Prediction of thoracic dimensions and spine length based on individual pelvic dimensions: Validation of the use of pelvic width obtained with radiographs

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Background

- Important outcome measures in EOS/TIS:
  - Change in thoracic dimensions and spine length
- Measurement of change in individual patients over time and comparisons are confounded in EOS :
  - Variable growth rates, etiologic diagnoses, and statures

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Prediction of Thoracic Dimensions and Spine Length Based on Individual Pelvic Dimensions in Children and Adolescents

An Age-Independent, Individualized Standard for Evaluation of Outcome in Early Onset Spinal Deformity

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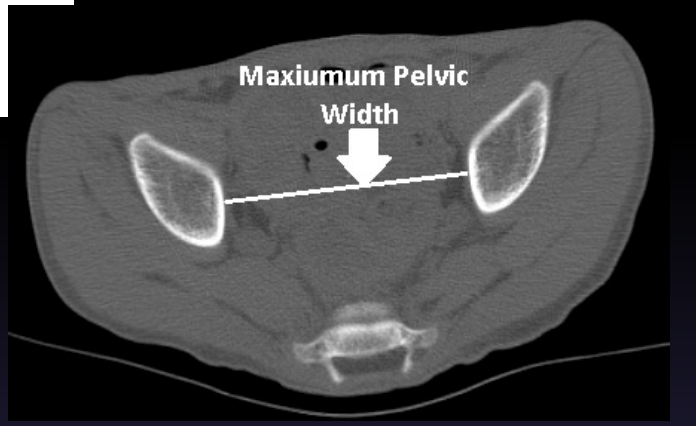
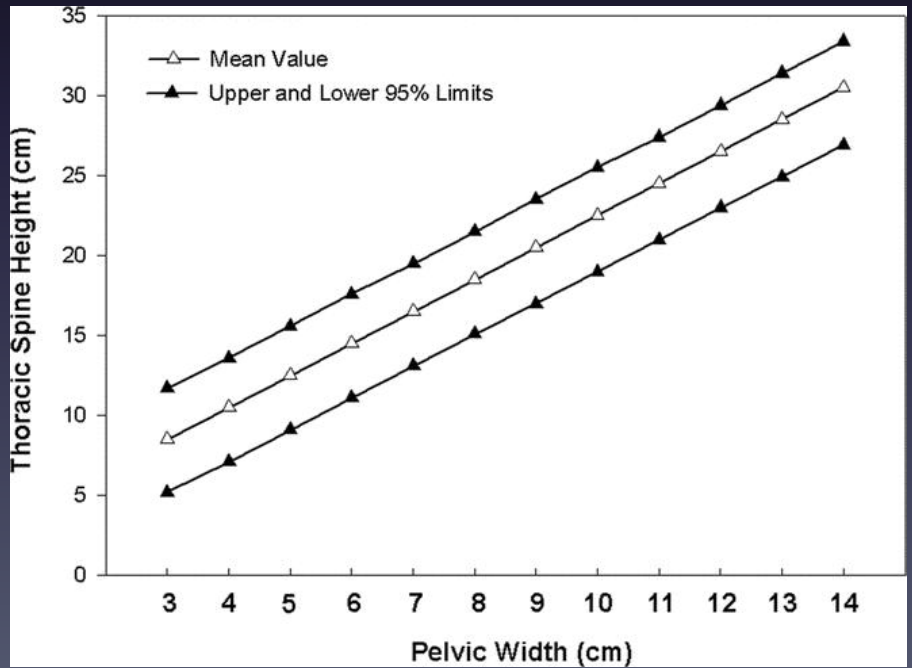
and David Zurakowski, PhD*

