SPIROMETRY 360

COACHING OFFICE SPIROMETRY PART 2

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Session Objectives

- Correctly apply ATS criteria to office spirometry cases.
- Describe how to troubleshoot common errors and respond correctly to machine error messages.
- Explain when and why the coach, based on ATS acceptability criteria, should override the machine-generated quality measure.
- Practice assessing spirometry quality.

Review of Coach One Session

- Spirometry is usually easy to perform but requires good effort by both the coach and the patient
- Both the volume/time curve and the flow/volume curve are evaluated to determine ATS acceptability
- ATS criteria includes obtaining 3 acceptable maneuvers

Review of Coach One Session

1. Enter accurate demographic information
2. Perform 3-8 maneuvers
   - Demonstrate, Instruct and Coach
3. Confirm there are 3 acceptable maneuvers
   - Perform a visual inspection of curves
   - Confirm acceptable length of FET
   - Review start of test and end of test
4. Confirm that 2 best curves are reproducible

Troubleshooting Common Errors

- Assessing the curve quality—EasyOne prompts
  - The EasyOne Spirometer help identify problems after an effort with prompts. For example, the prompt may say:
    - "***Blast out harder***" indicating the patient needs to blow out more explosively.
    - "***Blow out longe***r" indicating that the patient did not blow out long enough.
- These indicate the maneuver was ***not acceptable.***

EasyOne manual (Easy Guide) p. 9

Assigning a Quality Grade

- The EasyOne spirometer helps assess the session by applying a quality grade upon completion of the session.
- Adding more efforts to a spirometry session often will improve the grade.
- More efforts may be added after an initial grade has been given to help improve the final quality grade.

When The EasyOne Grade is Inaccurate:

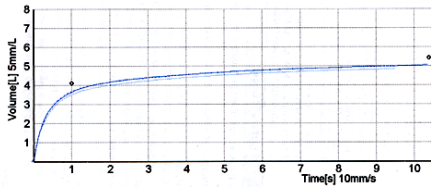
- Spirometers will not always detect:
  - Air leaks, cough, insufficient effort
- It is important for the coach to observe the patient for problems with technique and note these on the print out
- It is important for the coach to make a visual inspection of the curves to help determine if the maneuver is acceptable
- Repeat the effort if there were problems with patient technique or the curves fail visual inspection

Acceptability Criteria

- A spirometric maneuver is considered acceptable when:
  - A full inspiration was achieved
    - Good effort, no leaks
  - A forceful and complete expiration was achieved
    - Good start, no coughing, no variable flow
- Acceptable curves
  - VT curve with quick rise, long plateau
  - FV curve with sharp peak, smooth curve
  - Try for an FET of at least 3-6 seconds depending on age or at least a one second plateau

Volume/Time Curve

Volume: How much air is expired – FVC (forced vital capacity)
Time: Over a given period of time – FET (forced expiratory time)

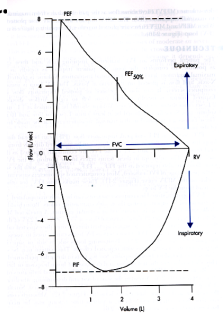


Volume/Time Curve

- The patient achieved a full inspiration
- Good effort on the part of the patient during exhalation
  - Long, hard, maximal expiration
  - No early termination
  - The VT curve should rise rapidly before reaching a plateau
  - The VT curve should flatten at the very end with no additional volume in the last second
  - The Forced Expiratory Time can be seen at end of plateau

Flow/Volume Curve

- Measures how much air is expelled (volume – FVC) during a spirometric maneuver in relation to the speed (flow) in which it comes out.



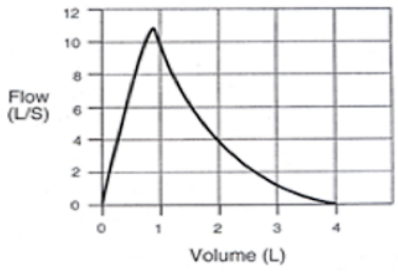
Allows for the measurement of:

- FVC – Forced Vital Capacity
- FEV1 – Forced Expired Volume in one second
- FEF 25%-75% - Measures the average flow rate over the mid range of the curve, also referred to as the mid flow range
- PEF – Peak Expiratory Flow, the highest of fastest flow

Additional parameters are also displayed on the printout which may assist in the interpretation

