Asthma : Adults, Teenagers and Children

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ASTHMA

Adults, Teenagers and Children

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This quality of care may be dependent on the appropriate allocation of resources to practices involved in its delivery. Resource allocation by the state is variable depending on geographical location and individual practice circumstances. There are constraints in following the guidelines where the resources are not available to action certain aspects of the guidelines. Therefore, individual healthcare professionals will have to decide whether the standard is achievable within their resources particularly for vulnerable patient groups.
The guide does not however override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of individual patients in consultation with the patient and/or guardian or carer.

Guidelines are not policy documents. Feedback from local faculty and individual members on ease of implementation of these guidelines is welcomed.

Evidence-Based Medicine

Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients.

In this document you will see that evidence and recommendations are graded according to levels of evidence (Level 1 – 5) and grades of recommendations (Grades A-C) respectively. This grading system is an adaptation of the revised Oxford Centre 2011 Levels of Evidence.

Levels of Evidence

Level 1: Evidence obtained from systematic review of randomised trials
Level 2: Evidence obtained from at least one randomised trial
Level 3: Evidence obtained from at least one non-randomised controlled cohort/follow-up study
Level 4: Evidence obtained from at least one case-series, case-control or historically controlled study
Level 5: Evidence obtained from mechanism-based reasoning

Grades of Recommendations

A Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation (evidence levels 1, 2).

B Requires the availability of well-conducted clinical studies but no randomised clinical trials on the topic of recommendation (evidence levels 3, 4).

C Requires evidence obtained from expert committee reports or opinions and/or clinical experience of respected authorities. Indicates an absence of directly applicable clinical studies of good quality (evidence level 5).

Abbreviations used in the document

SABA = Short acting beta2 agonist
LABA = Long acting beta2 agonist
ICS = Inhaled corticosteroid
PEF = Peak expiratory flow
FEV1 = Forced expiratory volume in 1 second
SPT = Skin prick test
FeNO = Fractional exhaled Nitric Oxide
COPD = Chronic obstructive pulmonary disease.
OCS= Oral corticosteroids
GINA = Global Initiative for Asthma
LTRA = Leukotriene receptor agonist.
DPI =Dry powder inhaler
HFA = hydrofluoroalkane
ICU = Intensive care unit

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Introduction

Asthma is a chronic inflammatory condition of the airways characterised by recurrent episodes of wheezing, breathlessness, chest tightness and coughing. Asthma is a common and potentially serious chronic disease that imposes a substantial burden on patients, their families and the community. It causes respiratory symptoms, limitation of activity, and flare-ups (attacks) that sometimes require urgent health care and may be fatal.

There are about 450,000 patients with asthma in Ireland, which has the 4th highest prevalence of asthma in the world. The majority are managed solely in general practice, but it remains sub-optimally controlled in the majority of patients. Asthma cannot be prevented or cured but the clinical manifestations can be effectively controlled with appropriate treatment. When asthma is controlled, there should be no more than occasional recurrence of symptoms and severe exacerbations should be rare.

This revised guideline is based on the 2017-18 update of the GINA guidelines and incorporates all the clinically relevant updates since the second edition of 'Asthma Control in General Practice' in 2013.[1] The guideline provides recommendations for the diagnosis and management of asthma in patients in general practice and is a core component of the National Asthma Program. We would like to thank the GINA committee and especially Rebecca Decker in allowing us reproduce the GINA updated asthma management guidelines in this document.

The scope of the National Asthma Program is to ensure the management of asthma is based on current international evidence-based care in all care settings including primary care.[2] The aim of the Program is to reduce morbidity and mortality associated with asthma in Ireland and to improve the quality of life for all patients with asthma.

The purpose of this document is to assist the healthcare professional to improve diagnostic accuracy; assess, treat and monitor asthma; develop an asthma management plan for individual patients; optimise asthma control; and to manage exacerbations in line with approved protocols. The widespread implementation of the tools outlined in the document will be a significant factor in achieving this. This quality of care cannot be fully implemented without the appropriate allocation of resources to practices involved in its delivery.

A separate section on managing children under 6 years has been added as this group provide a challenge to manage and require special attention. The management of asthma in this group requires involvement of parents/carers in all aspects of care. Good communications and education is essential to ensure that clear goals are set early and agreement with management plans are consistent between clinician and parent/carer. The use of a therapeutic trial is an important step in establishing a diagnosis as formal testing is difficult in this age group. It is important to review the diagnosis on a regular basis and monitor the treatment and any potential side effects. The cycle of care for asthma is now part of the under 6 years GP contract and requires data returns to be made about a number of aspects of care. Children aged between 2 to 6 may be enrolled in the cycle of care.

The under 6 cycle of care has a number of parameters that are part of the dataset to be returned and include:

- Review of treatment
- Check compliance
- Check inhaler technique
- Education re reliever/preventer
- Discuss Asthma action plan
- Vaccinate where appropriate
- Smoking advise in household
- Give printed action plan

We would like to thank Teresa Curtin in the ICGP for her help with the guidelines. Again we thank the GINA committee for allowing us to reproduce much of the GINA 2018 guidelines.

Prof Pat Manning (National clinical lead – Asthma) and Dr Dermot Nolan (ICGP clinical lead- Asthma) 2019

Section 1: Making the Diagnosis

Making the Initial Diagnosis

Making the diagnosis of asthma[3], as shown in Figure 1 is based on identifying both a characteristic pattern of respiratory symptoms such as wheezing, shortness of breath (dyspnoea), chest tightness or cough, and variable expiratory airflow limitation. The pattern of symptoms is important; as respiratory symptoms may be due to acute or chronic conditions other than asthma. If possible, the evidence supporting a diagnosis of asthma (figure 2) should be documented when the patient first presents, as the features that are characteristic of asthma may improve spontaneously or with treatment; as a result, it is often more difficult to confirm a diagnosis of asthma once the patient has been started on controller treatment.

Patterns of Respiratory Symptoms that are Characteristic of Asthma:

The following features are **typical of asthma** and, if present, increase the probability that the patient has asthma:

- More than one symptom (wheeze, shortness of breath, cough, chest tightness), especially in adults
- Symptoms often worse at night or in the early morning
- Symptoms vary over time and in intensity
- Symptoms are triggered by viral infections (colds), exercise, allergen exposure, changes in weather, laughter, or irritants such as car exhaust fumes, smoke or strong smells

The following features **decrease the probability** that respiratory symptoms are due to asthma:

- Isolated cough with no other respiratory symptoms
- Chronic production of sputum
- Shortness of breath associated with dizziness, light-headedness or peripheral tingling (paraesthesia)
- Chest pain
- Exercise-induced dyspnoea with noisy inspiration

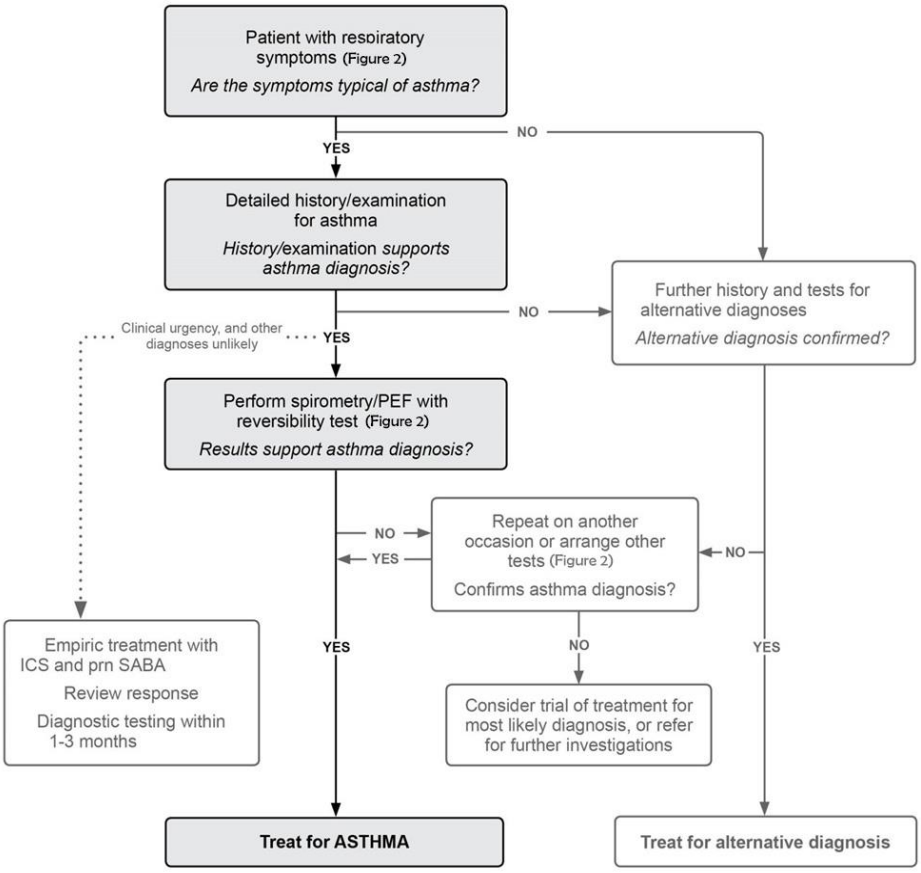

Figure 1: *Diagnostic flowchart for clinical practice – initial presentation*

History and Family History

Commencement of respiratory symptoms in childhood, a history of allergic rhinitis or eczema, or a family history of asthma or allergy, increases the probability that the respiratory symptoms are due to asthma. However, these features are not specific for asthma and are not seen in all asthma phenotypes. Patients with allergic rhinitis or atopic dermatitis should be asked specifically about respiratory symptoms.

Physical Examination

Physical examination in people with asthma is often normal. The most frequent abnormality is expiratory wheezing (rhonchi) on auscultation, but this may be absent or only heard on forced expiration.

Wheezing may also be absent during severe asthma exacerbations, due to severely reduced airflow (so called 'silent chest'), but at such times, other physical signs of respiratory failure are usually present. Examination of the nose may reveal signs of allergic rhinitis or nasal polyposis.

Lung Function Testing to Document Variable Expiratory Airflow Limitation

Asthma is characterized by variable expiratory airflow limitation, i.e. expiratory lung function varies over time and in magnitude to a greater extent than in healthy populations. In asthma, lung function may vary between

completely normal and severely obstructed in the same patient. Objective confirmation of asthma is a vitally important step to confirm the diagnosis of asthma and should ideally be performed prior to commencement of treatment. Spirometry shows an obstructive pattern with reversibility is the gold standard in making the diagnosis but requires time and expertise. Peak flow measurement is more widely available in general practice and patients should be encouraged to have their own device to monitor their own asthma.

