

Spirometry Interpretation

Hannah Hunt

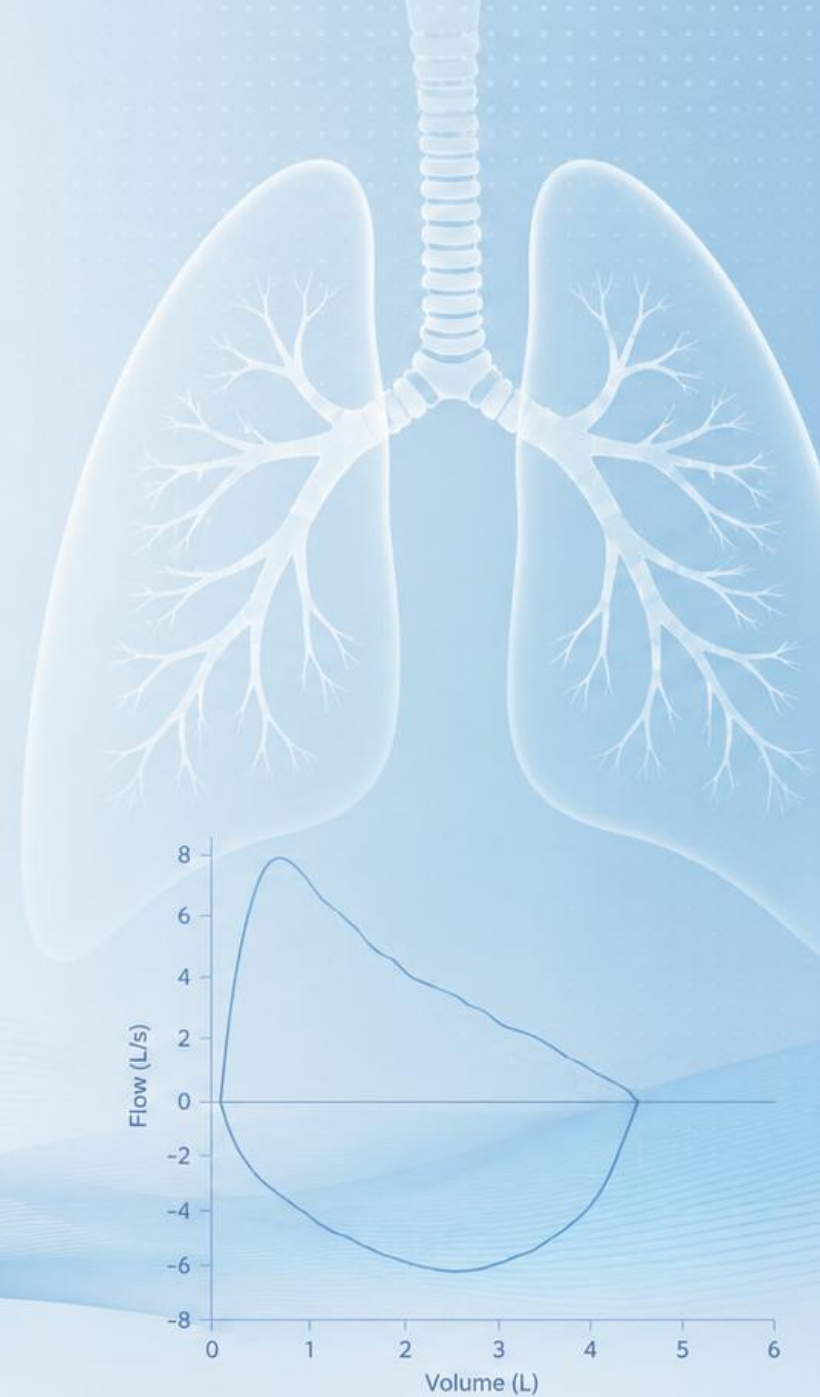
Physiology Lead

Respiratory Network

NHS Performance & Improvement

Session Overview

- Assessing acceptability of results
- Interpretation of results
- Q&A



Assessing Acceptability: Technical Comments



GIG Cymru NHS Wales
Respiratory Physiology
LUNG FUNCTION REPORT

First Name:
Identification:
Date of Birth:
Height:
Weight:
Race:
Pred. Module:

170.0 cm
75.0 kg
Caucasian
GLI_MIX

Last Name:
NHS Number:
Gender:
Age:
BMI:
Smoking status:
Ref. Physician:

female
38 Years
26 kg/m2

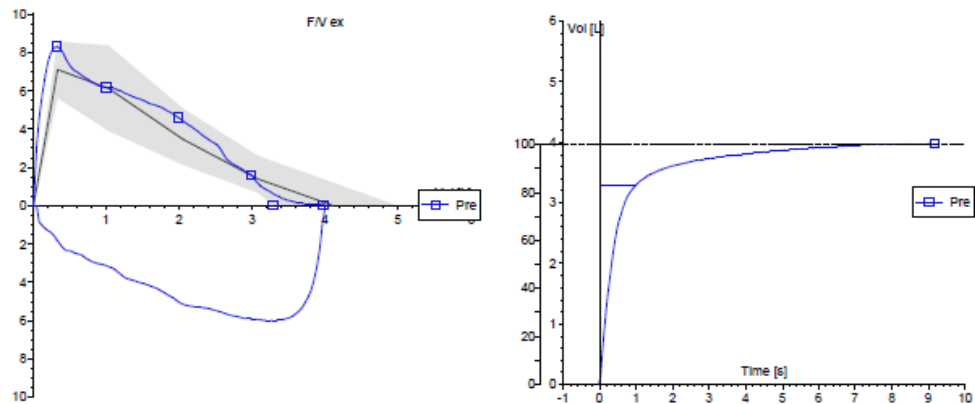
Visit date:
Location:

SBU,Neath Port Talbot Hospital 7A3CJ

Visit time:

SPIROMETRY

		Test	LLN	ULN	% Pred	Z-Score
FEV 1	L	3.29	2.68	4.01	98.0	-0.17
FVC	L	3.97	3.28	4.96	96.7	-0.27
FEV 1 % VC MAX	%	82.85	71.27	91.34	100.6	0.09
MMEF 75/25	L/s	3.70	2.12	5.05	107.2	0.27
PEF	L/min	499	337	515	117.2	1.36
VC MAX	L	3.97	3.28	4.96	96.7	-0.27
FET	sec	9.19				



The figure contains two graphs. The left graph is labeled 'F/V ex' and shows flow (L/s) on the y-axis (ranging from -10 to 10) versus time (s) on the x-axis (ranging from 0 to 5). It displays a 'Pre' trace (blue line with square markers) and a shaded area representing normal ranges. The right graph is labeled 'Vol (L)' and shows volume (L) on the y-axis (ranging from 0 to 6) versus time (s) on the x-axis (ranging from -1 to 10). It also displays a 'Pre' trace (blue line with square markers) and a shaded area representing normal ranges.

PHYSIOLOGIST COMMENTS

Test performed well with good effort and technique.
Results were reproducible and appear to be accurate.
Patient took Salbutamol inhaler 1.5 hours prior to test.

XXX - Respiratory Physiologist

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Assessing Acceptability: Technical Comments



GIG
CYMRU
NHS
WALES

GIG Cymru NHS Wales Respiratory Physiology LUNG FUNCTION REPORT



First Name: [REDACTED]
Identification: [REDACTED]
Date of Birth: [REDACTED]
Height: 170.0 cm
Weight: 75.0 kg
Race: Caucasian
Pred. Module: GLI_MIX

Last Name: [REDACTED]
NHS Number: [REDACTED]
Gender: female
Age: 38 Years
BMI: 26 kg/m2
Smoking status:
Ref. Physician:

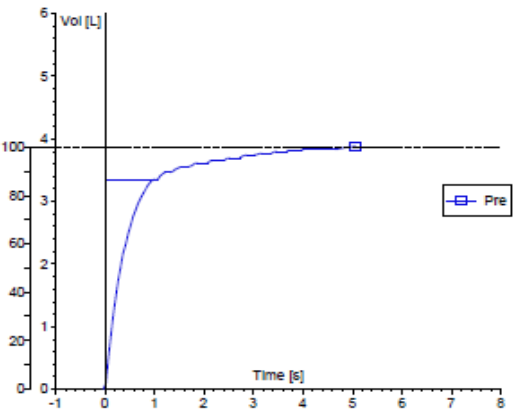
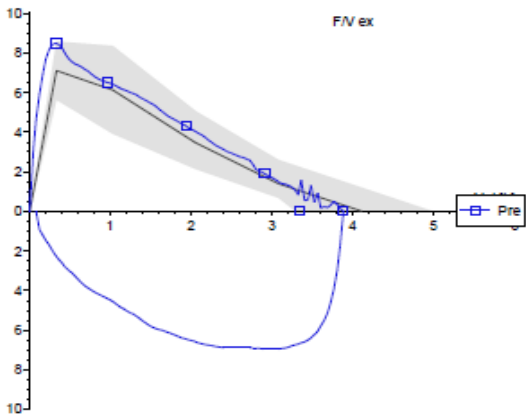
Visit date: [REDACTED]

Visit time: [REDACTED]

Location: SBU, Neath Port Talbot Hospital 7A3CJ

SPIROMETRY

		Test	LLN	ULN	% Pred	Z-Score
FEV 1	L	3.34	2.68	4.01	99.5	-0.04
FVC	L	3.87	3.28	4.96	94.3	-0.46
FEV 1 % VC MAX	%	86.36	71.27	91.34	104.9	0.70
MMEF 75/25	L/s	3.84	2.12	5.05	111.1	0.42
PEF	L/min	510	337	515	119.6	1.55
VC MAX	L	3.87	3.28	4.96	94.3	-0.46
FET	sec	5.08				



PHYSIOLOGIST COMMENTS

Patient struggled with cough throughout test.
Maximum of 8 attempts reached. Best result shown.
PEF and FEV1 were reproducible, however, cough towards end of expiration may cause an underestimated FVC.
PEF and FEV1 are reliable, FVC should be interpreted with caution.

XXXX - Respiratory Physiologist

PHYSIOLOGIST COMMENTS

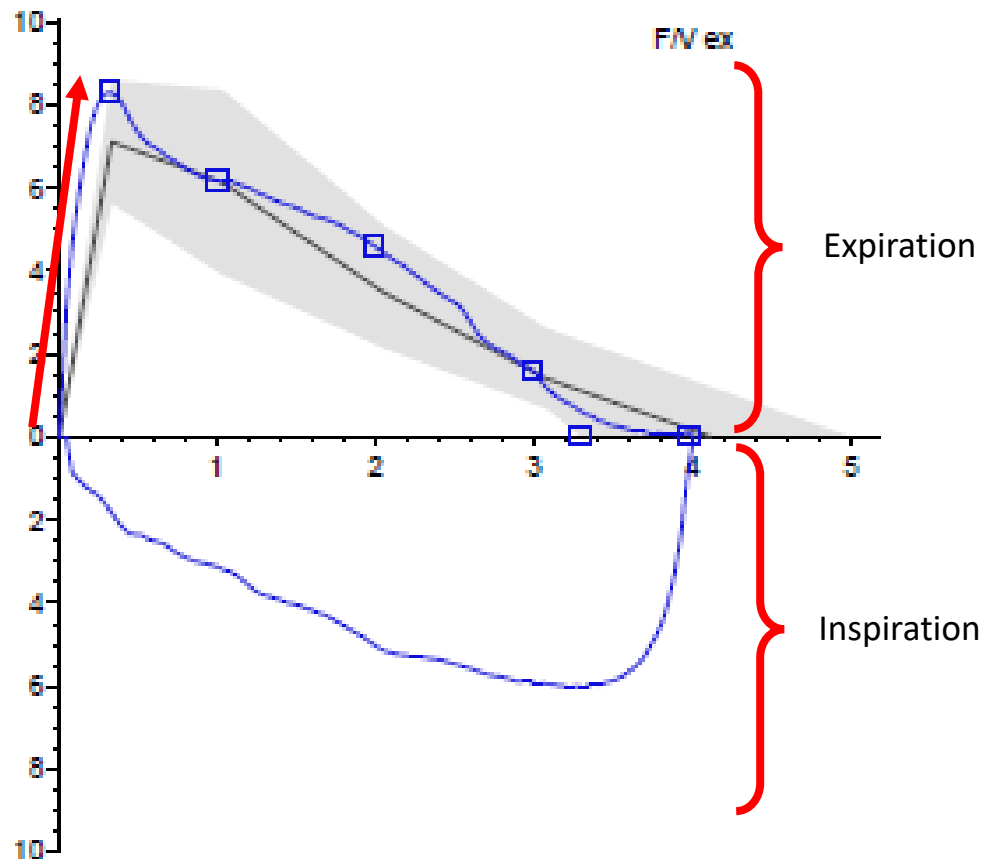
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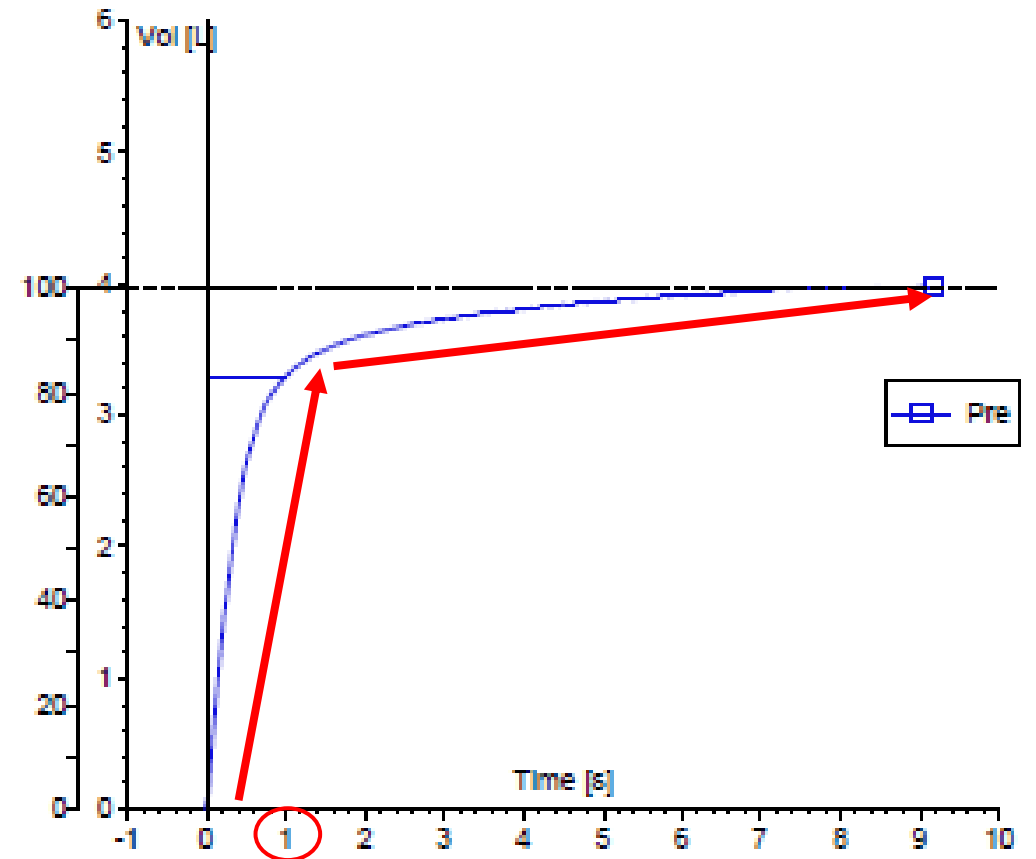
Assessing Acceptability: Assessing the loops

What does 'normal' look like?

