# Chronic Disease Management & IM/IT Workshop

# - Spirometry -


**Pulmetrics**

On-site Spirometry Service

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Department of Respiratory Medicine

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# What is Spirometry?

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Spirometry is the measure of:

- How quickly the lung can be emptied and filled, and
- How much air can be blown out

# Why Perform Spirometry?

# Why Perform Spirometry?

- Diagnostic
  - **Causes of symptoms (eg. breathlessness)**
    **Is breathlessness due to heart or lung disease?**
  - **Assess pre-operative risk.  Fit for surgery?**
  - **Screen individuals at risk of lung disease (eg. smokers)**
  - **Measure severity of airway obstruction or restriction**
  - **Demonstrates to the patient, the presence and reversibility of airway obstruction. Eg Asthma**

# Why Perform Spirometry?

- Objective Assessment
  - **The patients subjective assessment is often misleading**
  - **Helps differentiate organic and psychosomatic disorders**
  - **Numerical results can be compared with other data**
  - **Provides objective feedback to the patient about the presence and severity of respiratory defect**

# Why Perform Spirometry?

## Monitoring

- **Assess response to bronchodilator therapy**
- **Determine the minimum effective dose of preventative medication**
- **Tool used in the Asthma 3+ Plan**

## Evaluations for Disability / Impairment

**Assessment for:**

- **rehabilitation program - capacity for work?**
- **medico-legal reasons**
- **insurance evaluation -risk?**
- **Fitness to dive**

# Limitations to Spirometry

- **Effort dependant**
  - **If patient can't or won't follow instructions, the quality of results are poor and interpretation difficult**
- **Doesn't exclude asthma if spirometry is normal**
  - **but may diagnose it**
- **Normal Spirometry doesn't mean there is no problem**
  - **eg. Pulmonary vascular disease: Normal spirometry but reduced TLCO**

    **May be a prelude to further investigations**

# How do we Perform Spirometry?

# American Thoracic Society (ATS) Spirometry Guidelines

**Reference: Standardization of Spirometry 1994 Update**

**Am J Resp Crit Care Med Vol 152. pp 1107-1136, 1995**

# American Thoracic Society (ATS) Spirometry Guidelines

- Minimum of 3 technically acceptable blows (may need to perform up to 8 or more blows)
- Rapid take-off with no hesitation, cough, leak, tongue occlusion, glottic closure, early termination, valsalva manoeuvre
- Reproducible: within 200 ml from 2 of 3 technically acceptable blows
- Blow out for at least 6 seconds
- A nose peg is encouraged
- Prefer to have patient sitting