Specific criteria for demonstrating excessive variability in expiratory lung function are listed in Figure 2.

If spirometry is not available, or variable airflow limitation is not documented, a decision about whether to investigate further or start controller treatment immediately depends on clinical urgency and access to other tests.

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable expiratory airflow limitation.	
Diagnostic Feature	Criteria for Making the Diagnosis of Asthma
1. History of variable respiratory symptoms	
Wheeze, shortness of breath, chest tightness and cough Descriptors may vary between cultures and by age, e.g. children may be described as having heavy breathing	• Generally, more than one type of respiratory symptom (in adults, isolated cough is seldom due to asthma) • Symptoms occur variably over time and vary in intensity • Symptoms are often worse at night or on waking • Symptoms are often triggered by exercise, laughter, allergens, cold air • Symptoms often appear or worsen with viral infections
2. Confirmed variable expiratory airflow limitation	
Documented excessive variability in lung function (one or more of the tests below) AND documented airflow limitation	The greater the variations, or the more occasions excess variation is seen, the more confident the diagnosis At least once during diagnostic process when FEV_1 is low, confirm that FEV_1/FVC is reduced (normally >0.75–0.80 in adults, >0.90 in children)
Positive bronchodilator (BD) reversibility test (more likely to be positive if BD medication is withheld before test: SABA ≥4 hours, LABA ≥15 hours)	*Adults*: increase in FEV_1 of >12% and >200 mL from baseline, 10–15 minutes after 200–400 mcg salbutamol or equivalent (greater confidence if increase is >15% and >400 mL). *Children*: increase in FEV_1 of >12% predicted
Excessive variability in twice-daily PEF over 2 weeks	*Adults*: average daily diurnal PEF variability >10% *Children*: average daily diurnal PEF variability >13%
Significant increase in lung function after 4 weeks of anti-inflammatory treatment	*Adults*: increase in FEV_1 by >12% and >200 mL (or PEF by >20%) from baseline after 4 weeks of treatment, outside respiratory infections
Excessive variation in lung function between visits (less reliable)	*Adults*: variation in FEV_1 of >12% and >200 mL between visits, outside of respiratory infections *Children*: variation in FEV_1 of >12% in FEV_1 or >15% in PEF between visits (may include respiratory infections)

Figure 2: *Diagnostic criteria for asthma in adults, adolescents, and children 6–11 years*

Other Tests

Allergy Tests

The presence of atopy increases the probability that a patient with respiratory symptoms has allergic asthma, but this is not specific for asthma. Atopic status can be identified by skin prick testing or by measuring the level of specific immunoglobulin E (sIgE) in a blood test. Skin prick testing(SPT) can be safely performed in general practice. Measurement of sIgE is no more reliable than skin tests and is more expensive, but may be preferred for uncooperative patients, those with widespread skin disease or when SPTs are not available.

Exhaled Nitric Oxide

Measurement of the fractional concentration of exhaled nitric oxide (FENO) is a new method of measuring eosinophil activity in the lung. It has shown promise as a diagnostic tool to identify patients who may respond better to inhaled steroids[4]. It is not widely available in Irish general practice currently.

Making the Diagnosis of Asthma in Special Populations

Patients presenting with cough as the only respiratory symptom

Diagnoses to be considered are cough variant asthma, cough induced by angiotensin converting enzyme (ACE) inhibitors, gastroesophageal reflux, chronic upper airway cough syndrome (often called 'postnasal drip'), chronic sinusitis, and vocal cord dysfunction[5]. Cough as a sole feature of asthma in adults is rare and may require consideration of other causes.

Occupational asthma and work-aggravated asthma

Asthma acquired in the workplace is frequently missed. Asthma may be induced or (more commonly) aggravated by exposure to allergens or other sensitizing agents at work. Occupational rhinitis may precede asthma by up to a year and early diagnosis is essential, as persistent exposure is associated with worse outcomes.

An estimated 5–20% of new cases of adult-onset asthma can be attributed to occupational exposure[6]. Adult-onset asthma requires a systematic inquiry about work history and exposures, including hobbies. Asking patients whether their symptoms improve when they are away from work (weekends or vacation) is an essential screening question. It is important to confirm the diagnosis of occupational asthma objectively as it may lead to the patient changing their occupation, which may have legal and socioeconomic implications. Specialist referral is usually necessary, and frequent PEF monitoring at and away from work is often used to help confirm the diagnosis.

Smokers and ex-smokers

Asthma and COPD may be difficult to distinguish in clinical practice, particularly in older patients and smokers and ex- smokers, and these conditions may overlap (asthma-COPD overlap, or ACO). The Global Strategy for Diagnosis, Management and Prevention of COPD (GOLD) defines COPD on the basis of chronic respiratory symptoms, exposure to a risk factor such as smoking, and lack of reversibility.

However, bronchodilator reversibility (>12% and >200 mL) is found in some COPD patients, and uncertainty in the diagnosis should prompt early referral for specialized investigation and treatment recommendations, as patients with asthma-COPD overlap have worse outcomes than those with asthma or COPD alone.

Assessment of Asthma

Overview

For every patient, assessment of asthma should include areas:

1. Control
2. Treatment issues
3. Comorbidities

Asthma control has two domains: symptom control and future risk of adverse outcomes (Figure 3). Both should be assessed.

1. Assess Asthma Control = Symptom Control and Future Risk of Adverse Outcomes
• Assess symptom control over the last 4 weeks. (Fig 4 A) • Identify any other risk factors for exacerbations, fixed airflow limitation or side-effects. (Fig 4 B) • Measure lung function at diagnosis/start of treatment, 3–6 months after starting controller treatment, then periodically
2. Assess Treatment Issues
• Document the patient's current treatment step • Watch inhaler technique, assess adherence and side-effects • Check that the patient has a written asthma action plan • Ask about the patient's attitudes and goals for their asthma and medications
3. Assess Comorbidities
• Rhinitis, gastroesophageal reflux, obesity, obstructive sleep apnea, depression and anxiety can contribute to symptoms and poor quality of life, and sometimes to poor asthma control

Figure 3: *Assessment of asthma in adults, adolescents, and children 6–11 years*

Assessing Asthma Symptom Control

Asthma symptom control tools for adults, adolescents and children 6–11 years of age

A. Asthma Symptom Control	Level of Asthma Symptom Control		
In the past 4 weeks, has the patient had:	Well controlled	Partly controlled	Uncontrolled
Daytime asthma symptoms more than twice/week? Yes☐ No☐ Any night waking due to asthma? Yes☐ No☐ Reliever needed for symptoms* more than twice/week? Yes☐ No☐ Any activity limitation due to asthma? Yes☐ No☐	None of these	1–2 of these	3–4 of these

B. Risk Factors for Poor Asthma Outcomes	
Assess risk factors at diagnosis and periodically, particularly for patients experiencing exacerbations. Measure FEV_1 at start of treatment, after 3–6 months of controller treatment to record the patient's personal best lung function, then periodically for ongoing risk assessment.	
Potentially modifiable independent risk factors for flare-ups (exacerbations) • Uncontrolled asthma symptoms • High SABA use (with increased mortality if >1 x 200-dose canister/month) • Inadequate ICS: not prescribed ICS; poor adherence; incorrect inhaler technique • Low FEV_1, especially if <60% predicted • Major psychological or socioeconomic problems • Exposures: smoking; allergen exposure if sensitized • Comorbidities: obesity; rhinosinusitis; confirmed food allergy • Sputum or blood eosinophilia, elevated FeNO (in adults with allergic asthma) • Pregnancy Other major independent risk factors for flare-ups (exacerbations) • Ever intubated or in intensive care unit for asthma • ≥1 severe exacerbation in last 12 months	Having one or more of these risk factors increases the risk of exacerbations even if symptoms are well controlled.
Risk factors for developing fixed airflow limitation • Lack of ICS treatment • Exposures: tobacco smoke; noxious chemicals; occupational exposures • Low initial FEV_1; chronic mucus hypersecretion; sputum or blood eosinophilia	
Risk factors for medication side-effects • *Systemic*: frequent OCS; long-term, high dose and/or potent ICS; also taking P450 inhibitors • *Local*: high-dose or potent ICS, poor inhaler technique	

**Excluding use pre sport.*

Figure 4: *GINA assessment of asthma control in adults, adolescents and children 6–11 years*

Section 2: Medications and Strategies for Symptom Control and Risk Reduction

Initial Controller Treatment

For the best outcomes, regular daily controller treatment should be initiated as soon as possible after the diagnosis of asthma is made, as the evidence suggests that:

- Early initiation of low dose ICS in patients with asthma leads to a greater improvement in lung function than if symptoms have been present for more than 2–4 year. Patients not taking ICS who experience a severe exacerbation have a greater long-term decline in lung function than those who have already started ICS
- For patients with occupational asthma, early removal from exposure to the sensitizing agent and early treatment increase the probability of recovery

The patient's response should be reviewed, and treatment stepped down once good control is achieved.

Based on current evidence, GINA recommends treatment with low-dose ICS for most patients with asthma, even those with infrequent symptoms to reduce the risk of serious exacerbations.

