Facts about Asthma in sub-Saharan Africa: Epidemiology and risk factors

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Outline

Introduction
- Definition of asthma
- Asthma pathogenesis
- Diagnosis of asthma
  - Possible, probable, definite

Burden
- Prevalence
- Mortality
- Severe asthma

Determinants
- Genetics of asthma
- Environmental risk factors
- Adult onset asthma
- Occupational asthma
  - Asthma and tropical infection
Introduction

Definition of asthma
Asthma pathogenesis
Phenotypes an endotypes
Diagnosis of asthma
Possible, probable, definite
Definition

• Asthma is defined by Global Initiative for asthma (GINA) as a heterogenous disease usually characterized by chronic airway inflammation and accompanied by a history of recurrent or persistent respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable airflow obstruction.

• The variation in symptoms and airflow obstruction can in most cases be associated with an identifiable trigger such as allergen exposure, exercise, change in weather or a chest infection.

• Symptoms can be absent for several weeks or months following appropriate asthma treatment or even spontaneously.
Asthma diagnosis

- The diagnosis of asthma should be based on:
  - A history of characteristic symptom patterns
  - Evidence of variable airflow limitation, from bronchodilator reversibility testing or other tests
- Document evidence for the diagnosis in the patient’s notes, preferably before starting controller treatment
  - It is often more difficult to confirm the diagnosis after treatment has been started
- Asthma is usually characterized by airway inflammation and airway hyperresponsiveness, but these are not necessary or sufficient to make the diagnosis of asthma.
Box 1-2. Diagnostic criteria for asthma in adults, adolescents, and children 6–11 years

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable expiratory airflow limitation.

**DIAGNOSTIC FEATURE**

1. History of variable respiratory symptoms
   - Wheeze, shortness of breath, chest tightness and cough
   - Descriptors may vary between cultures and by age, e.g. children may be described as having heavy breathing

2. Confirmed variable expiratory airflow limitation
   - Documented excessive variability in lung function* (one or more of the tests below) AND documented airflow limitation*
   - Positive bronchodilator (BD) reversibility test* (more likely to be positive if BD medication is withheld before test: SABA ≥ 4 hours, LABA ≥ 15 hours)
   - Excessive variability in twice-daily PEF over 2 weeks*
   - Significant increase in lung function after 4 weeks of anti-inflammatory treatment
   - Positive exercise challenge test*
   - Positive bronchial challenge test (usually only performed in adults)
   - Excessive variation in lung function between visits* (less reliable)

**CRITERIA FOR MAKING THE DIAGNOSIS OF ASTHMA**

- Generally more than one type of respiratory symptom (in adults, isolated cough is seldom due to asthma)
- Symptoms occur variably over time and vary in intensity
- Symptoms are often worse at night or on waking
- Symptoms are often triggered by exercise, laughter, allergens, cold air
- Symptoms often appear or worsen with viral infections

**Adults**: increase in FEV₁ by >12% and >200 mL from baseline, 10–15 minutes after 200–400 mcg albuterol or equivalent (greater confidence if increase is ≥15% and >400 mL).

**Children**: increase in FEV₁ of >12% predicted, or PEF >15%

**Adults**: average daily diurnal PEF variability >10%**

**Children**: average daily diurnal PEF variability >13%**

**Adults**: fall in FEV₁ of >10% and >200 mL from baseline

**Children**: fall in FEV₁ of >12% predicted, or PEF >15%

Fall in FEV₁ from baseline of ≥20% with standard doses of methacholine or histamine, or ≥15% with standardized hyperventilation, hypertonic saline or mannitol challenge

**Adults**: variation in FEV₁ of >12% and >200 mL between visits, outside of respiratory infections

**Children**: variation in FEV₁ of >12% in FEV₁ or >15% in PEF between visits (may include respiratory infections)
Definite probable and possible asthma

No definitive test

Proposed diagnostic approach

• **Possible asthma** = symptoms alone, response to medications, supportive evidence such as allergy family history etc.

• **Probable asthma** = symptoms, supportive evidence plus significant reversibility (FEV1 of 200 ml or greater and 12% improvement from baseline after inhalation of short acting beta2-agonists) and no airflow limitation (FEV1/FVC ratio<0.70 or LLN)

• **Definite asthma** = evidence of expiratory airflow limitation (FEV1 of 200 ml or greater and 12% improvement from baseline after inhalation of short acting beta2-agonists) plus airflow limitation (FEV1/FVC ratio<0.70 or LLN)
Pathogenesis of asthma

The common pathological pathway in asthma is airway inflammation from multiple cells.

1. Mast cells = histamine, prostaglandin D2, and cysteinyl leukotrienes (LTC4, D4, and E4) = contraction & stimulate reflex neural pathways

2. Eosinophils = basic proteins and cysteinyl leukotrienes

3. T lymphocytes = interleukin-4 (IL-4), IL-5, IL-9 and IL-13 = eosinophilic inflammation

4. Dendritic cells = mobilize allergens from the airway surface into regional lymph nodes = T cell produce production.

5. Structural cells eg epithelial cells = inflammatory proteins, cytokines and chemokines in response to mechanical changes = presence of air pollutants and bacteria and viruses

6. Airway smooth muscle = hyperplasia and hypertrophy and produce cytokines and chemokines

7. Endothelial cells of the bronchial circulation = increased recruitment of inflammatory cells to sites of injury in asthma.

8. Fibroblasts and myofibroblasts = increased production of connective components such collagen

9. Airway nerves = heightened response which result into bronchoconstriction and mucus secretion.
Major mechanisms of asthma onset.

