Taddle Creek
Family Health Team

MEDICAL DIRECTIVE

Title:	Reversibility Spirometry Testing	**Number:**	TCFHT-MD11
Activation Date:	10-06-2014	**Review Date:**	10-06-2015

Sponsoring/Contact Person(s) *(name, position, contact particulars):*

Aislinn Hemingway, MN, RN – ahemingway@tchft.on.ca
726 Bloor Street West, Suite 207, Toronto
415-538-3939

Dr. Beverley Jackson
726 Bloor Street West, Suite 207;
416-538-3939

Sherry Kennedy, Executive Director – skennedy@tcfht.on.ca
790 Bay Street, Suite 306, Toronto
416-260-1315, x307

Order and/or Delegated Procedure:

Appendix Attached: __X__ **No** ___ **Yes**
Title:

For patients referred by a physician or nurse practitioner for spirometry testing, the authorized implementer may perform the following:

- Perform spirometry testing (pre- and post-bronchodilator)
- If reversibility testing is required, administer a single dose of bronchodilator (salbutamol or ipratropium) via inhalation (dose as per American Thoracic Society/European Respiratory Society [ATS/ERS] Standards for Spirometry[1])

Recipient Patients:

Appendix Attached: ___ **No** __X__ **Yes**
Title: Appendix A – Authorizer Approval Form

Recipient patients must:

- Be active patients of a TCFHT primary care provider who has approved this directive by signing the Authorizer Approval Form
- Be over the age of 6 yrs.
- Have a suspected or confirmed diagnosis of asthma or COPD
- Meet the conditions identified in this directive

Authorized Implementers:

Appendix Attached: ___ **No** _X_ **Yes**
Title: Appendix B – Implementer Approval Form

Implementers must be TCFHT employed Regulated Health Care Providers or Physician Assistants (under the supervision of a physician).
Implementers must have basic life-support training[2]

Implementers must complete the following preparation and sign the Implementer Approval Form:

- Successfully complete a recognized spirometry training course. Preferred training is SpiroTrec (which includes 16 hours of pre-workshop learning, an 8 hour workshop and subsequent quality assurance review of 5 – 10 tests/month for 3 months) offered by the Lung Association[2]. Accessible from: http://www.resptrec.org

Indications:

Appendix Attached: ___ **No** _X_ **Yes**
Title: Appendix C - Reasons for relative contraindications

The authorized implementers may apply this directive pursuant to a physician or nurse practitioner's order.

Absolute Contraindications:

- Patient/POA refusal

Relative Contraindications to Spirometry[4]:

- Cerebral aneurysm
- Recent brain surgery
- Recent concussion
- Significant glaucoma
- Recent eye surgery
- Recent sinus surgery or middle ear surgery or infection
- Acute disorders affecting performance (nausea, vomiting, dizziness)
- Pneumothorax
- Hemoptysis, active TB, or hepatitis B (infection control procedures must be taken)
- Recent abdominal or thoracic surgery
- Recent MI, unstable angina or pulmonary embolism
- Non-compensated heart failure
- Significant atrial/ventricular arrhythmias
- Systemic hypotension or severe hypertension (>200/120mmHg)
- Significant aortic aneurysms
- Pregnancy with an incompetent cervix
- History of syncope related to forced exhalation/cough
- The following conditions may result in suboptimal or inaccurate lung function results: age <6yrs, chest or abdominal pain of any cause, oral or facial pain exacerbated by a mouthpiece, stress incontinence, dementia, or confused state.

Contraindications to salbutamol: hypersensitivity to salbutamol
Contraindications to ipratropium: hypersensitivity to ipratropium, atropine, bromide, soya lecithin or peanuts

Consent:

Appendix Attached: __X__ No __ Yes
Title:

Consent is implied upon referral from physician/NP for spirometry testing. However, the authorized implementer will explain the purpose and procedures involved with spirometry testing to further obtain verbal consent from the patient or POA.

Guidelines for Implementing the Order/Procedure:

Appendix Attached: __ No __X__ Yes
Title: Appendix D – Procedure for Spirometry Testing

The implementer shall be able to perform spirometry and reversibility testing, through the administration of a short-acting bronchodilator, as well as advising patients on which inhaled medication to withhold prior to spirometry testing.

- The decision to avoid bronchodilators before testing depends on the reason for the test. If post-bronchodilator testing is to be performed to diagnose an underlying lung condition, the patient may/should withhold the following medications prior to spirometry testing (note: the patient must be told they may use their rescue inhaler for symptoms if needed)[3].