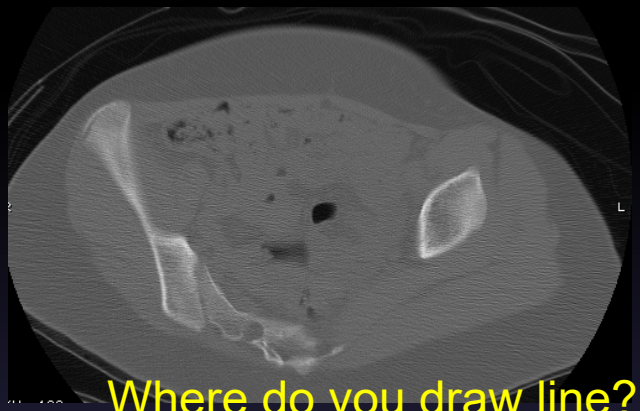


- Age-Independent, individualized standard for evaluation of outcome in early onset spinal deformity
- Normal patients who had CT scans

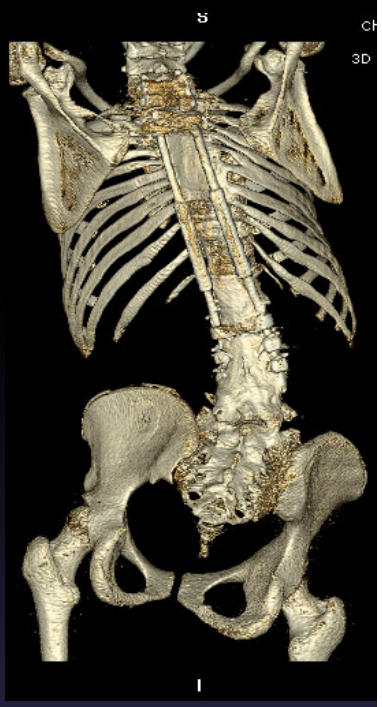


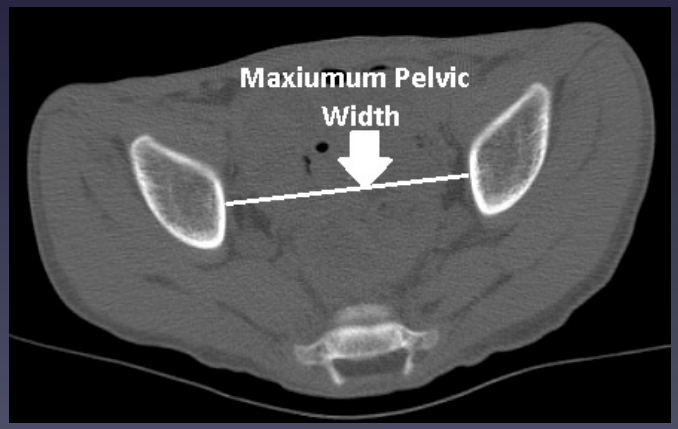
Background

- Limitations:
  - Radiation
  - Cost
  - Measuring in patients with deformity is **NOT** straight forward on CT



Where do you draw line?

