

# Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma Full Report 2007

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## TARGET POPULATION

Eligibility

Inclusion Criterion

Exclusion Criterion

## KNOWLEDGE COMPONENTS

### DEFINITIONS

- Term:** Asthma severity
- Term Meaning:** the intrinsic intensity of disease
- Term:** Exacerbations of asthma
- Term Meaning:** acute or subacute episodes of progressively worsening shortness of breath, cough, wheezing, and chest tightness—or some combination of these symptoms. Exacerbations are characterized by decreases in expiratory airflow that can be documented and quantified by simple measurement of lung function (spirometry or PEF). Exacerbations of asthma can vary widely among individuals and within individuals, from very rare to frequent. Although the classification of severity focuses on the frequency of exacerbations, it is important to note that the severity of disease does not necessarily correlate with the intensity of exacerbations, which can vary from mild to very severe and life-threatening. Patients at any level of severity, even intermittent asthma, can have severe exacerbations.
- Term:** The level of asthma control (well controlled, not well controlled, or poorly controlled)
- Term Meaning:** the degree to which both dimensions of the manifestations of asthma—impairment and risk—are minimized by therapeutic intervention. The level of control at the time of followup assessment will determine clinical actions—that is, whether to maintain or adjust therapy. In previous guidelines
- Term:** The Expert Panel recommends that asthma control be defined as follows (Evidence A): Asthma Control
- Term Meaning:** Reduce impairment — Prevent chronic and troublesome symptoms (e.g., coughing or breathlessness in the daytime, in the night, or after exertion) — Require infrequent use (andlt;2 days a week) of SABA for quick relief of symptoms — Maintain (near) “normal” pulmonary function — Maintain normal activity levels (including exercise and other physical activity and attendance at work or school) — Meet patients’ and families’ expectations of and satisfaction with asthma care  
Reduce risk — Prevent recurrent exacerbations of asthma and

minimize the need for ED visits or hospitalizations — Prevent progressive loss of lung function; for children, prevent reduced lung growth — Provide optimal pharmacotherapy with minimal or no adverse effects

**Term:** Reducing impairment

**Term Meaning:** Prevent chronic and troublesome symptoms (e.g., coughing or breathlessness in the daytime, in the night, or after exertion) — Require infrequent use (2 days a week) of SABA for quick relief of symptoms (not including prevention of EIB) — Maintain (near) normal pulmonary function — Maintain normal activity levels (including exercise and other physical activity and attendance at work or school) — Meet patients' and families' expectations of and satisfaction with asthma care

**Term:** Reducing risk

**Term Meaning:** Prevent recurrent exacerbations of asthma and minimize the need for ED visits or hospitalizations — Prevent progressive loss of lung function; for children, prevent reduced lung growth — Provide optimal pharmacotherapy with minimal or no adverse effects

**Term:** minimal or intermittent impairment, but a persistent risk of exacerbation

**Term Meaning:** more than two exacerbations a year that require oral systemic corticosteroids, without symptoms between them

#### **RECOMMENDATION:** Selecting Initial Therapy

**Conditional:** 0–4 Years of Age: Initiating Long-Term Control Therapy. The Expert Panel concludes that initiating daily long-term control therapy: and#14; Is recommended for reducing impairment and risk of exacerbations in infants and young children who had four or more episodes of wheezing in the past year that lasted more than 1 day and affected sleep AND who have risk factors for developing persistent asthma: either (1) one of the following: parental history of asthma, a physician diagnosis of atopic dermatitis, or evidence of sensitization to aeroallergens OR (2) two of the following: evidence of sensitization to foods, 4 percent peripheral blood eosinophilia, or wheezing apart from colds (Evidence A).  
{Rec\_1: Cond\_1 }

**Decision Variable:** 0–4 Years of Age

**Decision Variable:** four or more episodes of wheezing in the past year that lasted more than 1 day and affected sleep

**Decision Variable:** parental history of asthma

**Decision Variable:** a physician diagnosis of atopic dermatitis

**Decision Variable:** evidence of sensitization to aeroallergen

**Decision Variable:** evidence of sensitization to foods

**Decision Variable:** 4 percent peripheral blood eosinophilia

**Decision Variable:** wheezing apart from colds

**Action:** initiating daily long-term control therapy: initiating daily long-term control therapy is recommended

**Reason:** reducing impairment and risk of exacerbations in infants and young children

**Evidence Quality:** (Evidence A)

**Recommendation Strength:** "is recommended"

**RECOMMENDATION:** Selecting Initial Therapy (2)

**Conditional:** 0–4 Years of Age: Initiating Long-Term Control Therapy. The Expert Panel concludes that initiating daily long-term control therapy: Should be considered for reducing impairment in infants and young children who consistently require symptomatic treatment more than 2 days per week for a period of more than 4 weeks (Evidence D). {Rec\_2: Cond\_2 }

**Decision Variable:** consistently require symptomatic treatment more than 2 days per week for a period of more than 4 weeks

**Decision Variable:** 0–4 Years of Age

**Action:** initiating daily long-term control therapy: Should be considered

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** should be considered

**RECOMMENDATION:** Selecting Initial Therapy (3)

**Conditional:** 0–4 Years of Age: Initiating Long-Term Control Therapy. The Expert Panel concludes that initiating daily long-term control therapy: Should be considered for reducing risk in infants and young children who have a second asthma exacerbation requiring systemic corticosteroids within 6 months (Evidence D). Recognition of these children and treatment with daily low-dose ICS therapy can significantly reduce overall symptom burden and the frequency of exacerbations, even though such treatment will not alter the underlying severity of asthma in later childhood {Rec\_3: Cond\_3 }

**Decision Variable:** a second asthma exacerbation requiring systemic corticosteroids within 6 months

**Decision Variable:** 0–4 Years of Ag

**Action:** initiating daily long-term control therapy: Should be considered

**Reason:** for reducing risk

**Reason:** Recognition of these children and treatment with daily low-dose ICS therapy can significantly reduce overall symptom burden and the frequency of exacerbations, even though such treatment will not alter the underlying severity of asthma in later childhood (Guilbert et al. 2006)

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** should be considered

**RECOMMENDATION: Selecting Initial Therapy (4)**

**Conditional:** 0–4 Years of Age: Initiating Long-Term Control Therapy.  
The Expert Panel concludes that initiating daily long-term control therapy: May be considered for use only during periods of previously documented risk for a child (Evidence D). If daily long-term control therapy is discontinued after the season of increased risk, written asthma action plans indicating specific signs of worsening asthma and actions to take should be reviewed with the caregivers, and a clinic contact should be scheduled 2–6 weeks after discontinuation of therapy to ascertain whether adequate control is maintained satisfactorily (Evidence D). {Rec\_4: Cond\_4 }

**Decision Variable:** periods of previously documented risk for a child

**Decision Variable:** 0–4 Years of Age

**Action:** initiating daily long-term control therapy: May be considered

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** may be considered

**RECOMMENDATION: 5–11 Years of Age: Initiating Long-Term Control Therapy.**

**Conditional:** 5–11 Years of Age: Initiating Long-Term Control Therapy.  
The Expert Panel recommends daily long-term control therapy for children who have persistent asthma {Rec\_5: Cond\_5 }

**Decision Variable:** 5–11 Years of Age

**Decision Variable:** persistent asthma

**Action:** The Expert Panel recommends daily long-term control therapy

**Risk/Harm:** possible long-term effects of inadequately controlled asthma

**Risk/Harm:** possible adverse effects of medications given over prolonged periods

**Evidence Quality:** (Evidence A)

**Recommendation Strength:** The Expert Panel recommends

**RECOMMENDATION: Adjusting Therapy**

**Conditional:** The Expert Panel recommends that, if a child is already taking long-term control medication, treatment decisions are based on the level of asthma control that has been achieved: therapy should be stepped up if necessary to achieve control {Rec\_6: Cond\_6 }

**Decision Variable:** already taking long-term control medication

**Action:** therapy should be stepped up if necessary to achieve control

**Description:** After identifying the patient's treatment step, based on the patient's or parents' report of what

medications the patient is currently taking, classify the level of control by measuring impairment based on symptoms, SABA use, and lung function (in children 5–11 years of age) and risk based on previous exacerbations and potential side effects.

**Description:** 0–4 years of age: The level of impairment generally is judged on the most severe symptom. The risk domain is usually more strongly associated with asthma morbidity than the impairment domain, because children are often symptom free between exacerbations.

**Description:** 5–11 years of age: The level of impairment generally is judged on the most severe measure among symptom report, asthma control score (using validated tools if available), and pulmonary function measures. For patients at step 3 or higher care, if office spirometry is feasible and suggests poorer control than does the assessment of impairment based on other measures, consider fixed airway obstruction as the explanation and reassess the other measures of impairment. If fixed airway obstruction does not appear to be the explanation, consider a step up in therapy, because low FEV1 is a predictor of risk for exacerbations in children. (See “Component 1: Measures of Asthma Assessment and Monitoring.”)

