

Alberta College of Family Physicians

55th Annual Scientific Assembly, February 25-27, 2010

Banff, AB

A New Spirometry Interpretation Algorithm Developed to Minimize Disease Misclassification

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Disclosure

- No Conflicts of interest to declare with respect to this workshop

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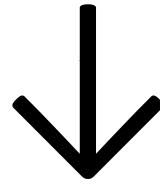
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*Member, Primary Care Respiratory Alliance of Canada (PCRC)

New Spirometry Interpretation Algorithm Developed to Minimize Disease Misclassification

- **Spirometry: Describes the relationship between FLOW and VOLUME during a forced expiratory maneuver**
 - Appropriate technique is critical to promote meaningful interpretation of results

FLOW / VOLUME



FEV_1^* / FVC^*

* Actual values measured

- **FEV_1 = forced expiratory volume in one second**
 - Volume linked to time = **measure of flow**
- **FVC = forced vital capacity = volume**

Spirometric Diagnosis of Asthma and COPD

- $FEV_1 \rightarrow$ Asthma
- FVC
- $FEV_1/FVC \rightarrow$ COPD

*COPD = Chronic Obstructive Pulmonary Disease

Spirometric Diagnosis of Asthma

- FEV₁ increase of 12% and 200 mL above baseline after bronchodilator challenge

$$\frac{\text{FEV}_1 \text{ Post} - \text{FEV}_1 \text{ Pre}}{\text{FEV}_1 \text{ Pre}}$$

Spirometric Diagnosis of COPD

- Post-bronchodilator $FEV_1/FVC < 0.70$ or below LLN
- Changes in FEV_1 post-bronchodilator not considered

*LLN = lower limit of normal

O'Donnell DE et al. Can Resp J 2003: 10(4):183-85.

FEV₁ / FVC

- Pure obstruction = ↓ FEV₁/FVC but FVC normal:
often normal in Asthma
- Restriction = Normal FEV₁/FVC but both FEV₁ and FVC reduced
- Combined obstruction/restriction/hyperinflation =
↓ FEV₁/FVC plus ↓ FVC

Reversibility of Airflow Obstruction

- **Asthma**

- FEV₁ improving 12% and 200 mL with bronchodilator
- FEV₁ often normalizes with bronchodilation
- FEV₁/FVC may remain below 0.70 or LLN with bronchodilator

Reversibility of Airflow Obstruction

- **COPD**

- FEV₁ may improve 12% and 200 mL with bronchodilator
- FEV₁/FVC remains below 0.70 or LLN with bronchodilation

Spirometric overlap between Asthma and COPD

| | Asthma | COPD |
|---------------|----------------|----------------|
| FEV_1^* | Normal/Reduced | Normal/Reduced |
| FEV_1/FVC^* | Normal/Reduced | Reduced |

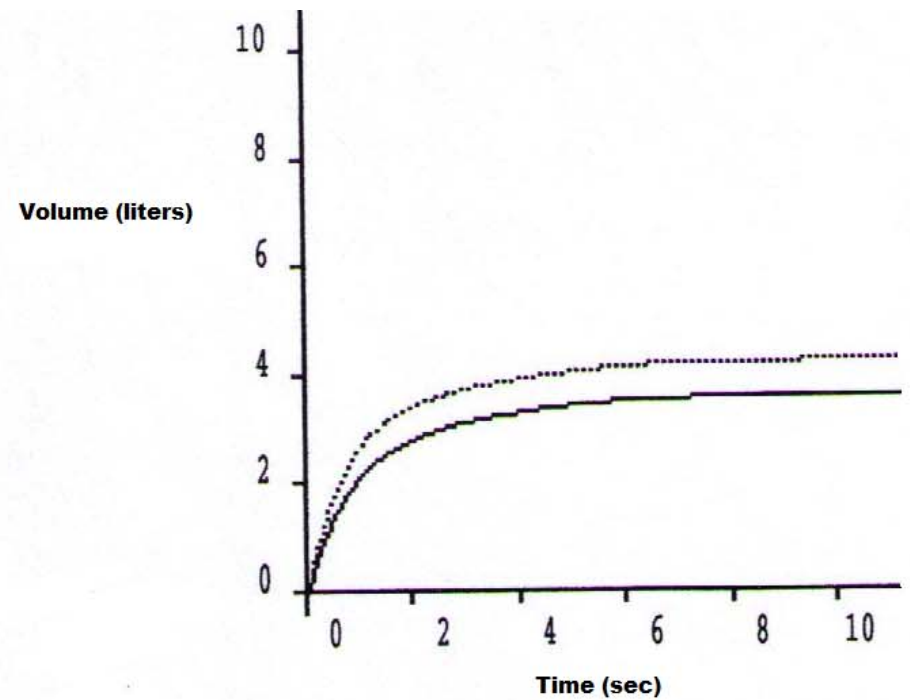
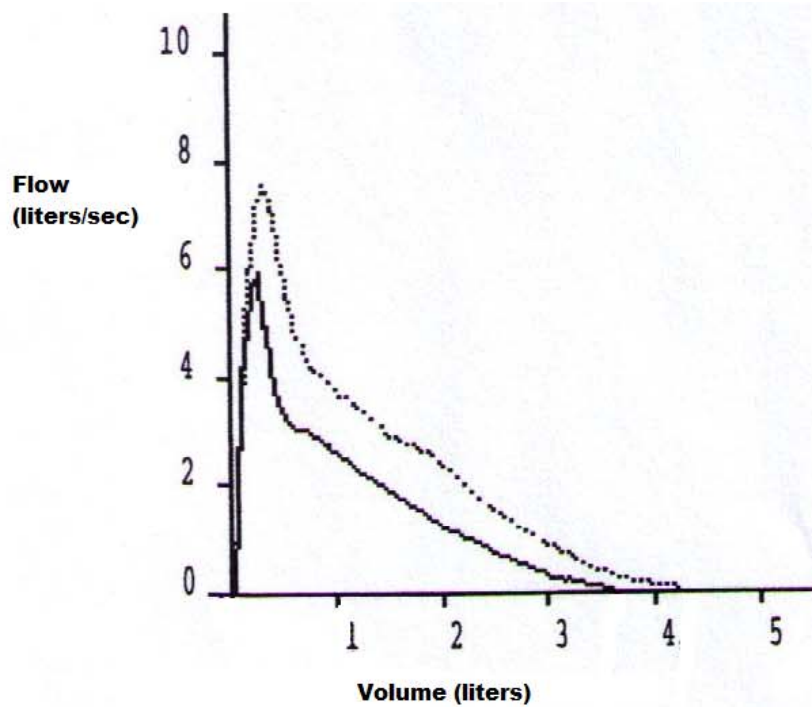
* Post-bronchodilator

