Resumption of Pulmonary Function Testing during the Post-Peak Phase of the COVID-19 Pandemic
A Position Statement from the Canadian Thoracic Society and the Canadian Society of Respiratory Therapists

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This position statement aims to provide rapid guidance for resumption of pulmonary function services during the post-peak phase[1] of the COVID-19 pandemic (i.e., period of low community prevalence). If the prevalence of COVID-19 increases (pandemic phase – high community prevalence) or decreases (post-pandemic phase – controlled) these recommendations may need to be revised. ***These recommendations are based on the consensus of the authors, who are members of either the Canadian Thoracic Society or the Canadian Society of Respiratory Therapists and are subject to change as information regarding COVID-19 and its effects are further understood.*** We plan to update this guidance as new information becomes available and recommend periodically checking the Canadian Thoracic Society website (https://cts-sct.ca/covid-19/) or Canadian Society of Respiratory Therapists website (https://www.csrt.com/position-statements/) for updates. The Canadian Association of Cardio-Pulmonary Technologists endorses this position statement.

Pulmonary function tests (PFTs) are important for the diagnosis, management and monitoring of disease and there is an urgent need to safely resume services. Patients cannot wear a mask during the test and physical distancing of two meters between the patient and the respiratory therapist/pulmonary function technologist performing PFTs is not always feasible. Patients must also come in contact with laboratory equipment. Coughing induced during and after a PFT may result in high aerosol generation[2], which can spread droplets from an infected individual even if they are asymptomatic. Furthermore, many patients who attend pulmonary function laboratories have underlying respiratory conditions that render them at higher risk of complications from COVID-19.[3] Given these factors, the safety of both patients and staff require careful consideration when resuming PFT services.

We recognize the diversity of circumstances in different jurisdictions across Canada, and between health facilities. Guidance from the Public Health Agency of Canada and from local public health or infection

control units regarding health care facility capacity to resume services, public health measures and screening practices should supersede this document. We recommend that facility specific resumption plans include consultation with a multi-disciplinary team of relevant stakeholders. This could include a respiratory therapist/pulmonary function technologist, respirologist, medical director, manager, infection control representative, administrative team member including registration and scheduling personnel, screening team, environmental services, facilities, biomedical engineering, filter/equipment providers and/or occupational health, as appropriate to the facility.

Current evidence suggests that SARS-CoV-2 is transmitted through droplets and aerosols[4-8], typically when symptomatic individuals cough or sneeze.[8] There is also evidence that SARS-CoV-2 can be transmitted by asymptomatic individuals, including by speaking and coughing.[6-13] PFT test manoeuvres can generate expiratory airflow rates that are higher than those during cough, and are high enough to aerosolise microorganisms.[14] The risk of aerosol generation during PFTs will depend on both the test and patient. Methacholine challenge testing, exercise challenge testing, and cardiopulmonary exercise testing are higher risk than spirometry, six-minute walk test, and measurement of lung volumes or diffusion capacity. ***Given these factors, it is the consensus of the authors that an abundance of caution be used to protect patients and staff until there is clear evidence regarding the risk of transmission of SARS-CoV-2 during PFTs.*** This is consistent with guidance from other national and international organizations.[15-17]

Screening

- Screening of patients and PFT laboratory staff for COVID-19 is recommended.
    - Hospital based laboratories should follow the screening practices recommended by their facility and avoid duplicate and/or contradictory screening questionnaires
    - Independent laboratories can use screening forms developed by local public health offices.
- Screening should be performed for all patients scheduled to attend PFTs, within 72 hours of the scheduled test and upon entrance into the clinic or hospital on the day of testing. ***Patients who screen positive should not undergo PFTs.***
- Patients with pending COVID-19 test results should not have PFTs until COVID-19 can be ruled out.
- Patients who have tested positive for COVID-19 should NOT be permitted in the PFT laboratory until symptoms have resolved, and/or have two consecutive COVID-19 PCR swabs collected ≥24 hours apart that are negative.[18] Viral shedding can occur after 10 days, therefore resolution of symptoms and a minimum period of 3 weeks after symptom onset is recommended when negative tests cannot be obtained.[19, 20]
- Many patients who require PFTs also have chronic respiratory conditions with symptoms that are similar to those of COVID-19, therefore those with ***acute*** symptoms (e.g., self-reported and/or documented fever, cough, sore throat, dyspnea, or additional respiratory symptoms or myalgia or fatigue) should not be tested. In the absence of acute symptoms, or a change in symptoms, PFTs may be performed despite patients having respiratory symptoms.
- Staff with COVID-19 symptoms should not report to work and follow local occupational health policies regarding testing for COVID-19.
- Since COVID-19 screening and testing can lead to false negatives, it is prudent to assume that all individuals may be asymptomatic transmitters of COVID-19. This risk of false negatives should be considered in context of the level of community spread in each jurisdiction.