**Evidence Quality:** Evidence B—extrapolated from studies in youths and adults

**Recommendation Strength:** The Expert Panel recommends

**RECOMMENDATION:** control of the impairment domain is not achieved and maintained

**Conditional:** The Expert Panel recommends the following actions if control of the impairment domain is not achieved and maintained at any step of care: Patient adherence and technique in using medications correctly should be assessed and addressed as appropriate (Evidence C). {Rec\_7: Cond\_7 }

**Decision Variable:** if control of the impairment domain is not achieved and maintained

**Action:** Patient adherence and technique in using medications correctly should be assessed and addressed as appropriate

**Description:** Key questions to ask the child and parent include: Which medicines is your child currently taking? How often? Who is responsible for administering the child’s medicine? Please show me how the child takes the medicine. How many times a week does the child miss taking the medication? What problems have you/your child had taking the medicine (cost, time, lack of perceived need)? What concerns do you have about your asthma medicines?

**Action:** Other factors that diminish control of asthma impairment should be addressed as possible reasons for poor

response to therapy and targets for intervention (

**Description:** These factors include the presence of a coexisting condition (e.g., sinusitis), a new or increased exposure to allergens or irritants, or psychosocial problems. In some cases, alternative diagnoses, such as vocal cord dysfunction (VCD), should be considered.

**Evidence Quality:** (Evidence C)

**Recommendation Strength:** The Expert Panel recommends

**Conditional:** If patient adherence, inhaler technique, and environmental control measures are adequate, and asthma is not well controlled, a step up in treatment may be needed {Rec\_7: Cond\_8 }

**Decision Variable:** patient adherence

**Value:** adequate

**Decision Variable:** inhaler technique

**Value:** adequate

**Decision Variable:** environmental control measures

**Value:** adequate

**Action:** a step up in treatment may be needed

**Description:** For patients who have asthma that is not well controlled, in general step up one treatment step. For patients who have very poor asthma control, consider increasing treatment by two steps, a course of oral corticosteroids, or both (Evidence D).

**Evidence Quality:** Evidence B—extrapolated

**Recommendation Strength:** recommends

**RECOMMENDATION:** Address the risk domain (0-4 years)

**Conditional:** The Expert Panel recommends the following actions if control of the risk of exacerbations is not achieved or maintained (Evidence D): 0–4 years of age: If there is a history of one or more exacerbations, review adherence to medications and control of environmental exposures, review the patient’s written asthma action plan to confirm that it includes oral prednisone for patients who have histories of severe exacerbations, and consider stepping up therapy to the next level (Evidence D) {Rec\_8: Cond\_9 }

**Decision Variable:** control of the risk of exacerbations is not achieved or maintained (a history of one or more exacerbations)

**Decision Variable:** 0–4 years of age

**Action:** review adherence to medications and control of environmental exposures

**Action:** review the patient’s written asthma action plan to confirm that it includes oral prednisone for patients who have histories of severe exacerbations

**Action:** consider stepping up therapy to the next level

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** The Expert Panel recommends

**RECOMMENDATION:** Address the risk domain.(5-11 years)

**Conditional:** The Expert Panel recommends the following actions if control of the risk of exacerbations is not achieved or maintained (Evidence D) 5–11 years of age: If the history of exacerbations suggests poorer control than does the assessment of impairment, the following actions are recommended: reassess the impairment domain, review adherence to medications and control of environmental exposures, review the patient’s written asthma action plan to confirm that it includes oral prednisone for patients who have a history of severe exacerbations, and consider a step up in therapy, especially for children who have reduced lung function {Rec\_9: Cond\_10 }

**Decision Variable:** 5–11 years of age

**Decision Variable:** the history of exacerbations suggests poorer control than does the assessment of impairment

**Action:** reassess the impairment domain

**Action:** review adherence to medications and control of environmental exposures

**Action:** review the patient’s written asthma action plan to confirm that it includes oral prednisone for patients who have a history of severe exacerbations

**Action:** consider a step up in therapy, especially for children who have reduced lung function

**RECOMMENDATION:** Address the risk domain with regard to side effects

**Conditional:** The Expert Panel recommends consideration of alternative and/or adjunctive therapies within the step of care the patient is receiving if the patient experiences troublesome or debilitating side effects. In addition, confirm efforts to control environmental exposures {Rec\_10: Cond\_11 }

**Decision Variable:** patient experiences troublesome or debilitating side effects

**Action:** consideration of alternative and/or adjunctive therapies within the step of care the patient is receiving

**Action:** confirm efforts to control environmental exposures

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** The Expert Panel recommends

**RECOMMENDATION:** Consider referral to an asthma specialist.

**Conditional:** The Expert Panel recommends referral to an asthma specialist for consultation or comanagement of the patient if (Evidence D): — There are difficulties achieving or maintaining control of asthma. — A child 0–4 years of age requires step 3 care or higher (step 4 care or higher for children 5–11 years of age) to achieve and maintain control or if additional education is indicated to improve the patients’ management skills or

adherence. Referral may be considered if a child 0–4 years of age requires step 2 care or a child 5–11 years of age requires step 3 care. — The patient has had an exacerbation requiring hospitalization. — Immunotherapy or other immunomodulators are considered, or additional tests are indicated, to determine the role of allergy. {Rec\_11: Cond\_12 }

**Decision Variable:** difficulties achieving or maintaining control of asthma

**Decision Variable:** The patient has had an exacerbation requiring hospitalization.

**Decision Variable:** Immunotherapy or other immunomodulators are considered, or additional tests are indicated, to determine the role of allergy

**Action:** referral to an asthma specialist for consultation or comanagement of the patient

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** The Expert Panel recommends

**Linkage:** Bullet 2 "A child..." is very complexly worded.

**Conditional:** A child 0–4 years of age requires step 3 care or higher (step 4 care or higher for children 5–11 years of age) to achieve and maintain control or if additional education is indicated to improve the patients' management skills or adherence. Referral may be considered if a child 0–4 years of age requires step 2 care or a child 5–11 years of age requires step 3 care {Rec\_11: Cond\_13 }

**Decision Variable:** 0–4 years of age

**Decision Variable:** requires step 3 care or higher to achieve and maintain control

**Decision Variable:** if additional education is indicated to improve the patients' management skills or adherence

**Action:** Expert Panel recommends referral to an asthma specialist for consultation or comanagement of the patient

**Evidence Quality:** (Evidence D)

**Recommendation Strength:** the Expert Panel recommends

**Conditional:** A child 0–4 years of age requires step 3 care or higher (step 4 care or higher for children 5–11 years of age) to achieve and maintain control or if additional education is indicated to improve the patients' management skills or adherence. Referral may be considered if a child 0–4 years of age requires step 2 care or a child 5–11 years of age requires step 3 care {Rec\_11: Cond\_14 }

**Decision Variable:** 5–11 years of age

**Decision Variable:** requires step 4 care or higher

**Decision Variable:** additional education is indicated to improve the patients' management skills or adherence

**Action:** recommends referral to an asthma specialist for consultation or comanagement of the patient



	<b>Recommendation Strength:</b> recommends
<b>Conditional:</b>	Referral may be considered if a child 0–4 years of age requires step 2 care or a child 5–11 years of age requires step 3 care. {Rec_11: Cond_15 }
	<b>Decision Variable:</b> 0–4 years of age <b>Decision Variable:</b> requires step 2 care <b>Action:</b> Referral
	<b>Recommendation Strength:</b> may be considered
<b>Conditional:</b>	Referral may be considered if a child 0–4 years of age requires step 2 care or a child 5–11 years of age requires step 3 care {Rec_11: Cond_16 }
	<b>Decision Variable:</b> 5–11 years of age <b>Decision Variable:</b> requires step 3 care <b>Action:</b> Referral may be considered
	<b>Recommendation Strength:</b> may be considered

**RECOMMENDATION:** Followup

<b>Imperative:</b>	The Expert Panel recommends that regular followup contact is essential (Evidence B).
	<b>Directive:</b> regular followup contact is essential <b>Description:</b> Contact at 1- to 6-month intervals is recommended, depending on the level of control; <b>Description:</b> consider a 3-month interval if a step down in therapy is anticipated (Evidence D). <b>Evidence Quality:</b> (Evidence B) <b>Recommendation Strength:</b> The Expert Panel recommends

