Asthma:
Chronic Management

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April 26, 2015
Global Strategy for Asthma Management and Prevention

- Evidence-based
- Implementation oriented
  - Diagnosis
  - Management
  - Prevention
- Outcomes can be evaluated

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<table>
<thead>
<tr>
<th>Evidence Category</th>
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Global Strategy for Asthma Management and Prevention

- Definition and Overview
- Diagnosis and Classification
- Asthma Medications
- Asthma Management and Prevention Program
- Implementation of Asthma Guidelines in Health Systems

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Clinical Features of Asthma

Inflammation in the airways of asthmatic patients leads to airway hyperresponsiveness and symptoms.

Diagram:
- Allergens
- Sensitizers
- Viruses
- Air pollutants?

Inflammation:
- Chronic eosinophilic bronchitis

Hyperresponsiveness:
- Airway hyperresponsiveness

Symptoms:
- Cough
- Wheeze
- Chest tightness
- Dyspnea

Triggers:
- Allergens
- Exercise
- Cold air
- $SO_2$
- Particulates

Airway Inflammation → Airway Hyperresponsiveness
Figure 1-8: Airway Narrowing in Asthma

Airway smooth muscle contraction in response to multiple bronchoconstrictor mediators and neurotransmitters is the predominant mechanism of airway narrowing and is largely reversed by bronchodilators.

Airway edema is due to increased microvascular leakage in response to inflammatory mediators. This may be particularly important during acute exacerbations.

Airway thickening due to structural changes, often termed “remodeling,” may be important in more severe disease and is not fully reversible by current therapy.

Mucus hypersecretion may lead to luminal occlusion (“mucus plugging”) and is a product of increased mucus secretion and inflammatory exudates.

* Airway remodeling: irreversible narrowing of the airways, the characteristic structural changes are including airway smooth muscle, fibrosis, angiogenesis, and mucus hyperplasia.
Burden of Asthma

- Asthma is one of the most common chronic diseases worldwide with an estimated 300 million affected individuals.
- Prevalence increasing in many countries, especially in children.
- Poorly controlled asthma is expensive; investment in prevention medication likely to yield cost savings in emergency care.
ETIOLOGY

Figure 1-2. Factors Influencing the Development and Expression of Asthma

<table>
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<th>HOST FACTORS</th>
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<td>Genetic, e.g.,</td>
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<td>- Genes pre-disposing to atopy</td>
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<tr>
<td>- Genes pre-disposing to airway hyperresponsiveness</td>
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<td>Obesity</td>
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<td>Sex</td>
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<table>
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<th>ENVIRONMENTAL FACTORS</th>
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<tr>
<td>Allergens</td>
</tr>
<tr>
<td>- Indoor: Domestic mites, furred animals (dogs, cats, mice), cockroach allergen, fungi, molds, yeasts</td>
</tr>
<tr>
<td>- Outdoor: Pollens, fungi, molds, yeasts</td>
</tr>
<tr>
<td>Infections (predominantly viral)</td>
</tr>
<tr>
<td>Occupational sensitzers</td>
</tr>
<tr>
<td>Tobacco smoke</td>
</tr>
<tr>
<td>- Passive smoking</td>
</tr>
<tr>
<td>- Active smoking</td>
</tr>
<tr>
<td>Outdoor/Indoor Air Pollution</td>
</tr>
<tr>
<td>Diet</td>
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**Triggers**

- Allergens
- Upper respiratory tract viral infections
- Exercise and hyperventilation
- Cold air
- Sulfur dioxide
- Drugs (beta-blockers, aspirin)
- Stress
- Irritants (household sprays, paint fumes)
- Food, additives, GERD
Asthma Diagnosis

- History and patterns of symptoms
- Measurements of lung function
  - Spirometry
  - Peak expiratory flow
- Measurement of airway responsiveness
  - Methacholine provocation test
- Measurements of allergic status to identify risk factors
- Extra measures may be required to diagnose asthma in children <=5 years and the elderly

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Asthma Management and Prevention Program: Five Components

1. Develop Patient/Doctor Partnership
2. Identify and Reduce Exposure to Risk Factors
3. Assess, Treat and Monitor Asthma
4. Manage Asthma Exacerbations
5. Special Considerations

