



The Effect of the COVID-19 Pandemic on Pulmonary Diagnostic Procedures

To the Editor:

Pulmonary diagnostic procedures have been dramatically affected by the coronavirus disease (COVID-19) pandemic, as many have been believed to have high infectious transmission risk. This potential risk made many pulmonary function laboratories either shut down or reduce testing to minimal in fear of causing viral spread in the early months of the pandemic, beginning in March 2020 in the United States. This effect of deferring “elective” pulmonary diagnostic testing for acute and chronic pulmonary conditions may not be felt in the short term, but long-term effects are not known (1). The concern is that this could lead to suboptimal care and inferior long-term outcomes of chronic respiratory conditions (2). At the onset of the pandemic in March 2020, infectious disease and public health experts attempted to develop models for predicting how long this period of reduced testing would occur. A few initial models projected that reduced testing across all medical specialties would need to continue for another 6–18 months to help prevent subsequent waves of COVID-19 infections (3, 4). A year later, as of April 2021, during the rise in vaccination rates and increased knowledge of COVID-19 transmission, it remains unknown whether the amount of pulmonary diagnostic testing specifically would be trending back toward prepandemic numbers. The purpose of this study is to provide a brief overview of trends regarding the total number of pulmonary diagnostic tests performed throughout 2020 and into 2021 as compared with 2019.

Methods

This was a multicenter retrospective cohort study from 50 institutions using data from the National COVID Cohort Collaboration (N3C). This database includes all patients with complete data ($n = 4,960,128$) seen at 50 institutions across the United States between January 1, 2019, and March 31, 2021. This study was approved by the Mayo Clinic Institutional Review Board (#21-004454) and the N3C Data Access Committee (RP-30DBD1). This study was provided full data access (level 3) in N3C.

Daily unique counts of different pulmonary diagnostic procedures, which included pulmonary function tests (complete pulmonary function tests and spirometries) (PFTs), bronchoscopies (flexible bronchoscopies, biopsies, and rigid bronchoscopies), cardiopulmonary exercise tests (CPETs), and ambulatory exercise testing (6-minute-walk tests and oxygen titration tests), were obtained. Data were displayed as monthly totals and analyzed by viewing overall trends of monthly totals. Differences in totals at

notable time points were then compared by calculating a percentage change.

Results

Monthly totals of PFTs, bronchoscopies, CPETs, and ambulatory exercise tests as compared with time are shown in Figure 1. Each graph shows the prepandemic monthly totals trend from 2019 into 2020, a sharp decrease starting in March 2020, a rebound increase afterward 3 months later, and trends into 2021.

PFTs peaked at 13,305 tests in January 2020 and dropped to the lowest in April 2020 at 1,561 tests, an 88.2% decrease. PFTs rebounded to total 10,806 in October 2020 and then trended slightly downward to 9,442 being performed in March 2021, similar to prepandemic amounts.

Bronchoscopy totals steadily increased throughout 2019, peaking at 3,303 in January 2020. There was a decrease to 2,304 in April 2020, a 30.2% decrease. Bronchoscopic procedures rebounded to a total of 3,605 in July 2020 and have remained higher than in 2019.

Ambulatory exercise tests increased into 2020, peaking at 1,948 tests in January 2020 (prepandemic) and decreasing to 307 in April 2020, an 84.2% decrease. Exercise testing rebounded to a total of 1,815 in October 2020 and has remained elevated with 1,670 tests being performed in March 2021.

CPETs peaked at 414 tests in January 2020 and dropped to 81 in April 2020, an 80.4% decrease. CPETs rebounded to total 647 in October 2020 and then remained higher than before the pandemic.

Discussion

In viewing the overall trends for the United States, after trending upward into 2020, all four testing modalities took a sharp drop in testing numbers starting in March 2020, with the lowest testing numbers in April 2020. This corresponded to the height of the pandemic lockdowns in the United States to try and mitigate viral spread. The greatest decrease was in PFT numbers, likely because of the potential concerns of viral transmission of this testing modality. This dramatic drop could also highlight that PFTs, for the purposes of measuring disease severity, could be viewed as less critical in patient management than other diagnostic procedures. All procedures then rebounded back upward at different points later in 2020, but within a few months, which is likely the result of different facilities developing safety measures to resume testing at different time points.