**RECOMMENDATION:** Maintaining control

<b>Conditional:</b>	The Expert Panel recommends that once well-controlled asthma is achieved and maintained for at least 3 months, a reduction in pharmacologic therapy—a step down— can be considered helpful to identify the minimum therapy for maintaining well-controlled asthma (Evidence D). {Rec_13: Cond_17 }
	<b>Decision Variable:</b> well-controlled asthma is achieve <b>Decision Variable:</b> well-controlled asthma is maintained for at least 3 months, <b>Action:</b> a reduction in pharmacologic therapy—a step down— can be considered <b>Description:</b> The opinion of the Expert Panel is that the dose of ICS may be reduced about 25–50 percent every 3 months to the lowest dose possible required to maintain control <b>Evidence Quality:</b> (Evidence D) <b>Recommendation Strength:</b> can be considered

**RECOMMENDATION:** Pharmacologic Issues for Children 0–4 Years of Age

<b>Conditional:</b>	If there is no clear response within 4–6 weeks, the therapy
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should be discontinued and alternative therapies or alternative diagnoses considered {Rec\_14: Cond\_18 }

**Decision Variable:** no clear response within 4–6 weeks

**Action:** therapy should be discontinued

**Action:** alternative therapies or alternative diagnoses considered

**Reason:** treatment of young children is often in the form of a therapeutic trial

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommends

**Conditional:** If there is a clear and positive response for at least 3 months, a step down in therapy should be undertaken to the lowest possible doses of medication required to maintain asthma control {Rec\_14: Cond\_19 }

**Decision Variable:** a clear and positive response for at least 3 months

**Action:** a step down in therapy should be undertaken

**Description:** to the lowest possible doses of medication required to maintain asthma control

**Evidence Quality:** Treatment for young children, especially infants, has not been studied adequately. Recommendations are based on expert opinion, limited data, and extrapolations from studies in older children and adults

#### **RECOMMENDATION:** Step 1 Care, Children 0–4 Years of Age

**Conditional:** The Expert Panel recommends the following treatment for intermittent asthma: SABA taken as needed to treat symptoms is usually sufficient therapy for intermittent asthma (EPR2 1997). If effective in relieving symptoms, intermittent use of SABA can continue on an as-needed basis. Increasing use, however, may indicate more severe or inadequately controlled asthma and thus a need to step up therapy. {Rec\_15: Cond\_20 }

**Decision Variable:** intermittent asthma

**Action:** SABA taken as needed to treat symptoms

**Description:** If effective in relieving symptoms, intermittent use of SABA can continue on an as-needed basis. Increasing use, however, may indicate more severe or inadequately controlled asthma and thus a need to step up therapy.

**Reason:** usually sufficient therapy for intermittent asthma

**Recommendation Strength:** The Expert Panel recommends

#### **RECOMMENDATION:** managing exacerbations due to viral respiratory infections

**Conditional:** If the symptoms are mild, SABA (every 4–6 hours for 24 hours, longer with a physician consult) may be sufficient to control symptoms and improve lung function. {Rec\_16: Cond\_21 }

**Decision Variable:** (URI) symptoms are mild  
**Action:** SABA (every 4–6 hours for 24 hours, longer with a physician consult)  
**Reason:** to control symptoms and improve lung function.  
**Recommendation Strength:** The Expert Panel recommends

**Conditional:** If this therapy needs to be repeated more frequently than every 6 weeks, consider a step up in long-term care. {Rec\_16: Cond\_22 }

**Decision Variable:** this therapy (SABA every 4–6 hours for 24 hours, longer with a physician consult )  
**Action:** consider a step up in long-term care  
**Recommendation Strength:** The Expert Panel recommends

**Conditional:** If the viral respiratory infection provokes a moderate-to-severe exacerbation, a short course of oral systemic corticosteroids should be considered (1 mg/kg/day prednisone or equivalent for 3–10 days) {Rec\_16: Cond\_23 }

**Decision Variable:** viral respiratory infection provokes a moderate-to-severe exacerbation,  
**Action:** a short course of oral systemic corticosteroids should be considered  
**Description:** 1 mg/kg/day prednisone or equivalent for 3–10 days

**Recommendation Strength:** The Expert Panel recommends  
**Conditional:** For those patients who have a history of severe exacerbations with viral respiratory infections, consider initiating oral systemic corticosteroids at the first sign of the infection. {Rec\_16: Cond\_24 }

**Decision Variable:** history of severe exacerbations with viral respiratory infections,  
**Action:** consider initiating oral systemic corticosteroids at the first sign of the infection.  
**Recommendation Strength:** The Expert Panel recommends

**RECOMMENDATION:** asthma action plan

**Conditional:** The Expert Panel recommends that a detailed written asthma action plan be developed for those patients who have intermittent asthma and a history of severe exacerbations {Rec\_17: Cond\_25 }

**Decision Variable:** intermittent asthma  
**Decision Variable:** history of severe exacerbations  
**Action:** develop a detailed written asthma action plan  
**Description:** The patient's written asthma action plan should include indicators of worsening asthma (specific symptoms) as well as specific recommendations for using SABAs, early administering of oral systemic corticosteroids, and seeking medical care

**Evidence Quality:** Evidence B  
**Recommendation Strength:** The Expert Panel recommends

## RECOMMENDATION: PERSISTENT ASTHMA

- Conditional:** Daily long-term control medication at step 2 or above is recommended for children who had four or more wheezing episodes in 1 year and risk factors for persistent asthma {Rec\_18: Cond\_26 }
- Decision Variable:** children who had four or more wheezing episodes in 1 year  
**Decision Variable:** risk factors for persistent asthma  
**Action:** Daily long-term control medication at step 2 or above  
**Evidence Quality:** Evidence A  
**Recommendation Strength:** The Expert Panel recommends
- Conditional:** Consider daily therapy for children who have a second exacerbation requiring oral systemic corticosteroids in 6 months or children who consistently require symptomatic treatment andgt;2 days a week for andgt; 4 weeks {Rec\_18: Cond\_27 }
- Decision Variable:** children who have a second exacerbation requiring oral systemic corticosteroids in 6 months  
**Decision Variable:** children who consistently require symptomatic treatment andgt;2 days a week for andgt; 4 weeks  
**Action:** Consider daily therapy  
**Evidence Quality:** Evidence D  
**Recommendation Strength:** The Expert Panel recommends
- Conditional:** To gain more rapid control of asthma, a course of oral systemic corticosteroids may be necessary for the patient who has an exacerbation at the time long-term control therapy is started or in patients who have moderate or severe asthma with frequent interference with sleep or normal activity {Rec\_18: Cond\_28 }
- Decision Variable:** patient has an exacerbation at the time long-term control therapy is started  
**Decision Variable:** moderate or severe asthma with frequent interference with sleep or normal activity  
**Action:** a course of oral systemic corticosteroids may be necessary  
**Reason:** To gain more rapid control of asthma,  
**Recommendation Strength:** The Expert Panel recommends
- Conditional:** If no clear response occurs within 4–6 weeks and medication technique and adherence are satisfactory, the treatment should be discontinued and a change in therapy or alternative diagnoses should be considered. {Rec\_18: Cond\_29 }
- Decision Variable:** no clear response occurs within 4–6 weeks  
**Decision Variable:** medication technique and adherence are satisfactory  
**Action:** treatment should be discontinued and a change in

therapy or alternative diagnoses should be considered

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommends

**Conditional:** If there is a clear and positive response for at least 3 months, a step down in therapy should be undertaken to the lowest possible doses of medication required to maintain asthma control ( {Rec\_18: Cond\_30 } )

**Decision Variable:** a clear and positive response for at least 3 months

**Action:** a step down in therapy should be undertaken to the lowest possible doses of medication required to maintain asthma control

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommends

**Imperative:** SABA should be taken as needed to relieve symptoms

**Directive:** SABA should be taken as needed to relieve symptoms

**Description:** SABA should be taken as needed to relieve symptoms (EPR2 1997). The intensity of treatment will depend on the severity of the exacerbation (See section 5, "Managing Exacerbations of Asthma."). Use of SABA more than 2 days a week for symptom control (not prevention of EIB), or increasing use, indicates the need for additional long-term control therapy.

**Recommendation Strength:** The Expert Panel recommends

**Imperative:** Giving daily therapy only during specific periods of previously documented risk for a child may be considered

**Directive:** Giving daily therapy only during specific periods of previously documented risk

**Reason:** it is possible that children who have specifically defined periods of increased risk for symptoms and exacerbations (e.g., during the seasons in which viral respiratory infections are common) may require daily long-term control therapy only during this historically documented period of risk.

