

**Evaluation of the Global Lung Initiative 2012 reference values for spirometry in
African children**

Online data supplement

Michele Arigliani, Mario C. Canciani, Giovanni Mottini, Michele Altomare, Andrea

Magnolato, Sofia Vanda Loa Clemente, Leon Tshilolo, Paola Cogo, Philip H. Quanjer

METHODS

Recruitment

Local investigators in each country enlisted two public and two private schools. These were mostly institutes that had previously collaborated with local reference hospitals for health campaigns. In every school the principal investigator (PI) presented the study to the Director. A formal authorization was requested for participation. No remuneration was offered for being enrolled in the study. One school in DR Congo refused to be enrolled, all the other schools that were proposed accepted. Every director was asked to provide a list of students for every class with names and dates of birth of the pupils.

Age

The date of birth of each child was assessed consulting the students' list with names and dates of birth provided by the presidency for every class. Children, whose date of birth was not in the list, were asked their age and birthday. The distribution by age is shown in table E2.

Assessments

Standing height was measured to the nearest mm using a stadiometer with a movable right angle headpiece (Leicester stadiometer, Seca, Hamburg, Germany). Weight (Seca digital scales, Germany) was measured with light clothes and without shoes, and Body Mass Index (BMI) calculated. Sitting height was measured with the child sitting erect on a stool, back and buttocks to the wall and with the head in the Frankfort horizontal plane, knees directed straight ahead; the sitting height measurement was corrected for the height of the stool. The Cormic index was calculated as the sitting height/height ratio. Anthropometric measures were performed by two medical students in Madagascar, a young doctor in Angola and a nurse in DR Congo. These investigators, who were already experienced in anthropometric measurements, received a specific training on the protocol of

measurements and were supervised by the PI.

All spirometric tests were performed by the PI who was, at the time of the study, a resident in paediatrics with experience of hundreds of spirometric tests performed in children under the supervision of a senior pediatric pulmonologist during one-year attendance of the pediatric respiratory clinic at the University Hospital of Udine, Italy. All studies were performed with a Pony FX (Cosmed, Rome, Italy) spirometer, which meets ATS/ERS requirements (E1). Calibration was performed with a 3-L syringe before each test session.

RESULTS

Children in the present study were smaller than African American peers. Pupils from DR Congo were comparable to black Americans in both height and Cormic index (figure E1). Malagasy children showed the lowest stature and BMI, and they had a relatively larger trunk as indicated by the highest Cormic index (figure E1). Angolan children had the lowest Cormic index (figure E1).

References

E1. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, Crapo R, Enright P, van der Grinten CP, Gustafsson P, Jensen R, Johnson DC, MacIntyre N, McKay R, Navajas D, Pedersen OF, Pellegrino R, Viegi G, Wanger J; ATS/ERS Task Force. Standardisation of spirometry. *Eur Respir J* 2005; 26(2):319-338.

E2. http://www.who.int/growthref/who2007_bmi_for_age/en/. date last accessed: July 25, 2016

E3. http://www.cdc.gov/growthcharts/percentile_data_files.htm. date last accessed July 25, 2016

E4. Quanjer PH, Stanojevic S, Cole TJ, Baur X, Hall GL, Culver BH, Enright PL, Hankinson JL, Ip MS, Zheng J, Stocks J. Multi-ethnic reference values for spirometry for the 3–95 years age range: the global lung function 2012 equations. *Eur Respir J* 2012; 40:1324–1343.

FIGURES LEGEND

Figure E1 – Average height according to WHO growth charts (E2) and Cormic index in boys and girls in black children from NHANES III study, and from Angola, D.R. Congo and Madagascar.

Figure E2 – Percentage of thinness, stunted growth and the combination of the two in primary school aged boys and girls from Angola, D.R. Congo, Madagascar. Z-scores values for BMI (zBMI) are based on CDC growth charts (E3). Z-scores values for height (zHeight) are based on WHO growth charts (E2). Thinness was defined as zBMI <-2. Stunted growth was defined as zHeight <-2.

