

DEPARTMENT OF THE ARMY  
 HEADQUARTERS, NORTH ATLANTIC REGIONAL MEDICAL COMMAND  
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NARMC Pamphlet  
 No. 40-1

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Medical Records  
**TELE-PULMONARY FUNCTION TESTING CONSULT MANAGEMENT**

**1. History**

This is a new North Atlantic Regional Medical Command (NARMC) pamphlet.

**2. Applicability**

All NARMC Pulmonary Function Testing (PFT) Laboratories participating in the program, including relevant staff, commanders and directors.

**3. Purpose**

This Clinical Business Practice is provided as a guide to the successful implementation and operation of a tele-pulmonary function testing consult system.

**4. References**

- a. Telemedicine Policy Memorandum, 15 December 1997.
- b. Walter Reed Army Medical Center (WRAMC) Pulmonary Function Laboratory standard operating procedures.

**5. Responsibilities**

a. Referring Facility.

- (1) Director.
  - (a) Oversee all aspects of clinical care, training and research in the PFT lab.
  - (b) Ensure that all lab personnel are appropriately trained.
  - (c) Oversee PFT training of pulmonary fellows.
  - (d) Review lab techniques for adherence to accepted national standards.

(2) Referring Provider.

- (a) Give patient a signed Standard Form 513, Medical Record Consultation Sheet for referral.
- (b) Check to see that the interpreted consult is returned within 72 hours plus local procedure.
- (c) Query Respiratory Therapy (RT) as to missing/late studies.

(3) Pulmonary Function Lab Technician.

- (a) Assist in maintenance, security, calibration and quality control of PFT equipment, as directed by the Non-Commissioned Officer-in-Charge (NCOIC).
  - (b) Conduct daily PFT testing with accuracy, efficiency and compassion.
  - (c) Serve as Training Non-Commissioned Officer (NCO) or Logistics NCO as directed by NCOIC.
  - (d) Obtain signed informed consent. See Appendix A, Consent Form.
- (4) Non-Commissioned Officer-in-Charge.
- (a) Responsible for the daily accountability and conduct of laboratory enlisted personnel.
  - (b) Oversee technical training and maintain competency files for all lab personnel.
  - (c) Secure and maintain in good working order all PFT equipment and supplies.

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(d) Coordinate leaves, passes and other absences of lab personnel to ensure adequate staffing levels.

(e) Ensure completion of the arterial blood gas laboratory Quality Control (QC) program.

(f) Provide Quality Improvement (QI) reports to the director, as requested.

(g) Prepare and maintain pulmonary function computerized scheduling.

(h) Provide workload accounting in Composite Health Care System (CHCS), Uniformed Chart of Accounts Personnel Utilization System (UCAPERS), and Military Evaluation Personnel Reporting System (MEPRS) as directed.

(i) Distribute and maintain copies of pulmonary function test results, in accordance with applicable storage and confidentiality procedures.

(j) Copy consulting facility on QI reports.

(k) Report usage statistics on a weekly or a monthly basis, including total number of consults performed each period broken down by each supported referring site to 202-782-4028, or [consult.wramc@na.amedd.army.mil](mailto:consult.wramc@na.amedd.army.mil).

b. Consulting Facility.

(1) Director.

(a) Oversee all aspects of clinical care, training and research in the PFT lab.

(b) Ensure that all lab personnel are appropriately trained.

(c) Oversee PFT training of pulmonary fellows.

(d) Review lab techniques for adherence to accepted national standards.

(e) Represent the PFT lab to the Pulmonary Service QI committee.

(2) Consulting Pulmonary and Critical Care Medicine (PCCM).

(a) Regular scheduling of on-call e-mail read/response.

(b) Viewing and research.

(c) Return consult form.

(d) Turn consult around within 72 hours.

(e) Quality improvement for consults not returned within 72 hours.

(f) Further availability/follow-up as directed by the requesting provider.

(3) Non-Commissioned Officer-in-Charge.

(a) Responsible for the daily accountability and conduct of laboratory enlisted personnel.

(b) Oversee technical training and maintain competency files for all lab personnel.

(c) Secure and maintain in good working order all PFT equipment and supplies.

(d) Coordinate leaves, passes and other absences of lab personnel to ensure adequate staffing levels.

(e) Ensure completion of the arterial blood gas laboratory QC program.

(f) Provide QI reports to the director, as requested.

(g) Prepare and maintain pulmonary function computerized scheduling.

(h) Provide workload accounting in CHCS, UCAPERS and MEPRS as directed.