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommends "may be considered"

#### **RECOMMENDATION:** Step 2 Care, Children 0–4 Years of Age

**Conditional:** If an alternative treatment is selected and adequate asthma control is not achieved and maintained in 4–6 weeks, then discontinue that treatment and use the preferred medication before stepping up therapy. {Rec\_19: Cond\_31 }

**Decision Variable:** alternative treatment is selected

**Decision Variable:** adequate asthma control is not achieved and maintained in 4–6 weeks

**Action:** discontinue that treatment

**Action:** use the preferred medication before stepping up therapy

**Recommendation Strength:** recommends

**Conditional:** Therefore, it is the opinion of the Expert Panel that low-dose ICS is the preferred daily long-term control therapy for infants and young children who have never before been treated with long-term control therapy. This medication should be prescribed in the form of a therapeutic trial, and response should be monitored carefully. Treatment should be stopped if a clear beneficial effect is not obvious within 4–6 weeks and the patient/family medication technique and adherence are satisfactory. If a clear and positive response exists for at least 3 months (and given the high rates of spontaneous remission of symptoms in this age group), the need for ICS therapy should be reevaluated. A step down to intermittent therapy, as needed for symptoms, may then be considered {Rec\_19: Cond\_32 }

**Decision Variable:** infants and young children who have never before been treated with long-term control therapy

**Action:** low-dose ICS is the preferred daily long-term control therapy

**Description:** This medication should be prescribed in the form of a therapeutic trial, and response should be monitored carefully. Treatment should be stopped if a clear beneficial effect is not obvious within 4–6 weeks and the patient/family medication technique and adherence are satisfactory. If a clear and positive response exists for at least 3 months (and given the high rates of spontaneous remission of symptoms in this age group), the need for ICS therapy should be reevaluated. A step down to intermittent therapy, as needed for symptoms, may then be considered

**Reason:** At present, few studies of medications have been conducted in children younger than 3 years of age. ICSs have been shown to be effective in long-term clinical studies with infants and young children (Bisgaard et al. 2004; Guilbert et al. 2006). In contrast, cromolyn has demonstrated inconsistent symptom control in children younger than 5 years of age (Tasche et al. 2000). Montelukast has shown some effectiveness in children 2–5 years of age (Knorr et al. 2001) and, in young children who have a history of exacerbations, can reduce symptoms associated with exacerbations and the amount of ICSs used during exacerbations, although montelukast was not shown to reduce requirements for oral systemic corticosteroid to control exacerbations (Bisgaard et al. 2005).

**Evidence Quality:** Evidence D

**Recommendation Strength:** it is the opinion of the Expert

	Panel
<b>Conditional:</b>	A trial of montelukast in children 2 years of age or older can be considered in situations in which inhaled medication delivery is suboptimal due to poor technique or adherence. {Rec_19: Cond_33 }
	<b>Decision Variable:</b> 2 years of age or older <b>Decision Variable:</b> inhaled medication delivery is suboptimal due to poor technique or adherence <b>Action:</b> A trial of montelukast can be considered <b>Recommendation Strength:</b> can be considered
<b>Imperative:</b>	Preferred treatment for step 2 care is daily ICS at a low dose
	<b>Directive:</b> daily ICS at a low dose <b>Evidence Quality:</b> Evidence A based on studies of individual drug efficacy in this age group; comparator trials are not available
<b>Imperative:</b>	Alternative, but not preferred, treatments include (listed in alphabetical order) cromolyn (Evidence B—extrapolated from studies in older children) and montelukast (Evidence A). If an alternative treatment is selected and adequate asthma control is not achieved and maintained in 4–6 weeks, then discontinue that treatment and use the preferred medication before stepping up therapy.
	<b>Directive:</b> cromolyn (Evidence B—extrapolated from studies in older children) <b>Directive:</b> montelukast (Evidence A) <b>Evidence Quality:</b> EvidenceB, A) <b>Recommendation Strength:</b> recommends
<b>Imperative:</b>	Theophylline is not recommended as alternative treatment (EPR2 1997) because of its erratic metabolism during viral infections and febrile illness in children less than 5 years of age and the need to closely monitor and control serum concentrations.
	<b>Directive:</b> Theophylline is not recommended <b>Reason:</b> because of its erratic metabolism during viral infections and febrile illness in children less than 5 years of age and the need to closely monitor and control serum concentrations.

**RECOMMENDATION:** Step 3 Care, Children 0–4 Years of Age

<b>Conditional:</b>	The Expert Panel recommends increasing the dose of ICS, for children 0–4 years of age whose asthma is not well controlled on low doses of ICS, to ensure that an adequate dose is delivered (due to the inherent difficulty and variability of delivering aerosols) before adding adjunctive therapy {Rec_20: Cond_34 }
	<b>Decision Variable:</b> children 0–4 years of age <b>Decision Variable:</b> asthma is not well controlled on low doses of ICS <b>Action:</b> increasing the dose of ICS before adding adjunctive

therapy

**Reason:** to ensure that an adequate dose is delivered (due to the inherent difficulty and variability of delivering aerosols)

**Evidence Quality:** Evidence D

**Recommendation Strength:** Expert Panel recommends i

**Imperative:** Medium-dose ICS is the preferred step 3 treatment

**Directive:** Medium-dose ICS

**Evidence Quality:** Evidence D

**RECOMMENDATION:** Step 4 Care, Children 0–4 Years of Age

**Imperative:** Medium-dose ICS AND either (listed in alphabetical order) LABA or montelukast is the preferred treatment for step 4

**Directive:** Medium-dose ICS AND LABA

**Directive:** Medium-dose ICS AND montelukast

**Evidence Quality:** Evidence D

**Recommendation Strength:** may be considered

**Imperative:** Theophylline is not recommended as add-on therapy

**Directive:** Theophylline is not recommended

**Reason:** No data were found on add-on therapy in children 0–4 years of age whose asthma is not well controlled on medium-dose ICS. In the opinion of the Expert Panel, and extrapolating from studies in older children and adults, adding a noncorticosteroid long-term control medication to the medium dose of ICS may be considered before increasing the dose of ICS to high dose, to avoid the potential risk of side effects with high doses of medication. The LABA DPI preparation is difficult to administer correctly to the majority of children less than 4 years of age; studies are needed to determine if the recently released LABA HFA will be convenient to administer in this age group. Montelukast (an LTRA) in combination with lower doses of an ICS can be considered for add-on therapy in these children. Theophylline is not recommended as add-on therapy due to the erratic metabolism of theophylline during viral infections and febrile illness (See figure 4–4a.), which are common in this age group, and the need for careful monitoring of serum concentration levels

**Recommendation Strength:** recommended

**RECOMMENDATION:** Step 5 Care, Children 0–4 Years of Age

**Imperative:** High-dose ICS AND either LABA or montelukast is the preferred treatment

**Directive:** High-dose ICS AND LABA

**Directive:** High-dose ICS AND montelukast

**Evidence Quality:** Evidence D

**RECOMMENDATION:** Step 6 Care, Children 0–4 Years of Age

**Imperative:** High-dose ICS AND either LABA or montelukast AND oral



systemic corticosteroids may be given for step 6

**Directive:** High-dose ICS AND LABA AND oral systemic corticosteroids

**Directive:** High-dose ICS AND montelukastA AND oral systemic corticosteroids

**Description:** Before oral systemic corticosteroids are given for prolonged periods as a long-term control medication, consider a 2-week course of oral systemic corticosteroids to confirm clinical reversibility and the possibility of an effective response to therapy or, in 4-year-old children, consider high-dose ICS in combination with both an LTRA and a LABA. For patients who require long-term oral systemic corticosteroids: and#14; Use the lowest possible dose (single dose daily or on alternative days). and#14; Monitor patients closely for corticosteroid adverse effects (See component 4—Medications.). and#14; When control of asthma symptoms is achieved, make persistent attempts to reduce oral systemic corticosteroids. High doses of ICS are preferable because they have fewer side effects than oral systemic corticosteroids. and#14; Recommend consultation with an asthma specialist.

**Evidence Quality:** Evidence D

**RECOMMENDATION:** Treatment: Special Issues for Children 5–11 Years of Age

**Conditional:** The Expert Panel recommends that, when initiating daily long-term control therapy for mild or moderate persistent asthma, the choice of medication includes consideration of treatment effectiveness, the domain of particular relevance to the patient’s asthma (impairment, risk, or both), the individual patient’s history of previous response to therapies, the ability of the patient and family to use the medication correctly, anticipated patient and family adherence to the treatment regimen, and cost {Rec\_24: Cond\_35 }

**Decision Variable:** when initiating daily long-term control therapy for mild or moderate persistent asthma,

**Action:** the choice of medication includes consideration of treatment effectiveness

**Action:** the choice of medication includes the domain of particular relevance to the patient’s asthma (impairment, risk, or both)

**Action:** the choice of medication includes consideration of the individual patient’s history of previous response to therapies,

**Action:** the choice of medication includes consideration of the ability of the patient and family to use the medication correctly

**Action:** the choice of medication includes consideration of

anticipated patient and family adherence to the treatment regimen

**Action:** the choice of medication includes consideration of cost

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommends

**Imperative:** The Expert Panel recommends that the clinician prepare a written asthma action plan for the student's school or childcare setting.