Stepwise Approach for Adjusting Asthma Treatment in Adults, Adolescents and Children 6–11 Years' Old

Once asthma treatment has been commenced, ongoing treatment decisions are based on a cycle

1. Assessment (Diagnosis, symptom control, inhaler technique and patient preference)
2. Adjustment of treatment (Medications, Non pharmacological strategies and risk factors)
3. Review of the response (Symptoms, Flare ups, Side effects, lung function, Patient satisfaction)

Controller medication is adjusted up or down in a stepwise approach (Figure 5) to achieve good symptom control and minimize future risk of exacerbations. Once good asthma control has been maintained for 2–3 months, treatment may be stepped down in order to find the patient's minimum effective treatment

If a patient has persisting symptoms and/or exacerbations despite 2–3 months of controller treatment, assess and correct the following common problems before considering any step up in treatment:

- Incorrect inhaler technique
- Poor adherence
- Persistent exposure at home/work to agents such as allergens, tobacco smoke, indoor or outdoor air pollution, or to medications such as beta-blockers or (in some patients) non-steroidal anti-inflammatory drugs (NSAIDs)
- Comorbidities that may contribute to respiratory symptoms and poor quality of life
- Incorrect diagnosis

Summary of Treatment Steps

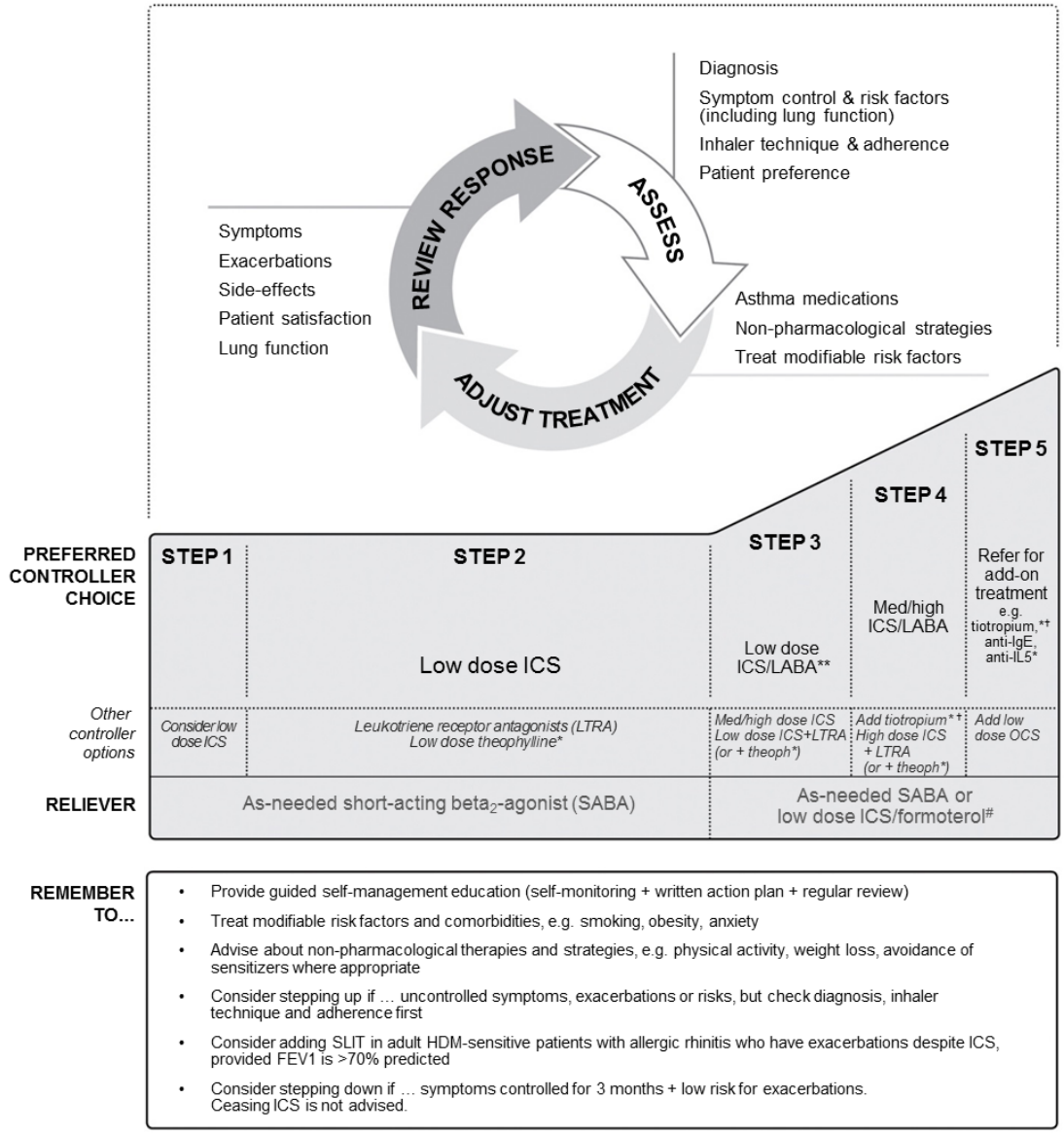

Figure 5: *Stepwise approach to control symptoms and minimize future risk*

See figure 6 for low, medium and high doses of ICS for adults, adolescents and children 6–11 years.

* Not for children under 12years

** For children 6–11 years, the preferred Step 3 treatment is medium dose ICS.

Low dose ICS/formoterol is the reliever medication for patients prescribed low dose ICS/formoterol maintenance and reliever therapy.

ł Tiotropium by mist inhaler is an add-on treatment for patients with a history of exacerbations; it is not indicated in children <12 years.

Adults and Adolescents (12 years and older)			
Drug	Daily dose (mcg)		
	Low	Medium	High
Beclometasone dipropionate	100–200	>200–400	>400
Budesonide (DPI)	200–400	>400–800	>800
Ciclesonide (HFA)	80–160	>160–320	>320
Fluticasone furoate (DPI)	100	n.a.	200
Fluticasone propionate(DPI)	100–250	>250–500	>500
Fluticasone propionate (HFA)	100–250	>250–500	>500
Mometasone furoate	110–220	>220–440	>440

***Figure 6**: Low, medium and high daily doses of inhaled corticosteroids*

For patients aged 6-11years, equivalent dose is approximately half the above doses.

Figure 8 is not a table of equivalence, but of estimated clinical comparability.

For all preparations, manufacturer's information should be reviewed carefully; products containing the same molecule may not be clinically equivalent.

STEP 1: As-Needed Reliever Inhaler

Preferred option: as-needed inhaled short-acting beta2-agonist (SABA).

SABAs are highly effective for the quick relief of asthma symptoms (Evidence A). This option should be reserved for patients with occasional daytime symptoms (e.g. less than twice a month) of short duration (a few hours), with no night waking and with normal lung function. More frequent symptoms, or the presence of any exacerbation risk factors such as FEV1 <80% personal best or predicted or an exacerbation in the previous 12 months, indicate that regular controller treatment is needed (Evidence B).

STEP 2: Low Dose Controller Medication Plus As-Needed Reliever Medication

Preferred option: regular low dose ICS plus as-needed SABA

Treatment with ICS at low doses reduces asthma symptoms, increases lung function, improves quality of life, and reduces the risk of exacerbations and asthma-related hospitalizations or death (Evidence A). Figure 4 lists doses that are considered to be low, medium and high for different ICS products.

Other Options

Leukotriene receptor antagonists (LTRA) are less effective than ICS (Evidence A). They may be appropriate for initial controller treatment for some patients who are unable or unwilling to use ICS; for patients who experience intolerable side-effects from ICS; or for patients with concomitant allergic rhinitis (Evidence B).

For adult or adolescent patients not previously using controller treatment, combination low dose ICS/LABA as the initial maintenance controller treatment reduces symptoms and improves lung function compared with low dose ICS alone.

However, it is more expensive and does not further reduce the risk of exacerbations compared with ICS alone (Evidence A).

STEP 3: One or Two Controllers plus as-needed Reliever Medication

Preferred option (adults/adolescents): combination low dose ICS/LABA as maintenance treatment plus as-needed SABA OR combination low dose ICS/formoterol as both maintenance and reliever treatment

Preferred option (children 6–11 years): moderate dose ICS plus as-needed SABA

The options at this step differ depending on age. For adults and adolescents, there are two 'preferred'

Step 3 options: combination low dose ICS/LABA as maintenance treatment with as-needed SABA as reliever, and low dose ICS/ formoterol as both maintenance and reliever treatment. Currently approved combination ICS/LABA inhalers for Step 3 treatment of asthma include low doses of fluticasone propionate/formoterol, fluticasone furoate/vilanterol, fluticasone propionate/salmeterol and budesonide/formoterol.

The maintenance and reliever regimen can be prescribed for budesonide/formoterol.

For adult patients with allergic rhinitis and sensitized to house dust mite, with exacerbations despite low-high dose ICS, consider adding sublingual allergen immunotherapy (SLIT), provided FEV1 is >70% predicted.

Other Options

Another option for adults and adolescents is to increase ICS to medium dose, but this is less effective than adding a LABA (Evidence A). Other less efficacious options are low dose ICS plus either LTRA (Evidence A) or low dose, sustained-release theophylline (Evidence B).

STEP 4: Two or More Controllers plus as-needed Reliever Medication

Preferred option (adults/adolescents): combination low dose ICS/formoterol as maintenance and reliever treatment, OR combination medium dose ICS/LABA plus as-needed SABA.

Preferred option (children 6–11 years): refer for expert assessment and advice

For adult and adolescent patients with ≥1 exacerbation in the previous year, combination low dose ICS/formoterol as maintenance and reliever treatment is more effective in reducing exacerbations than the same dose of maintenance ICS/LABA or higher doses of ICS (Evidence A). This regimen can be prescribed with low dose budesonide/formoterol as in Step 3; the maintenance dose may be increased if necessary. For patients taking low dose maintenance ICS/LABA with as-needed SABA, whose asthma is not adequately controlled, treatment may be increased to medium dose ICS/LABA (Evidence B)

For children 6–11 years, if asthma is not well controlled on moderate dose ICS (see figure 6), the recommendation is to refer the child for expert assessment and advice.

Other Options

Tiotropium (long-acting muscarinic antagonist) by mist inhaler may be used as add-on therapy for adult or adolescent patients with a history of exacerbations (Evidence A); it is not indicated in children <12 years.

For adult patients with allergic rhinitis and sensitization to house dust mite, with exacerbations despite low-high dose ICS, consider adding sublingual allergen immunotherapy (SLIT), provided FEV1 is >70% predicted.

STEP 5: Higher Level Care and/or add-on Treatment

Preferred option: referral for specialist investigation and consideration of add-on treatment

Patients with persistent symptoms or exacerbations despite correct inhaler technique and good adherence with Step 4 treatment and in whom other controller options have been considered, should be referred to a specialist with expertise in management of severe asthma (Evidence D).

Reviewing Response and Adjusting Treatment

How Often Should Asthma Be Reviewed?

Patients with asthma should be reviewed regularly to monitor their symptom control, risk factors and occurrence of exacerbations, as well as to document the response to any treatment changes. For most controller medications, improvement begins within days of initiating treatment, but the full benefit may only be evident after 3–4 months.

Stepping Down Treatment when Asthma is well Controlled

Once good asthma control has been achieved and maintained for 3 months and lung function has reached a plateau, treatment can often be successfully reduced, without loss of asthma control. The aims of stepping down are:

- To find the patient's minimum effective treatment, i.e. to maintain good control of symptoms and exacerbations, and to minimize the costs of treatment and potential for side-effects

Treating Other Modifiable Risk Factors

Some patients continue to experience exacerbations even with maximal doses of current treatment. Having even one exacerbation increases the risk that a patient will have another within the next 12 months.

Other Therapies

Non-Pharmacological Interventions

In addition to pharmacological treatments, other therapies and strategies may be considered where relevant, to assist in improving symptom control and/or reducing future risk.

