

Understanding the Capacity for Life

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OVERVIEW

WHO, What,
Why, How

What it is &
what it isn't

Case studies
– basic
interpretation

RESPIRATORY DISEASE IN NZ 2013

- **PULMONARY REHABILITATION**
- **LONG-TERM OXYGEN THERAPY**
- **NON-INVASIVE VENTILATION**
- **ADVANCE CARE PLANNING**
- **SPIROMETRY**



HISTORY

1846

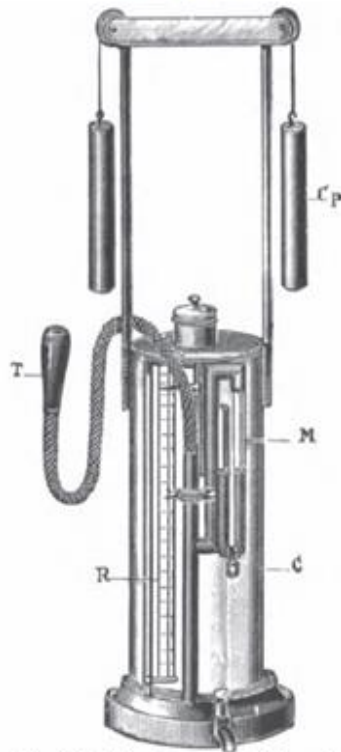


FIG. 176.—Spirometer. T, mouthpiece; M, manometer; Cp, counterpoise; R, scale.

John Hutchinson develops
the first spirometer

1947



First clinical application
using FEV₁ & FVC

1960



European Community for
Coal & Steel issues
recommendations (males)

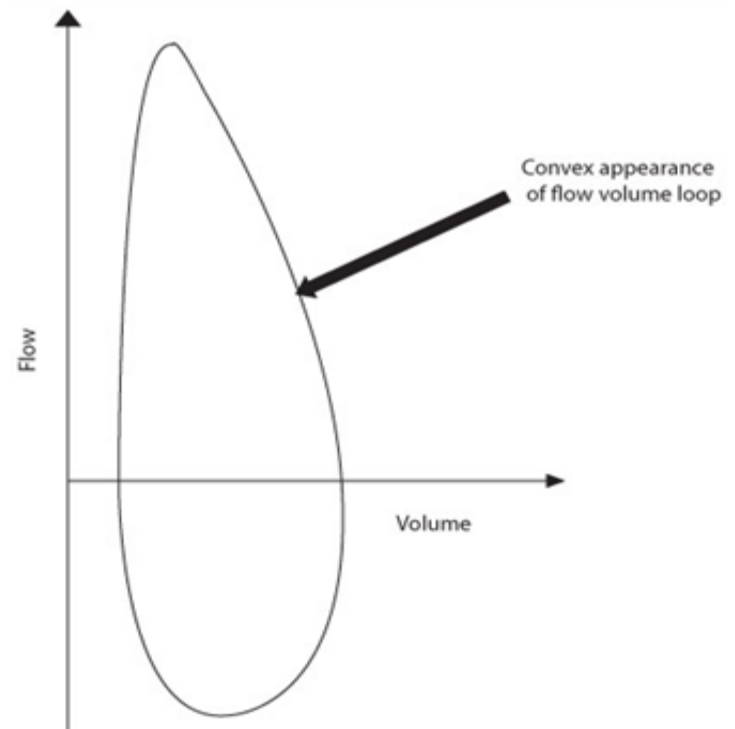
HISTORY

2005



ATS/ERS Joint Committee
compile reference values

1991

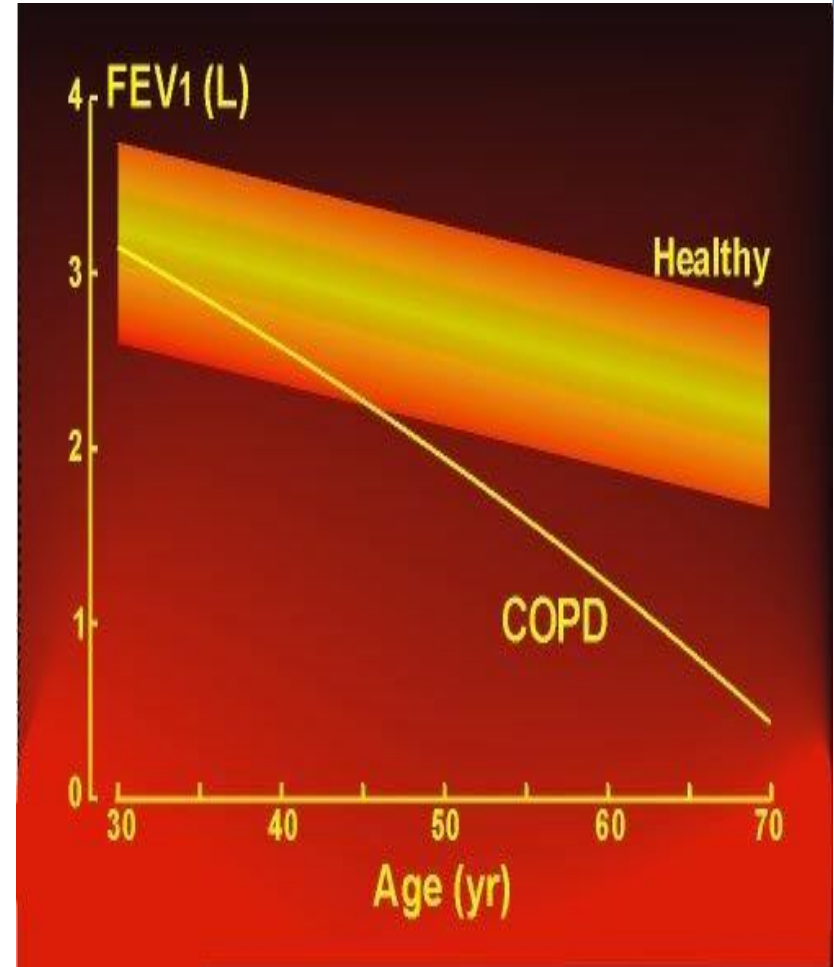


ATS suggests
'restrictive pattern'

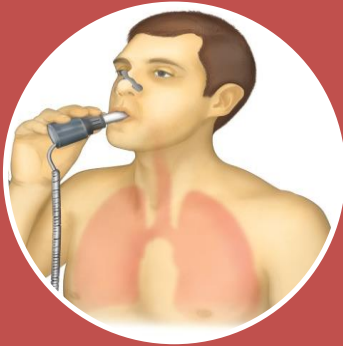
REFERENCE VALUES



Adding clinical context:
Overlap/range of
'normal' varies



WHAT IS SPIROMETRY?



A method of assessing lung function by measuring the volume of air a pt is able to expel from the lungs after maximal inspiration



It can differentiate between obstructive airway disorders (asthma COPD) & restrictive diseases where the size of the lung is reduced (fibrosis)



It can also used to determine severity of COPD



BUT....

THEY DO NOT ACT ALONE

THEY ACT ONLY
TO **SUPPORT** OR
EXCLUDE A
DIAGNOSIS



A **COMBINATION** OF
THOROUGH HISTORY &
PHYSICAL EXAM,
SUPPORTING
LABORATORY DATA WILL
HELP ESTABLISH A
DIAGNOSIS



"Excellent health statistics - smokers are less likely to die of age related illness"

WHY DO SPIROMETRY?