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Asthma Management and Prevention Program

Goals of Long-term Management

- Achieve and maintain control of symptoms
- Maintain normal activity levels, including exercise
- Maintain pulmonary function as close to normal levels as possible
- Prevent asthma exacerbations
- Avoid adverse effects from asthma medications
- Prevent asthma mortality

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The Goal of Asthma Management

Overall asthma control

Achieving:
- Current control
  - Symptoms
  - Activity
  - Reliever use
  - Lung function

Reducing:
- Future risk
  - Instability/worsening
  - Exacerbations
  - Loss of lung function
  - Adverse effects of medication

Asthma can be effectively controlled in most patients.

Early intervention to stop exposure to the risk factors may help improve the control of asthma and reduce medication needs.

Although there is no cure for asthma, appropriate management most often results in the achievement of control.
Asthma Management and Prevention Program

Part 1: Educate Patients to Develop a Partnership

- Guidelines on asthma management should be available but adapted and adopted for local use by local asthma planning teams

- Clear communication between health care professionals and asthma patients is key to enhancing compliance
Asthma Management and Prevention Program

Component 1: Develop Patient/Doctor Partnership

- Educate continually
- Include the family
- Provide information about asthma
- Provide training on self-management skills
- Emphasize a partnership among health care providers, the patient, and the patient’s family

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Component 1: Develop Patient/Doctor Partnership

Key factors to facilitate communication:

- Friendly demeanor
- Interactive dialogue
- Encouragement and praise
- Provide appropriate information
- Feedback and review
Example Of Contents Of An Action Plan To Maintain Asthma Control

**Your Regular Treatment:**
1. Each day take ___________________________
2. Before exercise, take _____________________

**WHEN TO INCREASE TREATMENT**
Assess your level of Asthma Control
In the past week have you had:
- Daytime asthma symptoms more than 2 times?  
  No  Yes
- Activity or exercise limited by asthma?  
  No  Yes
- Waking at night because of asthma?  
  No  Yes
- The need to use your [rescue medication] more than 2 times?  
  No  Yes
- If you are monitoring peak flow, peak flow less than________?  
  No  Yes

*If you answered YES to three or more of these questions, your asthma is uncontrolled and you may need to step up your treatment.*

**HOW TO INCREASE TREATMENT**
STEP-UP your treatment as follows and assess improvement every day:
____________________________________________  [Write in next treatment step here]
Maintain this treatment for ____________ days  [specify number]

**WHEN TO CALL THE DOCTOR/CLINIC:**
Call your doctor/clinic: _______________  [provide phone numbers]
If you don’t respond in _______ days [specify number]
_________________________________________  [optional lines for additional instruction]

**EMERGENCY/SEVERE LOSS OF CONTROL**
✓ If you have severe shortness of breath, and can only speak in short sentences,
✓ If you are having a severe attack of asthma and are frightened,
✓ If you need your reliever medication more than every 4 hours and are not improving.

1. Take 2 to 4 puffs ___________  [reliever medication]
2. Take ____mg of ____________  [oral glucocorticosteroid]
3. Seek medical help: Go to _____________________; Address___________________
   Phone: _______________________
4. Continue to use your _________[reliever medication] until you are able to get medical help.
## Factors Involved in Non-Adherence

<table>
<thead>
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<th>Medication Usage</th>
<th>Non-Medication Factors</th>
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<tbody>
<tr>
<td>Difficulties associated with inhalers</td>
<td>Misunderstanding/lack of information</td>
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<tr>
<td>Complicated regimens</td>
<td>Fears about side-effects</td>
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<tr>
<td>Fears about, or actual side effects</td>
<td>Inappropriate expectations</td>
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<tr>
<td>Cost</td>
<td>Underestimation of severity</td>
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<tr>
<td>Distance to pharmacies</td>
<td>Attitudes toward ill health</td>
</tr>
<tr>
<td></td>
<td>Cultural factors</td>
</tr>
<tr>
<td></td>
<td>Poor communication</td>
</tr>
</tbody>
</table>

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Component 2: Identify and Reduce Exposure to Risk Factors

- Measures to prevent the development of asthma, and asthma exacerbations by avoiding or reducing exposure to risk factors should be implemented wherever possible.

