

Study of Asthma in Children Aged 5 to 14 Years: According to Global Initiative for Asthma Criteria

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Abstract

Asthma is the most common chronic disease in children. Its incidence has been increasing in recent decades and represents a real public health problem responsible for morbidity and mortality in children in Sub-Saharan Africa. **Aims:** The general objective of our study was to determine asthma prevalence in 5 - 14-year-olds based on spirometry data. The specific objectives were to diagnose asthma according to GINA criteria, analyze the factors linked to obstruction, and analyze the results obtained in comparison with the conclusions of practitioners in the physiology laboratory. **Materials and Methods:** Retrospective study from March 2014 to October 2018 on medical records of children who underwent respiratory function testing at the physiology and functional exploration laboratory of the UCAD. **Results:** The study included 151 children aged 5 to 14 years, with a slight male predominance (sex ratio 1.15). Nearly 25% of children had a history of declared asthma. Approximately 27.15% of children had bronchial obstruction, defined by a decreased FEV1/FVC ratio. According to GINA criteria, only 8.61% of children were considered asthmatic. Among children with obstruction, 31.7% had bronchial reversibility after bronchodilator administration. An influence of anthropometric data on

spirometric parameters was noted. Indeed, lung volumes and flows were positively correlated with age, weight, and height. The FEV1/FVC ratio tended to be negatively correlated with age and height. **Conclusion:** This study highlighted a significant prevalence of bronchial obstruction in children in the studied population. However, the diagnosis of asthma according to GINA criteria was less frequent. The results suggest that age, sex, and environmental factors may influence respiratory function in children.

Keywords

Asthma, Spirometry, Respiratory Function Tests, GINA Method

1. Introduction

Asthma, a chronic inflammatory disorder of the airways, is a major non-communicable disease affecting both children and adults. It represents a significant public health problem, particularly in children. The WHO estimates that worldwide, more than 262 million people suffered from asthma in 2019, resulting in 455,000 deaths [1]. This mortality is usually linked to insufficient diagnosis, inadequate monitoring, and poor management of the disease. Approximately 24.8 million DALYs were attributable to asthma in 2016 [2].

Despite therapeutic advances, its prevalence continues to increase in Sub-Saharan Africa, particularly in Senegal, where it was 10% in 2018, including 3% in children, leading to a significant burden in terms of public health and socioeconomic costs [1] [2].

Asthma is significantly influenced by the interaction of genetic predispositions and environmental factors, particularly in Senegal, where socioeconomic conditions play a crucial role. While genetic studies have identified susceptibility genes impacting immune response and airway function, environmental exposures such as indoor and outdoor pollution, exacerbated by urbanization and solid fuel use, contribute to airway inflammation. Furthermore, poverty and limited access to healthcare compound these environmental risks [3]-[5].

The diagnosis of asthma is largely based on respiratory function testing, particularly spirometry. This test measures the flow rate of expired air and can detect bronchial obstruction, a characteristic of asthma [6]-[8]. The GINA (Global Initiative for Asthma) guidelines, an international reference for asthma, provide guidelines for the interpretation of spirometry results and the establishment of a diagnosis [9].

The Global Initiative for Asthma (GINA) criteria, the international standard for asthma diagnosis, rely on a combination of clinical symptoms, patient history, and pulmonary function tests, particularly spirometry. Spirometry is crucial for confirming reversible bronchial obstruction, a hallmark of asthma, indicated by a reduced FEV1/FVC ratio and a significant FEV1 improvement ($\geq 12\%$ and ≥ 200 mL) post-bronchodilator.

Accurate asthma diagnosis, essential for effective management, is achieved by

integrating clinical findings with spirometry results, ensuring quality through reproducibility and artifact-free measurements. Differential diagnosis to exclude other respiratory conditions is also critical.

This study aims to deepen the understanding of asthma in children by assessing the prevalence of asthma according to GINA criteria in a pediatric population aged between 5 and 14 years and by identifying factors associated with bronchial obstruction in asthmatic children. Thus, this research aims to better characterize asthma in children to improve its management and follow-up.

2. Methods

2.1. Study Design

This was a retrospective, descriptive, and analytical study conducted from March 20, 2014, to October 9, 2018, at the Physiology and Functional Exploration Laboratory of the Faculty of Medicine, Pharmacy, and Dentistry of Cheikh Anta Diop University in Dakar. The study focused on medical records of children aged 5 to 14 years who had undergone complete spirometry. Records of children who did not perform the ventilatory maneuvers satisfactorily were excluded.