These include:

1. Avoid smoking – active and passive
2. Keep active and exercise
3. Avoid trigger factors such as occupational irritants, indoor and outdoor allergens
4. Keep to a healthy weight
5. Breathing exercises (where available and under trained professional)
6. Vaccinations where indicated
7. Help for psychosocial problems

Indications for Referral for Expert Advice

Difficulty confirming the diagnosis of asthma
• Patient has symptoms of chronic infection, or features suggesting a cardiac or other non-pulmonary cause (immediate referral recommended) • Diagnosis is unclear even after a trial of therapy with ICS or systemic corticosteroids • Patients with features of both asthma and COPD, if there is doubt about priorities for treatment
Suspected occupational asthma
• Refer for confirmatory testing and identification of sensitizing or irritant agent, specific advice about eliminating exposure and pharmacological treatment.
Persistent uncontrolled asthma or frequent exacerbations
• Patient's symptoms remain uncontrolled, or patient has ongoing exacerbations or low lung function despite correct inhaler technique and good adherence with Step 4 treatment. Before referral, depending on the clinical context, identify and treat modifiable risk factors and comorbidities • Patient has frequent asthma-related health care utilization (e.g. multiple ED visits or urgent primary care visits)
Any risk factors for asthma-related death
• Near-fatal asthma attack (ICU admission, or mechanical ventilation for asthma) at any time in the past • Anaphylaxis or confirmed food allergy in a patient with asthma
Evidence of, or risk of, significant treatment side-effects
• Patients with significant side-effects from treatment • Need for long-term oral corticosteroid use • Frequent courses of oral corticosteroids (e.g. two or more courses a year)
Symptoms suggesting complications or sub-types of asthma
• e.g. aspirin-exacerbated respiratory disease; allergic bronchopulmonary aspergillosis
Additional reasons for referral in children 6–11 years
• Doubts about diagnosis of asthma e.g. respiratory symptoms are not responding well to treatment in a child who was born prematurely • Symptoms or exacerbations remain uncontrolled despite moderate dose ICS with correct inhaler technique and good adherence • Suspected side-effects of treatment (e.g. growth delay) • Asthma and confirmed food allergy

***Figure 7**: Indications for considering referral for expert advice, where available*

While the majority of people with asthma can usually be managed in primary care, some clinical situations warrant referral for expert advice regarding diagnosis and/or management.

Section 3: Guided Asthma Self-Management Education and Skills Training

Overview

With a chronic disease such as asthma, it is important for patients to be provided with education and skills in order to effectively manage their asthma. This is most effectively achieved through a partnership between the patient and their health care providers. The essential components for this include:

- Skills training to use inhaler devices effectively
- Encouraging adherence with medications, appointments and other advice, within an agreed management strategy
- Asthma information (see Asthma Society of Ireland for more information).
- Training in guided self-management, with self-monitoring of symptoms or peak flow; a written asthma action plan to show how to recognize and respond to worsening asthma; and regular review by a health care provider.

Skills Training for Effective Use of Inhaler Devices

Poor inhaler technique leads to poor asthma control, increased risk of exacerbations and increased adverse effects. Most people with incorrect technique are unaware that they have a problem. There is no 'perfect' inhaler – patients can have problems using any inhaler device.

Use of placebo inhalers to demonstrate usage helps to improve inhaler technique and use of online resources such as the Asthma Society of Ireland website can be useful for patients.

Strategies for ensuring effective use of inhaler devices are summarized in Figure 8.

Choose
• Choose the most appropriate inhaler device for the patient before prescribing • If different options are available, encourage the patient to participate in the choice • For pMDIs, use of a spacer improves delivery and (with ICS) reduces the potential for side-effects • Ensure that there are no physical barriers, e.g. arthritis, that limit use of the inhaler • Avoid use of multiple different inhaler types where possible, to avoid confusion
Check
• Check inhaler technique at every opportunity • Ask the patient to show you how they use their inhaler (don't just ask if they know how to use it) • Identify any errors using a device-specific checklist
Correct
• Show the patient how to use the device correctly with a physical demonstration, e.g. using a placebo inhaler • Check technique again, paying attention to problematic steps. You may need to repeat this process 2–3 times • Only consider an alternative device if the patient cannot use the inhaler correctly after several repeats of training • Re-check inhaler technique frequently. After initial training, errors often recur within 4–6 weeks.
Confirm
• Clinicians should be able to demonstrate correct technique for each of the inhalers they prescribe • Pharmacists and nurses can provide highly effective inhaler skills training

***Figure 8**: Strategies to ensure effective use of inhaler devices*

Adherence with Medications and Other Advice

Identifying Poor Adherence

Poor adherence is defined as the failure of treatment to be taken as agreed upon by the patient and the health care provider. There is increasing awareness of the importance of poor adherence in chronic diseases, and of the potential to develop interventions to improve adherence[9]. Approximately 50% of adults and children on long-term therapy for asthma fail to take medications as directed at least part of the time.
In clinical practice, poor adherence may be identified by an empathic question that acknowledges the likelihood of incomplete adherence and encourages an open discussion.

Factors Contributing to Poor Adherence

It is important to elicit patients' beliefs and concerns about asthma and asthma medications in order to understand the reasons behind their medication-taking behaviour.

Interventions to Improve Adherence in Asthma

Few adherence interventions have been studied comprehensively in asthma. Some examples are:

- Shared decision-making for medication/dose choice improved adherence and asthma outcomes.
- Inhaler reminders for missed doses improved adherence and reduced exacerbations.
- In a difficult inner-city environment, home visits for a comprehensive asthma program by an asthma nurse led to improved adherence and reduced prednisone courses over the following several months.
- Providing adherence information to clinicians did not improve ICS use among patients with asthma unless clinicians chose to view the details of their patients' medication use.

Asthma Information

While education is relevant to asthma patients of all ages, the information and skills training required by each person may vary, as will their ability or willingness to take responsibility. All individuals will require certain core information and skills but most education must be personalized and provided in a number of steps.

Information alone improves knowledge but does not improve asthma outcomes. Social and psychological support may also be required to maintain positive behavioural change, and skills are required for effective medication delivery.

Training in Guided Asthma Self-Management

The essential components of effective guided asthma self-management are:

- Self-monitoring of symptoms and/or peak flow
- A written asthma action plan to show how to recognize and respond to worsening asthma
- Regular review of asthma control, treatment and skills by a health care provider

Self-management education that includes these three components dramatically reduces asthma morbidity in both adults (Evidence A) and children (Evidence A). An approved self-management document is included in this document and can be downloaded from the HSE and Asthma society of Ireland website (Appendix 1).

Written Asthma Action Plans

Personal written asthma action plans show patients how to make short-term changes to their treatment in response to changes in their symptoms and/or PEF. They also describe how and when to access medical care. An approved self-management plan is found at the end of the document in Appendix 1.

The efficacy of self-management education is similar regardless of whether patients self-adjust their medications according to an individual written plan or whether the medication adjustments are made by a doctor (Evidence A). Thus patients who are unable to undertake guided self-management can still achieve benefit from a structured program of regular medical review.

Managing Asthma in Special Populations or Settings

Adolescents

Clinical Features:

Care of teenagers with asthma should take into account the rapid physical, emotional, cognitive and social changes that occur during adolescence.

Management:

An empathic approach should be used to identify beliefs and behaviours that may be barriers to optimal treatment. Medication regimens should be tailored to the adolescent's needs and lifestyle, and reviews arranged regularly so that the medication regimen can be adjusted for changing needs. Information about local youth-friendly resources and support services should be provided, where available.

Exercise-Induced Bronchoconstriction (EIB)

Management:

Guidelines for exercise-induced bronchoconstriction (EIB) have been published[12]. Pharmacotherapy can substantially reduce EIB. If the patient's only symptoms are during or after exercise, and no other risk factors for exacerbations are present, an as-needed strategy using inhaled SABA before exercise or to relieve symptoms that develop after exercise is sufficient (Evidence A). However, with regular (more than once-daily) use, tolerance to the protective effects of inhaled beta2-agonists against EIB develops. LTRAs are alternative pre-exercise treatments (Evidence A).

For patients with asthma symptoms unrelated to exercise, or with any risk factors for exacerbations, regular controller treatment with ICS or LTRA is recommended and generally results in the reduction of EIB (Evidence A).

Athletes

Clinical Features:

Athletes, particularly those competing at a high level, have an increased prevalence of various respiratory conditions compared to non-athletes.

Management:

Preventative measures to avoid high exposure to air pollutants, allergens (if sensitized) and chlorine levels in pools, particularly during training periods, should be discussed with the athlete. They should avoid training in extreme cold or pollution (Evidence C), and the effects of any therapeutic trials of asthma medications should be documented. Adequate anti-inflammatory therapy, especially ICS, is advised; minimization of use of beta2-agonists will help to avoid the development of tolerance[12]. Information on treatment of exercise-induced asthma in athletes can be on the World Anti-Doping Agency website (http://www.wada-ama.org).

Pregnancy

Clinical Features:

Asthma control often changes during pregnancy; in approximately one-third of women asthma symptoms worsen, in one-third they improve, and in the remaining one-third they remain unchanged[13].
Exacerbations are common in pregnancy, particularly in the second trimester. If asthma is well controlled throughout pregnancy, there is little or no increased risk of adverse maternal or foetal complications.

Management:

Although there is a general concern about any medication use in pregnancy, the advantages of actively treating asthma in pregnancy markedly outweigh any potential risks of usual controller and reliever medications (Evidence A).

Regular Review by a Health Care Provider

The third component of effective asthma self-management education is regular review by a health care provider. Follow- up consultations should take place at regular intervals.

See Asthma Society of Ireland for more information.

Definition of Asthma Flare Ups (Exacerbations)

Flare ups of asthma are episodes characterized by a progressive increase in symptoms of shortness of breath, cough, wheezing or chest tightness and progressive decrease in lung function. Flare ups usually occur in response to exposure to an external agent (e.g. viral upper respiratory tract infection, pollen or pollution) and/or poor adherence with controller medication; however, a subset of patients present more acutely and without exposure to known risk factors. Severe flare ups can occur in patients with mild or well-controlled asthma.

Identifying Patients at Risk of Asthma-Related Death

In addition to factors known to increase the risk of asthma flare ups (Figure 4) some features are specifically associated with an increase in the risk of asthma-related death (see bullet points below). The presence of one or more of these risk factors should be quickly identifiable in the clinical notes, and these patients should be encouraged to seek urgent medical care early in the course of an exacerbation.