- Asthma exacerbations may be caused by a variety of risk factors – allergens, viral infections, pollutants and drugs.

- Reducing exposure to some categories of risk factors improves the control of asthma and reduces medications needs.
- Reduce exposure to indoor allergens
- Avoid tobacco smoke
- Avoid vehicle emission
- Identify irritants in the workplace
- Explore role of infections on asthma development, especially in children and young infants
Influenza vaccination should be provided to patients with asthma when vaccination of the general population is advised.

However, routine influenza vaccination of children and adults with asthma does not appear to protect them from asthma exacerbations or improve asthma control.
The goal of asthma treatment, to achieve and maintain clinical control, can be achieved in a majority of patients with a pharmacologic intervention strategy developed in partnership between the patient/family and the healthcare professional.
The focus on asthma control is important because:

- The attainment of control correlates with a better quality of life, and reduction in health care use.
- Determine the initial level of control to implement treatment (assess patient impairment).
- Maintain control once treatment has been implemented (assess patient risk).
# Levels of Asthma Control
(Assess patient impairment)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Controlled (All of the following)</th>
<th>Partly controlled (Any present in any week)</th>
<th>Uncontrolled</th>
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<tr>
<td><strong>Daytime symptoms</strong></td>
<td>Twice or less per week</td>
<td>More than twice per week</td>
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<tr>
<td>Limitations of activities</td>
<td>None</td>
<td>Any</td>
<td>3 or more features of partly controlled asthma present in any week</td>
</tr>
<tr>
<td>Nocturnal symptoms / awakening</td>
<td>None</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Need for rescue / “reliever” treatment</td>
<td>Twice or less per week</td>
<td>More than twice per week</td>
<td></td>
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<tr>
<td>Lung function (PEF or FEV$_1$)</td>
<td>Normal</td>
<td>&lt; 80% predicted or personal best (if known) on any day</td>
<td></td>
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**Assessment of Future Risk** (risk of exacerbations, instability, rapid decline in lung function, side effects)
Measurements of Lung Function

- Provides an assessment of the severity of airflow limitation, its reversibility and its variability
- Simple spirometry confirms airflow limitation with a reduced FEV1, FEV1/FVC ratio, PEF (peak expiratory flow)
Peak Expiratory Flow (PEF)

- **Diagnosis and monitor**
- Underestimate the degree of airflow limitation
- Compared to the patients own previous best measurements using their own peak flow meter

**Variability** = \[rac{[\text{PEFn} - \text{PEFd}]}{1/2 \times [\text{PEFn} + \text{PEFd}]} \]

- **Green:** <20%
- **Yellow:** 20-30%
- **Red:** >30%

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### Peak flow chart

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<th>Color</th>
<th>Meaning</th>
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<tr>
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</tr>
<tr>
<td>100.0</td>
<td>Red</td>
<td>Score</td>
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</tbody>
</table>

**Legend**
- Green: Normal
- Yellow: Score
- Red: Critical

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**Observation (days)**

- Mild asthma
- Moderate asthma
- Severe asthma

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**Peak expiratory flow (l/min)**

- 0 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- 600 to 700
- 700 to 800
Differences between poor asthma control and AE

慢性氣喘控制不良
- Morning dipping
- Wide diurnal variability
- PEF Improved post bronchodilator

氣喘急性發作
During exacerbations, consecutive PEF values fell linearly over several days then improved linearly.

Assess (Asthma Control Test)

12歲(含)以上成人
氣喘控制測驗ACT™

第1題
在過去四週中，您的氣喘會讓您無法完成一般的工作、課業或家事嗎？
1. 總是如此
2. 經常如此
3. 有時如此
4. 很少如此
5. 不曾如此

第2題
在過去四週中，您多常發生呼吸急促的問題？
1. 一天超過1次
2. 一天1次
3. 一週3至6次
4. 一週1至2次
5. 完全沒有發生過

第3題
在過去四週中，您多常因氣喘症狀（喘鳴、嘔咳、呼吸急促、胸悶或胸痛）而讓您半夜醒來或是提早醒來？
1. 一週4次或4次以上
2. 一週2至3次
3. 一週1次
4. 1或2次
5. 完全沒有發生過