(i) Distribute and maintain copies of pulmonary function test results, in accordance with applicable storage and confidentiality procedures.

(j) Copy referring facility on QI reports.

(k) Report usage statistics on a weekly or a monthly basis, including total number of consults performed each period to (202) 782-4031, or consult.wramc@na.amedd.army.mil.

**c. General**

(1) System Administrator (refer to VMAX™ Reference Manual).

- (a) Maintenance on acquisition station.
- (b) Disk space.
- (c) Volume management.
- (d) Mail server, settings and timing.

(e) Coordinate file replication to coincide with off-peak network use.

- (f) Maintenance on server.
- (g) Disk space.
- (h) Mail server, settings and timing.

(i) Coordinate file replication to coincide with off-peak network use.

**6. Scope of Care**

Patients referred for Pulmonary Function Testing by physicians who wish expedited and cost-effective consults with pulmonary specialists at the Walter Reed Army Medical Center.

**7. Preparation**

**a. Referring Facility.**

**(1) Precautions.**

(a) Tuberculosis (TB) Screening: Patients should be screened for TB prior to testing. Pulmonary Function Testing technicians must review the answers, and discuss suggestive answers with the PCCM lab fellow or staff physician prior to testing.

(b) Universal precautions must be observed.

(c) Disposable gloves are to be worn during all invasive procedures.

(d) Supplies, masks and face-shields must be available for use by technicians.

(e) First Aid supplies should be on hand as per local procedure.

**(2) Workstations.**

(a) Log workstation on to local area network (LAN), if it is not already logged on.

(b) Where necessary, map workstation to appropriate network and local drives.

(c) From Desktop, right click on Network Neighborhood icon. Choose Map Network Drive.

(d) Select a drive from the list at the bottom, allowing your computer to assign its own drive letter. Note that access to some drives may be controlled by a password.

**(3) Equipment.**

**(a) Preparation of Equipment**

(b) Patients must perform all forced exhalations through a bacterial filter.

(c) Disposable filters must be changed between patients.

(d) Disposable mouthpieces must be changed between patients for the performance of metered dose inhaler (MDI) delivery and airway pressure testing.

(e) Spirometry equipment must be calibrated daily, prior to use.

(f) Check all connections and hoses for tightness of fit and obvious leaks, breaks, or misconnections. (There may be two small hoses connected to the main hose. The braided hose is for arterial blood gas (ABG) analysis, and may not be necessary on all stations.)

(4) VMAX™ Setup.

(a) Go to Setup, then Settings.

(b) Choose source and destination drives for retrieving and storing data.

(c) The local drive will normally be assigned the drive letter c. Other facilities sharing the same LAN will be assigned automatically their own drive letters.

(d) NOTE: If VMAX™ was properly installed, it should find the necessary drives automatically as part of normal startup functions. VMAX™ will display a message informing you of the drives it is searching for, and whether or not it has found them.

(e) Periodically you may wish to customize certain data fields. Under Setup or using the F10 key you may alter the pull-down list of options that appears for a data field. Examples are the addition of technician and clinician names to the appropriate fields, to reduce constant re-typing.

(f) Frequent network delays can cause difficulties in the operation of the VMAX™ software. Such difficulties will normally appear as delays in finding and/or saving files, "missing" seconds on the program clock during testing, and a pattern of missed and/or invalid data.

(g) While VMAX™ is running, if it is using a network drive, you will see a network connection icon in the top right corner of the screen, which should contain a green checkmark to indicate a strong connection. This checkmark will disappear and the icon will flash when the network connection becomes unreliable. Another indication of a deteriorating network connection is the time display; during testing, the timer will skip seconds when it cannot read data through the network quickly enough.

(h) To avoid this problem, change the VMAX™ setup to use the local drive. *When the network clears, or at the end of your shift, transfer all local data to the network drive.*

(i) To transfer data, go to "Database Operations," and then "Merge." Enter your network password, search on your source drive for all records by entering no search criteria, and select the network drive as the destination for those records.

(j) The database merge described in 7c (1) will also operate to transfer records from other drives on the network to the local drive for review.

(k) Should your workstation display only a blank screen when you try to view reports or graphs, exit VMAX™. Right click on the desktop, and select Properties. Click on the Settings tab, and try changing the desktop resolution to 800x600. If this does not work, try changing the display to 256 colors.

(5) VMAX™ Calibration.

(Note: Filters should be used during calibration in all cases where they will be used with patients.)