**Directive:** clinician prepare a written asthma action plan for the student's school or childcare setting

**Description:** The written asthma action plan should include the following information (See "Component 2: Education for a Partnership in Asthma Care," figure 3–16.): instructions for handling exacerbations (including the clinician's recommendation regarding self-administration of medication); recommendations for long-term control medications and prevention of EIB, if appropriate; and identification of those factors that make the student's asthma worse, so the school may help the student avoid exposure.

**Description:** It is preferable to schedule daily, long-term medications so that they are not taken at school, even if this results in unequal dosing intervals throughout the day. In school districts that have more comprehensive school nurse coverage, however, children who would benefit from close supervision to promote adherence may be given medications at school. In this way, daily medication can be administered, and patient education can be supplemented most days of the week

**Description:** Students who have asthma often require medication during school to treat acute symptoms or to prevent EIB that may develop during physical education class, school recess, or organized sports. Reliable, prompt access to medication is essential, but it may be difficult because of school rules that preclude the child from carrying medications. The NAEPP and several member organizations have adopted resolutions that endorse allowing students to carry and self-administer medications when the physician and parent consider this appropriate. Many State governments have passed legislation that allows self-administration of asthma medication in schools. It may be helpful for some children to have a compressor-driven nebulizer and medication available at the school.

**Reason:** Nonrandomized studies and observational studies have demonstrated the usefulness of written asthma action

plans and peak flow monitoring in schools (Barbot et al. 2006; Borgmeyer et al. 2005; Byrne et al. 2006; Erickson et al. 2006)

**Evidence Quality:** Evidence C

**Recommendation Strength:** The Expert Panel recommends

**Imperative:** The Expert Panel recommends that physical activity at play or in organized sports is an essential part of a child's life, and full participation in physical activities should be encouraged

**Directive:** full participation in physical activities should be encouraged

**Description:** Treatment immediately before vigorous activity or exercise usually prevents EIB. If symptoms occur during usual play activities, a step up in long-term therapy is warranted. Poor endurance or EIB can be an indication of poorly controlled persistent asthma; appropriate use of long-term control medication can reduce EIB (See the section on "Managing Special Situations in Asthma—Exercise-Induced Bronchospasm."). Activity should be limited or curtailed only as a last resort.

**Recommendation Strength:** he Expert Panel recommends

#### **RECOMMENDATION:** Step 1 Care, Children 5–11 Years of Age

**Conditional:** Manage moderate or severe exacerbations due to viral respiratory infections, especially common in children, with a short course of oral systemic corticosteroids. {Rec\_25: Cond\_36 }

**Decision Variable:** moderate or severe exacerbations due to viral respiratory infections

**Action:** short course of oral systemic corticosteroids

**Conditional:** Consider initiating systemic corticosteroids at the first sign of infection in children who have a history of severe exacerbations with viral respiratory infections {Rec\_25: Cond\_37 }

**Decision Variable:** history of severe exacerbations with viral respiratory infections

**Action:** Consider initiating systemic corticosteroids at the first sign of infection

**Evidence Quality:** Evidence D

**Recommendation Strength:** Consider

**Conditional:** Provide a detailed written asthma action plan for those patients who have intermittent asthma and a history of severe exacerbations {Rec\_25: Cond\_38 }

**Decision Variable:** patients who have intermittent asthma and a history of severe exacerbations

**Action:** Provide a detailed written asthma action plan

**Description:** The patient's written asthma action plan should include indicators of worsening asthma (specific symptoms and peak expiratory flow (PEF))

measurement), specific recommendations for using SABA, early administration of systemic corticosteroids, and seeking medical care. Recommendations regarding avoidance or control of allergies, irritants, or comorbid conditions that affect the child's asthma should also be included

**Evidence Quality:** Evidence B

**Recommendation Strength:** The Expert Panel recommends

**Imperative:** The Expert Panel recommends the following therapy for intermittent asthma (step 1 care): SABA, taken as needed to treat symptoms, is usually sufficient therapy for intermittent asthma.

**Directive:** SABA, taken as needed to treat symptoms

**Description:** If a child requires increasing amounts of as-needed SABA, this may indicate more severe or poorly controlled asthma and thus the need to step up therapy

#### **RECOMMENDATION: PERSISTENT ASTHMA**

**Conditional:** To gain more rapid control of asthma, consider a course of oral systemic corticosteroids for the patient who has an exacerbation at the time long-term control therapy is started or in patients who have moderate or severe asthma with frequent interference with sleep or normal activity {Rec\_26: Cond\_39 }

**Decision Variable:** has an exacerbation at the time long-term control therapy is started

**Decision Variable:** patients who have moderate asthma with frequent interference with sleep or normal activity

**Decision Variable:** patients who have severe asthma with frequent interference with sleep or normal activity

**Action:** consider a course of oral systemic corticosteroids

**Recommendation Strength:** The Expert Panel recommends

**Conditional:** Consider treating patients who had two or more exacerbations requiring oral systemic corticosteroids in the past year the same as patients who have persistent asthma, even in the absence of an impairment level consistent with persistent asthma {Rec\_26: Cond\_40 }

**Decision Variable:** two or more exacerbations requiring oral systemic corticosteroids in the past year t

**Action:** Consider treating as patients who have persistent asthma

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommend

**Imperative:** Use daily long-term control medication.

**Directive:** Use daily long-term control medication

**Description:** The most effective long-term control medications are those with anti-inflammatory effects, that is, those that diminish chronic airway

inflammation and airway hyperresponsiveness

**Evidence Quality:** Evidence A

**Recommendation Strength:** The Expert Panel recommends

**Imperative:** SABA, taken as needed to relieve symptoms, is recommended

**Directive:** SABA, taken as needed to relieve symptoms,

**Description:** The intensity of treatment will depend on the severity of the exacerbation (See section 5 on “Managing Exacerbations of Asthma.”). Increasing use of SABA or use more than 2 days week for symptom control (not prevention of EIB) indicates the need to step up therapy.

**Evidence Quality:** Evidence A

**Recommendation Strength:** The Expert Panel recommend

**Imperative:** Giving daily therapy only during specific periods of previously documented risk for a child may be considered

**Directive:** Giving daily therapy only during specific periods of previously documented risk

**Description:** Although this approach is not yet evaluated, it is possible that children who have specifically defined periods of increased risk for symptoms and exacerbations (e.g., during the seasons in which viral respiratory infections are common) may require daily long-term control therapy only during this historically documented period of risk. If long-term control therapy is discontinued, then written action plans for recognizing and handling signs of worsening asthma should be reviewed with the caregivers, and followup appointments 2–6 weeks later should be conducted to ensure that asthma control is maintained.

**Evidence Quality:** Evidence D

**Recommendation Strength:** The Expert Panel recommends may be considered

**RECOMMENDATION:** Step 2 Care, Children 5–11 Years of Age

**Imperative:** Daily low-dose ICS is the preferred step 2 treatment

**Directive:** Daily low-dose ICS

**Reason:** High-quality evidence demonstrates the effectiveness of ICS as initial therapy for children who have persistent asthma

**Evidence Quality:** Evidence A

**Imperative:** Alternative treatments at this step include (listed in alphabetical order) cromolyn, LTRA, nedocromil, and theophylline

**Directive:** cromolyn

**Directive:** LTRA

**Directive:** nedocromil

**Evidence Quality:** Evidence B

**RECOMMENDATION:** Step 3 Care, Children 5–11 Years of Age

**Imperative:** Low-dose ICS plus the addition of some form of adjunctive therapy or medium-dose ICS are equivalent options in step 3 care, based on extrapolation from studies in adults

**Directive:** Low-dose ICS plus LABA

**Description:** In adult patients whose asthma is not well controlled on low-dose ICS, the clinician has several options: (1) increasing the ICS dose, (2) adding a LABA, (3) adding a leukotriene modifier, or (4) adding theophylline. Based on considerable available evidence, the first two are preferred. In children, none of these options has been studied adequately or compared in the age range of 5–11 years, and the options have not been studied at all in those andlt;5 years of age.

**Directive:** Low-dose ICS plus LTRA

**Directive:** Low-dose ICS plus theophylline

**Reason:** Two trials demonstrated that children 4–11 years of age who had asthma not completely controlled by ICS achieved improved lung function and symptom control with the addition of LABA compared to placebo (Russell et al. 1995; Zimmerman et al. 2004). FDA approval for the combination in 4- to 11-year-old children, however, is based primarily on safety and extrapolation of efficacy from adolescents and adults (Malone et al. 2005; Van den Berg et al. 2000). To date, studies have not shown a reduction in significant asthma exacerbations from the addition of LABA to ICS treatment in children (Bisgaard 2003). One negative study of LABA in combination with ICS in children who had mild or moderate persistent asthma failed to establish a need in the study participants, at baseline, for more therapy than low-dose ICS, and thus did not sufficiently address the question of combination therapy with LABA (Verberne et al. 1998).