第4題
在過去四週中，您多常使用急救型藥物或噴霧型藥物（例如：Albuterol®（舒坦寧®）、Ventolin®（泛得林®）、Berotec®（備勞喘®）或Bricanyl®（撲可喘®）等氣喘藥物）？
1. 一天3次或3次以上
2. 一天1或2次
3. 一週2或3次
4. 一週1次或更少
5. 完全沒有使用過

第5題
在過去四週中，您自認為氣喘控制程度如何？
1. 完全沒有受到控制
2. 控制不好
3. 稍微受到控制
4. 控制良好
5. 完全受到控制

病人獲得的氣喘控制分數
- 全面控制 = 25分
- 控制良好 = 20到24分
- 未受到控制 = 低於20分
Assess Patient Risk

Features that are associated with increased risk of adverse events in the future include:

- Poor clinical control
- Frequent exacerbations in past year
- Ever admission to critical care for asthma
- Low $\text{FEV}_1$, exposure to cigarette smoke, high dose medications
Any exacerbation should prompt review of maintenance treatment
Component 3: Assess, Treat and Monitor Asthma

- Depending on level of asthma control, the patient is assigned to one of five treatment steps

- Treatment is adjusted in a continuous cycle driven by changes in asthma control status. The cycle involves:
  - Assessing Asthma Control
  - Treating to Achieve Control
  - Monitoring to Maintain Control

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A stepwise approach to pharmacological therapy is recommended.

The aim is to accomplish the goals of therapy with the least possible medication.

Although in many countries traditional methods of healing are used, their efficacy has not yet been established and their use can therefore not be recommended.
The choice of treatment should be guided by:

- Level of asthma control
- Current treatment
- Pharmacological properties and availability of the various forms of asthma treatment
- Economic considerations

Cultural preferences and differing health care systems need to be considered
THE TREATMENT OF ASTHMA

[Diagram showing flow versus volume with baseline and after corticosteroid treatment graphs]

[Chart listing different types of medications for relievers, controllers, and combinations with images of inhalers and descriptions]
Route of Administration

- **Orally**
- **Parenterally**
  - subcutaneous, intramuscular, intravenous injection
- **Inhaled**
  - directly into the airways, higher local concentrations, less risk of systemic side effects

Route of Administration - Inhaled medications

- 1. Pressurized metered-dose inhalers (MDIs)
  - Coordinate activation of the inhaler and inhalation
- 2. Breath-actuated MDIs
  - For patients who have difficulty using the “press and breathe” pressurized MDI
- 3. Dry powder inhalers (DPIs)
  - Generally easier to use, but they require a minimal inspiratory flow rate
- 4. Soft mist inhalers
  - Require less coordination
- 5. Nebulized or “wet” aerosols

**Inhaler**
LEVEL OF CONTROL

controlled
partly controlled
uncontrolled
exacerbation

TREATMENT OF ACTION

REDUCE

maintain and find lowest controlling step
consider stepping up to gain control
step up until controlled
treat as exacerbation

INCREASE

TREATMENT STEPS

STEP 1
STEP 2
STEP 3
STEP 4
STEP 5

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<table>
<thead>
<tr>
<th>REDUCE</th>
<th>TREATMENT STEPS</th>
<th>INCREASE</th>
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<td>STEP 1</td>
<td>SELECT ONE</td>
<td>TO STEP 4 TREATMENT, ADD EITHER</td>
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<tr>
<td></td>
<td>low-dose ICS*</td>
<td>oral glucocorticosteroid (lowest dose)</td>
</tr>
<tr>
<td></td>
<td>leukotriene modifier**</td>
<td>anti-IgE treatment</td>
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<tr>
<td>STEP 2</td>
<td>SELECT ONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>low-dose ICS plus long-acting β2-agonist</td>
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</tr>
<tr>
<td></td>
<td>medium- or high-dose ICS plus long-acting β2-agonist</td>
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<td>STEP 3</td>
<td>SELECT ONE</td>
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<td>STEP 4</td>
<td>TO STEP 3 TREATMENT, SELECT ONE OR MORE</td>
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<td>sustained-release theophylline</td>
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<td>low-dose ICS plus sustained-release theophylline</td>
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</table>