DIAGNOSIS



SCREENING



DISEASE
PROGRESSION



ASSESS
TREATMENT



SMOKING &
SYMPTOM



VOLUME

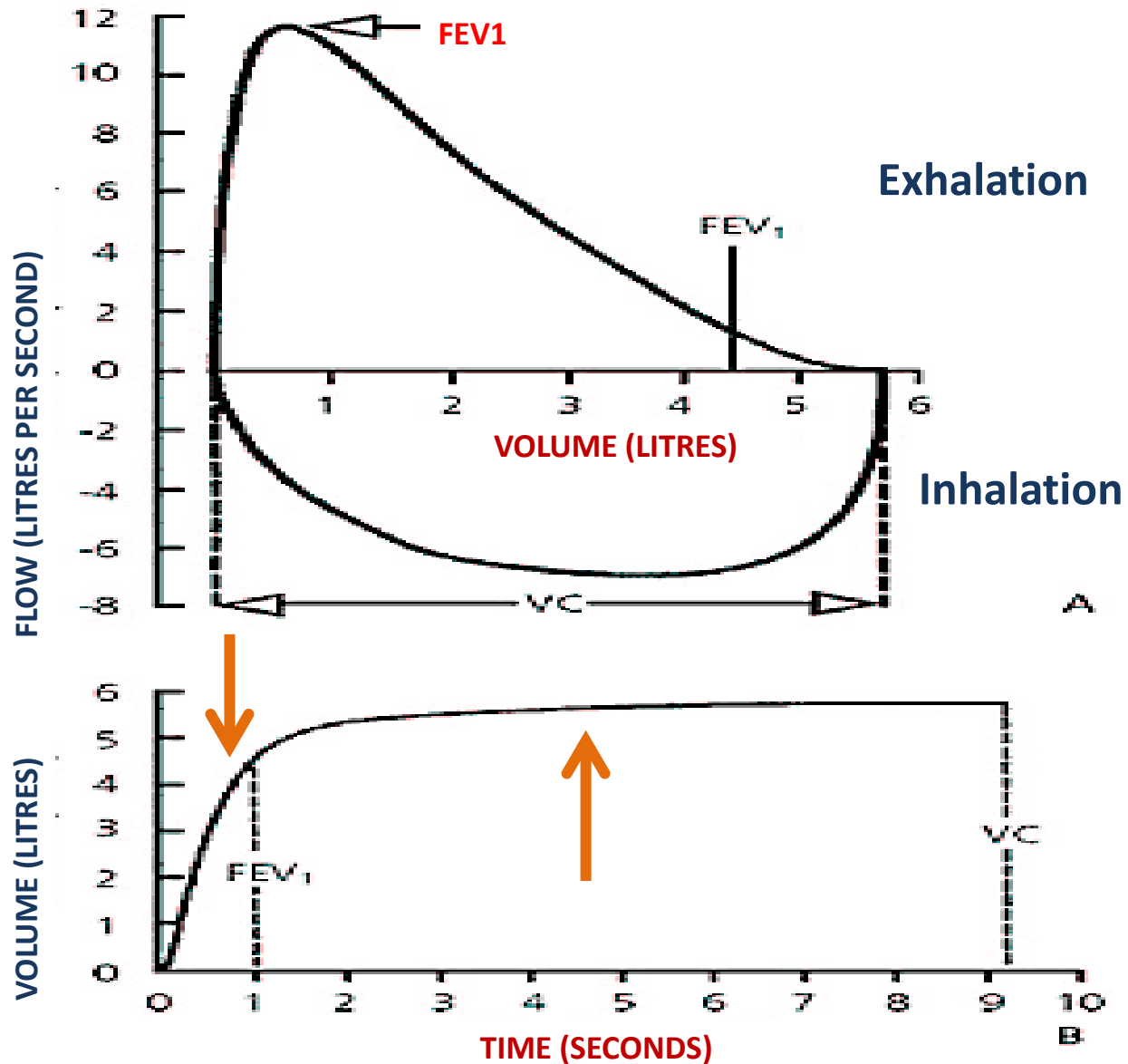
The rate at which the lung **changes volume** during forced breathing manoeuvres

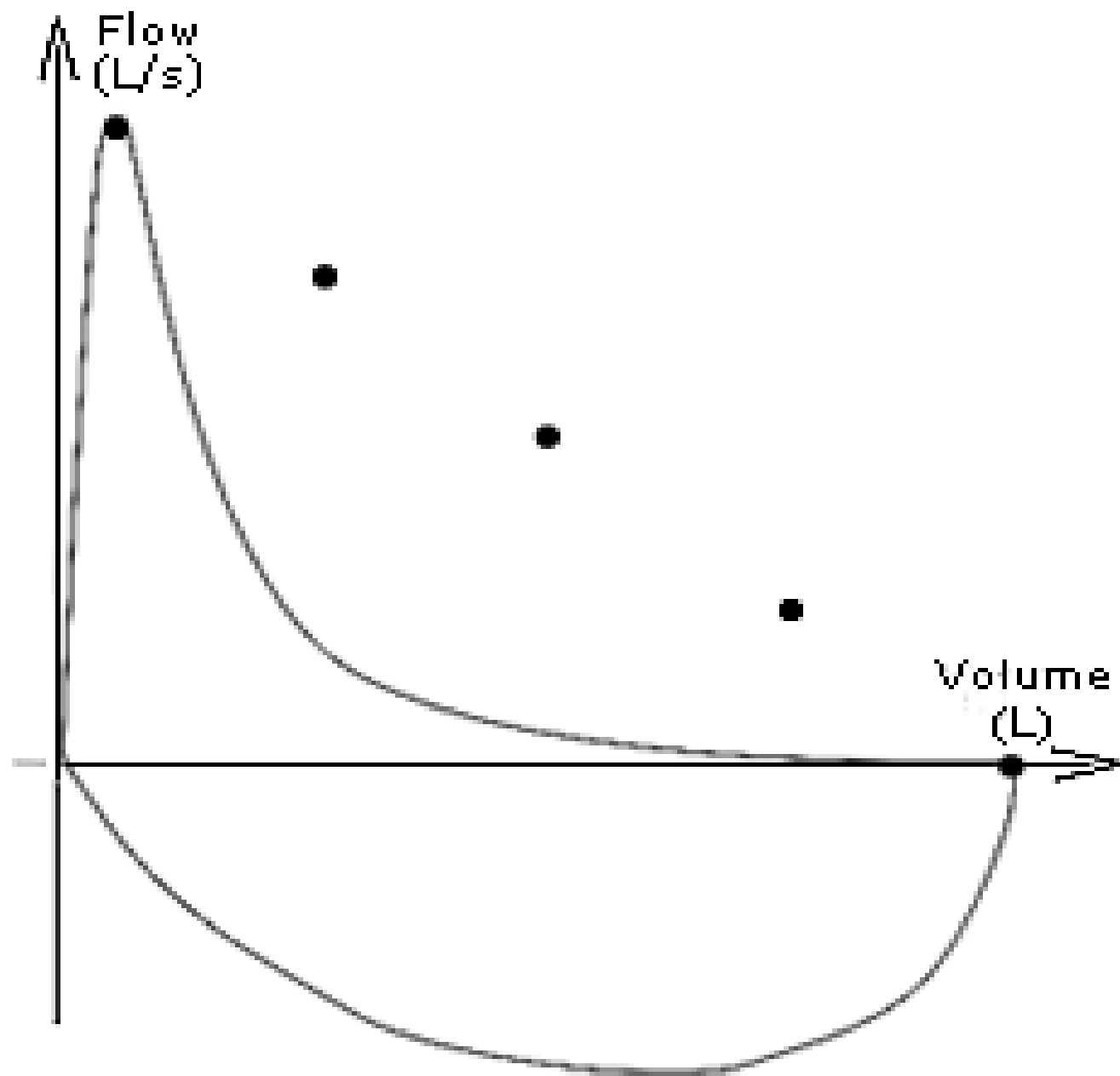
Begins with a full inhalation, followed by **forced expiration** that rapidly empties the lungs

Expiration continued until a **plateau** is reached



THE FVC MANOEUVRE





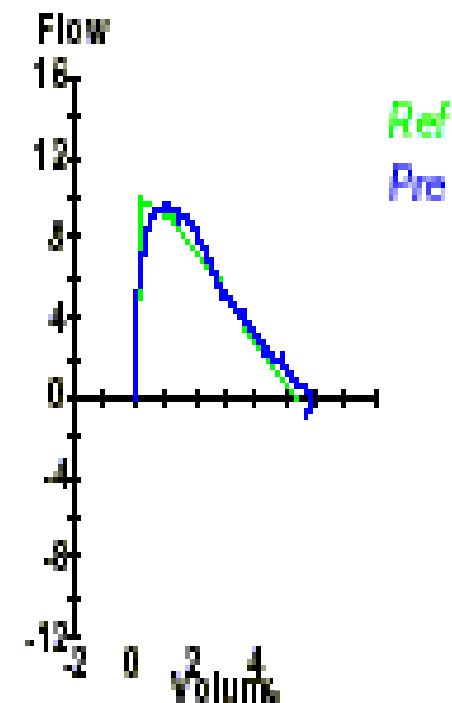
Spirometry

		Ref	Pre	% Ref
FEV1	Liters	4.69	5.03	107
FVC	Liters	5.43	5.80	107
FEV1/FVC	%	85	87	
PEF	L/min	589	620	105
FEF50%	L/min	362	330	91
FEF75%	L/min	166	156	94
FEF25-75%	L/min	314	304	97
FET100%	Sec		2.82	
MVV	L/min	190		

Comments:

Good effort

unable to exhale for 6 seconds on spirometry but
reproducible results obtained.