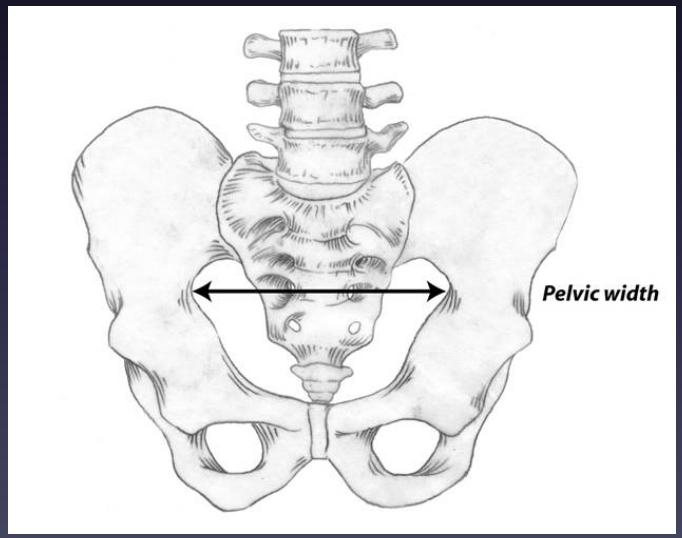




Purpose

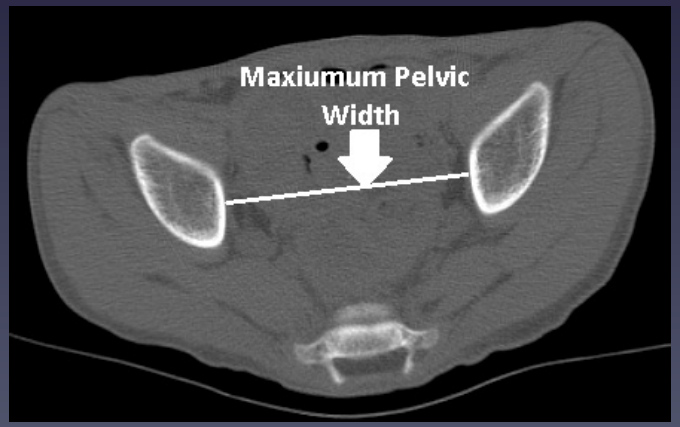
- Validate pelvic width (plain radiograph) as an independent standard

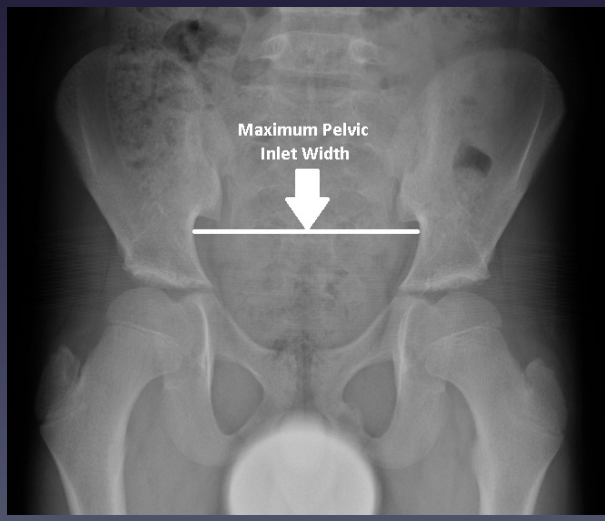
- Correlate with thoracic dimensions



Methods

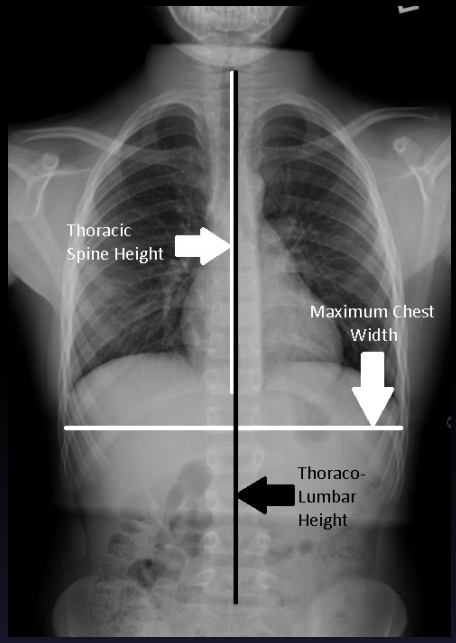
- Group 1
  - Patients with scoliosis who had both a CT and a pelvic radiograph were identified.
  - Pelvic inlet width was measured and compared between CT and plain radiograph.

