

# Pulmonary Function Testing in the COVID-19 Pandemic

Katrina Hynes, MHA, RRT, RPFT

# Disclosure to Learners

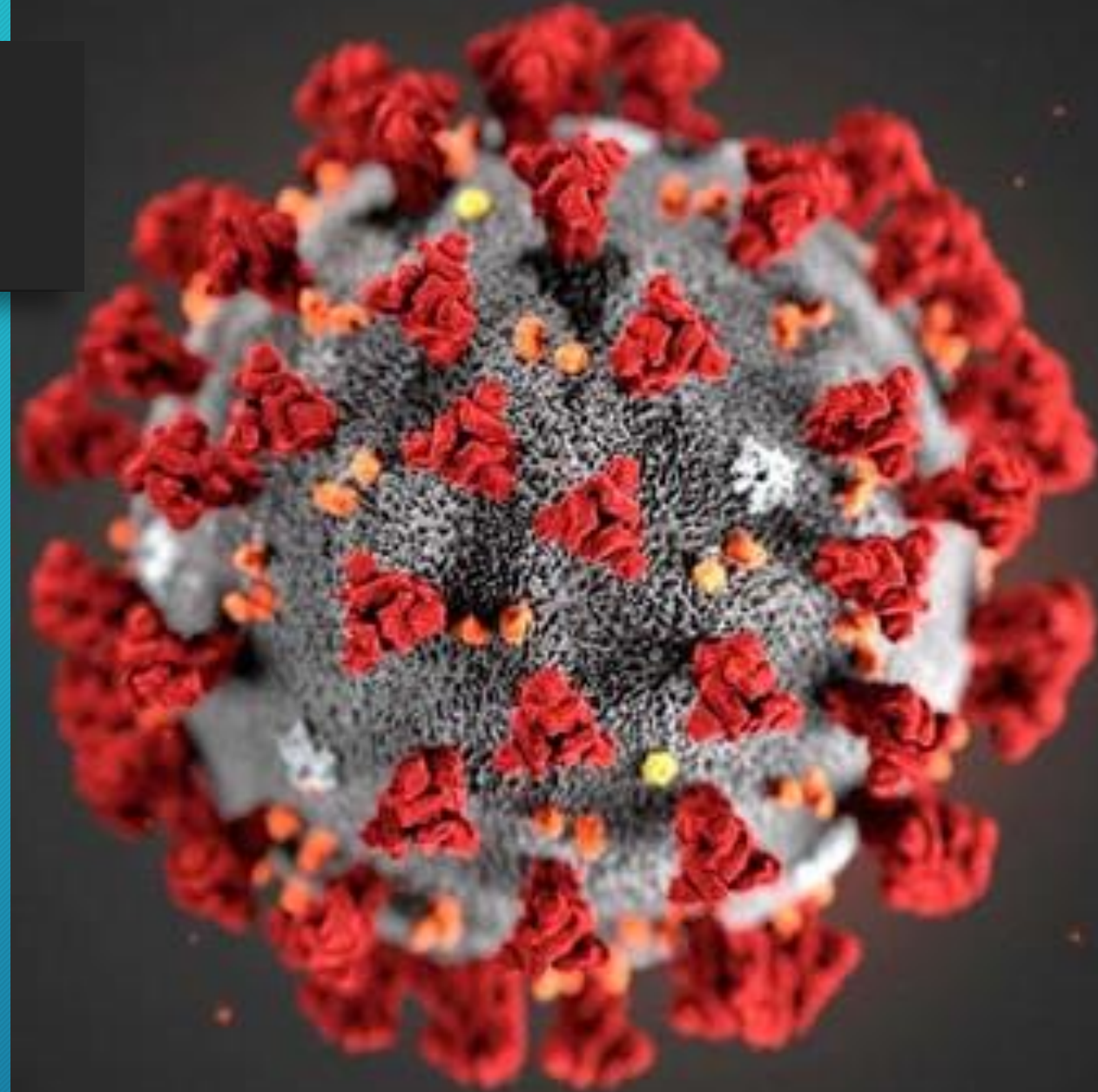
- Sr. Manager, Customer Education, Vyair Medical
- ATS PFT Committee Member

# Objectives

1. Identify credible resources to guide decisions
2. Define an aerosol generating procedure
3. Perform quality PFTs safely

# Pulmonary Function Testing in the COVID-19 Pandemic

- *Pandemic and the PF Lab*
  - Cessation of All Testing
  - Staffing
    - Panic/fears
    - Reduced patient workload
    - Process change
  - Infection control
    - Environment
    - Equipment
    - Staff
  - Testing procedures



