

## Occupational Spirometry and Fit Testing in the COVID-19 Era:

Updated Recommendations from the American College of Occupational and Environmental Medicine

*Philip Harber, MD, MPH, FACOEM, ATSF; Michael J. Levine, MD, MPH, FACOEM; and Mary C. Townsend, DrPH*

On March 16, 2020, due to the national outbreak of coronavirus disease (COVID-19), the American College of Occupational and Environmental Medicine (ACOEM) recommended that routine spirometry be postponed until further notice. On April 16, 2020, the U.S. Occupational Safety and Health Administration (OSHA) issued an Enforcement Memo, instructing its inspectors to avoid citing or fining employers who made good-faith efforts to obtain spirometry tests. However, occupational health clinics increasingly encounter situations where a spirometry test and/or fit testing must be conducted.

The challenge presented to clinics when patients are infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is unprecedented. SARS-CoV-2 is a highly contagious virus that can be transmitted by persons with COVID-19, whether they are symptomatic or asymptomatic. Since spirometry creates significant amounts of droplets and aerosols, steps must be taken to minimize the risk of infection to patients and staff during testing. In addition, in many parts of the U.S., infection rates are once again rising. Clinicians need to be concerned about their patients and staff and for the community and family members with whom staff and patients have contact. Some health care providers have similar concerns about the safety of performing respirator fit testing.

To address these challenges, ACOEM is providing the following updated guidance on how to safely conduct spirometry and fit testing in the COVID-19 era.

### SPIROMETRY TESTING

#### 1) The Patient

- a. **Assess the need for testing:** Base the decision to test or defer on several considerations: 1) does risk to patient and staff outweigh the risk to the patient of deferring testing; 2) is testing required by a government or employer standard? (Enforcement memo defers OSHA-mandated spirometry testing as long as the employer makes a good-faith effort to obtain the tests. Affected standards are listed in the Appendix); and 3) if baseline test is required to qualify a new employee, can this information be obtained from other sources?
  - *Routine periodic surveillance testing:* In general, such testing should be delayed until the prevalence of COVID-19 disease in the community is very low and extensive exposure control in the testing facility has been instituted. **OSHA has provided an enforcement memo supporting the deferral of such testing for an indefinite time.**<sup>1</sup> ACOEM has also issued a statement supporting this view.<sup>2</sup>
  - *New patient testing:* The occupational physician should use expert judgment to determine if there is a bona fide reason to conduct the testing at this time or if it may be delayed.
  - *Clinical diagnostic testing:* In some cases, necessary tests can be referred to a pulmonary function testing (PFT) lab, where testing can be done in a more controlled setting.
- b. **Communicate with patients, employers, and other clinicians** about the appropriateness of testing. Occupational physicians should discuss which testing is needed at this time and which may be appropriately deferred. Physicians should work jointly with employers and/or regulatory agencies to explain the necessity.
- c. **Prescreen patients to detect those who are infected, symptomatic, and capable of transmitting disease**
  - Patients must be screened with a questionnaire and temperature check on day of testing. The questionnaire should elicit any history of exposure to COVID-19 within the past 2 weeks, exhibiting any COVID-19 symptoms, and/or recent travel to high-risk areas. If positive, a spirometry test should not be performed, but rescheduled.
  - Passing the pre-screening test does not indicate that a patient is not infected. The patient may be infected but asymptomatic or pre-symptomatic and able to infect others.
  - With future improvements in speed, availability, and accuracy in ruling out SARS-CoV-2 infection, nucleotide amplification assay tests (NAATs) or other antigen tests may become a practical screening method. This is currently not the case.