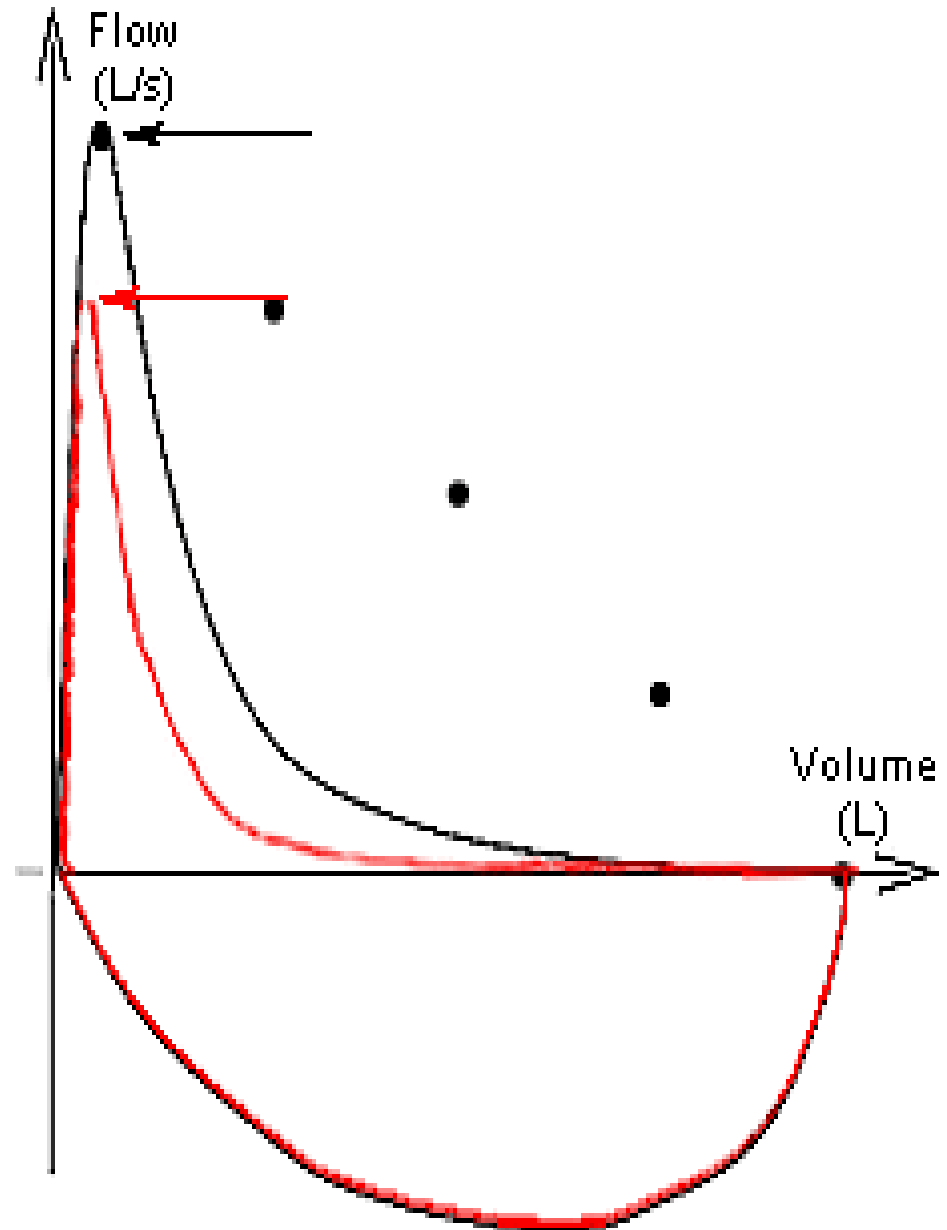


Limitation of Peak Flow

→ Normal PF
in mild COPD

→ Low PF in
mod-severe
COPD

- Limited use
- Variable



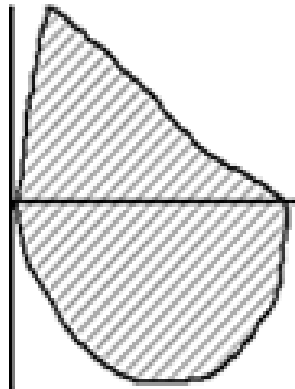
Spirometry Performed

Abnormal Ventilatory Function

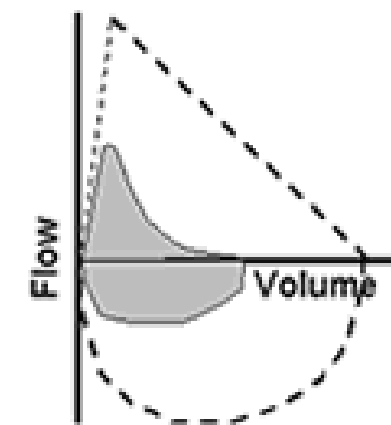
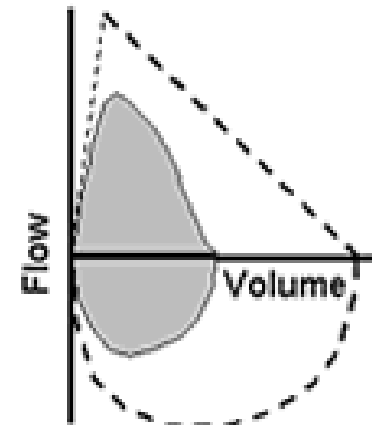
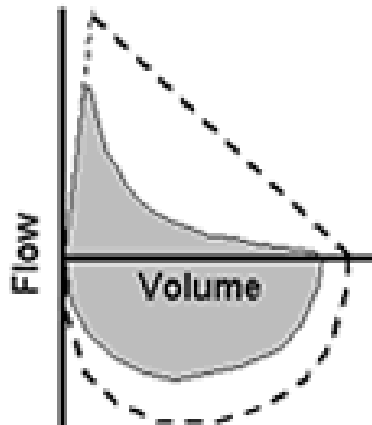
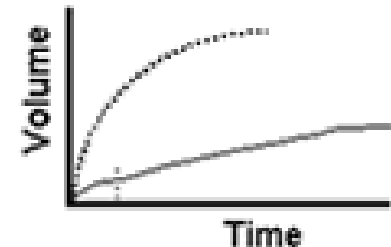
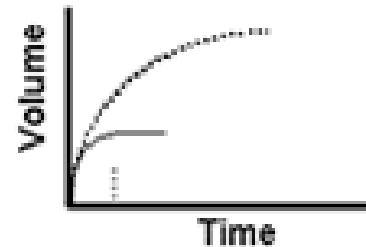
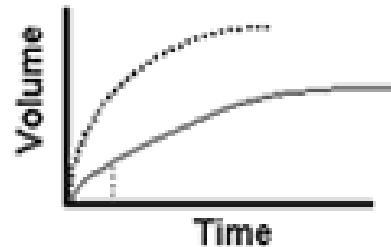
Obstruction