Table E1 – Differences in mean z-scores for BMI (SD) and spirometric indices between public and private schools in boys and girls in Angola, Madagascar and D.R. Congo.

Country	Sex	School	N	zBMI	zFEV1	zFVC	zFEV1/FVC
Angola	Boys	Public	47	-1.19 (2.36)	-0.42 (0.62)	-0.63 (0.68) [#]	0.41 (0.66) ^{&}
		Private	106	-0.59 (2.13)	-0.07 (0.77)	-0.13 (0.77)	0.09 (0.72)
	Girls	Public	47	-0.56 (1.68)	-0.54 (0.76)	-0.57 (0.87)	0.04 (0.92)
		Private	106	-0.50 (2.28)	-0.43 (0.71)	-0.44 (0.80)	0.00 (0.80)
Congo	Boys	Public	102	-0.42 (0.63) [#]	-0.03 (0.79)	-0.01 (0.86)	-0.05 (0.74)
		Private	105	-0.07 (0.79)	-0.14 (0.72)	-0.06 (0.79)	-0.20 (0.72)
	Girls	Public	89	-0.54 (0.76) ^{&}	-0.17 (0.90)	-0.12 (0.92)	-0.16 (0.67)
		Private	81	-0.43 (0.71)	-0.31 (0.72)	-0.21 (0.72)	-0.30 (0.68)
Madagascar	Boys	Public	73	-1.14 (1.03)	0.11 (0.87)	0.10 (0.84)	0.02 (0.80)
		Private	129	-0.91 (1.06)	0.26 (0.90)	0.36 (0.87)	-0.14 (0.98)
	Girls	Public	74	-1.47 (1.10) ^{&}	-0.09 (0.91)	-0.04 (0.83)	-0.06 (1.08)
		Private	123	-0.95 (1.07)	0.03 (0.84)	0.12 (0.81)	-0.15 (0.93)
Total			1082	-0.64 (1.52)	-0.11 (0.83)	-0.08 (0.86)	-0.07 (0.83)

Definition of abbreviations: BMI = body mass index; FEV₁: forced expiratory volume in 1 s; FVC: forced vital capacity.

Results are presented as mean (SD), unless otherwise specified.

‡ zBMI values based on CDC growth charts (E3).

Spirometry z-scores based on Global Lung Function Initiative–2012 equations for African Americans (E4).

Differences between countries: # p<0.001, ## p<0.05

Differences between public and private schools &: p < 0.001; #: p < 0.02 (ANOVA and Tukey's honestly significant differences test)

Table E2. Distribution of children by calendar age.