Asthma phenotypes & endotypes

**Asthma Syndrome**
Characterized by variable and recurring symptoms, airflow obstruction, bronchial hyperresponsiveness, and inflammation

**Phenotypes**
Observable characteristics including clinical presentation, triggers, and treatment response

**Endotypes**
Condition subtype defined by a distinct functional or pathophysiological mechanism (links clinical characteristic with a molecular pathway)
Asthma phenotype?

- **Discordant symptoms**
  - Early symptom predominant
    - Early onset, atopic.
    - Normal BMI.
    - High symptom expression.
  - Obese non-eosinophilic
    - Later onset, female preponderance.
    - High symptom expression.

- **Early onset atopic asthma**
  - Concordant symptoms, inflammation and airway dysfunction.
  - Monitoring inflammation allows down-titration of corticosteroids.

- **Benign asthma**
  - Mixed middle-aged cohort
  - Well controlled symptoms and inflammation. Benign prognosis.

- **Concordant disease**
  - Symptom-based approach to therapy titration may be sufficient.
  - Monitoring inflammation allows targeted corticosteroids to lower exacerbation frequency.

- **Inflammation predominant**
  - Late onset, greater proportion of males.
  - Few daily symptoms but active eosinophilic inflammation.
Endotypes
Burden

Prevalence
Mortality
Severe asthma
Prevalence of asthma

- 334 million people affected globally;

- Prevalence decreasing in developed western countries

- Increasing in most low and middle income countries (LMIC): 74.4M in 1990, 119.3M in 2010
## Prevalence of asthma in different Africa countries

<table>
<thead>
<tr>
<th>Region¹</th>
<th>Country</th>
<th>Doctor Diagnosed Asthma</th>
<th>Clinical Asthma</th>
<th>Wheezing Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>Burkina Faso</td>
<td>2.02</td>
<td>2.26</td>
<td>5.32</td>
</tr>
<tr>
<td></td>
<td>Chad</td>
<td>3.68</td>
<td>3.94</td>
<td>7.64</td>
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<tr>
<td></td>
<td>Comoros³</td>
<td>7.55</td>
<td>7.80</td>
<td>12.85</td>
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<tr>
<td></td>
<td>Congo³</td>
<td>4.65</td>
<td>4.79</td>
<td>7.93</td>
</tr>
<tr>
<td></td>
<td>Cote d’Iviore³</td>
<td>4.22</td>
<td>4.59</td>
<td>7.70</td>
</tr>
<tr>
<td></td>
<td>Ethiopia</td>
<td>2.00</td>
<td>2.00</td>
<td>5.53</td>
</tr>
<tr>
<td></td>
<td>Ghana</td>
<td>3.65</td>
<td>3.77</td>
<td>4.88</td>
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<tr>
<td></td>
<td>Kenya</td>
<td>2.86</td>
<td>3.12</td>
<td>6.22</td>
</tr>
<tr>
<td></td>
<td>Malawi</td>
<td>4.62</td>
<td>4.67</td>
<td>7.76</td>
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<tr>
<td></td>
<td>Mali</td>
<td>2.65</td>
<td>2.82</td>
<td>4.77</td>
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<tr>
<td></td>
<td>Mauritania</td>
<td>6.95</td>
<td>7.54</td>
<td>11.78</td>
</tr>
<tr>
<td></td>
<td>Mauritius</td>
<td>3.88</td>
<td>3.92</td>
<td>6.88</td>
</tr>
<tr>
<td></td>
<td>Namibia</td>
<td>3.16</td>
<td>3.39</td>
<td>8.14</td>
</tr>
<tr>
<td></td>
<td>Senegal</td>
<td>3.43</td>
<td>3.72</td>
<td>8.40</td>
</tr>
<tr>
<td></td>
<td>South Africa⁵</td>
<td>5.92</td>
<td>6.09</td>
<td>12.40</td>
</tr>
<tr>
<td></td>
<td>Swaziland⁵</td>
<td>8.74</td>
<td>9.69</td>
<td>15.37</td>
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<td></td>
<td>Zambia⁴</td>
<td>2.83</td>
<td>2.96</td>
<td>6.25</td>
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<tr>
<td></td>
<td>Zimbabwe</td>
<td>2.28</td>
<td>2.52</td>
<td>5.48</td>
</tr>
<tr>
<td></td>
<td><strong>Regional Sub-total</strong></td>
<td><strong>3.94</strong></td>
<td><strong>4.19</strong></td>
<td><strong>7.75</strong></td>
</tr>
<tr>
<td></td>
<td><strong>World wide</strong></td>
<td><strong>4.27</strong></td>
<td><strong>4.46</strong></td>
<td><strong>8.61</strong></td>
</tr>
</tbody>
</table>
Worldwide prevalence of wheezing asthma, from To T et al.
Uganda

- Uganda National asthma survey
- Weighted prevalence of asthma 11.02% 95% CI (8.87 – 13.17)
  - males 10.27%
  - females 11.40%
  - urban 12.99%
  - rural 8.86%
  - Most affected age group 35-44 age group, 14.42%
Asthma Mortality

• 420,000 deaths in 2016 globally 24.3% lower than that reported in 2006

• Asthma mortality data limited in Africa.

• 449 Ugandan asthmatics followed up for 2 years 17 patients died (3.7%, 27.3 deaths per 1000-person years).

• Mortality associated with FEV$_1$ OR 0.30 (95% CI: 0.14 – 0.65; p=0.002)
Fig 1. Trends in morbidity and mortality due to asthma in Africa.