(a) Calibration diagnostics must be completed daily before VMAX™ is used. VMAX™ has sensors to detect environmental conditions in the testing room, but the settings should be reviewed before operation. Clicking on them and typing will alter values in gray boxes. Pressing F10 allows you to alter values in green boxes. It is recommended you leave the relative humidity set to the default. This document presumes that 3-liter syringes will be used during calibration.

(b) To begin testing the machine, press F1. The F1 button at the bottom of the screen will remain highlighted during the initial diagnostic tests.

(c) You will be prompted to give 2 even strokes of air into the machine with the syringe in order for the machine to clear out stale air, check its flow sensors, and stabilize. Green bars will appear on the screen to indicate the machine's progress. If the bar has not reached full length before 30 seconds, the machine has failed this diagnostic.

(d) You will next be prompted to give 5 strokes of the syringe. Each stroke should progress evenly between the red dotted lines indicating positive and negative 3 liters on the (flow time or flow volume) graphs. Each stroke should take 1 second to complete.

(e) F2 should now be highlighted, indicating that you are beginning the second phase of calibration.

(f) You will be prompted to give another 5 strokes of the syringe. Maintain steady pressure to keep the flow volume at .5 liters/second throughout. For the 3 Liter syringes, 6 seconds will be required for each stroke. The Flow/Time graph will display red dotted lines through the .5-liter line, in order to help you gauge your pressure and progress.

(g) VMAX™ will next prompt you for strokes of varying speed, normally at least one in each of the low, mid and high ranges of flow volume per second.

(h) When you have completed the necessary syringe work, check the report displayed in the chart at the top of the screen (for the suggested contents of this short report. The strokes in each of the above groups should have measured values within 3% of each other, both on inspiration and expiration. For a 3-liter syringe, these values should therefore fall between 2.91L and 3.09L. If any value is outside of the 3% range, the machine must be recalibrated prior to use.

(i) When calibration is completed between the acceptable ranges, use the F3 button to store the settings. Alternatively, exit the diagnostic and VMAX™ will store the calibration data automatically.

(j) During the course of a day's trials, you may wish to review the calibration settings. F2 will verify the settings during trials, without necessitating a re-run of the calibration program. When in doubt, run tests on yourself or the person used by your lab as a reference, in order to get an idea of likely problems.

(k) All VMAX™ equipment should be checked against one another and their own previous records on a single control subject at least once per quarter, in order to ensure accuracy and reliability.

(6) Patient Processing.

(a) Greet the patient and make him/her comfortable.

(b) Referrals—Form SF 513.

(c) Receive and file a completed form SF 513 from the patient. *Be sure the form is signed by a physician, and the tests ordered are possible for that patient at that time.*

(d) Use referral information to determine important foci for testing and/or to anticipate further testing that may be needed.

(7) Facilities utilizing a contract RT should have some sort of contingency plan for situations where those people do/can not show on a day when trials are scheduled.

b. Consulting Facility Workstation. See 7a(2), above. VMAX™ Preparation. See 7a(4), above.

**8. Procedures**

a. Referring Facility.

(1) To begin a trial, select New Study.

(a) Enter the information gathered on the patient from the SF 513, the survey that they filled out, and relevant medical records.

(b) Be sure to fill out the statistical tracking information on smoking, medications, symptoms, etc.

(c) Be sure to summarize all such data for the consulting physician in the Comments section at the end of the trial, in order to ensure the consultant is aware of the data.

(d) Check height and weight yourself before testing, and use your data in place of height or weight information appearing in the records. Also, be sure to choose an appropriate pulmonary reference based on the patient's demographic data.

(e) Using the incorrect Pulmonary Reference will skew these results by an average of 15%. Likewise, every incorrect inch of height will skew results by roughly 5%.

(f) You may wish to use the Room field to track the workstation where testing takes place.

(g) You may wish to use the Any Info field to track the referring clinic for each trial.

(h) If you need to change the patient's demographic information, click or press F3 while viewing the main screen.

#### (2) Recommended Display.

(a) To facilitate these and other QI concerns during trials, it is suggested you have three report windows open on the screen during testing: a time flow graph, a flow volume graph, and an abbreviated report containing at least: forced expiratory volume in 1 second (FEV-1), forced vital capacity (FVC), FEV/FVC ratios, (when this value falls below 90%, it indicates possible obstruction and may prompt you to perform a post-broncho dilator testing, if such has not already been ordered anyway), peak expiratory flow (PEF) 25-75 (values that should vary no more than 10% between the different trials for a given patient), and PEF (again, values should vary no more than 10% between the different trials for a given patient). Clicking on any of the report windows will enlarge that window to fill the screen. Clicking on the short report will display the long report. The values that appear in these reports can be customized during setup.