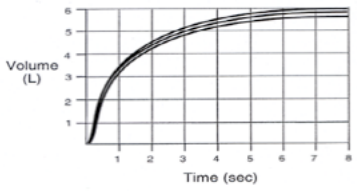
Flow Volume Curves

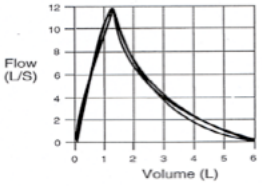
- The curve should rise rapidly before reaching a peak (PEF)
- The peak should be fairly sharp, not rounded. A rounded peak means the patient didn't blow hard enough
- No early termination



Reproducibility

- Acceptable spirometry as illustrated with volume/time and flow/volume graphs
- Three acceptable trials have been recorded, of which two trials have FVCs and FEV1s that both agree with 5%



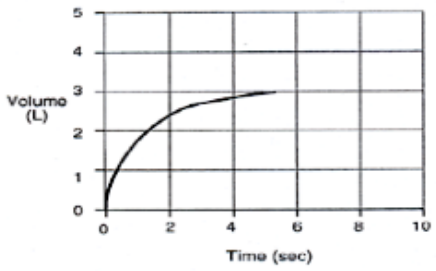


Group Summary Data

- Here is a look at a summary performance thus far for the group

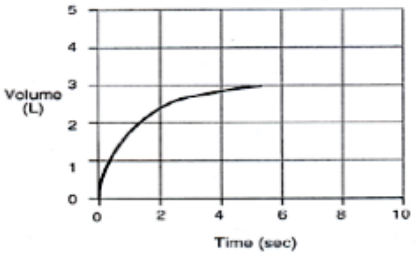
Testing Essentials

- Assessing the Volume/Time Curve



Polling Question #1

Polling Question 1



- Which of the following can be said about the curve?

A) The patient didn't blow out long enough.

B) The curve is acceptable.

C) Perhaps the coaching could be better.

D) A and C

E) It is unacceptable because of variable flow.

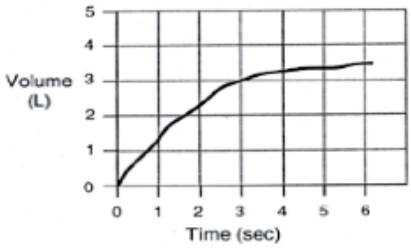
Testing Essentials

- Assessing the Volume/Time Curve cont.

Polling Question #2

Polling Question 2

- Which of the following can be said about the curve?



A) It is unacceptable because of variable flow.

B) The curve is acceptable.

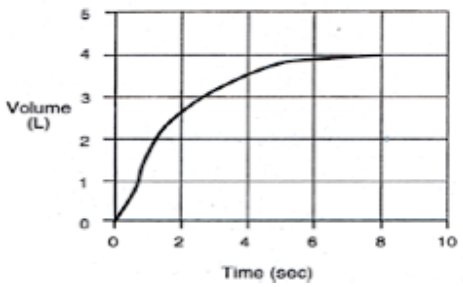
C) The patient didn't blow out long enough.

D) It is unacceptable because of coughing.

E) C and D

Testing Essentials

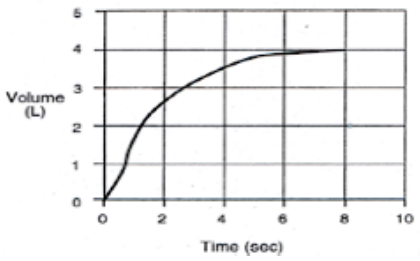
- Assessing the Volume/Time Curve cont.



Polling Question #3

Polling Question 3

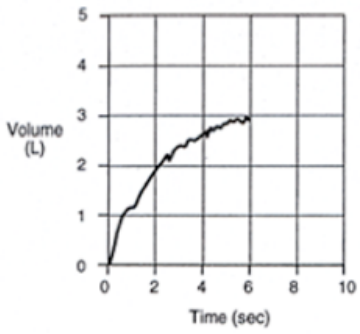
- Which of the following can be said about the curve?



A) It is unacceptable because no rapid rise is demonstrated on the curve.
B) The curve is acceptable.
C) It is unacceptable because of a poor test start.
D) It is unacceptable because of coughing.
E) A and C

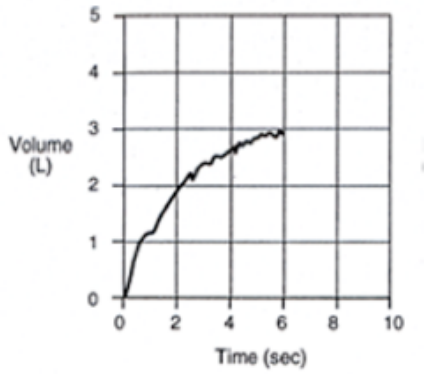
Testing Essentials

- Assessing the Volume/Time Curve cont.



