Normative data for multiple breath washout outcomes in school-aged Caucasian children

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ABSTRACT

Background: The multiple breath nitrogen washout (N2MBW) technique is increasingly used to assess the degree of ventilation inhomogeneity in school-aged children with lung disease. However, reference values for healthy children are currently not available. The aim of this study was to generate reference values for N2MBW outcomes in a cohort of healthy Caucasian school-aged children.

Methods: N2MBW data from healthy Caucasian school-age children between 6 and 18 years old were collected from four experienced centres. Measurements were performed using an ultrasonic flowmeter (Exhalyzer D, Eco Medics AG, Duernten, Switzerland) and were analysed with commercial software (Spiroware version 3.2.1, Eco Medics AG). Normative values and upper limits of normal (ULN) were generated for lung clearance index (LCI) at 2.5% (LCI2.5%) and at 5% (LCI5%) of the initial nitrogen concentration and for moment ratios (M1/M0 and M2/M0). A prediction equation was generated for functional residual capacity (FRC).

Results: Analysis used 485 trials from 180 healthy Caucasian children aged from 6 to 18 years old. While
LCI increased with age, this increase was negligible (0.04 units·year$^{-1}$ for LCI$_{2.5\%}$) and therefore fixed ULN were defined for this age group. These limits were 7.91 for LCI$_{2.5\%}$, 5.73 for LCI$_{5\%}$, 1.75 for M$_1$/M$_0$ and 6.15 for M$_2$/M$_0$, respectively. Height and weight were found to be independent predictors of FRC.

**Conclusion:** We report reference values for N$_2$MBW outcomes measured on a commercially available ultrasonic flowmeter device (Exhalyzer D, Eco Medics AG) in healthy school-aged children to allow accurate interpretation of ventilation distribution outcomes and FRC in children with lung disease.