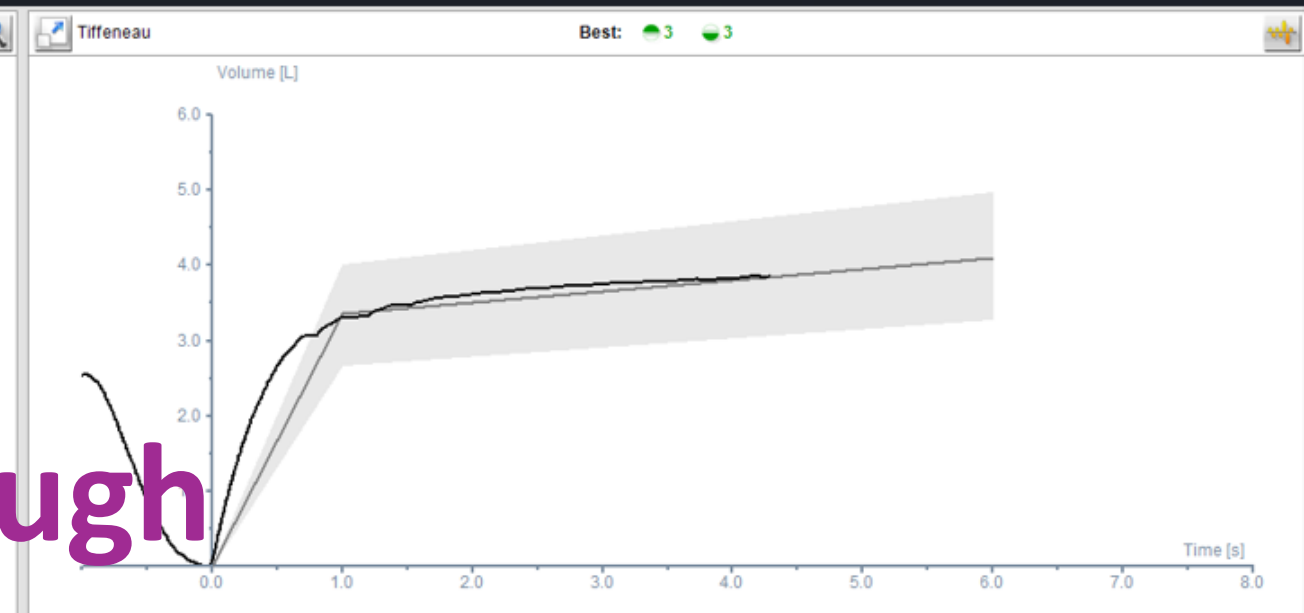
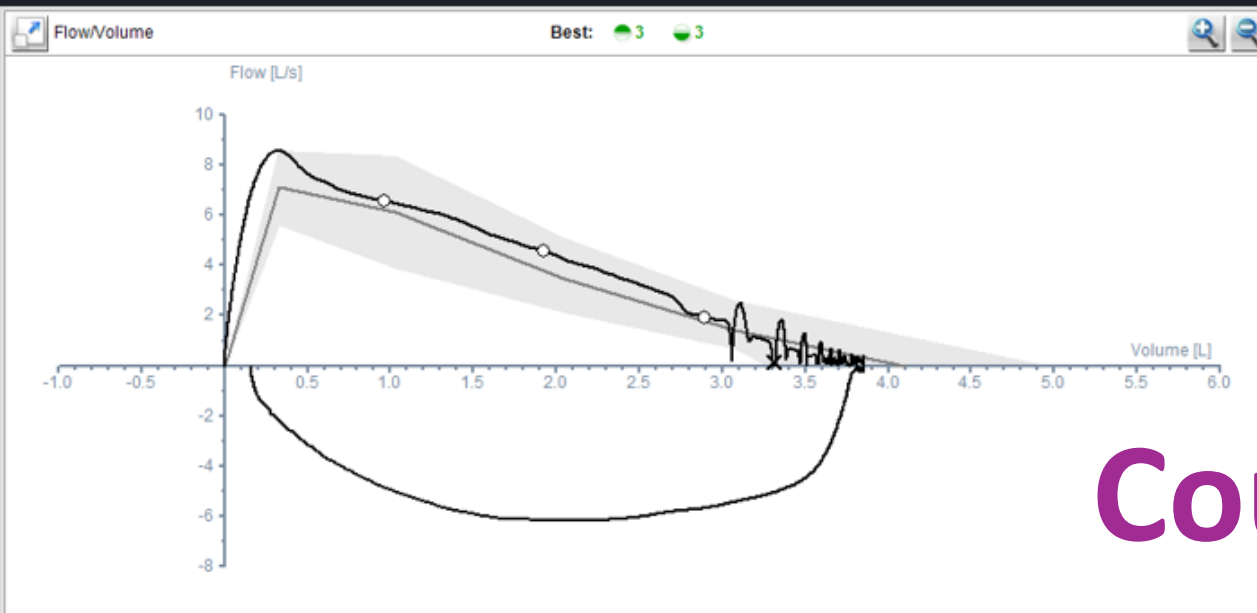
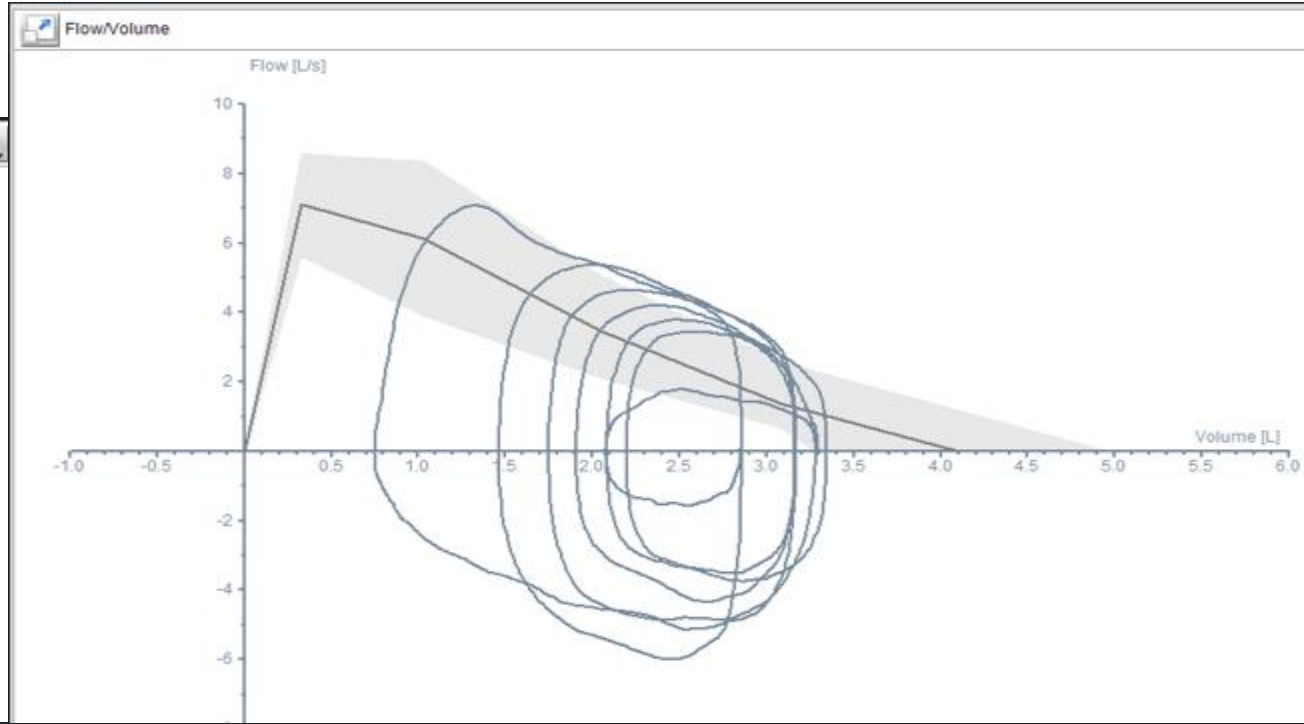
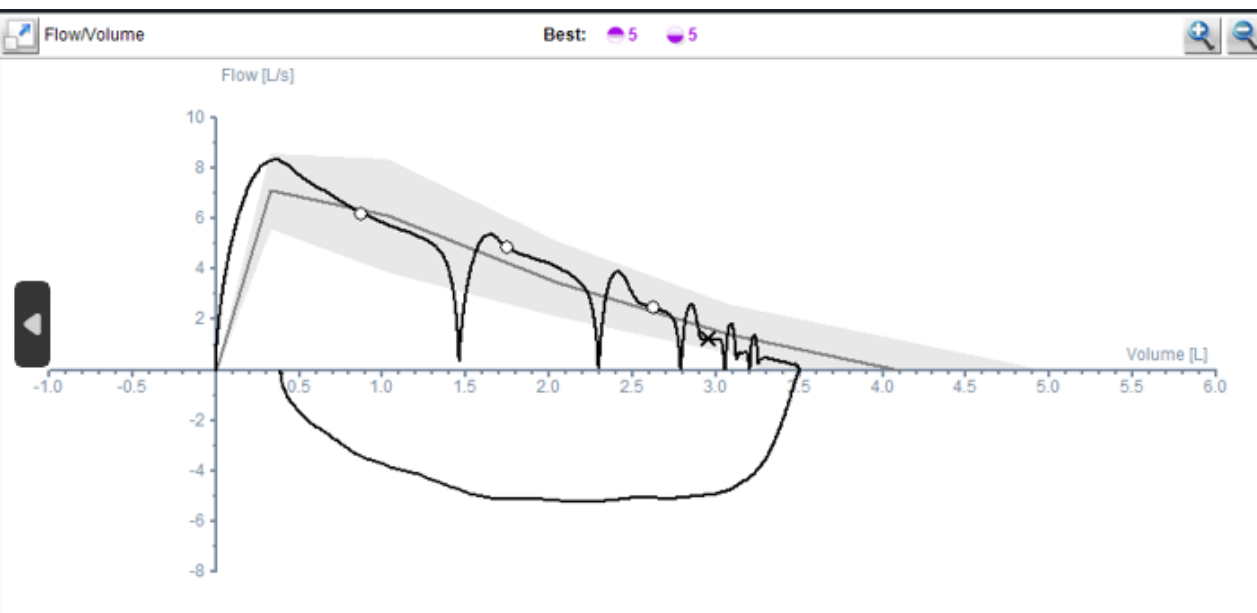
Flow Volume Loop



Volume Time Curve

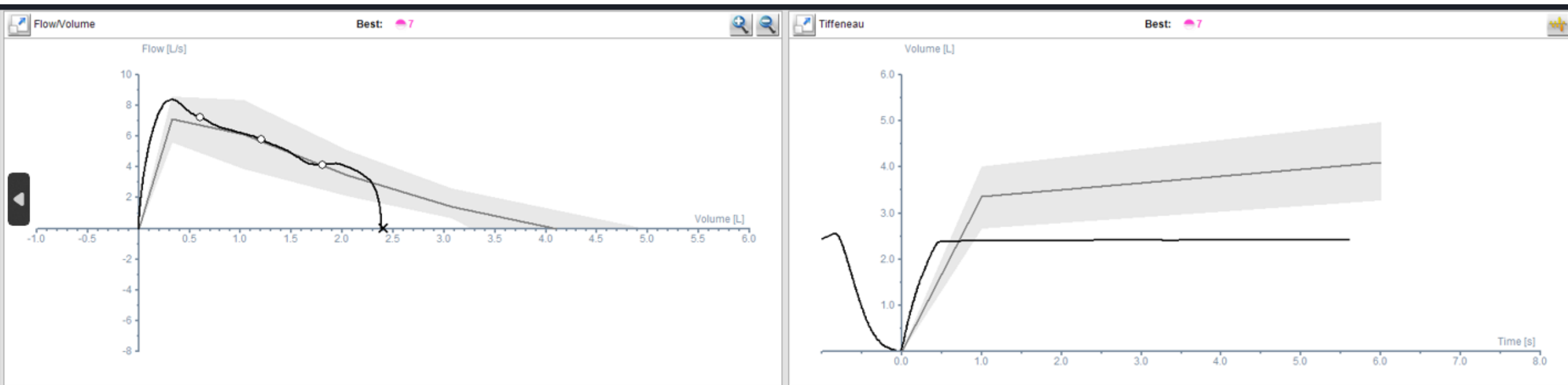


Identifying Errors



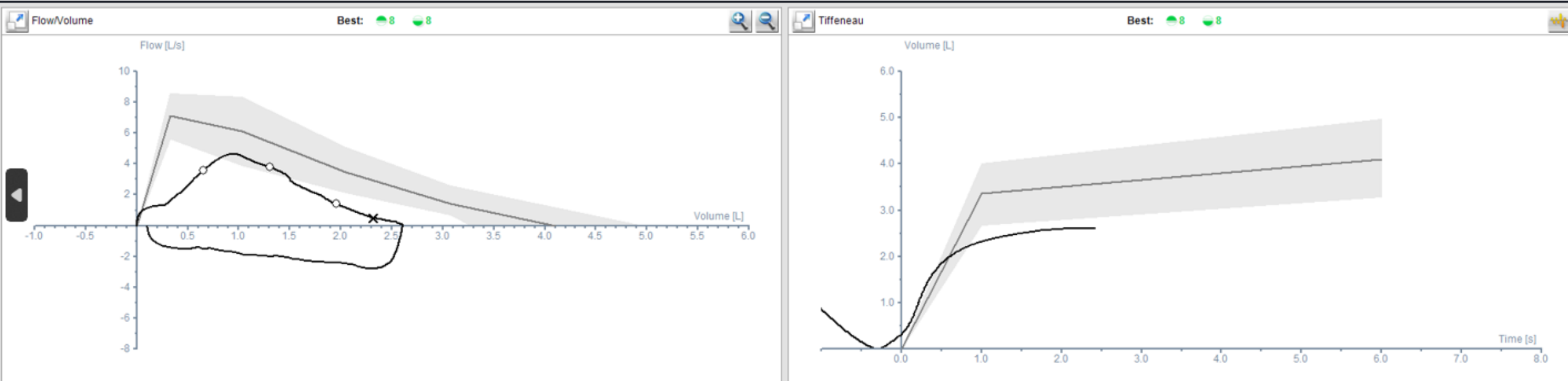
Cough

Identifying Errors



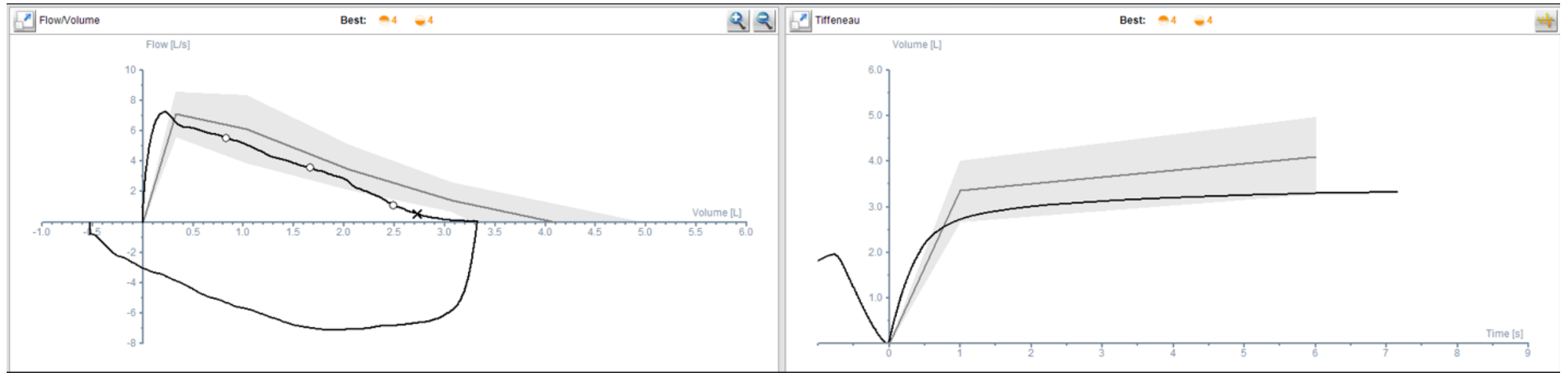
Early Termination

Identifying Errors



Slow Start / Poor Effort

Identifying Errors



Sub maximal Inspiration

Interpretation

Structured approach:

- Technical Comments
- Demographics
- Shape of the curves
- Review the numbers



GIG Cymru NHS Wales Respiratory Physiology LUNG FUNCTION REPORT



First Name: [REDACTED]
Identification: [REDACTED]
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Height: 170.0 cm
Weight: 75.0 kg
Race: Caucasian
Pred. Module: GLI_MIX

Last Name: [REDACTED]
NHS Number: [REDACTED]
Gender: female
Age: 38 Years
BMI: 26 kg/m2
Smoking status:
Ref. Physician: [REDACTED]

Visit date

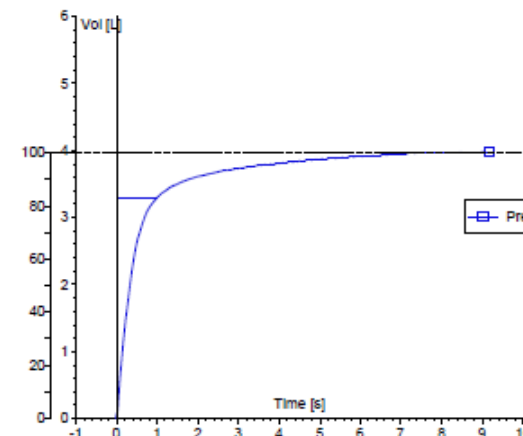
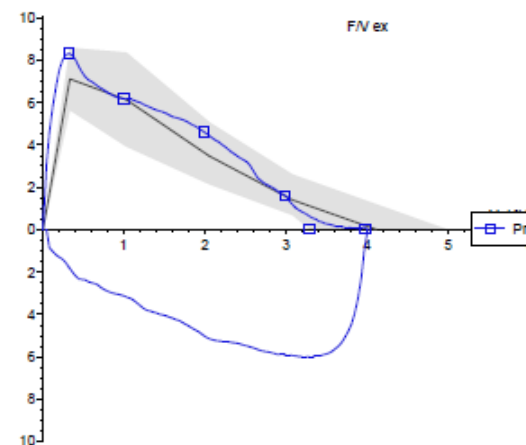
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SBU, Neath Port Talbot Hospital 7A3CJ