## 2) The Facility

- a. **Testing Room Ventilation:** Assuring proper ventilation and negative pressure in the room is critically important. Testing should be performed in a well-ventilated room, preferably one which meets standards for airborne infection isolation rooms (AIIRs). Air should flow from clean to potentially contaminated areas (negative pressure) and exhaust from the room to outside, or through filters capable of capturing droplets and aerosols, such as high efficiency particulate air (HEPA) filters. The American Institute of Architecture recommends 12 air changes per hour.<sup>4</sup> Negative pressure may be achieved by modifying the balance of source and return air in the HVAC system. Such adjustments may require consultation with engineering or ventilation professionals. ASHRAE also suggests consideration of effective free-standing filtration units in a closed space.
- b. **Outdoor testing:** If portable spirometers are used, testing may be performed outdoors if sheltered from the wind. However, strong background air motion may interfere with accurate setting of the zero-flow baseline. Use of a tent, shelter, or mobile testing van can be considered.
- c. **Dedicated room:** Whenever possible, the room should be dedicated to spirometry testing and not used for other purposes. Some facilities have converted bathrooms with commercial exhaust fans into negative pressure spirometry rooms. For many facilities, this may not be an option, particularly in the short term.

3) **Scheduling** – If a spirometry test is necessary (e.g., mandatory pre-placement exams for firefighters), appropriate arrangements should be made, such as testing the subject at the end of the day to allowing adequate time for ventilation, and then disinfecting the room and leaving it unoccupied overnight.

## 4) Procedural Changes

- a. **Social Distancing** must be performed at all times. It is particularly important to maintain distance between the technician and the patient. Physical positioning should be carefully planned to keep a technician out of the direct plume of exhaled air.
- b. **Staff PPE:** Staff performing the testing should use adequate respiratory protection (fit-tested N95 or higher level of filter efficiency, or PAPR). They should use disposable gloves and wash hands thoroughly before and after each test. Staff should also use a face shield or eye protection.
- c. **Limited Use of Testing Room:** Only the patient to be tested and the technician should be present in the room. If, as is often the case, clinic rooms are multi-purpose with many patients and staff members moving in and out of them, testing should be restricted to the end of the day so that the test subject and the technician are the last people to use the room for the day. After the test is completed, the room should remain unused for 30 minutes to allow ventilation to occur, and then be thoroughly cleaned and disinfected.
- d. **Spirometer BVF Filters:** A spirometer that has a high-efficiency in-line bacterial and viral filter (BVF) should be used. The filters should be purchased from the spirometer manufacturer. These filters are single use and are discarded after use by each patient.
- e. **Spirometer Accuracy:** The in-line microbial filter must not interfere with the accuracy or precision of the spirometer. Therefore, only spirometers with filters that are routinely used with the spirometer and have passed validation testing with the filter in place should be employed. Many spirometers currently used in occupational settings may not be adequate to prevent cross-contamination with SARS-CoV-2. If a generic filter is placed on one of those mouthpiece/sensors, it may affect the measurement accuracy.<sup>7</sup>
- f. **Test Procedures:** To ensure accurate results, it is critical that patients receive careful instructions involving the testing procedures. It is even more essential that these safety procedures be followed during the pandemic. To protect the patient as much as possible from inhaling any virus particles in the room, they should wear nose clips and inhale maximally through the filter. Then, keeping the filter in their mouth, they should forcefully exhale through the filter, so that any virus particles in their lungs will not be blasted into the testing space. In most cases, the spirometer can be configured for the usual testing protocol that is performed at the clinic,<sup>6</sup> even if inhalation through the sensor is added. Patients should wear a mask in between maneuvers. Manufacturer instructions for cleaning the sensors during COVID-19 must be followed.