*inhaled glucocorticosteroids
**receptor antagonist or synthesis inhibitors

**Shaded green - preferred controller options**
### Treatment Steps

**Step 1**
- **Controller Options**
  - As needed rapid-acting $\beta_2$-agonist

**Step 2**
- **Controller Options**
  - Low-dose ICS

**Step 3**
- **Controller Options**
  - Low-dose ICS plus long-acting $\beta_2$-agonist

**Step 4**
- **Controller Options**
  - Medium- or high-dose ICS plus long-acting $\beta_2$-agonist

**Step 5**
- **Controller Options**
  - Medium- or high-dose ICS

---

*Inhaled glucocorticosteroids

**Receptor antagonist or synthesis inhibitors**

**Shaded green - preferred controller options**
Step 1 – As-needed reliever medication

- Patients with occasional daytime symptoms of short duration

- A rapid-acting inhaled $\beta_2$-agonist is the recommended reliever treatment (Evidence A)

- When symptoms are more frequent, and/or worsen periodically, patients require regular controller treatment (step 2 or higher)
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<tr>
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**TREATMENT STEPS**

- **Step 1**: Asthma education
- **Step 2**: Environmental control
- **Step 3**: As needed rapid-acting β₂-agonist
- **Step 4**: Medium- or high-dose ICS plus long-acting β₂-agonist
- **Step 5**: Oral glucocorticosteroid (lowest dose)

**SELECT ONE**

- Low-dose ICS
- Leukotriene modifier

**SELECT ONE**

- Low-dose ICS plus long-acting β₂-agonist
- Medium- or high-dose ICS
- Leukotriene modifier
- Oral glucocorticosteroid (lowest dose)

**SELECT ONE**

- Low-dose ICS plus sustained-release theophylline
- Sustained-release theophylline
- Anti-IgE treatment

*Inhaled glucocorticosteroids
**Receptor antagonist or synthesis inhibitors

**Shaded green - preferred controller options**
Step 2 – Reliever medication plus a single controller

- A low-dose inhaled glucocorticosteroid is recommended as the initial controller treatment for patients of all ages (Evidence A)

- Alternative controller medications include leukotriene modifiers (Evidence A) appropriate for patients unable/unwilling to use inhaled glucocorticosteroids
### Treatment Steps

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### Controller Options

- As needed rapid-acting β₂-agonist
- Low-dose ICS
- Leukotriene modifier
- Low-dose ICS plus long-acting β₂-agonist
- Medium- or high-dose ICS
- Low-dose ICS plus leukotriene modifier
- Sustained-release theophylline
- Oral glucocorticosteroid (lowest dose)
- Anti-IgE treatment

**Shaded green - preferred controller options**

*Inhaled glucocorticosteroids

**Receptor antagonist or synthesis inhibitors
Step 3 – Reliever medication plus one or two controllers

- For adults and adolescents, combine a low-dose inhaled glucocorticosteroid with an inhaled long-acting β₂-agonist either in a combination inhaler device or as separate components (Evidence A)
- Inhaled long-acting β₂-agonist must not be used as monotherapy
- For children, increase to a medium-dose inhaled glucocorticosteroid (Evidence A)
Additional Step 3 Options for Adolescents and Adults

- Increase to medium-dose inhaled glucocorticosteroid (Evidence A)
- Low-dose inhaled glucocorticosteroid combined with leukotriene modifiers (Evidence A)
- Low-dose sustained-release theophylline (Evidence B)
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**SELECT ONE**

**SELECT ONE**

**SELECT ONE**

**SELECT ONE**

**SELECT ONE**

- low-dose ICS
- leukotriene modifier
- low-dose ICS plus leukotriene modifier
- low-dose ICS plus sustained-release theophylline
- low-dose ICS plus long-acting β₂-agonist
- medium- or high-dose ICS plus long-acting β₂-agonist
- sustained-release theophylline
- anti-IgE treatment

**inhaled glucocorticosteroids**

**receptor antagonist or synthesis inhibitors**

*Shaded green - preferred controller options*
Step 4 – Reliever medication plus two or more controllers

- Selection of treatment at Step 4 depends on prior selections at Steps 2 and 3

- Where possible, patients not controlled on Step 3 treatments should be referred to a health professional with expertise in the management of asthma
Step 4 – Reliever medication plus two or more controllers