2.2. Data Collection

Data was collected using Excel 2013 and included the patient's civil status, anthropometric parameters obtained by measuring height with a graduated ruler and weight with an OMRON BF511 impedance meter, the indication for spirometry on the examination report, medical history, and spirometric results.

The spirometry procedure involves a patient performing maximal inspiration followed by forced expiration into a spirometer, with recorded measurements including FVC, FEV₁, FEV₁/FVC ratio, and PEF. Performed by qualified personnel with calibrated equipment, the test requires patient cooperation and adherence to pre-test guidelines.

Spirometric parameters were measured before and after administration of inhaled bronchodilators using a Jaeger® Vyntus PM spirometer.

The spirometric data collected before and after bronchodilation were:

- Forced vital capacity (FVC)
- Forced expiratory volume in one second (FEV₁)
- FEV₁/FVC ratio
- Peak expiratory flow (PEF)

Asthma was diagnosed based on reversibility after inhalation of beta-2-mimetics when:

- In patients younger than 12 years, FEV₁ increased by more than 12% compared to the predicted value;
- In patients 12 years and older, FEV₁ increased by more than 12% compared to the pre-bronchodilator value and by at least 200 ml.

According to GINA criteria, bronchial obstruction was confirmed when the FEV₁/FVC ratio was less than or equal to 0.85 for children under 12 years and less

than or equal to 0.75 - 0.80 for children 12 years and older. For the latter age group, we retained the limit of 0.80.

The interpretation was based on a reduction of at least 20% in the FEV1/FVC ratio ($\leq 80\%$) to diagnose obstruction in children. Subsequently, an increase in the value after bronchodilation compared to the pre-value was considered significant from 20%. Anomalies related to peak expiratory flow (PEF) were also considered.

2.3. Statistical Analysis

Statistical analysis was performed using SigmaStat 3.0 software. Quantitative data was expressed as mean \pm standard deviation. The intrinsic values of subjects before (pre) and after (post) bronchodilator administration were analyzed according to reference values. Correlations were sought between spirometric data on the one hand and anthropometric data (Pearson) and indications (Spearman) on the other. Comparisons were made based on age, gender, and degree of obstruction using the t-test. If the normality test failed, it would be replaced by the Mann-Whitney Rank Sum Test. The significance level was set at $p < 0.05$.

3. Results

3.1. Population Characteristics

The initial population consisted of 157 children, of whom 73 (46.5%) were girls, with a male-to-female ratio of 1.15. Six records were excluded due to missing data or input errors. Of the 151 children included, 97 (64%) were between 5 and 11 years old (Group 1 = G1) and 54 (38%) were between 12 and 14 years old (Group 2 = G2). The mean age of the study population was (10.3 ± 2.5) years, the mean weight was (36.3 ± 13.6) kg, and the mean height was (143.95 ± 14.71) cm. The mean age of G1 was (8.78 ± 1.71) years, and of G2 was (13 ± 0.9) years. The anthropometric data of the patients is presented in **Table 1**.

Table 1. Anthropometric data of the general population and the two groups.

Characteristics	Population (N= 151)	G1 (5 - 11 years) (N = 97)	G2 (12 - 14 years) (N = 54)
Mean Age (years)	10.3 \pm 2.51	8.78 \pm 1.71	13 \pm 0.9
Weight (kg)	36.32 \pm 13.58	30.7 \pm 9.72	46.43 \pm 13.75
(mean \pm stdev)	(17.6 - 85.2)	(17.6 - 66.1)	(27.4 - 85.2)
Size (cm)	143.95 \pm 14.71	136.12 \pm 10.93	158 \pm 9.13
(mean \pm stdev)	(113 - 175)	(113 - 168)	(138 - 175)

stdev = standard deviation.

3.2. Asthma and Obstructive Syndrome

In the study population, 24.5% of patients reported a history of asthma, and 50.3% were referred with a suspicion of asthma, representing 74.8% of patients.

The distribution of obstruction and asthma cases by sex is shown in **Table 2**. The number of FFRs considered abnormal, indicating obstruction, was 60.26%, according to clinicians' conclusions. They considered abnormalities related to the

FEV1/FVC ratio as well as PEF.

Table 2. Distribution according to gender, obstruction, and reversibility.