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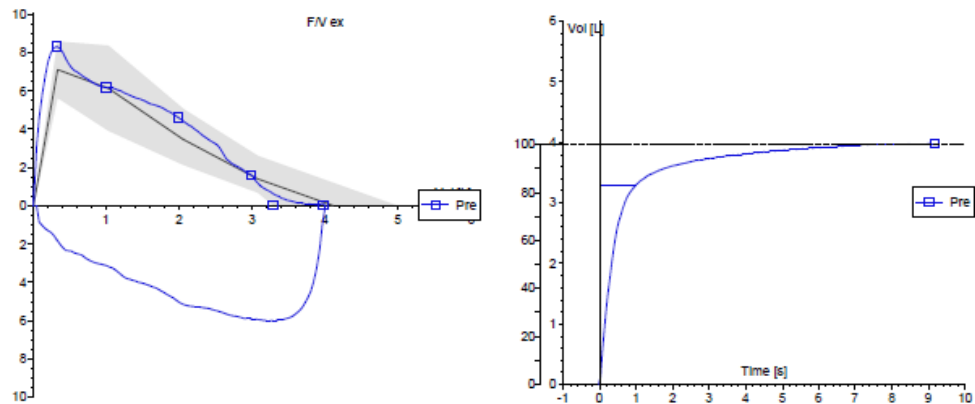
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Interpretation: Demographics



GIG Cymru NHS Wales

Respiratory Physiology

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Gender: female

Age: 38 Years

BMI: 26 kg/m2

Smoking status: [redacted]

Ref. Physician: [redacted]

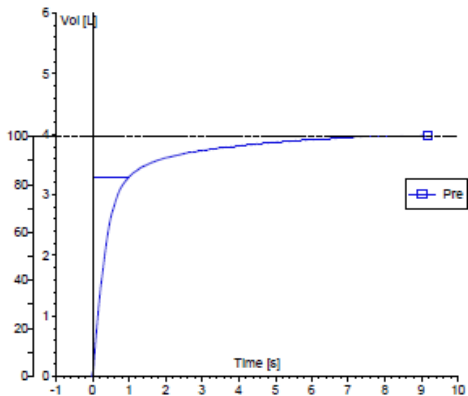
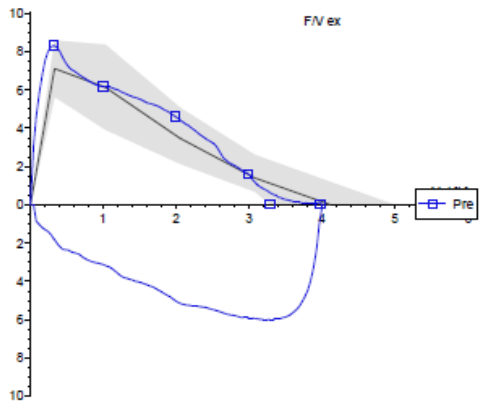
Visit date: [redacted]

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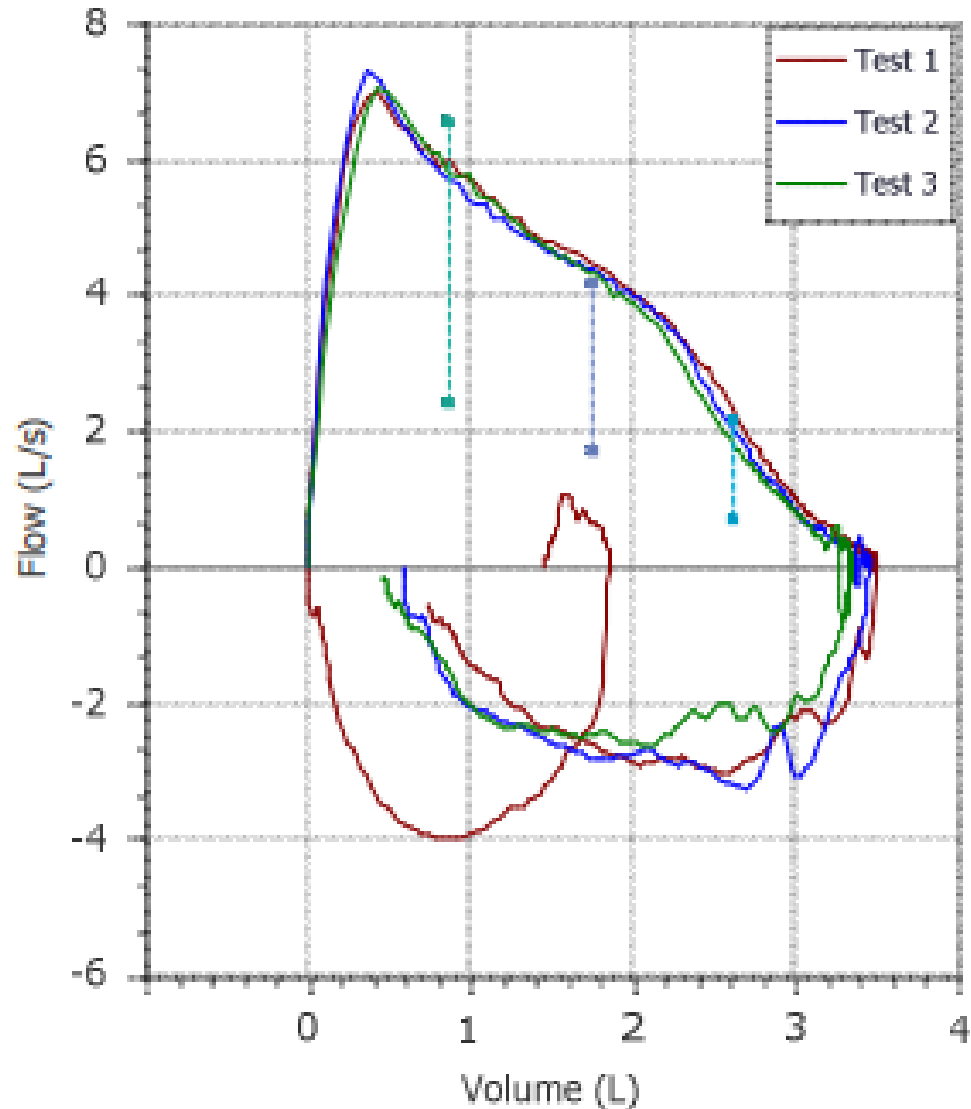
BMI: 26 kg/m2

Smoking status: Never

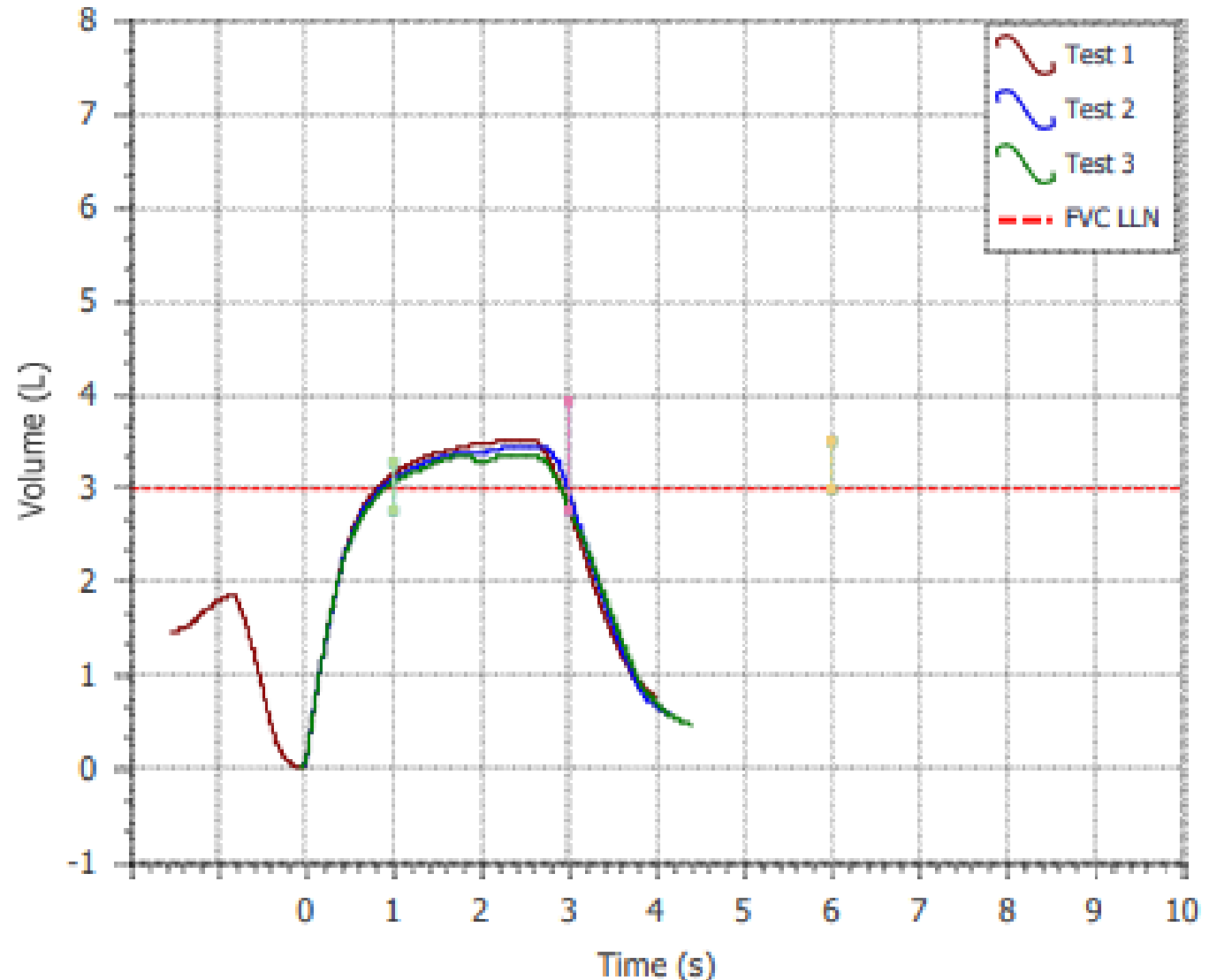
Ref. Physician: [redacted]

Interpretation: Assessing the loops

Flow/Volume Graph

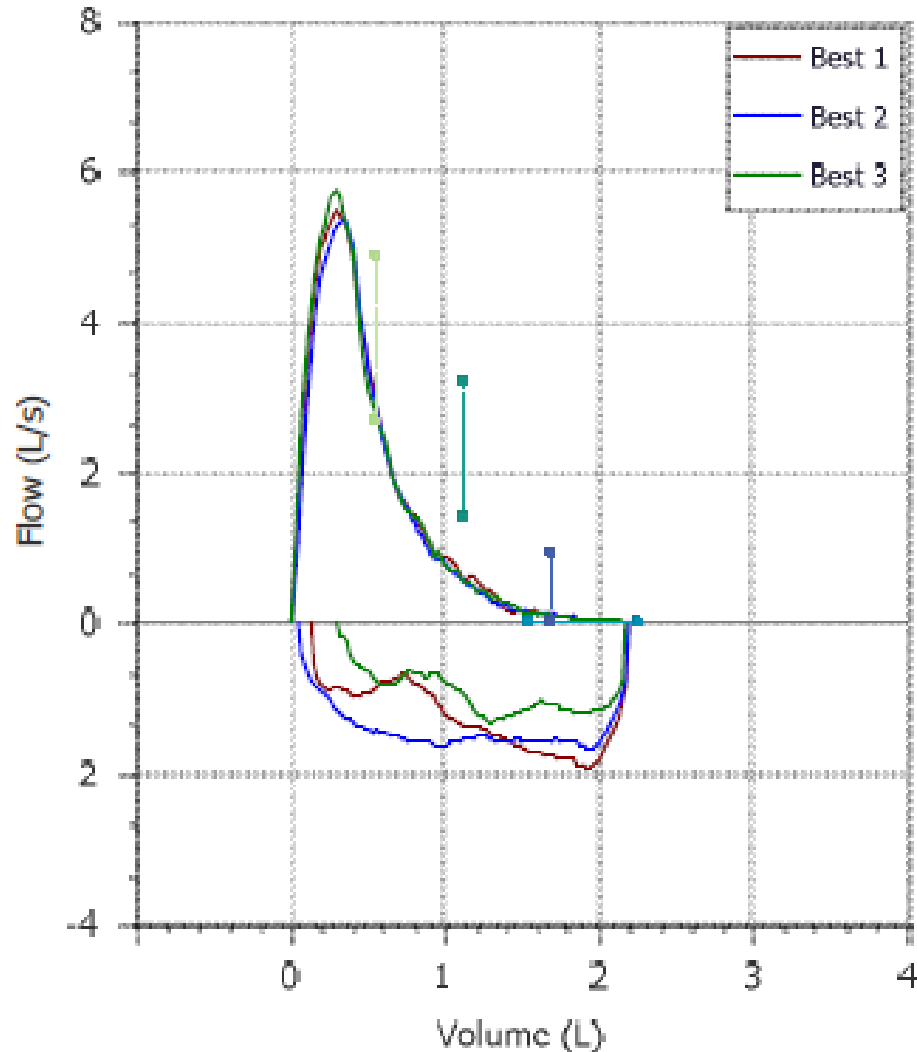


Volume/Time Graph

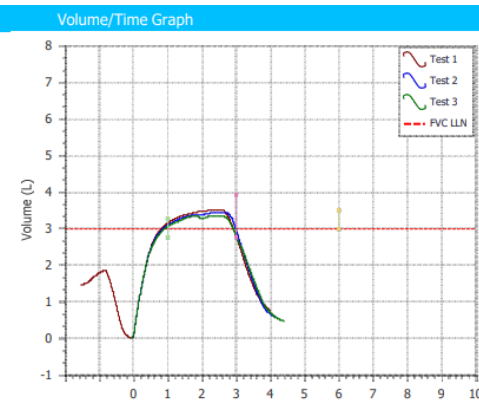
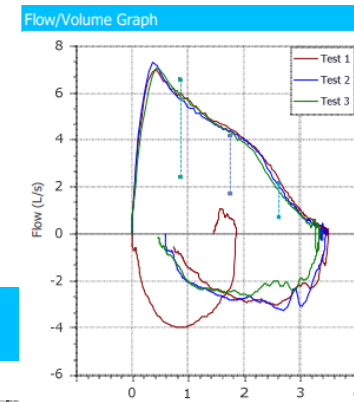
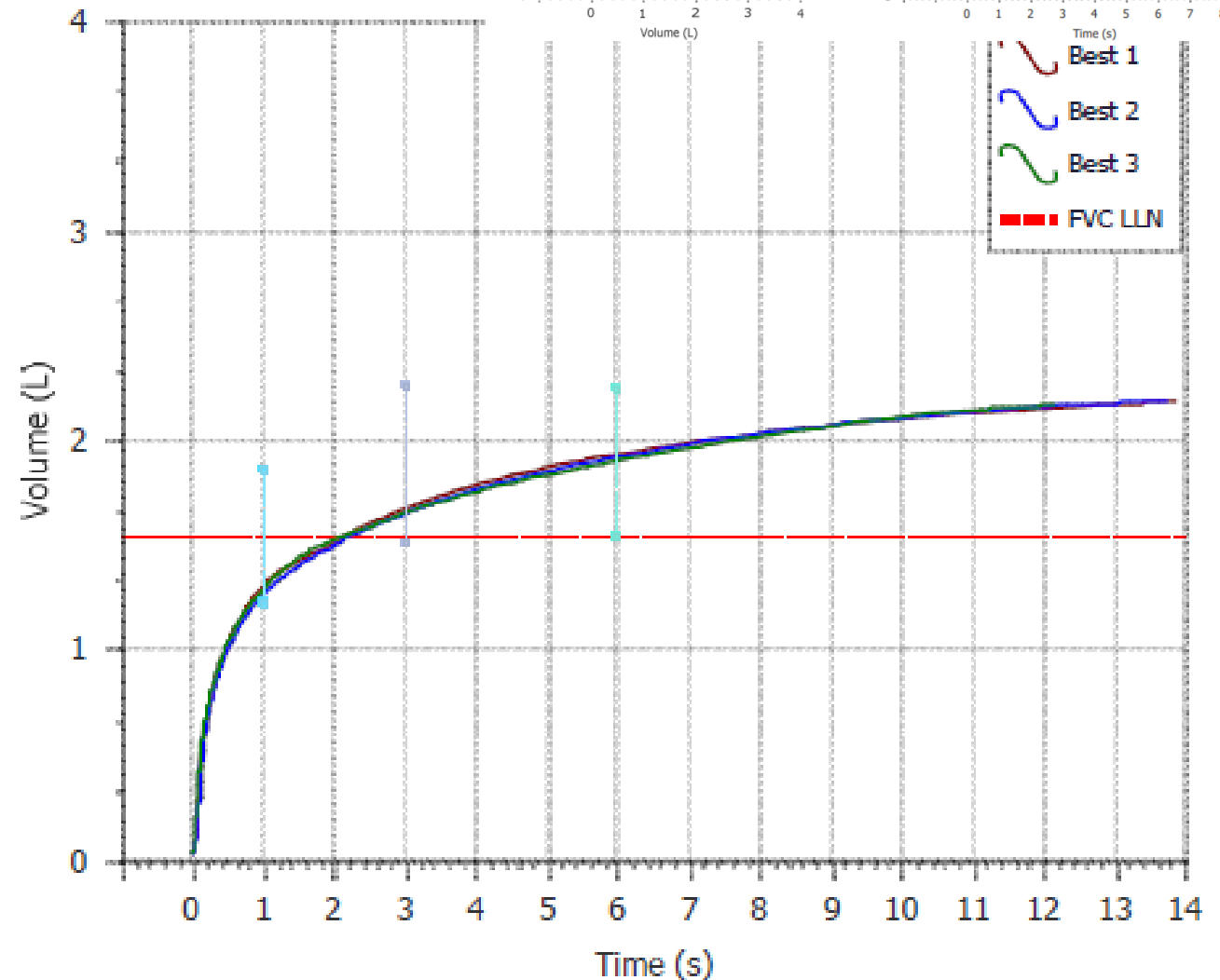