Polling Question #4

Polling Question 4

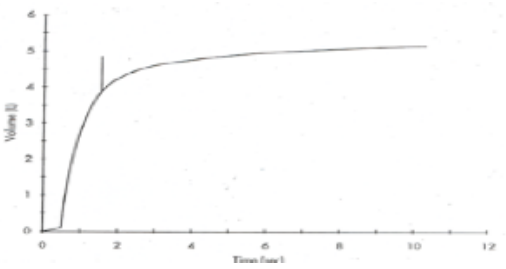


- Which of the following can be said about the curve?

A) The curve is acceptable.
B) The patient was coughing during the maneuver.
C) The maneuver should be repeated.
D) B and C

Testing Essentials

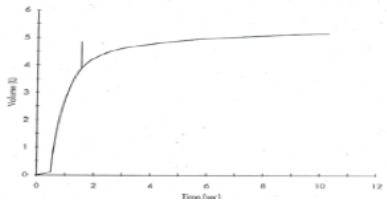
- Assessing the Volume/Time Curve cont.



Polling Question #5

Polling Question 5

- Which of the following are true of the volume/time curve?



A. The FVC is approximately 5 liters.

B. The FEV1 is approximately 4 liters.

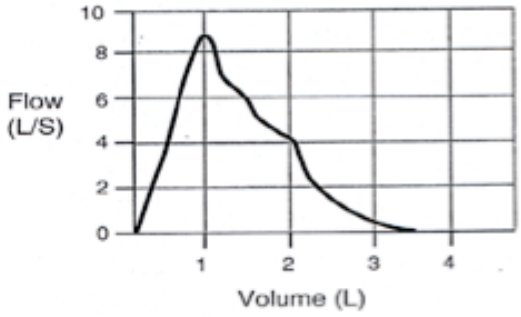
C. The FEV1/FVC ratio is approximately 40%.

D. The FEV1/FVC ratio is approximately 80%.

E. A, B and D

Testing Essentials

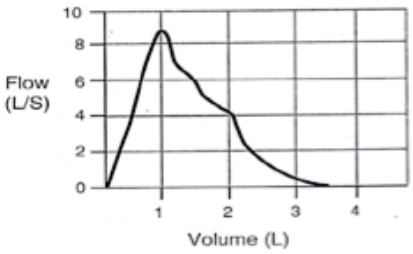
- Assessing the Flow/Volume Curve



Polling Question #6

Polling Question 6

- Which of the following can be said about the curve?



A) Good effort was achieved throughout the entire breathing maneuver.

B) The curve is acceptable.

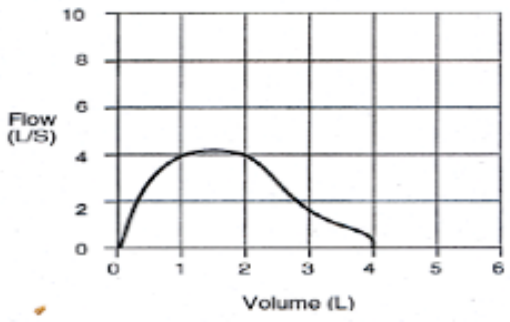
C) The curve shows variable flow, the patient didn't blow out hard and consistently.

D) The curve does not need to be repeated.

E) B and D

Testing Essentials

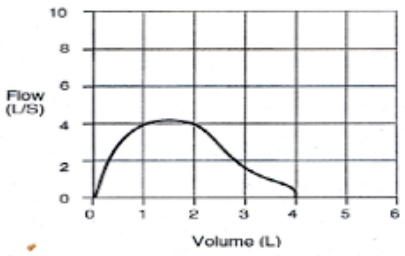
- Assessing the Flow/Volume Curve cont.



Polling Question #7

Polling Question 7

- Which of the following can be said about the curve?



A) The curve meets the criteria and is acceptable.

B) A sharp peak was not achieved.