	G1 (5 - 11 years)			G2 (12 - 14 years)			Total population
	Girls (%)	Boys (%)	Total N = 97	Girls (%)	Boys (%)	Total N = 54	N = 151 (%)
Obstruction	34.88	31.48	32.98	7.69	25.00	16.66	27.15
Asthma	9.30	11.11	10.30	3.84	7.14	5.55	8.60
Normal	55.81	57.40	56.70	88.46	67.85	77.77	64.23

Among the female population, obstruction was present in 24.63% of cases, with 34.88% in G1 (under 12 years) and 7.69% in G2 (under 12 years and over).

In boys, the figures were 29.26%, with 31.48% for G1 and 25% for G2, respectively. Thus, obstruction was relatively more frequent in boys.

Overall, obstruction was present in 27.15% of children. The number of asthmatics was 8.61% of the total population according to GINA criteria, and the reversibility rate was 31.7% (13 out of 41 who had obstruction).

The comparison of anthropometric and spirometric data according to age is shown in **Table 3**.

Table 3. Comparison by age of anthropometric and spirometric data.

	G1	G2	P
	5 - 11 years mean ± stdev (values)	12 - 14 years mean ± stdev (values)	
Age (years)	8.78 ± 1.71	13 ± 0.9	<0.001
Weight (kg)	30.7 ± 9.72 (17.6 - 66.1)	46.43 ± 13.75 (27.4 - 85.2)	<0.001
Size (cm)	136.12 ± 10.93 (113 - 168)	158 ± 9.13 (138 - 175)	<0.001
CVF pre (L)	1.75 ± 0.46 (0.81 - 3.11)	2.58 ± 0.68 (1.02 - 4.33)	<0.001
FVC post (L)	1.83 ± 0.46 (0.76 - 2.91)	2.64 ± 0.66 (1.12 - 4.38)	<0.001
Pre FEV1 (L)	1.54 ± 0.41 (0.51 - 2.56)	2.3 ± 0.57 (0.92 - 3.43)	<0.001
Post FEV1 (L)	1.67 ± 0.43 (0.6 - 2.7)	2.43 ± 0.58 (1.02 - 3.57)	<0.001
Pre FEV1/FVC (%)	88.27 ± 9.49 (50.41 - 100)	89.51 ± 8.32 (68.68 - 100)	0.53
Post FEV1/FVC (%)	91.13 ± 7 (59.81 - 100)	92.22 ± 6.41 (73.53 - 100)	0.27
DEP pre (L)	3.82 ± 1.12 (1.18 - 6.98)	5.82 ± 1.58 (2.67 - 9.02)	<0.001
DEP post (L)	4.04 ± 1.18 (1.02 - 7.22)	6.19 ± 1.57 (3.6 - 9.91)	<0.001
Δ FEV (ml)	129.27 ± 132.58 (-90 - 730)	133.7 ± 149.72 (-180 - 630)	0.95
Δ DEP (ml)	241.81 ± 484.44 (-1370 - 1390)	367.4 ± 620.1 (-570 - 1980)	0.52

A significant difference was noted between the two groups except for relative parameters such as the FEV1/FVC ratio and variations (Δ) of FEV1 and PEF. When all children were considered, the older ones had the highest values.

The comparison between obstructive and non-obstructive subjects of anthropometric and spirometric parameters is presented in **Table 4**.

Table 4. Comparison between obstructive and non-obstructive anthropometric and spirometric parameters.

	Non-Obstructive mean \pm stdev (values)	Obstructive mean \pm stdev (values)	P
Age (years)	10.32 \pm 2.57 (5 - 14)	10.24 \pm 2.35 (6 - 14)	0.795
Weight (kg)	36.61 \pm 14.14 (17.8 - 85.2)	35.55 \pm 12.1 (17.6 - 66.1)	0.91
Size (cm)	144.21 \pm 14.96 (115 - 175)	143.24 \pm 14.18 (113 - 170)	0.72
CVF pre (L)	2 \pm 0.64 (0.94 - 3.52)	2.13 \pm 0.78 (0.81 - 4.33)	0.75
FVC post (L)	2.1 \pm 0.62 (1 - 3.54)	2.17 \pm 0.78 (0.76 - 4.38)	0.74
Pre FEV1 (L)	1.87 \pm 0.57 (0.92 - 3.19)	1.65 \pm 0.63 (0.51 - 4.43)	0.03
Post FEV1 (L)	1.98 \pm 0.59 (0.98 - 3.34)	1.85 \pm 0.66 (0.6 - 3.57)	0.31
Pre FEV1/FVC (%)	93.16 \pm 4.47 (82 - 100)	76.77 \pm 7.36 (50.4 - 85.11)	<0.001
Post FEV1/FVC (%)	93.93 \pm 4.64 (79.89 - 100)	85 \pm 7.54 (59.81 - 100)	<0.001
DEP pre (L)	4.78 \pm 1.56 (1.62 - 8.94)	3.89 \pm 1.6 (1.18 - 9)	0.002
DEP post (L)	4.99 \pm 1.63 (1.97 - 9.91)	4.35 \pm 1.75 (1 - 9.89)	0.042
Δ FEV (ml)	102.91 \pm 108.74 (-180 - 540)	205.85 \pm 178.24 (-70 - 730)	<0.001
Δ DEP (ml)	222.84 \pm 510.45 (-1210 - 1720)	460 \pm 578.66 (-1370 - 1980)	0.008

Parameters illustrating flow rates (FEV1, PEF, and their variation Δ) and the FEV1/FVC ratio were significantly lower in children with obstruction. However, this difference disappeared after administration of beta2-mimetics for FEV1. The comparison between the two groups is justified by the observed matching of age and height; there is no difference between these two parameters.

The comparison by sex, in obstructive patients, of anthropometric and spirometric data is presented in **Table 5**.

Table 5. Comparison according to sex, in obstructive patients of anthropometric and spirometric data.

	Girls (N = 17) mean \pm stdev (values)	Boys (N = 24) mean \pm stdev (values)	P
Age (years)	10 \pm 1.97 (6 - 14)	10.41 \pm 2.62 (6 - 14)	0.583
Weight (kg)	38.4 \pm 15.27 (21.8 - 61.1)	33.53 \pm 9 (17.6 - 51)	0.508
Size (cm)	145 \pm 13.5 (118 - 170)	142 \pm 14.8 (113 - 168)	0.512
CVF pre (L)	2.1 \pm 0.82 (0.81 - 4)	2.16 \pm 0.77 (1 - 4.33)	0.781
FVC post (L)	2.11 \pm 0.84 (0.76 - 4.1)	2.22 \pm 0.75 (1.07 - 4.38)	0.667
Pre FEV1 (L)	1.65 \pm 0.64 (0.51 - 3.19)	1.64 \pm 0.64 (0.6 - 3.43)	0.966
Post FEV1 (L)	1.84 \pm 0.72 (0.6 - 3.43)	1.86 \pm 0.64 (0.64 - 3.57)	0.891
Pre FEV1/FVC (%)	78.82 \pm 5.71 (62.96 - 85.11)	75.31 \pm 8.11 (50.41 - 84.18)	0.098
Post FEV1/FVC (%)	86.85 \pm 5.36 (73.82 - 94.73)	83.81 \pm 8.65 (59.81 - 100)	0.234
DEP pre (L)	3.91 \pm 1.72 (1.66 - 9.02)	3.87 \pm 1.55 (1.18 - 7.77)	0.945
DEP post (L)	4.38 \pm 1.88 (1.57 - 9.89)	4.32 \pm 1.69 (1 - 7.97)	0.924

Continued

Δ FEV (ml)	183.53 \pm 196 (-70 - 730)	221.66 \pm 166.98 (10 - 650)	0.397
Δ DEP (ml)	470.58 \pm 492.18 (-250 - 1390)	452.5 \pm 643.19 (-1370 - 1980)	0.923

In asthmatics, age, weight, and height significantly influenced all isolated parameters. When considering relative values (FEV1/FVC, percentage increase in FEV1 and PEF), only the FEV1/FVC ratio before bronchodilator administration tended to be negatively correlated with age ($r = -0.51$; $p = 0.073$) and with height ($r = -0.49$; $p = 0.083$). This trend was not noted with weight ($r = -0.37$; $p = 0.2$) (Table 6).

Table 6. Correlations between spirometric and anthropometric data in asthmatics.

	Correlations in asthmatics (r; p)		
	Age	Weight	Height
CVF pre (L)	0.843; 0.0002	0.776; 0.001 84	0.83; 0.0003
FVC post (L)	0.83; 0.0003	0.833; 0.0004	0.930; 0.000 004
Pre FEV1 (L)	0.73; 0.004	0.686; 0.009 59	0.73; 0.004
Post FEV1 (L)	0.80; 0.0009	0.793; 0.001	0.88; 0.000 05
Pre FEV1/FVC (%)	-0.51; 0.073	-0.37; 0.2	-0.49; 0.083
Post FEV1/FVC (%)	-0.34; 0.251	-0.33; 0.26	-0.41; 0.15
DEP pre (L)	0.66; 0.01	0.58; 0.03	0.71; 0.006
DEP post (L)	0.763; 0.0024	0.61; 0.025	0.79; 0.001
Δ FEV (ml)	0.23; 0.44	0.31; 0.29	0.42; 0.15
Δ DEP (ml)	0.41; 0.16	0.21; 0.48	0.37; 0.2

4. Discussion

4.1. Medical History and Indications

In our study population, 24.5% of patients had a history of asthma, and 50.3% of patients were referred with a suspicion of asthma. Some of these patients, even if they could not confirm it, had received treatment for asthma. This could influence the results obtained in spirometry, reducing the number of positive diagnoses.

Thus, the results of our study show a lower prevalence of asthma than that reported by Ninterese *et al.* in a study conducted at Albert Royer Children's Hospital in Dakar, with 83.4% of patients having a history of asthma [10]. This difference could be explained by several factors, including the diagnostic criteria used, the characteristics of the study population, and selection bias. Indeed, the high proportion of reported asthma history by Ninterese could be due to a preferential inclusion of children already being followed for this pathology.

4.2. Sociodemographic and Anthropometric Data

The mean age of our study population was (10.3 \pm 2.51) years, which is comparable to the results of Diouf *et al.*, who had a mean age of 9 years, in a study at Albert Royer Children's Hospital in Dakar [11]. Ba *et al.* found a mean age of 7.5 years

in Senegal [12].

The male predominance (54.3%) observed in our study agrees with the majority of studies on childhood asthma in Senegal, which have also shown a predominance in favor of boys, with a rate of 56.3% [13] [14]. However, this predominance gradually decreases with age. This observation was made by Schatz and also Kynyk, who found that girls represented only 40% of asthmatics in the pediatric population, while in adults, they represented 68% [15] [16].

While hormonal influence is often cited, other factors such as allergen exposure, genetic, environmental, and behavioral factors (physical activity, smoke exposure) could also contribute to this difference [17]-[19]. It would be interesting to explore these factors in more detail in future studies.

The average height of our population was 143.95 ± 14.71 , and the average weight was 36.32 ± 13.58 . The anthropometric characteristics of our population agree with those reported in other Senegalese studies, with a slight predominance of younger children. These differences can be explained by the inclusion criteria of the different studies and by the specific characteristics of each center. The observed variations according to age and sex agree with the literature and reflect normal growth processes.

4.3. Spirometric Data

When analyzing their files after spirometry, according to GINA criteria, we found 8.61% of asthmatics. Bronchial obstruction was present in 27.15% of patients based on the FEV1/FVC ratio. As expected, FEV1, PEF, and their variation (Δ), as well as the FEV1/FVC ratio, were significantly lower in children with obstruction. However, this difference decreased after administration of beta2-mimetics for FEV1.

In subjects with obstruction, 13 of them had a significant improvement in FEV1 after bronchodilation, representing a reversibility rate of 31.71%. In a study by Pfitzenmeyer *et al.*, obstruction was reversible in 50% of cases [20].

The low rate of asthma diagnosed according to GINA criteria could be explained by several factors. First, the GINA criteria were developed primarily in Western populations and may not be perfectly adapted to our context. Indeed, environmental, genetic, and socioeconomic factors specific to Senegal could influence the clinical presentation of asthma and response to treatments. Moreover, it is possible that some patients had already received treatment before the functional tests were performed, which could mask bronchial obstruction. However, in other GINA recommendations, the use of the diurnal variation of PEF or FEV1 in the same patient could be more contributory. We observed, moreover, that after bronchodilation, there was no longer a difference in FEV1 between obstructive and non-obstructive subjects.

The more recent GLI (Global Lung Function Initiative) standards offer an interesting alternative for the diagnosis of bronchial obstruction. They are based on broader reference values and consider the age and sex of patients [21]. The use of

these standards could improve the accuracy of the diagnosis and better compare our results with those of other studies.

Several studies have been conducted with varying results in terms of obstruction. Thus, in France, 20.3% of subjects with obstruction were found [22], a slightly lower rate than in our study. Rates of bronchial obstruction were found in the Democratic Republic of Congo at 11.6% in 3869 children, in Poland at 19.7% in 755 subjects [23], and in Casablanca at 15.5% for 744 patients [24].

Lung volumes and flows taken in isolation were positively and significantly correlated with age, weight, and height. This is a classic finding in the study of the determinants of spirometric parameters. Among the relative values, only the FEV1/FVC ratio tended to be negatively correlated with age ($r = -0.51$; $p = 0.073$) and with height ($r = -0.49$; $p = 0.083$).

In children, due to growth, it is normal for age and height to evolve in the same direction. The severity of obstruction in older children could be explained, in part, by greater exposure to pollutants and allergens and by the possible expression of genetic factors.

Differences in bronchial obstruction between children aged 5 - 11 and adolescents aged 12-14 with asthma can be attributed to a combination of factors:

- Lung Development: Younger children have smaller airways and ongoing alveolar growth, affecting bronchial responsiveness.
- Hormonal Changes: Puberty in adolescents introduces hormonal influences (e.g., sex hormones) on lung function and airway inflammation.
- Environmental Exposure: Adolescents have longer exposure durations and potentially different exposure types (e.g., smoking, sports) compared to younger children.
- Asthma Phenotypes: Age groups may differ in the distribution and evolution of asthma phenotypes (e.g., allergic, non-allergic, exercise-induced).
- Genetic Factors: Age-related variations in gene expression and gene-environment interactions can influence asthma severity.
- Treatment Response: Differences in airway anatomy and physiology can lead to age-specific variations in response to bronchodilators and inhaled corticosteroids.

On the other hand, the trend noted for age and height was not found for weight ($r = -0.37$; $p = 0.2$), which, alone, is not a determinant of lung volumes and capacities. BMI, which includes height, could have a negative influence and be used in a study conducted in adults [25]. Some authors have agreed with this approach by using this parameter in children [26].

5. Limitations of the Study

The limitations of our study primarily include the relatively small sample size, which may limit the statistical power of our results. Additionally, we did not collect detailed data on the patients' family history of asthma, environmental exposures (e.g., air pollution, allergens, secondhand smoke), or socioeconomic factors

(e.g., poverty, overcrowding, access to healthcare), a factor that could influence the development of asthma.

This lack of data limits our ability to thoroughly analyze the complex factors contributing to asthma development and severity in this population. Consequently, we cannot accurately determine the relative influence of genetic versus environmental factors on asthma prevalence. Furthermore, the absence of family history data precludes assessment of genetic predisposition's role in the disease.

Therefore, future research is needed to better understand the evolution of respiratory function in Senegalese children with asthma and to evaluate the effectiveness of treatments. The search for specific biomarkers could also allow for earlier identification of children at risk and for the personalization of treatments.

To improve asthma outcomes in Senegalese children, the following recommendations are proposed:

Epidemiological Studies are needed to assess the impact of environmental exposures (e.g., air pollution, allergens, secondhand smoke) and socioeconomic factors (e.g., poverty, overcrowding) on asthma development and severity. Also, it is important to explore traditional beliefs and practices related to asthma and their influence on care-seeking behaviors. Furthermore, developing active asthma screening strategies for at-risk populations (e.g., children and individuals with environmental risk factors) should be provided. We also need to develop and validate asthma diagnostic tools tailored to resource-limited Senegalese healthcare settings.

Implementing these recommendations will contribute to a better understanding, diagnosis, and management of asthma in Senegalese children, ultimately reducing the burden of this disease.

6. Conclusions

In conclusion, this study examined the anthropometric and spirometric characteristics of a population of 151 children, a significant proportion of whom presented signs of asthma or obstructive syndrome. These results underscore the importance of screening for and managing respiratory disorders in children, particularly in at-risk populations.

Senegal faces significant challenges in asthma diagnosis due to limited access to diagnostic tools like spirometry and a lack of public awareness. Critically, research on the interplay of genetic and environmental factors in the Senegalese population is scarce. Therefore, further research is urgently needed to identify population-specific risk factors and develop effective prevention and management strategies tailored to the unique context of Senegal.

The low rate of asthma diagnosed according to GINA criteria leads us to question the universal applicability of these criteria. Our results highlight the need to adapt diagnostic and management strategies for asthma to the specific context of developing countries. It is, therefore, crucial to establish reference spirometry standards adapted to our populations, which would allow for harmonization of

the interpretation of respiratory function test results. Close collaboration between physiologists, pulmonologists, and pediatricians is essential to carry out this research on pulmonary function.

Further studies, with larger samples and longitudinal follow-ups, would be necessary to better understand the evolution of these disorders and evaluate the effectiveness of interventions.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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