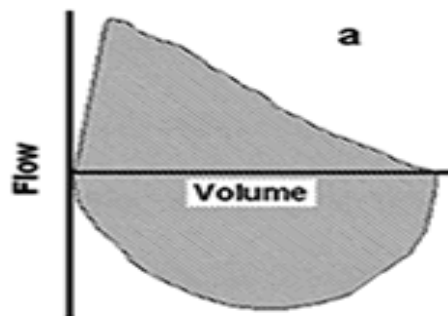
Restriction

Mixed

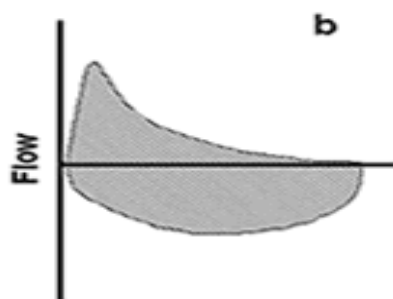


Normal

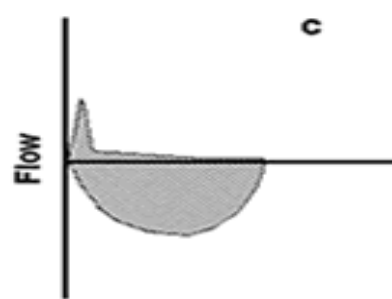




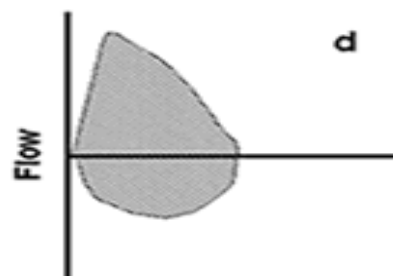
a) normal subject



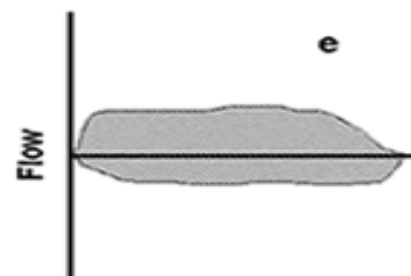
b) obstructive airway disease
(e.g. asthma);



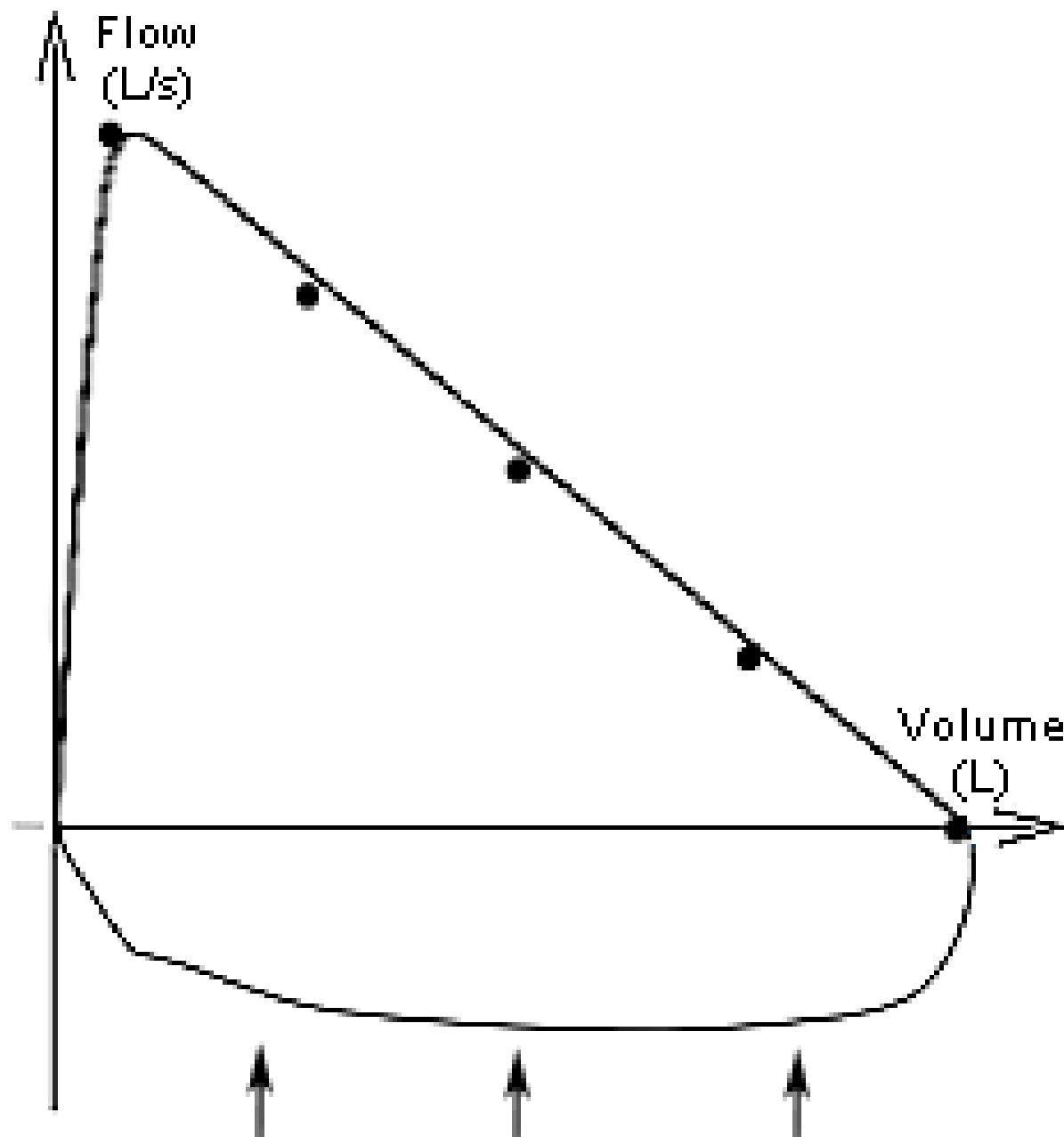
c) severe obstructive disease
(e.g. emphysema)