Medication	Withholding Time Prior to Spirometry
Short-acting Beta2 agonist (SABA) e.g. salbutamol, terbutaline	4 – 8 hours
Short-acting anticholinergic (SAAC) e.g. ipratropium	6 hours
Long-acting Beta2 agonist (LABA) e.g. salmeterol, formoterol, indacaterol	24 hours
Long-acting anticholinergic/muscarinic antagonist (LAAC/LAMA) e.g. Glycopyrronium, tiotropium	24 hours
Inhaled Corticosteroids (ICS) e.g. fluticasone, budesonide, ciclesonide, beclomethasone	Do not withhold
Oral Steroids e.g. Prednisone	Do not withhold
Leukotriene receptor antagonists e.g. Singulair, Accolate	24 hours

- If the test is to determine the response to a medication, then the medications should not be withheld (with the exception of SABA's and SAAC's, as these will be delivered as part of the test to assess for reversibility) [3].

Method for performing reversibility spirometry testing[1]:

Note: a current height and weight need to be recorded for each spirometry visit

1) The patient performs three acceptable and two repeatable maneuvers, as per ATS/ERS Standards for Spirometry (not to exceed 8 attempts)[1]

2) One of the following bronchodilators is administered via MDI inhalation using a disposable spacer device[4]:

Medication	ATS/ERS Dose Recommendation	Wait Time
Salbutamol	4 inhalations* of 100 mcg (Children <12yoa: 2 inhalations*)	15 min
Terbutaline	2 inhalations* of 500 mcg	15 min
Ipratropium	8 inhalations* of 20 mcg (Children <12yoa: 4 inhalations*)	30 min

*A smaller dose may be used if the patient is at risk of or has had an uncomfortable reaction to these medications (e.g., shakiness, trembling, or heart palpitations)

3) A minimum of three acceptable and two repeatable maneuvers must be obtained, after the appropriate wait time, post-bronchodilator[3].

Documentation and Communication:

Appendix Attached: _X_ No __ Yes
Title:

The implementer will document spirometry results directly into the progress notes of the patient's EMR and the primary care provider alerted, so that appropriate follow up can be conducted. A PDF copy of the spirometry report should also be entered into the progress notes as a Diagnostic Test report (Pulmonary Function Test).

The final report must include (at minimum) [3]:

- Date and time of the test
- Patient details: age, gender, race, height and weight
- Flow-volume graph and volume-time graph
- Implementer's name
- Implementer's comments on the quality of the test, which may aid interpretation.

Review and Quality Monitoring Guidelines:

Appendix Attached: _X_ No __ Yes
Title:

- Routine renewal will occur annually on the anniversary of the activation date. Renewal will involve a collaboration between the authorizing primary care providers and the authorized implementers.
- At any such time that issues related to the use of this directive are identified, TCFHT must act upon the concerns and immediately undertake a review of the directive by the authorizing primary care providers and the authorized implementers.
- This medical directive can be placed on hold if routine review processes are not completed, or if indicated for an ad hoc review. During the hold, implementers cannot perform the procedures under authority of the directive and must obtain direct, patient-specific orders for the procedure until it is renewed.
- This medical directive should be reviewed with each update of the ATS/ERS or CTS Standards for Spirometry.

- Quality control checks are to be regularly performed[4].
    1) Spirometer must have a daily accuracy check (or at minimum, conducted on the days that the spirometer will be in use): using 3L syringe, injected into the spirometer at differing speeds. This will be recorded in a log.
    2) Monthly checks include: biological control testing on one staff member with normal lung function. The results should be essentially the same each time; temperature calibration must also be done monthly.
    3) Any deviation in the accuracy checks should be followed up with a calibration of the spirometer, and then performed again. Further deviation indicates there is a fault in the equipment, and should be followed up with the manufacturer.

References:

1. Miller MR, et al. Series "ATS/ERS Task Force: Standardisation of Lung Function Testing" – Standardisation of spirometry (Number 2 in the Series). *Eur Respir J,* 2005; 25: 319-338.
2. Coates AL, et al. Spirometry in primary care. *Can Respir J,* 2013; 20(1): 13-21.
3. The Lung Association (2010). The Spirometry Training and Educator Course
4. The Lung Association of Ontario (2013, Dec). Primary Care Asthma Program: Spirometry Manual.