# American Thoracic Society (ATS) Spirometry Guidelines

- Manoeuvre performance recommendations

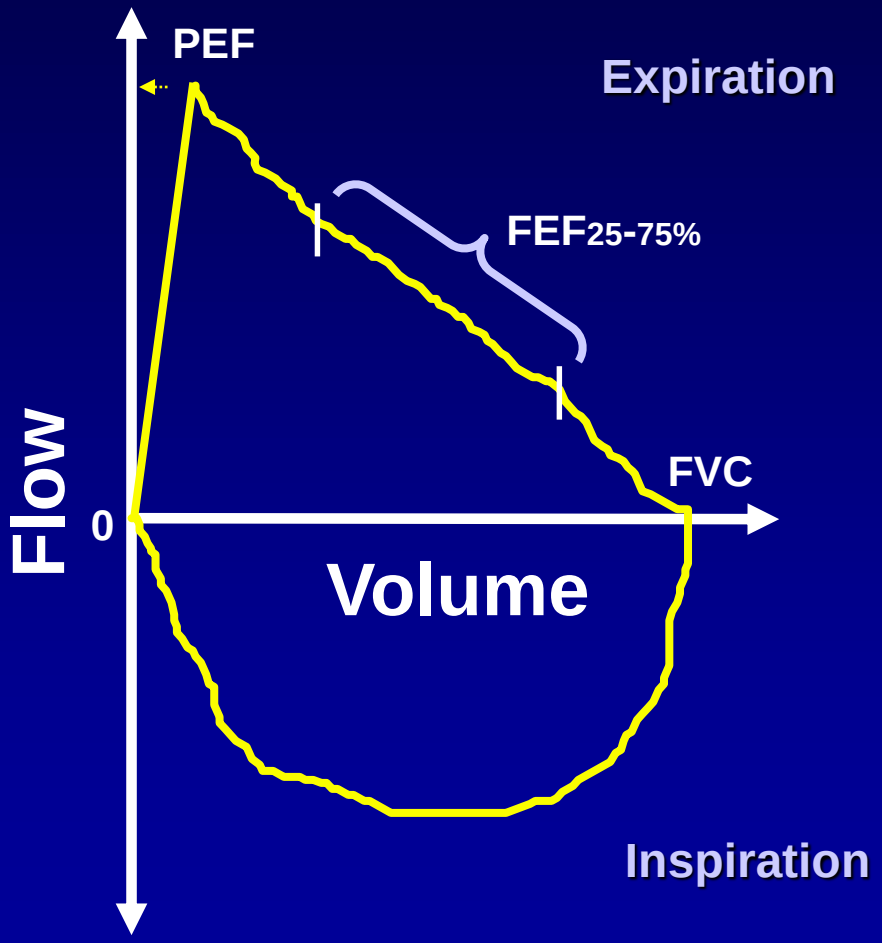
## Guidelines also covers:

- Equipment specifications
- Equipment Validation (PWG)
- Quality Control
- Hygiene and Infection control
- Reference values
- Interpretation

# Flow Volume loop

- (FEV1)
- FVC
- FEV1 / FVC  (FER%)
- $FEF_{25-75\%}$

- Shape Analysis



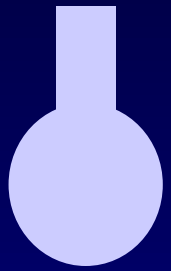

Spirometry: The Measurement and Interpretation of Ventilatory Function in Clinical Practice. R Pierce & D.P. Johns 1995

# Ventilatory Defects

# &

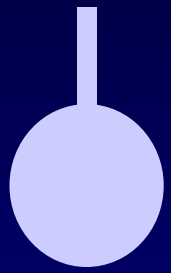
# Normal Values

# Classification of Ventilatory Defects



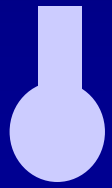
Reversibility
Effect of Therapy

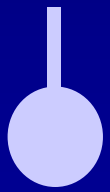
Bronchial Challenge



**Normal**

**Obstruction**
**(Cannot blow out quickly)**



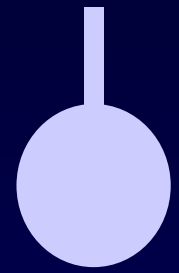


**Restriction**
**(small lungs)**

**Mixed**
**Obstruction / Restriction**

# Airflow Obstruction

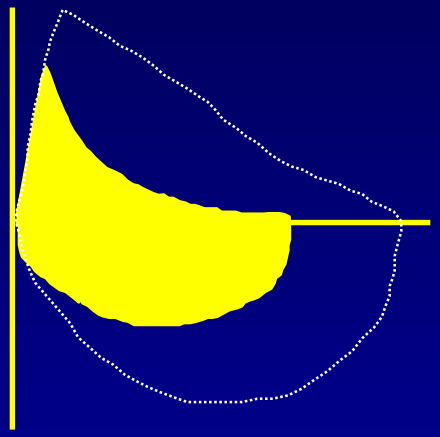
## (Unable to blow out quickly)



- **Asthma: a disease involving airway inflammation, mucus plugging and bronchoconstriction. It is characterised by airway hyperresponsiveness and attacks of reversible airflow obstruction**
- **Chronic Bronchitis: is characterised by persistent cough and sputum production due to excessive secretion**
- **Emphysema: is a disease characterised by increase beyond normal in the size of air spaces distal to the terminal bronchioles and with destruction of their walls**
- **Foreign bodies eg. Peanut!**
- **Tumours**

