

International Reference Ranges for Spirometry for Young Children

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Background

Currently, interpretation of pulmonary function tests in preschool children is limited by the lack of reference values with which to distinguish the effects of disease.

An international collaborative initiative has been established to collate existing measurements in healthy children to develop more valid reference ranges for young children.

Data Collection

Centres with data from healthy preschool (3-6 years) children were identified through the ERS/ATS Paediatric Task Force, a PubMed search and at international conferences.

Spirometry data from 8,541 "healthy" children were collected from 13 centres. In addition to individual demographic and pulmonary function data, centre specific details, including documentation of relevant equipment, protocols and quality control criteria were collected.

	FEV _{0.5}	FEV _{0.75}	FEV ₁	FVC
Male (n)	566	725	3563	3412
Female (n)	620	620	3728	3545

Statistical Analysis

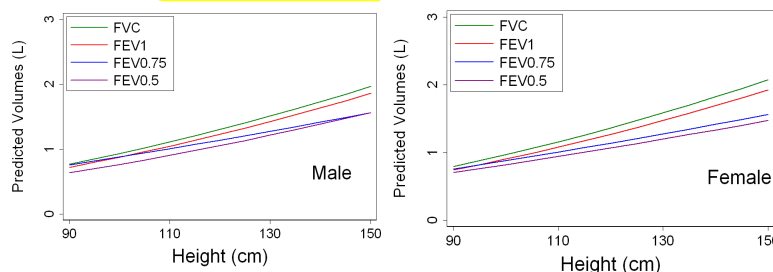
The LMS method, an extension of regression analysis widely used to construct growth charts, was used to model the relationship between pulmonary function, age and body size using the GAMLSS technique in the statistical package R.

Sex specific predicted median FEV_t and FVC were determined using a linear multiplicative model with height, age and weight as covariates. The variability between children was also modelled.



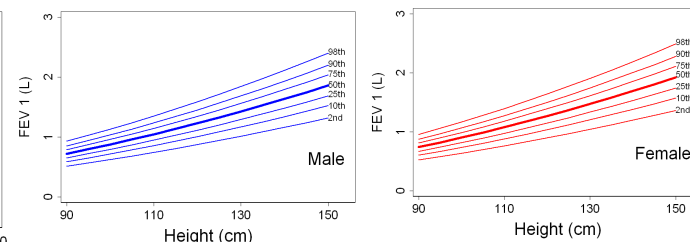
Results

Predicted Volumes Depend on Height After adjustment for age and weight



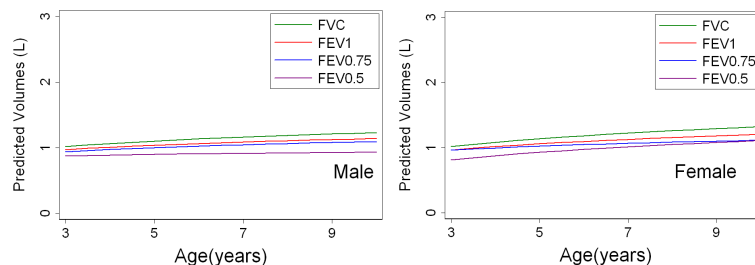
Growth Charts for Spirometry

Fitted centiles for FEV₁ adjusted for age and weight

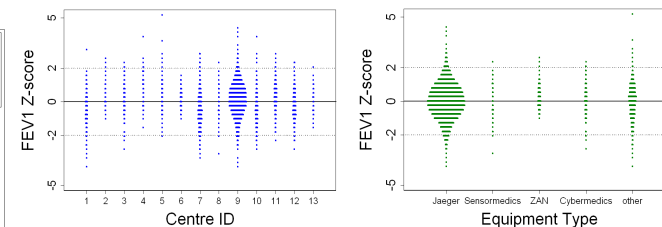


The median and variability can be combined to determine a sex-height-age-weight adjusted z-score (or centile) for an individual child.

Predicted Volumes also Depend on Age After adjustment for height and weight



Differences Between Centres



There were small but significant differences between centres and equipment.

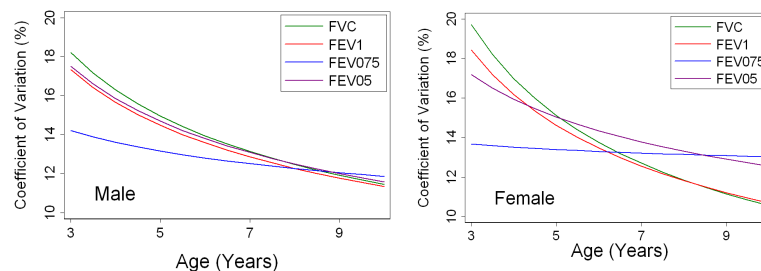
Future Directions

- Develop growth charts for flows, FEV_t/FVC and PEF
- Practical considerations of differences between centres
- Develop user-friendly software program
- Publish growth charts

Summary

- Height is the best predictor of FEV_t and FVC in young children, the effects of age and weight are significant but not as strong
- Variability between children depends on age and the lower limit of normal should not be fixed at 80% predicted
- Differences between centres need to be further explored

Predicted Variability Depends on Age



The lower limit of normal is not 80% predicted (i.e. CV of 10%) but varies with age.