What Pulmonary Assessment Should We Do, and When Should We Do It?

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Disclosures

- Pediatric Pulmonary section editor, UpToDate

Why do a test?

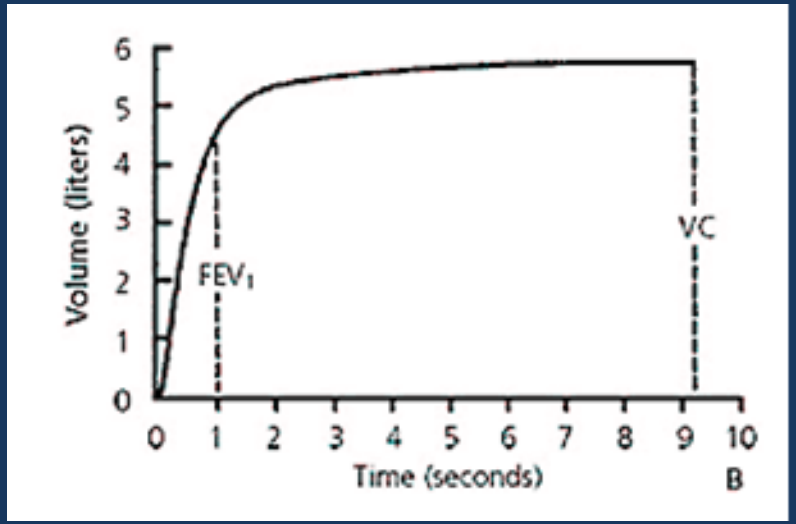
- Assess:
  - the Mechanisms of disease; how much does each play a role in a particular patient?
  - Impact of the deformity on lung function at initial presentation
  - Presence of co-morbid conditions, e.g. asthma, neuromuscular weakness, pulmonary hypoplasia
  - Impact of serial treatments for the deformity
  - Risk of cardiopulmonary complications post-op

Spine and Chest Wall Deformities Early in Life: Respiratory Consequences

FUNCTIONAL FEATURES	
Low lung volumes:	CT imaging and PFT's
Stiff chest walls:	Compliance measures in the OR
↓ Diaphragm excursion:	Dynamic MRI's
↓ Respiratory muscle strength and endurance:	PFT's (MIP/MEP)
FUNCTIONAL OUTCOMES	
↓ Exercise tolerance:	6-minute walk, VO2
↓ Sleep quality:	Sleep studies
↓ Weight velocity:	Growth curves
↓ Quality of Life in some domains	EOS survey

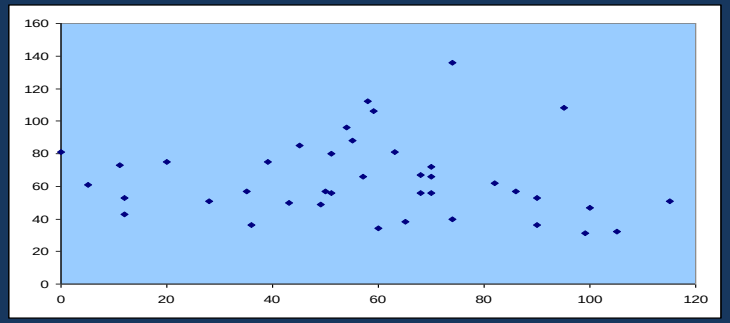
What does Vital Capacity mean?

- It is an integrated measure of multiple pathologic pulmonary processes.
- It has to be normalized for post-natal growth and correlates best with height in normal children.



COBB ANGLE

FVC % Predicted



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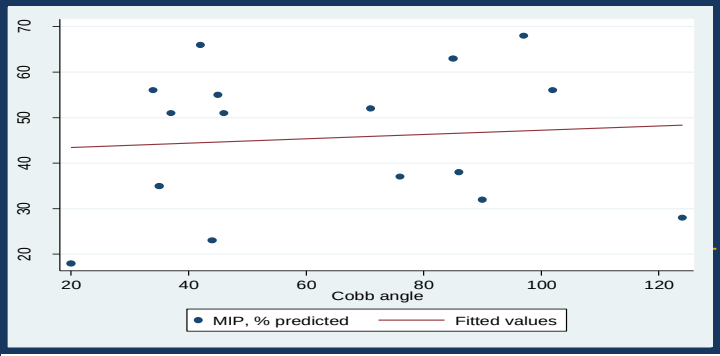
MIP