Pre-bronchodilator FEV_1/FVC often normal in Asthma

Spirometric Overlap between Asthma and COPD

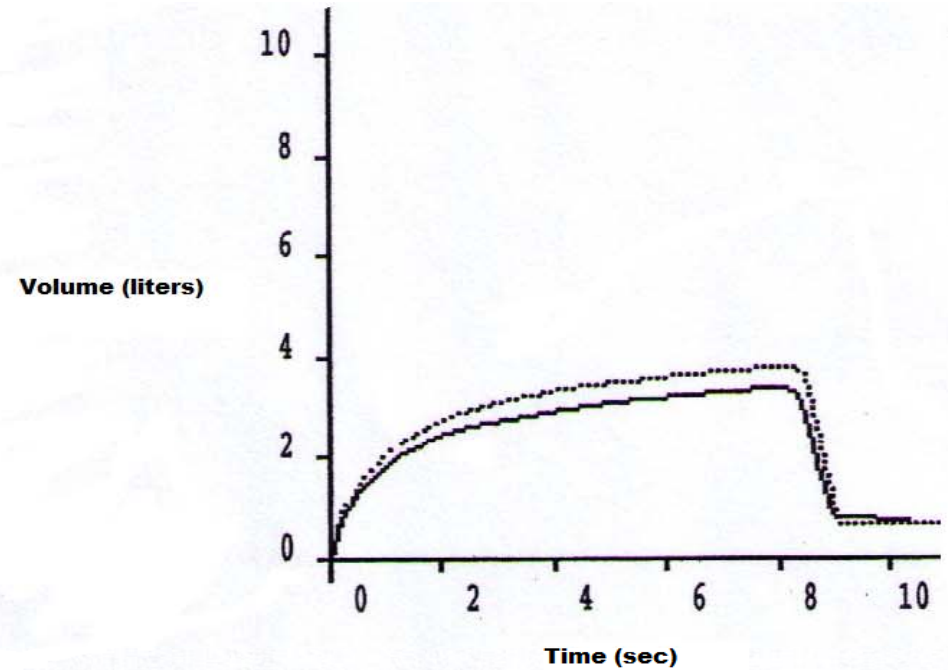
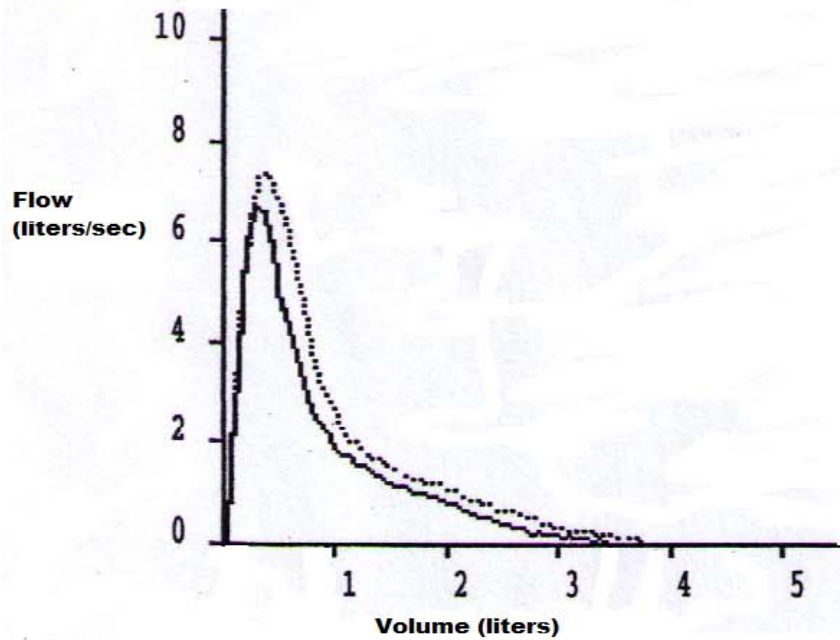
- Changes in Post-bronchodilator FEV_1 are not useful for differentiating asthma from COPD
- A NORMAL FEV_1/FVC (> 0.70 or LLN) rules out a spirometric diagnosis of COPD

