Pulmonary Function Testing Newsletter January 2024

Featured Courses: **Spirometry Refresher (NIOSH-approved):**
September 24, 2024
Interpretation of Spirometry - Beyond the Numbers:
September 25, 2024

In the this issue:

2024 Spirometry Training Course Schedule

The University of Cincinnati is pleased to announce the following training courses that may be of interest to you or your staff. They are:

NIOSH-Approved Spirometry (initial course):
Apr 2-4, 2024 (2 spots remaining)
June 18-20, 2024
Sept 10-12, 2024
Nov 12-14, 2024

Spirometry Refresher (NIOSH-approved):
September 24, 2024

Interpretation of Spirometry - Beyond the Numbers:
Sept 25, 2024

On-site and On-line training is available.

Standardized Reporting of Spirometry Results
Comment on Predicted Values

The 2017 ATS guideline for a standardized spirometry report has the following recommendation:

> "The predicted value itself is unnecessary, as it does **not** aid in the interpretation of abnormality."
>
> Source: American Thoracic Society Recommendations for a Standardized Pulmonary Function Report. An Official American Thoracic Society Technical Statement. 2017
> Note: Font color & bolding was added to emphasis the word "not".

This means the committee feels it is **un**necessary to print the predicted value for spirometry reports. Their goal was to make pulmonary function reports visually easier to read with less clutter. Manufacturers ultimately respond to ATS and ERS standardized guidelines and other recommendations.

I disagree with the decision to omit predicted values for several reasons. A few of these reasons are provided below:

1) Pulmonary function testing software calculates predicted values using data entered by people. This includes, but is not limited to entry of the subjects age (or date of birth), height, gender, race/ethnicity. Unfortunately, human errors for data entry occur. If this should occur, all of the predicted values and lower limits of normal (5^{th} percentiles and/or Z-Scores), will also be in **error**. It's highly unlikely that an operator or interpreter would readily recognize an error in the reported LLN or Z-Score, but they may catch an unreasonable predicted value, especially if compared to another test date.

2) Test reports may be compared to those

conducted by another provider or from another spirometer. If the other provider's report has an incorrect data entry, it is once again highly unlikely that an operator or interpreter would readily recognize an error in the reported LLN or Z-Score, but they may catch an unreasonable or different predicted value. For example, a predicted value of 4.00 on one report and 4.50 on another is more readily recognized than a Z-Scores of -1.28 and -1.43, respectively.

3) In some facilities, operators are responsible for changing the source of predicted values to comply with different regulatory and other requirements, such as compliance with ATS, ERS, OSHA, NIOSH, AMA, disability guidelines, etc. If an error is made in the selection for the source of the predicted values, it may not be recognized by the operator or interpreter.

4) Manufacturers have made programming (coding) errors in the formulas used to calculate lower limits of normal. Once again, an error in the lowest 5th percentile (e.g., 3.47), would be more difficult to recognize than an error in the predicted value, especially if compared to another report.

In conclusion, humans make errors. When this occurs, the calculated lower limits of normal, whether they be 5th percentiles, Z-Scores, or other statistical values will be incorrect. This will also affect computer generated statements regarding interpretation of results with possible miss-classification from normal to abnormal, or vice versa. Recognizing these errors will be more difficult if the predicted value is not provided.

Bronchiectasis: Color of Phlegm Predicts Outcome

Here's a summary of a September 10, 2023 presentation by Dr Megan Crichton given at the European Respiratory Society International Congress in Milan, Italy. Dr. Crichton reported that the color of phlegm from patients with bronchiectasis can indicate the degree of inflammation in their lungs and predict their future outcomes. The study included nearly 20,000 patients from 31 countries. For the first time, the color of phlegm (sputum) has been shown to provide clinically relevant information that reflects prognoses and, therefore, can aid decisions about treatment.