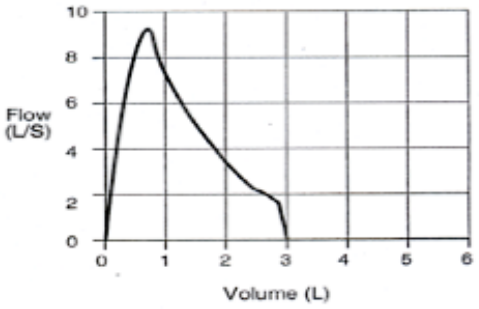
C) A rounded curve means poor start or weak effort.

D) B and C

E) The curve would be acceptable as a volume/time curve.

Testing Essentials

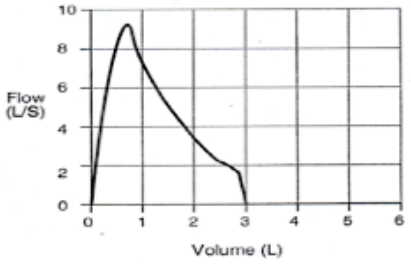
- Assessing the Flow/Volume Curve cont.



Polling Question #8

Polling Question 8

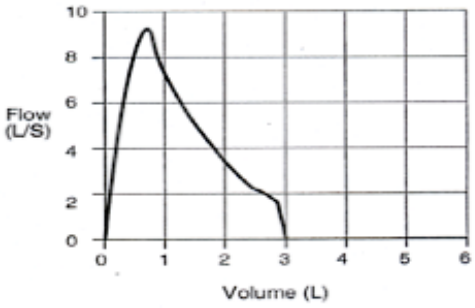
- Which of the following can be said about the curve?



A) The curve displays early termination.
B) The test should be repeated because of excessive coughing.
C) A and B
D) All criteria for acceptability are present.
E) The PEF (peak expiratory flow rate) is probably reduced.

Testing Essentials

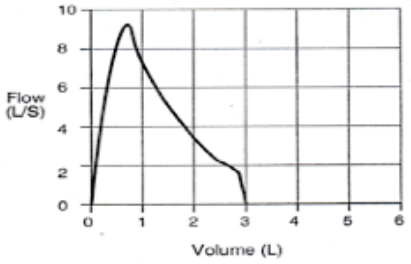
- Assessing the Flow/Volume Curve cont.



Polling Question #9

Polling Question 9

- Which of the following can be said about the curve?



A) Accepting the curve will underestimate the patient's FVC.

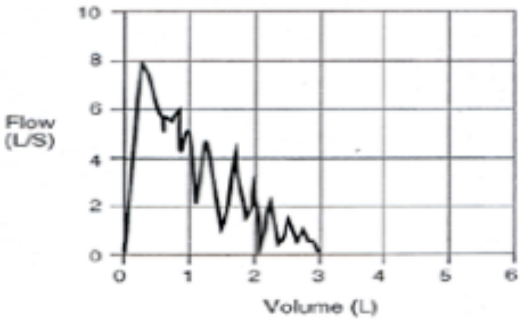
B) The patient should be coached to blow out longer.

C) There is still air left in the patient's lungs.

D) All of the above.

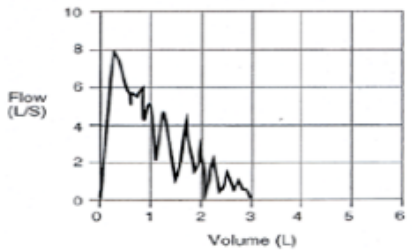
Testing Essentials

- Assessing the Flow/Volume Curve cont.



Polling Question #10

Polling Question 10



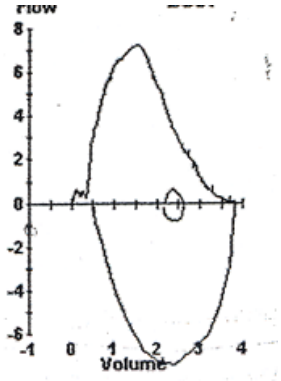
- Which of the following can be said about the curve?

A) The curve is acceptable.
B) The patient was coughing during the maneuver.
C) The maneuver should be repeated.
D) B and C

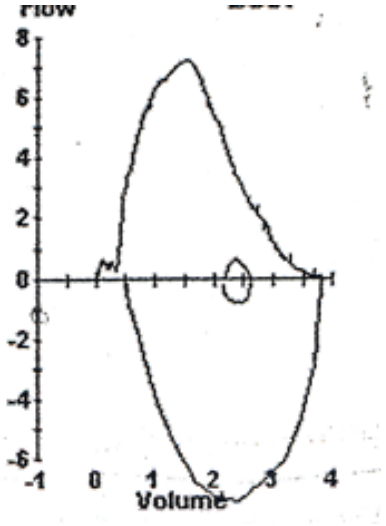
Testing Essentials

- Assessing the Flow/Volume Curve cont.

