

Summary of childhood asthma guidelines, 2021: A consensus document

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Asthma is the most common chronic illness of childhood. The prevalence is rising and the mortality and morbidity from asthma are unacceptably high in South Africa. It is important to make a correct diagnosis based, most importantly, on the clinical history and supported by investigations. The appropriate drug and device must be chosen to achieve good asthma control. Patients must be followed up regularly and their asthma control must be assessed. The treatment can then be adjusted according to the level of control. The COVID-19 pandemic has placed new challenges on the care of our asthmatics. Asthma education and adherence are important components of management of the condition.

S Afr Med J 2021;111(5):395-399. <https://doi.org/10.7196/SAMJ.2021.v111i5.15703>

The South African Childhood Asthma Working Group (SACAWG), a sub-committee of the Allergy Society of South Africa (ALLSA), first published its guidelines for the management of chronic asthma in children and adolescents in 1992, followed by revisions in 1994, 2000 and 2009.^[1-8] In the interim, there have been a number of key changes in the diagnostic criteria (particularly in young children, assessment of asthma control, management principles, new drugs, new drug-delivery devices and assessment of asthma control and risk). This new updated consensus statement attempts to provide an update on the management of childhood asthma, incorporating new information and including a section on COVID-19. The full document appears on the ALLSA website (<https://allsa.org>).

Asthma prevalence

Asthma is the most common chronic respiratory disorder in childhood. The prevalence of asthma in childhood is high and is rising. Asthma is underdiagnosed and undertreated.

Asthma diagnosis

Asthma should be diagnosed in children who present with episodes of variable expiratory airflow limitation. It remains a largely clinical diagnosis, which should be supported by lung function testing in school-aged children. The symptoms may include episodic wheeze (due to bronchoconstriction), shortness of breath, difficult

or laboured breathing, chest tightness and reduced activity with or without cough. The intensity varies over time and symptoms improve after correct use of a rapid-acting inhaled bronchodilator. The symptoms are not specific to asthma, and other conditions may mimic the condition. Chronic airway inflammation and variable expiratory airflow limitation define asthma. We propose the following four steps to guide the clinician.

Children <6 years of age

Step 1. History taking

This is the most important step. The inception of asthma is associated with a number of risk factors (refer to the main document on the ALLSA website: <https://allsa.org>).

The history regarding the features of episodes of wheezing assists in the diagnosis:

- **Variable airflow limitation.** A history of (preferably doctor-confirmed) bronchodilator-initiated improvement of wheeze would support an asthma diagnosis.
- **Severity of wheeze events.** A history of more severe wheeze (e.g. with respiratory distress or a need for oxygen supplementation) favours an asthma diagnosis, but does not exclude alternative diagnoses.
- **Frequency and duration of episodes.** Events that occur more frequently (>3 episodes per year) and that last longer (>10 days at

a time) may indicate an asthma diagnosis, but will not exclude an alternative reason.

- **Temporal pattern of symptoms.** Wheeze that does not only occur during airway infections, but also in response to other triggers in-between infections, supports an asthma diagnosis. Events that persist after 3 years of age, night-time worsening, an association with exercise or environmental change (e.g. cold air exposure) further support an asthma diagnosis.

Step 2. Exclude an alternative reason for wheezing episodes

The aim of the clinical examination is not only to find signs of asthma and other features of atopic disease (atopic dermatitis, allergic rhinitis, etc.) that may support an asthma diagnosis, but also to look for clinical findings that would indicate an alternative reason to wheeze (such as digital clubbing, growth faltering, asymmetric wheeze) (Table 1).

Step 3. Assess inflammation

Clinical features of other atopic disease (such as atopic dermatitis and allergic rhinitis) and the presence of allergen-specific IgE (through skin-prick testing or ImmunoCAP (ThermoFisher Scientific, USA)) may support an asthma diagnosis. A pragmatic therapeutic trial will confirm the presence of corticosteroid-responsive inflammation (Table 2).

A step-wise trial of correctly administered low-dose inhaled corticosteroid (ICS) should be followed when starting treatment in

any child with a wheezing disorder. Treatment should be viewed as a *therapeutic trial* and the initial treatment response must be evaluated in 6 - 8 weeks.^[9-12] If there is no clinical response to correctly administered ICS therapy, it should be discontinued, and the child investigated further. Symptoms that resolve during ICS therapy may be due to the natural history of a preschool wheezing disorder or to an effect of treatment. This must be distinguished by again withdrawing treatment. Treatment should only be restarted if symptoms recur. An ongoing benefit of ICS treatment should be reviewed every 3 months and the ICS kept at the lowest possible dose for symptom control.^[10-15]

Step 4. Seek objective evidence of variable expiratory airflow limitation

A clinical assessment of the response to a correctly administered rapid-acting inhaled bronchodilator can be helpful. The clinician should pursue every opportunity to document improvement in wheeze and hyperinflation after the administration of a rapid-acting inhaled bronchodilator. The more it is confirmed clinically, the more likely that the correct diagnosis is asthma (Table 3).

Children 6 - 11 years of age

For children 6 - 11 years of age, the same steps as for younger children should be followed (Table 4). A proper history, exclusion of an alternative reason to wheeze and an assessment for inflammation should be undertaken. Objective evidence of variable expiratory airflow limitation can then be demonstrated and should ideally be

Table 1. Differential diagnosis of asthma in children <6 years of age

Infective	Structural	Functional
Bronchiolitis	Trachea and bronchomalacia	Wheezy phenotypes
Atypical infection	Tracheal webs	Primary ciliary dyskinesia
Bacterial airway infection	Tracheal and bronchial stenosis	
Laryngotracheobronchitis	Lymphadenopathy	Cystic fibrosis
	Tumours	
	Vascular compression	Gastro-oesophageal reflux disease
	Double aortic arch	
	Innominate artery compression	
	Left pulmonary artery sling	
	Patent ductus arteriosus ligament	
	Cardiac chamber or pulmonary artery enlargement	
Protracted bacterial bronchitis	Cystic lesions and masses	Retained foreign body
	H-type tracheo-oesophageal fistula	Pulmonary oedema/cardiac disease
	Laryngeal clefts	Interstitial lung disease
		Bronchiolitis obliterans
		Bronchopulmonary dysplasia
		Bronchiectasis
		Immunodeficiency
		Perceived tight chest

Table 2. Management of persistent asthma in children ≤6 years of age^[9,17]

Intermittent asthma	Management of persistent asthma			
Step 1	Step 2	Step 3	Step 4	Step 5
SABA* and short course (7 - 10 days) of ICS at start of URTI	Daily low-dose ICS and SABA*	Medium-dose ICS, or, in children >4 years of age, daily low-dose ICS/LABA and SABA*	Daily medium-dose ICS/LABA and SABA* or medium-dose ICS plus LTRA	Refer to specialist

SABA = short-acting beta-2 agonist; ICS = inhaled corticosteroid; URTI = upper-respiratory tract infection; LABA = long-acting beta-agonist; LTRA = leukotriene-receptor antagonist. *As needed.

done before commencement of controller therapy. Peak expiratory flow (PEF) measurements or, preferably, spirometry can be used (Table 3).^[15] Normal test results do not exclude the diagnosis of asthma.^[14] Where the history is suggestive of asthma, and the spirometry does not support the diagnosis, other specialised tests, such as exercise bronchoprovocation or methacholine challenge, may be done by a pulmonologist to confirm the diagnosis.

Goals of asthma treatment

The long-term goals of asthma management include the following:

- to achieve good symptom control
- to maintain normal activity levels
- to minimise future risk of asthma-related mortality
- to reduce exacerbations
- to maintain lung function and normal lung development
- to minimise side-effects of treatment
- to provide a written action plan
- to consider the patient's own goals with regard to treatment.

The goals of asthma management can only be achieved through an appropriate understanding between the patient, parent/caregiver and medical team. A cycle of *assess* (diagnosis, symptom control, risk factor assessment, medication technique and adherence), *adjust treatment*

(medications, non-pharmacological strategies, treatment of modifiable risk factors) and *review response* (medication effects and side-effects), in combination with education of both the parent/caregiver and the child with regard to effective inhaler use, adherence, symptom monitoring and a written personalised action plan, should be done during every visit.

Asthma management

This involves avoidance of triggers, and pharmacological treatment.

Avoidance of triggers

Asthma triggers, such as exercise, are difficult to avoid. However, all attempts should be made to reduce exposure to avoidable triggers, particularly where a clear association between exposure and symptoms is seen:

- environmental tobacco smoke and other indoor air pollutants
- control of indoor allergens, such as house-dust mites, pets, cockroach and mould allergy.

Treatment

Principles of asthma treatment

- Decide on the level of severity (Table 5).
- Choose the treatment, based on severity (Tables 6 - 8).

Table 3. Confirmation of variable airflow limitation with peak expiratory flow or spirometry^[15]

Confirmation of variable expiratory airflow limitation

For PEF measurements

- PEF variability with an average daily diurnal variability >13% when documented twice daily for 2 weeks
- Positive exercise challenge test with decrease in PEF >15% after reaching target heart rate (0.8 × 220 minus age in years)
- Excessive variation of PEF >15% between outpatient visits (using the same equipment) with or without airway infections

For spirometry measurements

- Decreased FEV₁/FVC ratio due to decreased FEV₁ (normal ratio >0.9)
- Positive bronchodilator reversibility with increase in FEV₁ >12%
- Positive exercise challenge test with decrease in FEV₁ >12% after reaching target heart rate (0.8 × 220 minus age in years)
- Excessive variation of FEV₁ >12% between outpatient visits (using the same equipment) with or without airway infections

PEF = peak expiratory flow; FEV₁ = forced expiratory volume; FVC = forced vital capacity.

Table 4. Management of persistent asthma in children 6 - 11 years of age^[9,17]

Intermittent asthma	Management of persistent asthma			
Step 1	Step 2	Step 3	Step 4	Step 5
SABA* and short course (7 - 10 days) of ICS at start of URTI or daily low-dose ICS	Daily low-dose ICS and SABA* or LTRA or low-dose ICS when SABA is taken	Daily and as-needed low-dose ICS/ LABA (formoterol) combination or low-dose ICS/ LTRA	Daily and as-needed medium-dose ICS/LABA (formoterol) combination or high-dose ICS/LABA or add LTRA or add tiotropium	Refer for expert advice for assessment for anti-IgE therapy or other biologic therapy or daily and as-needed high-dose ICS/LABA combination plus LRTA

SABA = short-acting beta-2 agonist; ICS = inhaled corticosteroid; URTI = upper-respiratory tract infection; LTRA = leukotriene-receptor antagonist; LABA = long-acting beta-agonist. *As needed.

Table 5. Classification of asthma severity based on symptoms and lung function presenting for the first time without treatment^[16]

	Mild intermittent (step 1)	Mild persistent (step 2)	Moderate persistent (step 3)	Severe persistent (step 4)
Symptoms	≤2/week	>2/week	Daily symptoms	Continual symptoms
Night-time symptoms	≤2/month	>2/month	>1/week	Frequent
PEF (predicted), %	≥80 predicted	≥80 predicted	>60 - ≤80	≤60
PEFR variability, %	<20	20 - 30	>30	>30

PEF = peak expiratory flow; PEFR = peak expiratory flow rate.

Table 6. Preferred low-dose inhaled corticosteroid in children <5 years of age

Inhaled corticosteroid	Total daily inhaled dose, µg
Beclomethasone dipropionate (HFA)	100
Budesonide (pMDI and spacer)	200
Budesonide (nebulised)	500
Fluticasone propionate (HFA)	100

HFA = hydrofluoroalkane; pMDI = pressurised metered-dose inhaler.

- Choose an appropriate device and delivery system.
- Start treatment.
- Review in 4 - 6 weeks.
- Assess asthma control (Table 9).
- Step up or step down treatment, depending on level of control.

Metered-dose inhalers

The most common asthma pump is the metered-dose inhaler (MDI), preferably with a spacer. Spacers comprise a simple holding chamber with or without a valve. The medication is suspended within the

Table 7. Estimated equipotent daily dosage of inhaled corticosteroid for children 6 - 11 years of age

Drug	Low daily dose, µg	Medium daily dose, µg	High daily dose, µg
Children 6 - 11 years of age			
Beclomethasone dipropionate	100 - 200	200 - 400	>400
Budesonide*	100 - 200	200 - 400	>400
Ciclesonide*†	80	80 - 160	>160
Fluticasone propionate‡	100 - 200	200 - 500	>500
Mometasone furoate	110 - 220	220 - 440	>440
Triamcinolone acetonide	400 - 800	800 - 1 200	>1 200
Adolescents ≥12 years of age			
Beclomethasone dipropionate HFA§	100 - 200	>200 - 400	>400
Budesonide*	200 - 400	>400 - 800	>800
Ciclesonide	80 - 160	>160 - 320	>320
Fluticasone propionate‡	100 - 250	>250 - 500	>500
Mometasone furoate	110 - 220	>220 - 440	>440

HFA = hydrofluoroalkane; CFC = chlorofluorocarbon.

*Approved for once daily dosing in patients with mild illness.

†Ciclesonide is registered for children ≥12 years of age.

‡May be used at half the dose of budesonide equivalent.

§As CFC preparations are taken off the market, medication inserts for HFA preparations should be carefully reviewed for the equivalent correct dosage.

Table 8. Combination products available in South Africa

Combination	Device	Dose, µg
Fluticasone propionate/salmeterol	DPI (Accuhaler)	100/50
		250/50
		500/50
Fluticasone propionate/salmeterol	pMDI	50/25
		125/25
		250/25
Budesonide/formoterol fumarate	pMDI	80/4.5
		160/4.5
Budesonide/formoterol fumarate	DPI (Turbuhaler)	80/4.5
		160/4.5
		320/9
Fluticasone furoate/vilanterol	pMDI	100/25
Mometasone furoate/formoterol fumarate	pMDI	100/5
Mometasone furoate/formoterol fumarate	pMDI CFC free	100/5
		200/5

pMDI = pressurised metered-dose inhaler; DPI = dry-powder inhaler; CFC = chlorofluorocarbon.

Table 9. GINA assessment of asthma control and future risk in children <5 years of age, 6 - 11 years of age, adolescents and adults

Symptom control	Well controlled	Partly controlled	Uncontrolled
In the past week, has the patient had:	None of these	1 - 2 of these	3 - 4 of these
• Daytime asthma symptoms more than twice per week?			
• Night-time awakening due to asthma?			
• Reliever (SABA) use more than twice per week?			
• Limitation of activity?			

GINA = Global Initiative for Asthma; SABA = short-acting beta-2 agonist.

spacer and then breathed in, enhancing lung deposition. A spacer is recommended for all children and adults with difficult-to-control asthma. A very effective spacer device can be constructed out of a 500 mL plastic cold-drink bottle. A hole large enough to take the mouthpiece of an MDI is cut (or burnt) in the bottom end of the bottle to form a simple low-cost non-valved spacer.

Nebulisers

Home nebulisers are not recommended for asthma management.

Dry-powder inhalers

Dry-powder inhalers (DPIs) are easy to use, but are only suitable for older children and adults because of the inspiratory flow required for their actuation. Measurements of peak inspiratory flow can be done with appropriate devices to assess suitability of DPIs.

Asthma control

Asthma control is the extent to which the effects of asthma can be seen in a patient or have been reduced or removed by treatment.^[9] Evaluation of asthma control includes two broad concepts, i.e. *symptom control* and *future risk* of adverse outcomes. Symptom control is assessed by frequency of symptoms, reliever medication use and activity limitation over the past week and month.

Future risk refers to the possibility of exacerbations, medication side-effects (oral symptoms and impaired growth in children) or loss of lung function. No test is a gold standard and all tests must be used in conjunction with a good history and clinical examination to assess control.^[18,19] After initiation of treatment, it is essential to assess asthma control at every follow-up visit, no less than 6-monthly, and to adjust treatment accordingly.

Advice for asthmatics to avoid viral-induced exacerbations

The common steps individuals take to avoid influenza and other respiratory infections also protect from the coronavirus:

- Keep a distance from others (social distancing, ~1 m).
- Avoid people who are sick.
- Avoid crowded venues.
- Wash your hands often for 20 - 30 seconds, always after coughing or sneezing.
- Disinfect surfaces, but avoid disinfectants that precipitate asthma exacerbations.

Wearing a mask to protect people from coronavirus in public spaces is now recommended by the World Health Organization (WHO), and is also endorsed for patients with asthma. There is no evidence to suggest that mask-wearing is deleterious to people with asthma.

Asthma education

Asthma education is an important part of the management of asthmatics. Patients must be informed of triggers and the need for adherence, and should be given a written treatment action plan.

Treatment adherence

Adherence to asthma treatment in the paediatric population is poor, with studies reporting only one-third of children using ICS therapy appropriately. Assessing adherence is part of the clinical assessment of the asthmatic child. Barriers to adherence may be intentional (driven by illness perceptions or medication beliefs, leading to patients and caregivers deliberately choosing not to follow treatment recommendations) or unintentional (related to family routines and socioeconomic factors).

Comorbidities

Identification and treatment of associated comorbidities may improve asthma control. These are:

- rhinitis or sinusitis
- obesity
- gastro-oesophageal reflux disease (GORD)
- Allergic bronchopulmonary aspergillosis (ABPA).

Summary of the changes

- In children <6 years of age with recurrent wheezing triggered by respiratory tract infections and no wheezing between infections, we recommend starting a short course (7 - 10 days) of daily ICS at the onset of a respiratory tract infection with an as-needed short-acting beta-2 agonist (SABA) for quick-relief therapy compared with as-needed SABA for quick-relief therapy only.
- In children 6 - 11 years of age we recommend as-needed SABA and a short course (7 - 10 days) of ICS at the start of an upper-respiratory tract infection or daily low-dose ICS.
- In children aged ≥6 years with moderate to severe persistent asthma, we recommend ICS-formoterol in a single inhaler as daily controller and reliever therapy compared with either higher-dose ICS as daily controller therapy and SABA for quick-relief or same-dose ICS-LABA as daily controller therapy and SABA for quick-relief therapy.

Declaration. None.

Acknowledgements. None.

Author contributions. All authors contributed equally to the literature review and writing of the document.

Funding. None.

Conflicts of interest. Most authors have received honoraria for speaking engagements and from pharma companies (advisory boards). Individual activities are available on request.

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Accepted 18 March 2021.