Bronchiectasis is a long-term condition of the bronchi, which widens and leads to a build-up of excess mucus, making the lungs more vulnerable to infection. Over time, this can lead to gradually worsening damage to the lungs. Causes can include having a lung infection such as pneumonia or whooping cough, cystic fibrosis, and underlying problems with the body's immune system that make the bronchi more vulnerable to infection. Bronchiectasis is one of the three most common chronic inflammatory airway diseases (along with asthma and COPD). It can affect people of any age, although symptoms do not normally develop until middle age. There is also no cure.

Productive cough is a characteristic finding, with almost three quarters of bronchiectasis patients producing sputum daily. When patients develop chest infections, their sputum color darkens, and this color change is due to the protein myeloperoxidase (MPO), which is released from the inflamed cells.

Sputum is classified into **four levels**:

Mucoid:	looks clear
Mucopurulent:	frothy and grey-colored
Purulent:	yellow or green with thicken texture
Severe purulent:	darker green turning into brown, sometimes with streaks of blood

Sputum samples can be easily collected and the color has shown to be a useful indicator to determine disease progression. Implementation of this biomarker into clinical practice will improve treatment and monitoring of bronchiectasis patients.

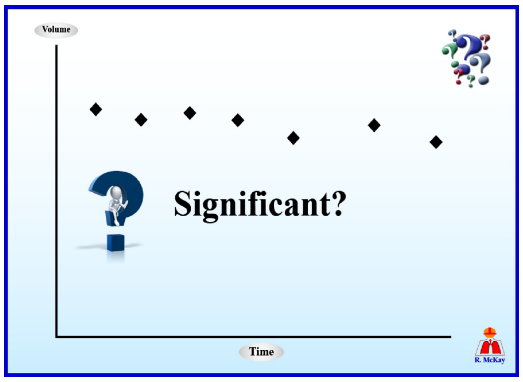
Sputum sampling is non-invasive for patients and can be a means of self-monitoring and self-management, that can give patients control over their condition, which is important for improving patient quality of life.

For additional information click here and select line item 17

Source: Abstract no: PA397. "Sputum color assessment and clinical outcomes in bronchiectasis: data from the EMBARC Registry", by Dr Megan Crichton et al. Poster session, "Bronchiectasis registries, cohorts and subgroups" at 08.00-09.30 hrs CEST on Sunday 10 September 2023.

Spirometry Refresher Reminder

If your last NIOSH-approved spirometry training course was taken in **2019**, you're due for a refresher in **2024**. Currently, a 7-month grace period is in effect to renew your NIOSH Spirometry certificate. Therefore, re-certification must be completed within 5 years and 7 months of your previous course date.



Evaluating Change in Spirometry?
Do you have spirometry tests on a worker or patient and curious if there's a significant change in lung function? Calculations using percent change and other methods are notorious for producing false positive and false negative results. Most methods lack reliable criteria to distinguish true change from normal aging and/or variability. Calculating FEV1Q has serious limitations and lacks a recognized endpoint. If you have five (5) or more test dates, Dr. McKay can perform an independent expert analysis looking at consistency using multiple models, rather than relying on a single model. A straightforward answer, along with tabular and graphic displays are included in a simple to read report. For additional details, email Dr. McKay at roy@drmckay.com and request additional information.

NEW

2023 ERS-ATS Lung Volume Update
If you conduct lung volume testing or refer others for these tests, be aware of a new European Respiratory Society (ERS) and American Thoracic Society (ATS) standard for the measurement of TLC, RV, and FRC.
Note: See next article for error in 2023 Lung Volume Update.

One of the values of lung volume measurement is the ability to help distinguish reductions in FVC during spirometry testing. These reductions may be due to a restrictive ventilatory defect, air trapping due to an obstructive defect, or the combined presence of obstructive and restrictive defects. Measurement of residual volume (RV) and functional residual capacity (FRC) can help identify the cause of a reduced FVC or TLC.


European Respiratory Society/American Thoracic Society technical statement: standardisation of the measurement of lung volumes, 2023 update

The 2023 **update** is the first revision to the previous ERS-ATS technical standard for the measurement of lung volumes, which I was a co-authored in 2005. During this nearly 20 year period, there have been significant advancements in testing hardware, software, and new research findings.

Unlike spirometry, which has only one methodology, lung volumes can be measured using a variety of techniques. These include body plethysmography (body box), multiple breath washout (MBW) and inert gas dilution using helium. When used in healthy subjects, these techniques provide similar results (when conducted correctly), these approaches yield similar results. However, in the presence of lung disease, results can be quite different.

Some of the key changes are:

An emphasis on linking maneuvers for determining lung volumes after measurement of functional residual capacity (FRC).

New equipment quality control and validation recommendations. This includes a requirement for isothermal lung mechanical models for calibration and verification of body plethysmographs (body box).

Recommendations on panting frequency when measuring airway resistance using body plethysmography and a comment regarding panting versus tidal breathing.

Concept of multiple breath washout (MBW) techniques beyond nitrogen (N_2) and updated procedures.

Differentiation between inert-gas dilution equipment that use volume-based versus flow-based spirometers.

A new acceptability and QA grading system for assessment of the quality of lung volume measurements with inclusion of FRC repeatability.

An interim recommendation for the selection of Global Lung Initiative (GLI) lung volume reference values.

For additional information, go to the source:
Bhakta NR, McGowan A, Ramsey KA, et al. European Respiratory Society/American Thoracic Society technical statement: standardisation of the measurement of lung volumes, 2023 update. Eur Respir J 2023; 62: 2201519 [DOI: 10.1183/13993003.01519-2022].
To obtain a copy of the 23 page 2023 Update, go to:
https://bit.ly/474TxuC
Or, just Click Here

In Case You Missed It

Error in 2023 Lung Volume Update

The November issue of the European Respiratory Journal published an "Errata" for the above mentioned 2023 Lung Volume Update. Typical of most journals, they don't identify the incorrect text or specific location of the error. However, I'm showing the affected text below. Due to the complexity of Table 3, only the incorrect text is shown (in red font) and the corrected text is shown in purple font. The remainder of Table 3, remains unaffected.

TABLE 3 (Modified to only show changes. Refer to the online version to see entire table).

Acceptability and usability criteria for spirometry for calculation of residual volume and total lung capacity

Spirometry manoeuvre after FRC measurement

Acceptable# Linked spirometry:

Change from:

- if aged ≤6 years, SVC ≥ FVC (100 mL or 10% of FVC, whichever is smaller)

Change to:

- if aged ≤6 years, SVC ≥ (FVC − 100 mL) or (FVC − 10% of FVC), whichever is smaller

Useable¶ Any of:

Change from:

- if aged >6 years, SVC ≥ FVC (250 mL)

Change to:

- if aged >6 years, SVC ≥ (FVC − 250 mL)

Change from:

- if aged ≤6 years, SVC ≥ FVC (200 mL or 10% of FVC, whichever is smaller

Change to:

- if aged ≤6 years, SVC ≥ (FVC − 200 mL) or (FVC − 10% of FVC), whichever is smaller

Not acceptable or useable (reject) Any of:

Change from:

- if aged >6 years, SVC < FVC (250 mL)

Change to:

- if aged >6 years, SVC < (FVC − 250 mL)

Change from:

- if aged ≤6 years, SVC < FVC (200 mL or 10% of FVC, whichever is smaller)

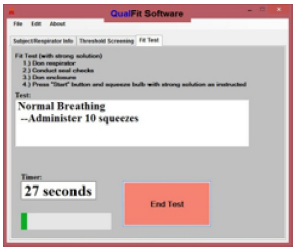
Change to:

- if aged ≤6 years, SVC < (FVC − 200 mL) or (FVC − 10% of FVC), whichever is smaller

Note: If the symbol "≥" doesn't clearly display, if means "greater than or equal to".

QualFit™ Software© An easier, more accurate way to administer respirator fit tests using sweet or bitter fit test methods.

QualFit™ software automates and records qualitative respirator fit testing using Saccharin and/or Bitrex aerosol solutions. The software prompts the operator to deliver the aerosol solution with the correct number of squeezes for each exercise, at the proper time, and in the proper order. This improves fit testing accuracy. The software displays the current exercise in progress, automates the timing sequence and calculates the number of squeezes to be administered, based on threshold screening results. Visual and audible prompts allow the operator to focus their attention on the respirator wearer. The entire procedure becomes less frustrating for the operator and subject being tested. The software tracks each step of the fit testing procedure required in mandatory Appendix A of the OSHA Respirator Standard. **QualFit™** software improves the quality and efficiency of respirator fit testing. An OSHA compliant report can be printed or electronically saved. The employer benefits by knowing the test procedure was properly administered and provides written documentation for compliance with record keeping requirements specified in paragraph "m" of the OSHA standard. The employee benefits by knowing a standardized procedure was followed, rather than what often appears to be a random procedure.



For Information visit: www.QualFit.net

To place a secure online credit card order visit: https://qualfit-software.square.site/

Reminder: Refresher Training Due Dates

If your last initial or refresher spirometry training was in 2019, your re-certification **due date is 2024**.

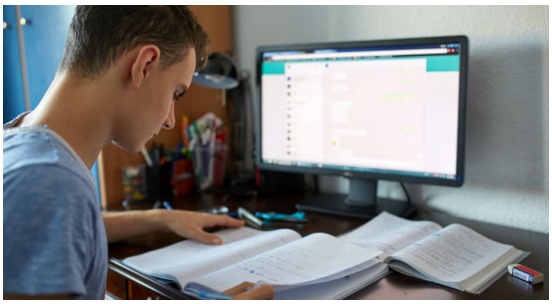
Students who wish to maintain their NIOSH Spirometry certification must take a NIOSH-approved Refresher program **every 5 years**.

Next in-person Refresher course date is:

September 24, 2024

On-line, self-paced Refresher training, taken at your own convenience, is also available.

For details visit www.DrMcKay.com and look at the our Refresher course information section.



NEW Online Spirometry REFRESHER Training (NIOSH-approved):

This online, self-paced course fulfills requirements for NIOSH-Approved Spirometry **Refresher** training necessary for compliance with some OSHA standards. Course content was developed by Dr. McKay (University of Cincinnati) and includes the most recent changes to ATS-ERS spirometry standards. Upon successful completion of this course, students will receive a NIOSH-Approved Spirometry **Refresher** training certificate.

To receive a course brochure, email Roy@DrMcKay.com or Click Here

Click here for information, fees or to submit a registration request

For a brief 2 minute Video Description:
https://youtu.be/uu8UQ0j-S9E

NEW Online Fundamentals of Spirometry:

This interactive online, self-paced course is designed to teach essential spirometry testing procedures consistent with current ATS-ERS spirometry guidelines. It includes; terminology, how to administer a test, testing technique, acceptability/repeatability criteria, how to read tracings, and much more. This course is designed for persons who plan to conduct spirometry testing in an office, clinical and some occupational health settings. It can help prepare respiratory therapists taking the RPFT exam and occupational health nurses taking the COHN exam. It is **not** designed for persons who need a NIOSH-approved spirometry training course.

To receive a course brochure, email Roy@DrMcKay.com or Click Here

Click here for information, fees, or to submit a registration request

In-person Training opportunities

Spirometry Refresher NIOSH-approved
Refresher training is **required every 5-years** for testing technicians who wish to maintain their current NIOSH-approved training status. Refresher training is also recommended by the American Thoracic Society (ATS) and European Respiratory Society (source: ATS/ERS General Considerations for Lung Function Testing; *Eur Respir J* 2005; 26:258) and other organizations. This one-day course will be given by Roy McKay, Ph.D., a contributing author to the previous ATS/ERS Spirometry standard used worldwide. This Refresher course will review the new 2019 ATS/ERS spirometry testing guidelines and will stress testing skills, spirometry patterns (flow & volume), recognition and causes of unacceptable maneuver performance, methods to improve testing technique, occupational surveillance concerns, and basic spirometry patterns. Examples of acceptable or usable, and unacceptable tracings will be shown to help the student recognize if the tracing has usable information. This course is also an excellent way to obtain answers to questions not foreseen during initial training and maintain your NIOSH-approved certification status.

Partial Listing of Course Topics
* Changes to spirometry standards.
* Definitions & Significance of: FVC, FEV1, $FEF_{25-75\%}$.
* Review and improve proper test procedures and subject preparation.
* Recognition of unacceptable maneuver performance.
* How to identify an improperly performed test.
* How to use the Flow - Volume display to improve test performance.
* How to use Peak Flow to evaluate subject effort.
* How to recognize obstructive & restrictive patterns.
* Recognition of artifacts that impact patient test results (e.g., zeroing errors, sub-maximal effort, etc.)
* Methods you can use to improve test quality.
* Understanding the display and equipment recorder requirements of the ATS/ERS.

Note: Our refresher class is not a repeat of initial spirometry training. It's specifically designed to meet the needs of students who have previously attended a spirometry training program in the past.

Our next Spirometry Refresher classes will be held:
September 24, 2024

For additional information, visit our web site at:
www.DrMcKay.com

Certificates for persons that successfully complete all training requirements will indicate 7.5 contact hours with 0.75 CEUs from the University of Cincinnati.

Interpretation of Spirometry: Beyond the Numbers
This annual, 1-day course is ideal for health professionals who desire comprehensive training specific to interpretation of spirometry tests. Several interpretative strategies will be discussed including those published by the American Thoracic Society (ATS), European Respiratory Society (ERS), and Dr. McKay. The strengths, weaknesses, and limitations of other strategies (GOLD, NICE, etc.) will also be discussed from the perspective of a co-author of the previous ATS/ERS spirometry and interpretative strategy guidelines. Practice problems will help the student recognize common spirometry patterns such as upper, lower & central airway obstruction, restrictive, mixed and those caused by either sub-maximal inspiration or expiration. Students will learn when unacceptable maneuvers still have usable information for interpretation purposes. Examples of poorly administered and improperly performed tests will be used to help students recognize poor subject effort, poor technique, and other factors that alter interpretation. This class will clarify **FEV1*Q*** and **PRISm** and explain which spirometry parameters should be used for interpretation. Students will also learn how to recognize the magnitude and direction of error introduced when less than ideal results are obtained.

A variety of methods will be presented to identify potentially significant change in lung function. This information is very helpful in regards to identifying persons with true lung disease versus variability in the test. At the conclusion of this course, students will be capable of recognizing acceptable spirometry maneuvers and will learn how to interpret test results while decreasing the false positive and false negative rate of obstructive and restrictive lung disease patterns. This course is a "must" for persons who want a greater understanding of spirometry interpretation.

Objectives:
Recognize important components of spirometry standards that impact interpretation of results.
Interpret spirometry graphs as to the type of

pattern.
Recognize conditions that affect spirometry results.
Identify errors in test procedures or testing equipment that may affect results.
Recognize factors that cause miss-classification of spirometry patterns (i.e., obstructive to normal, etc.).
Recognize potentially significant change in spirometry testing.
Understand new concepts including FEV1*Q* and PRISm.

This course is a "must" for persons who want a comprehensive understanding of spirometry interpretation. At the conclusion of this course, students will learn how to interpret test results while decreasing the false positive and false negative rate of obstructive and restrictive lung disease patterns.

Students who materially participate and attend the entire training program will receive a training certificate from the University of Cincinnati (Sponsor & Accreditor) indicating 7.5 Contact hours (0.75 CEUs).