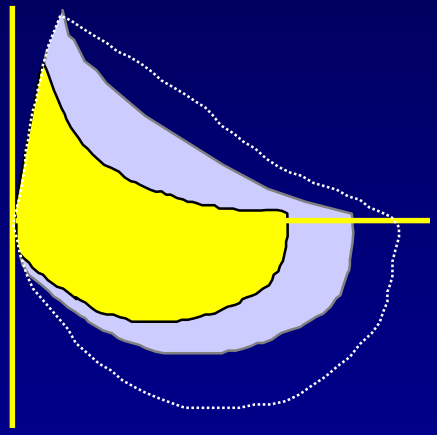
# Airflow Obstruction

**Before Bronchodilator**



- Patient is obstructed

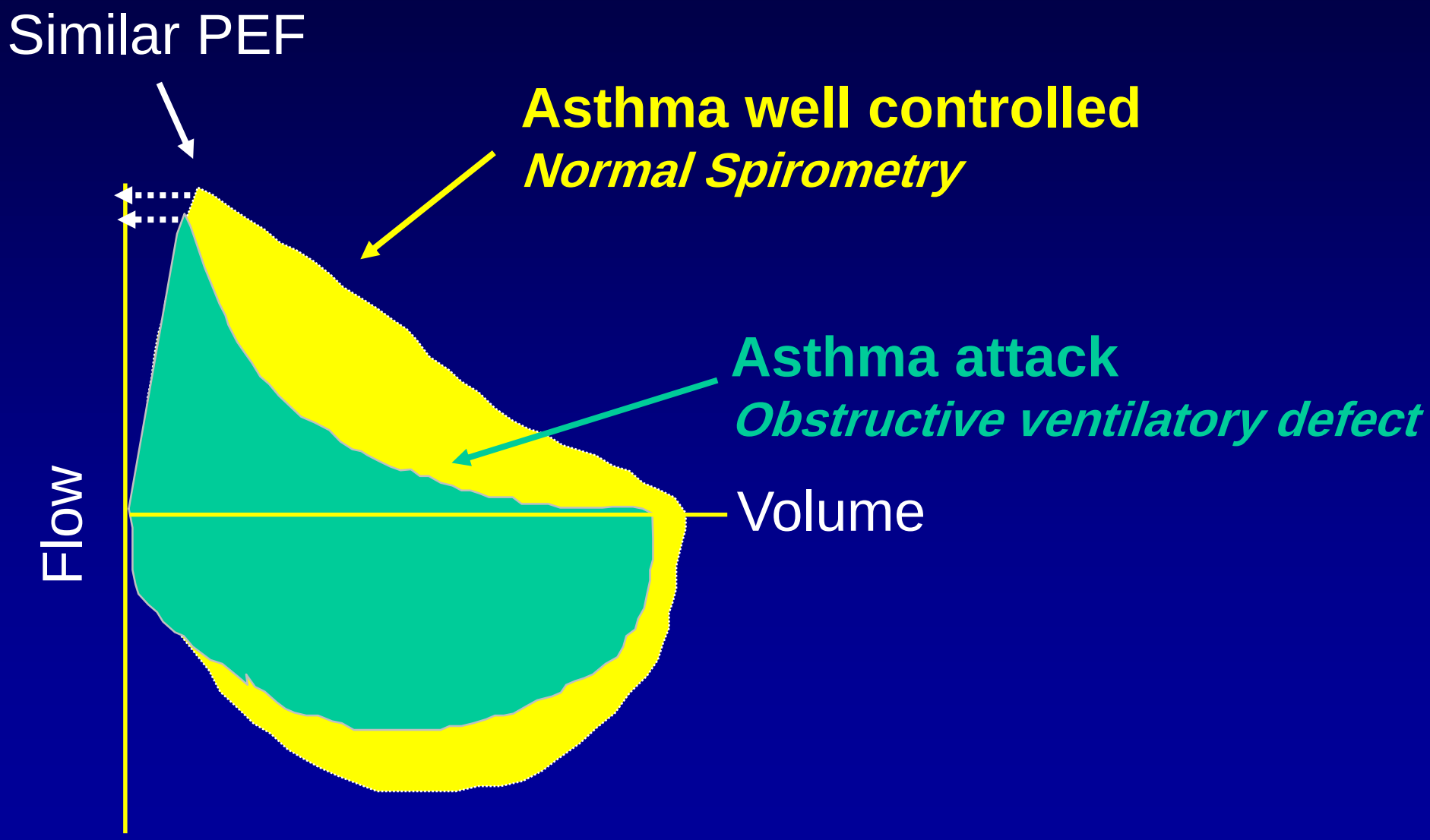
**Post Bronchodilator**



- Patient less obstructed

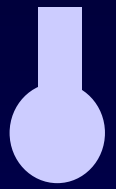
– – – Normal loop

# Spirometry vs Peak Flow



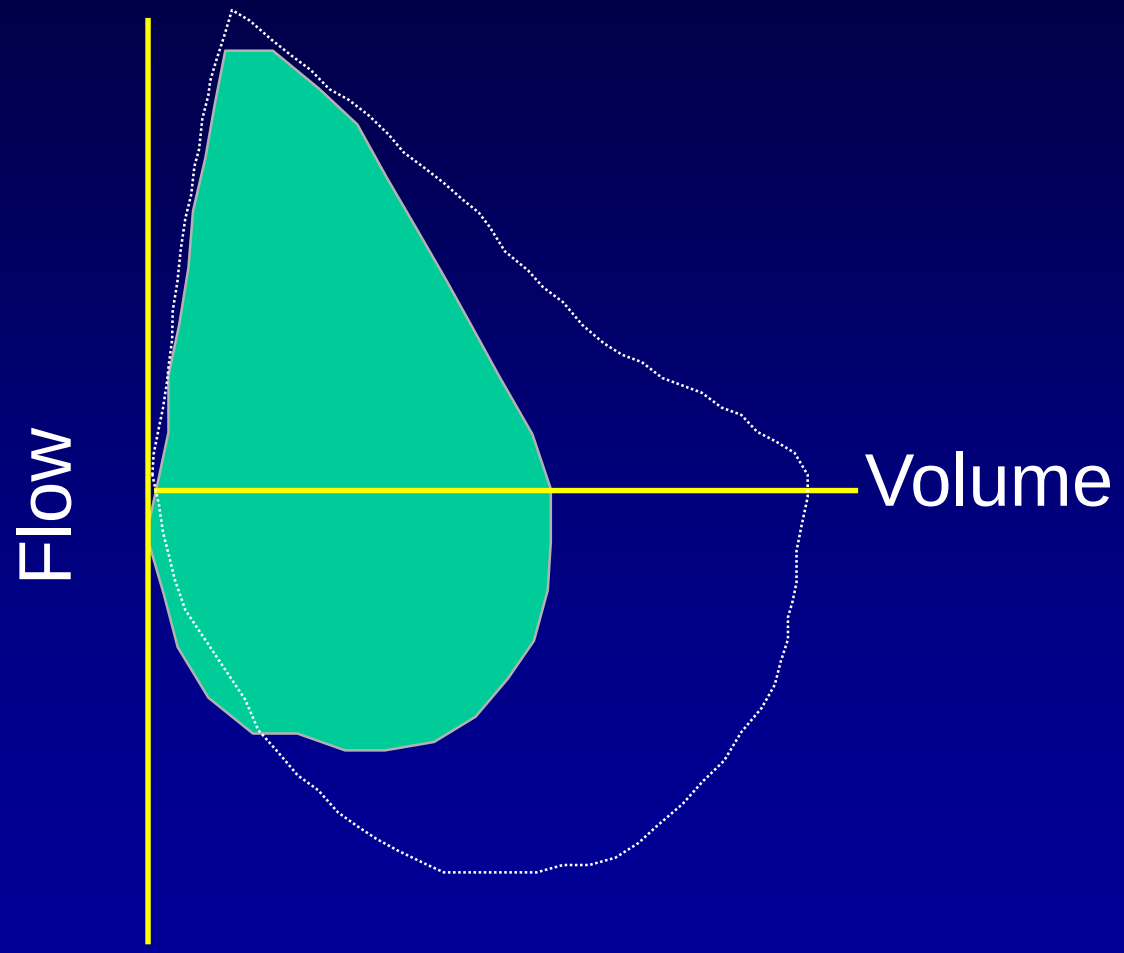
# Restriction

## (reduced volumes - appear to be small lungs)



- Stiff lungs due to fibrosis (eg fibrosing alveolitis)
- Congestion
- Lobectomy or pneumonectomy
- Pleural effusion (fluid in the pleural space)
- Kyphoscoliosis (chest wall disease leading to distortion of dorsal region of verebral column)
- Some obese patients
- Neuromuscular diseases

# Restriction




– – – **Normal loop**

# Normal Values

- Mean predicted value and a range of normality

- $FEV_1$, FVC, PEF, $FEF_{25-75\%}$ vary with:
  - age
  - height
  - sex
  - race

- There are many normal value studies to choose from so you need to choose the most appropriate one for the population you test.

# Spirometry

# and

# GP Asthma Initiative: the 3+ Visit Plan

# GP Asthma Initiative: the 3+ Visit Plan

**The GP Asthma Initiative: the 3+ Visit Plan, introduced by the Federal Government, financially supports GPs to better manage their patients with moderate to severe asthma.**

- **The measurement of Spirometry is recommended to diagnose and assess patient progress.**
