Changes in hospitalizations for respiratory diseases following the COVID-19 epidemic

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To the Editor: During the ongoing coronavirus disease 2019 (COVID-19) pandemic, hundreds of millions of people have been infected. The prevention and control measures guided by the Chinese government, including the wearing of face masks, maintaining hand hygiene, reducing gatherings, and physical distancing, have become commonplace across China. The protective measures have been confirmed to reduce the risk of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. In addition to COVID-19, other respiratory infectious diseases, such as viral pneumonia and bacterial pneumonia, remain a threat to inpatients. Whether the pandemic and associated protective measures have impacted the spectrum of respiratory diseases in inpatients in pulmonary and critical care medicine (PCCM) departments remains unclear.

This study evaluated the influence of protective measures against COVID-19 on the spectrum of other respiratory diseases in the PCCM inpatients. This was a single-center, observational study. We analyzed information from patients admitted to the PCCM Department of Sichuan University, West China Hospital (one of the largest 3A general hospitals in Western China) within 1 year before and following the COVID-19 outbreak. For the patient cohorts, young patients refer to those aged 18–44 years, middle-aged patients refer to those aged 45–59 years, older patients refer to those aged 60–74 years, and elderly patients refer to those aged 75–89 years. The longevity group included those over 90 years. This study was divided into two stages: January to December 2019 (the year preceding the COVID-19 outbreak) and January to December 2020 (the year following the COVID-19 outbreak).

We analyzed the main discharge diagnosis for multiple groups of patients: pulmonary infectious diseases, acute exacerbation of chronic obstructive pulmonary disease (AECOPD), bronchiectasis, asthma, pulmonary embolism, pulmonary hypertension, sarcoidosis, thoracic vascular malformation, interstitial lung disease, pneumothorax, chest malignant tumor, extrapulmonary diseases, and rare pulmonary diseases. The etiology of pulmonary infectious diseases was also analyzed. Viral pneumonia was recorded with the specific virus type. The methods used to confirm virus type in cases of viral pneumonia were nucleic acid testing for Epstein Barr virus and cytomegalovirus, and metagenomic next-generation sequencing of sputum and bronchoalveolar lavage fluid. Bacterial pneumonia is a clinical diagnosis, and there were no records of the specific bacteria. Epidemiological and demographic data, the discharge diagnosis as recorded by the 10th edition of the International Classification of Diseases, and the respiratory tract microbiological examination results were obtained from the electronic medical records of West China Hospital. All data were confirmed by two clinicians, one medical record administrator, and one information administrator.

The measurement data are presented as means and standard deviations. The differences in patient demographic characteristics between the two groups were compared using Student's t tests. The proportions of each respiratory disease in the total patient cohort are expressed as percentages (%). Differences in the percentage of each respiratory disease between the two groups were compared using the Chi-squared test or Fisher's exact test. The statistical analyses were performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). The annual trends of each respiratory disease are presented as the monthly patient number.

From January 2019 to December 2020, a total of 15,175 patients were included in this study, with an average patient age of 59 years (range: 12–98 years). Thoracic malignant tumors were the most common disease,

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followed by thoracic infectious diseases. The demographic data of the two groups were of no statistical differences (all $P > 0.05$). Following the COVID-19 outbreak, the proportion of thoracic malignant tumors increased from 46.4% (3596/7746) to 49.1% (3648/7429), and the proportion of young patients and elderly patients decreased.

Following the COVID-19 outbreak, the proportion of pulmonary infectious diseases decreased from 25.0% (1936/7746) to 21.4% (1590/7429), the number of influenza A pneumonia (H1N1) cases decreased from 122 to 2, the number of influenza A pneumonia (H3N2) cases decreased from 16 to 2, the number of influenza B pneumonia cases decreased from 9 to 4, and the number of adenovirus pneumonia cases decreased from 6 to 0. Deaths from influenza pneumonia decreased from 13 to 1. The proportion of bacterial pneumonia cases decreased from 9.1% (708/7746) to 7.8% (578/7429). Pulmonary fungal infections, especially *Aspergillus* and *Mucor* infection, showed a downward trend, but it was not statistically significant. There was no significant change in the proportion of tuberculosis (TB) patients. The proportion of hospitalized patients with AECOPD was significantly decreased following the COVID-19 outbreak (5.4% *vs.* 6.8%, $\chi^2 = 13.280$, $P < 0.001$). There was no change in the proportion of patients with bronchiectasis, but the proportion of patients with bronchiectasis complicated with infection decreased (1.5% *vs.* 2.1%, $\chi^2 = 5.448$, $P = 0.020$). The proportion of hospitalized patients with other noninfectious pulmonary diseases did not change, except for interstitial lung disease (4.2% *vs.* 5.1%, $\chi^2 = 6.510$, $P = 0.011$) [Supplementary Table 1, http://links.lww.com/CM9/A831].