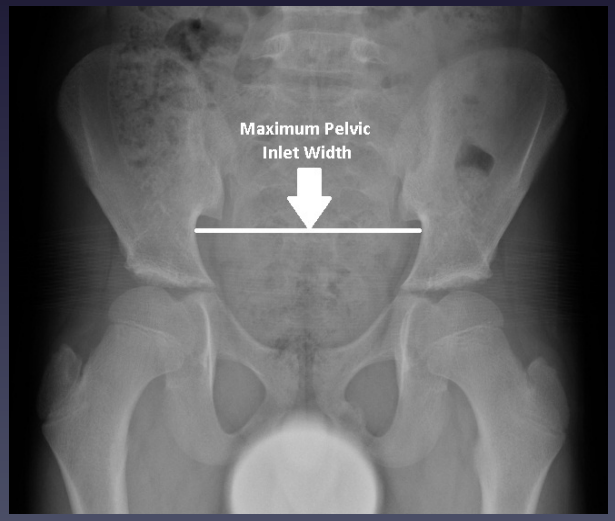




Methods

- Group 2
  - Patients with minimal deformity (Summation of all cobb angles less than 15 degrees)
  - Pelvic width compared to previously published, CT-based chest and spinal measurements

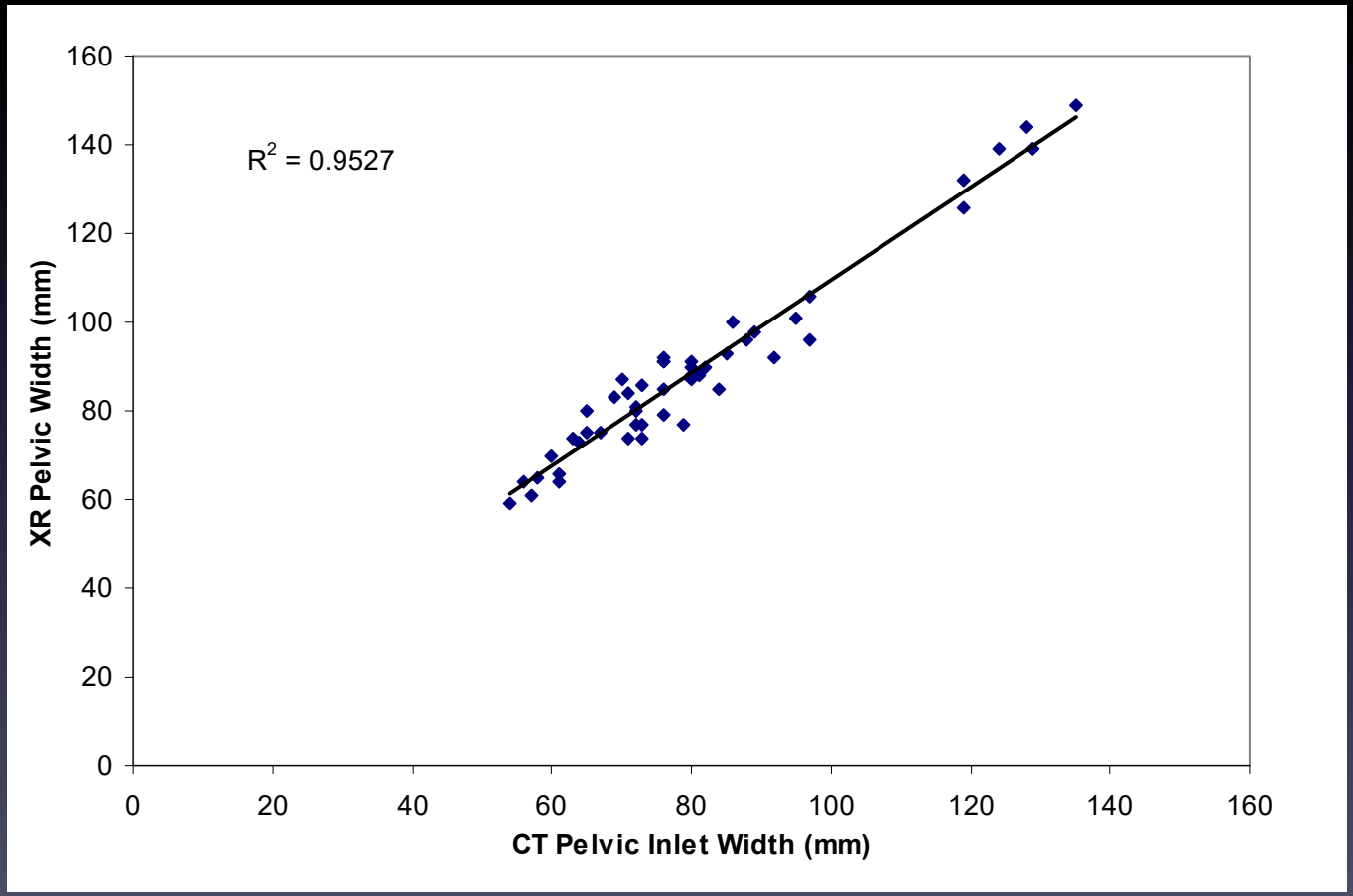




Methods

- Intraclass correlation coefficient was calculated for all measurements to evaluate interobserver reliability

Group 1:
CT vs XR Pelvic Width



Group 2: Minimal Deformity

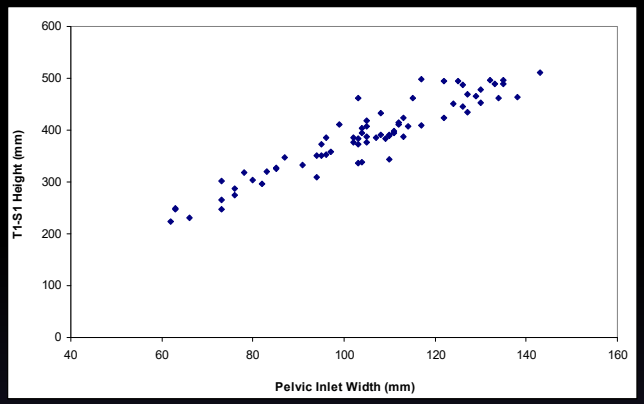
Age at X-ray (yr)	Males	Females	Total
0-5	10 (13.7)	4 (4.4)	14 (8.6)
6-10	16 (21.9)	29 (32.2)	45 (27.6)
11-15	39 (53.4)	49 (54.4)	88 (54.0)
16-20	8 (11.0)	8 (8.9)	16 (9.8)
	73	90	163

The distribution of patients across age groups was comparable for males and femails as determined by the Pearson Chi-square test (P=0.124)