#### (3) Testing.

(a) From the main menu screen, F5 takes you to the PFT menu. Select the trial type, trial

protocols, and testing levels from the PFT pull-down menus. Click or press F1 to begin testing.

(b) VMAX™ will prompt the technician throughout the testing procedure to have the patient perform as necessary for the selected trial protocol and level. You will ask the patient to take a few normal breaths into the machine in order to re-test for leaks. Then the patient will be required to inhale fully and then forcefully expel all of their air, holding the exhale for between 6 and 15 seconds. According to the 1994 American Telemedicine Association (ATA) criteria, you should see a 1 second plateau. Continue with the testing prompts that appear on the bottom of the screen, paying attention to flow capacity. If capacity drops too low, check the predicted values, check the demographic information, check the patient's files or the consult sheet for indications. Be aware that the referring physician will likely send patients who score too low back to the PFT lab for full workups, so try to catch simple errors in the testing process now.

#### (4) Desired Results.

(a) Note that on the flow graphs, tick marks show volumes (top of loop), and flows (bottom of loop). The numbers will likely bunch differently at different points on the graph, so be aware of the scale on each graph, particularly between the .5 and 1 liter marks, and between the 1 and 3 liter marks. Pressing or clicking F1 allows you to view a test. F2 will allow you to remove a test from the trial, to delete a test entirely, and to edit certain test values for trending and similar purposes. F4 will automatically accept the best effort from the tests as your best FVC and FEV1. These values should correlate with a very good peak flow (the total of FVC and FEV1 that creates the loop on the graphs). Error codes will appear for each trial in a binary fashion: 0's in the error row indicates an error free trial, 1's indicate different errors based on their position in the error row.

#### (5) Test Completion.

(a) Select the best and most representative trial to store on the system.

VMAX will choose a best effort that will be stored by default unless you override the selection with one of your own.

(b) You may wish to combine two tests rather than accepting the best effort selected by VMAX™, in order to truly get the best picture of both inspiration and expiration. To do so, go to Windows on the menu bar, and select All Flow Volume to display an image of each of the flow volume loops from your current trial. Choose the loop with the best effort (FVC + FEV1) as your starting point. Check to be sure the effort was acceptable, error free, and not deleted. Next click on the "Inspir" button toward the bottom of the page and choose the loop with the best inspiratory effort. Select Reports from the Flow Volume Loops Page, and then either print or review the report. Newer versions of VMAX™ also have the capability to write the new report into Adobe Acrobat (PDF) format.

(6) Day End Responsibilities.

(a) Daily Report. Again, search patterns can be set under setup, along with the contents of the report. Once you have called up all of the trials run, back them up to the network drive, and also to a backup storage unit. Common fields for this report are date, patient name, patient identification number, the referring clinic, the referring physician, and procedure codes. Each procedure code is assigned values (that can also be modified under Setup) for allotted time and other administrative details of each procedure. F5 will print the report, but you must make sure that your printer is set to Landscape mode or the procedure codes will not appear on the paper copy.

(7) Minimum Age Limits.

(a) Patients under the age of 18 must have the approval of their parent or guardian, either in person or in writing, before undergoing PFT testing.

(b) Spirometry, diffusion capacity and full PFT testing will be provided for patients between 6 and 17 years old who are capable of cooperating with the test, but only upon request

by a pediatrician. Arterial blood gas analysis will be included in full PFT's for minors only upon specific request by the referring pediatrician.

(c) Additional testing on patients less than 18 years old may be performed at the discretion of the director of the PFT lab, on a case-by-case basis.

(d) Parents or guardians may be requested to remain in the waiting area during testing, at the discretion of the lab technician.

(8) Cleanup.

(a) Reusable mouthpieces, valves and nebulizers will be cleaned in an approved detergent (Klenzyme, etc.), air-dried and subjected to autoclave sterilization.

(b) Countertops in the blood gas lab and dirty utility room, and patient contact surfaces on PFT equipment will be cleaned with an approved disinfectant (Cavicide, etc.), daily and as needed.

(9) Follow-Up.

(a) Respiratory Therapy queries database by name or date to receive interpreted studies 72 hours after test.

(b) Identifies delinquent studies, and contacts consulting PCCM or Pulmonary lab director for follow up.