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0216568
Severe Asthma

Box 1. What proportion of adults have difficult-to-treat or severe asthma?

- 24% GINA Step 4-5 treatment
- 17% difficult-to-treat asthma = GINA Step 4-5 treatment + poor symptom control
- 3.7% severe asthma = GINA Step 4-5 treatment + poor symptom control + good adherence and inhaler technique

These data are from a Dutch population survey of people ≥18 years with asthma²
The African severe asthma project experience

Phenotypic characteristics and asthma severity in an East African cohort of adults and adolescents with asthma: findings from the African severe asthma project

General population

General patients population at study hospitals and clinics

Asthma patients

Eligibility screening

Enrolled

Baseline measurements

Demographics, clinical, lung function, BHR, depression, FeNO, CBC, HIV, stool exam, SPT, IgE, QoL, blood sampling, SNP genotyping and biobanking

Severity/control assessment

Not severe asthma

Monthly follow up to 6 and then 9 & 12 for endpoints adherence and adverse events

Severe asthma

Severe untreated asthma (not adherent)

Not severe asthma

Severe untreated asthma

Treatment resistant

Excluded: <12 years, contraindication to study procedures and tests, other primary lung diagnosis (COPD, fibrosis, bronchiectasis), significant diseases likely to confound assessment of asthma (e.g. active tuberculosis), patient unable to perform study tests and procedures, exposure to experimental treatments within the past three months, pregnant women
Project setting

SITES

- **Uganda** - Mulago Hospital
- **Kenya** - Kenyatta National Hospital
- **Ethiopia** - Black Lion Hospital Addis Ababa
- **Netherlands** - University of Groningen Medical Center
# Table 1  Study participants baseline characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All (n=1671)</th>
<th>Uganda (n=621)</th>
<th>Kenya (n=431)</th>
<th>Ethiopia (n=419)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender: male, n (%)</td>
<td>490 (29.3)</td>
<td>206 (25.1)</td>
<td>109 (25.3)</td>
<td>175 (41.8)</td>
</tr>
<tr>
<td>Median age (IQR)</td>
<td>40 (26–52)</td>
<td>31 (20–44)</td>
<td>42 (32–51)</td>
<td>52 (42–60)</td>
</tr>
<tr>
<td>Median age at asthma diagnosis (IQR)</td>
<td>25 (14–36)</td>
<td>20 (10–33)</td>
<td>26.5 (16–39)</td>
<td>29 (22–36)</td>
</tr>
<tr>
<td>Adult onset asthma (≥19 years)</td>
<td>1050 (62.8)</td>
<td>421 (61.3)</td>
<td>283 (65.66)</td>
<td>346 (82.6)</td>
</tr>
<tr>
<td>Family history of asthma, n (%)</td>
<td>869 (52.0)</td>
<td>491 (59.8)</td>
<td>229 (53.1)</td>
<td>149 (36.6)</td>
</tr>
<tr>
<td>Smoking (current/former), n (%)</td>
<td>113 (6.8)</td>
<td>39 (4.8)</td>
<td>38 (8.8)</td>
<td>36 (8.6)</td>
</tr>
<tr>
<td>Secondhand smoke exposure, n (%)</td>
<td>141 (8.4)</td>
<td>51 (6.2)</td>
<td>67 (15.6)</td>
<td>23 (5.5)</td>
</tr>
<tr>
<td>Biomass exposure, n (%)</td>
<td>1221 (73.1)</td>
<td>643 (78.3)</td>
<td>274 (63.6)</td>
<td>304 (72.6)</td>
</tr>
<tr>
<td>Cough, n (%)</td>
<td>736 (44.1)</td>
<td>350 (43.9)</td>
<td>187 (43.4)</td>
<td>189 (45.1)</td>
</tr>
<tr>
<td>Wheeze, n (%)</td>
<td>664 (39.7)</td>
<td>319 (38.9)</td>
<td>187 (43.4)</td>
<td>158 (37.7)</td>
</tr>
<tr>
<td>Median BMI kg/m² (IQR)</td>
<td>24.2 (20.9–28.5)</td>
<td>23.7 (20.4–28.4)</td>
<td>26.1 (22.1–30.7)</td>
<td>23.8 (21.1–26.8)</td>
</tr>
<tr>
<td>Pre-BD FVC%, median (IQR)</td>
<td>94 (76–109)</td>
<td>101 (84–115)</td>
<td>89 (74–101)</td>
<td>2.3 (1.7–2.9)</td>
</tr>
<tr>
<td>Pre-BD FEV%, median (IQR)</td>
<td>76 (53–95)</td>
<td>87 (65–103)</td>
<td>76 (58–90)</td>
<td>53 (40–69)</td>
</tr>
<tr>
<td>Pre-BD FEV/FVC ratio, median (IQR)</td>
<td>0.7 (0.6–0.8)</td>
<td>0.8 (0.7–0.8)</td>
<td>0.7 (0.6–0.8)</td>
<td>0.5 (0.4–0.6)</td>
</tr>
<tr>
<td>Bronchodilator reversibility, median (IQR)</td>
<td>19 (12–30.8)</td>
<td>20.5 (15.0–31.6)</td>
<td>9 (4–19)</td>
<td>24.9 (17.3–41.9)</td>
</tr>
<tr>
<td>Ova/cysts</td>
<td>1 (0.2)</td>
<td>1 (0.2)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Uncontrolled asthma (ACQ &gt;1.5)</td>
<td>957 (57.3)</td>
<td>427 (52.0)</td>
<td>223 (51.7)</td>
<td>307 (73.3)</td>
</tr>
<tr>
<td>Number of exacerbations in past year, median (IQR)</td>
<td>3 (1–10)</td>
<td>4 (2–10)</td>
<td>3 (0–10)</td>
<td>2 (0–8)</td>
</tr>
<tr>
<td>Number of courses of oral steroids prescribed</td>
<td>1 (0–4)</td>
<td>1 (0–4)</td>
<td>0 (0–2)</td>
<td>1 (0–5)</td>
</tr>
<tr>
<td>Three or more exacerbations in the past year, n (%)</td>
<td>984 (59.1)</td>
<td>566 (68.9)</td>
<td>223 (52.0)</td>
<td>195 (47.0)</td>
</tr>
<tr>
<td>Any hospitalisation in past year, n (%)</td>
<td>358 (21.4)</td>
<td>204 (24.9)</td>
<td>51 (11.9)</td>
<td>103 (24.6)</td>
</tr>
<tr>
<td>On any ICS</td>
<td>230 (14.0)</td>
<td>65 (17.3)</td>
<td>89 (12.7)</td>
<td>76 (13.3)</td>
</tr>
<tr>
<td>Not on any asthma medication</td>
<td>206 (12.5)</td>
<td>73 (19.5)</td>
<td>87 (12.6)</td>
<td>46 (8.1)</td>
</tr>
</tbody>
</table>