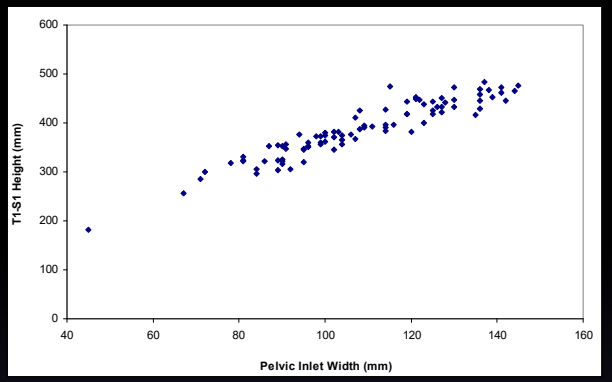
- 73 males
- 80 Females

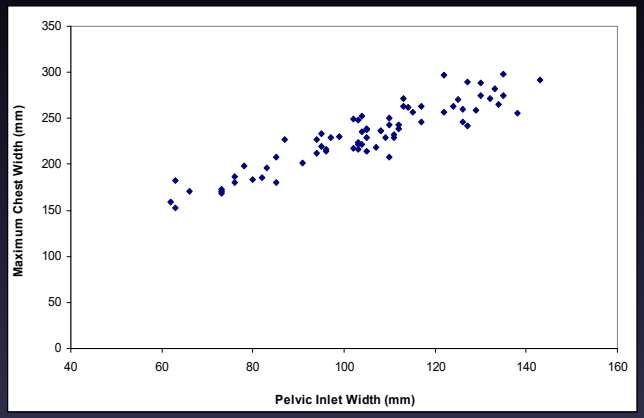
MALES

FEMALES

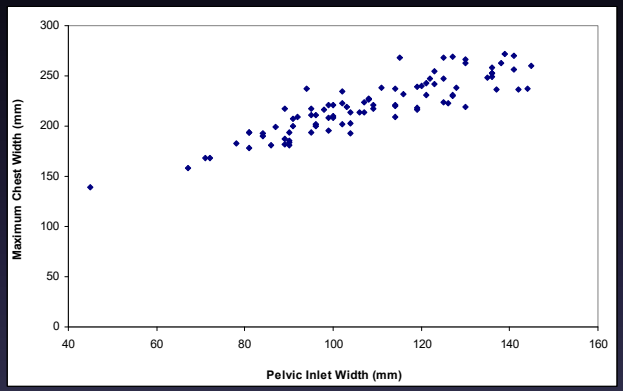


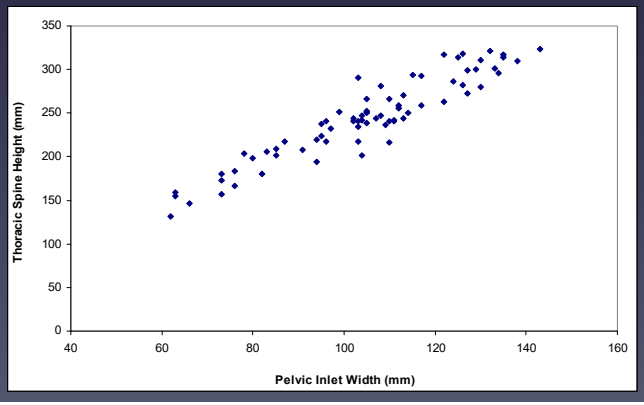
Spine height
R= 0.93



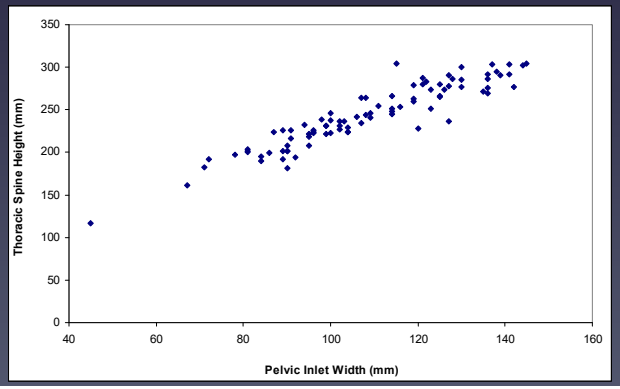


Chest width
R= 0.86





Thoracic Height
R= 0.92



Equations

Variable	Pearson Correlation	Coefficient of Determination	Equation for Males	Equation for Females
Maximum Chest Width	0.86	0.81	1.4 X PW + 86.5	1.4 X PW + 69.7
Thoracic Height	0.92	0.86	1.9 X PW + 41.1	1.9 X PW + 33.0
Lumbar Height	0.88	0.78	1.1 X PW + 30.9	1.1 X PW + 60.1
Thoracolumbar Height	0.93	0.90	3.0 X PW + 72.0	3.0 X PW + 27.2

Inter-rater reliability

CT v XR pelvic inlet

Measure	Intraclass Correlation Coefficient	Lower 95% Confidence Limit	Upper95% Confidence Limit
ctinlet	0.997	0.992	0.999
xrinlet	0.985	0.973	0.992

XR measures normal

Measure	Intraclass Correlation Coefficient	Lower 95% Confidence Limit	Upper95% Confidence Limit
xrchest	0.994	0.988	0.997
xrinletN	0.995	0.991	0.998
xrt1t12	0.978	0.961	0.989
xrt1s1	0.985	0.966	0.993

Discussion/Conclusion

- Pelvic width on plain radiographs correlates with:
  - Pelvic width measurements obtained on CT in patients with deformity
  - Spine and thoracic parameters in patients with minimal deformity.
- Fast, reliable method of assessing skeletal
- Lower radiation exposure
- Can be used to assess patients with EOS, and the impact surgical treatment has on chest and spinal growth