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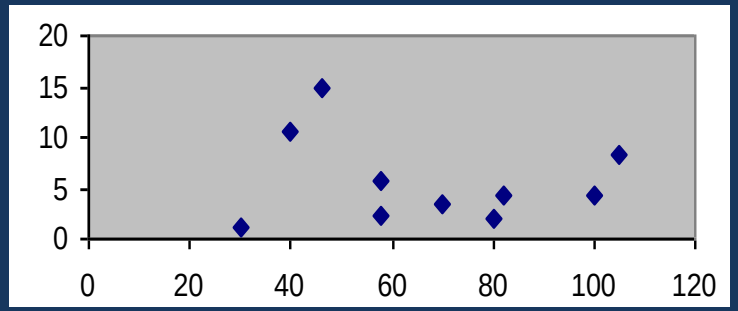
AHI



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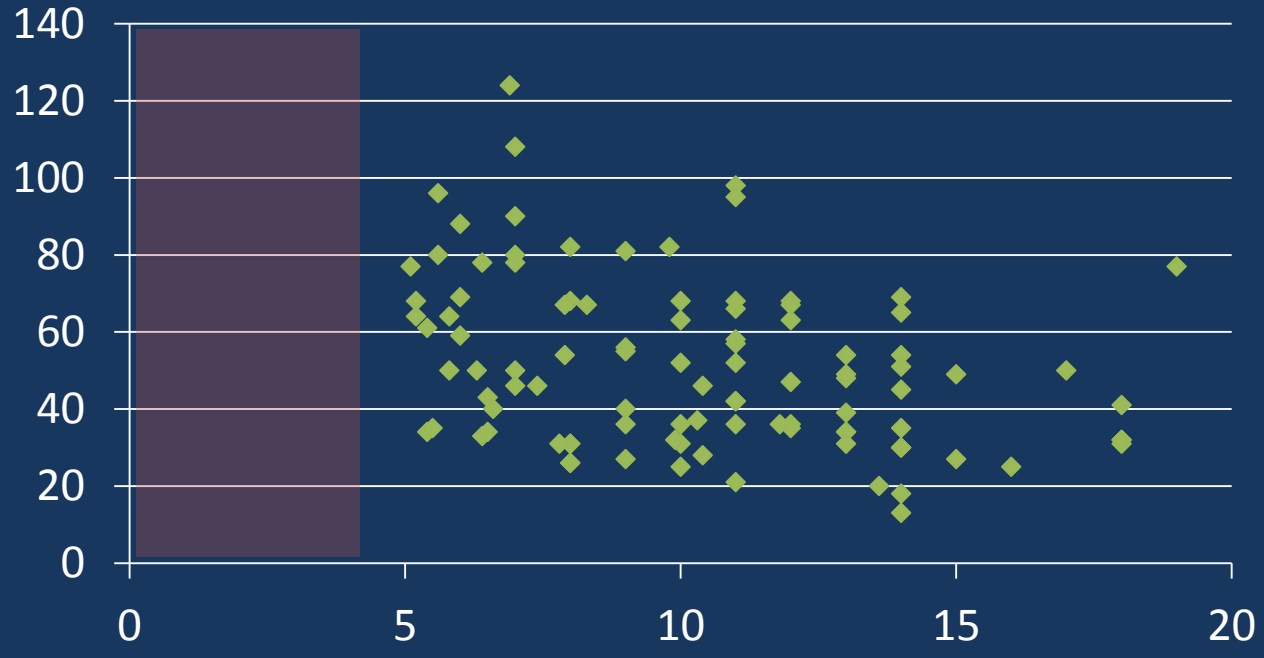
Poor Correlations Between Lung Function and Cobb Angle: Use together in treatment decisions and monitoring

Mayer OH, et al. J Pediatr Ortho 29:35-38, 2009.
Redding GJ, et al. *Spine J* 8:639-644, 2007.
Striegl A. *American Thoracic Society* (ATS), 2008.