Appendix A:

Authorizer Approval Form

Name	Signature	Date

Appendix B:

Implementer Approval Form

To be signed when the implementer has completed the required preparation, and feel they have the knowledge, skill, and judgement to competently carry out the actions outlined in this directive.

Name	Signature	Date
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Appendix C:

Reasons for Relative Contraindications[4]

Relative Contraindications	Comments
• Cerebral aneurysm • Recent brain surgery • Recent concussion • Recent eye surgery • Significant glaucoma	Spirometry may lead to increased intraocular pressure in most patients and a 3-4 week recovery post-surgery is recommended before testing
• Recent sinus surgery or middle ear surgery or infection	There is a risk that forced maneuvers can cause pain and even ear drum ruptures in cases of middle ear infection
• Pneumothorax • Significant aortic aneurysm* • Recent thoracic surgery** • Recent abdominal surgery • Pregnancy***	*Spirometry causes increases in intrathoracic and intra-abdominal pressure that may increase blood pressure **Physiotherapy and coughing has been shown to be beneficial after cardiothoracic and abdominal surgery. Cough increases intrathoracic pressure up to 400cmH2O compared with 70cmH2O- 200cmH2O during spirometry. The risk is therefore low in most patients. ***Lung function tests may increase the risk of early delivery in the case of an incompetent cervix
• Systemic hypotension or severe hypertension (e.g., >200/120mmHg) • Significant atrial/ventricular arrhythmia • Non-compensated heart failure • Recent myocardial infarction (MI) or pulmonary embolus • History of syncope related to forced exhalation/cough	Exercise testing one week after MI appears to be safe, however, caution is necessary where persistent myocardial ischemia exists. The use of beta2- agonists when doing post-bronchodilator spirometry can also be a risk for people with these conditions, although the risk of a single administration is likely to be minimal.
• Active tuberculosis • Hepatitis B • Hemoptysis or oral bleeding	Infection control procedures must be taken according to local procedures
• Inability to follow direction (e.g., confusion, dementia, young age, language barrier)	In some cases, successful spirometry can be done with increased coaching and aid of an interpreter

Note: Recent Indicates within 6 weeks.

Appendix D:

Procedure for Spirometry Testing

Step-by-step Instructions:

1. Open VMware Fusion program if using Mac computer
2. Open WinspiroPRO in the PC window
3. Find or enter the patient:
    a. For a new patient:
        i. Click on "Patient" → "New" → enter HC#, Name, DOB, ethnicity, sex → click on "Go to Visit" → enter weight and height → click on "OK"
    b. For a follow-up patient: find patient on drop-down list
4. Attach a disposable turbine/mouthpiece to the spirometer and turn it on
5. Press "FVC" button in the top menu bar
6. A window will pop-up with the flow-time chart and it will say "blow" at the bottom
    a. Ask the patient to take a couple of breaths so that you can see it registering on the chart
    b. Near the end of an exhale, ask the patient to take a deep breath in
    c. At the end of the inhale, get the patient to blow out as hard and fast as they can
    d. Patient can stop blowing after 6 seconds or when no more flow registers and the machine gives out a long beep (note: people with COPD are able to exhale for >6 seconds. For one trial only, ask the patient to blow out as long as they can (stop them at 15 seconds)).
7. Click on "Accept"
8. Repeat blowing manoeuvre at least 3 times until criteria are met

Post-Bronchodilator testing:

1. Administer appropriate bronchodilator, as per medical directive, via disposable spacer.
2. Wait appropriate amount of time, based on medication used.
3. Click on "PostBD Testing"
4. Click on "FVC" and repeat above procedure for spirometry testing

Printing to PDF for the EMR:

1. When testing is complete, click on "Print". Keep pressing "Print/OK" (once or twice more) until you get to the window where it lets you name the file [the printer should be: "Cute PDF file"]
2. Name the file and press "Print" one last time (it won't actually print)
3. The PDF of the spirometry results will save in the "Spirometry reports" file on the desktop
4. The PDF can now be dragged directly into the progress notes of your patient's chart (enter as a New Report→ Diagnostic Test → PFT)
5. Once entered into the patient's chart, delete the file from the Mac and PC environment.

TIPS:

- Be sure to explain and/or demonstrate the manoeuvre to the patient
- For children, you have to use the paediatric mouthpiece and filter, unless the child is considered an adult by height and weight.