ACQ, asthma control questionnaire; BMI, body mass index; FVC, forced expiratory volume; FEV, forced vital capacity; ICS, inhaled corticosteroids; pre-BD, pre-bronchodilator.
**Phenotypes**

![Venn diagram](image)

**Figure 1** Venn diagram showing overlap between high AEC, high FeNo and $\geq 1$ positive SPT in patients with all three variables measured ($n=1275$). Of note, 8.9% of the patients did not demonstrate positivity on any of the variables. AEC, absolute eosinophil count; FeNO, fractional exhaled nitric oxide; SPT, skinprick test.
Asthma control in ASAP by country and follow up interval
Determinants

1. Genetics of asthma
2. Environmental risk factors
3. Adult onset asthma
4. Asthma and HIV
5. Occupational asthma
Risk factors for asthma

- Asthma develops from the interaction of host susceptibility factors and environmental factors.
- Host factors include genetics, obesity, sex and prematurity and low birth weight.
- Environmental factors
- Exposure to allergens, occupational sensitizers, respiratory infections, tobacco smoke exposure, indoor and outdoor air pollution, the microbiome, certain diets, pre and perinatal factors and medication use.
Environmental risk factors

Odajima H, Kawano T, Wakatsuki M, Akaminea Y, Okabe K, Oki T, Matsuizaki H, Murakami Y, Iwata M, Taba N, Motomura C. Annual changes in the prevalence of asthma may be related to air pollution in Fukuoka: 29 years of observation. ERJ Open Research. 2020 Apr 1;6(2).
Asthma and Air pollution

1a

1b

Percentage of predicted lung function

FVC  FEV1  FEF

p<0.001  p<0.001  p=0.006

p = 0.043  p = 0.001  p = 0.002

Kampala city
Jinja municipality
Buwenge subcounty

Urban
Rural
Associated factors in Uganda

- adjusted odds ratios (AOR (95% CI), p-value).
  - Smoking = 3.26 (1.96 – 5.41, p <0.001)
  - Family history = 2.90 (98 – 4.22 p- <0.001)
  - Nasal congestion = 3.56 (2.51 – 5.06, p<0.001)
  - Biomass exposure = 2.04 (1.29 – 3.21p=0.02)
  - Urban residence = 2.01(1.23 – 3.27, p=0.05)
  - cough 2.41 (1.66-3.50, p<0.001)
  - shortness of breath 6.84 (4.57-10.23, p<0.001)
  - chest pain 3.00 (2.15-4.19, p<0.001)
  - Sputum production 1.81 (1.16-2.88, p=0.009)
Age and gender

![Graph showing prevalence by age group and gender.](image-url)
Asthma and HIV
Occupational asthma

- Occupational asthma (OA) is a form of work-related asthma attributable to a particular exposure in the workplace and not due to stimuli encountered outside the workplace
- More than 350 agents have been reported to cause OA
- Occupational asthma accounts for approximately 10 to 25 percent of adult onset asthma

Types:
- OA caused by workplace sensitizers: allergic or immunological (with a latency period)
- OA caused by irritants: nonallergic or nonimmunologic, irritant-induced asthma including reactive airways dysfunction syndrome (RADS).
Mechanisms in OA

IgE-Mediated
Occupational agent

APC
MHC Class II
Ag presentation

CD4 Th2
IL-5
IL-3
GM-CSF

B-cell — IgE synthesis — IgE

IL-4

Macrophage
Eosinophil
Mast Cell
Inflammatory mediators
cytokines

Non-IgE-mediated
Occupational agent

APC
MHC Class I
Ag presentation?