Interestingly, bronchoscopies showed the smallest decline throughout 2020. The other procedures can be subcategorized into studies focused on evaluating disease severity, whereas a bronchoscopy procedure is generally performed for diagnostic purposes. Thus, bronchoscopies could have continued or simply been delayed to later months while the other procedures were postponed or cancelled all together. Also, bronchoscopies are performed in a more controlled environment, which also facilitated continuation during the pandemic. Although the database does not clarify inpatient or outpatient performance location or infection status, one explanation is that this increase could be due to diagnostic bronchoscopies in patients with critical respiratory illnesses from COVID-19. A few centers have published reports highlighting the need for bronchoscopy to diagnose superimposed infections in critically ill patients with

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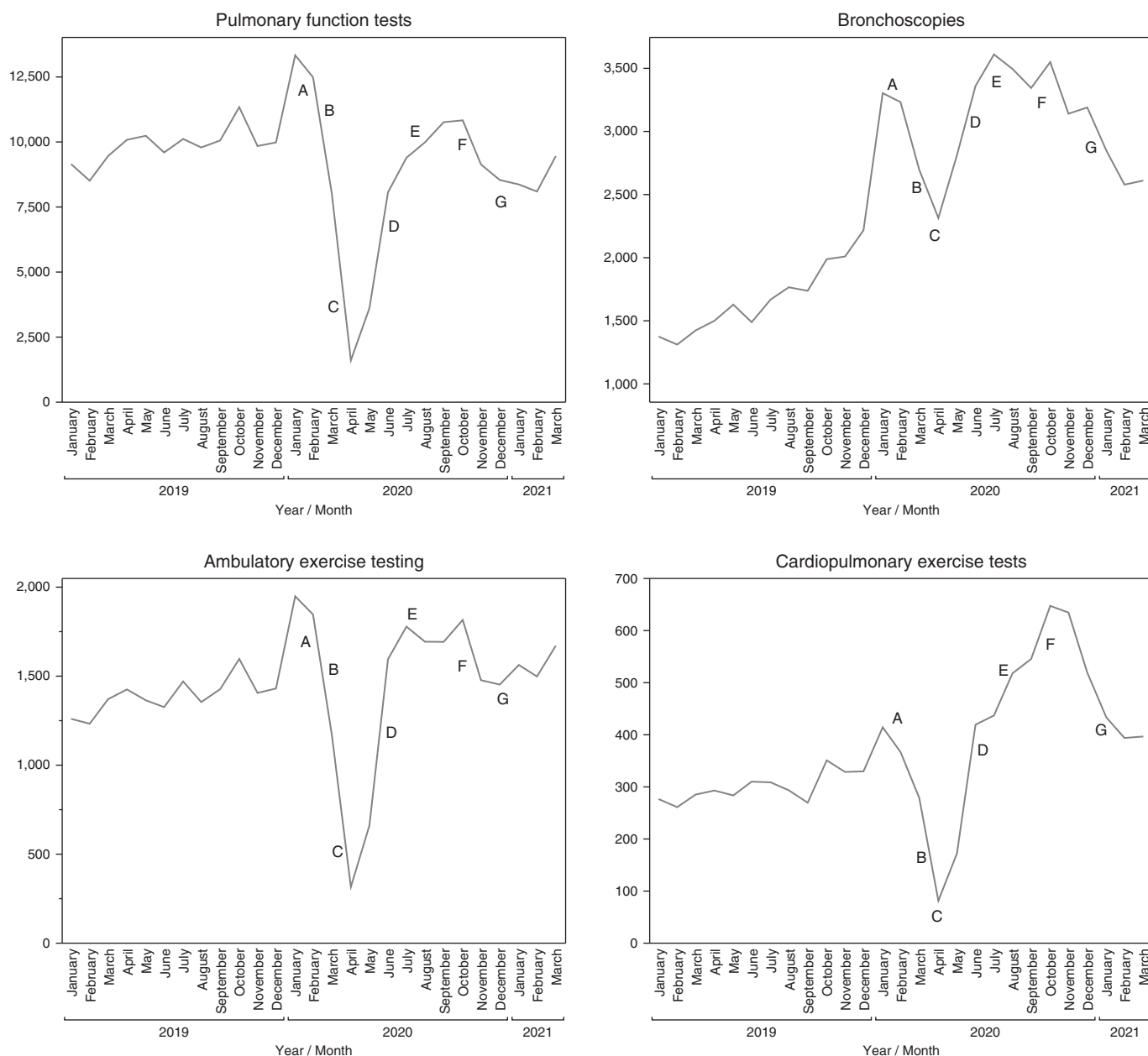


