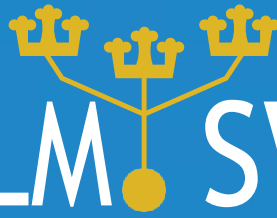




57TH ANNUAL MEETING



STOCKHOLM SWEDEN

SEPTEMBER 14-17, 2022 • Stockholm Waterfront Congress Centre



FINAL PROGRAM

www.srs.org • www.srs.org/am22

97. NATURAL HISTORY OF IDIOPATHIC SCOLIOSIS: VALIDATED MODELS OF CURVE PROGRESSION FOR THREE GROUP AGES (PRE, AT AND POST GROWTH SPURT)

Stefano Negrini, MD; Maryna Yaskina, PhD; Sabrina Donzelli, MD; Giulia A. Rebagliati, MD; Alberto Negrini; Claudio Cordani, PT; Eric C. Parent, PhD

Hypothesis
The progression of idiopathic scoliosis (IS) can be predicted from x-rays obtained at the initial specialist consult.

Design
Secondary analysis of natural history data prospectively collected (n=22387) in a national clinical database since 2003.

Introduction
Knowledge of the natural history of IS during growth has limits (models not validated; only one age or treated patients included). We validated a model with fair precision (<63%) from age 6 to bone maturity to predict progression from the first x-ray. Duval-Beaupère described three progression risk periods: before, at, and after the growth spurt. We aimed to verify if three models specific to these growth periods provided better prediction than one encompassing all growth.

Methods
Inclusion: IS, age <26, no prior treatment, first consult and at least one previous spine x-ray. We identified three groups: before (GA), at (GB) and after (GC) growth spurt. Since growth spurt age is individual, for validation purposes, we chose the upper age limit for GA so to minimize Risser 1 patients (growth spurt ongoing) and have a sample size of GA good enough for validation. We developed linear mixed-effects models with random effects and a variance components structure to predict future Cobb angles. We evaluated models by the smallest Akaike (AIC) and Bayesian (BIC) Information Criterion. Due to the low number of males and the growth spurt differences between sexes, we developed a model for females and checked if valid for males in GB. We used two methods to evaluate the accuracy of the models: the standard prediction interval that comes with the model (standard) and the interval formed using 95% CI from coefficients' estimates (new).

Results
At ages 9, 10 and 11 we had 77, 246 and 548 patients with 1.3%, 3.2% and 10.2% Risser 1, respectively. Consequently, we included ages 10 in GA and 11 in GB. We included 275 participants (allowing three cross-validations) in GA, 782 (5) females and 190 (3) males in GB, and 316 (3) in GC. The selected predictors were similar in all the models, with sex influencing only model GC. Of note, curve severity over the clinically significant threshold of 30° improved all models. The prediction accuracy ranged 15-85% (standard), and 62-99% (new).

Conclusion
The accuracy of IS progression models increased when tailored by growth spurt periods.

PREDICTIVE LINEAR MIXED-EFFECTS MODELS											
INTERCEPT	COBB	THOR	THOR ²	SCORE-RIS ¹	SCORE-RIS ²	SCORE-RIS ³	SCORE-RIS ⁴	SCORE-RIS ⁵	SCORE-RIS ⁶	SCORE-RIS ⁷	SCORE-RIS ⁸
GROUP A (AGE 9-11)											
-5.17	-1.32	-1.40	-0.01	-0.35	-0.40	-0.45	-0.50	-0.55	-0.60	-0.65	-0.70
GROUP B (AGE 11 - RISSER 1)											
1.14	-1.00	-1.17	-0.02	-0.24	-0.28	-0.30	-0.32	-0.34	-0.36	-0.38	-0.40
GROUP C (RISER 1-5)											
-4.20	-1.00	-1.10	-0.10	-0.20	-0.25	-0.30	-0.35	-0.40	-0.45	-0.50	-0.55

FUTURE COBB ANGLE PREDICTION ACCURACY						
	STANDARD METHOD			NEW METHOD*		
	WITHIN PREDICTION INTERVAL	WITHIN PREDICTION ± 5°	WITHIN PREDICTION INTERVAL ± 5°	WITHIN PREDICTION INTERVAL	WITHIN PREDICTION ± 5°	WITHIN PREDICTION INTERVAL ± 5°
GROUP A	57.5%	59.8%	77.5%	62.0%	61.7%	86.6%
GROUP B						
Females	15.1%	18.2%	69.4%	61.7%	78.0%	91.0%
Males	14.8%	18.2%	69.1%	61.7%	78.0%	91.0%
GROUP C	27.8%	72.3%	81.6%	84.2%	73.8%	99.2%

CO: Cobb; TH: Thorax; RIS: Risser & Thoracolumbar; DT: Double Thoracic; upper Thoracic; Right; Left; RIS: to be determined. *New: years between observation and prediction. †The new method consists of making a prediction interval for each patient using the lower limit estimates for the coefficients (95%) and then using the upper limit value of this interval for the coefficients in the model.

Predictive models and prediction accuracy