CD8
IL-5
IL-2
IFN-γ

Asthmatic reactions - chronic airway inflammation - airway hyperresponsiveness
Thank you

If your lungs are not working nothing else works
THEME:
“Uncovering Asthma Misconceptions”
FACTS ABOUT ASTHMA IN SUB-SAHARAN AFRICA: MANAGEMENT PRINCIPLES

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Enugu, Nigeria
DISCLOSURES

• No conflicts of interest relevant to this presentation
OUTLINE/OBJECTIVES

• Introduction
• Interplay of factors in asthma management
• Management principles and the related issues
  • - diagnosis
  • - treatment
  • - environmental management
  • - education/partnership
INTRODUCTION

• Asthma is a chronic disease involving the airways
• Symptoms include: coughing, wheezing, shortness of breath and/or chest tightness.
• Data shows: that there are real asthma management issues and misconceptions in Subsaharan Africa (SSA)
INTERPLAY OF FACTORS IN ASTHMA

Asthma control

Current clinical control → Future risk

Asthma severity (based on intensity of treatment required)

Disease activity

Asthma phenotypes

Genetic and environmental factors

Treatment
A TRUE STORY ABOUT MWOLLOLO

• Mwololo lived in a rural nomadic community in Ghana; got a ‘routine ritual’ exorcism
• During one of such ‘routine rituals’ doctors carrying out studies in that community found 'the spirit of breathlessness' being exorcised from Mwololo and recognized that she was actually having an asthmatic attack
• They were able to administer a bronchodilator with relief to the girl.
• .................
FOUR MAIN ASTHMA MANAGEMENT PRINCIPLES

1. Identify/properly diagnose asthma and classify the severity:

   – Symptom assessment using symptom identification and guidelines such as National Asthma Education Program's Expert Panel (NAEPEP)

   – Use of objective tools to confirm diagnosis/monitor
     • Spirometry (and other lung function tools)

     n.b- in COVID era: put appropriate hygienic protocols in place

     • Asthma control questionnaire tools (ACT, cACT, ATAQ, ACQ, GINA)
NAEPEP SUMMARY

Diagnosis of asthma,

- Episodic symptoms of airflow obstruction/airway hyperresponsiveness
- Airflow obstruction is at least partially reversible.
- Alternative diagnoses are excluded.

**Recommended methods** — Detailed medical history.
- Physical exam focusing on the upper respiratory tract, chest, and skin.
- Spirometry to demonstrate obstruction and assess reversibility, including in children 5 years of age or older.
  - Reversibility is determined either by an increase in FEV1 of ≥12 percent from baseline or by an increase ≥10 percent of predicted FEV1 after inhalation of a short-acting bronchodilator.
- Additional studies may be necessary to exclude alternate diagnoses.
2. Pharmacologic therapy/correct adjuncts (spacers) & procedures (pMDI)
3. Control of environmental factors and comorbid conditions that affect asthma
4. Education for a partnership in asthma care (which is part of what we are doing today)
DIAGNOSING ASTHMA - studies

**Previous spirometry training % (n)**
- Formal training: 14.1 (9)
- Informal training: 15.6 (10)
- None: 70.3 (45)

**Knowledge of the existence of GINA % (n)**
- Yes: 82.8 (53)
- No: 17.2 (11)

**The practice of GINA contents % (n)**
- Yes: 51.6 (33)
- No: 48.4 (31)

**Uses of any lung function equipment to support asthma diagnosis % (n)**
- Yes: 59.4 (38)
- No: 40.6 (26)

**Recent management of the patient with asthma % (n)**
- Less than three months: 56.5 (36)
- More than three months: 43.8 (28)
<table>
<thead>
<tr>
<th>Clinical practice parameters</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirms asthma diagnosis with pulmonary functions tests</td>
<td>31 (47.0)</td>
<td>35 (53.0)</td>
</tr>
<tr>
<td>Familiar with peak flow meter</td>
<td>48 (72.7)</td>
<td>18 (27.3)</td>
</tr>
<tr>
<td>Familiar with spirometer</td>
<td>12 (18.2)</td>
<td>54 (81.8)</td>
</tr>
<tr>
<td>Assesses inhaler technique at each visit</td>
<td>35 (53.0)</td>
<td>31 (47.0)</td>
</tr>
<tr>
<td>Assesses treatment adherence at each visit</td>
<td>56 (84.8)</td>
<td>10 (15.2)</td>
</tr>
<tr>
<td>Identify triggers and attempt at environmental manipulations</td>
<td>57 (86.4)</td>
<td>9 (13.6)</td>
</tr>
<tr>
<td>Uses guideline to assess asthma control</td>
<td>35 (53.0)</td>
<td>31 (47.0)</td>
</tr>
<tr>
<td>Addresses patients’ concerns</td>
<td>57 (86.4)</td>
<td>10 (15.2)</td>
</tr>
<tr>
<td>Insists on spacer with face mask for children &lt;6 years</td>
<td>36 (54.5)</td>
<td>30 (45.5)</td>
</tr>
<tr>
<td>Routinely provides written asthma action plan</td>
<td>24 (36.4)</td>
<td>42 (63.6)</td>
</tr>
<tr>
<td>Prescribes inhaled corticosteroids as initial maintenance therapy</td>
<td>12 (18.2)</td>
<td>54 (81.8)</td>
</tr>
<tr>
<td>Prescribes LTRA when ICS only is not available for children</td>
<td>17 (25.8)</td>
<td>49 (74.2)</td>
</tr>
<tr>
<td>Prescribes ICS/LABA combination</td>
<td>23 (34.8%)</td>
<td>43 (65.2)</td>
</tr>
<tr>
<td>Checks allergy status of patients</td>
<td>12 (18.2)</td>
<td>54 (81.8)</td>
</tr>
<tr>
<td>Allows 3 months on current medications before stepping up</td>
<td>31 (47.0)</td>
<td>35 (53.0)</td>
</tr>
<tr>
<td>Refers to asthma nurse counsellors</td>
<td>21 (31.8)</td>
<td>45 (68.2)</td>
</tr>
</tbody>
</table>
2. PHARMACOLOGIC MANAGEMENT