Polling Question #11



Polling Question 11

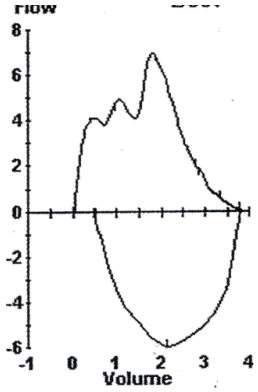


- Which of the following can be said about the curve?

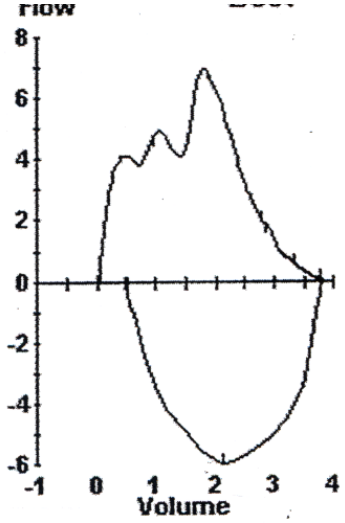
A) Poor start.
B) Acceptability criteria met.
C) There is no need to repeat the maneuver.
D) All of the above.

Testing Essentials

Polling Question #12



Polling Question 12



- Which of the following can be said about the curve?

A) Acceptability criteria met.

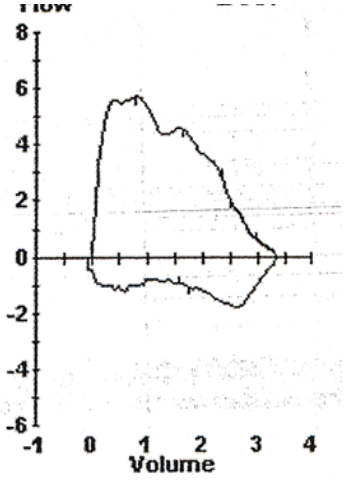
B) Poor effort yielding variable flow rates.

C) Coughing throughout the expiration.

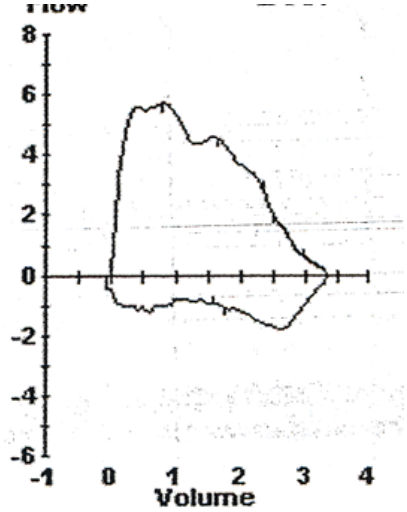
D) All of the above.

Testing Essentials

Polling Question #13



Polling Question 13

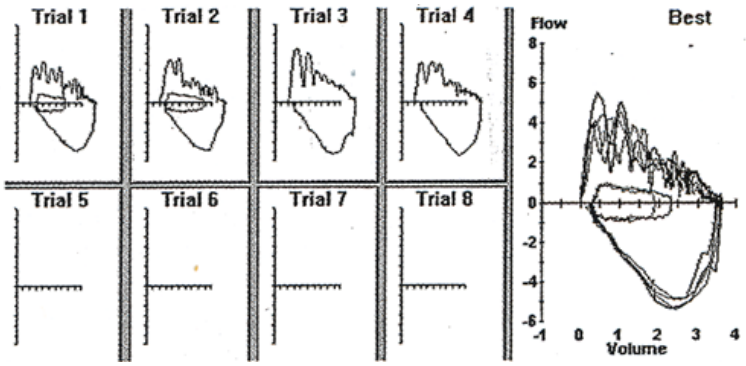


- How about this one?

A) Variable flow rates.
B) Coughing throughout the expiration.
C) A and B
D) The patient has his/her tongue in the middle of the mouthpiece.
E) A and D

Testing Essentials

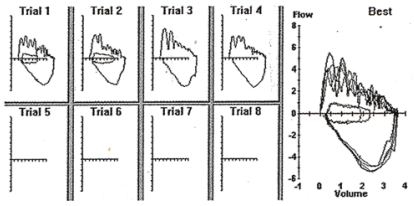
- Assessing the Flow/Volume Loop cont.