For a complete listing of course content, please visit: www.DrMcKay.com

Next course date is: September 25, 2024

Spirometry Fundamentals Workshop

Contact us for next course date

This spirometry training program covers the fundamentals of spirometry testing and is ideal for those working in family practice, internal medicine, and other clinical facilities. Students will learn basic spirometry terminology, definitions, and how to administer tests to meet American Thoracic Society (ATS) – European Respiratory Society (ERS) standards. Students will also learn the basic skills needed to "read" and understand volume-time and flow-volume tracings. In addition, students will learn how to recognize when tests meet acceptability and repeatability criteria and how to utilize the tracings to improve patient results and test quality. This is critically important since technically flawed tests too often lead to inaccurate interpretation of respiratory health. This may result in falsely labeling normal subjects as "impaired" or impaired subjects as "normal." Such flawed results are not only useless, but also convey false information which could be harmful. This course will help testing technicians identify technically flawed curves and distinguish acceptable from non-acceptable tests. This is an important concern, since spirometers generate printouts and reports, regardless of whether or not the results are accurate. Failure to obtain quality spirometry results can lead to inaccurate interpretation of results.

To accomplish this goal a combination of lecture, demonstration, and hands-on student participation will be used. All participating students will receive a certificate of completion from the University of Cincinnati. All lectures will be given by Dr. Roy McKay, who has taught spirometry training for nearly three (3) decades and a co-author of ATS/ERS standards.

Who Should Attend:
This course is designed for persons who plan to conduct spirometry testing in an office or clinical setting. This course is **not** designed for students who need a NIOSH-approved course for testing in an occupational setting. Students who need NIOSH-approval should consider taking our 3-day NIOSH-approved spirometry training course (course approval # 010).

Prerequisites:
None. No prior experience is needed.

Objectives:
The participant will learn the fundamental principles and skills needed to obtain tests that meet American Thoracic Society (ATS) – European Respiratory Society (ERS) standards for spirometry.

Listing of Course Topics:
Overview of spirometry standards
Definitions: FVC, FEV1, FEV1/FVC%, Peak Flow, etc.
How to read volume-time and flow-volume tracing
Acceptability & repeatability criteria
How to administer a spirometry test & testing technique
How to recognize tests with less than maximal effort
Common spirometry problems, pitfalls, and solutions
Predicted normal values
Basic spirometry patterns (normal, obstructive, restrictive, & mixed)
Calibration and system verification requirements
Workshop:
Demonstration of testing technique
Student participation (hands-on testing)

NIOSH-Approved Spirometry Training

This 3-day "initial" training course is designed for persons who need to learn how to administer spirometry testing according to the most recent 2019 ATS/ERS guidelines. This "hands-on" training covers all aspects of spirometry testing and uses a combination of lecture, hands-on training and small group problem solving sessions.

Next NIOSH-approved Spirometry course dates:

Apr 2-4, 2024 (2 spots remaining)
June 18-20, 2024
Sept 10-12, 2024
Nov 12-14, 2024

Certificates for persons that successfully complete all training requirements will indicate 22 contact hours with 2.2 CEUs from the University of Cincinnati.

2024 Respirator Training Schedule
Respirator training dates for calendar year 2024 have set as follows. Class size is limited. If interested, submit a registration request early. Payment is not required to submit a registration request, but space is assigned when payment is received. To submit a request or for additional information, go to: www.DrMcKay.com

Apr 16:	Overview of Respiratory Protection
Apr 17-18:	Fit Testing Workshop (2-days)
May 14:	Comprehensive Respirator Selection
May 15:	Development of Change Out Schedules
May 16:	Fit Testing Refresher & Advanced topics
Oct 22:	Overview of Respiratory Protection
Oct 23-24	Fit Testing Workshop (2-days)

For information about **QualFit™** Software© for qualitative respirator fit testing with sweet and/or bitter agents, go to www.QualFit.net

Learn Respirator Fit Testing
Join us April 17-18, 2024 for a Respirator Fit Testing Workshop in Cincinnati. For details go to: www.DrMcKay.com

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There is no cost to subscribe. Your email address is NOT given to any other source. Newsletters are sent 3 - 4 times per year.

If you Receive Duplicate Newsletters:
Email us with the address to remove if newsletters are coming to multiple addresses. If duplicates are being received at the same email address, let us know to retain one of the addresses.

Students attending our programs help support our graduate training programs and research projects. We hope to see you at a future training course.

Roy McKay, Ph.D.
Course Director
University of Cincinnati
www.DrMcKay.com

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