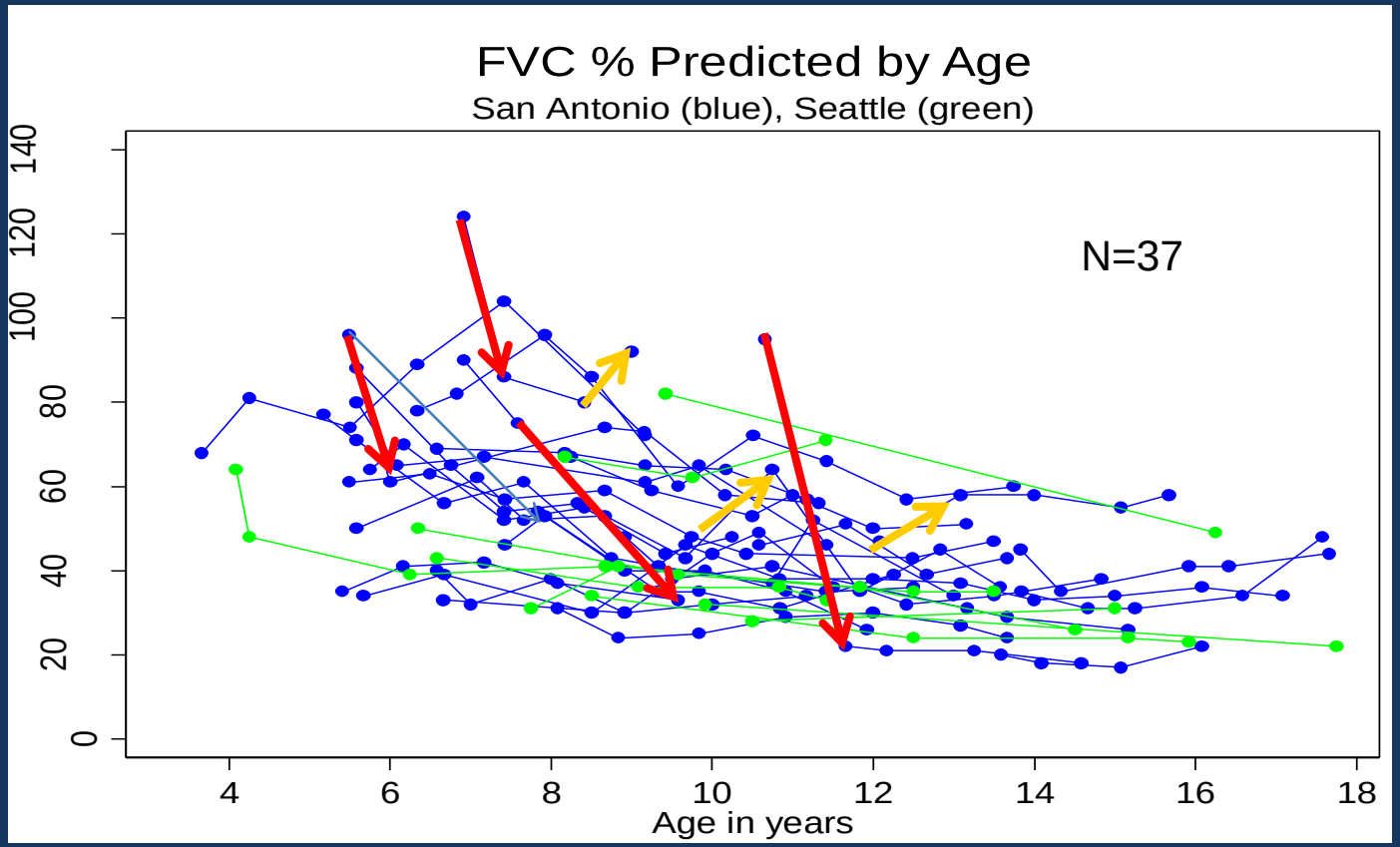
Seattle-Philadelphia-San Antonio: Initial FVC*



CSSG Registry: 54% of 3,968 patients > 5 years old at presentation

Pulmonary Exam in EOS for < 5 Year Old Children

- Respiratory rate (age specific norms)
- Asymmetry of breath sounds
- Asymmetric timing of breath sounds
- Abdominal muscle use in expiration
- Intercostal & suprasternal retractions
- Muscle tone/spasticity
- Chest radiograph: flattened diaphragms, low lung volumes



Serial FVC over a 6 Year Interval: Group and Individual Changes

16% Reduction Over 6 Years

Dede O et al. *J Bone Joint Surg Am* 96:1295-1302, 2014.
Redding G. Longitudinal trends over 5 years in Cobb angle, lung function, and nutritional status in children with EO. ID: 1500 E-Poster. 50th SRS Annual Meeting & Course, Abstract Minneapolis, Minnesota, September 30 – October 3, 2015.

Suggestions To Consider

- Measure lung function early and often. Progressive deformity can be described in functional terms as well as structural changes.
- Use functional measures in parallel with orthopedic findings to make treatment decisions.
- Keep mechanistic measures and outcome measures separate but of equal importance.

FVC: Compared to What?

- How does reduced FVC relate to 6 minute walk?
- At what FVC does sleep become compromised?
- What FVC leads to increased hospital surgical morbidity?
- What FVC at what age predicts early mortality in adulthood?