Personal Protective Equipment

- Based on the available evidence and the consensus opinion of our expert authors and other major professional bodies,[15, 16, 21] during pandemic and post-peak pandemic phases, ***fit-tested N95 masks (or equivalent), face shields and protection appropriate for aerosol generating medical procedures (AGMP) should be employed by clinicians conducting PFTs.***
- We acknowledge that some PFTs are more likely to induce cough than others. Nonetheless, out of an abundance of caution, we recommend AGMP precautions be taken for all PFTs.

Testing Environment

- Negative pressure rooms or HEPA filtration systems with UV germicidal lamps are recommended while there is documented community spread of COVID-19 (pandemic phase/post peak phase).[22] The use of these devices does not replace the need for appropriate PPE.
- When the use of negative pressure rooms, HEPA filtration and UV light are not available in the testing environment, pulmonary function testing may still resume, provided PPE, time-between patients and cleaning precautions are followed to protect patients and staff from viral transmission.
- Patients should be asked to wear procedure masks while in waiting areas and adequate physical distancing (2-meter distance) should be followed in waiting rooms. Staggered appointment times may be appropriate, to limit the number of patients in waiting areas. Where possible, one-way patient flow in laboratories should be implemented.
- Patients and staff should follow appropriate hand hygiene measures.
- Staff should be educated and trained on correct donning and doffing technique for PPE.
- Single use bacterial/viral inline filters that meet international standards of filtration performance should be used for each patient[23] (e.g. filters with minimum proven efficiency for high expiratory flow of 600 to 700 L/min). Laboratories should confirm with manufacturers that filters adequately protect against COVID-19 sized viral particles.
- Patients should be tested one at a time in designated enclosed testing rooms. Testing room door should remain closed for the duration of test.
- There should be sufficient time between appointments to allow for aerosols to settle or dissipate and for cleaning and disinfecting of surfaces. Time between patients should consider the number of air changes in the testing room (determined by each facility) to ensure 99.0 % - 99.9 % removal of airborne microorganisms. See CDC guidance for time required per air change rate.[24] For example, at 6 air exchanges per hour a minimum of 46 and 69 minutes is required for 99 and 99.9% removal, respectively. Additional guidance that considers ambient relative humidity is available.[25]
- Facilities are encouraged to determine their air exchange rate in each PFT testing room. Where it is not feasible to determine the air exchange rate, a minimum of three hours should elapse between test termination and cleaning /subsequent testing.[26, 27]
- Equipment used for testing and testing rooms should be easy to clean and disinfect between patients. The person performing the cleaning should wear the PPE recommended above. Cleaning and disinfecting should include wiping down all surfaces that the patient and staff came into contact with and that were within a 2-meter radius of the patient and staff member. A hospital-grade antiviral disinfectant should be used. All non-essential accessories should be removed from the designated testing room.

Scheduling and Patient Prioritisation

- Consistent with existing recommendations during the pandemic phase of COVID-19 only ***essential*** testing should be performed (i.e. where testing is required for immediate management decisions).[15,28,29]
- During the post-peak phase, services should resume for patients in whom care decisions require PFTs (e.g. lung transplant or lung resection candidates, monitoring post-lung transplant, chemotherapy surveillance or pre/post monitoring of cancer therapy protocols associated with lung radiation damage, pre-operative risk evaluation, urgent clinical decision for patients with acute or chronic lung disease).
- Routine testing (i.e. tests that are not required to guide current clinical decisions) should be postponed until capacity increases to meet the demands of essential cases.
- During the pandemic and post-peak phases of the pandemic, PFT requests should be reviewed by a trained clinician (medical director/respirologist/lead respiratory therapist or pulmonary function technologist) to ensure that patients in whom PFT results are required to make care decisions are prioritized.
- Since modifications to the testing environment (e.g. requirement for PPE, extra cleaning etc.) are necessary, capacity for testing will be decreased. Time required to complete testing, including donning/doffing of PPE, cleaning/disinfecting and wait time between patients, will be considerably longer than what was previously possible. Scheduling of visits should consider these additional time demands.
- The logistics within each facility regarding the direction/spacing of patient flow should be considered to minimize contact between patients (e.g. waiting room capacity with adequate spacing). It may be beneficial to instruct patients to arrive no more than 10 minutes prior to their appointment time, to limit contact with staff and other patients.
- In selected patients with chronic respiratory conditions, spirometry and 6-minute walk tests may be performed by the patient at home where available (with appropriate guidance, training and quality control procedures), with results reviewed by the clinical team via telemedicine.

