonia. *Radiology*. Published online February 13, 2020. doi:10.1148/radiol.2020200370
5. China National Health Commission. Diagnosis and treatment of 2019-nCoV pneumonia in China. In Chinese. Published February 8, 2020. Accessed February 19, 2020. <http://www.nhc.gov.cn/yzygj/s7653p/202002/d4b895337e19445f8d728fcafe3e13a.shtml>
6. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for typical 2019-nCoV pneumonia: relationship to negative RT-PCR testing. *Radiology*. Published online February 12, 2020. doi:10.1148/radiol.2020200343

Characteristics of Faculty Accused of Academic Sexual Misconduct in the Biomedical and Health Sciences

Despite protections mandated in educational environments, unwanted sexual behaviors have been reported in medical training.¹⁻⁴ Policies to combat such behaviors need to be based on better understanding of the perpetrators. We characterized faculty accused of sexual misconduct resulting in institutional or legal actions that proved or supported guilt at US higher education institutions in the biomedical and health sciences.

Methods | Given the nonpublic nature of most Title IX investigations, we performed internet searches after consultation with biomedical informatics experts to identify faculty

accused of academic sexual misconduct. We searched *sexual misconduct*, *sexual harassment*, *rape*, *sexual discrimination*, and *sexual assault* followed by AND (*instructor OR professor OR dean*) AND (*college OR medical school OR university OR Title IX*) AND (*medicine OR physician OR health science OR health services OR nurse OR dentist OR psychologist OR pharmacist OR researcher*) in Google and FindLaw, a publicly accessible database of federal and state court decisions. The top 500-ranked search results excluding sponsored content were reviewed between November 2018 and April 2019.

To identify less prominent events, Google searches were repeated with the inclusion of individual states and the District of Columbia. Additional cases were identified through the Academic Sexual Misconduct Database, a continuously updated data set of academic sexual misconduct abstracted from publicly available documents and media reports.⁵ Both authors independently performed Google, Google News, and FindLaw searches of the accused faculty's name to abstract characteristics and targets, institutional actions, and outcomes between April 2019 and July 2019, with an update in January 2020. Discrepancies were resolved by discussion between the authors.

The search results included public social profiles, institution websites, news reports, journal websites, and clinician board websites. The authors categorized the misconduct into assault (unwanted or nonconsensual sexual contact), harassment (sexual discrimination including oral, written, or physical behavior), consensual relationships, and exploitation (taking nonconsensual or abusive sexual advantage of other persons including voyeurism or distributing sexual information). Searches were not restricted to any time period. The study was exempt from institutional review board review under federal regulation because the data were publicly available.

Results | We identified 125 faculty accused of sexual misconduct between 1982 and 2019 and affecting at least 1668 targets. Faculty were from a variety of disciplines and institution types, with 33.6% located at a *US News & World Report* top 50-ranked college or university. Of accused faculty, 97.6% were male and 91.5% targeted only females (Table); 72% of perpetrators targeted subordinates and 19.2% targeted clinical trainees. Half (51.2%) of perpetrators were full professors and 16.8% were department chairs, directors, or deans.

Sexual assault was committed by 29.6% and sexual harassment by 56%. Recurring inappropriate behaviors were exhibited by 87.2% of perpetrators, spanning years (median, 2 years; interquartile range, 1-7.5 years) and involving multiple targets (median, 2 targets; interquartile range, 1-4 targets). Of accused faculty, 49.2% resigned or retired, 20.8% were terminated, and 8.8% were sanctioned by funding sources or boards governing clinical practice. We identified 50 accused faculty who remained in academia, of whom 40% held positions at a different teaching institution. Of the 50 faculty who remained in academia, 6 had been terminated by the first institution, 15 had resigned or retired, and the remaining had faced sanctions or were disciplined.