- Medium- or high-dose inhaled glucocorticosteroid combined with a long-acting inhaled $\beta_2$-agonist (Evidence A)
- Medium- or high-dose inhaled glucocorticosteroid combined with leukotriene modifiers (Evidence A)
- Low-dose sustained-release theophylline added to medium- or high-dose inhaled glucocorticosteroid combined with a long-acting inhaled $\beta_2$-agonist (Evidence B)
### Treatment Steps

<table>
<thead>
<tr>
<th>Step</th>
<th>Controller Options</th>
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<td>Leukotriene modifier**</td>
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<td>Leukotriene modifier</td>
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<td>Oral glucocorticosteroid (lowest dose)</td>
<td>Anti-IgE treatment</td>
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*Inhaled glucocorticosteroids
**Receptor antagonist or synthesis inhibitors

**Shaded green - preferred controller options**
Step 5 – Reliever medication plus additional controller options

- Addition of oral glucocorticosteroids to other controller medications may be effective (Evidence D) but is associated with severe side effects (Evidence A)

- Addition of anti-IgE treatment to other controller medications improves control of allergic asthma when control has not been achieved on other medications (Evidence A)
Treating to Maintain Asthma Control

- When control as been achieved, ongoing monitoring is essential to:
  - maintain control
  - establish **lowest step/dose** treatment

- Asthma control should be **monitored by the health care professional and by the patient**
Stepping down treatment when asthma is controlled

- When controlled on medium- to high-dose inhaled glucocorticosteroids: 50% dose reduction at 3 month intervals (Evidence B)

- When controlled on low-dose inhaled glucocorticosteroids: switch to once-daily dosing (Evidence A)
Treating to Maintain Asthma Control

Stepping down treatment when asthma is controlled

- When controlled on combination inhaled glucocorticosteroids and long-acting inhaled $\beta_2$-agonist, reduce dose of inhaled glucocorticosteroid by 50% while continuing the long-acting $\beta_2$-agonist (Evidence B)

- If control is maintained, reduce to low-dose inhaled glucocorticosteroids and stop long-acting $\beta_2$-agonist (Evidence D)
Treating to Maintain Asthma Control

Stepping up treatment in response to loss of control

- Rapid-onset, short-acting or long-acting inhaled β2-agonist bronchodilators provide temporary relief.

- Need for repeated dosing over more than one/two days signals need for possible increase in controller therapy.

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Treating to Maintain Asthma Control

Stepping up treatment in response to loss of control

- Use of a combination rapid and long-acting inhaled β₂-agonist (e.g., formoterol) and an inhaled glucocorticosteroid (e.g., budesonide) in a single inhaler both as a controller and reliever is effecting in maintaining a high level of asthma control and reduces exacerbations (Evidence A)

- Doubling the dose of inhaled glucocorticosteroids is not effective, and is not recommended (Evidence A)
Asthma can be effectively controlled in most patients by intervening to suppress and reverse inflammation as well as treating bronchoconstriction and related symptoms.

Although there is no cure for asthma, appropriate management that includes a partnership between the physician and the patient/family most often results in the achievement of control.
A stepwise approach to pharmacologic therapy is recommended. The aim is to accomplish the goals of therapy with the least possible medication.

The availability of varying forms of treatment, cultural preferences, and differing health care systems need to be considered.
Instruction and Education for Patients

- Know what are the Controllers and Relievers
- Know what are the potential adverse effects of drugs
- Know how to use the PEFR meters and inhaler devices
- Know how to prevent the AE of asthma
- Know the symptoms of AE and next step to start
- Monitor the degree of asthma control
- How and when to seek for medical service
- Establish the patient’s “self-management plan”
  - How to use the Controller and Reliever
  - How to use the PEFR meter and daily symptoms to record the patient’s own PEFR diary
  - How to deal with the worsening symptoms, declined lung function, and frequent use of Reliever
  - How to seek for medical consultation or help for the management of AE
評估是否須轉介給氣喘專家

- 威脅生命的嚴重發作
- 經治療3個月後無效
- 非典型氣喘症狀
- 嚴重之持續型氣喘
- 職業性氣喘
- 需使用大量的類固醇
Thanks for your attention!