



Quality Assurance Processes for Pulmonary Function Tests in an Asthma Clinical Trial: The AsthmaNet BARD Trial

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Introduction

Like most asthma clinical trials, the Best African American Response to Asthma Drugs (BARD) trial of the NHLBI's Asthma Network (AsthmaNet) (NCT01967173) relies on findings of pulmonary function tests (PFTs, e.g., spirometry and methacholine challenges) to characterize and qualify study participants. PFT results are also used directly in the assessment of the BARD trial's primary outcome. Given the importance of PFTs to the success of the trial, and the more than 150 technicians performing PFTs on pediatric and adult participants at 30 clinical sites, it is essential to have well-defined processes in place to ensure excellent test quality. This work was supported by NHLBI grant U10HL098115.

Methods

Standardized Equipment

At its inception, the AsthmaNet Steering Committee (SC) appointed an equipment subcommittee (EQC) to research, evaluate and obtain quotes from multiple companies that manufacture spirometers. The EQC included pulmonologist investigators, a certified respiratory therapist, research coordinators, and staff from the Data Coordinating Center (DCC). AsthmaNet elected to use the USB PC-based MedGraphics® CPFS/D™ spirometer (Medical Graphics Corp., St Paul, MN). All 30 sites were equipped with two systems.

Methods

Manuals of Operations (MOPs)

The EQC, in collaboration with professionals from MedGraphics®, assembled comprehensive MOPs for spirometry and methacholine challenges. MOPs cover the following topics:

- Procedure description and measurements collected
- Equipment set-up and usage
- Participant preparation and safety
- Procedure performance, evaluation, and quality control
- Cleaning, maintenance and troubleshooting instructions
- Certification requirements and overreading criteria

Clinical Staff Training

An on-site group training session was held prior to the launch of the first AsthmaNet trial. AsthmaNet's PFT overreader, a registered pulmonary function technologist with more than 35 years of experience, delivered a slide presentation and demonstrated procedures with the MedGraphics® system. Clinical staff were given the opportunity for hands-on training.

Additional training was provided via on-line video modules (created by MedGraphics®) with quiz "self-checks" at the end of each unit.

Periodic refresher presentations are held during clinical staff Web-based conference calls. Training materials are posted on the AsthmaNet website.

Methods

Certification Requirements

Clinical staff must achieve appropriate certifications before they can perform PFTs on study participants.

Spirometry Certification:

- View MedGraphics® training modules and pass all 10 self-checks
- Perform acceptable spirometry sessions on 5 individuals
 - ✓ Maneuvers must meet American Thoracic Society (ATS) criteria; ATS preschool guidelines are applied to children less than 8 years of age
 - ✓ 3-8 total maneuvers per session
 - ✓ Repeatability criteria met
 - ✓ Pediatric certification requires at least 3 of the 5 certification sessions to be on children ages 5-11

Methacholine Challenge Certification:

- Achieve spirometry certification
- Perform 3 acceptable methacholine challenges with supervision from a certified technician (or perform "mock" challenges)

Overreading

All tests performed in the course of a trial are uploaded to the MedGraphics® Central Database (CD) on a daily basis. Each test is evaluated by a single overreader. The overreader can select and deselect maneuvers and enter comments. Each test is scored according to specific criteria.

Methods

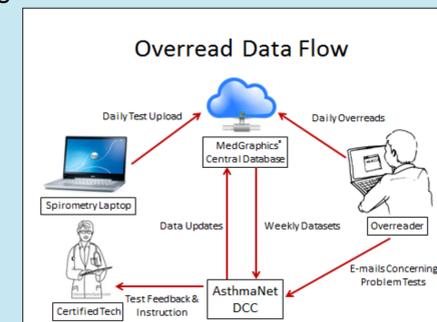
Spirometry Criteria

Criterion	Score Range	Scoring
Technician Test Evaluation	0-4	<ul style="list-style-type: none"> • 4: 3 acceptable maneuvers (AM) • 3: < 3 AM with comment • 2: < 3 AM without comment • 1: 0 AM with comment • 0: 0 AM without comment
Best Test Evaluation	0-5	<ul style="list-style-type: none"> • 1 pt for no delayed peak • 1 pt for high/clearly determined peak • 1 pt for acceptable back extrapolation • 1 pt for test free of cough in 1st second • 1 pt for appropriate end of test
Repeatability	0-2	<ul style="list-style-type: none"> • 1 pt for repeatable FVC • 1 pt for repeatable FEV₁