- 5) **Consistency with Other Clinical Practice Recommendations** – Policies for spirometry testing should be consistent with other clinical policies of the institution. These include matters such as regular testing and monitoring of health care workers, limited access to the facility, maintaining a log of all persons entering and exiting, etc.
- 6) **Technician Certification** – Under multiple standards, the person performing the testing should have successfully passed a course approved by the National Institute for Occupational Safety and Health (NIOSH) and maintain a valid certificate of course completion. NIOSH has issued a statement extending certificates expiring in 2019-2020 years.<sup>5</sup> Many NIOSH-approved courses have been postponed pending further notice.<sup>5</sup> And, OSHA's enforcement memo indicates that if employers try to register their staff for a postponed NIOSH-approved course, they will not be cited or fined during the pandemic.<sup>1</sup>

## FIT TESTING

Fit testing of workers newly assigned to respirator use is required by OSHA and should proceed since fit-testing is needed to assure adequate respiratory protection. Fit testing should also be performed when: a) the type of respirator changes; b) the user experienced difficulty with use; c) weight loss or illness has occurred that may affect fit. However, where limited capacity for fit testing exists, OSHA recommends employers prioritize use of fit-testing equipment to protect employees who must use respirators for high-hazard procedures.<sup>9</sup>

In other situations, the following is recommended:

- 1) Periodic fit testing can be deferred if an individual has been previously fitted for the current respirator and facial fit characteristics are unchanged. It may also be deferred if previously fitted with a respirator that the manufacturer says is a similar model with comparable fit.
- 2) Many respirators are equipped with exhalation valves. These reduce resistance to exhalation and improve comfort, but provide no filtration of droplets or aerosols in the exhaled air. As with spirometry, fit testing should only be performed in a room with suitable ventilation. If this is unavailable, fit testing can also be conducted out of doors in a shelter, tent, or mobile testing van.
- 3) Fit testing is often performed in industrial worksites. Limited testing could be performed in areas – e.g., a warehouse – where few people are present and there is a large volume of air that can provide suitable dilution.
- 4) Technicians performing fit testing should wear gloves, a fit-tested N95 or higher level of filter efficiency, or PAPR respirator, and eye protection or face shield.
- 5) Fit-testing hoods, adapters required for quantitative fit testing equipment, and shared elastomeric respirators, if used, should be disinfected per manufacturer recommendations, and allowed to dry thoroughly between uses. This may require purchase of additional equipment to avoid delay between tests.
- 6) As with spirometry, attention must be paid to cleaning and disinfection of fixed surfaces subject to contamination.
- 7) While agents used in qualitative fit testing are usually available, it has been reported that Bitrex™ and saccharin solutions are presently in short supply.<sup>9</sup> If solutions are unavailable from the usual suppliers, a compounding pharmacy can prepare solutions, or it can be done at the clinic if suitably equipped. NIOSH recently posted step by step instructions on its website.<sup>10</sup> OSHA also provides formulae for mixing threshold check solutions and fit test solutions in Appendix A to §1910.134 (Fit Testing Procedures).

## SUMMARY

As the U.S. gradually reopens its workplaces, this guidance will provide clinicians and managers with information on how to safely resume spirometry and respirator fit testing in situations where it is necessary. **If testing is essential, implementation of the measures outlined in this document will minimize risk to patients and health care personnel.** Occupational medical specialists should also regularly assess local COVID-19 incidence rates as well as governmental recommendations and mandates when making decisions regarding the safe resumption of spirometry and respirator fit testing.