  **(Asthma Management Handbook 2002)**

- **Spirometry will probably be <u>mandatory</u> some time this year.**

# GP Asthma Initiative: the 3+ Visit Plan

- **Visit 1**
  - **Perform physical examination (including Spirometry)** ***(baseline)***
- **Visit 2**
  - **Perform Spirometry (if not already done, or consider redoing)** ***(Monitor progress)***
- **Subsequent Visits (every 3-6 months)**
  - **Assess progress and asthma control, including Spirometry** ***(Back titrate inhale steroids)***

# Medicare Rebates

**Item No. 11506** **MEASUREMENT OF RESPIRATORY FUNCTION involving a permanently recorded tracing performed before and after inhalation of bronchodilator**

**85% of Scheduled Fee = $14.20**

# Spirometry Options

1. GP or Practice Nurse performs Spirometry

2. GP Refers Patient to Hospital Respiratory Laboratory

3. On-Site Spirometry Service (Pulmetrics) Respiratory Scientist performs Spirometry at the GP practice

# GP or Practice Nurse performs Spirometry

**Very important to perform & interpret Spirometry correctly**

**Poor quality spirometry results in:**

- **Unnecessary Patient distress**
- **Misdiagnoses**
- **Poor clinical decisions**
- **Medico-legal issues - especially. industrial screening, disability assessments**

# GP or Practice Nurse performs Spirometry

**Good quality Spirometry relies on:**

1. **The operator providing clear instructions to the patient**
2. **The operators ability to trouble-shoot (patient and equipment problems)**
3. **The patient understanding what is required of them**
4. **Having an accurate Spirometer . Must set up a Quality Assurance program for the spirometer.**

**Alfred Hospital offers a Spirometer Checking Service**

**Tel: 9276 3476 Email: e.side@alfred.org.au**

# Calibration and Quality Assurance

# GP or Practice Nurse performs Spirometry

## Calibration

**Depending on the type of spirometer, the ATS recommend calibration should be performed using a 3L syringe:**

- **Everyday the spirometer is used, and again if….**
- **Temperature changes (BTPS factor changes)**
- **Sensor is replaced eg. pneumotach has got wet**

**Calibration is different to Quality Assurance**

# GP or Practice Nurse performs Spirometry

## Quality Assurance

**Definition:** A formal program to document and maintain both the instrument and personnel performance

**Design of QA program:**

Should cater for spirometer idiosyncrasies which results from its design or component weakness

Should include maintenance eg. Cleaning sensors, Back-up database & check remaining hard disk space