**Reason:** One trial of medications for children compared the addition of montelukast to budesonide, 400 mcg/day, and reported a slight increase in lung function (PEF, although not FEV1) and a reduction in as-needed SABA use (Simons et al. 2001)

**Reason:** A small trial in 36 children, 6–18 years of age, reported a small improvement in PEF, but not FEV1 or bronchial reactivity, from the addition of theophylline to ICS (Suessmuth et al. 2003). Because of the risk of toxicity, multiple drug interactions, and the need to monitor serum concentrations regularly, with no significant beneficial effect over other adjunctive treatments, theophylline would be considered the less desirable option for adjunctive therapy.

**Evidence Quality:** Evidence B—extrapolation

**Imperative:** Increasing the dose of ICS to medium dose

**Recommendation Strength:** the Expert Panel considers

increasing the dose of ICS to the medium-dose range or using lower doses of ICS plus adjunctive therapy to be equivalent options

**Flexibility:** In summary, based on the small amount of data available concerning asthma in children 5–11 years of age, as well as the lack of comparison studies for various long-term control regimens, it is not possible to recommend firmly whether administering higher doses of ICS or maintaining the low dose of ICS and adding adjunctive therapy is the best treatment approach for step 3 care.

**RECOMMENDATION: Step 4 Care, Children 5–11 Years of Age**

**Conditional:** In the opinion of the Expert Panel, if the add-on therapy initially administered does not lead to improvement in asthma control, discontinue it and use a trial of a different add-on therapy before stepping up. {Rec\_29: Cond\_41 }

**Decision Variable:** add-on therapy initially administered does not lead to improvement in asthma control

**Action:** discontinue it and use a trial of a different add-on therapy before stepping up

**Evidence Quality:** opinion of the Expert Panel

**Imperative:** Medium-dose ICS AND LABA is the preferred step 4 treatment

**Directive:** Medium-dose ICS AND LABA

**Evidence Quality:** Evidence B— extrapolated from studies in youths 12 years and adults)

**Imperative:** Alternative, but not preferred, treatment is medium-dose ICS AND either LTRA or theophylline

**Directive:** medium-dose ICS AND either LTRA or theophylline

**Reason:** No data specifically address the comparative effects of the various choices of treatments to add on to ICS in children andlt;11 years of age. Based on comparative studies in older children and adults (Evidence A), the preferred add-on treatment is LABA. If the physician has concerns regarding use of LABA, an LTRA can be given a therapeutic trial first. If a trial of LTRA is deemed ineffective, then the LTRA should be discontinued, and theophylline could be added. Theophylline is a less desirable option because of its safety profile and the need to monitor serum concentration levels. Cromolyn has not been demonstrated to be effective as add-on therapy.

**Evidence Quality:** Evidence B—extrapolated from studies in youths 12 years of age and adults

**RECOMMENDATION: Step 5 Care, Children 5–11 Years of Age**

**Imperative:** High-dose ICS AND LABA is the preferred step 5 treatment

**Directive:** High-dose ICS AND LABA

**Evidence Quality:** Evidence B—extrapolated

**Imperative:** Alternative, but not preferred, add-on treatments include LTRA or theophylline

**Directive:** add-on treatments LTRA or theophylline

**Evidence Quality:** Evidence B—extrapolated

**RECOMMENDATION:** Step 6 Care, Children 5–11 Years of Age

**Conditional:** When well-controlled asthma is achieved, make persistent attempts to reduce oral systemic corticosteroids. High-dose ICS therapy is preferable to oral systemic corticosteroids.  
{Rec\_31: Cond\_42 }

**Decision Variable:** well-controlled asthma is achieved

**Action:** make persistent attempts to reduce oral systemic corticosteroids

**Description:** High-dose ICS therapy is preferable to oral systemic corticosteroids

**Imperative:** High-dose ICS AND LABA AND oral systemic corticosteroids long term is the preferred treatment

**Directive:** High-dose ICS AND LABA AND oral systemic corticosteroids

**Evidence Quality:** Evidence D

**Imperative:** Alternative, but not preferred, add-on treatments are either an LTRA or theophylline AND oral systemic corticosteroids

**Directive:** LTRA or theophylline AND oral systemic corticosteroids (

**Directive:** theophylline AND oral systemic corticosteroids

**Description:** Before maintenance prednisone therapy is initiated, consider a 2-week course of oral corticosteroids to confirm clinical reversibility and the possibility of effective response to therapy. At this level of treatment, it is strongly recommended to add measures of pulmonary function to assess response to oral corticosteroid therapy. If response is poor, a careful review for other pulmonary conditions or concomitant medical conditions should be conducted to ensure the primary diagnosis is indeed severe asthma. For patients who require long-term oral systemic corticosteroids:  
• Use the lowest possible dose (single dose daily or on alternate days).  
• Monitor patients closely for corticosteroid adverse side effects

**Evidence Quality:** Evidence D

**Imperative:** Recommend consultation with an asthma specialist.

**Directive:** Recommend consultation with an asthma specialist.

**RECOMMENDATION:** PULMONARY FUNCTION TESTING (SPIROMETRY)

**Conditional:** The Expert Panel recommends that spirometry measurements—FEV<sub>1</sub>, forced expiratory volume in 6 seconds (FEV<sub>6</sub>), FVC, FEV<sub>1</sub>/FVC—before and after the patient inhales a short-acting bronchodilator should be undertaken for



patients in whom the diagnosis of asthma is being considered, including children 5 years of age {Rec\_32: Cond\_43 }

**Decision Variable:** patients in whom the diagnosis of asthma is being considered

**Decision Variable:** children 5 years of age

**Action:** FEV1 before and after the patient inhales a short-acting bronchodilator

**Action:** forced expiratory volume in 6 seconds (FEV6 ) before and after the patient inhales a short-acting bronchodilator

**Action:** FVC before and after the patient inhales a short-acting bronchodilator

**Action:** FEV1 /FVC before and after the patient inhales a short-acting bronchodilator

**Reason:** These measurements help to determine whether there is airflow obstruction, its severity, and whether it is reversible over the short term (Bye et al. 1992; Li and O'Connell 1996). (See box 3–2 for further information.) Patients' perception of airflow obstruction is highly variable, and spirometry sometimes reveals obstruction much more severe than would have been estimated from the history and physical examination.

**Conditional:** The Expert Panel recommends that office-based physicians who care for asthma patients should have access to spirometry, which is useful in both diagnosis and periodic monitoring. Spirometry should be performed using equipment and techniques that meet standards developed by the ATS {Rec\_32: Cond\_44 }

**Decision Variable:** office-based physicians who care for asthma patients

**Action:** have access to spirometry

**Description:** using equipment and techniques that meet standards developed by the ATS (EPR2 1997). Correct technique, calibration methods, and maintenance of equipment are necessary to achieve consistently accurate test results

**Conditional:** The Expert Panel recommends that when office spirometry shows severe abnormalities, or if questions arise regarding test accuracy or interpretation, further assessment should be performed in a specialized pulmonary function laboratory {Rec\_32: Cond\_45 }

**Decision Variable:** office spirometry shows severe abnormalities

**Decision Variable:** questions arise regarding test accuracy or interpretation

**Action:** further assessment should be performed in a specialized pulmonary function laboratory

## **RECOMMENDATION: CLASSIFY ASTHMA SEVERITY**

**Imperative:** The Expert Panel recommends that clinicians classify asthma severity by using the domains of current impairment and future risk (Evidence B—secondary analyses of clinical trials, and Evidence C—observational studies, for assessing impairment; Evidence C, for distinguishing intermittent versus persistent asthma by risk of exacerbations; Evidence D, for distinguishing different categories of persistent asthma by varying frequencies of exacerbations).

**Directive:** classify asthma severity by using the domains of current impairment and future risk

**Description:** initial assessment of asthma severity is made immediately after diagnosis, or when the patient is first encountered, generally before the patient is taking some form of long-term control medication. Assessment is made on the basis of current spirometry and the patient's recall of symptoms over the previous 2–4 weeks, because detailed recall of symptoms decreases over time. If the assessment is made during a visit in which the patient is treated for an acute exacerbation, then asking the patient to recall symptoms in the period before the onset of the current exacerbation will suffice until a followup visit can be made.

