

Bronchodilator Response in Pediatric Asthma: A Definition Not Yet Decided

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The bronchodilator response (BDR) allows for the objective confirmation of improvement in variable airflow limitation in asthma, making it useful for distinguishing the condition from other chronic respiratory diseases and from healthy individuals. Spirometry is currently considered the gold standard pulmonary function test for measuring BDR in children; however, there is no consensus regarding the cutoff points that should be used to define it. The global search for a definition of BDR formally began with the 2005 American Thoracic Society/European Respiratory Society (ATS/ERS) Task Force, which recommended defining a positive BDR response as a change in forced expiratory volume in one second (FEV_1) or forced vital capacity (FVC) of $\geq 12\%$ or >200 mL [1]. The ERS incorporated an increase in FEV_1 of $\geq 12\%$ and/or ≥ 200 mL as a recommendation for the diagnosis of asthma in children aged 5 to 16 years [2]. In 2021, a new ATS/ERS Task Force report was published recommending that BDR be measured relative to predicted values, with the aim of minimizing the variability caused by gender and height in the 2005 criteria. It also defined a significant BDR as an increase of $>10\%$ in FEV_1 or FVC relative to the GLI 2012 predicted values [3,4]. To date, some guidelines incorporating spirometry into the diagnosis of pediatric asthma have proposed using both criteria [5], whereas the latest update of the Global Initiative for Asthma (GINA) 2026 recommends a hybrid criterion for diagnosing asthma in children: an increase in FEV_1 of $\geq 12\%$ of the predicted value [6]. The majority of studies analyzed to define BDR in the ATS/ERS guidelines (2005 and 2021) involved adult patients; therefore, no specific recommendations were made for defining positive BDR in the pediatric population.

So, are the 2005-2021 ATS/ERS BDR criteria useful for diagnosing pediatric asthma? To date, five publications have analyzed the impact of a positive (+) or negative (-) BDR—using both criteria—in healthy children and adolescents and in those with suspected or treated asthma; these warrant discussion. A prospective study recruited a cohort of children from community vaccination centers and subsequently performed spirometry at the age of 6 years. The study demonstrated that, among both healthy children and those with asthma symptoms, the BDR+2021 criterion yielded a higher proportion of positive results than the RB+2005 criterion (26.7% vs. 11.2%, $p < 0.001$). Furthermore, only 20% of the children classified as BDR-2005/BDR+2021 exhibited symptoms consistent with asthma; therefore, the authors concluded that the new criteria could increase the overdiagnosis of asthma if other clinical elements are not taken into account [7]. In a retrospective study, the 2005 and 2021 BDR cut-off points were compared using spirometry data from children and adolescents aged 5 to 18 years diagnosed with asthma or chronic cough. In this study, spirometry results categorized as BDR-2025/BDR+2001 showed baseline z-scores for FEV_1 , FVC, or FEV_1/FVC that were significantly higher than those classified as BDR+2005/BDR-2021 ($p = 0.0001$); consequently, the authors inferred that applying the 2021 criterion increases the diagnosis of pediatric asthma in patients with normal or near-normal baseline lung function [8]. In a cohort of children and adolescents treated for asthma, a high degree of agreement was found between the 2005 and 2021 criteria ($k = 0.79$). This study also reported that patients classified as BDR+2005/BDR-2021 had significantly higher proportions of older age (12-17 years), higher GINA treatment steps 3 to 5, and baseline FEV_1 or FEV_1/FVC values below the lower limit of normal compared to those classified as BDR-2005/BDR+2021 ($p < 0.001$ for all variables) [9]. Another study analyzed the impact of variables such as age, gender, and body size on the agreement between the 2005 and 2021 BDR criteria.

Although levels of agreement were high across all groups ($k > 0.8$), they decreased slightly among patients aged 12 years or older, females, and those with a height of less than 147 centimeters [10]. Finally, a study conducted on asthmatic patients aged 4 to 18 years found a significantly higher proportion of positive cases in the group classified as BDR+2005/BDR-2021 than in those categorized as BDR-2005/BDR+2021 (6% vs. 1.4%, $p < 0.001$). Although this study reported good agreement between both criteria ($k > 0.8$) across different age groups (preschoolers, school-age children, and adolescents), it was demonstrated that, in discordant cases, the only variable that exerted an independent influence was the baseline FEV_1 z-score [11].

A separate area of inquiry concerns BDR in preschoolers; interpreting this has always been challenging because, at this stage of life, not all children are able to produce an acceptable FEV_1 . Alternative parameters with shorter expiratory times, such as $FEV_{0.75}$ or $FEV_{0.5}$, have been recommended by the ATS/ERS for this age group [12]. The $FEV_{0.75}$ BDR, using various cut-off points ($>8.5\%$, $>11\%$, and $>14\%$), has been reported as a useful parameter for distinguishing between preschool children with asthma and healthy children [13-15]. BDR with $FEV_{0.5}$ ($\geq 16\%$, $\geq 20\%$, and $> 11\%$) has also been considered for distinguishing between preschoolers with and without asthma [16,17]. However, a recent meta-analysis demonstrated that methodological differences across studies measuring BDR preschool spirometry do not yet allow for the recommendation of a universal cutoff point [18].