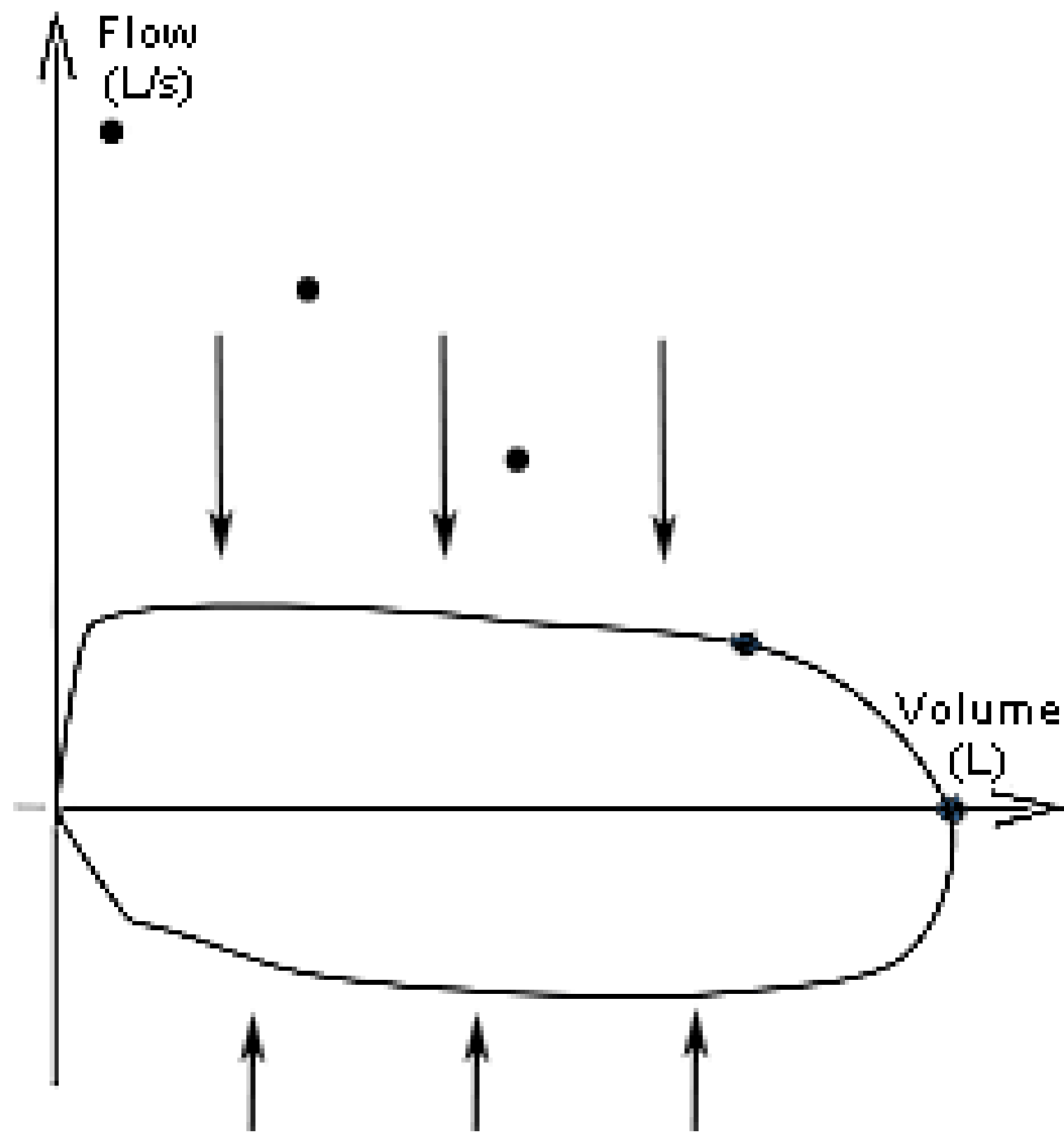


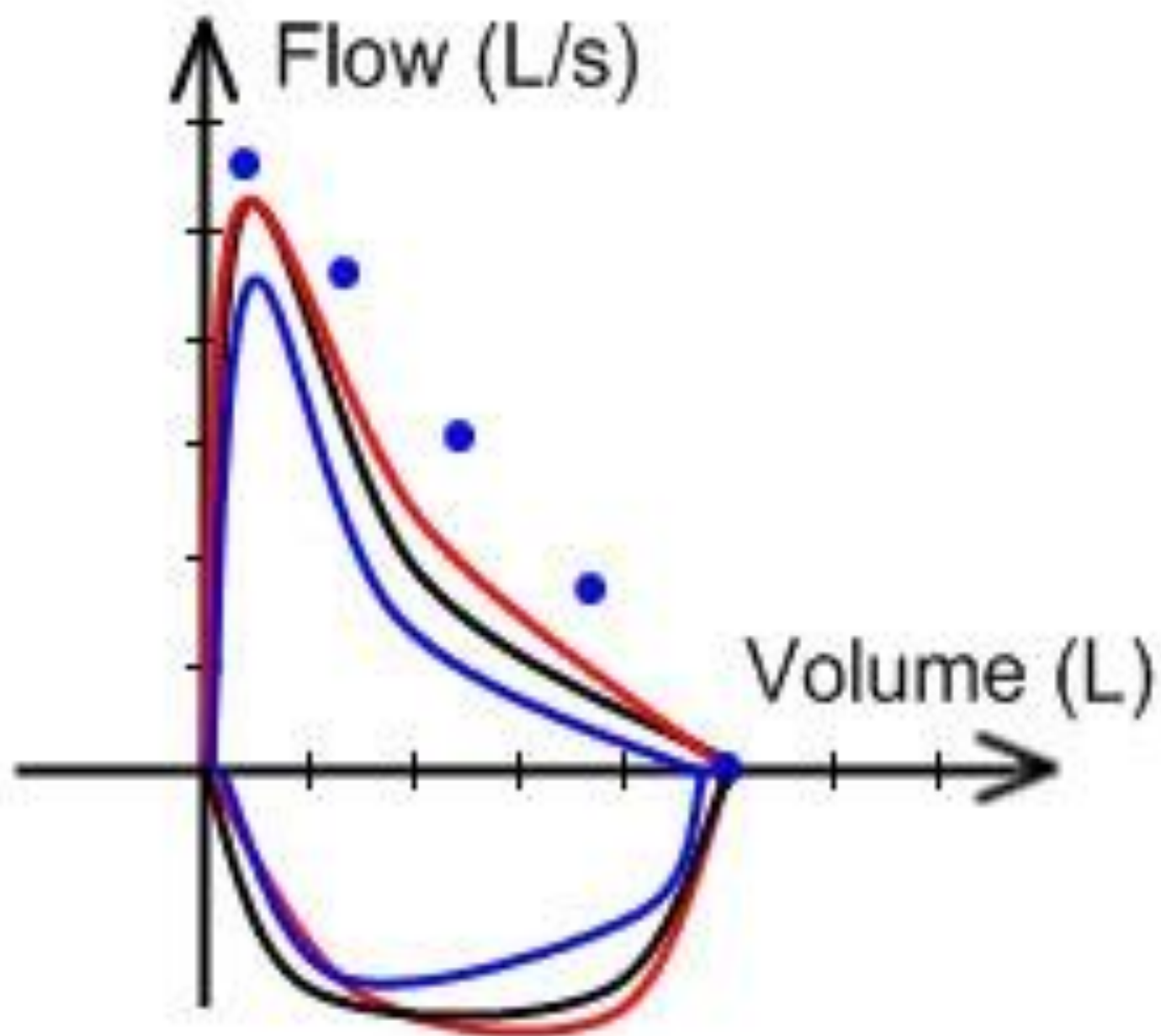
d) restrictive lung disease
(e.g. pulmonary fibrosis)

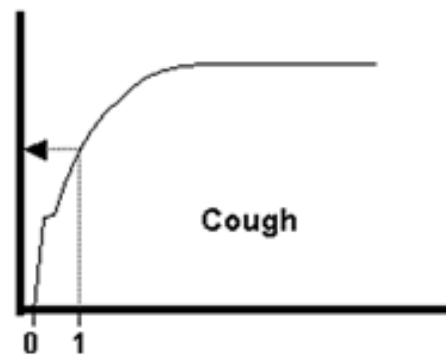
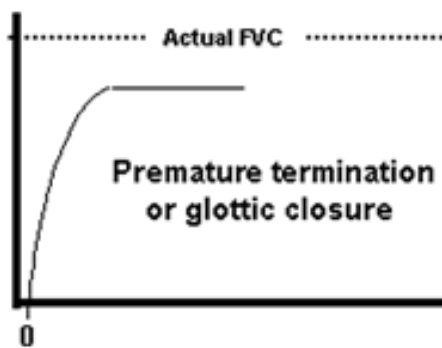
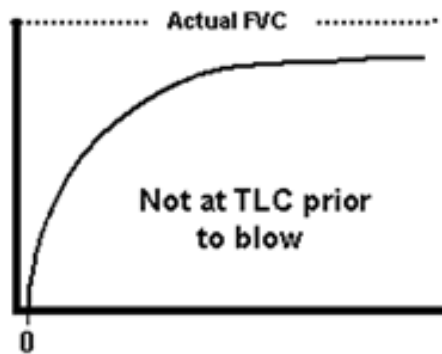
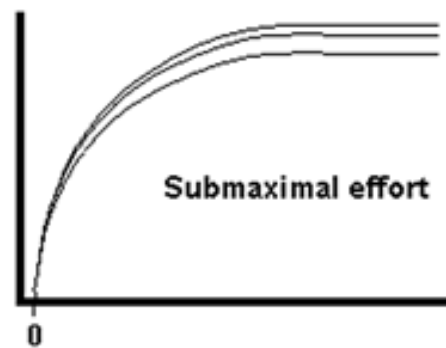
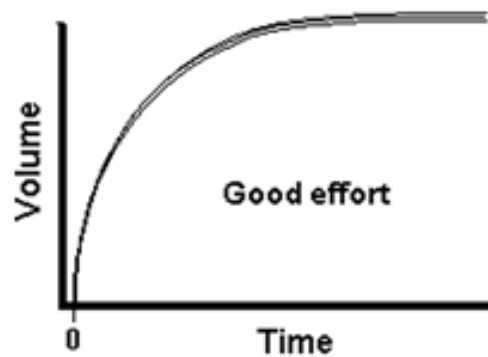


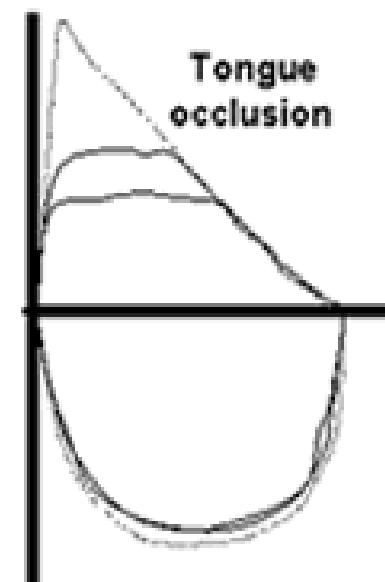
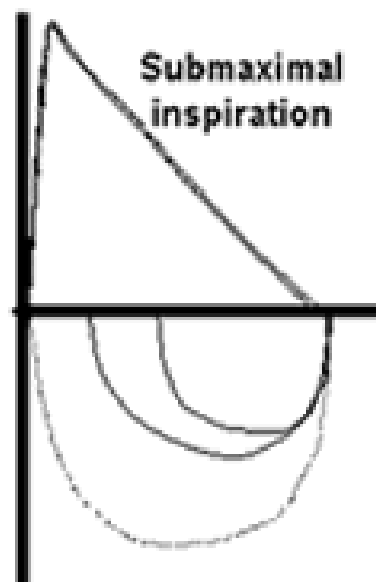
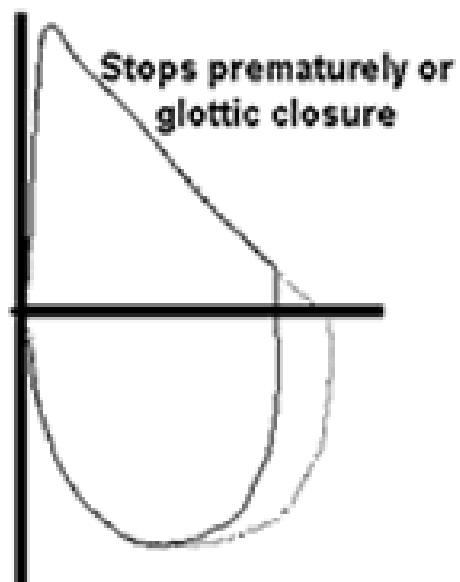
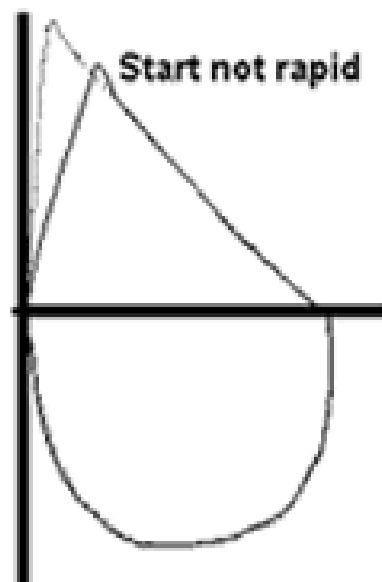
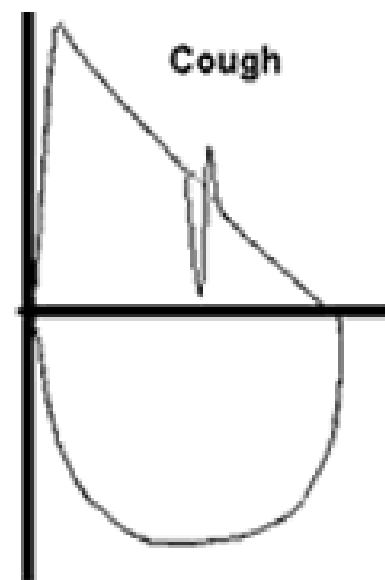
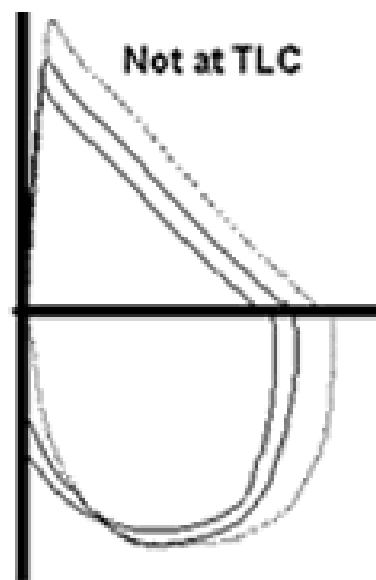
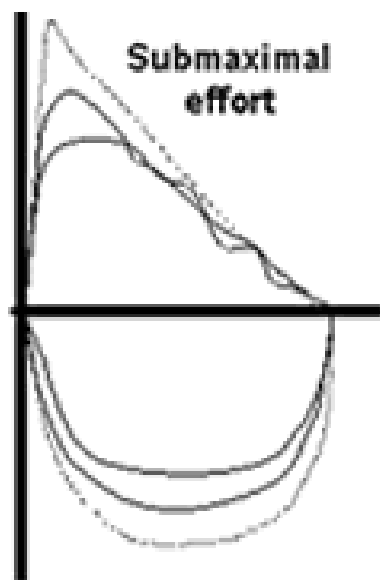
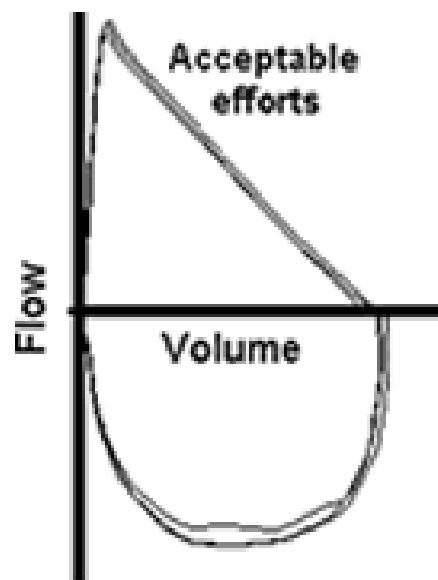
e) fixed major airway obstruction
(e.g. carcinoma of the trachea).











OBSTRUCTIVE VS RESTRICTIVE

ASTHMA

↓ FEV₁

↓ ⇌ ratio

RESTRICTIVE

↓ FEV₁ & FVC,
↑ or normal ratio

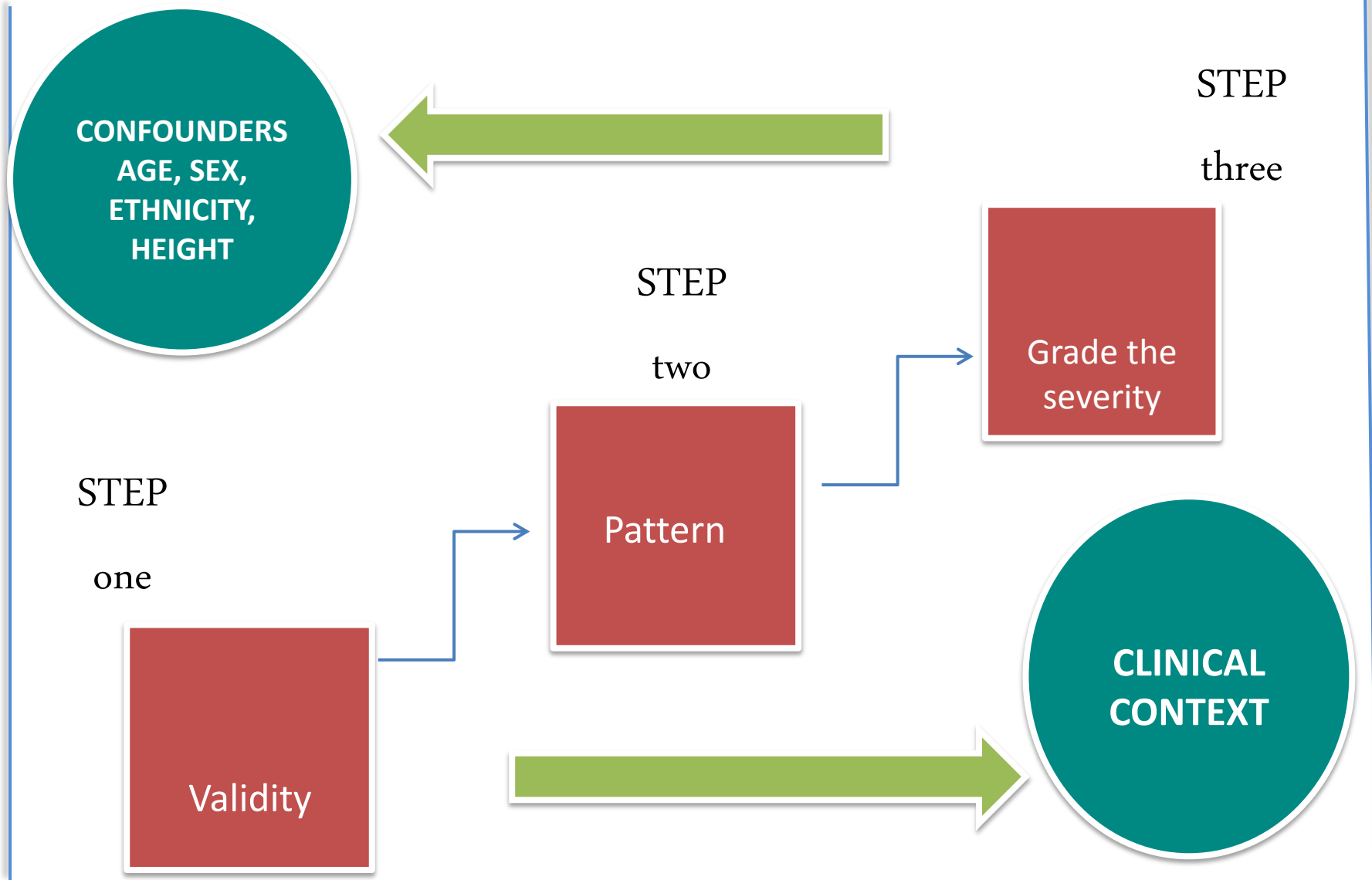
(also ↓ RV & TCL)

COPD

↓ FEV₁

↓ ratio

INTERPRETATION



OBSTRUCTIVE SPIROMETRY

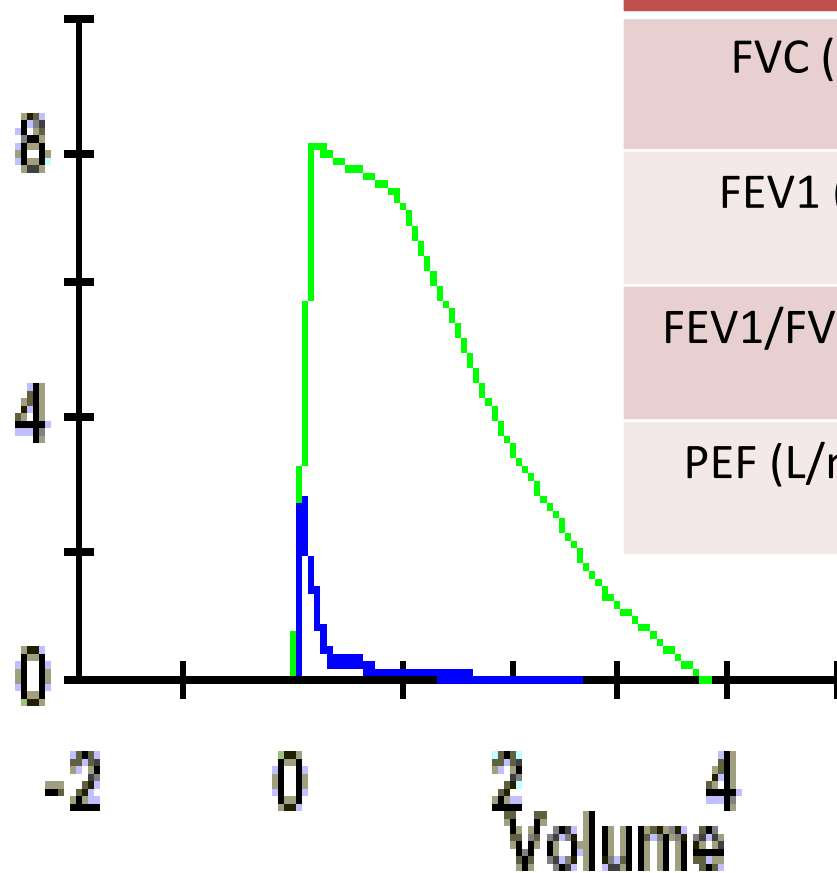


COPD OR ASTHMA?

	PRED	MEAS	% PRED
FVC (L)	3.66	3.05	83
FEV1 (L)	2.99	1.66	55
FEV1/FVC (%)	83	54	
PEF (L/min)	390	298	76

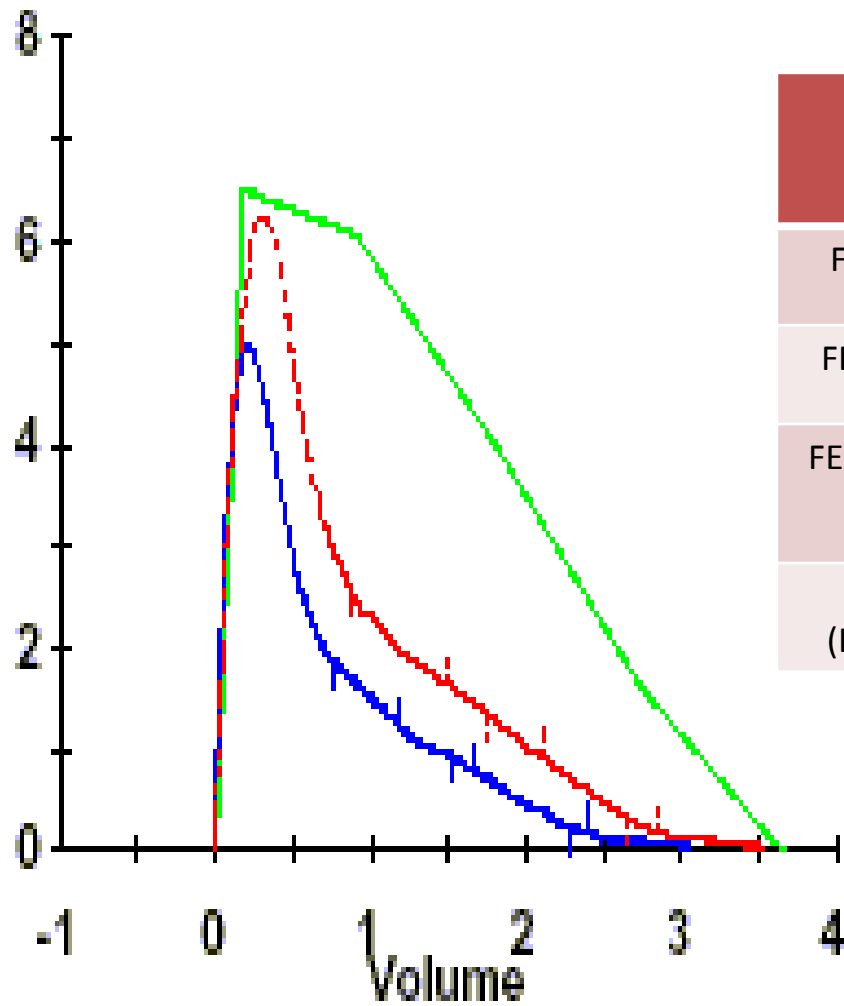
COPD SPIROMETRY

Flow



	PRED	MEAS	% PRED
FVC (L)	3.85	2.67	69
FEV1 (L)	3.04	0.54	18
FEV1/FVC (%)	79	20	
PEF (L/min)	484	166	34

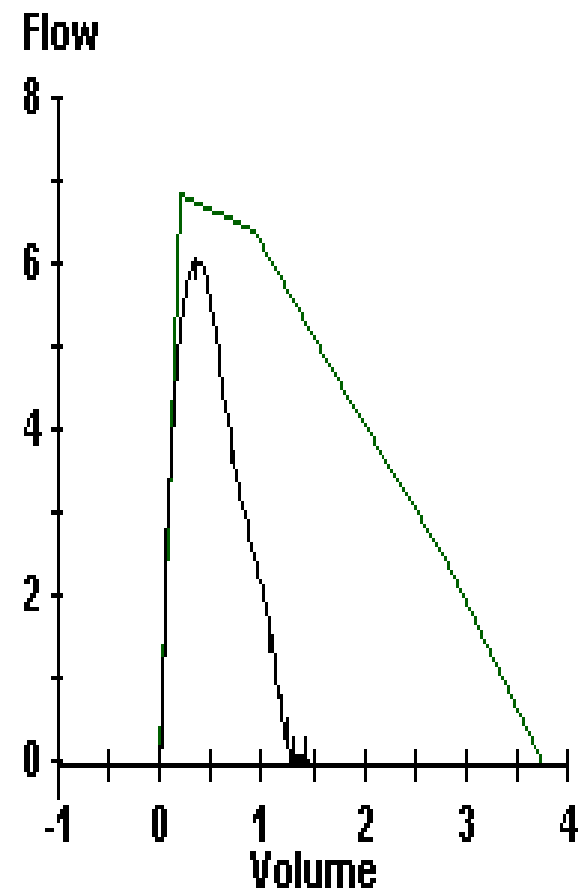
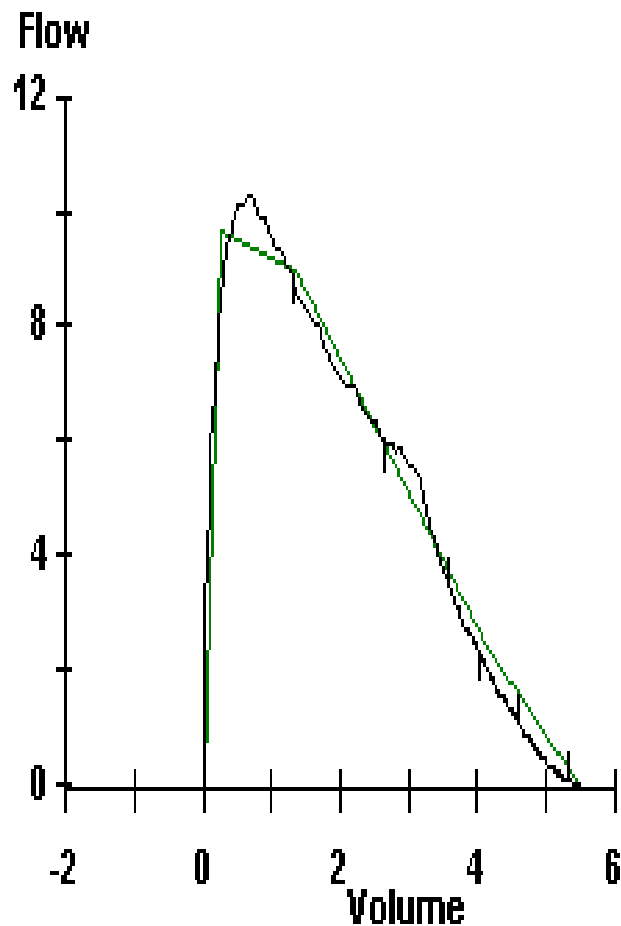
REVERSIBILITY



	PRED	MEAS	% PRED	POST MEAS	% CHANGE
FVC (L)	3.66	3.05	83	3.51	15
FEV1 (L)	2.99	1.66	55	2.10	27
FEV1/FVC (%)	83	54		60	
PEF (L/min)	390	298	76	372	25

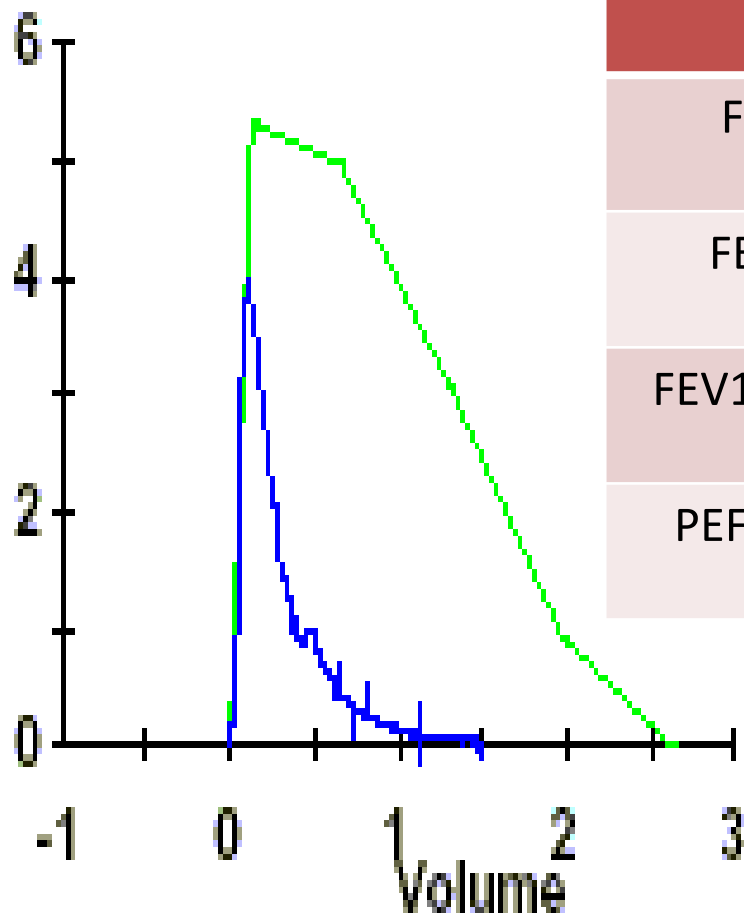
A significant response
Diagnostic with asthma
Defined as both a >20% rise
and >400ml increase in FEV1

RESTRICTIVE SPIROMETRY



MIXED SPIROMETRY

Flow



	PRED	MEAS	% PRED
FVC (L)	3.64	1.50	57
FEV1 (L)	2.15	0.81	38
FEV1/FVC (%)	83	54	
PEF (L/min)	318	251	79

**OBSTRUCTED/RESTRICTED
SPIROMETRY**

CONTEXT & CLINICAL PRESENTATION



Confirms chronic airflow limitation but **limited value distinguishing** between asthma with fixed airflow obstruction, COPD & ACOS

Single visit spirometry is **NOT** always a confirmation of diagnosis

ICS & LABA blurred picture

RESTRICTIVE SPIROMETRY

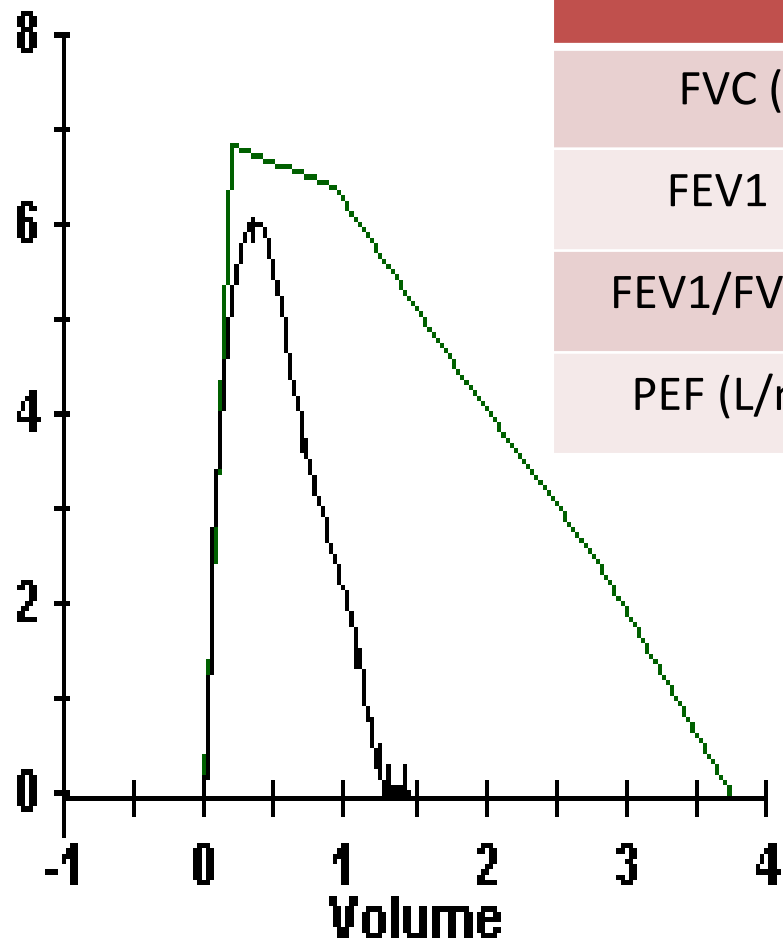


CASE STUDY:

- Newton
- 59 years
- Coughing / smoking

RESTRICTIVE SPIROMETRY

Flow



	PRED	MEAS	% PRED
FVC (L)	3.74	1.45	39
FEV1 (L)	3.32	1.33	40
FEV1/FVC (%)	87	92	
PEF (L/min)	416	368	89

CASE STUDY:

- Newton
- 59 years
- Coughing / smoking

CONTRAINDICATIONS

**Respiratory
Infection**

**Haemoptasis of
unknown origin**

Pneumothorax

**Recent abdo, chest
or eye surgery**

**Uncontrolled HT
or PE**

**MI in previous
month**

**Pain N & V (or
middle ear
infection)**

Confusion

ROLE IN DIAGNOSIS

Spirometry is essential assessment of suspected disease of airways

Initial & subsequent

Before & after
treatment

Early confirmation or
exclusion

Avoid needless therapy

Avoid delay in initiating
other investigations



If you can't explain it **simply**, you
don't understand it well enough.

— Albert Einstein