Figure 1. Figure showing the trend of pulmonary diagnostic testing (pulmonary function tests; bronchoscopies, both flexible and rigid; ambulatory exercise testing [6-minute-walk and oxygen titration tests]; and cardiopulmonary exercise tests) from January 2019 to March 2021. Letters show important time points during the pandemic. A: January 31, the World Health Organization (WHO) issues a global health emergency. B: March 11, WHO declares coronavirus disease (COVID-19) a pandemic. C: March 19, the first U.S. states issue stay-at-home orders. D: June 10, U.S. COVID-19 cases reach 2 million. E: July 9, WHO announces airborne transmission of COVID-19. F: October 19, global cases of COVID-19 reach 40 million. G: December 14, the first COVID-19 vaccination was administered.

COVID-19 (5, 6). As the pandemic unfolded and intensive care units treated more cases of COVID-19, the number of bronchoscopies could reflect that rise as well.

Ambulatory exercise tests and CPETs both had higher-than-prepandemic testing numbers as the pandemic progressed. A similar explanation to bronchoscopies could be the reason CPETs increased after this low point, but it could also be because of prolonged symptoms after a COVID-19 infection. Around the peak of CPETs in

October 2020, there was debate that cardiopulmonary exercise testing was crucial during the postinfection phase of COVID-19 for preoperative evaluation (7). It has also been suggested that cardiopulmonary testing might be helpful in the interpretation of impaired pulmonary function in patients who recovered from COVID-19 (8). This could explain the dramatic increase in CPETs toward the latter end of 2020 and into 2021, which then returned to prepandemic baseline by March 2021. However, this speculation is

limited as the N3C data did not clarify COVID-19 infection history in those undergoing CPETs.

This study is limited by its lack of data on inpatient versus outpatient status for these tests and the lack of data on COVID-19 infection status for the included sites. However, these would not change overall test numbers. This study also did not evaluate clinical outcomes affected by this reduced testing, an important area for future study. As such, this study opens the door for many speculations as we continue analyzing trends of subsequent waves of COVID-19 infections and variants. These data and subsequent studies based on similar trends may inform the necessity of performing these tests as future studies explore correlations to clinical outcomes of pulmonary disease. ■

Author disclosures are available with the text of this letter at www.atsjournals.org.

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External Validation of a Risk Score for Daily Prediction of Atrial Fibrillation among Critically Ill Patients with Sepsis

To the Editor:

Atrial fibrillation (AF) occurs frequently among patients with sepsis (1–3) and is associated with short- and long-term morbidity

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and mortality (1, 4). Predicting which patients will develop AF during sepsis can enrich trials that seek to study and prevent AF in critical illness and may aid management decisions for clinicians. One prior risk score has been developed to predict new-onset AF among critically ill patients with sepsis (5), but this has not been validated outside of the original publication. We sought to externally validate performance of AF prediction in a cohort of critically ill patients with sepsis.

Methods

The transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD) checklist was used to design and conduct this study (6). We used the Medical Information Mart for Intensive Care III data set (7), which consists of data from ~60,000 intensive care unit (ICU) admissions at a single U.S. tertiary-care hospital. We identified adult patients (≥ 18 yr) admitted to the ICU with sepsis. Sepsis was defined by an *International Classification*