Drugs Used In Asthma

- Oxygen (for low $p_{O2}$)
- Anti-inflammatory agents
  - Corticosteroids
    - ICS
      - Oral
    - Leukotriene modifiers
    - Degranulation inhibitors
      - Antibodies
  - Methylxanthines
  - Bronchodilators
    - β$_2$ agonists
      - SABA
      - LABA
    - Muscarinic antagonists

- Receptor blockers
  - Lipoxigenase inhibitors
### Box 3-5A

**Adults & adolescents 12+ years**

**Personalized asthma management:**
Assess, Adjust, Review response

**Confirmation of diagnosis if necessary**
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Patient preferences and goals

**Treatment of modifiable risk factors and comorbidities**
Non-pharmaceutical strategies
Asthma medications (adjust down or up)
Education & skills training

---

**Asthma medication options:**
Adjust treatment up and down for individual patient needs

**PREFERRED CONTROLLER**
to prevent exacerbations and control symptoms

<table>
<thead>
<tr>
<th>STEP 1</th>
<th>As-needed, low dose ICS-formoterol</th>
</tr>
</thead>
</table>

**Other controller options**

| Low dose ICS taken whenever SABA is taken† |
| Daily leukotriene receptor antagonist (LTRA), or low dose ICS taken whenever SABA taken † |

**PREFERRED RELIEVER**

| As-needed low dose ICS-formoterol * |

**Other reliever option**

| As-needed short-acting β₂-agonist (SABA) |

---

**STEP 2**
Daily low dose inhaled corticosteroid (ICS), or as-needed low dose ICS-formoterol *

**STEP 3**
Low dose ICS-LABA

**STEP 4**
Medium dose ICS-LABA

**STEP 5**
High dose ICS-LABA

Refer for phenotypic assessment ± add-on therapy, e.g. tiotropium, anti-IgE, anti-IL5/IL5R, anti-IL4R

---

* Data only with budesonide-formoterol (bud-form)
† Separate or combination ICS and SABA Inhalers
‡ Low-dose ICS-form is the reliever only for patients prescribed bud-form or BDP-form maintenance and reliever therapy
# Consider adding HDM SLIT for sensitized patients with allergic rhinitis and FEV1 >70% predicted

---

GINA 2020, Box 3-5A © Global Initiative for Asthma, www.ginasthma.org
Box 3-5B
Children 6-11 years

Personalized asthma management:
Assess, Adjust, Review response

Symptoms
Exacerbations
Side-effects
Lung function
Child and parent satisfaction

Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Child and parent preferences and goals

Treatment of modifiable risk factors & comorbidities
Non-pharmacological strategies
Asthma medications (adjust down or up)
Education & skills training

Asthma medication options:
Adjust treatment up and down for individual child’s needs

PREFERRED CONTROLLER
to prevent exacerbations and control symptoms

Low dose ICS taken whenever SABA taken, or daily low dose ICS

Low dose ICS-LABA or medium dose ICS

Medium dose ICS-LABA
Refer for expert advice

Low dose ICS + LTRA
High dose ICS-LABA, or add-on fluticasone, or add-on LTRA
Add-on anti-IL-5, or add-on low dose ICS, but consider side-effects

As-needed short-acting β₂-agonist (SABA)

* Separate ICS and SABA inhalers

GINA 2020, Box 3-5B © Global Initiative for Asthma, www.ginasthma.org
# ICS Dose Range

<table>
<thead>
<tr>
<th>Inhaled corticosteroid</th>
<th>Total daily ICS dose (mcg)</th>
<th>Adults and adolescents (12 years and older)</th>
<th>Total daily ICS dose (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Beclometasone dipropionate (pMDI, standard particle, HFA)</td>
<td>100–200</td>
<td>&gt;200–400</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Beclometasone dipropionate (pMDI, extrafine particle*, HFA)</td>
<td>50–100</td>
<td>&gt;100–200</td>
<td>&gt;200</td>
</tr>
<tr>
<td>Budesonide (DPI)</td>
<td>100–200</td>
<td>&gt;200–400</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Budesonide (nebuliser)</td>
<td>250–500</td>
<td>&gt;500–1000</td>
<td>&gt;1000</td>
</tr>
<tr>
<td>Ciclesonide (pMDI, extrafine particle*, HFA)</td>
<td>80</td>
<td>&gt;80–160</td>
<td>&gt;160</td>
</tr>
<tr>
<td>Fluticasone furoate (DPI)</td>
<td>50</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Fluticasone propionate (DPI)</td>
<td>50–100</td>
<td>&gt;100–200</td>
<td>&gt;200</td>
</tr>
<tr>
<td>Fluticasone propionate (pMDI, standard particle, HFA)</td>
<td>50–100</td>
<td>&gt;100–200</td>
<td>&gt;200</td>
</tr>
<tr>
<td>Mometasone furoate (pMDI, standard particle, HFA)</td>
<td>100</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>
PHARMACOLOGIC MANAGEMENT OF ASTHMA

• Long term use of Inhaled corticosteroids (ICSs) are thus the **cornerstone** for preventive therapy
• Unfortunately the majority of the prescribers worldwide aren’t aware of ICSs/correct prescription
• Others are afraid because of ‘steroidophobia’ - including doctors
• All these will promote **misconceptions**
Figure 1: Patient's reasons for underutilization of ICS.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Frequencies and Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>If one person has asthma, then all of the families are likely to have asthma as well</td>
<td>15 (11.4)</td>
</tr>
<tr>
<td>Asthma is contagious</td>
<td>56 (42.2)</td>
</tr>
<tr>
<td>People with asthma cannot do as much physical exercise as other people</td>
<td>30 (22.7)</td>
</tr>
<tr>
<td>Asthma can be cured</td>
<td>30 (22.7)</td>
</tr>
<tr>
<td>Asthma can’t be controlled</td>
<td>42 (31.8)</td>
</tr>
</tbody>
</table>

*Table 4: Attitude of respondents regarding Asthma (n = 132).*
MISCONCEPTIONS

• Asthma is only controllable with high dose steroids.