- A history of near-fatal asthma requiring intubation and mechanical ventilation
- Hospitalization or emergency care visit for asthma in the past year
- Currently using or having recently stopped using oral corticosteroids (a marker of event severity)
- Not currently using inhaled corticosteroids
- Over-use of SABAs, especially use of more than one canister of salbutamol (or equivalent) monthly
- A history of psychiatric disease or psychosocial problems
- Poor adherence with asthma medications and/or poor adherence with (or lack of) a written asthma action plan
- Food allergy in a patient with asthma

Treatment Options for Written Asthma Action Plans

A written asthma action plan helps patients to recognize and respond appropriately to worsening asthma. Doubling ICS dose is usually not sufficient and patients should be advised to increase dose of ICS four-fold. Some patients will require courses of oral steroids to initiate when symptom start and with a drop in peak flow. See Appendix 1.

Reviewing Response

Patients should see their doctor immediately or present to an acute care unit if their asthma continues to deteriorate despite following their written asthma action plan, or if their asthma suddenly worsens.

Follow Up After a Self-Managed Exacerbation

After a self-managed flare up, patients should see their primary care health care provider for a semi-urgent review (e.g. within 1–2 weeks), for assessment of symptom control and additional risk factors for exacerbations (Figure 2), and to identify the potential cause of the exacerbation. The written asthma action plan should be reviewed to see if it met the patient's needs.

Management of Asthma Flare Up in Primary Care

Assessing Exacerbation Severity

A brief focused history and relevant physical examination should be conducted concurrently with the prompt initiation of therapy, and findings documented in the notes. If the patient shows signs of a severe or life-threatening flare up, treatment with SABA, controlled oxygen and systemic corticosteroids should be initiated while arranging for the patient's urgent transfer to an acute care facility where monitoring and expertise are more readily available. Milder exacerbations can usually be treated in a primary care setting, depending on resources and expertise.

History

The history should include:

- Timing of onset and cause (if known) of the present flare up
- Severity of asthma symptoms, including any limiting exercise or disturbing sleep
- Any symptoms of anaphylaxis
- Any risk factors for asthma-related death
- All current reliever and controller medications, including doses and devices prescribed, adherence pattern, any recent dose changes, and response to current therapy.

Physical Examination

The physical examination should assess:

- Signs of flare up severity and vital signs (e.g. level of consciousness, temperature, pulse rate, respiratory rate, blood pressure, ability to complete sentences, use of accessory muscles, wheeze).
- Complicating factors (e.g. anaphylaxis, pneumonia, pneumothorax)
- Signs of alternative conditions that could explain acute breathlessness (e.g. cardiac failure, upper airway dysfunction, inhaled foreign body or pulmonary embolism).

Objective Measurements

- Pulse oximetry. Saturation levels <90% in children or adults signal the need for aggressive therapy.
- PEF in patients older than 5 years

Treating Flare Ups in Primary Care

The main initial therapies include repetitive administration of short-acting inhaled bronchodilators, early introduction of systemic corticosteroids, and controlled flow oxygen supplementation The aim is to rapidly relieve airflow obstruction and hypoxemia, address the underlying inflammatory pathophysiology, and prevent relapse.

Inhaled Short-Acting Beta$_2$-Agonists

For mild to moderate exacerbations, repeated administration of inhaled SABA (up to 4–10 puffs every 20 minutes for the first hour) or 2.5mg of nebulized salbutamol is usually the most effective and efficient way to achieve rapid reversal of airflow limitation (Evidence A).

After the first hour, the dose of SABA required varies from 4–10 puffs every 3–4 hours up to 6–10 puffs every 1–2 hours, or more often. No additional SABA is needed if there is a good response to initial treatment (e.g. PEF >60–80% of predicted or personal best for 3–4 hours).

Oxygen therapy should be titrated against pulse oximetry (if available) to maintain oxygen saturation at 93–95% (94– 98% for children 6–11 years). Controlled or titrated oxygen therapy gives better clinical outcomes than high-flow 100% oxygen therapy (Evidence B). Oxygen should not be withheld if oximetry is not available, but the patient should be monitored for deterioration, somnolence or fatigue.

Systemic Corticosteroids

OCS should be given promptly, especially if the patient is deteriorating, or had already increased their reliever and controller medications before presenting (Evidence B). The recommended dose for adults is 1 mg prednisolone/kg/day or equivalent up to a maximum of 50 mg/day, and 1–2 mg/kg/day for children 6–11 years up to a maximum of 40 mg/day). OCS should usually be continued for 5–7 days (Evidence B).

Controller Medication

Patients already prescribed controller medication should be provided with advice about increasing the dose for the next 2–4 weeks. Patients not currently taking controller medication should usually be commenced on regular ICS-containing therapy, as a flare up requiring medical care indicates that the patient is at increased risk of future flare ups.

Reviewing Response

During treatment, patients should be closely monitored, and treatment titrated according to their response. Patients who present with signs of a severe or life-threatening flare up who fail to respond to treatment, or who continue to deteriorate should be transferred immediately to an acute care facility. Patients with little or slow response to SABA treatment should be closely monitored.

For many patients, lung function can be monitored after SABA therapy is initiated. Additional treatment should continue until PEF or FEV1 reaches a plateau or (ideally) returns to the patient's previous best. A decision can then be made whether to send the patient home or transfer them to an acute care facility.

Follow Up

Discharge medications should include as-needed reliever medication, OCS and, for most patients, regular controller treatment. Inhaler technique and adherence should be reviewed before discharge. A follow-up appointment should be arranged for about 2–7 days later, depending on the clinical and social context.

Controlled Oxygen Therapy (if available)

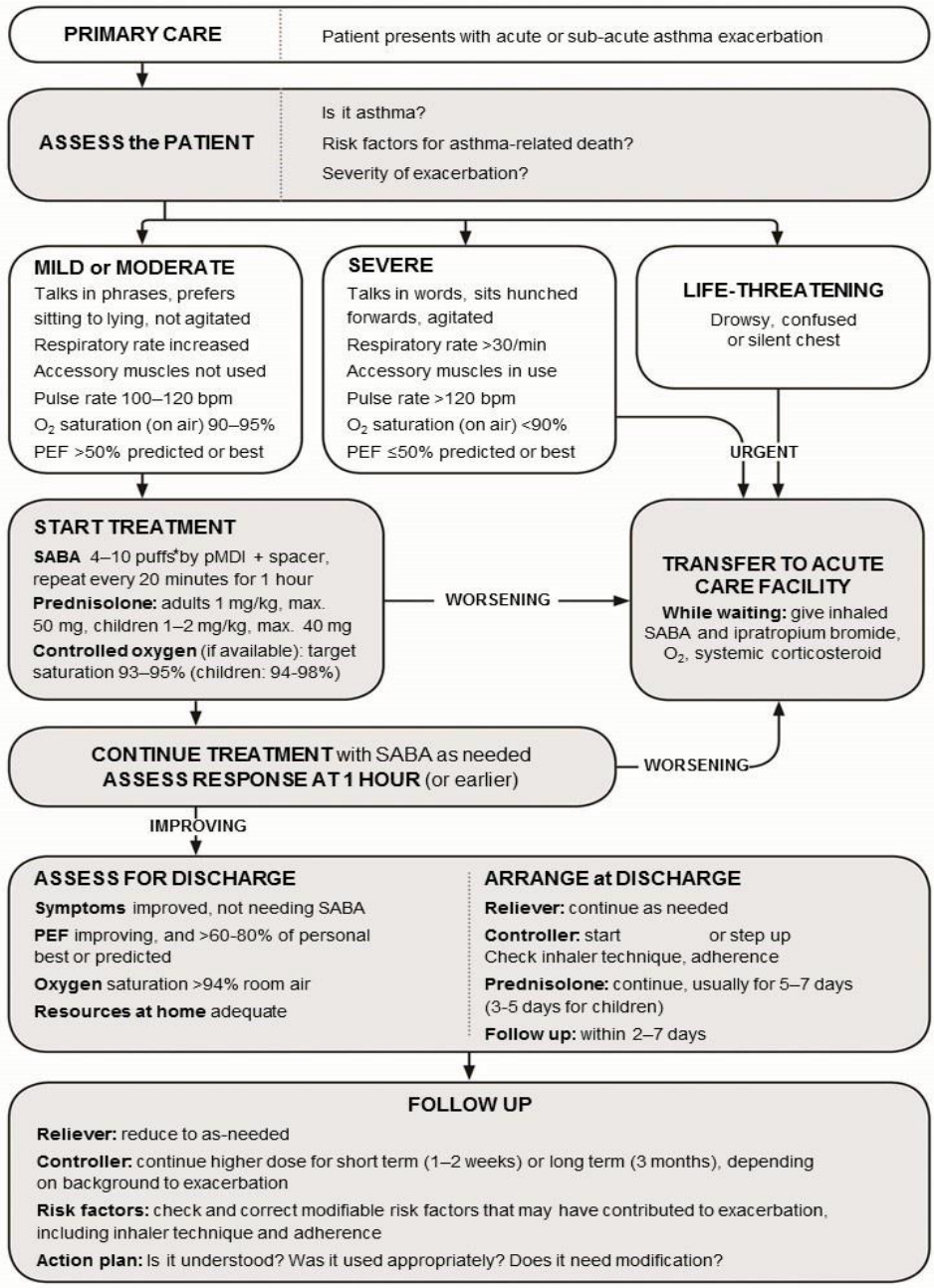

Figure 9: *Management of asthma exacerbations in primary care (adults, adolescents, children 6–11 years)* ****or 2.5mg nebulized***

Section 4: Making the Diagnosis in Under-6s

Asthma and Wheezing in Young Children Under-6s

Asthma is the most common chronic disease of childhood and the leading cause of childhood morbidity from chronic disease as measured by school absences, emergency department visits and hospitalizations[8]. Asthma often begins in early childhood; in up to half of people with asthma, symptoms commence during childhood. Atopy is present in the majority of children with asthma who are over 3 years old, and allergen-specific sensitization is one of the most important risk factors for the development of asthma[9].

Viral-Induced Wheezing

Recurrent wheezing occurs in a large proportion of children under 6 years. It is typically associated with upper respiratory tract infections (URTI), which occur in this age group around 6–8 times per year[10]. Many young children may wheeze with viral infections[11]. Therefore, deciding when wheezing with a respiratory infection is truly an initial or recurrent clinical presentation of childhood asthma is difficult.