Interpretation: Obstruction

Flow/Volume Graph

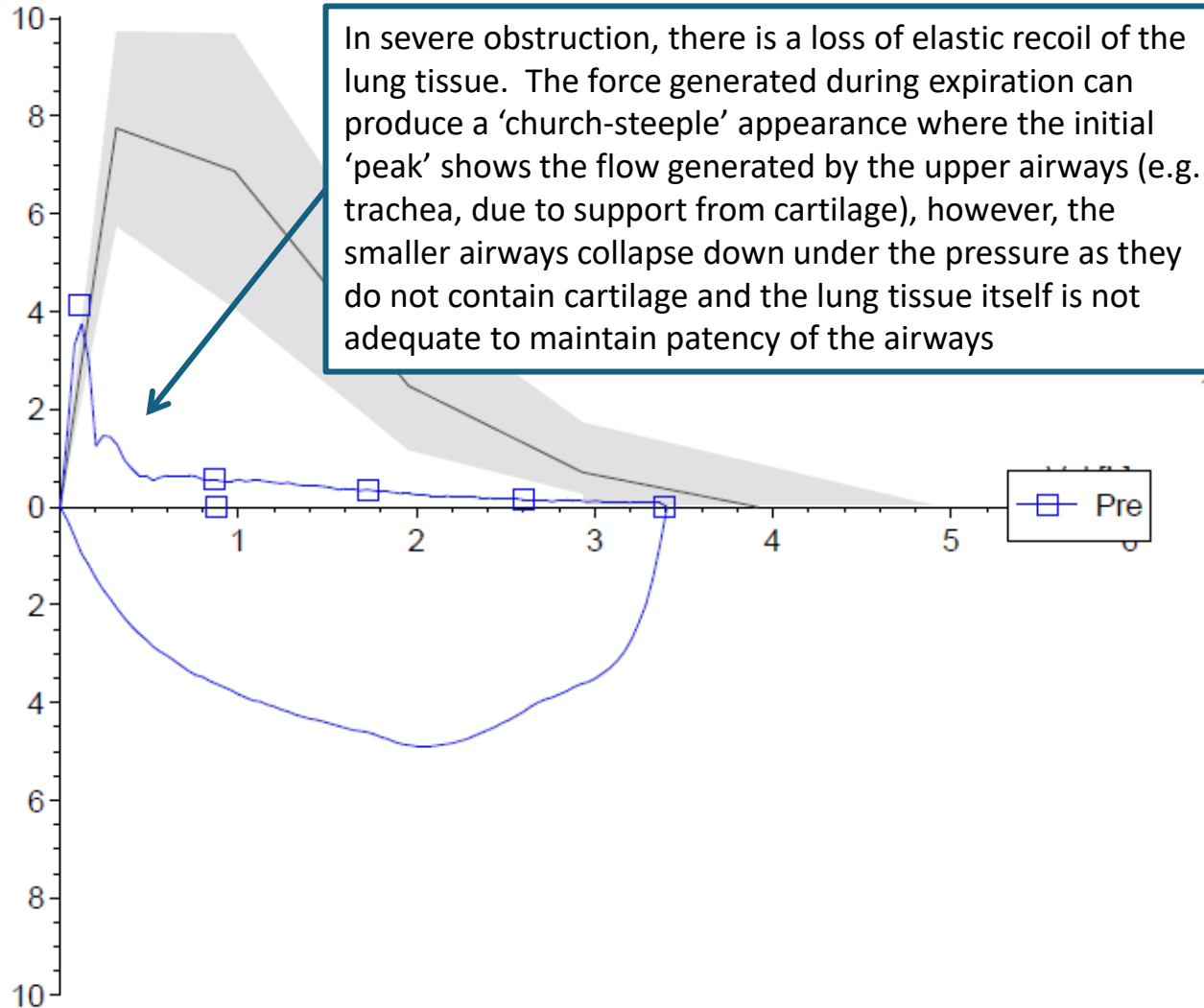


Volume/Time Graph

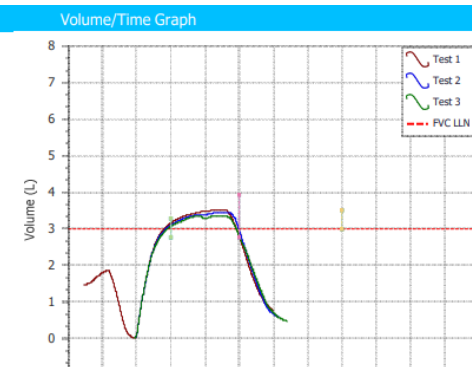
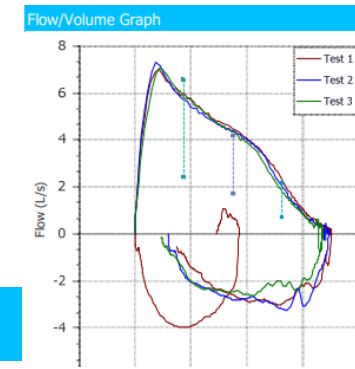
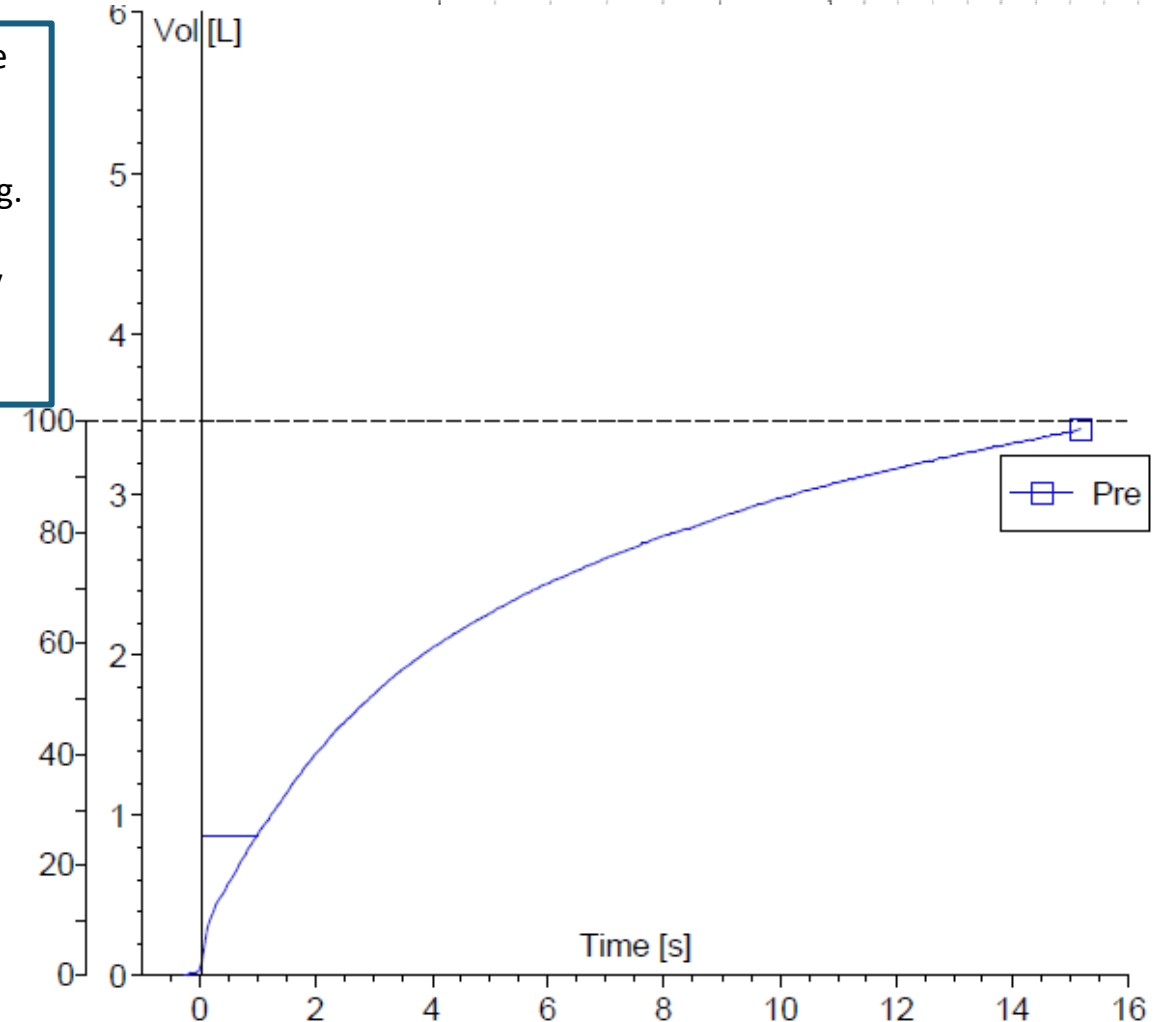