• The truth: Asthma is most often controllable with low dose inhaled steroids.

• n.b: ICS - in micrograms not mg; lowest possible dose that keeps symptoms under control - so monitor your patients and titrate.
<table>
<thead>
<tr>
<th>STUDIES</th>
<th>ESSENTIAL MEDICINE LIST</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mendis et al. [15] 6 LMIC ( included-Malawi), 20 public and 16 private facilities.</td>
<td>2 essential medicines (Salbutamol and Beclometasone inhalers)</td>
<td>Availability of beclometasone: 0% in public sector and 38% in private sector. Affordability of salbutamol and beclometasone combination: 9.2 days’ wages</td>
</tr>
<tr>
<td>Kibirige et al. [16] Uganda 23 public and 22 private facilities and 85 private pharmacies</td>
<td>17 essential medicines 2 diagnostic tests (Spirometry and peak flow-metry)</td>
<td>Availability of inhaled SABA, oral LTPA, ICS–LABA combinations, ICS, oral theophylline, inhaled SAMA, inhaled SAMA and SABA combination and inhaled LAMA monotherapy or with LABA: 75, 60.8, 46.9, 45.4, 16.9, 12.3, 10.8 and 0% respectively. Affordability: inhaled salbutamol-2.2 days’ wages, inhaled beclometasone-5.3 days’ wages, inhaled formeterol-beclometasone-6.4 days’ wages, oral montelukast-6.9 days’ wages, inhaled salmeterol-fluticasone propionate-10.2 days’ wages, inhaled salbutamol-ipratropium-10.7 days’ wages and 17.1 days’ wages for formoterol/budesonide. Availability of spirometry and peak flow-metry: 24.4% and 6.7% respectively. Affordability of spirometry: 27.8 days’ wages</td>
</tr>
</tbody>
</table>
### Armstrong-Hough et al. [20]
- **Uganda**
- 196 health facilities
- 2 essential medicines (Beclometasone and salbutamol inhalers)
- Availability of beclometasone and salbutamol inhalers was 1.5% and 19.9% respectively.

### Babar et al. [18]
- 52 LMICs (21 SSA countries)
- 2 private retail pharmacies, 1 national procurement centre and 1 public hospital for each participating country
- 3 essential medicines (Salbutamol, Beclometasone and Budesonide)
- **Availability of beclometasone and budesonide**: 0% in Burundi, Cameroon, Democratic Republic of Congo (DRC), Djibouti, Nigeria, Tanzania and Togo (sites surveyed)
- **Affordability** of innovator budesonide in Burkina Faso, Mozambique and Republic of Guinea was 48 days’ wages, 51 days’ wages and 107 days’ wages respectively
- Affordability of the lowest priced generic beclometasone was < 2 days’ wages in Kenya, South Africa, Uganda and Zambia and > 2 days’ wages in Ethiopia, Madagascar, Malawi, Sudan and Zimbabwe
- Affordability of the lowest priced generic salbutamol was < 2 days’ wages in Burkina Faso, DRC, Kenya, South Africa, Tanzania, Uganda, Zambia and Zimbabwe and ≥ 2 days’ wages in Benin, Burundi, Cameroon, Ethiopia, Republic of Guinea, Madagascar, Malawi, Mali, Mozambique and Togo
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>No. of Facilities</th>
<th>Medicines/Tests Provided</th>
<th>Percentage Availability of Medicines/Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nyarko et al.</td>
<td>Ghana</td>
<td>23 health facilities</td>
<td>3 essential medicines (Salbutamol inhaler, Ipratropium bromide and beclometasone inhaler) 1 diagnostic test (peak flow-metry)</td>
<td>Availability of ipratropium bromide, beclometasone inhaler and salbutamol inhaler was 4.5, 17.4 and 39.1% respectively. Availability of peak flow-metry was 13%</td>
</tr>
<tr>
<td>Desalu et al.</td>
<td>Nigeria</td>
<td>68 tertiary public hospitals</td>
<td>6 classes of essential medicines and 2 diagnostic tests (Spirometry and peak flow-metry)</td>
<td>Availability of inhaled anti-cholinergics, oral LTRA, ICS, SABA nebulus, ICS–LABA combinations, inhaled SABA and oral theophylline was 2.9%, 5.9%, 23.5%, 35.3%, 50%, 76.5%, 76.5% respectively. Availability of spirometry and peak flow-metry was 29.4% and 38% respectively</td>
</tr>
<tr>
<td>Mendis et al.</td>
<td>8 LMICs (3 SSA countries - Benin, Eriteria and Sudan)</td>
<td>30 health facilities.</td>
<td>3 essential medicines (beclometasone, salbutamol and ipratropium bromide inhalers)</td>
<td>Availability of beclometasone inhaler in Benin, Sudan and Eriteria was 16.7, 21.4 and 33.3% respectively. Availability of salbutamol inhaler in Benin, Sudan and Eriteria was 33.3, 71.4 and 100% respectively. Availability of ipratropium bromide was 0% in Benin and Eriteria and 14.3% in Sudan</td>
</tr>
</tbody>
</table>
Mash et al. [23]