Clinical Diagnosis of Asthma

It may be difficult to make a confident diagnosis of asthma in children under 6 years because episodic respiratory symptoms such as wheezing and cough are also common in children without asthma, particularly in those 0–2 years old[12]. Furthermore, it is not possible to routinely assess airflow limitation in this age group[13]. A probability-based approach, based on the pattern of symptoms during and between viral respiratory infections, may be helpful for discussion with parents/carers as outlines in Figure 9.

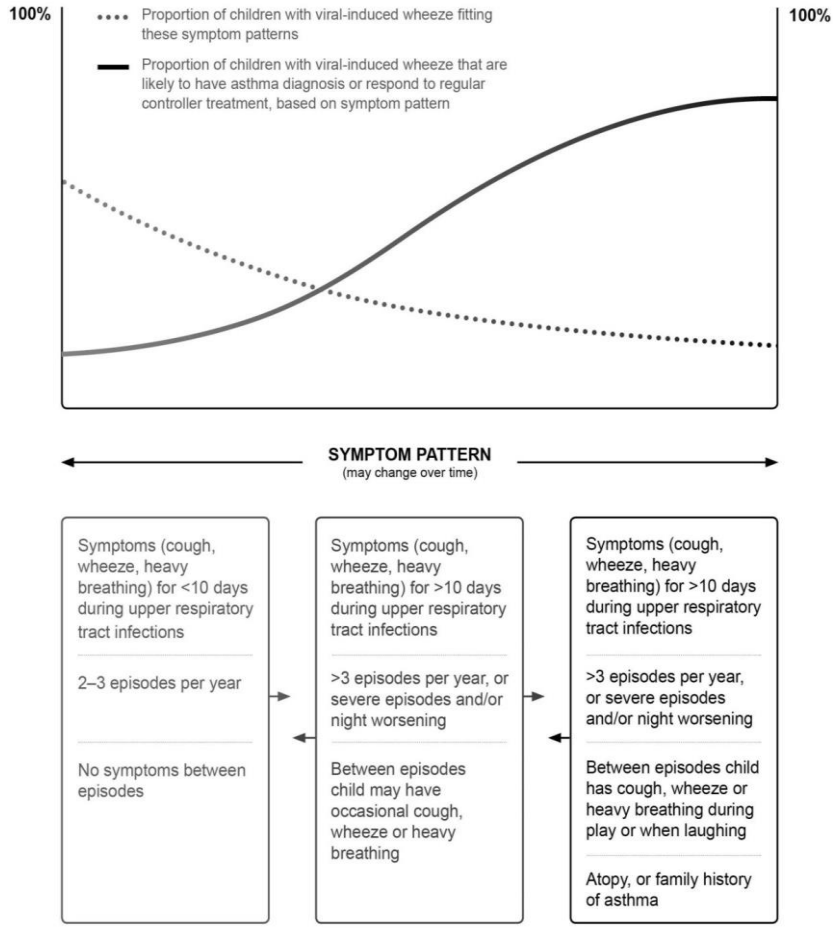

Figure 9: *Probability of asthma diagnosis or response to asthma treatment in children under 6.*

Many young children wheeze with viral infections, and deciding when a child should be given controller treatment is difficult. The frequency and severity of wheezing episodes and the temporal pattern of symptoms (only with viral colds or also in response to other triggers) should be taken into account.

A diagnosis of asthma in young children is therefore based largely on symptom patterns combined with a careful clinical assessment of family history and physical findings.

Symptoms Suggestive of Asthma in Children Under 6

As shown in Figure 10, an asthma diagnosis in children under 6 can often be based on:

- Symptom patterns (wheeze, cough, breathlessness (typically manifested by activity limitation), and nocturnal symptoms or awakenings)
- Presence of risk factors for development of asthma
- Therapeutic response to controller treatment

Feature	Characteristics suggesting asthma
Cough	Recurrent or persistent non-productive cough that may be worse at night or accompanied by some wheezing and breathing difficulties Cough occurring with exercise, laughing, crying or exposure to tobacco smoke in the absence of an apparent respiratory infection
Wheezing	Recurrent wheezing, including during sleep or with triggers such as activity, laughing, crying or exposure to tobacco smoke or air pollution
Difficult or heavy breathing or shortness of breath	Occurring with exercise, laughing, or crying
Reduced activity	Not running, playing or laughing at the same intensity as other children; tires earlier during walks (wants to be carried)
Past or family history	Other allergic disease (atopic dermatitis or allergic rhinitis) Asthma in first-degree relatives
Therapeutic trial with low dose inhaled corticosteroid and as-needed SABA	Clinical improvement during 2–3 months of controller treatment and worsening when treatment is stopped

Figure 10: *Features suggesting a diagnosis of asthma in children under 6 years*

Wheeze

Wheeze is the most common symptom associated with asthma in children. Wheezing occurs in several different patterns, but a wheeze that occurs recurrently, during sleep, or with triggers such as activity, laughing, or crying, is consistent with a diagnosis of asthma. The wheeze is typically heard on auscultation during expiration. Clinician confirmation is important, as parents may describe any noisy breathing as 'wheezing'.

Cough

Cough due to asthma is non-productive, recurrent and/or persistent, and is usually accompanied by some wheezing episodes and breathing difficulties. A nocturnal cough (when the child is asleep) or a cough that occurs with exercise, laughing or crying, in the absence of an apparent respiratory infection, supports a diagnosis of asthma.

Activity and Social Behaviour

Physical activity is an important cause of asthma symptoms in young children. Young children with poorly controlled asthma often abstain from strenuous play or exercise to avoid symptoms, but many parents are unaware of such changes in their children's lifestyle. Parents may report irritability, tiredness and mood changes in their child as the main problems when asthma is not well controlled.

Tests to Assist in Diagnosis

While no tests diagnose asthma with certainty in children under 6, the following are useful adjuncts.

Therapeutic Trial

A trial of treatment for at least 2–3 months with as-needed short-acting beta2-agonist (SABA) and regular low dose inhaled corticosteroids (ICS) may provide some guidance about the diagnosis of asthma (Evidence D). Response should be evaluated by symptom control (daytime and night-time), and the frequency of wheezing episodes and exacerbations. **It is important to stop the ICS after 3 months, even if symptoms improve to see if symptoms return.** Marked clinical improvement during treatment, and deterioration when treatment is stopped, support a diagnosis of asthma. This can help to demonstrate to parents/carers the importance of adherence to the ICS. Due to the variable nature of asthma in young children, a therapeutic trial may need to be repeated in order to be certain of the diagnosis.

Differential Diagnosis

A definite diagnosis of asthma in this young age group is challenging but has important clinical consequences. It is particularly important in this age group to consider and exclude alternative causes that can lead to symptoms of wheeze, cough, and breathlessness before confirming an asthma diagnosis. Key differential diagnoses are summarised in Figure 11.

Key Indications for Referral of a Child Under 6 years for Diagnostic Investigations

Any of the following features suggest an alternative diagnosis and indicate the need for further investigations:

- Failure to thrive
- Neonatal or very early onset of symptoms (especially if associated with failure to thrive)
- Vomiting associated with respiratory symptoms
- Continuous wheezing
- Failure to respond to asthma controller medications
- Parental concern or request.
- Focal lung or cardiovascular signs, or finger clubbing

Condition	Typical features
Recurrent viral respiratory tract infections	Mainly cough, runny congested nose for <10 days; wheeze usually mild; no symptoms between infections
Gastroesophageal reflux	Cough when feeding; recurrent chest infections; vomits easily especially after large feeds; poor response to asthma medications
Foreign body aspiration	Episode of abrupt, severe cough and/or stridor during eating or play; recurrent chest infections and cough; focal lung signs
Tracheomalacia	Noisy breathing when crying or eating, or during upper airway infections (noisy inspiration if extrathoracic or expiration if intrathoracic); harsh cough; inspiratory or expiratory retraction; symptoms often present since birth; poor response to asthma medications
Persistent bacterial bronchitis	Persistent “wet cough”, often worsening with posture.
Congenital heart disease	Cardiac murmur; cyanosis when eating; failure to thrive; tachycardia; tachypnea or hepatomegaly; poor response to asthma medications
Cystic fibrosis	Cough starting shortly after birth; recurrent chest infections; failure to thrive (malabsorption); loose greasy bulky stools
Primary ciliary dyskinesia	Cough and recurrent, mild chest infections; chronic ear infections and purulent nasal discharge; poor response to asthma medications.
Vascular ring	Respirations often persistently noisy; poor response to asthma medications
Bronchopulmonary dysplasia	Infant born prematurely; very low birth weight; needed prolonged mechanical ventilation or supplemental oxygen; difficulty with breathing present from birth
Immune deficiency	Recurrent fever and infections (including non-respiratory); failure to thrive

Figure 11: *Common differential diagnoses of asthma in children*

Section 5: Assessment and Management

Key Points

Goals of Asthma Management

As with other age groups, the goals of asthma management in young children are:

- To achieve good control of symptoms and maintain normal activity levels
- To minimize future risk; that is to reduce the risk of flare-ups, maintain lung function and lung development as close to normal as possible, and minimize medication side-effects.

Maintaining normal activity levels is particularly important in young children because engaging in play is important for their normal social and physical development. It is important to also elicit the goals of the parent/carer, as these may differ from conventional medical goals.

The goals of asthma management are achieved through a partnership between the parent/carer and the health professional team, with a cycle of:

- Assess (diagnosis, symptom control, risk factors, inhaler technique, adherence, parent preference)
- Adjust treatment (medications, non-pharmacological strategies, and treatment of modifiable risk factors)
- Review response including medication effectiveness and side-effects. This is carried out in combination with:
    - Education of parent/carer, and child (depending on the child's age)
    - Skills training for effective use of inhaler devices and encouragement of good adherence
    - Monitoring of symptoms by parent/carer
    - A written asthma action plan.

Assessment of Asthma

What does 'asthma control' mean?

Asthma control means the extent to which the manifestations of asthma are controlled, with or without treatment. It has two components (Figure 12):

A. The child's asthma status over the previous four weeks (symptom control),
B. How asthma may affect them in the future (future risk).

In young children, as in older patients, it is recommended that both symptom control and future risk should be monitored (Evidence D). In young children, lung function testing is not feasible for monitoring asthma control.

Assessing Asthma Symptom Control

Defining satisfactory symptom control in children under 6yrs is problematic. Health care providers are almost entirely dependent on the reports of family members and carers, who may be unaware either of how often the child has experienced asthma symptoms, or that their respiratory symptoms represent uncontrolled asthma.

Figure 12 shows a working schema for assessing asthma control in children <6 years, based on current expert opinion. It incorporates assessment of symptoms; the child's level of activity and their need for reliever/rescue treatment; and assessment of risk factors for adverse outcomes (Evidence D).

A. Symptom control	Level of asthma symptom control		
In the **past 4 weeks**, has the child had:	Well controlled	Partly controlled	Uncontrolled
Daytime asthma symptoms for more than a few minutes Yes ☐ No ☐	None of these	1–2 of these	3–4 of these
Any activity limitation due to asthma? Yes ☐ No ☐			
Reliever medication needed* more than once a week? Yes ☐ No ☐			
Any night waking or night coughing due to asthma? Yes ☐ No ☐			
B. Future risk for poor asthma outcomes			
Risk factors for asthma exacerbations within the next few months • Uncontrolled asthma symptoms • One or more severe exacerbation in previous year • The start of the child's usual 'flare-up' season (especially if autumn/fall) • Exposures: tobacco smoke; indoor or outdoor air pollution; indoor allergens (e.g. house dust mite, cockroach, pets, mold), especially in combination with viral infection • Major psychological or socio-economic problems for child or family • Poor adherence with controller medication, or incorrect inhaler technique			
Risk factors for fixed airflow limitation • Severe asthma with several hospitalizations • History of bronchiolitis			
Risk factors for medication side-effects • Systemic: Frequent courses of OCS; high-dose and/or potent ICS • Local: moderate/high-dose or potent ICS; incorrect inhaler technique; failure to protect skin or eyes when using ICS by nebulizer or spacer with face mask			

* Excludes reliever taken before exercise

Figure 12: *GINA assessment of asthma control in children under 6 years*

Assessing Future Risk of Adverse Outcomes

The relationship between symptom control and future risk of adverse outcomes such as exacerbations has not been sufficiently studied in young children. Although exacerbations may occur in children after months of apparently good symptom control, the risk is greater if current symptom control is poor.

The future risk of harm due to excessive doses of inhaled or systemic corticosteroids must also be avoided. This can be minimized by ensuring that the prescribed treatment is appropriate and reduced to the lowest dose that maintains satisfactory symptom control and minimizes exacerbations. The child's height should be measured and recorded at least yearly, as growth velocity may be lower in the first 1-2 years of ICS treatment, and poorly-controlled asthma can affect growth. The minimum effective dose of ICS to maintain good asthma control should be used. If decreased growth velocity is seen, other factors should be considered, including poorly-controlled asthma, frequent use of oral corticosteroids, and poor nutrition, and referral should be considered.

Assessment of Asthma

Choosing Medications for Children Under 6 Years

Good control of asthma can be achieved in a majority of young children with a pharmacological intervention strategy. This should be developed in a partnership between the family/carer and the health care provider. When recommending treatment for a young child, both general and individual questions apply.

What is the 'preferred' medication option at each treatment step to control asthma symptoms and minimize future risk?

How does this particular child differ from the 'average' child with asthma, in terms of;

- Response to previous treatment
- Parental preference (goals, beliefs and concerns about medications)
- Practical issues (cost, inhaler technique and adherence)

A stepwise treatment approach is recommended (Figure 13), based on symptom patterns, risk of exacerbations and side-effects, and response to initial treatment. Generally, treatment includes the daily, long-term use of controller medications to keep asthma well-controlled, and reliever medications for as-needed symptom relief.

The choice of inhaler device is also an important consideration (Figure 15).

Which Children Should Be Prescribed Regular Controller Treatment?

Intermittent or episodic wheezing of any severity may represent an isolated viral-induced wheezing episode, an episode of seasonal or allergen-induced asthma, or unrecognized uncontrolled asthma. The initial treatment of wheezing is identical for all of these – a SABA every 4–6 hours as needed for one or more days until symptoms disappear. Further treatment of the acute wheezing episodes themselves is described below (see acute asthma exacerbations in children under 6-years). However, uncertainty surrounds the addition of other drugs in these children, especially when the nature of the episode is unclear. In general, the following principles apply.

- If the symptom pattern suggests a diagnosis of asthma (Figure 10) and respiratory symptoms are uncontrolled (Fig 12) and/or wheezing episodes are frequent (e.g. three or more episodes in a season), regular controller treatment should be initiated (Step 2, Figure 13) and the response evaluated (Evidence D). Regular controller treatment may also be indicated in a child with less frequent, but more severe episodes of viral- induced wheeze (Evidence D).
- If the diagnosis of asthma is in doubt, and inhaled SABA therapy needs to be repeated frequently, e.g. more than every 6–8 weeks, a trial of regular controller treatment should be considered to confirm whether the symptoms are due to asthma (Evidence D).

It is important to discuss the decision to prescribe controller treatment and the choice of treatment with the child's parents or carers. They should be aware of both the relative benefits and risks of the treatments, and the importance of maintaining normal activity levels for their child's normal physical and social development.

Treatment Steps to Control Asthma Symptoms and Minimize Future Risk for Children Under 6 Years

Asthma treatment in young children follows a stepwise approach (Figure 13), with medication adjusted up or down to achieve good symptom control and minimize future risk of exacerbations and medication side-effects. The need for controller treatment should be re-assessed regularly.

Before Considering a Step-Up of Controller Treatment

If symptom control is poor and/or exacerbations persist despite 3 months of adequate controller therapy, check the following before any step up in treatment is considered.

- Confirm that the symptoms are due to asthma rather than a concomitant or alternative condition (Figure 11). Refer for expert assessment if the diagnosis is in doubt.
- Check and correct inhaler technique.
- Confirm good adherence with the prescribed dose.
- Enquire about risk factors such as allergen or tobacco smoke exposure (Figure 12).

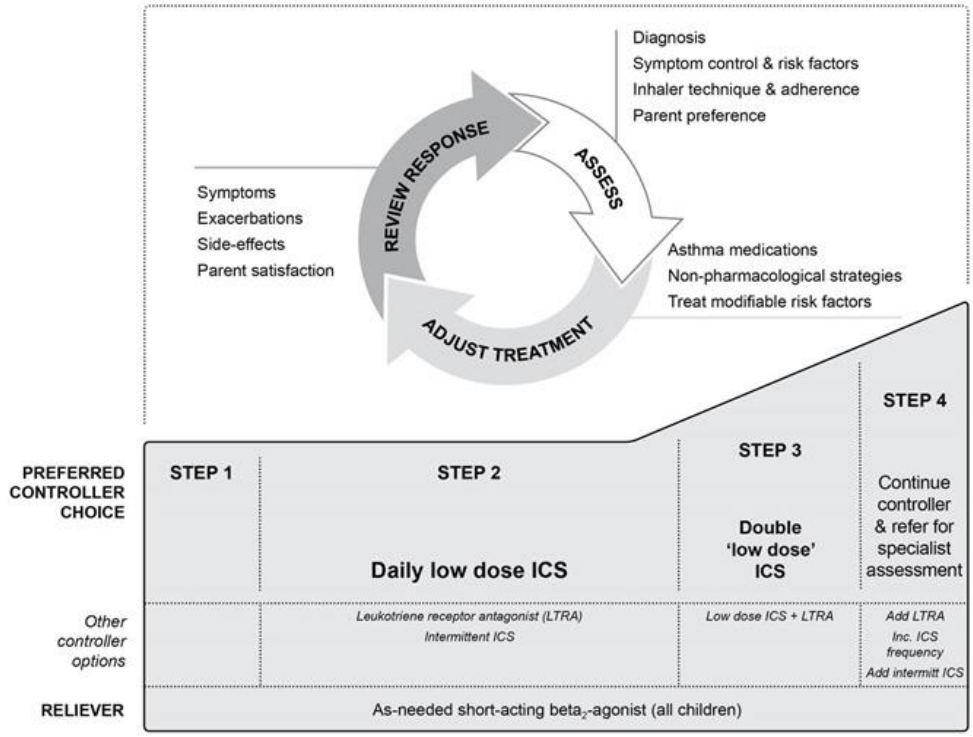

Figure 13: *Stepwise approach to long-term management of asthma in children under 6 years*

Step 1: As-needed inhaled short-acting beta2-agonist (SABA)

Preferred option: as-needed inhaled short-acting beta2-agonist (SABA)

All children who experience wheezing episodes should be provided with inhaled SABA for relief of symptoms (Evidence D), although it is not effective in all children. See Figure 15 for choice of inhaler device.

Other Options

Oral bronchodilator therapy is not recommended due to its slower onset of action and higher rate of side-effects compared with inhaled SABA (Evidence D). For children with intermittent viral-induced wheeze and no interval symptoms in whom inhaled SABA medication is not sufficient, intermittent ICS may be considered

Step 2: Initial controller treatment plus as-needed SABA

Preferred option: regular daily low dose ICS plus as-needed SABA

Regular daily, low dose ICS (Figure 14) is recommended as the preferred initial treatment to control asthma in children under 6 years (Evidence A). This initial treatment should be given for at least 3 months to establish its effectiveness in achieving good asthma control.

Other Options

In young children with persistent asthma, regular treatment with a leukotriene receptor antagonist (LTRA) modestly reduces symptoms and need for oral corticosteroids compared with placebo. For pre-school children with frequent viral-induced wheezing and with interval asthma symptoms, as-needed (prn) or episodic ICS may be considered but a trial of regular ICS should be undertaken first.

Step 3: Additional controller treatment, plus as-needed SABA

If 3 months of initial therapy with a low dose ICS fails to control symptoms, or if exacerbations persist, check the following before any step up in treatment is considered.

Confirm that the symptoms are due to asthma rather than a concomitant or alternative condition (Figure 11).

- Check and correct inhaler technique.
- Confirm good adherence with the prescribed dose.
- Enquire about risk factors such as allergen or tobacco smoke exposure (Figure 12).
- Preferred option: moderate dose ICS (double the 'low' daily dose)
- Doubling the initial low dose of ICS may be the best option (Evidence C). Assess response after 3 months.

Other Options

Addition of a LTRA to low dose ICS may be considered, based on data from older children (Evidence D).

Step 4: Continue controller treatment and refer for expert assessment

Preferred option: refer the child for expert advice and further investigation (Evidence D).

The child should be referred for expert assessment if symptom control remains poor and/or flare-ups persist, or if side-effects of treatment are observed or suspected.

Drug	Low daily dose in mcgs
Beclomethasone dipropionate (HFA)	100
Budesonide pMDI + spacer Budesonide nebulized	200 500
Fluticasone propionate (HFA)	100
Ciclesonide	160
Mometasone furoate	Not studied below age 4 years
Triamcinolone acetonide	Not studied in this age group

Figure 14: *Low daily doses of inhaled corticosteroids for children under 6 years.*

Reviewing Response and Adjusting Treatment

Assessment at every visit should include asthma symptom control and risk factors (Figure 12), and side-effects. The child's height should be measured every year, or more often. Asthma-like symptoms remit in a substantial proportion of children under 6 years, so the need for continued controller treatment should be regularly assessed (e.g. every 3–6 months) (Evidence D). If therapy is discontinued, schedule a follow-up visit 3–6 weeks later to check whether symptoms have recurred, as therapy may need to be reinstituted (Evidence D).

Choice of Inhaler Device

Inhaled therapy constitutes the cornerstone of asthma treatment in children under 6 years. A pressurized metered dose inhaler (pMDI) with a valved spacer (with or without a face mask, depending on the child's age) is the preferred delivery system (Figure 15) (Evidence A). This recommendation is based on studies with beta$_2$-agonists. The spacer device should have documented efficacy in young children. The dose delivered may vary considerably between spacers, so consider this if changing from one spacer to another.

Age	Preferred Device	Alternative Device
0 to 2 years	pMDI plus dedicated spacer with face mask –eg babyhaler™	Nebulizer with face mask
3 to 6 yrs	pMDI plus dedicated spacer with mouthpiece eg Aerochamber™ or FreeBreathe™ device	pMDI plus dedicated spacer with face mask or nebulizer with face mask

Figure 15: *Choosing an inhaler device for children under 6yrs*

Asthma Self-Management Education for Carers of Young Children

Asthma self-management education should be provided to family members and carers of wheezy children under 6 years when wheeze is suspected to be caused by asthma. An educational program should contain:

- A basic explanation about asthma and the factors that influence it
- Training about correct inhalation technique
- Information on the importance of the child's adherence to the prescribed medication regimen
- A written asthma action plan

Written Asthma Action Plans

Asthma action plans should be provided for the family/carers of all children with asthma, including those under 6 years (Evidence D). Action plans, developed through collaboration between an asthma educator, the health care provider and the family, have been shown to be of value in older children, although they have not been extensively studied in children under 6 years. A written asthma action plan includes:

- A description of how the parent or carer can recognize when symptom control is deteriorating
- The medications to administer
- When and how to obtain medical care, including telephone numbers of services available for emergencies (e.g. doctors' offices, emergency rooms and hospitals, ambulance services and emergency pharmacies

Management of Worsening Asthma and Exacerbations in Children Under 6 Years

Diagnosis of Flare Up

A flare-up or exacerbation of asthma in children under 6 years is defined as an acute or sub-acute deterioration in symptom control that is sufficient to cause distress or risk to health, and necessitates a visit to a health care provider or requires treatment with systemic corticosteroids.

Early symptoms of an exacerbation may include any of the following:

- An acute or sub-acute increase in wheeze and shortness of breath
- An increase in coughing, especially while the child is asleep
- Lethargy or reduced exercise tolerance
- Impairment of daily activities, including feeding
- A poor response to reliever medication.

Upper respiratory symptoms frequently precede the onset of an asthma exacerbation, indicating the important role of viral URTI in precipitating exacerbations in many, although not all, children with asthma.

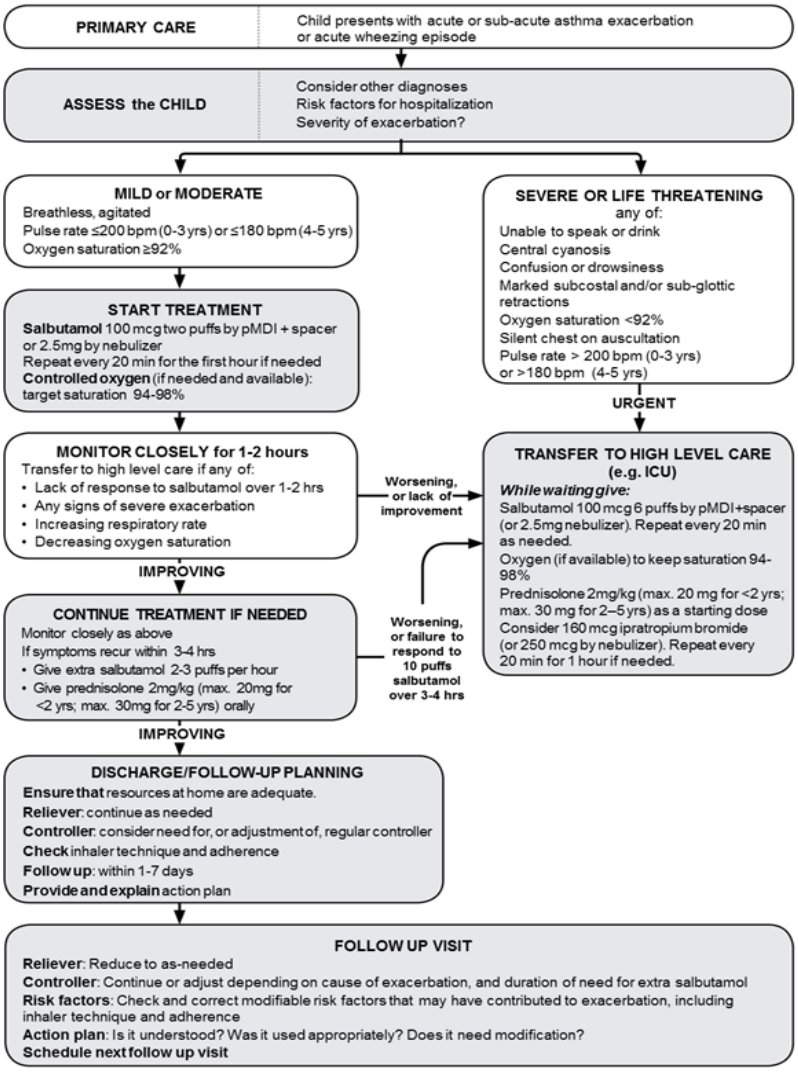

Figure 16: *Primary care management of acute asthma or wheezing in children under 6s*

Primary Care Management of Acute Asthma Exacerbations

Assessment of Exacerbation Severity

Conduct a brief history and examination concurrently with the initiation of therapy. The presence of any of the features of a severe exacerbation listed in Figure 17 are an indication of the need for urgent treatment and immediate transfer to hospital (Evidence D).

Symptoms	Mild	Severe*
Altered consciousness	No	Agitated, confused or drowsy
Oximetry on presentation (SaO_2)**	>95%	<92%
Speech†	Sentences	Words
Pulse rate	<100 beats/minute	>200 beats/minute (0–3 years)
		>180 beats/minute (4–6 years)
Central cyanosis	Absent	Likely to be present
Wheeze intensity	Variable	Chest may be quiet

Figure 17: *Initial assessment of acute asthma exacerbations in children under 6 years*

*Any of these features indicates a severe asthma exacerbation. **Oximetry, when available before treatment with oxygen or bronchodilator.

† The normal developmental capability of the child must be taken into account.

Indications for Immediate Transfer to Hospital

Children with features of a severe exacerbation that fail to resolve within 1–2 hours despite repeated dosing with inhaled SABA, with or without OCS, must be referred to hospital for observation and further treatment (Evidence D). Other indications are respiratory arrest or impending arrest; lack of supervision in the home or doctor's office; and recurrence of signs of a severe exacerbation within 48 hours (particularly if treatment with OCS has already been given). In addition, early medical attention should be sought for children less than 2 years of age as the risk of dehydration and respiratory fatigue is increased. These are summarised in Figure 18.

Emergency Treatment and Initial Pharmacotherapy

Oxygen (when available)

Treat hypoxemia urgently with oxygen by face mask to achieve and maintain percutaneous oxygen saturation 94–98% (Evidence A). To avoid hypoxemia during changes in treatment, children who are acutely distressed should be treated immediately with oxygen and SABA –2.5 mg of salbutamol delivered by an oxygen-driven nebulizer (if available). This treatment should not be delayed, and may be given before the full assessment is completed.

Immediate transfer to hospital is indicated if a child <6years years with asthma has ANY of the following:
At initial or subsequent assessment
Child is unable to speak or drink
Cyanosis
Severe subcostal retraction
Oxygen saturation <92% when breathing room air
Silent chest on auscultation
Lack of response to initial bronchodilator treatment
Lack of response to 6 puffs of inhaled SABA (2 separate puffs, repeated 3 times) over 1–2 hours
Persisting tachypnea* despite three administrations of inhaled SABA, even if the child shows other clinical signs of improvement
Social environment that impairs delivery of acute treatment, or parent/carer unable to manage acute asthma at home

Figure 18: *Indications for immediate transfer to hospital for children under 6 years*

*Normal respiratory rates: <60 breaths/minute in children 0–2 months; <50 breaths/minute in children 2–12 months; <40 breaths/minute in children 1–5 years.

Bronchodilator Therapy

The initial dose of SABA may be given by a pMDI with spacer and mask or mouthpiece or an air-driven nebulizer; or, if oxygen saturation is low, by an oxygen-driven nebulizer (as described above). For most children, pMDI plus spacer is favored as it is more efficient than a nebulizer for bronchodilator delivery (Evidence A). The initial dose of SABA is two puffs of salbutamol (100 mcg per puff) or equivalent, except in acute, severe asthma when six puffs should be given. When a nebulizer is used, a dose of 2.5 mg salbutamol solution is recommended. The frequency of dosing depends on the response observed over 1–2 hours (see below).

For children with moderate-severe exacerbations and a poor response to initial SABA, ipratropium bromide may be added, as 2 puffs of 80mcg (or 250mcg by nebulizer) every 20 minutes for 1 hour only.

Maintain Current Controller Treatment (if prescribed)

Children who have been prescribed maintenance therapy with ICS, LTRA or both should continue to take the prescribed dose during and after an exacerbation (Evidence D).

Inhaled Corticosteroids

For children not previously on ICS, an initial dose of ICS twice the low daily dose may be given and continued for a few weeks or months (Evidence D).

Oral Corticosteroids

For children with severe exacerbations, a dose of OCS equivalent to prednisolone 1–2 mg/kg/day, with a maximum of 20 mg/day for children under 2 years of age and 30 mg/day for children aged 2–5 years, is currently recommended (Evidence A). A 3 to 5-day course is sufficient in most children and can be stopped abruptly (Evidence D).

Follow up post flare up

It is important that children along with parents/carers are reviewed following a flare up to try to identify factors which may have contributed to it – adherence to medications, correct delivery device and factors such as specific triggers along with factors such as smoking, obesity and dampness in housing. The use of self-management plans should be given to parents/carers to help manage any future events.

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Appendix 1: HSE/Asthma Society Asthma Action Plan

Figure 59: *Asthma Action Plan*