Methacholine Challenge Criteria

Criterion	Score Range	Scoring
Baseline & Diluent Sessions	0-1	• 1 pt if baseline and diluent sessions each have ≥3 maneuvers that meet ATS criteria
Two Acceptable Maneuvers	0-1	• 1 pt if two acceptable maneuvers were performed after each methacholine concentration
Challenge Termination	0-1	• 1 pt if challenge was terminated at the correct concentration and results were acceptable

Tests that do not achieve perfect scores (11 for spirometry; 3 for challenges) and/or require data edits are e-mailed to the DCC. The DCC determines if study data need to be corrected or removed and forwards details to the technician. Unacceptable screening tests are repeated, if possible. DCC staff can access the CD to update non-data fields, such as participant ID. Overread files are transmitted to the DCC weekly for certification processing and report generation.



Methods

Overread Reports

When the overreader determines that a technician is repeating errors during testing, he contacts him or her via e-mail or phone to provide instruction and helpful tips. All technicians can generate AsthmaNet Overread Reports via the secure website. Reports include the following:

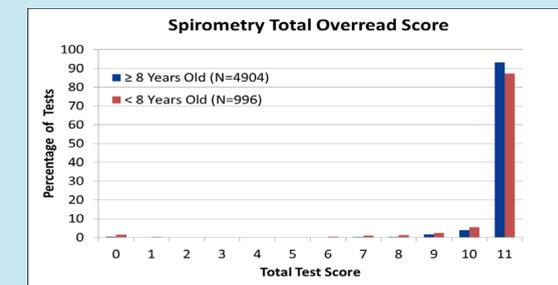
- Frequency tables of overread scores by site (Network-wide) for each of the PFT criteria
- Frequency tables of overread scores by technician (within requesting site)
- Listing of individual protocol tests with overread scores (within site)

See sample report attached to poster.

Technicians whose scores are consistently low are retrained. No technician has been de-certified to date.

Results

To date, 5900 BARD spirometry tests have been overread.

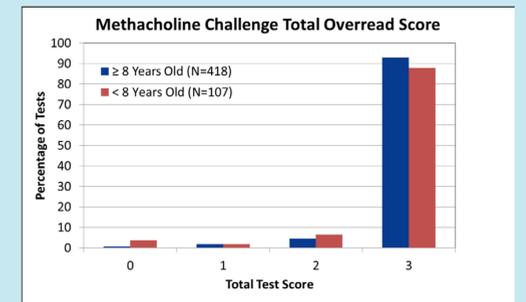


Overall, 5437 of 5900 tests received a perfect score (92.2%).

Results

The average spirometry score for participants under 8 years old was 10.6 (87.4% scored 11 points) as compared to 10.8 (93.1%) in the older age group.

To date, 525 BARD methacholine challenges have been overread.



Overall, 482 of 525 tests received a perfect score (91.8%). The average challenge score for participants under 8 years old was 2.8 (87.9% scored 3 points) as compared to 2.9 (92.8%) in the older age group.

Conclusions

Quality assurance measures have resulted in consistently excellent PFT quality in the AsthmaNet BARD study. Scores for the youngest participants (<8 years old) are likely lower due to the challenges of perfecting spirometry technique in this age group. Standardized training and certification, robust systems and processes, and a thorough overreader who provides prompt feedback to the DCC and clinic technicians are key to top quality PFT data.