Interpretation: Obstruction

Flow/Volume Graph

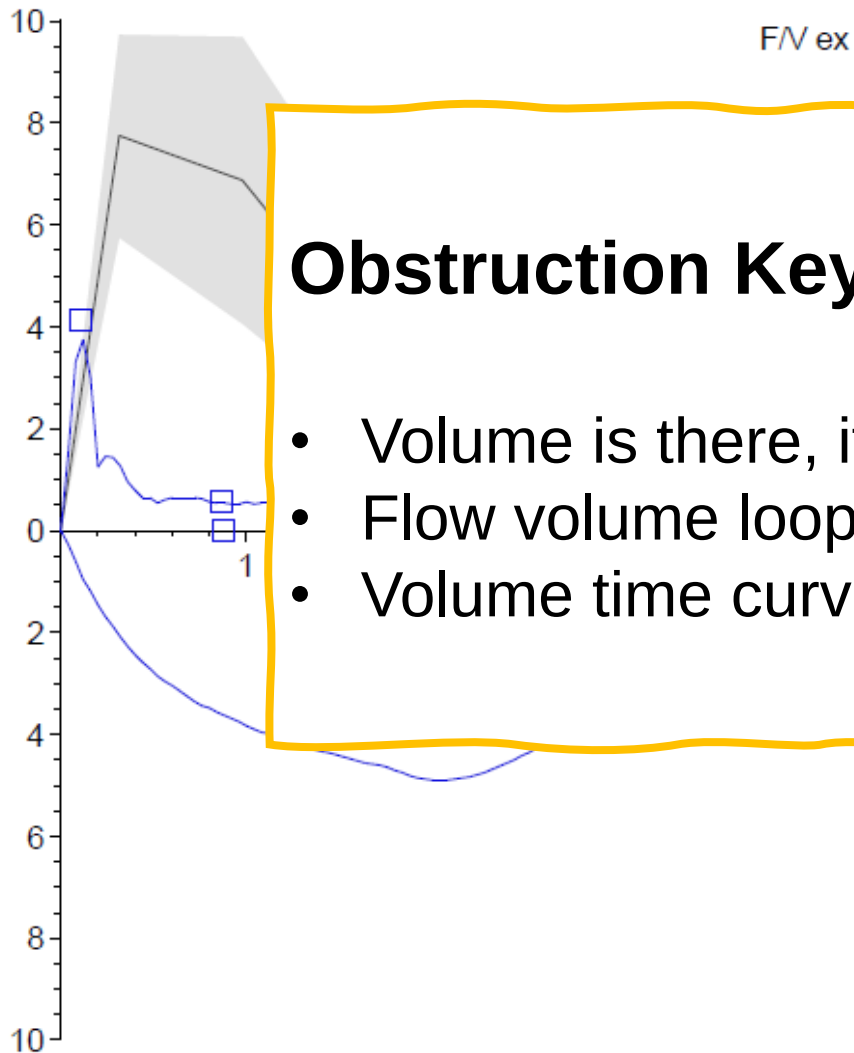


Volume/Time Graph

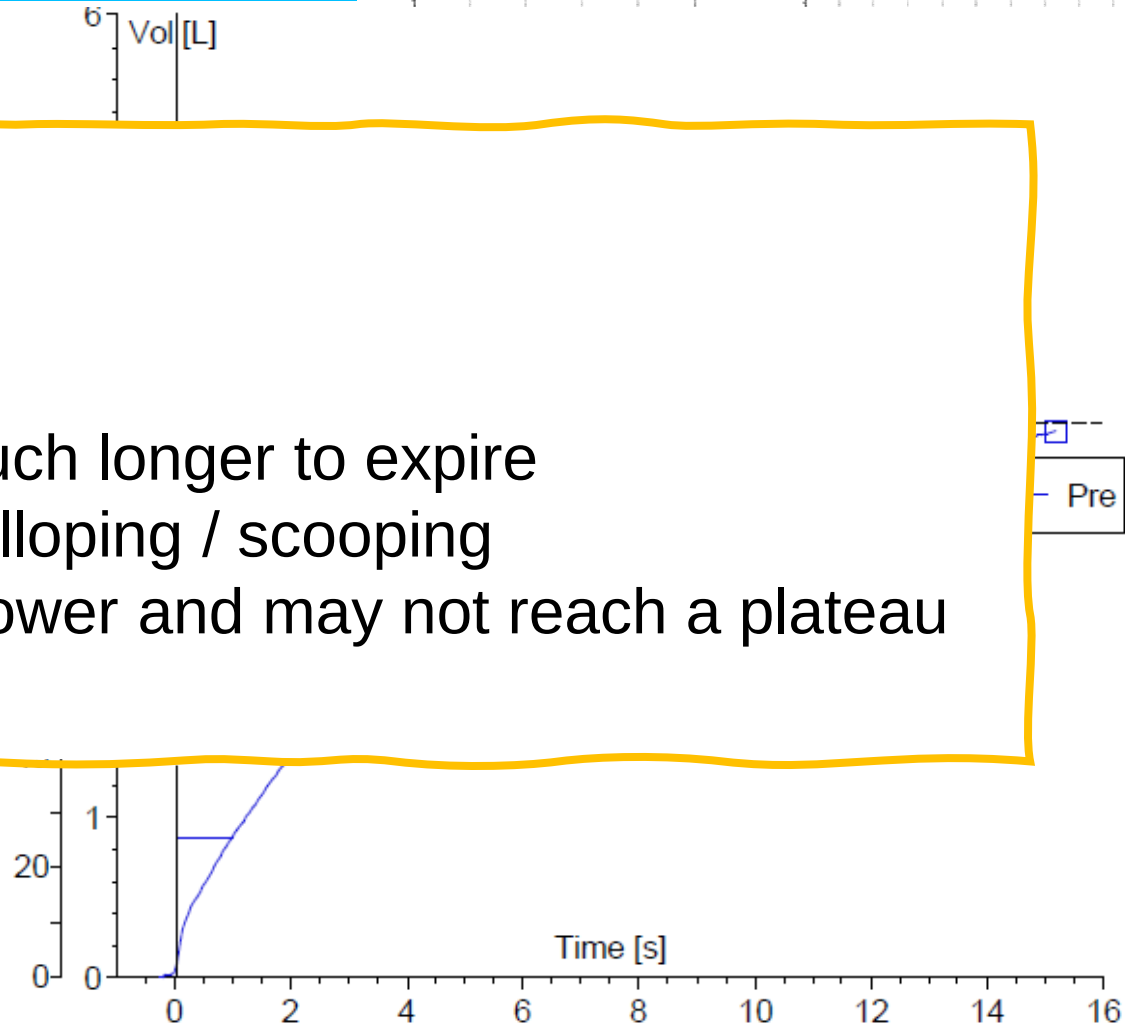


Interpretation: Obstruction

Flow/Volume Graph



Volume/Time Graph

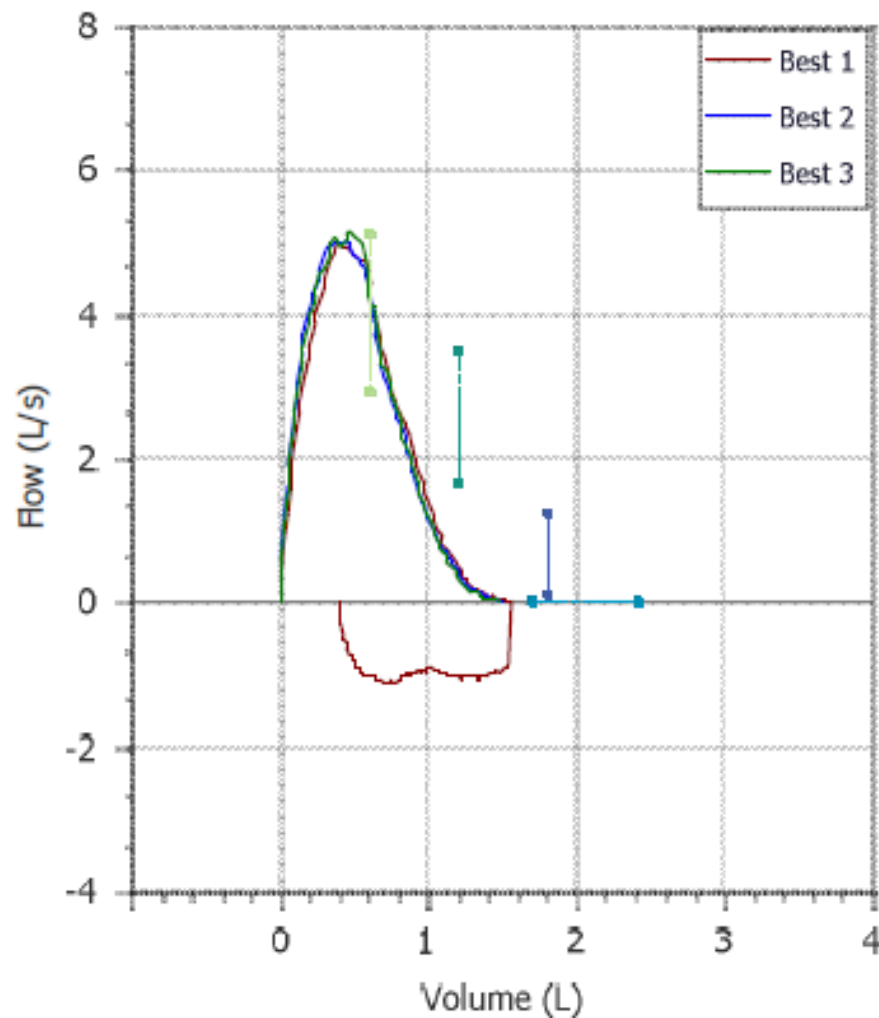


Obstruction Key Points

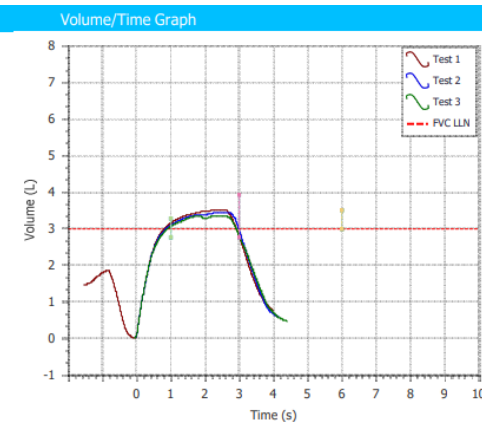
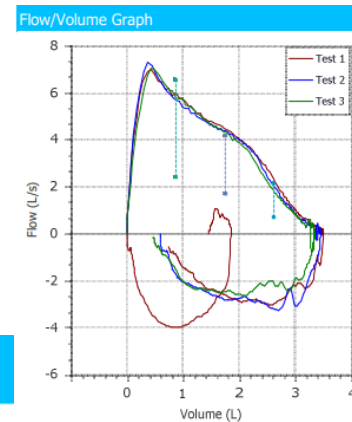
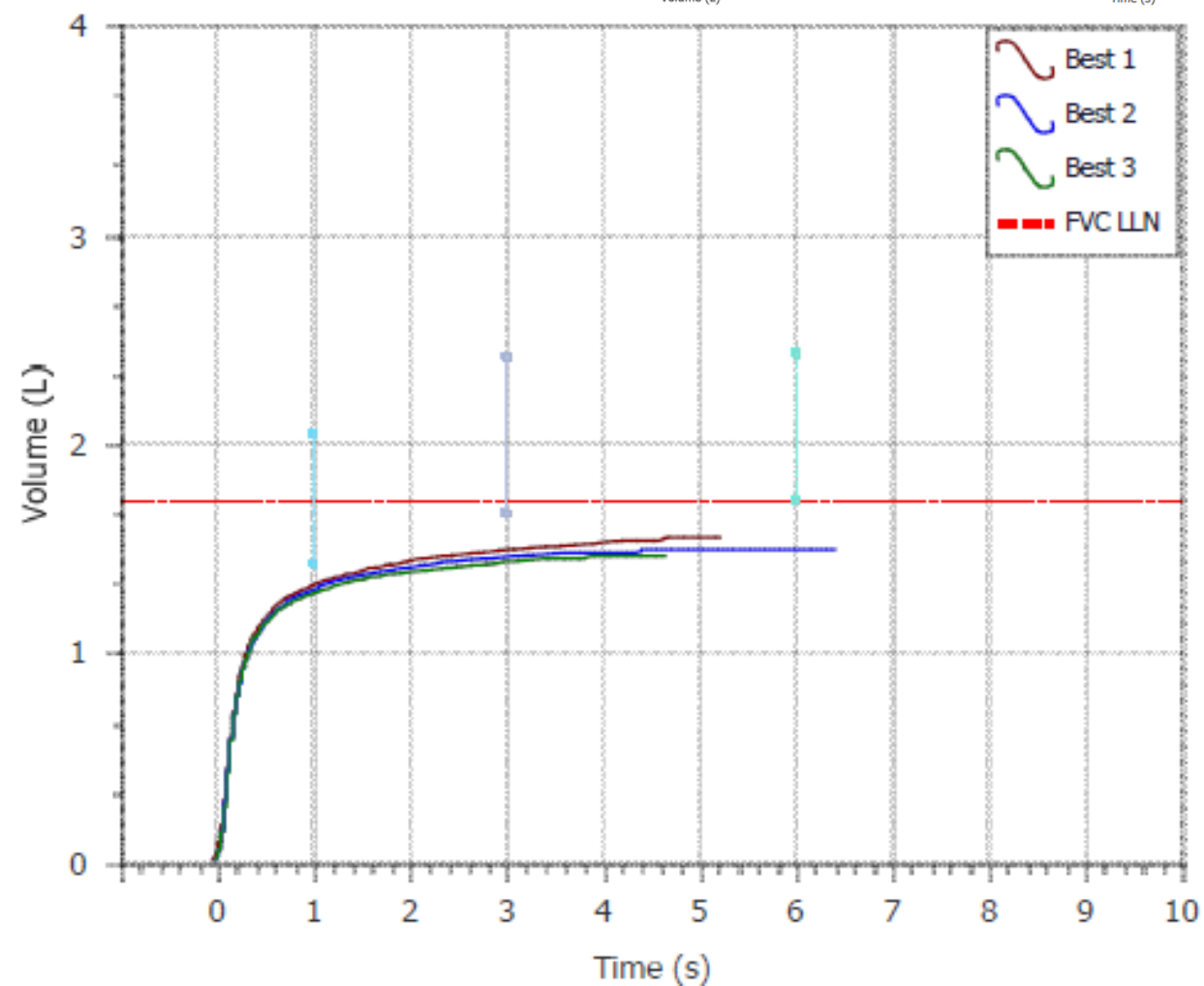
- Volume is there, it just takes much longer to expire
- Flow volume loop will show scalloping / scooping
- Volume time curve will be shallower and may not reach a plateau

Interpretation: Restriction

Flow/Volume Graph

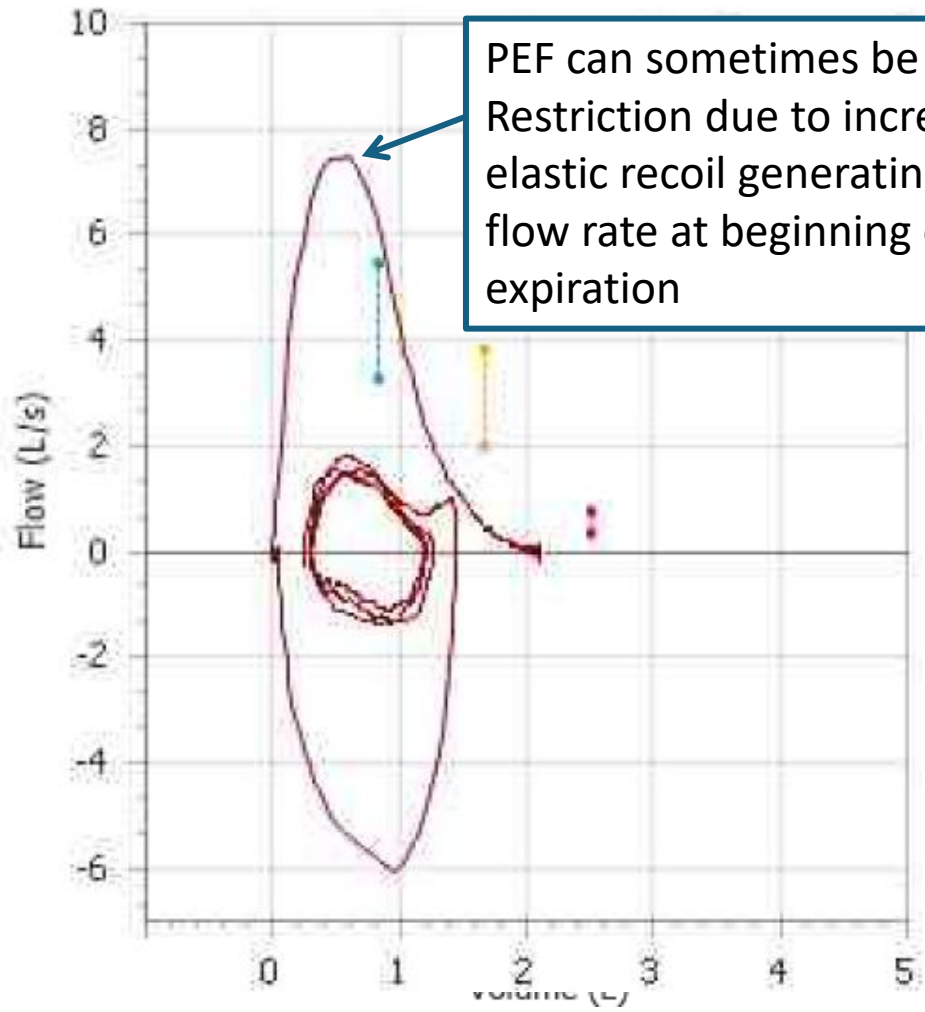


Volume/Time Graph



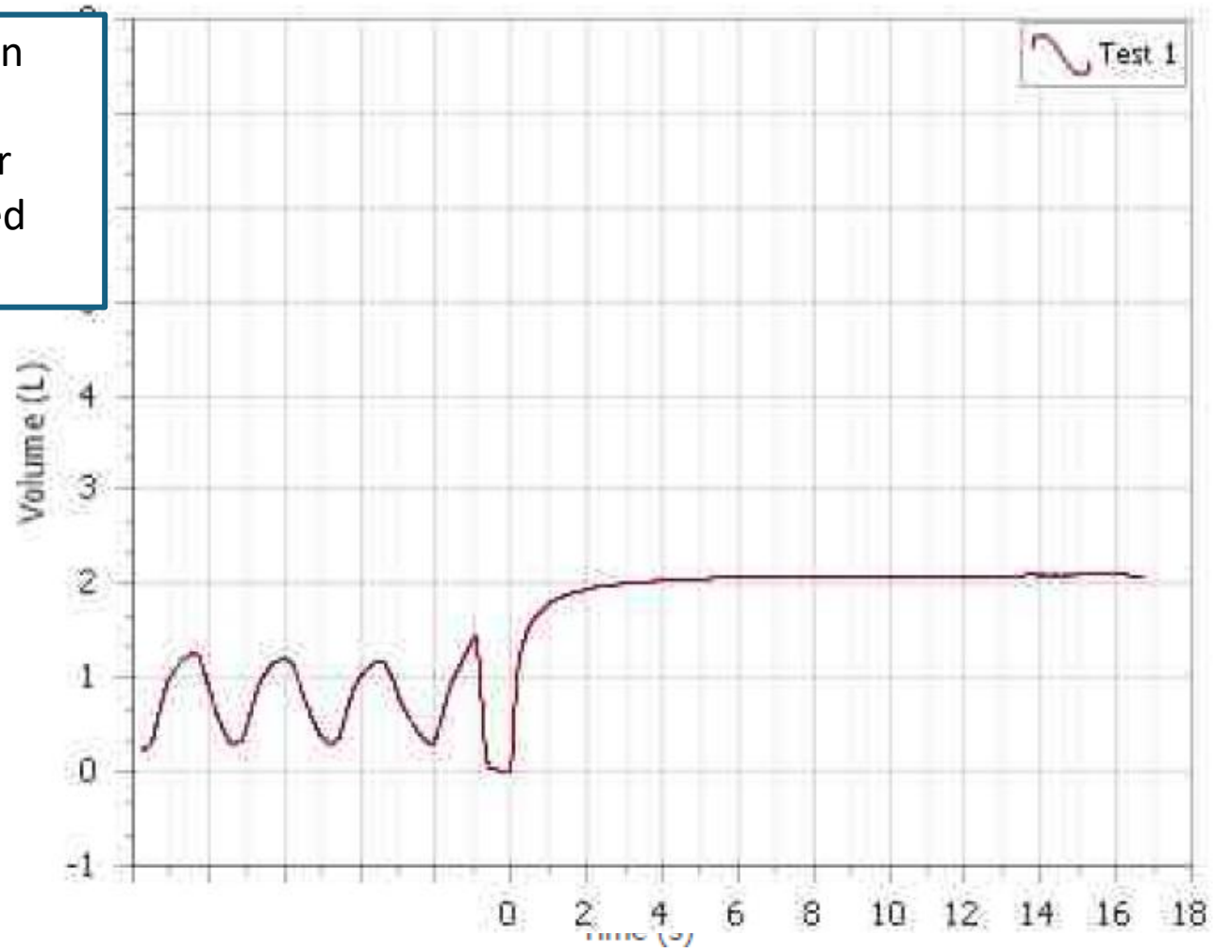
Interpretation: Restriction

Flow/Volume Graph

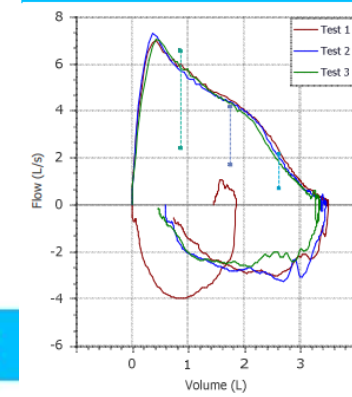


PEF can sometimes be raised in Restriction due to increased elastic recoil generating higher flow rate at beginning of forced expiration

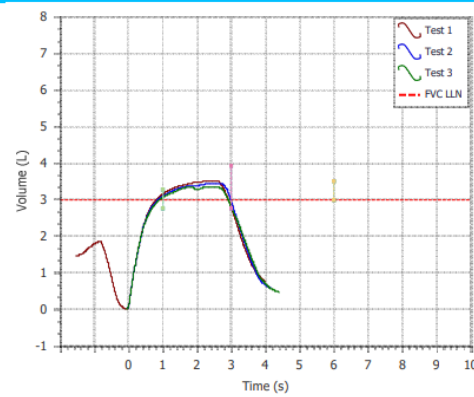
Volume/Time Graph



Flow/Volume Graph



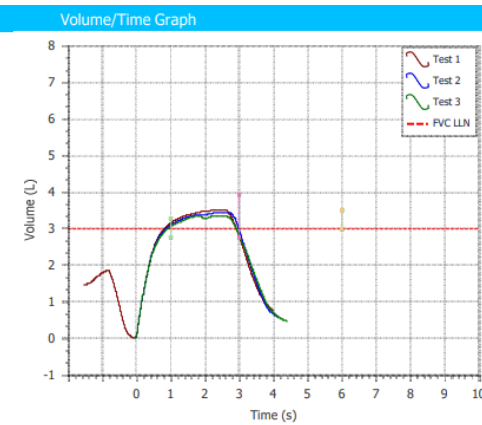
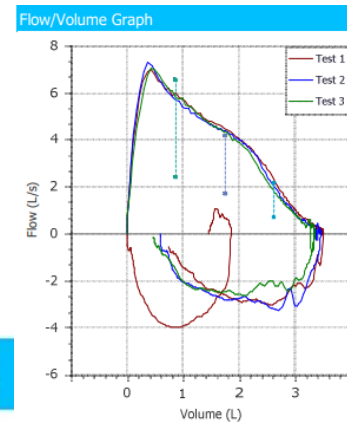
Volume/Time Graph