Additional Considerations

- Children with COVID-19 are more likely to be asymptomatic. While a child-friendly testing environment should be maintained as much as is feasible, at no time should appropriate infection control be overlooked to accomplish this.
- When required, one caregiver (e.g. parent; translator; or physical/mental/social support person) should be permitted to accompany the patient to the testing area. This caregiver must also be screened, follow hand hygiene procedures and be asked to wear a facemask.
- Patients and caregivers should be asked to wear masks while in the healthcare facility.

Resumption of Normal Services

- These recommendations should be maintained until public health determines that COVID-19 is controlled and in the post-pandemic phase.

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<u>Addendum</u> to Resumption of Pulmonary Function Testing during the Post-Peak Phase of the COVID-19 Pandemic: A Position Statement from the Canadian Thoracic Society and the Canadian Society of Respiratory Therapists (December 9, 2020)

The guidance and recommendations regarding COVID-19 vary greatly between countries and within Canada as well. Not only do the levels of community spread differ, there are unique jurisdictional circumstances with respect to patient populations and resources that make it challenging to have a single recommendation that applies to all settings. Many of the existing COVID-19 recommendations are based on limited or low-quality data and largely based on expert consensus. Therefore, it is not surprising that within Canada there are concerns around the lack of consistency regarding protocols and precautions related to pulmonary function testing (PFT).

The CTS/CSRT guidance for the resumption of PFT services considers the unique circumstances of the patient population and the PFT laboratory environment, and the potential risks posted to both health care workers and patients. The statement and recommendations apply to PFTs in all settings. The CTS/CSRT guidance are consistent with the recent consensus by World Health Organization[1], US Centers for Disease Control[2] and the Public Health Agency of Canada[3] that there is an increased risk of transmission of SARS-CoV-2 by aerosols and supports airborne precautions for patients in the PFT lab.

Recent evidence highlights that it is challenging to distinguish droplet from airborne transmission[4] and that SARS-CoV-2 can be detected in the air, up to three hours after aerosolization.[5] Evidence indicates that droplets travel further than 2m, in some cases as far as 8m.[4] Furthermore, recent data have been published further supporting that PFTs produce aerosols[6], and a greater number of aerosols than breathing/talking[7] and thus increase the potential risk of transmission between patients and staff, and between consecutive patients entering the testing environment. These recent findings further support the CTS/CSRT recommendations.

Supported by emerging evidence[4,8,9], the CTS/CSRT, consistent with the American Thoracic Society and European Respiratory Society, consider there to be an increased risk of aerosol generation during PFT testing and that health care workers are in direct contact for prolonged periods of time with patients who cannot wear masks during the procedure, thereby recommend that aerosol precautions are taken in the PFT laboratory. The CTS/CSRT recommendations include a layered range of precautions that include screening patients prior to testing, testing in private rooms, ensuring adequate ventilation of testing rooms, appropriate cleaning and time between patients. No single precaution is meant to eliminate the potential risk of transmission, but the collective use of these precautions within the local context can help to minimize potential risk. The use of an N95 mask alone is insufficient to protect patients and staff from the transmission of SARS CoV2 during the peak and post peak pandemic. Each facility must evaluate their local environment, the local epidemiology of viral transmission, the characteristics of the patient population and other facility wide practices to reduce the potential transmission to staff and vulnerable patient populations when they attend the PFT lab.

The duration of viral shedding and the period of infectiousness varies between individuals. It is recommended that patients who have previously tested positive for COVID-19 return to their baseline clinical status before PFTs are performed, unless PFTs are being used clinically to manage the COVID related pulmonary symptoms. The precautions outlined in the CTS/CSRT position statement for PPE, the testing environment and cleaning assume that asymptomatic patients attending the PFT lab are

suspected of being COVID positive, therefore these same precautions would apply to patients who have tested positive for COVID.

It is recognized that there needs to be a balance between increasing the number patients tested for the clinical management of their disease against the potential risks of testing. It is encouraging that many laboratories have modified the PFT environment to return to near pre-COVID testing levels.

The recommendations contained in this position paper are guided by published scientific studies and other international medical societies in order to guide safe practice during pulmonary function testing. The position paper was peer-reviewed by medical practitioners working in pulmonary function, including physicians and respiratory therapists, and approved by the Boards of each society. The authors of the CTS/CSRT position statement continue to review emerging evidence in relation to PFTs and the risk of aerosol generation and transmission of disease. In light of the absence of definitive evidence on these matters, and as the health and safety and practitioners and patients must remain paramount, there is insufficient reason to change the CTS/CSRT recommendations at this time.

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