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



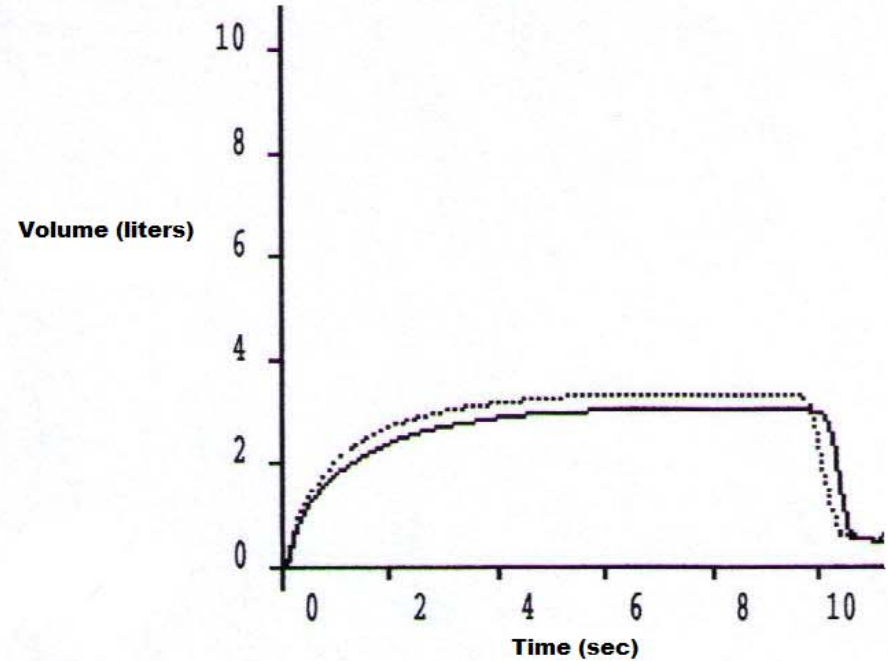
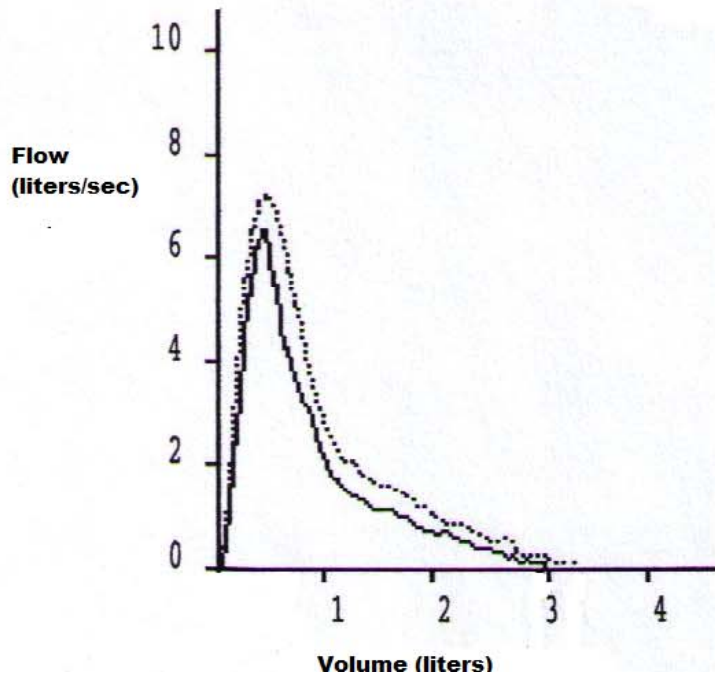
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 3.62 | 81 | 4.26 | 96 | 18 |
| FEV ₁ | 2.21 | 62 | 2.77 | 78 | 25 |
| FEV ₁ /FVC | 61.2 | | 65.0 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



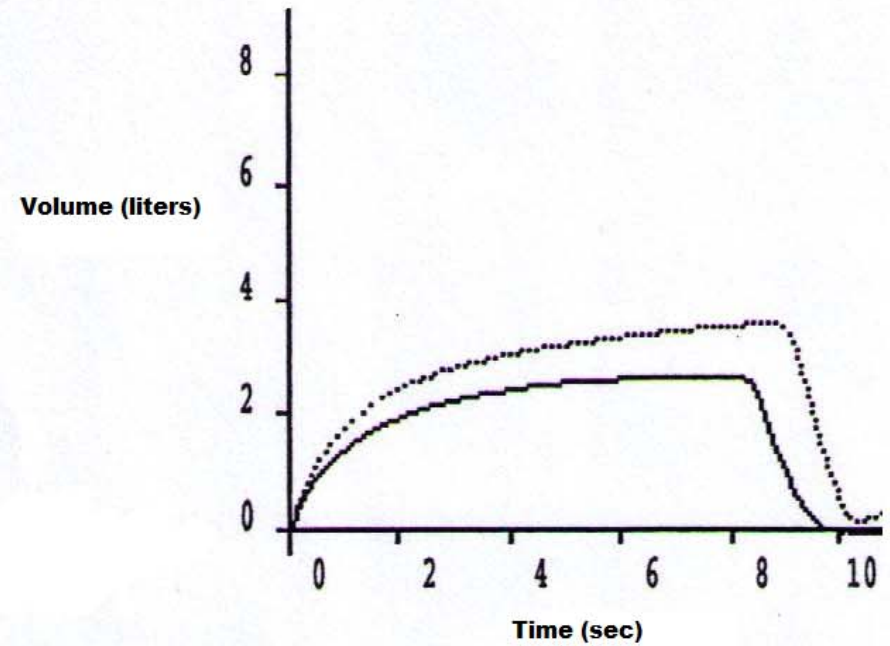
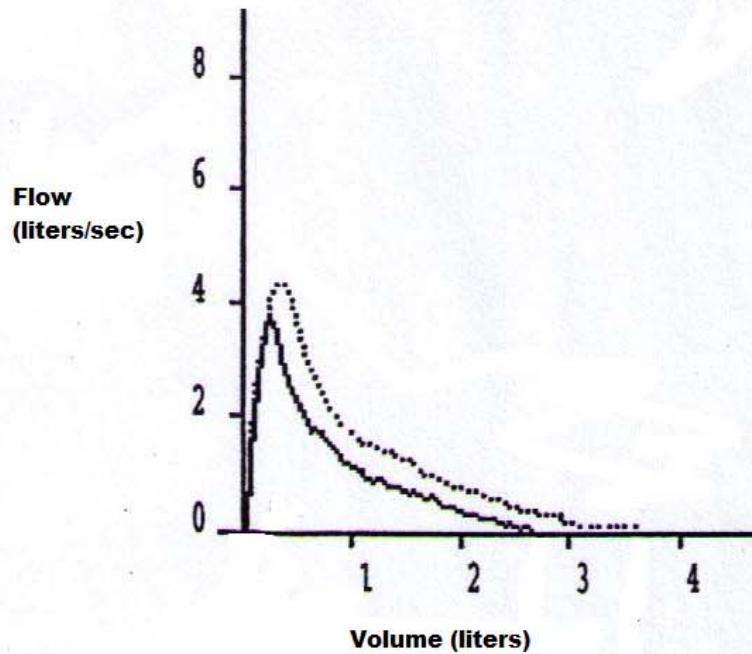
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 3.42 | 74 | 3.82 | 83 | 12 |
| FEV ₁ | 1.91 | 52 | 2.13 | 58 | 12 |
| FEV ₁ /FVC | 55.8 | | 55.8 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