# Pulmonary Function Testing in the COVID-19 Pandemic

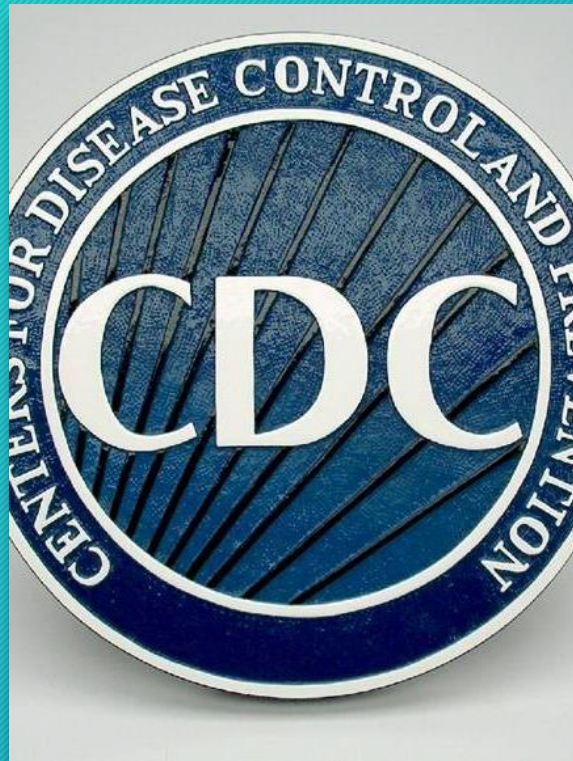
- In times of crisis, we look to leadership for guidance
  - National or government guidance
  - Professional guidance
  - Institutional practice implementation

ERS

EUROPEAN  
RESPIRATORY  
SOCIETY

*I breathe*

# Pulmonary Function Testing in the COVID-19 Pandemic



- Infection Control Precautions for Hospitalized SARS Patients
  - #1. Patient Care
  - #4. Hand Hygiene
  - #5. Personal Protective Equipment PPE
  - #11. Aerosol Generating Procedures

# Pulmonary Function Testing in the COVID-19 Pandemic

## *What is an Aerosol Generating Procedure?*

- Nebulized medication administration
- Diagnostic sputum induction
- Bronchoscopy
- Airway suctioning
- Endotracheal intubation
- Positive pressure ventilation via face mask (e.g., BiPAP, CPAP)
- High-frequency oscillatory ventilation





*We help the world breathe®*  
PULMONARY • CRITICAL CARE • SLEEP

## WORKSHOP REPORT

### **Restoring Pulmonary and Sleep Services as the COVID-19 Pandemic Lessens**

**From an Association of Pulmonary, Critical Care, and Sleep Division Directors and  
American Thoracic Society–coordinated Task Force**

Only tests deemed essential should be performed. In most situations, this will include spirometry with or without diffusing capacity

# Pulmonary Function Testing in the COVID-19 Pandemic

# Pulmonary Function Testing in the COVID-19 Pandemic



## Considerations for Conducting Spirometry During and After COVID19



Spirometry is the most common pulmonary function test and should be conducted in a safe manner with general infection prevention. The following guidance can assist primary care clinics in restarting spirometry testing during or after COVID19. These considerations should enhance your existing policies to ensure best practices to minimize the risks of healthcare infections; to prevent potential exposure to patients; and to prevent the spread through contaminated medical equipment, surfaces, and/or air.

Precautions during spirometry testing are recommended by the Centers for Disease Control and Prevention (CDC) and the American Thoracic Society (ATS). ATS recommends that “pulmonary function testing be limited to tests that are only essential for immediate [diagnosis] and treatment decisions, that the type of pulmonary function testing be limited to the most essential tests when possible, and that measures to protect both the staff and individuals being tested should be put in place.”