Interpretation: Restriction

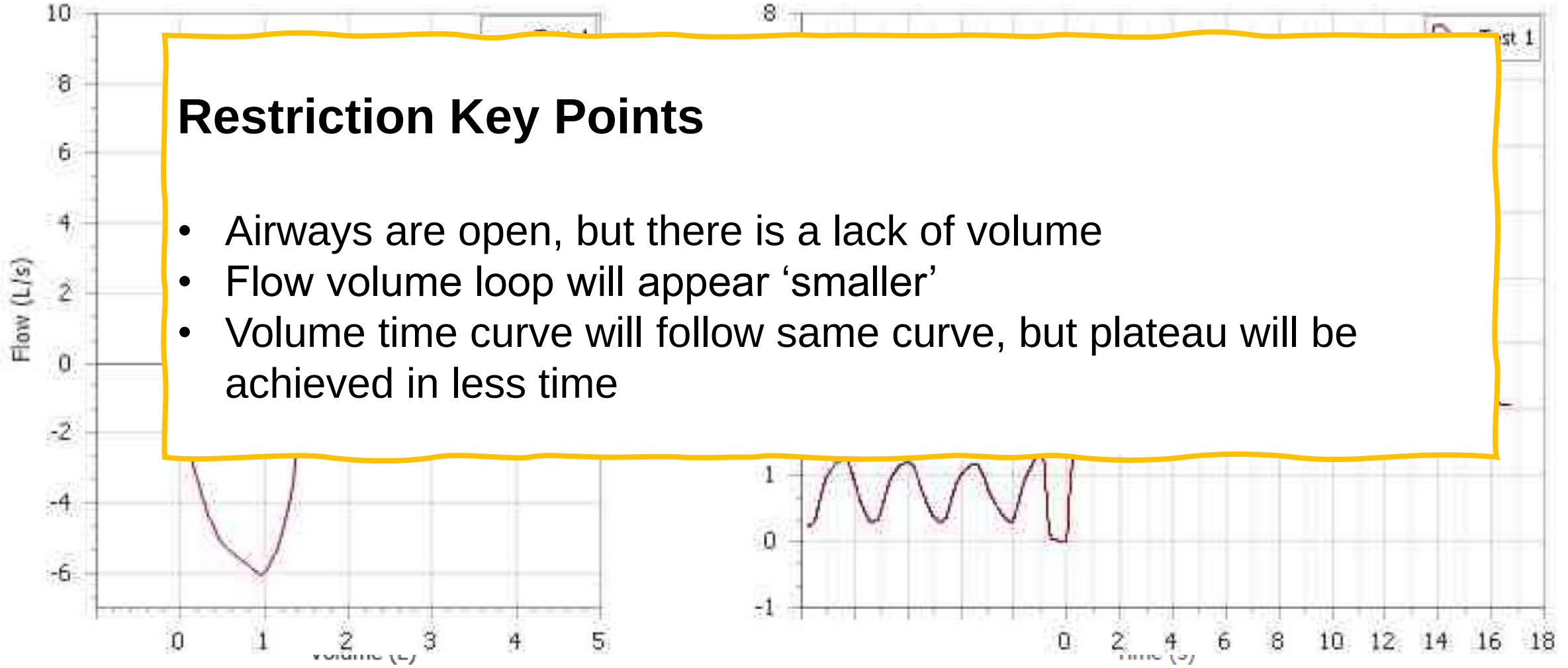
Flow/Volume Graph

Volume/Time Graph



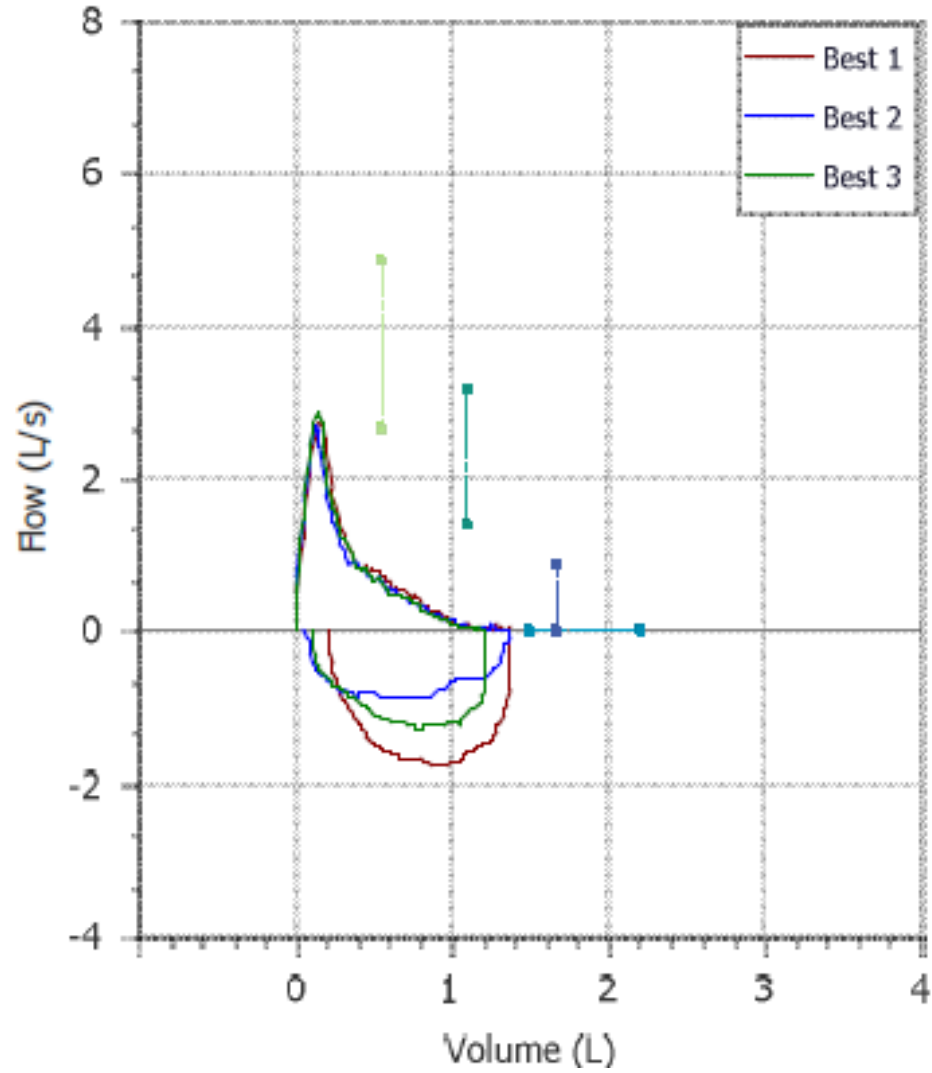
Restriction Key Points

- Airways are open, but there is a lack of volume
- Flow volume loop will appear 'smaller'
- Volume time curve will follow same curve, but plateau will be achieved in less time

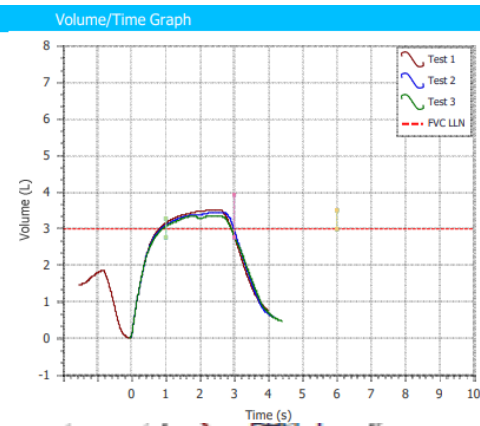
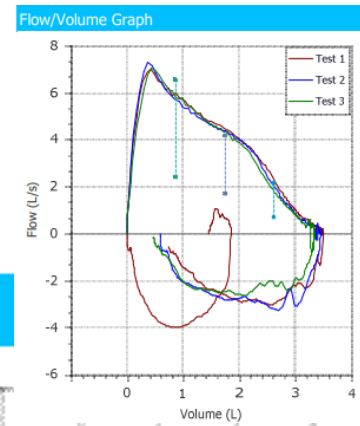
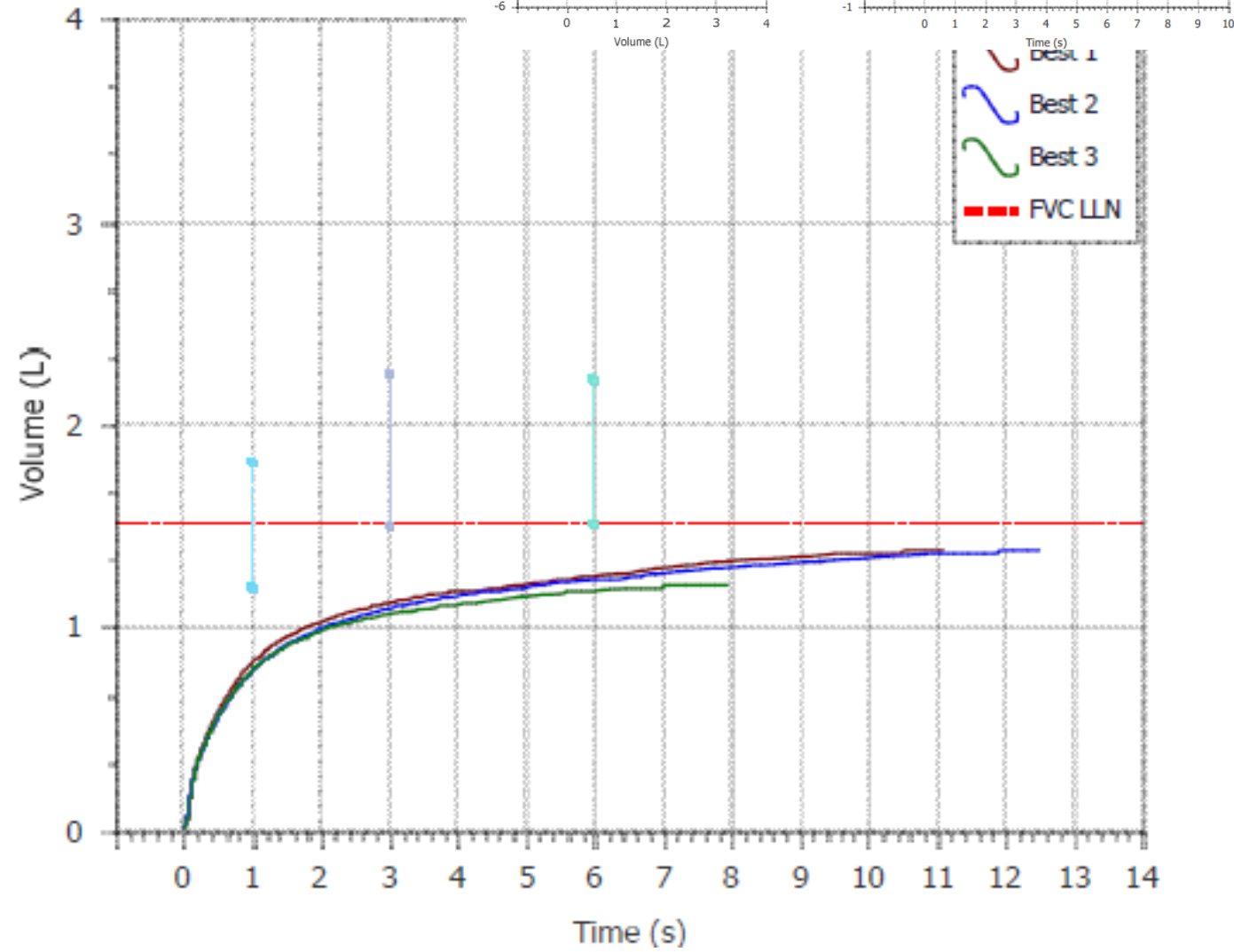


Interpretation: Mixed Defect

Flow/Volume Graph



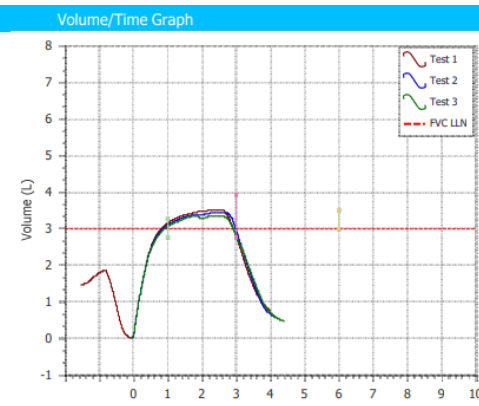
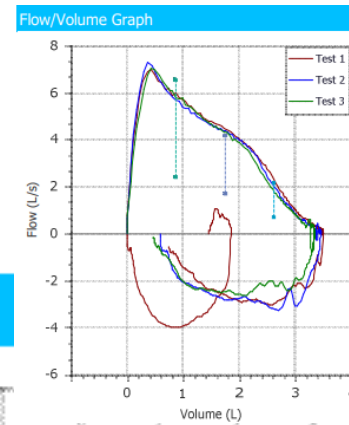
Volume/Time Graph



Interpretation: Mixed Defect

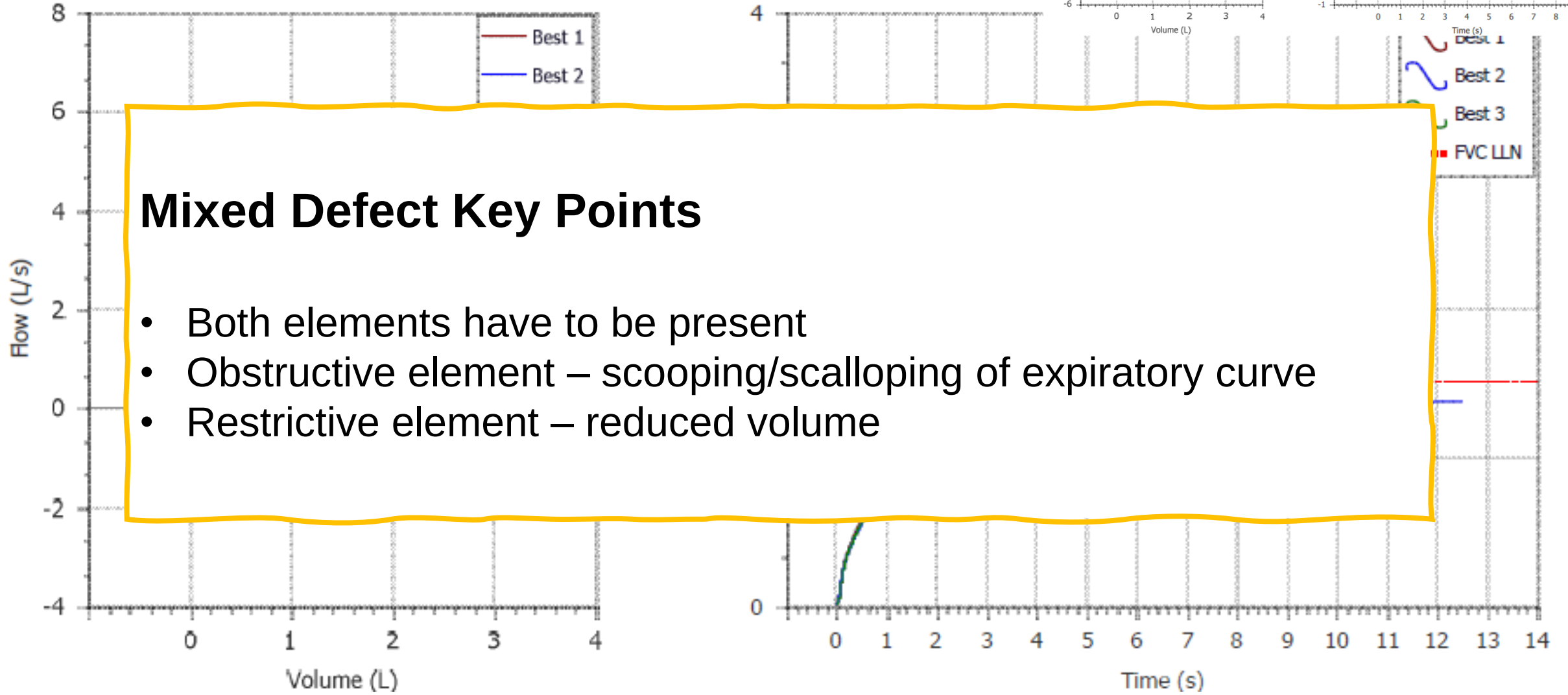
Flow/Volume Graph

Volume/Time Graph



Mixed Defect Key Points

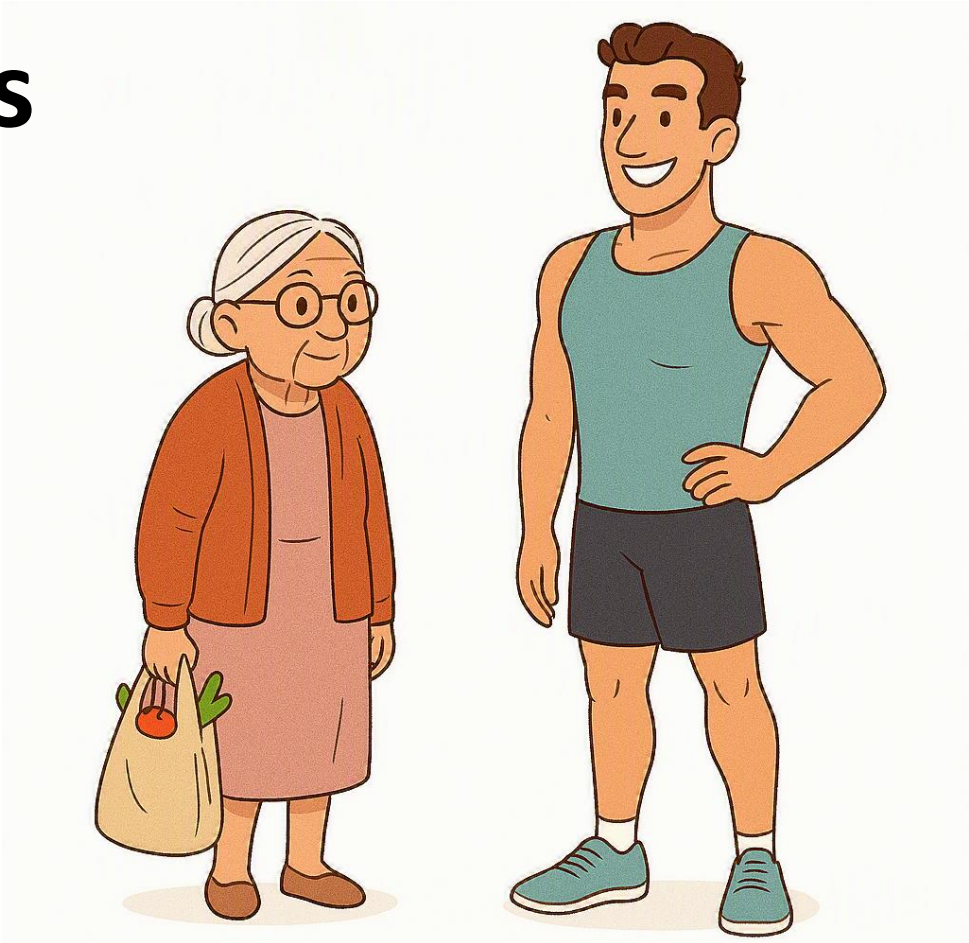
- Both elements have to be present
- Obstructive element – scooping/scalloping of expiratory curve
- Restrictive element – reduced volume



Interpretation: Review the numbers

FEV1	Litres	The volume expired in 1 second
FVC	Litres	The total volume of air expired
FEV1 / FVC	-	The proportion of the total volume (FVC) that is exhaled in the first second
PEF	L/sec, or L/min	The highest flow rate achieved during a forced breath out

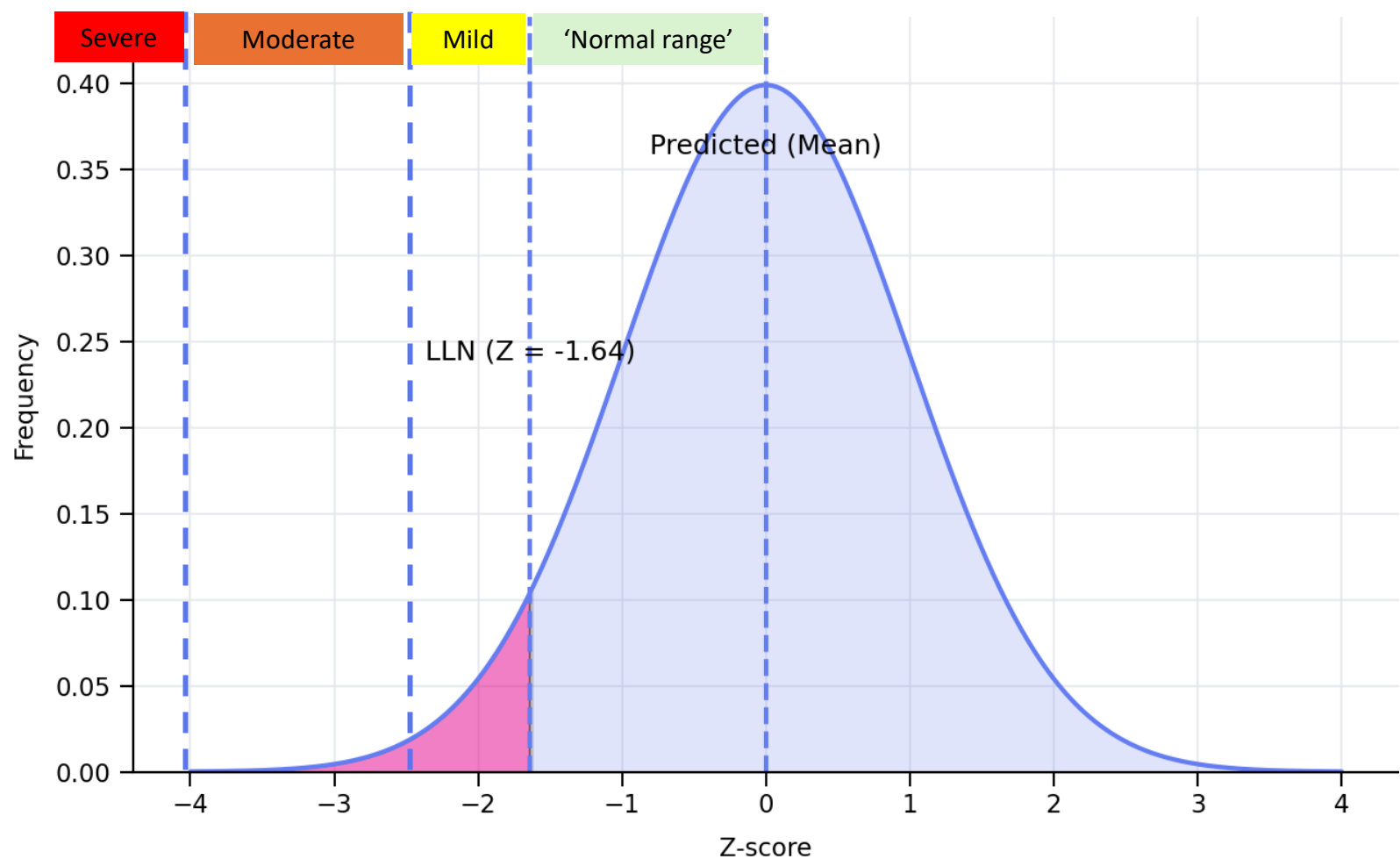
Predicated values



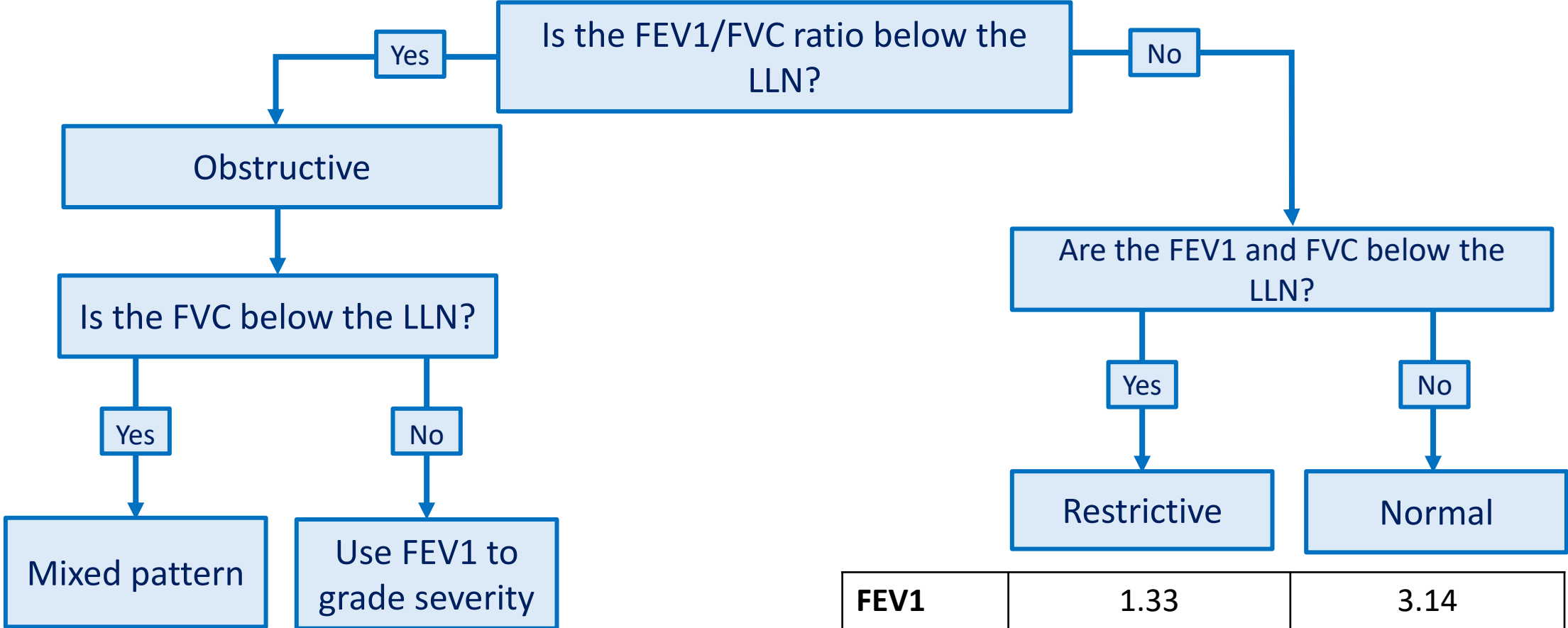
	Actual	Predicted
FEV1 (L)	1.12	1.23
FVC (L)	1.60	1.57
FEV1/FVC	0.70	0.78

	Actual	Predicted
FEV1 (L)	4.32	5.04
FVC (L)	5.80	6.05
FEV1/FVC	0.74	0.83

Z-Scores and Lower Limit of Normal (LLN)



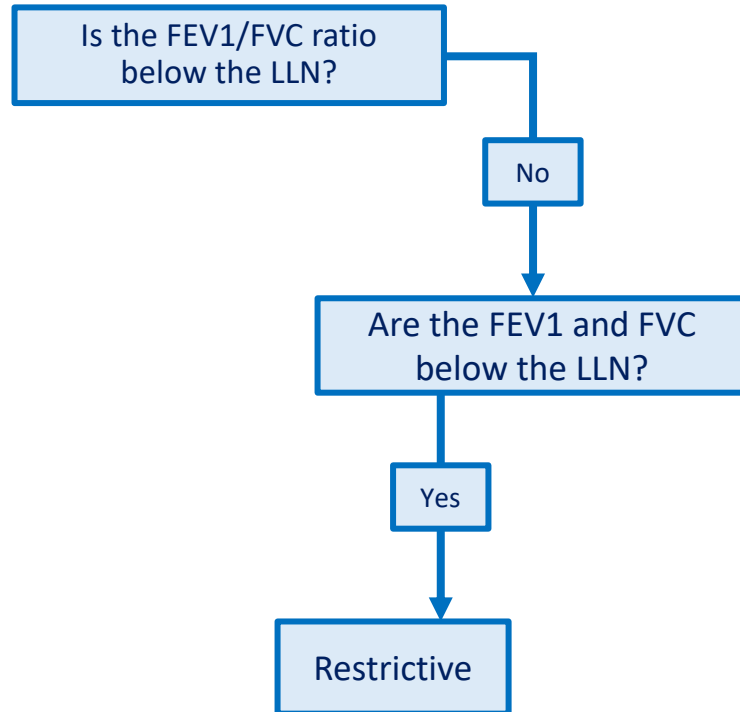
Interpreting the numbers



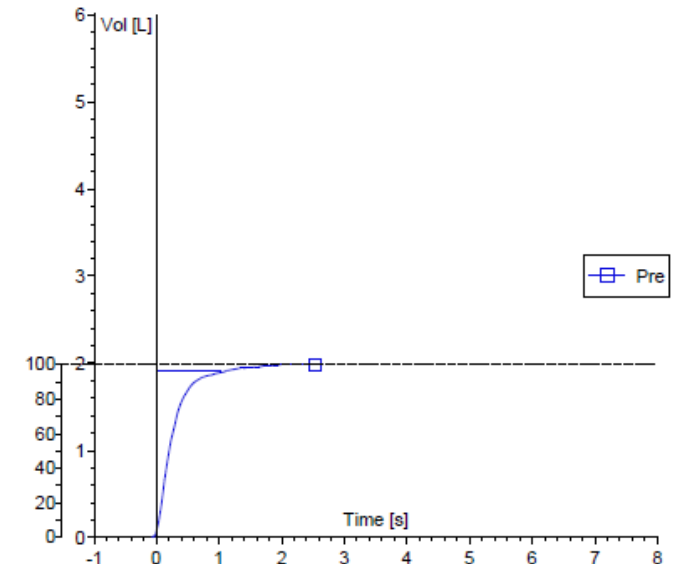
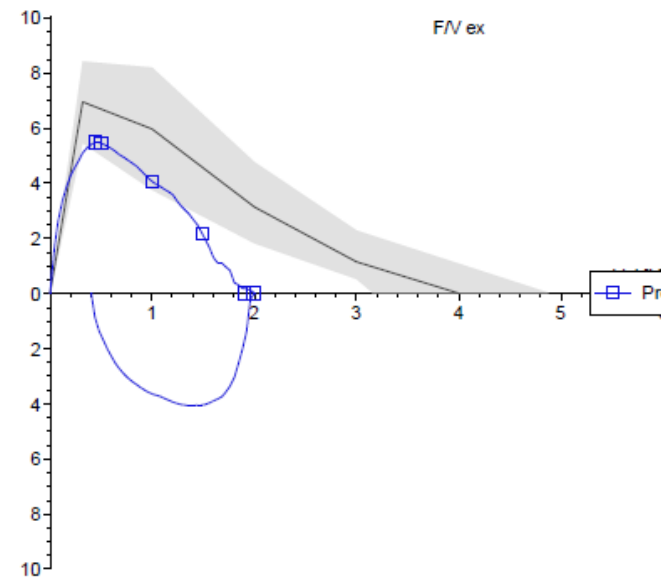
Threshold for z-score	Severity grading
<-1.645	Mild
<-2	Moderate
<-2.5	Moderately severe
<-3	Severe
<-4	Very severe

FEV1	1.33	3.14
FVC	1.56	3.49
FEV1/FVC	0.85	0.90

63 year old male, non-smoker
Referred with SOB when walking uphill



		Test	LLN	ULN	% Pred	Z-Score
FEV 1	L	1.91	2.52	3.86	59.6	-3.06
FVC	L	1.99	3.15	4.87	49.8	-4.06
FEV 1 % VC MAX	%	95.81	69.67	89.74	118.9	2.88
MMEF 75/25	L/s	3.83	1.81	4.76	122.5	0.75
PEF	L/min	328	327	505	78.8	-1.63
VC MAX	L	1.99	3.15	4.87	49.8	-4.06
FET	sec	2.53				
MIP Peak	kPa	3.69	3.82	7.84	47.1	-1.03
MEP Peak	kPa	3.60	6.75	8.97	40.1	-2.42



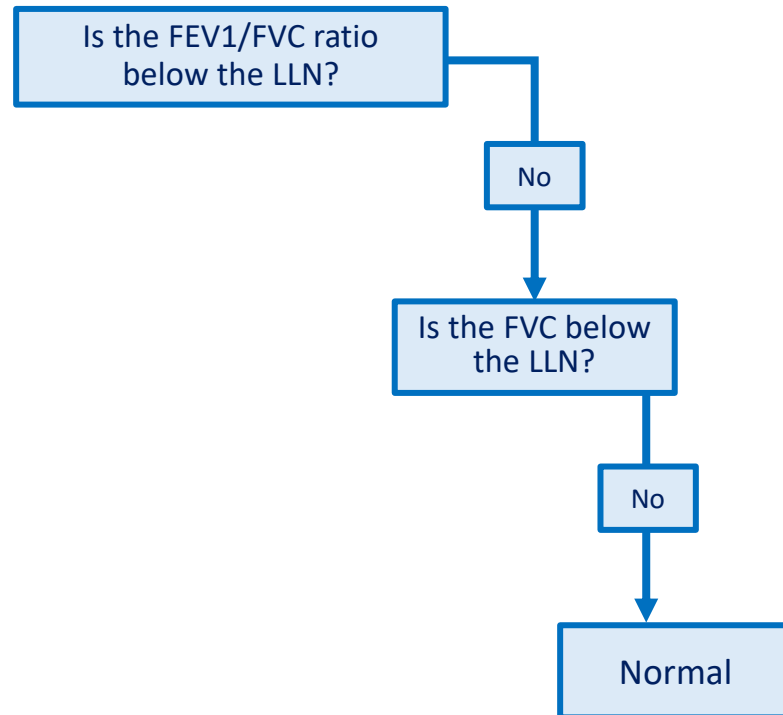
PHYSIOLOGIST COMMENTS

Inhaled / Steroid medication taken within effective duration? Patient is currently taking 20mg Prednisolone daily

Technical Acceptability:

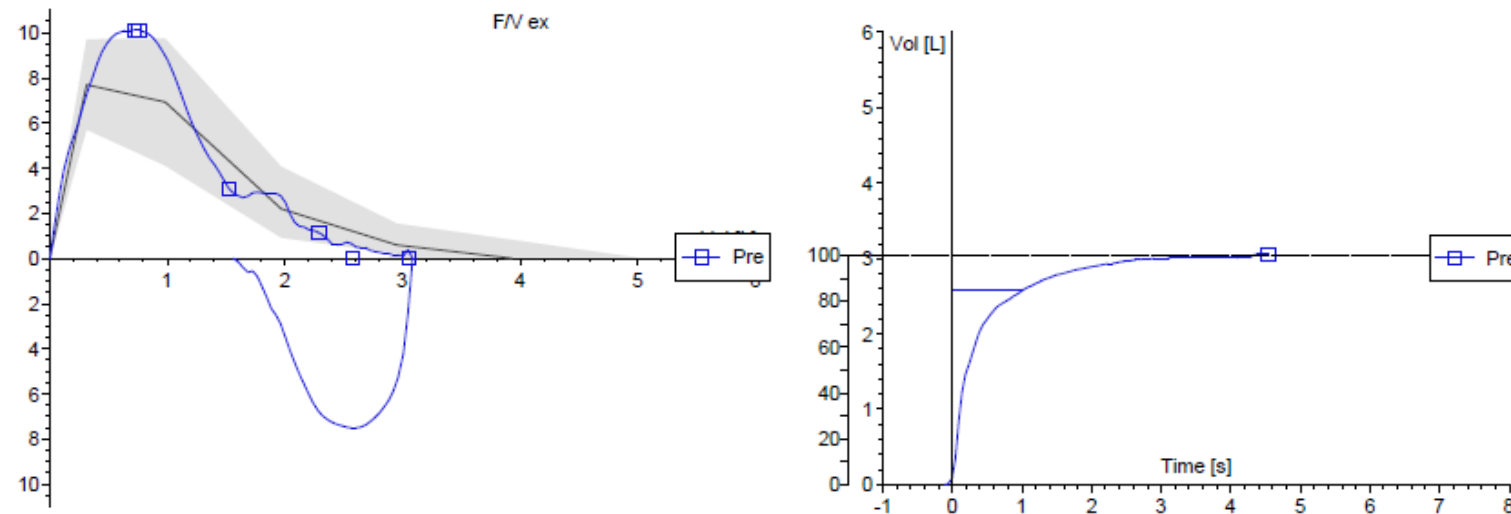
Test performed well. Patient was quite breathless during testing but managed good technique following adequate rest periods

54 year old female, Ex social smoker
Referred with SOB and cough



SPIROMETRY

		Test	LLN	ULN	% Pred	Z-Score
FEV 1	L	2.57	2.10	3.75	87.1	-0.75
FVC	L	3.05	2.88	4.99	77.7	-1.38
FEV 1 % VC MAX	%	84.34	61.58	88.10	111.6	1.13
MMEF 75/25	L/s	3.05	0.90	4.05	139.3	0.83
PEF	L/min	607	343	581	131.5	2.00
VC MAX	L	3.05	2.88	4.99	77.7	-1.38
FET	sec	4.54				



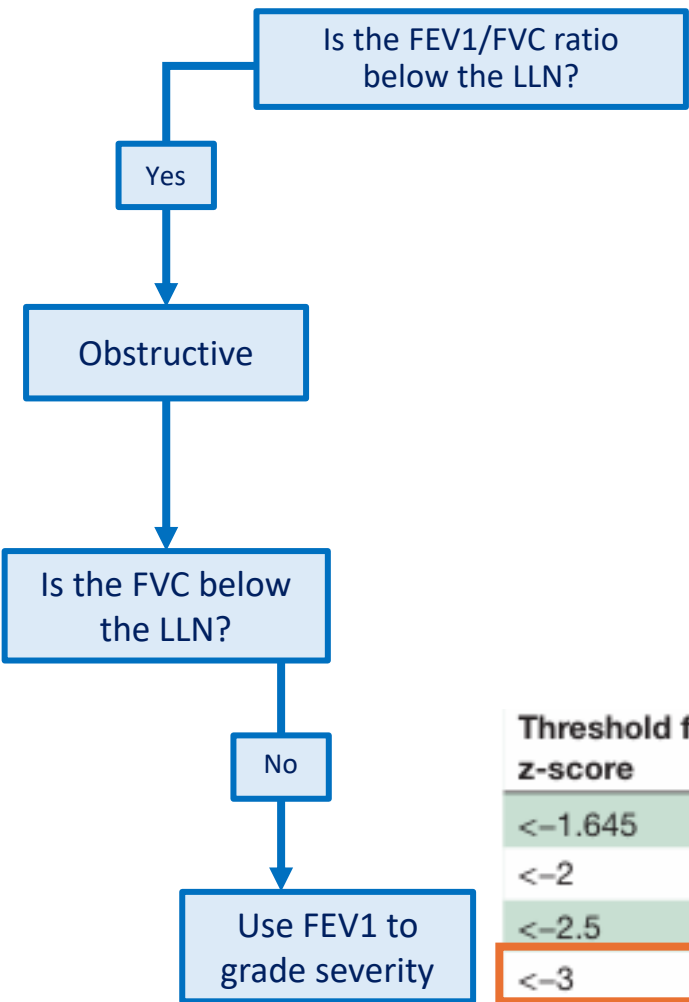
PHYSIOLOGIST COMMENTS

Inhaled / Steroid medication taken within effective duration? No

Technical Acceptability:

Only 1 technically acceptable result achieved. All 8 trials attempted, patient struggled with technique – interpret with caution

74 year old female, ex-smoker (40 pack year history)
Referred for ?COPD

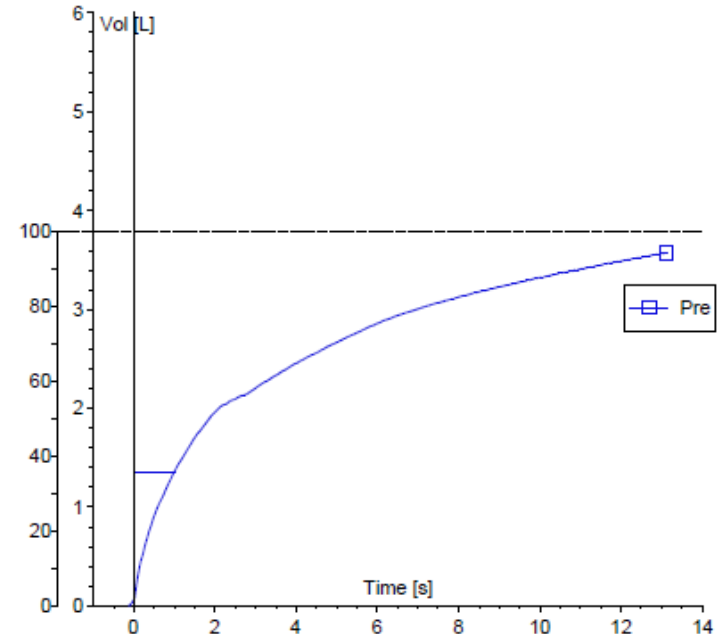
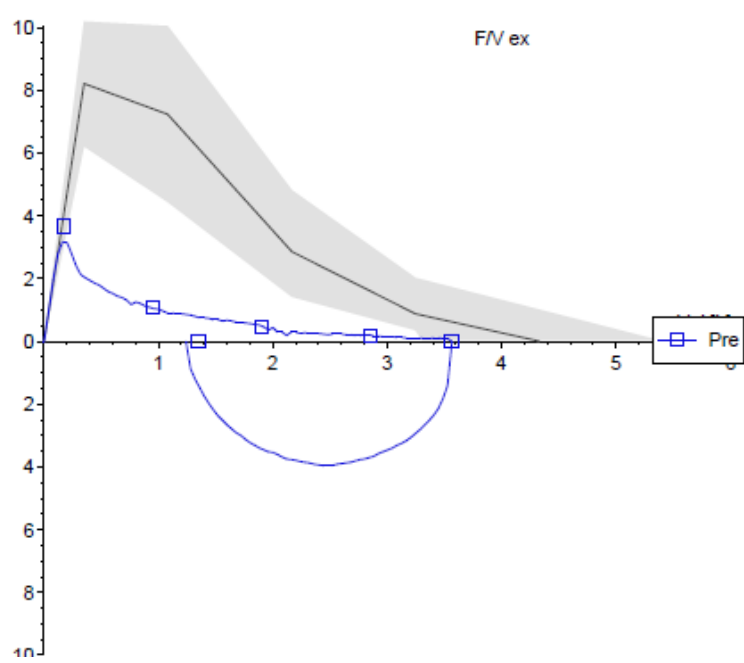


Threshold for z-score	Severity grading
<-1.645	Mild
<-2	Moderate
<-2.5	Moderately severe
<-3	Severe
<-4	Very severe

Adapted from Quanjer et al.⁵¹

SPIROMETRY

		Test	LLN	ULN	% Pred	Z-Score
FEV 1	L	1.35	2.54	4.14	40.0	-3.80
FVC	L	3.55	3.30	5.36	82.2	-1.24
FEV 1 % VC MAX	%	35.45	65.88	88.36	45.5	-4.62
MMEF 75/25	L/s	0.35	1.41	4.81	12.1	-3.60
PEF	L/min	219	373	612	44.5	-3.76
VC MAX	L	3.80	3.30	5.36	87.8	-0.84
FET	sec	13.12				



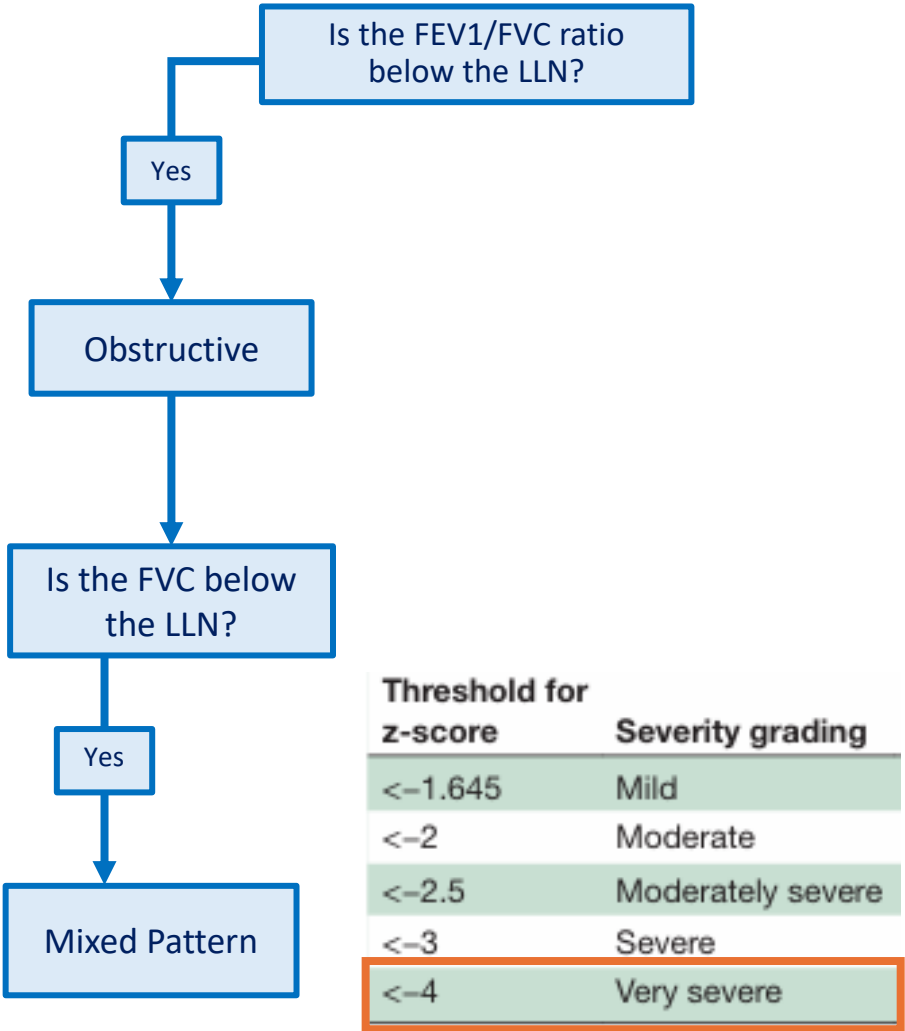
PHYSIOLOGIST COMMENTS

Inhaled / Steroid medication taken within effective duration? Salbutamol taken approx. 2.5 hours prior to testing

Technical Acceptability:

Test performed well with good effort and technique. FVC may be slightly underestimated as no plateau achieved.

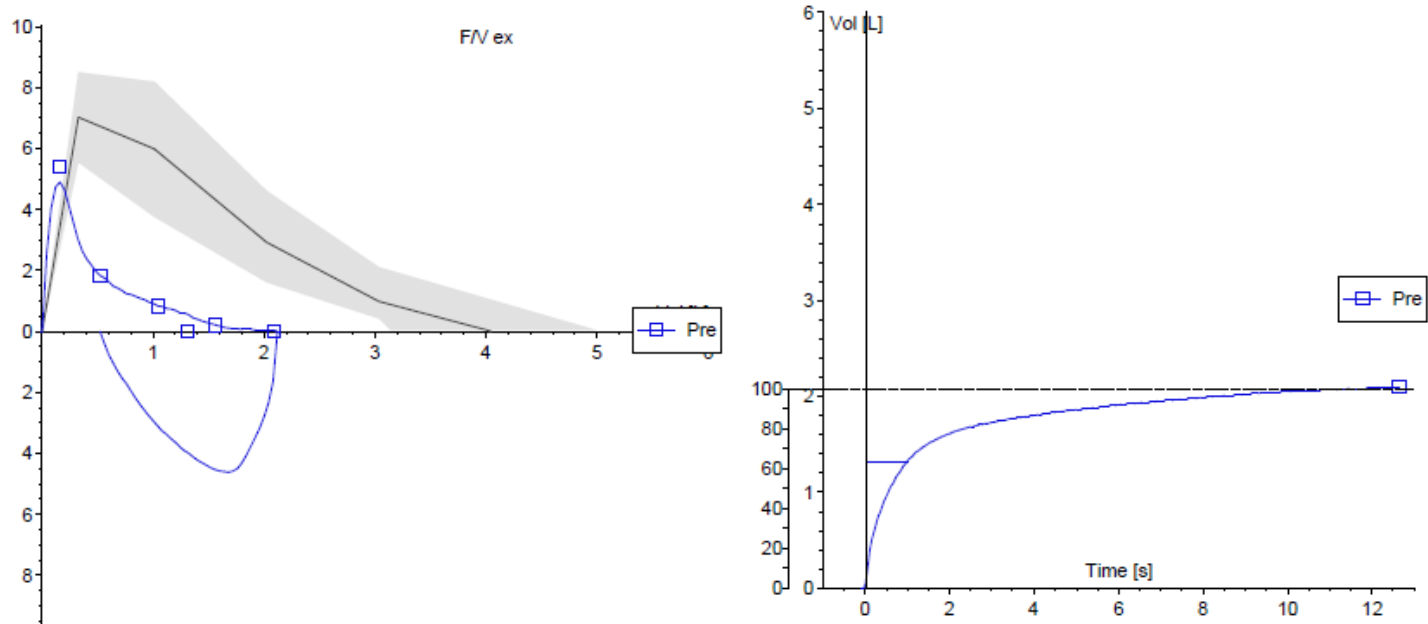
87 year old male, current smoker
Short of breath on exertion



Adapted from Quanjer *et al.*⁵¹

SPIROMETRY

		Test	LLN	ULN	% Pred	Z-Score
FEV 1	L	1.31	2.47	3.88	41.3	-4.11
FVC	L	2.08	3.14	4.98	51.5	-3.68
FEV 1 % VC MAX	%	63.19	68.26	88.99	79.5	-2.28
MMEF 75/25	L/s	0.64	1.59	4.60	22.0	-3.35
PEF	L/min	325	332	509	77.4	-1.76
VC MAX	L	2.08	3.14	4.98	51.5	-3.68
FET	sec	12.66				



PHYSIOLOGIST COMMENTS

Inhaled / Steroid medication taken within effective duration? Yes – Trimbow & Salbutamol taken prior to testing

Technical Acceptability:
FEV1 and PEF were reproducible, FVC variable, best effort shown

Thank you