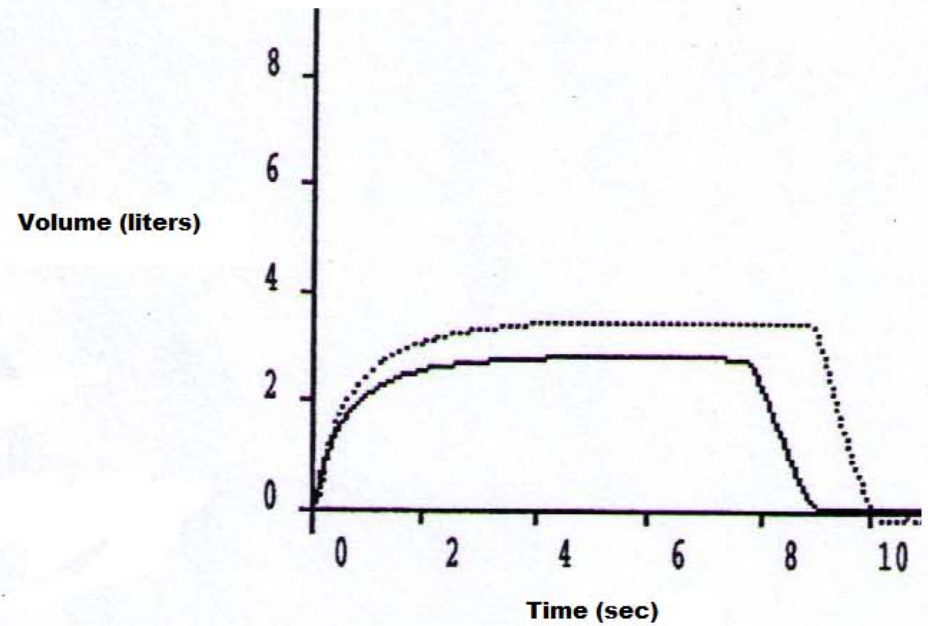
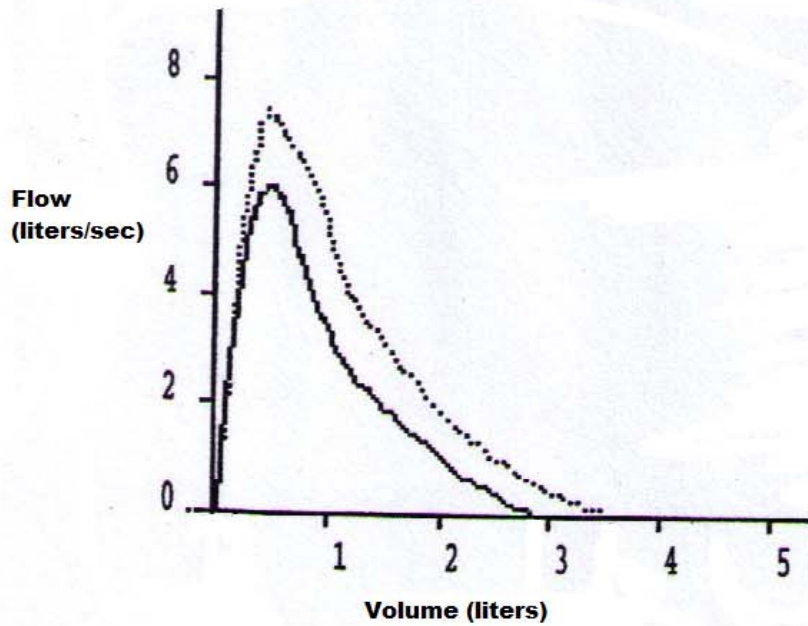
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|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 3.06 | 75 | 3.35 | 82 | 10 |
| FEV ₁ | 1.90 | 60 | 2.18 | 69 | 15 |
| FEV ₁ /FVC | 62.2 | | 65.1 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