The annual trends of each respiratory disease were as follows. The number of influenza pneumonia cases was decreased in all months following the COVID-19 outbreak [Supplementary Figure 1A, http://links.lww.com/CM9/A830]. In 2020, the number of hospitalized patients with pulmonary *Aspergillosis* was lower than that in 2019, except in June, July, and August [Supplementary Figure 1B, http://links.lww.com/CM9/A830]. There was no downward trend in the number of hospitalized patients with chest TB infection [Supplementary Figure 1C, http://links.lww.com/CM9/A830]. In 2020, the number of hospitalized patients with AECOPD was lower than that in 2019, except in June and July [Supplementary Figure 1D, http://links.lww.com/CM9/A830]. The number of hospitalized patients with bronchiectasis in 2020 was also decreased, except in August [Supplementary Figure 1E, http://links.lww.com/CM9/A830]. The incidence of infectious pulmonary diseases significantly decreased following the COVID-19 outbreak, especially for influenza pneumonia and bacterial pneumonia [Supplementary Figures 1A and 1F, http://links.lww.com/CM9/A830].

Respiratory tract infections can be caused by a wide variety of bacteria and viruses. Viral pneumonia is mainly transmitted by close contact and through the air. Airborne transmission via droplets and aerosols enables some of these viruses to spread efficiently among humans, causing outbreaks that are difficult to control. Wearing a face mask can block or filter airborne virus-carrying particles by intercepting these particles at the mask surface.

Transmission modeling analysis has shown that the population-wide use of face masks could make an important contribution to delaying an influenza pandemic. Mask use also reduces the viral reproduction number, possibly to levels sufficient for containing an influenza outbreak, and it also increases the odds of preventing SARS-CoV-2 transmission.[1] A cluster randomized trial confirmed that nonpharmaceutical interventions (NPIs), namely, the use of face masks and intensified hand hygiene, can prevent household transmission of influenza.[2] A multicenter randomized clinical study of outpatient health care personnel wearing either N95 respirators or medical masks found no significant difference in the incidence of laboratory-confirmed influenza.[3] The role of different types of masks in nonmedical settings has not been evaluated, although many countries recommend nonmedical masks or surgical masks for the community.

NPIs can reduce the spread of viral respiratory diseases, but no study has confirmed whether NPIs can slow the acute exacerbation of COPD and bacterial infection in patients with bronchiectasis. Considering the tolerance of COPD patients, one study recommended that patients with COPD who have a modified Medical Research Council dyspnea scale score ≥3 or forced expiratory volume in one second (FEV_1) <30% predicted should wear an N95 filtering facepiece respirator.[4]

Wu *et al*[5] reported a significant decline in TB detection during the COVID-19 pandemic (from March 27 to May 28, 2020), but they indicated that this may have been due to a reduction in people seeking health care because of the insufficient and delayed provision of TB services. We believe that the prevention and treatment of TB require more focused and professional measures. COVID-19 protective measures alone, such as wearing face masks and maintaining hand hygiene, cannot effectively reduce TB morbidity. Thus, the current study found no change in the proportion of TB in hospitalized patients.

The main limitations of the current study are the single-center study design and the limited number of patients. A multicenter study with a larger sample size is needed for further evaluation. In the post-COVID-19 era, we should maintain these beneficial lifestyle factors, such as maintaining proper hand hygiene, social distancing, and wearing face masks, especially in areas where people gather and in groups who have a high risk of infection. These measures are expected to reduce the incidence of respiratory infectious diseases, especially viral pneumonia, bacterial pneumonia, and AECOPD.

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Conflicts of interest

None.

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