(c) Prints interpreted studies, matches with filed SF 513 file, and forwards to requesting provider.

b. Consulting Facility.

(1) Operating VMAX™.

(a) Open the VMAX™ program.

(b) Under Settings, choose the source drive and click F3.

(c) Back on the main screen, click Find Patient. Choose your search criteria (normally dates) and press or click F1.

(d) From this screen, you can highlight the first record that you wish to review, and click or press F3.

(e) Before viewing your first record after starting the VMAX™ program, click on Reports from the main screen. Choose the report type that is appropriate, normally pre/post/diffusing capacity for carbon monoxide (DLCO/ABG), and click on view at the top of the screen.

(f) After bringing up your first record, you may notice that the column for predicted values is empty. If this occurs, open the Patient Demographics screen, and make sure that the correct pulmonary reference has been selected for that patient.

(g) When you are ready to interpret the study, click or press F7. The interpretation data entry screen can be customized to include any pre-set statements that you wish, so that the consulting PCCM can largely point and click in order to answer the consult request. When finished, click or press F8. Records are automatically marked as "interpreted."

(h) Go back to F1, and choose the next patient record that you wish to view. Click or press F3 to retrieve the next selected record. In some versions of the VMAX™ program, records are opened using the PFT reference data from the previous record. To correct this problem and safeguard against it, open a record, and then click View on the taskbar in order to refresh the calculations that VMAX™ must make for the new record.

(i) Be sure to check the drives dedicated to each clinic for pending consult requests.

**c. General.**

**(1) Searching for Records.**

(a) Searching for one or more patient records is essentially the same for all VMAX™ operations. A number of fields will appear, with

each field representing a possible search parameter. It is suggested that you use the minimum search criteria possible for the record(s) that you wish to retrieve, as the computer adheres exactly to the search criteria. Any incorrect data in any of the fields will prevent VMAX™ from finding your record, so be sure that all fields that you do not wish to search with remain blank. For example, to pull up all records between certain dates, enter only those dates, and be sure that all other fields are empty. To retrieve all records on a given drive, enter no criteria at all other than the source drive.

(b) Double clicking on a returned record will give you further information on that patient, while pressing or clicking F3 will write that record onto your local workstation for your use.

**9. Record keeping**

a. Referring Facility local procedures shall address the following components:

(1) Paper records, where applicable.

(a) After physician review, lab personnel shall send an interpreted report to the appropriate record room.

(b) Copies of Pulmonary Function Test reports from scheduled studies, from all patients referred by PCCM physicians, and on patients expected to undergo repeated testing will be maintained on file in the PFT lab for a period to be specified by local procedure.

(2) Computer Records.

(a) Computer based records must be transferred to the network. Files from each local drive should also be archived onto outside storage media at the end of each shift.

(b) Computer records are to be maintained in the network drive as active files as per local procedure. Archived copies shall likewise be maintained for a period set by local procedure.

b. Consulting Facility.

(1) Paper Records.

(a) At the consult level, paper records should be unnecessary. Should printouts be made of individually identifiable patient records, consulting PCCM's are cautioned to restrict access to such records and to destroy or securely file them when no longer needed, in order to preserve patient privacy.

(2) Computer Records.

(a) Again, it is unlikely records will need to be maintained or archived on drives or other media at the consulting facility. Privacy concerns must be addressed for any copies that are made.

**10. Workload**

a. Referring: PFT.

(1) Workload and accounting is the responsibility of the lab NCOIC. Tasks may be delegated as appropriate.

(2) Written or electronic reports will be completed by the last day of each month for the current month.

(3) Workload data will be reported in the appropriate format, with a copy delivered to manpower and UCAPERS.

(4) A workload database detailing the number and type of tests performed and the referring service will be maintained and provided to the director on a monthly basis.

(5) The technician will complete procedure codes for all patients tested on ambulatory data system (ADS) workload sheets.

(6) The consult will maintain and provide monthly statistics according to established reporting procedures and submit report reports to the Telemedicine Directorate, [telemedicine@na.amedd.army.mil](mailto:telemedicine@na.amedd.army.mil).

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**The proponent agency of this publication is the office of the North Atlantic Regional Medical Command, Walter Reed Army Medical Center, Telemedicine Directorate. Users are invited to send suggestions and comments on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Commander, Walter Reed Army Medical Center, ATTN: MCAT-CL-T, 6900 Georgia Avenue N.W., Washington, DC 20307-5001.**

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