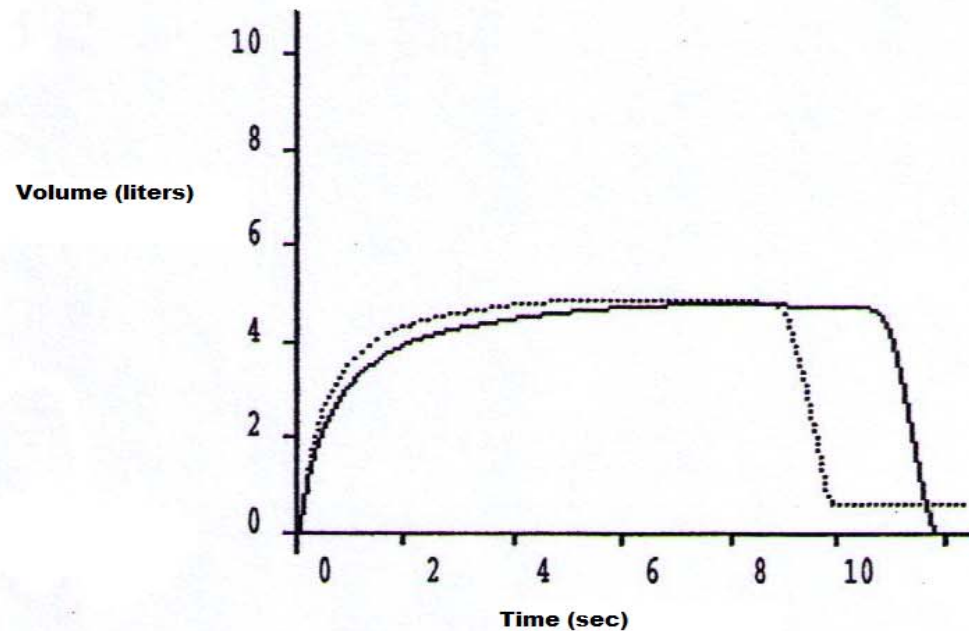
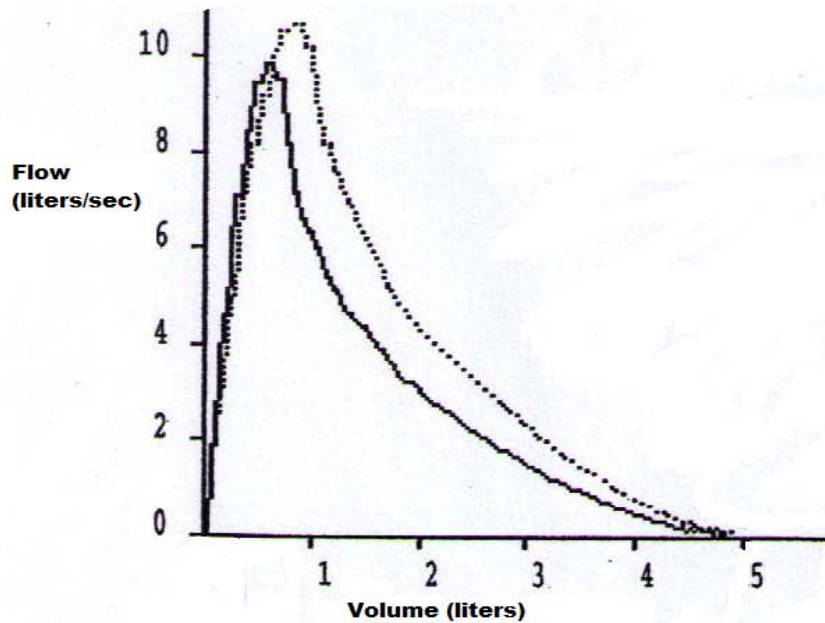
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 2.69 | 74 | 3.63 | 99 | 35 |
| FEV ₁ | 1.44 | 49 | 1.86 | 64 | 29 |
| FEV ₁ /FVC | 53.6 | | 51.4 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



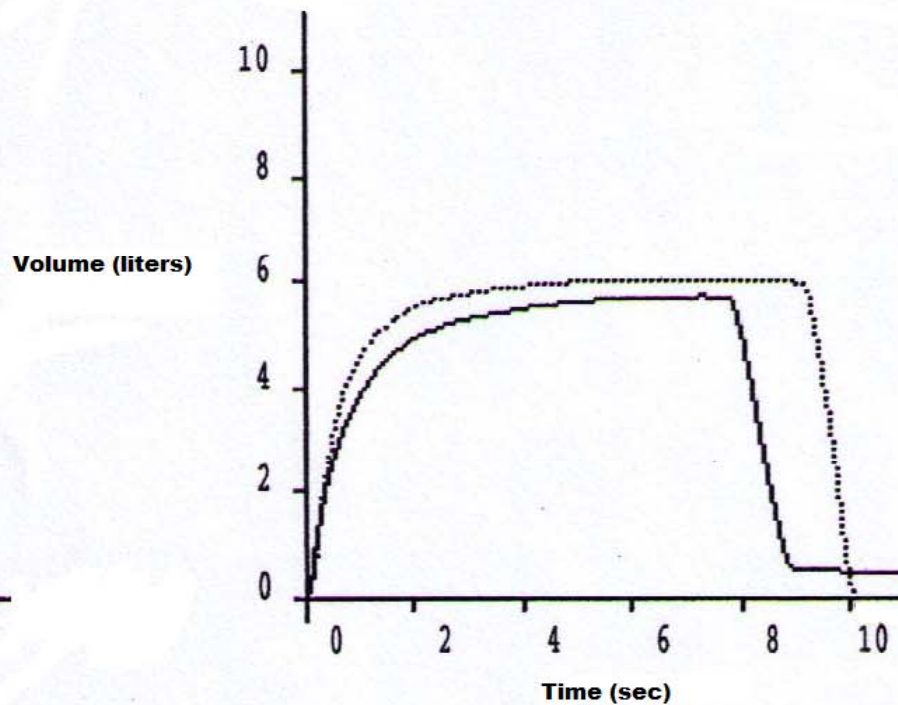
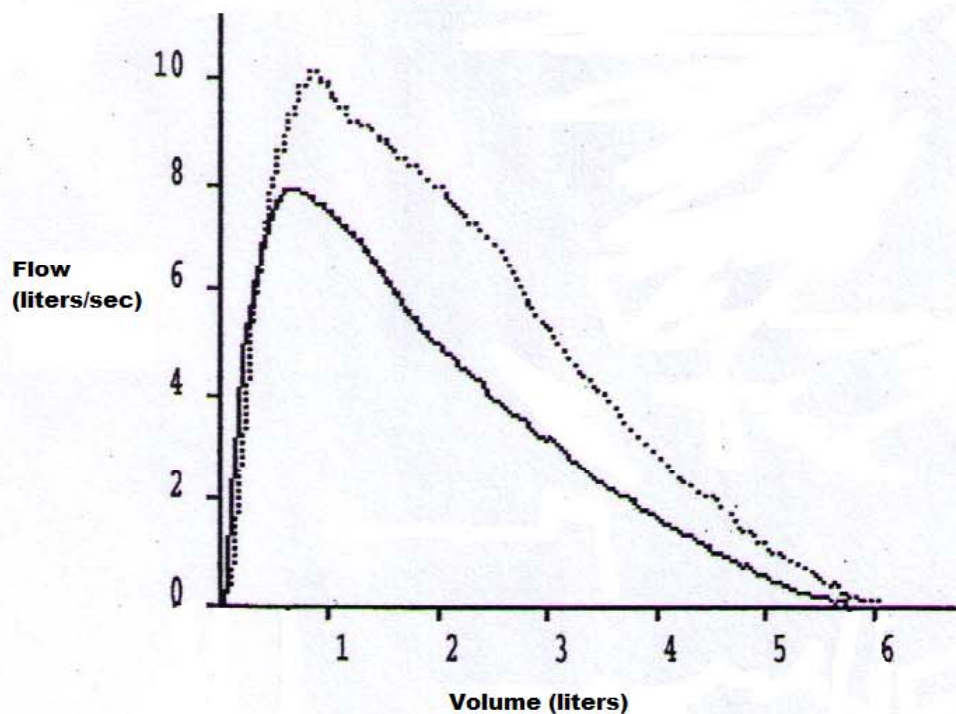
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 2.84 | 73 | 3.50 | 90 | 23 |
| FEV ₁ | 2.20 | 70 | 2.64 | 84 | 20 |
| FEV ₁ /FVC | 77.4 | | 75.4 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