South Africa
46 primary care facilities

1 diagnostic test (peak flow meter)

Availability of peak flowmetry was 53.6%

4 DIFFERENT STUDIES: South Africa Ghana Uganda Nigeria [17].

spacer device availability

In South Africa spacers were available in 72.9% of the surveyed 46 primary healthcare facilities
0% in Ghana, 18.5% and 19.2% for adult and paediatric spacers respectively in Uganda and 20.6% in Nigeria
Contributing Factors for Underutilization of Inhaled Corticosteroids Among Asthmatic Patients Attending at Adama Hospital Medical College, Adama, Ethiopia

Tadesse and Beyene

Figure 1 Patient’s reasons for underutilization of ICS.
3. ENVIRONMENTAL CONTROL

MISCONCEPTION:
There is a cure for asthma/allergies.

TRUTH
• While there is no cure for asthma and allergies, it is controllable
  – there are steps to reduce allergy and asthma triggers.
    • Examples include spring cleaning to reduce dust, pollen and other allergens
• Thus environmental control is an important principle in control of asthma
A TRUE STORY ABOUT MWOLolo

- .......Mwololo was eventually noticed to be allergic to animal fur, a gift she had received for her tenth birthday to shelter her from the cold nights.

- Consequently, an ‘attack’ occurs after spending any night under the fur and only got relief after spending time away from her manyatta, the same amount of time the healer performed his ritual in a different, fur-free shelter.
3. ENVIRONMENTAL CONTROL

**TABLE 5** Environmental exposures and association with severe asthma in African adolescents participating in ISAAC III

<table>
<thead>
<tr>
<th>Variables</th>
<th>Univariable OR 95%CI P-value</th>
<th>Multivariable OR 95%CI P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mom smokes</td>
<td>1.63 (1.39-1.90) *&lt;0.001</td>
<td>1.61 (1.38-1.89) *&lt;0.001</td>
</tr>
<tr>
<td>Dad smokes</td>
<td>1.15 (1.03-1.29) 0.02</td>
<td></td>
</tr>
<tr>
<td>Smokers at home</td>
<td>1.17 (1.03-1.34) 0.02</td>
<td></td>
</tr>
<tr>
<td>Electric cooking</td>
<td>1.03 (0.82-1.28) 0.81</td>
<td></td>
</tr>
<tr>
<td>Gas cooking</td>
<td>1.07 (0.93-1.23) 0.33</td>
<td></td>
</tr>
<tr>
<td>Fire cooking</td>
<td>1.07 (0.91-1.26) 0.43</td>
<td></td>
</tr>
<tr>
<td>Electric heating</td>
<td>1.00 (0.87-1.14) 0.99</td>
<td></td>
</tr>
<tr>
<td>Gas heating</td>
<td>1.02 (0.89-1.17) 0.77</td>
<td></td>
</tr>
<tr>
<td>Fire heating</td>
<td>1.15 (0.94-1.40) 0.17</td>
<td></td>
</tr>
<tr>
<td>Older siblings</td>
<td>0.95 (0.83-1.09) 0.46</td>
<td></td>
</tr>
<tr>
<td>Younger siblings</td>
<td>1.07 (0.94-1.20) 0.31</td>
<td></td>
</tr>
<tr>
<td>Cat at home</td>
<td>1.17 (1.07-1.29) *0.001</td>
<td>1.14 (1.04-1.25) 0.03</td>
</tr>
<tr>
<td>Dog at home</td>
<td>1.11 (1.00-1.24) 0.06</td>
<td></td>
</tr>
<tr>
<td>≥3 weekly exercise</td>
<td>1.42 (1.23-1.63) *&lt;0.001</td>
<td>1.42 (1.23-1.64) *&lt;0.001</td>
</tr>
<tr>
<td>≥3 hour daily television watching</td>
<td>1.12 (0.99-1.24) 0.07</td>
<td></td>
</tr>
<tr>
<td>≥1 Monthly paracetamol</td>
<td>1.21 (1.09-1.36) *0.001</td>
<td>1.20 (1.07-1.34) *&lt;0.001</td>
</tr>
</tbody>
</table>

Significant P values are marked in bold.
**Clinical practice parameters**  
<table>
<thead>
<tr>
<th>Clinical practice parameters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirms asthma diagnosis with pulmonary functions tests</td>
<td></td>
</tr>
<tr>
<td>Familiar with peak flow meter</td>
<td></td>
</tr>
<tr>
<td>Familiar with spirometer</td>
<td></td>
</tr>
<tr>
<td>Assesses inhaler technique at each visit</td>
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<td></td>
</tr>
<tr>
<td>Refers to asthma nurse counsellors</td>
<td></td>
</tr>
</tbody>
</table>
CONCLUSION

• Health workers in SSA - we need to step up our game!
• Updating health workers on usefulness of objective diagnosis, monitoring and asthma tools is required
• Demystify ICS use to tackle misconceptions
• Respiratory societies lead their governments to update policies/asthma essential drug list to ensure availability of inhaled corticosteroids
• Drug companies should have a sense of urgency to correct availability and affordability of asthma drugs in SSA
• Education for everyone and partnership in asthma will reduce misconception and all hands must be on deck
• The time to act is now!
REFERENCES


Thank you for listening.