Time interval: (eg weekly, monthly)

Record results and apply statistical analysis

# Infection Control

# Infection Control

**In recent years there has been concern about the risk of transmitting infection through the use of spirometers**

**This is a realistic concern because during the measurement of ventilatory function, the patient can generate expiratory flows capable of dislodging mucus, aerosolising saliva and contaminating equipment with pathogenic organisms.**

**Respiratory pathogens on mouthpieces and tubing has been found.**

**The Ideal Situation: The equipment is decontaminated after every patient**

# Infection Control Recommendations

## 1. American Thoracic Society

## 2. Thoracic Society of Australia and New Zealand

**Guidelines for infection control in the respiratory function laboratory - a position paper of the Thoracic Society of Australia and New Zealand.**

**Crockett et al. Thoracic Society News 1993: 4:6-7**

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## Follow Universal Precautions

## Treat all patients as potentially infectious

**Disinfect mouthpieces, noseclips and other equipment coming into direct contact with mucosal surfaces after every patient**

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**Option for mouthpiece:** **Use disposable barrier filters**
**Use disposable sensors**

# Spirometry Training

# GP or Practice Nurse performs Spirometry

## Spirometry Training

**Lung Health Promotion Centre at**
**The Alfred Hospital**

- Introduction to Performing Spirometry (1/2 Day)
- Principles and Practice of Spirometry (2 Day)

**Tel: 9276 2382**
**www.lunghealth.org**

# Spirometry Options

1. GP or Practice Nurse performs Spirometry

2. Refer Patient to Hospital Respiratory Laboratory

3. On-Site Spirometry Service (Pulmetrics)

# Pulmetrics On-site Spirometry Service

## How the Service Works

- **Booking in a Patient**
  - **Whenever the GP sees a patient requiring spirometry they arrange for the patient to return to the practice at a designated morning or afternoon for testing.**
  - **The patient can be given an 'Information Sheet'**
  - **The test takes about 15-20' to perform.**
  - **The GP completes a Spirometry Referral form.**

# Pulmetrics On-site Spirometry Service

## How the Service Works

- **Spirometry**

  **A trained Respiratory Scientist:**

  – **fully equipped with a computerised spirometer,**

  – **will attend the GP practice on each pre-arranged session (eg. fortnightly or monthly)**

  – **to perform full spirometry (flow-volume loop before and after the administration of a bronchodilator) on all the patients the GP has referred.**

# Pulmetrics On-site Spirometry Service

**How the Service Works**

- Preliminary Report
  - A preliminary report will be available immediately
    - **The GP can see the Patient immediately**
- Formal written Report
  - A formal written report prepared by a Respiratory Specialist will be sent to the GP within two days.

# Pulmetrics On-site Spirometry Service

**How the Service Works**

- Cost Neutral
  - All patients are Bulk Billed
    - No cost to the patient
    - No out of pocket expense to the GP
- We can provide a cost and time effective service if all the patients are brought together for a session of testing by specific appointment
  - ***Minimum of 6 patients per session***

# Pulmetrics On-site Spirometry Service

**How the Service Works**

- General Practitioners:
  - May not have the time to perform quality Spirometry (pre & post bronchodilator).
  - May not have an accurate spirometer (Equipment meets ATS Spirometer Standards).
  - May not want to purchase new equipment.

**Based on a $3000 spirometer & Medicare rebate of $14.20, need to perform approx 200 - 250 (with filters) tests to recover costs.**

# Pulmetrics On-site Spirometry Service

**How the Service Works**

- General Practitioners:
  - May not be prepared to maintain the diagnostic equipment including performing a regular QA program.
  - Need to address Infection Control issues.
  - May not be able to attend a refresher Spirometry course, or send the Practice Nurse.
  - May not feel confident to interpret results.

# Pulmetrics On-site Spirometry Service

**How the Service Works**

- General practices are busy places and diagnostic services need to minimise patient inconvenience, provide accurate, concise and timely clinical reports to physicians.

- **PULMETRICS** On-Site Spirometry service is designed to provide each of these.