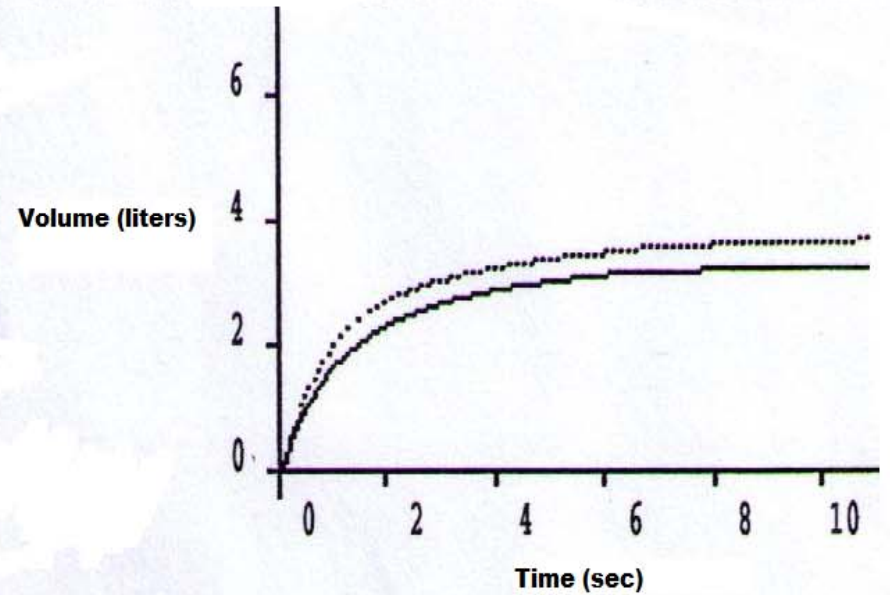
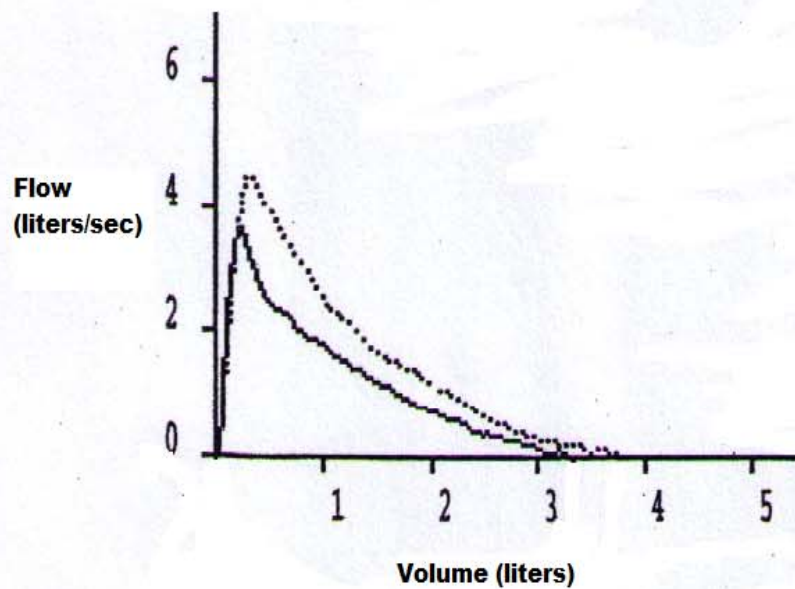
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 4.83 | 99 | 4.93 | 101 | 2 |
| FEV ₁ | 3.32 | 82 | 3.70 | 92 | 12 |
| FEV ₁ /FVC | 68.6 | | 75.1 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