Polling Question #14

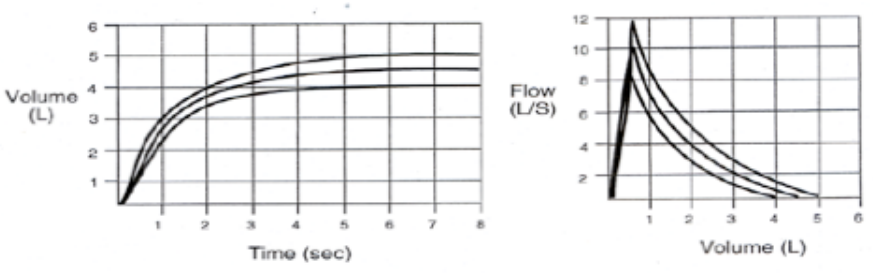
Polling Question 14

- How about these curves?

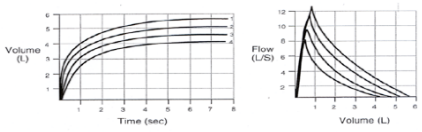


A) Variable flow rates.
B) Coughing on all efforts.
C) Early termination.
D) B and C.
E) Data may be accepted.

Testing Essentials



Polling Question 15



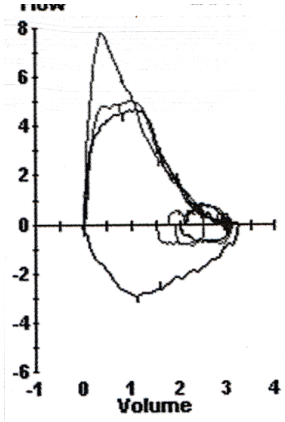
- How about these curves with regard to reproducibility?

A) The curves are not reproducible because the patient's effort weaken with each maneuver and do not meet reproducibility criteria.
B) The patient may benefit from improved coaching.
C) The highest FVCs and FEV1s do not agree within 5% or 150ml.
D) All of the above.

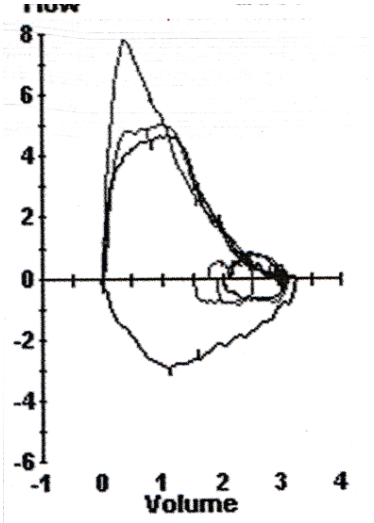
Testing Essentials

- Assessing the Flow/Volume Loop cont.

Polling Question #16



Polling Question 16



- How about this one?

A) The patient should be reinstructed on proper technique and repeated.

B) Only one effort demonstrates good technique.

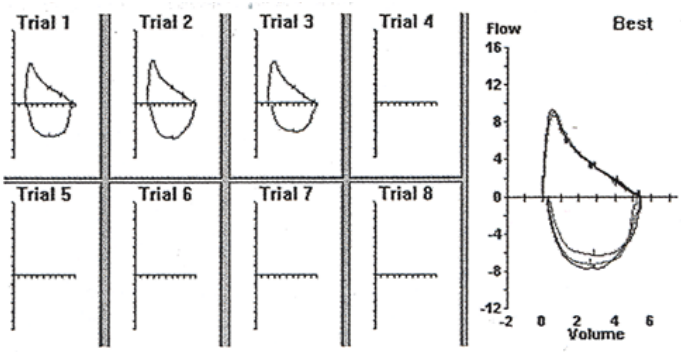
C) They do not meet reproducibility criteria.

D) A, B and C

E) All curves meet acceptability criteria.

Testing Essentials

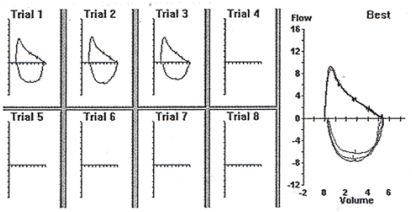
- Assessing the Flow/Volume Loop cont.