**Description:** For population-based evaluations, clinical research, or subsequent characterization of the patient's overall severity, asthma severity can be inferred after optimal therapy is established by correlating levels of severity with the lowest level of treatment required to maintain control. For clinical management, however, the emphasis is to assess asthma severity prior to initiating therapy and, then, assess control for monitoring and adjusting therapy

**Evidence Quality:** (Evidence B—secondary analyses of clinical trials, and Evidence C—observational studies, for assessing impairment; Evidence C, for distinguishing intermittent versus persistent asthma by risk of exacerbations; Evidence D, for distinguishing different categories of persistent asthma by varying frequencies of exacerbations)

**Recommendation Strength:** recommends

**Imperative:** Assessment of severity requires assessing the following components of current impairment: Symptoms — Nighttime awakenings — Need for SABA for quick relief of symptoms — Work/school days missed — Ability to engage in normal daily activities or in desired activities — Quality-of-life assessments Lung function, measured by spirometry: FEV<sub>1</sub>, FVC (or FEV<sub>6</sub>), FEV<sub>1</sub>/FVC (or FEV<sub>6</sub> in adults).

**Directive:** ASSESS: Nighttime awakenings

**Directive:** ASSESS: Need for SABA for quick relief of symptoms

**Directive:** ASSESS: Work/school days missed  
**Directive:** ASSESS: Ability to engage in normal daily activities or in desired activities  
**Directive:** ASSESS: Quality-of-life

**RECOMMENDATION: MEASURES FOR PERIODIC ASSESSMENT AND MONITORING OF ASTHMA CONTROL**

**Imperative:** The Expert Panel recommends that ongoing monitoring of asthma control be performed to determine whether all the goals of therapy are met—that is, reducing both impairment and risk (Evidence B); see figures 3–5 a, b, and c for assessing asthma control for different age groups

**Directive:** Monitor asthma control  
**Reason:** to determine whether all the goals of therapy are met—that is, reducing both impairment and risk  
**Evidence Quality:** Evidence B  
**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends that the frequency of visits to a clinician for review of asthma control is a matter of clinical judgment; in general, patients who have intermittent or mild persistent asthma that has been under control for at least 3 months should be seen by a clinician about every 6 months, and patients who have uncontrolled and/or severe persistent asthma and those who need additional supervision to help them follow their treatment plan need to be seen more often

**Directive:** Monitor asthma control  
**Description:** Monitoring signs and symptoms of asthma  
Monitoring pulmonary function — Spirometry  
— Peak flow monitoring  
Monitoring quality of life  
Monitoring history of asthma exacerbations  
Monitoring pharmacotherapy for adherence and for potential side effects  
Monitoring patient–provider communication and patient satisfaction  
Monitoring asthma control with minimally invasive markers and pharmacogenetics (requires further evaluation)  
**Evidence Quality:** The assessment measures for control monitor six areas described in this section and are recommended based on the opinion of the Expert Panel and review of the scientific literature.  
**Recommendation Strength:** recommends

**RECOMMENDATION: Monitoring Signs and Symptoms of Asthma**

**Conditional:** The Expert Panel recommends the following: If peak flow monitoring is performed, the written asthma action plan should use the patient’s personal best peak flow as the reference value {Rec\_35: Cond\_46 }

**Decision Variable:** peak flow monitoring is performed,  
**Action:** the written asthma action plan should use the patient’s personal best peak flow as the reference value

<b>Imperative:</b>	The Expert Panel recommends that every patient who has asthma should be taught to recognize symptom patterns that indicate inadequate asthma control (Evidence A) (See also “Component 2: Education for a Partnership in Asthma Care.”). Either symptom and/or PEF monitoring should be used as a means to determine the need for intervention, including additional medication, in the context of a written asthma action plan.
	<p><b>Directive:</b> Teach patients to recognize symptom patterns that indicate inadequate asthma control</p> <p><b>Evidence Quality:</b> Evidence A</p> <p><b>Recommendation Strength:</b> recommends</p>
<b>Imperative:</b>	The Expert Panel recommends that symptoms and clinical signs of asthma should be assessed at each health care visit through physical examination and appropriate questions
	<p><b>Directive:</b> Assess symptoms and clinical signs of asthma at each health care visit</p> <p><b>Recommendation Strength:</b> recommends</p>
<b>Imperative:</b>	The Expert Panel recommends that the detailed symptoms history should be based on a short (2–4 weeks) recall period
	<p><b>Directive:</b> Base detailed symptom history on a short (2-4 week) recall period</p> <p><b>Reason:</b> Patients’ detailed recall of symptoms decreases over time; therefore, the clinician may choose to assess over a 2-week, 3-week, or 4-week recall period.</p> <p><b>Recommendation Strength:</b> recommends</p>
<b>Imperative:</b>	The Expert Panel recommends that assessment of the patient’s symptom history should include at least four key symptom expressions
	<p><b>Directive:</b> Assess: Daytime asthma symptoms (including wheezing, cough, chest tightness, or shortness of breath)</p> <p><b>Directive:</b> Assess: Nocturnal awakening as a result of asthma symptoms</p> <p><b>Directive:</b> Assess: Frequency of use of SABA for relief of symptoms</p> <p><b>Directive:</b> Assess: Inability or difficulty performing normal activities (including exercise) because of asthma symptoms</p> <p><b>Evidence Quality:</b> Evidence B, extrapolation from clinical trials; and Evidence C, from observational studies</p> <p><b>Recommendation Strength:</b> recommends</p>
<b>Imperative:</b>	The Expert Panel recommends that, in addition to assessing symptoms, it is also important to assess pulmonary function periodically (Evidence B, extrapolation from clinical trials; and Evidence C, from observational studies).
	<p><b>Directive:</b> assess pulmonary function periodically</p> <p style="padding-left: 40px;"><b>Description:</b> The main methods are spirometry and peak flow monitoring.</p> <p><b>Evidence Quality:</b> Evidence B, extrapolation from clinical trials; and Evidence C, from observational studies</p>

**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends the following frequencies for spirometry measurements: (1) at the time of initial assessment (Evidence C); (2) after treatment is initiated and symptoms and PEF have stabilized, to document attainment of (near) “normal” airway function; (3) during a period of progressive or prolonged loss of asthma control; and (4) at least every 1–2 years to assess the maintenance of airway function (Evidence B, extrapolation from clinical trials). Spirometry may be indicated more often than every 1– 2 years, depending on the clinical severity and response to management (Evidence D). These spirometry measures should be followed over the patient’s lifetime to detect potential for decline and rate of decline of pulmonary function over time (Evidence C).

**Directive:** Perform spirometry: at the time of initial assessment (Evidence C)

**Directive:** Perform spirometry: after treatment is initiated and symptoms and PEF have stabilized, to document attainment of (near) “normal” airway function;

**Directive:** Perform spirometry: during a period of progressive or prolonged loss of asthma control;

**Directive:** Perform spirometry: at least every 1–2 years to assess the maintenance of airway function (Evidence B, extrapolation from clinical trials)

**Description:** Spirometry may be indicated more often than every 1– 2 years, depending on the clinical severity and response to management (Evidence D).

These spirometry measures should be followed over the patient’s lifetime to detect potential for decline and rate of decline of pulmonary function over time (Evidence C).

**Evidence Quality:** Evidence D

**Recommendation Strength:** recommends

**Imperative:** Consider long-term daily peak flow monitoring for: — Patients who have moderate or severe persistent asthma (Evidence B). — Patients who have a history of severe exacerbations (Evidence B). — Patients who poorly perceive airflow obstruction and worsening asthma (Evidence D). — Patients who prefer this monitoring method (Evidence D).

**Directive:** Consider long-term daily peak flow monitoring for: Patients who have moderate or severe persistent asthma (Evidence B)

**Directive:** Consider long-term daily peak flow monitoring for: Patients who have a history of severe exacerbations (Evidence B).

**Directive:** Consider long-term daily peak flow monitoring for: Patients who poorly perceive airflow obstruction and worsening asthma (Evidence D). —

**Directive:** Consider long-term daily peak flow monitoring

for: Patients who prefer this monitoring method (Evidence D).