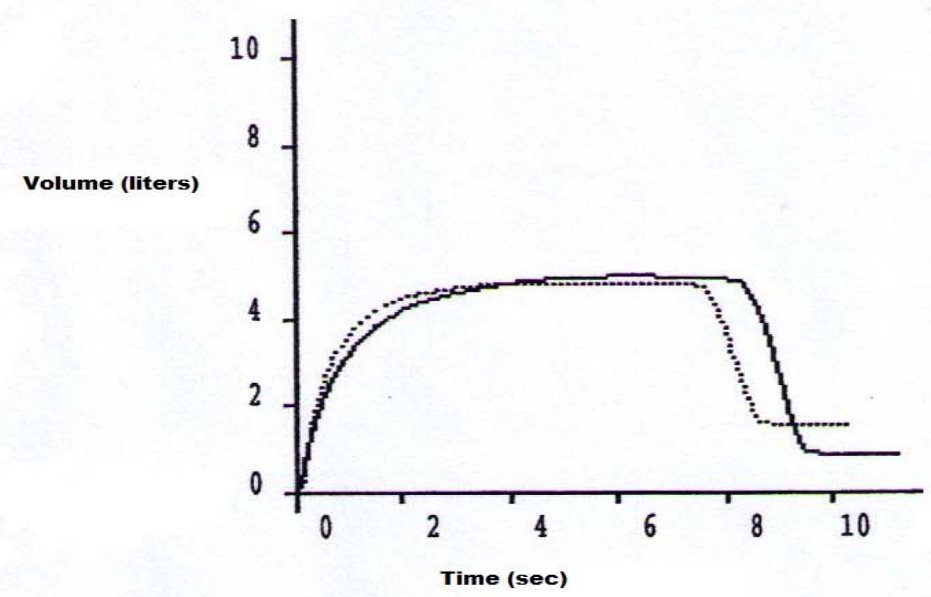
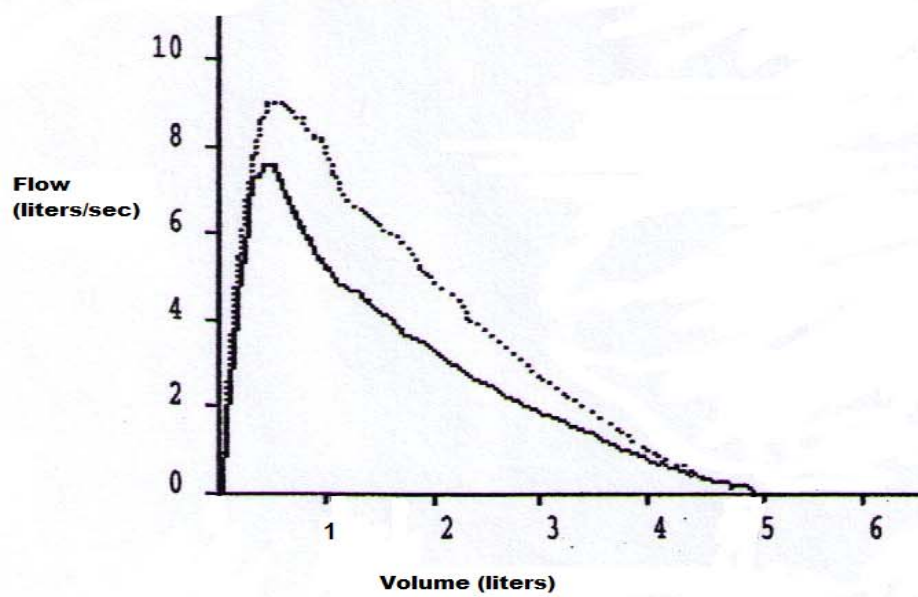
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 5.75 | 108 | 6.05 | 114 | 5 |
| FEV ₁ | 4.03 | 92 | 4.78 | 109 | 19 |
| FEV ₁ /FVC | 70.2 | | 79.0 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator: _____



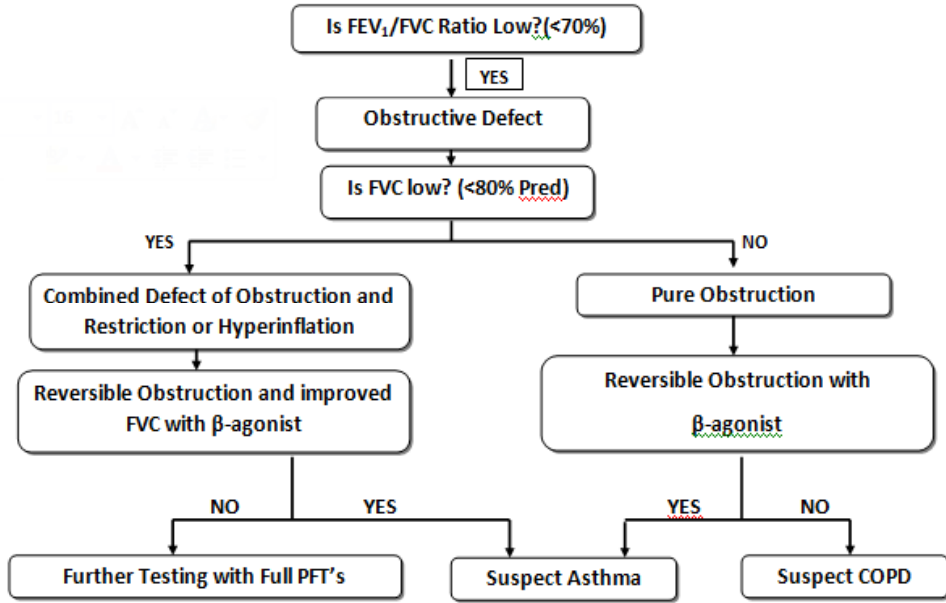
| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 3.26 | 90 | 3.74 | 104 | 15 |
| FEV ₁ | 1.80 | 61 | 2.17 | 73 | 20 |
| FEV ₁ /FVC | 55.4 | | 58.0 | | |

Post: Post-Bronchodilator : ----- Pre: Pre-Bronchodilator:

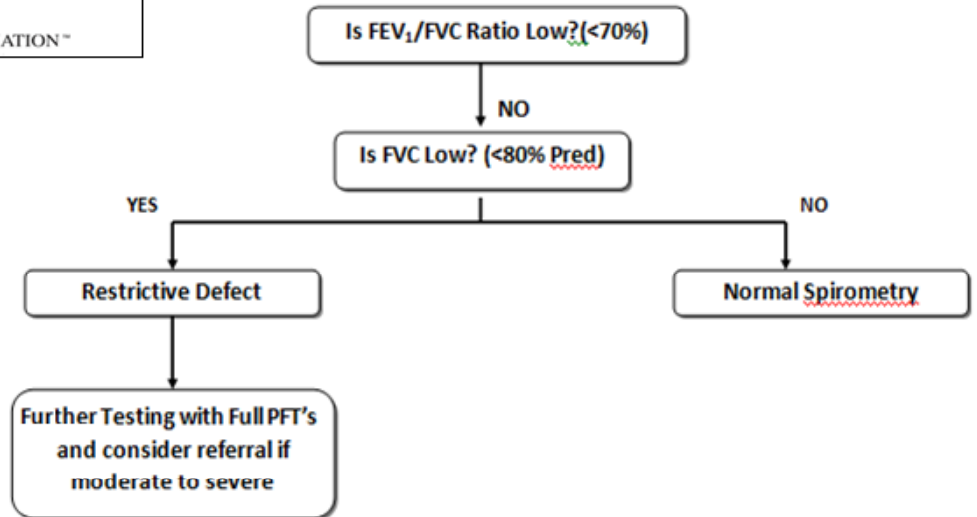


| | PRE | | POST | | % Change |
|-----------------------|------|--------|------|--------|----------|
| | Best | % Pred | Best | % Pred | |
| FVC | 5.02 | 102 | 4.84 | 98 | - 3 |
| FEV ₁ | 3.33 | 82 | 3.84 | 94 | 15 |
| FEV ₁ /FVC | 66.4 | | 79.3 | | |

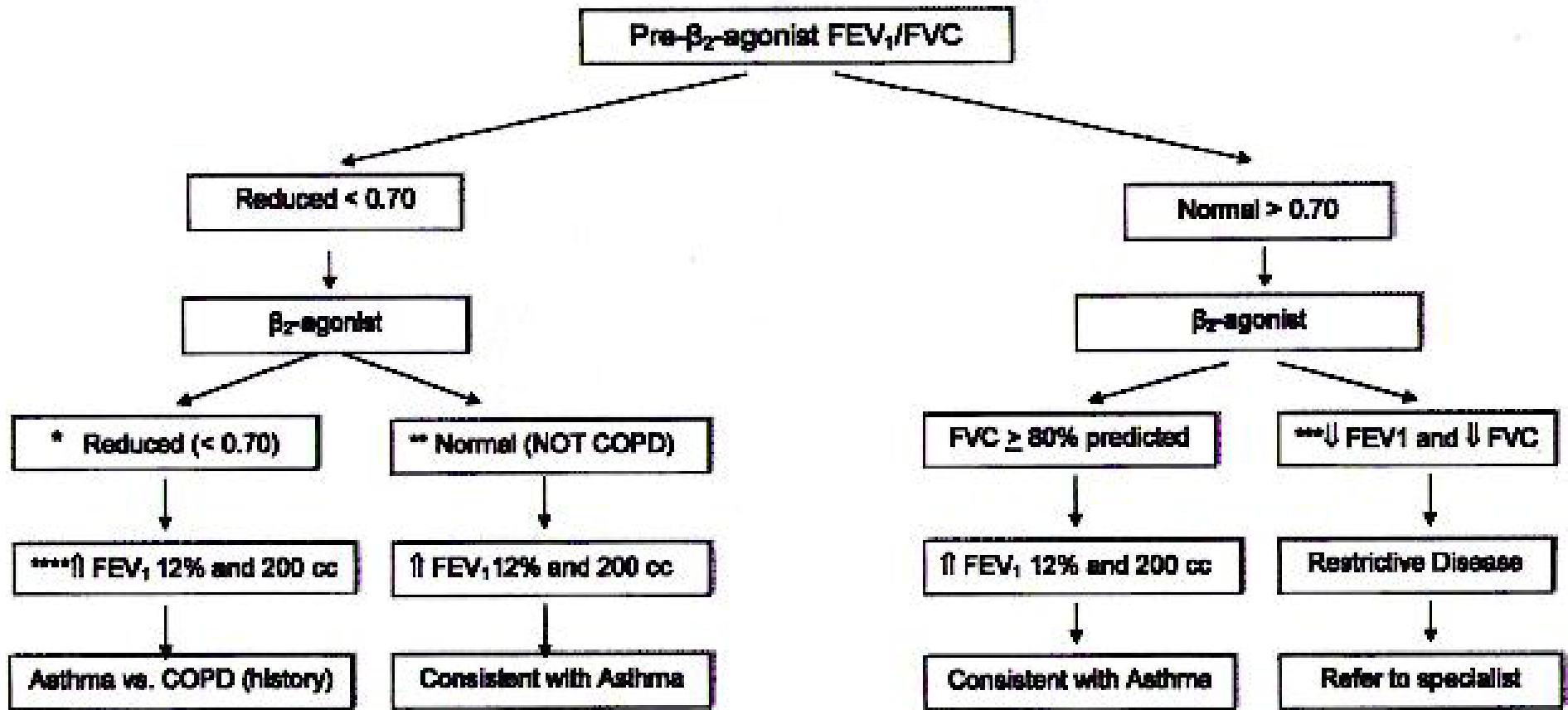
Diagnostic Flow Diagram For Obstruction



Diagnostic Flow Diagram For Restriction



Primary Care Respiratory Alliance of Canada (PCRC)



FEV₁: Maximal volume of air exhaled after a maximal inhalation in the first second of a forced exhalation

FVC: Maximal volume of air exhaled after inhalation during a forced exhalation

* FVC < 80 predicted = full pulmonary function tests (PFTs) to rule out hyperinflation vs. combined obstructive and restrictive defect

** FVC ≥ 80% predicted

***FEV₁ and FVC < 80% predicted

****The % change is calculated as Postbronchodilator FEV₁ – Prebronchodilator FEV₁ divided by the Prebronchodilator FEV₁