Polling Question #17

Polling Question 17

- How about these curves with regard to reproducibility?



A) Better coaching will yield significantly better results.

B) Only one effort demonstrates good technique.

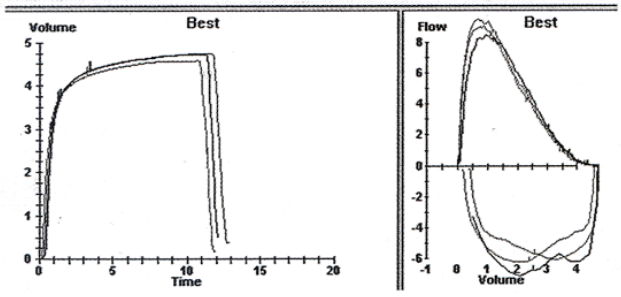
C) All curves meet acceptability criteria.

D) Although they are similar in shape, they do not meet reproducibility criteria.

E) The FVCs and FEV1s do not agree within 5% or 150ml.

Testing Essentials

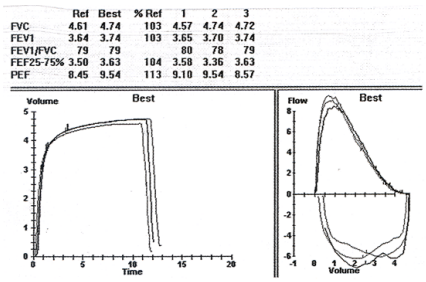
	Ref	Best	% Ref	1	2	3
FVC	4.61	4.74	103	4.57	4.74	4.72
FEV1	3.64	3.74	103	3.65	3.70	3.74
FEV1/FVC	79	79		80	78	79
FEF25-75%	3.50	3.63	104	3.58	3.36	3.63
PEF	8.45	9.54	113	9.10	9.54	8.57



Polling Question #18

Polling Question 18

- How about these curves with regard to reproducibility?



A) The FVCs and FEV1s from the two best curves agree within 5% or 150ml.

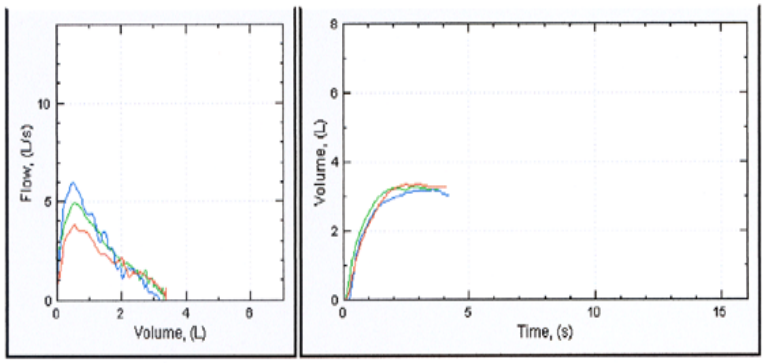
B) Although they are similar in shape, they do not meet reproducibility criteria.

C) The FVCs and FEV1s from the two best curves are not within 5% or 150ml.

D) Request that the patient try again because none of the curves are acceptable.

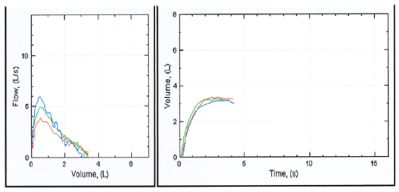
E) B, C and D

Polling Question #19



Polling Question 19

Choose the best response for this 12-year-old patient.



A) The FV curves look ok but the VT curves do not.

B) The VT curves look ok but the FV curves do not.

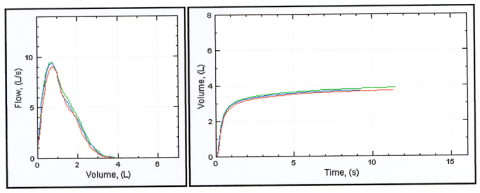
C) The Forced Expiratory Time is over 6 seconds.

D) This spirometry fails both acceptability and reproducibility.