Impulse oscillometry (IOS) is another pulmonary function procedure that allows for the measurement BDR in children with suspected asthma, and recent GINA guidelines have considered it an alternative method for diagnosing asthma [6]. In 2020, King, *et al.* published the ERS technical standards for IOS, in which they recommend considering a BDR+ in both adults and children when resistance at 5 Hz (R5) and/or reactance area (AX) decrease (by 40% and 80%, respectively) and/or if reactance at 5 Hz (X5) increases by 50% following bronchodilator administration [19]. However, the pediatric studies included in these recommendations were neither selected systematically nor subjected to diagnostic testing, and some relevant studies were excluded from the selection. A recent systematic review by Seneviratne, *et al.* included 11 studies involving children and adolescents, demonstrating that diagnostic sensitivity for asthma was nil when using the cut-off points suggested by the ERS. Furthermore, following regression analysis, the authors propose cut-off points that balance sensitivity and specificity—such as a 17% decrease in R5-R6 or a 20.2% increase in X5 after bronchodilator administration—which could be more accurate for diagnosing pediatric asthma, thereby avoiding the underdiagnosis of BDR [20].

Conclusively, these years of investigation have not been in vain; we now know that we must focus on the response of pediatric bronchi or bronchioles rather than extrapolating from findings in adults. We have learned that variables such as age, gender, height, and baseline lung function influence BDR in children and adolescents. We have also come to understand that preschool-aged children require a distinct diagnostic approach using parameters appropriate for their age. Overall, the development of other methods for BDR (e.g. IOS) should not be delayed if future evidence reveals them to be more useful for understanding the pathophysiology of pediatric asthma.

Bibliography

1. R Pellegrino, *et al.* "Interpretative strategies for lung function tests". *European Respiratory Journal* 26.5 (2005): 948-968.
2. EA Gaillard, *et al.* "European Respiratory Society clinical practice guidelines for the diagnosis of asthma in children aged 5-16 years". *European Respiratory Journal* 58.5 (2021): 2004173.
3. S Stanojevic, *et al.* "ERS/ATS technical standard on interpretive strategies for routine lung function tests". *European Respiratory Journal* 60.1 (2022): 2101499.
4. PH Quanjer, *et al.* "Multi-ethnic reference values for spirometry for the 3-95-yr age range: the global lung function 2012 equations". *European Respiratory Journal* 40.6 (2012): 1324-1343.

5. British Thoracic Society (BTS), National Institute for Health and Care Excellence (NICE) and Scottish Intercollegiate Guidelines Network (SIGN). "BTS/NICE/SIGN joint guideline on asthma: diagnosis, monitoring and chronic asthma management (November 2024) - summary of recommendations". *Thorax* 80.7 (2025): 416-424.
6. Global Initiative for Asthma. "Global Strategy for Asthma Management and Prevention, 2026". (2026).
7. S Shanthikumar, *et al.* "Comparing definitions of bronchodilator response in a population-based cohort of 6-year-old children". *Pediatric Pulmonology* 58.8 (2023): 2411-2414.
8. N Beydon and M Rosenfeld. "Comparison of bronchodilator responsiveness in asthmatic children using 2021 or 2005 ATS/ERS guidelines". *Pediatric Pulmonology* 59.1 (2024): 233-235.
9. C Stridsman, *et al.* "Clinical Implications of the New Criteria for a Positive Bronchodilator Response in Children With Asthma". *Acta Paediatrica* 114.7 (2025): 1731-1733.
10. N Blyth, *et al.* "Impact of new European Respiratory Society/American Thoracic Society bronchodilator reversibility interpretation on asthma diagnosis in children". *Pediatric Investigation* 9.3 (2025): 300-303.
11. J Zhao, *et al.* "Comparison of ERS/ATS guidelines across versions: differences in the application of bronchodilator responsiveness criteria in pediatric asthma by age subgroups (2005 vs 2021)". *Italian Journal of Pediatrics* 51.1 (2025): 299.
12. BL Graham, *et al.* "Standardization of Spirometry 2019 Update. An Official American Thoracic Society and European Respiratory Society Technical Statement". *American Journal of Respiratory and Critical Care Medicine* 200.8 (2019): e70-e88.
13. EF Burity, *et al.* "Bronchodilator response cut-off points and FEV 0.75 reference values for spirometry in preschoolers". *Jornal Brasileiro de Pneumologia* 42.5 (2016): 326-332.
14. LE Busi, S Restuccia, R Tourres and PD Sly. "Assessing bronchodilator response in preschool children using spirometry". *Thorax* 72.4 (2017): 367-372.
15. LM Borrego, *et al.* "Bronchodilator responsiveness using spirometry in healthy and asthmatic preschool children". *Archives of Disease in Childhood* 98.2 (2013): 112-117.
16. M Linares Passerini, *et al.* "Utility of bronchodilator response for asthma diagnosis in Latino preschoolers". *Allergologia et Immunopathologia* 42.6 (2014): 553-559.
17. D Vilozi, *et al.* "The role of computer games in measuring spirometry in healthy and 'asthmatic' preschool children". *Chest* 128.3 (2005): 1146-1155.
18. MD Wong, *et al.* "Assessment of bronchodilator response in preschoolers: A systematic review". *Pediatric Pulmonology* 59.11 (2024): 2732-2747.
19. GG King, *et al.* "Technical standards for respiratory oscillometry". *European Respiratory Journal* 55.2 (2020): 1900753.
20. SY Seneviratne, *et al.* "Oscillometry for the diagnosis of asthma in children: a systematic review". *European Respiratory Review* 35.180 (2026): 250293.