Age (yr)	6	7	8	9	10	11	12
Subjects (%)	7.7	18.7	18.5	18.2	17.3	12.4	7.3

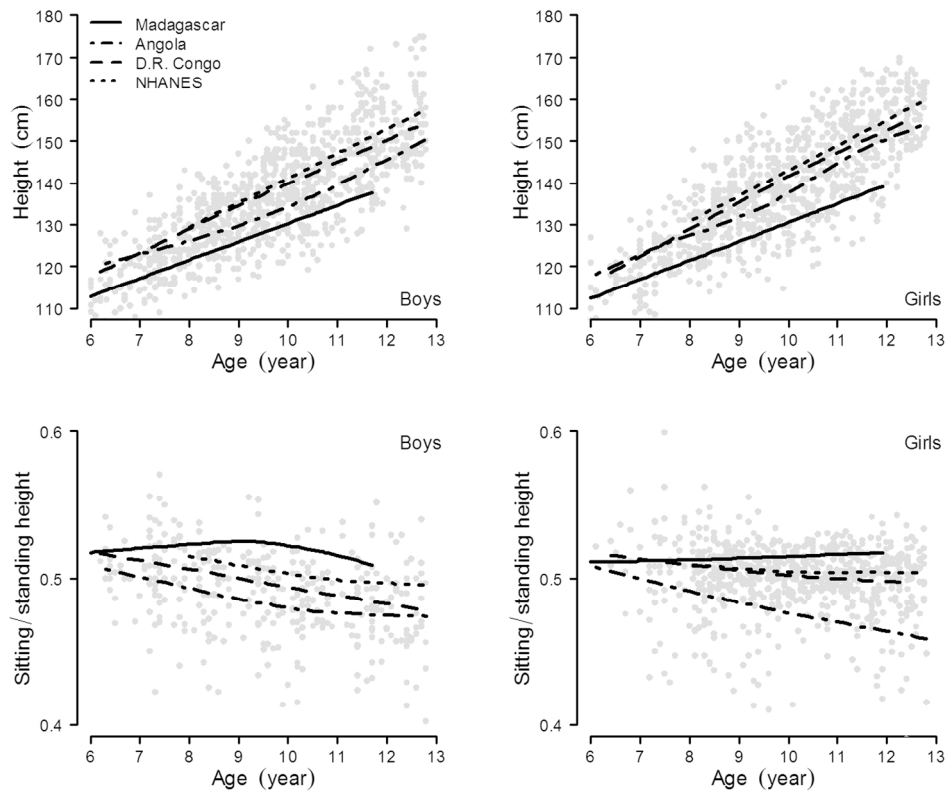


Figure E1 – Average height according to WHO growth charts (E2) and Cormic index in boys and girls in black children from NHANES III study, and from Angola, D.R. Congo and Madagascar.

(Table 1, Figure E1)
 124x103mm (300 x 300 DPI)

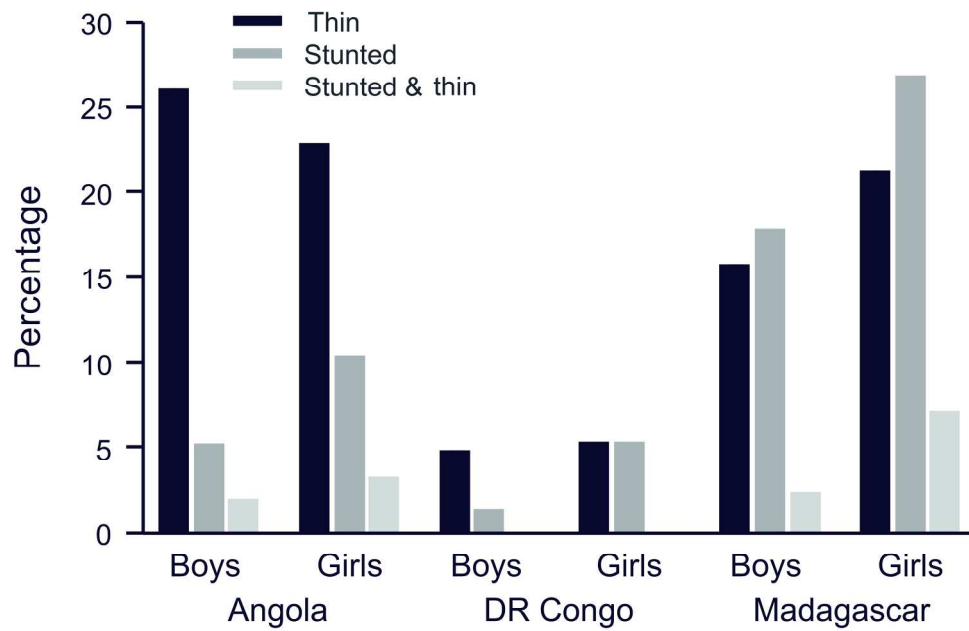


Figure E2 – Percentage of thinness, stunted growth and the combination of the two in primary school aged boys and girls from Angola, D.R. Congo, Madagascar. Z-scores values for BMI (zBMI) are based on CDC growth charts (E3). Z-scores values for height (zHeight) are based on WHO growth charts (E2). Thinness was defined as zBMI <-2. Stunted growth was defined as zHeight <-2.

thinness (Figure E2)
205x134mm (300 x 300 DPI)