# Pulmonary Function Testing in the COVID-19 Pandemic

## Pulmonary Function Laboratories: Advice Regarding COVID-19

### *Advice Regarding COVID 19 For Pulmonary Function Laboratories*

*Concern has been raised that pulmonary function testing could represent a potential avenue for COVID 19 transmission due to the congregation of patients with lung disease and because of the potential for coughing and droplet formation surrounding pulmonary function testing procedures. We recognize that most patients are screened for symptoms and travel before entry into our health care systems, but it is more difficult to screen and assess pulmonary patients who are more likely to have respiratory symptoms unrelated to COVID 19. There remain many unknowns about the possibility of transmission in this setting and the data are in evolution; however, the risks of transmission may be significant, and likely vary based on the prevalence of the virus in the community and the age, severity of lung disease and presence of immunosuppression.*

*We recommend that pulmonary function testing be limited to tests that are only essential for immediate treatment decisions, that the type of pulmonary function testing be limited to the most essential tests when possible, and that measures to protect both the staff and individuals being tested should be put in place. Protective measures include personal protective equipment (PPE) that limits aerosolized droplet acquisition for staff and enhanced cleaning of the testing space such as wiping down surfaces with appropriate cleaners. Use of PPE should be considered in discussions with your infection control team.*

*Decisions regarding the conduct of pulmonary function tests need to balance the potential risks against the need for assessment of lung function to make treatment decisions. We realize that this is an evolving situation and that the risk/benefit ratio will also continue to change over time.*

*Meredith C. McCormack, MD MHS*

*David A. Kaminsky, MD*

*2020 members of the ATS Proficiency Standards for Pulmonary Function Testing Committee*

# Pulmonary Function Testing in the COVID-19 Pandemic

- European Respiratory Society
  - Recommendation from ERS Group 9.1: Lung function testing during COVID-19 pandemic and beyond - 2020 White Paper
    - “Lung function tests (LFTs) often generate aerosols...therefore pose a considerable risk for the spread of infection to individuals and surrounding surfaces”.
    - We do not recommend any patients with symptoms of COVID-19 or flu like symptoms are tested under any circumstances at this time.

<b>Pandemic phase</b>	<b>High community prevalence</b>	<b>Level 1 safety recommendations</b>
<b>Post Peak phase</b>	<b>Low community prevalence</b>	<b>Level 2 safety recommendations</b>
<b>Post Pandemic phase</b>	<b>Controlled</b>	<b>Level 3 safety recommendations</b>

# Pulmonary Function Testing in the COVID-19 Pandemic

## General Recommendations in Level 1

- Screening questionnaires
  - Have you had symptoms in the last 72 hours?
    - Cough
- COPD
- Asthma
- Cystic Fibrosis
- ILD
- Etc.

# Pulmonary Function Testing in the COVID-19 Pandemic

Common Clinical Presentation	
Fever	77.4 – 98.6%
Cough	59.4 – 81.8%
Fatigue	38.1 – 69.6%
Dyspnea	3.2 – 55.0%
Myalgia	11.1 – 34.8%
Sputum Production	28.2 – 56.5%
Headache	6.5 – 33.9%



# Pulmonary Function Testing in the COVID-19 Pandemic

## General Recommendations in Level 1

- Screening patient referrals prior to PFTs
- **Pre-procedure testing to reduce pre-test probability of COVID-19 infection\***
  - SARS-CoV-2 PCR testing within 48 hours of testing (within 5 days acceptable, with outside results from a CLIA-certified lab allowed).
  - We are strongly discouraging PFTs within 90 days of a new COVID infection, recognizing the limited clinical utility of testing in this setting.
  - \*Mayo PFL practice



# Pulmonary Function Testing in the COVID-19 Pandemic

## U of Wisconsin Hospitals

- Form is completed for each patient
  - EMR
  - Phone screening (cost)
  - Is testing requested appropriate or needed?
  - Consult ordering provider if patient has high risk factors

### Pre-Screening Patients for Pulmonary Testing

Assessing for low or high-risk patient and low or high-risk community.

Patient name \_\_\_\_\_

Type of testing requested \_\_\_\_\_ Dx \_\_\_\_\_

Provider requesting testing \_\_\_\_\_

Review of EMR: Date/Time of access \_\_\_\_\_

State of residence \_\_\_\_\_ City \_\_\_\_\_ County \_\_\_\_\_

Previous result found for COVID-19 test \_\_\_\_\_ Date \_\_\_\_\_

Previous PFT testing? Type \_\_\_\_\_ Date of testing: \_\_\_\_\_

Phone Screening: Are you self-monitoring? \_\_\_\_\_ Do you practice social distancing? \_\_\_\_\_

Living situation: Lives alone Lives with partner Family/ Multi-family Group/Nursing home