Polling Question #20

Param	Best	2nd	3rd	Pred	%Pred	Var
Effort #	2	3	1			
FVC(L)	*3.86	3.72	3.71			142
FEV1(L)	*3.04	2.97	2.89			62
FEV1/FVC	0.79	0.80	0.78			
FEF25-75%	2.80	2.95	2.51			
BEV(ml)	0.09	0.11	0.14			
FET(s)	11.30	9.06	11.10			
PEFT(1/min)	0.08	0.08	0.09			
PEF(L/s)	9.42	9.34	9.00			88
Include	☐	☐	☐			

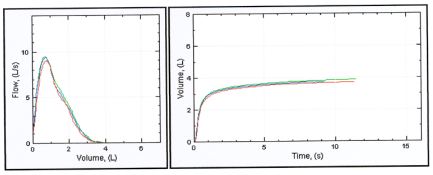
A A B



Polling Question 20

Param	Best	2nd	3rd	Pred	%Pred	Var
Effort #	2	3	1			
FVC(L)	*3.86	3.72	3.71			142
FEV1(L)	*3.04	2.97	2.89			62
FEV1/FVC	0.79	0.80	0.78			
FEF25-75%	2.80	2.95	2.51			
BEV(ml)	0.09	0.11	0.14			
FET(s)	11.30	9.06	11.10			
PEFT(1/min)	0.08	0.08	0.09			
PEF(L/s)	9.42	9.34	9.00			88
Include	☑	☑	☑			

A A B



Choose the best response:

A) This spirometry is acceptable but not reproducible.

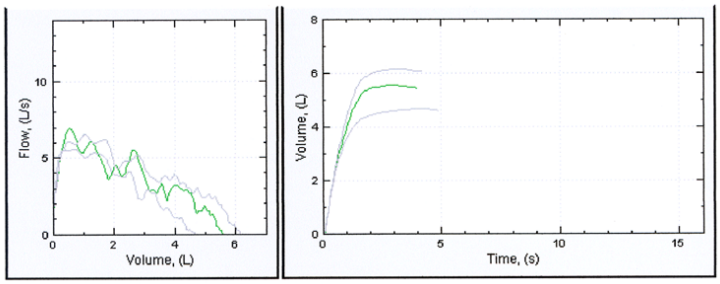
B) This spirometry is reproducible but not acceptable.

C) The FVCs and FEV1s from the two best curves are not within 5% or 150ml.

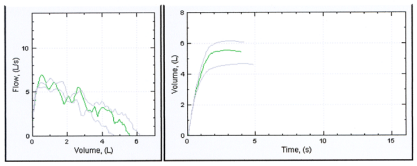
D) The test is acceptable and reproducible.

E) B and C

Polling Question #21



Polling Question 21



Choose the best response:

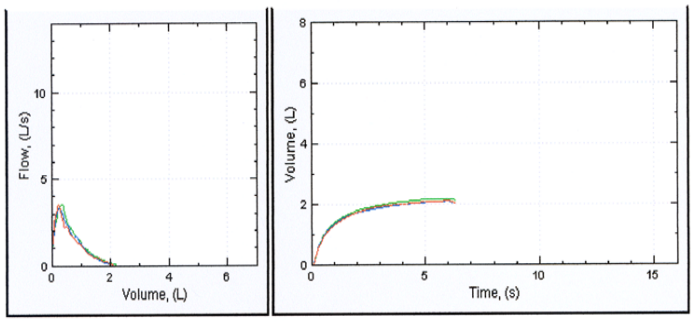
A) The FV curves look ok but the VT curves do not.

B) The VT curves look ok but the FV curves do not.

C) The Forced Expiratory Time is over 6 seconds.

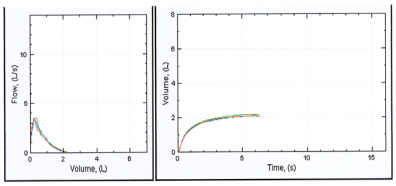
D) This spirometry fails both acceptability and reproducibility.

Polling Question #22



Polling Question 22

Choose the best response:



A) These curves pass visual inspection.

B) These curves meet acceptability criteria.

C) These curves are reproducible.

D) All of the above.

Working with 4-6 year olds

- A 3 second Forced Expiratory Time may not be obtainable. Try for smooth plateau on the VT curve.
- The first time a young child attempts spirometry can be especially challenging. This often improves on repeat visits.
- ATS criteria requires only TWO acceptable maneuvers for this age group.

ATS Criteria, Pulmonary Function Testing in Very Young Children, Am J Respir Crit Care Med, 2007

Three Take Home Points

- It is important for the coach to visually inspect the curves after each maneuver to confirm acceptability.
- The coach should confirm the spirometry session is both acceptable and reproducible.
- Common errors in primary care spirometry include variable effort and not enough maneuvers performed in one session.

Questions?