

Recommendation from ERS Group 9.1 (Respiratory function technologists /Scientists)

Lung function testing during COVID-19 pandemic and beyond

The following is a recommendation for healthcare professionals performing lung function testing during the COVID-19 pandemic. Since transmission of Corona virus is mostly by contact, during lung function procedures transmission can occur also via aerosolised respiratory secretions (during cough and sneezing). Since the safety of our patients and staff is of paramount importance, we recommend additional safety precautions during testing. We are aware that these will lead to longer testing times, need for more consumables, result in reorganisation of our daily practice and slow down the flow of the patient during his diagnostic workup.

Lung function tests (LFTs) often generate aerosols in the form of droplets due to patients coughing and testing often requires generation of high minute ventilation and flow rates. LFTs therefore pose a considerable risk for the spread of infection to individuals and surrounding surfaces within and around the test areas even in asymptomatic patients.

As COVID-19 is circulating in the community, this poses a potential risk to all patients attending lung function services and the staff working there. The prevalence of the virus differs from country to country and local prevalence of the virus will ultimately dictate the level of safety precaution that must be applied. The prevalence will restrict the range of tests allowable and also limit the availability of testing to those who require it the most. Local prevalence conditions can only be determined by consultation with local infectious disease control and department of health authorities.

We recommend the following safety measures for lung function testing based on the prevalence of COVID-19 in the community:

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

Recommendations for Pandemic Phase - Level 1 safety

During high prevalence of the virus in the community, referring personnel must carefully consider the safety of staff, cross-contamination of equipment and therefore restrict referrals to patients requiring urgent / essential tests only for immediate diagnostics of current illness.

We do not recommend any patients with symptoms of COVID-19 or flu like symptoms are tested under any circumstances at this time. Postpone all routine testing during the critical phase of this crisis. COVID patients must not be tested for a minimum of 30 days post infection.

Full operation of lung function services may only resume when viral prevalence is low and reliable testing based on a combination of symptom screening and testing is readily available. In the interim period, we are recommending that lung function services apply of the following strategies to limit the risk of transmission.

Organisational

- Screen patient referrals and prioritise patients for essential tests only
- Triage patients carefully for COVID-19 status (see example of paperwork in appendix 1)
- Reorganise waiting areas, patients should wear masks and sit a minimum of 2 meters from the next person or as guided by local policy. Patients should attend alone or be strictly limited to one parent, guardian or carer only if deemed necessary.
- Reorganise testing rooms and staff offices to minimise transmission of the virus. Ideally designate testing rooms into separate in-patient and out-patient test areas.
- Reorganise testing schedules to include extra time for post-test cleaning/decontamination procedures of the surfaces of the test equipment and environment, allow at least 15 minutes to ventilate the room (open windows, closed doors) and for personal protective equipment (PPE) donning and doffing. Recalibrate the lung function equipment after decontamination. We anticipate the extra time required will be in the region of 30 to 60 minutes, depending on local policy.
- Roster staff to provide support to fellow staff for donning /doffing procedures

Testing and equipment

- Test procedures should be limited to Spirometry and Diffusing capacity and other tests should only be introduced when risk has been appropriately evaluated. Lung volumes by whole body plethysmography may also be possible if droplet contamination can be contained and local national guidelines support this.
- Test should always be carried out with a high specification disposable in-line bacterial and viral filter in place (We recommend filters with minimum proven efficiency for high expiratory flow of 600 to 700 L/min). Use of disposable combined mouthpieces/sensors is not recommended at this time. The exception would be where an additional filter can be added to the patient circuit and not degrade the measurements.

- Maximise the use of single use consumables and dispose of the items with care e.g. nose clips, rubber mouthpieces, etc.
- Where reusable items are utilised, they should be managed carefully and should be thoroughly cleaned as recommended by local infection control policy.
- Exercise testing, nebulisation, bronchial challenge tests, and other aerosol generating procedures should be postponed at this time.
- For high risk out patient groups, consider using telemedicine for remote testing with live video instruction and coaching by trained lung function staff.
- For highest risk patients requiring essential testing, lung function should be carried out in a negative pressure room and using equipment only for purpose of high risk or infected patients. This may only be available at specialist centres.

Protection of staff performing LFTs

- Personal protective equipment is necessary in all circumstances. Use of PPE in high risk areas must be managed within the same space and staff should not move outside the area without removing the PPE.
- We recommend the use of either FFP3 masks or FFP2 where the former is not available. The duration of use of protective masks should comply with local policy. Eye protection must always be worn e.g. goggles or face shield.
- Disposable gloves should be used at all times when testing. These should be discarded after each patient and after cleaning of the surfaces.
- Hand hygiene protocols for patient and staff as per local policy, before and after glove use.

Cleaning and infection Control

- Use of masks for all patients attending for tests.
- Regular equipment cleaning protocols should be agreed locally and with strict adherence.
- Adequate room ventilation (negative pressure in testing areas if available), HEPA filters are NOT recommended (viral colonisation).
- UV light or ozone room decontamination at intervals compliant with local infection control policy.
- Implement strict infection control and cleaning protocols as per local policy.

Recommendations for Post Peak Phase - Level 2 safety

In this phase of disease prevalence, the pre-test probability of infection is lower than in the pandemic phase but still requires significant safety measures. Therefore, the essential procedures of infection control, organisational recommendations should remain the same as in Level 1.

The following is recommended in the post peak phase:

Testing and equipment

- All testing procedures can be reintroduced with extra precautions (Full PPE and appropriate mask should be guided by local policy e.g. FFP3 or FFP2).
- Exercise testing, nebulisation, bronchial challenge tests, and other aerosol generating procedures should be limited to specific equipment and testing rooms.
- Use filters to minimise escape of aerosol from the exhalation ports when using nebulisers.
- The use of filters connected to the inhalation/exhalation port of the facemask or mouthpiece during exercise testing can reduce the aerosol transmission. This can result in an increase the resistance to airflow as the ventilatory demand of exercise increases (humidification of the filter and increase of the resistance at increased ventilatory flow), therefore rendering the results of exercise less reliable, especially in dyspnoeic patients. However more work needs to be done in this area before a consensus on their use can be agreed. At this time we cannot recommend the use of filters during exercise testing and full PPE must be worn when conducting these tests.

Recommendations for Post Pandemic Phase - Level 3 safety

Return to Pre-COVID-19 standards for the delivery of lung function services. Refer to local and national policy for agreement and compliance with of all of this guidance.

This statement is endorsed by ERS assembly 4 and will be updated as evidence emerges.

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Appendix 1. Example of a Triage questionnaire:

Date and time of triage	Vital and epidemiological data														
	Body Temp.	Cold symptoms		Cough		Malaise, fatigue		Diarrhoea		Conjunctivitis		Throat (sore, ache,...)		Family history or respiratory illness in last 14 days	
	Result	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
	Quantitative and qualitative anomalies of taste /smell									COVID-19 Swab PCR Result (if available)				Other information	
	YES			No			Positive			Negative					
Details															

Full Name	
Date of Birth	
Contact number	
Contact number of accompanying person (if needed)	
Full Name	
Date of Birth	
Contact number	
Triage MD (so notification of positive status)	
Full Name of MD	
Signature of MD	
Actions (mark one):	
Patient is OK, no need for COVID brush	
Patient is possible COVID positive; isolation till nasopharyngeal brush result is available	
Patient is very probable COVID19 positive; isolation till nasopharyngeal brush result is available	

This Triage questionnaire was kindly provided by Professor Matjaž Fležar, MD PhD, Specialist in Pulmonology and Internal medicine.