Are / were any family members ill recently? \_\_\_\_\_

Occupation: \_\_\_\_\_

Are you considered an "essential worker"? \_\_\_\_\_

Location of employment: City/State \_\_\_\_\_

Were any of your co-workers ill recently or dx /screen for COVID-19? \_\_\_\_\_

Travel history – past 6 weeks \_\_\_\_\_

#### Symptom Review

- ☐ Fever (100°F or higher)
- ☐ Chills
- ☐ Cough
- ☐ Sore throat
- ☐ Shortness of breath/chest tightness
- ☐ Loss of taste or smell
- ☐ Runny nose
- ☐ Nasal congestion
- ☐ Headache
- ☐ Severe fatigue/exhaustion
- ☐ Muscle pain

Assessment: Low risk patient Low risk community High risk patient High risk community

# Pulmonary Function Testing in the COVID-19 Pandemic

## General Recommendations in Level 1

- Reorganize waiting areas and staff areas
  - Social Distancing
  - Patient only or with one family member



# Pulmonary Function Testing in the COVID-19 Pandemic

- General Recommendations  
in Level 1
- Hand hygiene
- “Gel in....gel out”



# Pulmonary Function Testing in the COVID-19 Pandemic

## General Recommendations in Level 1

- Protect Staff
  - Personal Protective Equipment
    - Gown
    - Gloves
    - N95 mask
    - Face shield
- Effective communication during testing



# Pulmonary Function Testing in the COVID-19 Pandemic

## General Recommendations in Level 1

- Use filter and equipment adjuncts to reduce contamination
  - Filter ( $> 0.03$  mm or 99.9% effective)
  - Enhanced surface, expiratory circuit cleaning, surface cleaning (Oxivir)



# Pulmonary Function Testing in the COVID-19 Pandemic

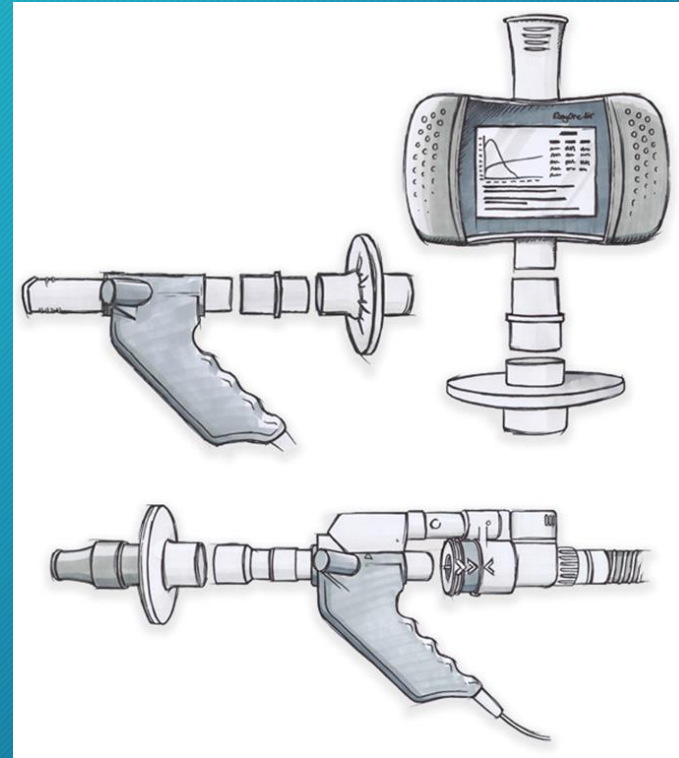
## The Breathing circuit or assembly

- Follow the manufacture recommendations for cleaning.
- If you are testing a high-risk patient or are in an area of high prevalence you could change out between patients.



# Pulmonary Function Testing in the COVID-19 Pandemic

- Equipment manufacturer modifications



# Pulmonary Function Testing in the COVID-19 Pandemic

## General Recommendations in Level 1

- Reorganize testing schedules to include extra time for post-test cleaning/decontamination procedures of the surfaces of the test equipment and environment, allow at least 30 minutes to ventilate the room.
  - Increase air change per hour
    - Increased the PFL room ACH from 7-8 to 12-15
    - OR's 20-22 ACH
- Follow or exceed manufacturers recommendations for cleaning

Calculator:  
Air Changes Per Hour

$$ACH = \frac{CFM \times 60}{Area \times Height_{ceiling}}$$

# Pulmonary Function Testing in the COVID-19 Pandemic

## Testing During Level 1



Initially all testing was suspended

- 3-4 weeks
- BMT and thoracic surgery requests

Spirometry and Diffusing Capacity

- No BD, methacholine challenge testing, CPET
- Lung volumes by plethysmography
- Technologist driven protocols

# Pulmonary Function Testing in the COVID-19 Pandemic

## Testing During Level 1

### Practice Safe Spirometry

- Maximize distance when possible
  - Don't be in the line of fire!!
- Use a filter
- Test with the “Box” door closed
- Instruct patient to wear mask between breathing maneuvers
- Cough etiquette
- Have tissues ready or dispense ahead of time

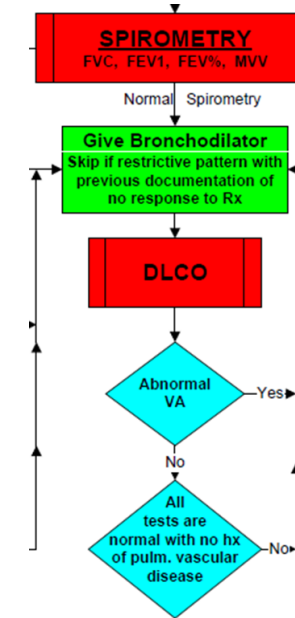
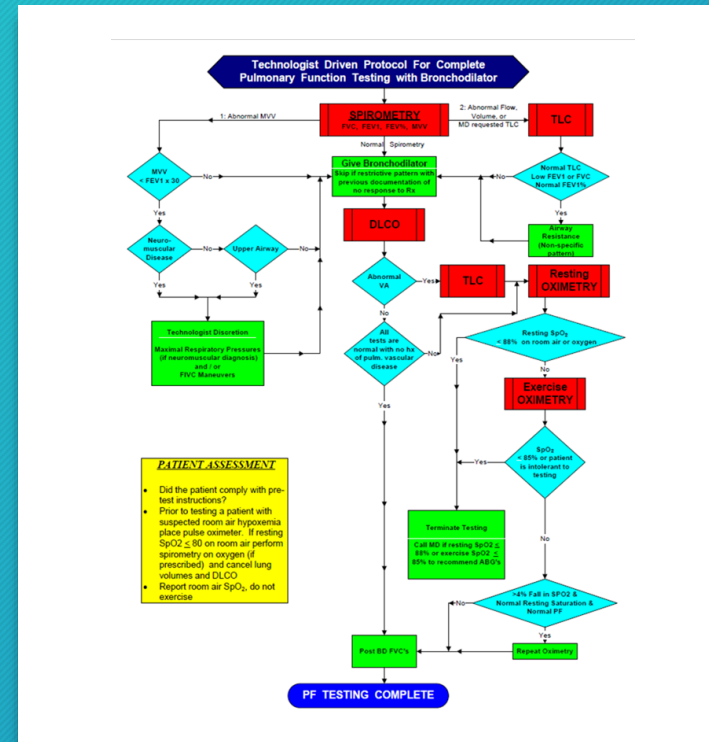
## Testing During Level 1



# Pulmonary Function Testing in the COVID-19 Pandemic

## Testing During Level 1

- Normal spirometry and DLCO/VA - No TLC



# Pulmonary Function Testing in the COVID-19 Pandemic

- Wireless spirometry, another tool to aid in spirometry
- There are several devices on the market that communicate via blue tooth.
- Lung transplant patient monitoring



# Pulmonary Function Testing in the COVID-19 Pandemic

- Bronchodilator Testing
  - ATS recommendation:
    - Use MDI with spacer or chamber
  - Common Cannister Protocol
    - TJC - Temporary permission
    - Actuator jacket cleaned in Oxivir
    - MDI cleaned with Sani-Cloth





# Pulmonary Function Testing in the COVID-19 Pandemic

- National Committee for Quality Assurance recruited five health plans to determine the proportion of patients  $\geq 40$  years old with a new diagnosis of COPD
  - 1,597,749 members with a total of 5,039 eligible COPD patients identified. Patients in the 40 to 64 age range had the highest percentage of new COPD
  - 32% of a broad range of patients with a new COPD diagnosis had undergone spirometry within the previous 2 years to 6 months following diagnosis.

## Spirometry Utilization for COPD

### How Do We Measure Up?

[Han MeiLan K., MD, MS](#)   • [Kim Min Gayles, MPH](#) • [Mardon Russell, PhD](#) • ... [Sullivan Sean, PharmD](#) • [Diette Gregory B., MD, MHS](#) • [Martinez Fernando J., MD, MS, FCCP](#) • [Show all authors](#)

Chest. 2007 Aug;132(2):368-70.

# Pulmonary Function Testing in the COVID-19 Pandemic

## CPET in a Pandemic, Testing in Level II

- **Recommendation from ERS Group 9.1 (Respiratory function technologists /Scientists) Lung function testing during COVID-19 pandemic and beyond**
- **Level II Post Peak Testing:** Exercise testing, nebulization, bronchial challenge tests, and other aerosol generating procedures should be limited to specific equipment and testing rooms.

Pandemic phase	High community prevalence	Level 1 safety recommendations
Post Peak phase	Low community prevalence	Level 2 safety recommendations
Post Pandemic phase	Controlled	Level 3 safety recommendations

# Pulmonary Function Testing in the COVID-19 Pandemic

## CPET in a Pandemic, Testing in Level II

### Do not use a filter

- Evidence lacking on the impact of filter use

### Screen patients

- Rapid PCR, questionnaires, temperature

### PPE for staff

- Mask for sure - N95 and face shield
- Gown and gloves

### Managing lab environment:

- Time in between test:
- This is dependent on ACH (air change hours) to properly ventilate room
- Wiping down all surfaces

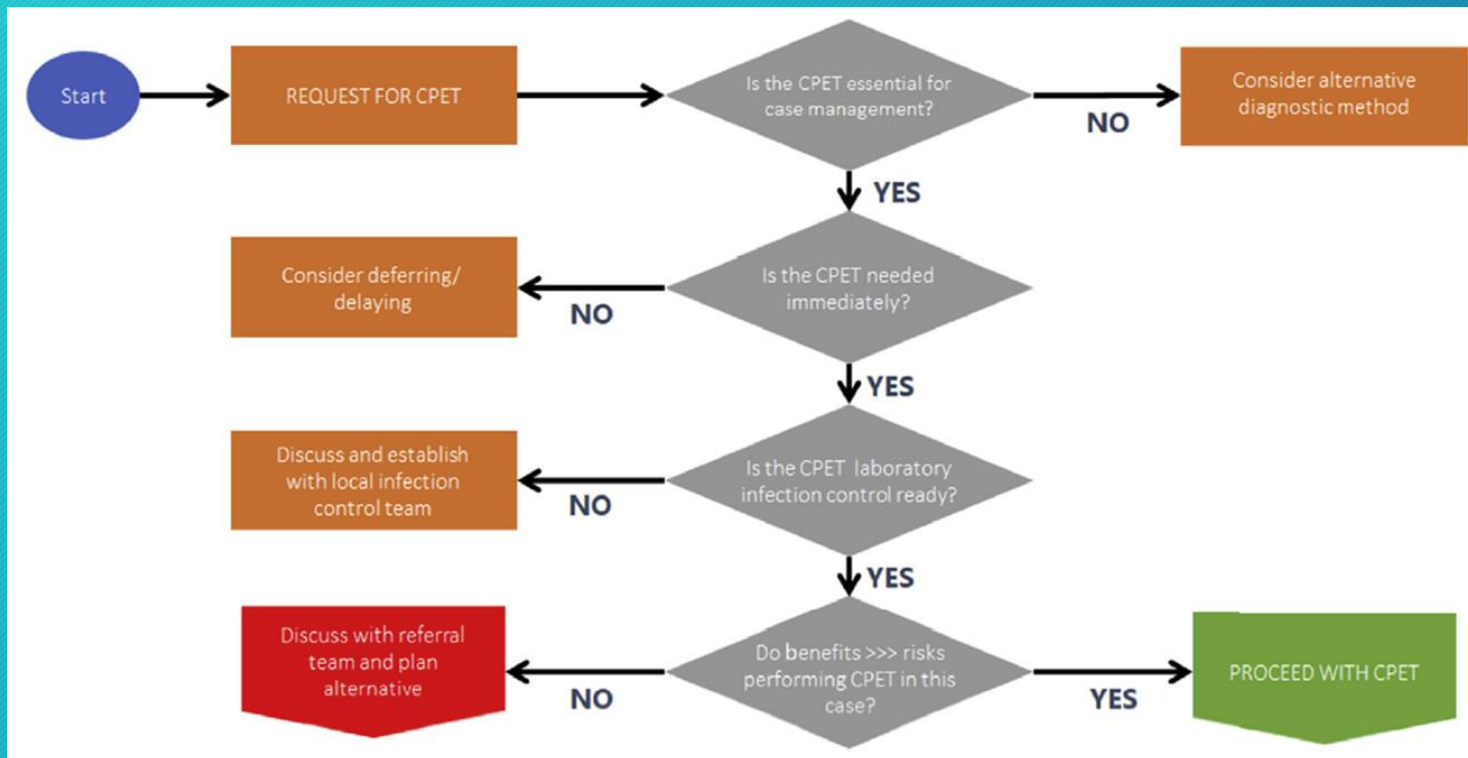
# Pulmonary Function Testing in the COVID-19 Pandemic

- Laboratory Environment
  - Well ventilated room 12-15 ACH
  - Temperature and humidity control: 18-22° C ( $\leq 72^{\circ}$  F), <60% RH
  - Large enough to accommodate equipment and allow room for emergency situations



# Pulmonary Function Testing in the COVID-19 Pandemic

British Journal of Anaesthesia, 125 (4): 447e449 (2020)



## Cardiopulmonary exercise testing in the COVID-19 endemic phase

Mark A. Faghy<sup>1,\*</sup>, Karl P. Sylvester<sup>2</sup>, Brendan G. Cooper<sup>3</sup> and James H. Hull<sup>4</sup>

# Pulmonary Function Testing in the COVID-19 Pandemic

## 6 Minute Walk Testing

- Social Distancing is possible
- The blue tooth communication to a device/tablet will enable distancing for some patients.




# Pulmonary Function Testing in the COVID-19 Pandemic




## Testing in Level II

- Methacholine Challenge
  - Current ERS Technical Standards promote the use of tidal breathing method
    - High aerosolized particles count
      - Add filter and direction valve
  - Dosimeter method

# Pulmonary Function Testing in the COVID-19 Pandemic

[Contact Us](#) | [Code of Conduct](#) | [Privacy Policy](#) | [AARCU](#) | [MYAARC](#) 




Home | Communities ▾ | Directory | Browse ▾ | Participate ▾ | Help Line ▾ | Events ▾ | Tutorials |

## Diagnostics Section

[Settings](#)


Community Home | Discussion 6.5K | Library 257 | Events 0 | Members 902



[Back to discussions](#) [Expand all](#) | [Collapse all](#)


### Delta Variant/Covid Testing prior to PFT

[Follow](#) ☆

➤  Heather Arena 2 days ago

[Hello friends, has anyone stopped requiring pre-PFT Covid testing for fully vaccinated patients, an...](#)

1. Delta Variant/Covid Testing prior to PFT 0 Like



Heather Arena

Actions ▾

Posted 2 days ago

Reply ▾

Hello friends, has anyone stopped requiring pre-PFT Covid testing for fully vaccinated patients, and if so, has the Delta variant caused you to reconsider and resume Covid testing again regardless of vaccination status? Thanks for your thoughts/discussion.

Heather Arena, RRT, RPFT  
Lakeland Pulmonology  
Saint Joseph, MI

PERKS OF  
AUTOPAY

- Uninterrupted membership!
- Save time!
- Environmentally friendly!

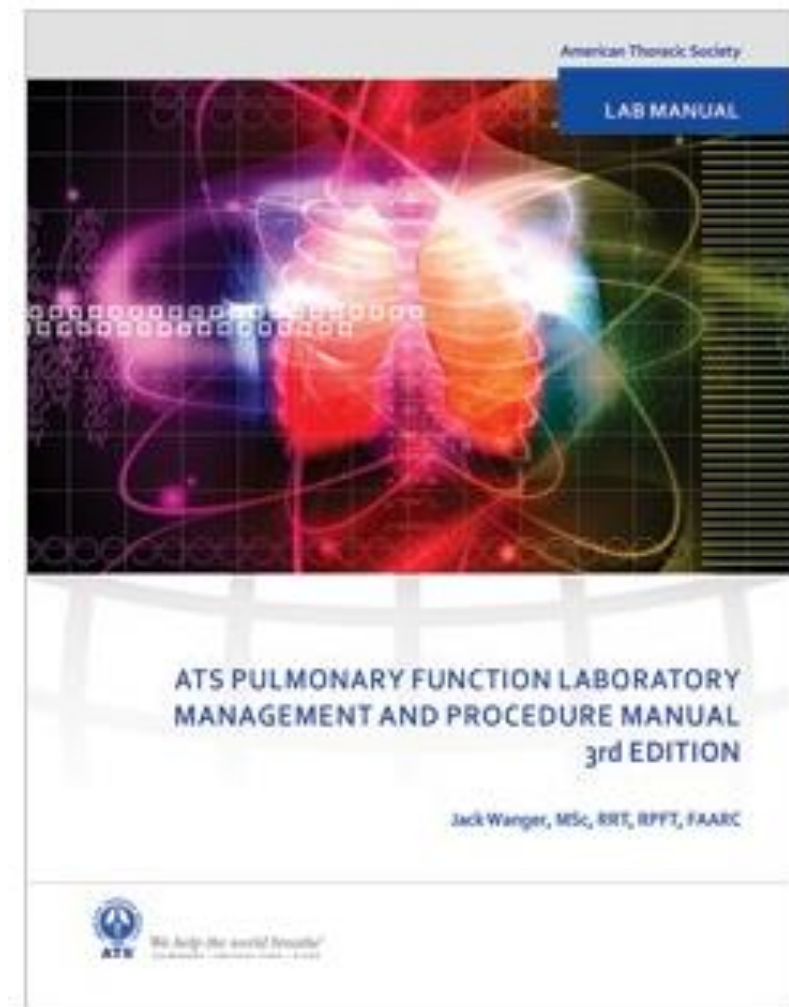
SIGN UP TODAY

- 7/19/2021 “We are still fully PPEd, 95 & surgical masks gown & gloves. Air rooms in between patients about 30 min for 12 air exchanges per hour. Covid test pts within 72 hrs of appointment. Use disposables, wipe down surfaces with antiviral. Find out what your mfgr recommends to use on your equipment. We are starting up CPETs and Methacholine Challenges and doing them in neg pressure rooms only.”
- 8/3/2021 “Since Covid is still here, we have not eased off the safety protocols we put into effect from starting up the labs. Covid negative within 72 hrs of test, staff fully PPEd, air room between pts time dependent on ACH, surfaces are cleaned with a mfgr recommended viricide. In addition, we had our lab converted to negative pressure rooms. One thing different is that we added CPETs & Metacholines back on. We still use only MDIs. For Methas we use BAN with exhalation filter.”

- 8/3/2021 “I wear a N-95 and eyewear in addition to gloves, per policy. The only nebulized medications used are methacholine and pentamidine. Pre and Post bronchodilators are MDI only.”
- 8/3/2021 “Would like to know if labs are closing rooms down in between patients. If so, for how long? Varies depending on the # of air exchanges in the room and if the patient had a negative covid test or not  
Are labs using surgical masks vs N95? surgical mask if negative covid test, N95 if not covid tested  
Are labs still requiring a negative covid test? for most patients, stats and urgents we are not and are closing the room between patients  
Are labs still using MDIs over aerosol treatments? yes  
Cleaning recommendations? following the manuf. Guidelines”
- 9/3/2021 “we did stop testing for vaccinated patients, but resumed because of Delta variant and so on. Otherwise, we have continued normal operations...no deliberate decrease in services though resources are strained due to high Covid+ census.”

# Pulmonary Function Testing in the COVID-19 Pandemic

- ATS PFL Management and Procedure Manual
  - 2016 3<sup>rd</sup> Edition
  - Professionals/education/PFT





Ever-changing environment as the Pandemic evolves



Lung function testing plays a vital role in the diagnosis and monitoring of disease and medical intervention.



Patient and employee safety is #1 priority



Have a written plan based on expert recommendations

# Summary

# Acknowledgements

- Mayo Clinic Pulmonary Function Laboratory
- PFW Consulting LLC

# References

- Wilson KC, Kaminsky DA, Michaud G, Sharma S, Nici L, Folz RJ, Barjaktarevic I, Bhakta NR, Cheng G, Chupp GL, Cole A, Dixon AE, Finigan JH, Graham B, Hallstrand TS, Haynes J, Hankinson J, MacIntyre N, Mandel J, McCarthy K, McCormack M, et al. Restoring pulmonary and sleep services as the COVID-19 pandemic lessens: from an association of pulmonary, critical care, and sleep division directors and American Thoracic Society-coordinated task force. Ann Am Thorac Soc. (in press) <https://doi.org/10.1513/AnnalsATS.202005-514ST>
- European Respiratory Society. Recommendation from ERS Group 9.1 (Respiratory function technologists/Scientists) Lung function testing during COVID-19 pandemic and beyond. Available from: <https://ers.app.box.com/s/zs1uu88wy51monr0ewd990itoz4tsn2h> (Accessed October 6, 2020).
- Haynes, Jeff. PFTs and COVID-19: Your Questions Answered. AARC Newsroom. November 24, 2020. <https://www.aarc.org/nn20-pfts-and-covid-19-your-questions-answered/>

Questions?