## References

1. Occupational Safety & Health Administration. Enforcement Memos: Discretion in Enforcement when Considering an Employer's Good Faith Efforts during the Coronavirus Disease 2019 (COVID-19) Pandemic. April 16, 2020. Available at: <https://www.osha.gov/memos/2020-04-16/discretion-enforcement-when-considering-employers-good-faith-efforts-during> Last accessed 06-25-2020.
2. American College of Occupational and Environmental Medicine. News. *ACOEM Advises Suspension of Routine Occupational Spirometry Testing During COVID-19 Pandemic*. March 16, 2020. Available at: <https://acoem.org/News/Press-Releases/ACOEM-Advises-Suspension-of-Routine-Occupational-Spirometry-Testing-During-COVID-19-Pandemic>.
3. American Thoracic Society. Disease Related Resources: Pulmonary Function Laboratories. *Advice Regarding COVID-19*. March 18, 2020. Available at: <https://www.thoracic.org/professionals/clinical-resources/disease-related-resources/pulmonary-function-laboratories.php> Last accessed 06-25-2020.
4. Minnesota Department of Health. *Airborne Infectious Disease Management Methods for Temporary Negative Pressure Isolation*. 2007. Available at: <https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf>.
5. NIOSH. Spirometry Training Program. Website: <https://www.cdc.gov/niosh/topics/spirometry/training.html>
6. Townsend M. ACOEM Guidance Statement. Spirometry in occupational health—2020. *J Occup Environ Med*. 2020;62(5):e208-e230. Available at: [https://journals.lww.com/joem/Fulltext/2020/05000/Spirometry\\_in\\_Occupational\\_Health\\_2020.15.aspx](https://journals.lww.com/joem/Fulltext/2020/05000/Spirometry_in_Occupational_Health_2020.15.aspx).
7. European Respiratory Society. Recommendation from ERS Group 9.1 (Respiratory function technologists/Scientists) Lung function testing during COVID-19 pandemic and beyond. 2020. Available at: <https://ers.app.box.com/s/zs1uu88wy51monr0ewd990itoz4tsn2h>.
8. OSHA. Personal Protective Equipment; Fit Testing Procedures. Appendix A to § 1910.134: Fit Testing Procedures (Mandatory). Available at: [https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=9780&p\\_table=STANDARDS](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9780&p_table=STANDARDS).
9. OSHA. Enforcement Memo. Expanded Temporary Enforcement Guidance on Respiratory Protection Fit-Testing for N95 Filtering Facepieces in All Industries During the Coronavirus Disease 2019 (COVID-19) Pandemic. April 8, 2020. Available at: <https://www.osha.gov/memos/2020-04-08/expanded-temporary-enforcement-guidance-respiratory-protection-fit-testing-n95>.
10. CDC. National Personal Protective Technology Laboratory. Preparing Solutions for Qualitative Fit Testing from Available Chemicals. Updated June 16, 2020. Available at: <https://www.cdc.gov/niosh/npptl/QualitativeFitTesting.html>.

ACKNOWLEDGEMENTS: Stacey E. Sanders, RN, COHN-S, Black Hills Occupational Medicine, Damir Mazlagic, MD, MPH, Southcoast Health, and Julie O'Neil, RN, BSN, WVU Medicine, for their creative ideas about solutions for spirometry testing.

**Appendix – OSHA Standards Requiring Spirometry**

Substance/Subject	Federal or Consensus Standard	Websites
Asbestos – General Industry	1910.1001(l)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1001">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1001</a>
Asbestos -- Construction	1926.1101(m)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1101">https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1101</a>
Asbestos – Maritime	1915.1001(m)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1915/1915.1001">https://www.osha.gov/laws-regs/regulations/standardnumber/1915/1915.1001</a>
Benzene	1910.1028(i); 1926.1128; 1915.1028	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1028">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1028</a>
Beryllium – General Industry	1910.1024(k)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1024">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1024</a>
Beryllium – Construction	1926.1124(k)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1124">https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1124</a>
Beryllium – Maritime	1915.1024(k)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1915/1915.1024">https://www.osha.gov/laws-regs/regulations/standardnumber/1915/1915.1024</a>
Cadmium	1910.1027(l); 1926.1127; 1915.1027; 1928.1027	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1027">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1027</a>
Coke Oven	1910.1029(j)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1029">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1029</a>
Cotton Dust	1910.1043(h)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1043">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1043</a>
Formaldehyde	1910.1048(l); 1926.1148; 1915.1048	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1048">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1048</a>
Silica – General Industry, Maritime	1910.1053(j)	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1053">https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1053</a>
Silica – Construction	1926.1153	<a href="https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1153">https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1153</a>
Standard on Comprehensive Occupational Medical Program for Fire Departments	NFPA-1582	<a href="https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1582">https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1582</a>