**Evidence Quality:** B-D

**Recommendation Strength:** consider

**Imperative:**

Provide to all patients a written asthma action plan that includes daily treatment and recognizing and handling worsening asthma, including self-adjustment of medications in response to acute symptoms or changes in PEF measures. Written action plans are particularly recommended for patients who have moderate or severe persistent asthma, a history of severe exacerbations, or poorly controlled asthma (Evidence B)

**Directive:** Provide to all patients a written asthma action plan

**Description:** Written asthma action plans include two important elements: Daily management — What medicine to take daily, including the specific names of the medications — What actions to take to control environmental factors that worsen the patient's asthma How to recognize and handle worsening asthma — What signs, symptoms, and PEF measurements (if peak flow monitoring is used) indicate worsening asthma — What medications to take in response to these signs — What symptoms and PEF measurements indicate the need for urgent medical attention — Emergency telephone numbers for the physician, ED, and person or service to transport the patient rapidly for medical care

**Benefit:** The effectiveness of written asthma action plans has been addressed in several recent systematic reviews and in five individual studies. A recent systematic review of 36 RCTs showed that self-management education that included self-monitoring by either PEF or symptoms, coupled with regular medical review and a written asthma action plan, reduced hospitalizations, urgent care visits, ED visits, work absences, and nocturnal asthma in adults (Gibson et al. 2003). Although subgroup analyses were not able to isolate the specific contribution of written plans to these outcomes, the authors conclude that education programs that enable people to adjust their medication using a written asthma action plan appear to be more effective than other forms of asthma self-management. In a later systematic review (Toelle and Ram 2004), three RCTs tested the effect of written plans versus no written plans and found no consistent evidence that written plans produced better patient outcomes than outcomes with no written plan. The trials were too small and the results too inconsistent to reach a firm conclusion about the contribution of written asthma action plans to asthma education. Five individual studies (including

four RCTs, and one with an additional, extended followup) and one case-control study have examined the contributions of written asthma action plans to the control of asthma (Abramson et al. 2001; Baldwin et al. 1997; Cowie et al. 1997; Jones et al. 1995; Klein et al. 2001; van der Palen et al. 2001). Two RCTs showed no effect for written asthma action plans compared to no written plans for measures of asthma morbidity or health care utilization (Baldwin et al. 1997; Jones et al. 1995). The individual benefit of including an asthma action plan for self-management of exacerbations was shown in a 2-year RCT

**Evidence Quality:** (Evidence B)

**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends that several key areas of quality of life and related loss of physical function should be assessed periodically for each person who has asthma (Evidence C). These include: Any work or school missed because of asthma Any reduction in usual activities (either home/work/school or recreation/exercise) Any disturbances in sleep due to asthma Any change in caregivers' activities due to a child's asthma (for caregivers of children who have asthma)

**Directive:** Assess periodically: Any work or school missed because of asthma

**Directive:** Assess periodically: Any reduction in usual activities (either home/work/school or recreation/exercise)

**Directive:** Assess periodically: Any disturbances in sleep due to asthma

**Directive:** Assess periodically: Any change in caregivers' activities due to a child's asthma (for caregivers of children who have asthma)

**Evidence Quality:** Evidence C

**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends that, during periodic assessments, clinicians should question the patient and evaluate any records of patient self-monitoring (figure 3–7) to detect exacerbations, both those that are self-treated and those treated by other health care providers (Evidence C).

**Directive:** Inquire and evaluate: records of patient self-monitoring (figure 3–7) to detect exacerbations,

**Description:** It is important to evaluate the frequency, rate of onset, severity, and causes of exacerbations. A history of previous exacerbations, especially in the past year, is the strongest predictor of future severe exacerbations leading to ED visits and hospitalizations (Adams et al. 2000; Eisner et al. 2001; Ford et al. 2001; Lieu et al. 1998). The patient should be asked about precipitating exposures and other factors. Specific

inquiry into unscheduled visits to health care providers, telephone calls for assistance, and use of urgent or emergency care facilities is helpful. Severity of the exacerbation can be estimated by the increased need for oral corticosteroids. Finally, any hospitalizations should be documented, including the facility, duration of stay, and any use of critical care or intubation.

**Evidence Quality:** Evidence C

**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends monitoring the following factors at each visit: patient's adherence to the regimen, inhaler technique, and side effects of medications (Evidence C)

**Directive:** Monitor at each visit: patient's adherence to the regimen

**Directive:** Monitor at each visit: inhaler technique,

**Directive:** Monitor at each visit: side effects of medications

**Evidence Quality:** Evidence C

**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends that health care providers should routinely assess the effectiveness of patient–clinician communication (Evidence D).

**Directive:** routinely assess the effectiveness of patient–clinician communication

**Description:** Open and unrestricted communication among the clinician, the patient, and the patient's family is essential to ensure successful self-management by the patient who has asthma. A patient's negative attitude toward medication and/or reluctance toward self-management are risk factors for severe exacerbations (Adams et al. 2000). Every effort should be made to encourage open discussion of concerns and expectation of therapy. See "Component 2: Education for a Partnership in Asthma Care" for specific strategies to enhance communication and patient adherence to the treatment plan.

**Evidence Quality:** Evidence D

**Recommendation Strength:** recommends

**Imperative:** The Expert Panel recommends that two aspects of patient satisfaction should be monitored: satisfaction with asthma control and satisfaction with the quality of care (Evidence D)

**Directive:** Monitor: satisfaction with asthma control

**Directive:** Monitor: satisfaction with the quality of care

**Evidence Quality:** Evidence D

**Recommendation Strength:** recommends

**RECOMMENDATION:** Referral to an Asthma Specialist for Consultation or Comanagement

**Conditional:** The Expert Panel recommends referral for consultation or care to a specialist in asthma care (usually, a



fellowship-trained allergist or pulmonologist; occasionally, other physicians who have expertise in asthma management, developed through additional training and experience) when (Evidence D): Patient has had a life-threatening asthma exacerbation. Patient is not meeting the goals of asthma therapy after 3–6 months of treatment. An earlier referral or consultation is appropriate if the physician concludes that the patient is unresponsive to therapy. Signs and symptoms are atypical, or there are problems in differential diagnosis. Other conditions complicate asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, VCD, GERD, COPD). Additional diagnostic testing is indicated (e.g., allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy). Patient requires additional education and guidance on complications of therapy, problems with adherence, or allergen avoidance. Patient is being considered for immunotherapy. Patient requires step 4 care or higher (step 3 for children 0–4 years of age). Consider referral if patient requires step 3 care (step 2 for children 0–4 years of age). Patient has required more than two bursts of oral corticosteroids in 1 year or has an exacerbation requiring hospitalization. Patient requires confirmation of a history that suggests that an occupational or environmental inhalant or ingested substance is provoking or contributing to asthma. Depending on the complexities of diagnosis, treatment, or the intervention required in the work environment, it may be appropriate in some cases for the specialist to manage the patient over a period of time or to comanage with the PCP. In addition, patients who have significant psychiatric, psychosocial, or family problems that interfere with their asthma therapy may need referral to an appropriate mental health professional for counseling or treatment. {Rec\_36: Cond\_47 }

**Decision Variable:** Patient has had a life-threatening asthma exacerbation

**Decision Variable:** Patient is not meeting the goals of asthma therapy after 3–6 months of treatment. An earlier referral or consultation is appropriate if the physician concludes that the patient is unresponsive to therapy.

**Decision Variable:** Signs and symptoms are atypical, or there are problems in differential diagnosis.

**Decision Variable:** Other conditions complicate asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, VCD, GERD, COPD)

**Decision Variable:** Additional diagnostic testing is indicated (e.g., allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy)

**Decision Variable:** Patient requires additional education and guidance on complications of therapy, problems with

adherence, or allergen avoidance.

**Decision Variable:** Patient is being considered for immunotherapy.

**Decision Variable:** Patient requires step 4 care or higher (step 3 for children 0–4 years of age).

**Decision Variable:** Consider referral if patient requires step 3 care (step 2 for children 0–4 years of age)

**Decision Variable:** Patient has required more than two bursts of oral corticosteroids in 1 year or has an exacerbation requiring hospitalization.

**Decision Variable:** Patient requires confirmation of a history that suggests that an occupational or environmental inhalant or ingested substance is provoking or contributing to asthma.

**Decision Variable:** patients who have significant psychiatric, psychosocial, or family problems that interfere with their asthma therapy

**Action:** referral for consultation or care to a specialist in asthma care

**Evidence Quality:** Evidence D

**Recommendation Strength:** recommends

**Imperative:** r

#### RECOMMENDATION: COST-EFFECTIVENESS

**Imperative:** The Expert Panel recommends that asthma self-management education that is provided by trained health professionals be considered for policies and reimbursements as an integral part of effective asthma care; the education improves patient outcomes (Evidence A) and can be cost-effective (Evidence B).

#### RECOMMENDATION: Clinical Decision Supports

**Imperative:** The Expert Panel recommends that: Prompts encouraging guideline-based care be integrated into system-based interventions focused on improving the overall quality of care rather than used as a single intervention strategy

**Evidence Quality:** Evidence B

**Recommendation Strength:** recommends

**Imperative:** System-based interventions that address multiple dimensions of the organization and delivery of care and clinical decision support be considered to improve and maintain quality of care for patients who have asthma

**Evidence Quality:** Evidence B and C

**Recommendation Strength:** recommends

#### ALGORITHM: