

# **The Wheezing Child and Asthma diagnosis**

**[A Diagnostic Workup]**

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# Asthma: Which talk...!

- Diagnosis
- Chronic asthma
- Acute asthma
- Difficult asthma
- Prevention of Asthma deaths
- Case study/presentation

# Reflection: GP referrals

- This child has wheeze, is it asthma?
- Parents are asking if he/she has got asthma

# Asthma: Which talk...!

## Diagnosis

- Chronic asthma
- Acute asthma
- Difficult asthma
- Prevention of Asthma deaths
- Case study/presentation



# Wheeze is the commonest asthma symptom



Cough

Wheeze → Breathlessness

# **Approach to the Wheezing Child**

**Recurrent wheeze and cough in young children is common problem:**

**Q. What is the cause?**

**Q. is it asthma?**

# Focus of the talk

- This talk is not about treatment and not about monitoring...
- Common question:  
Q. What is the cause of the wheeze in this child?

# Objectives

- Some update....
- Different types of wheeze (wheezing phenotypes)
- Review causes of wheeze in children
- **The challenges we face when we deal with wheeze and diagnosing asthma**
- **How to do it i.e. A practical approach to diagnosis.....**

# Age of onset is important

## < 5 years

- Infants and preschool aged children

## > 5years

- Older school aged children

# Wheezing in young children



**Wheeze**

## Challenging:

- Intermittent
- Persistent
- Variable
- Is not specific
- Many causes
- No easily available test
- Response to treatment is variable.

• **Common**

# **Wheeze is a common presentation**

About 20% of infants wheeze in infancy

At least 40% of children <6 years of age have at least one wheezing episode

**Common reason for GP consultation**

**Common reason for Hospital referral and admission**

**So it is important to all....**

**The presentation of wheeze in young children:**

**Can be a diagnostic and therapeutic challenge,  
as differential diagnoses are many  
and diagnostic tools are few,  
and response to treatment is variable.**



# Wheezy Child: age of onset and course of the illness

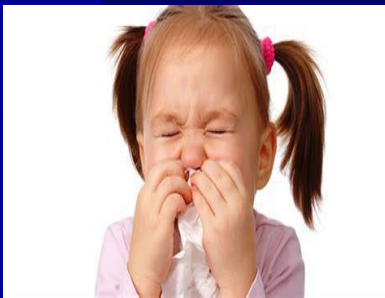
*Wheeze*



**< 3 years  
of age**



**> 3 years  
of age**



**≥ 6 years  
of age**



**What is a wheeze?**

# Noises with breathing

- Wheeze
- Stridor
- Throaty rattily noises
- Nasal noises
- Normal upper airway noises....
- Wheeze may be associated with other symptoms e.g. cough and breathlessness

# Does the child actually have wheeze?

- Not every noise is a wheeze.
- Documented wheeze: heard by a doctor.
- A child with intermittent symptoms has normal examination at the time of assessment.
- The “diagnosis of wheeze” is often entirely dependent on accurate parental description.

# Parents' interpretation of wheeze

- How accurate is the parents' description?
- How to verify if the child had wheeze?
- **Parental recognition of wheeze can differ from medically defined wheeze.**

# Parents' interpretation of wheeze

## In questionnaire surveys in European populations

Wheeze was only **correctly** identified by parents **83.5%** of the time and in **rural** populations **34%** had never heard of the term.

## In a UK population

**one-third** of parents who believed their infant had wheeze **changed their minds** after being shown **video** recordings of wheeze.

# What is a wheeze?

- Wheeze from the lower airways is a predominantly expiratory sound.
- It is often described as a 'musical sound' or 'polyphonic' in nature

# Difficulty in describing wheeze...!

- **Clinician to attempt to vocally reproduce the sound**  
(Given the difficulty in describing wheeze)
- The easiest course of action is to ask the parents to make an audio or video recording.







# An Audio Guide:

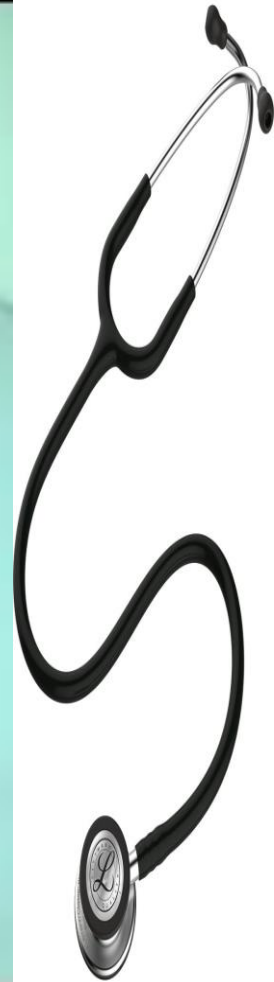
- An audio guide to breath sounds can be found on the 3M Stethoscopes website ([http://solutions.3m.com/wps/portal/3M/en\\_EU/3M-LittmannEMEA/stethoscope/littmannlearning-institute/heart-lung-sounds/lung-sounds/#wheezeexpiratory](http://solutions.3m.com/wps/portal/3M/en_EU/3M-LittmannEMEA/stethoscope/littmannlearning-institute/heart-lung-sounds/lung-sounds/#wheezeexpiratory)).

# Detecting wheeze

- The clinical sign of wheeze is the “wheezing sounds on expiration”
- Listen to the child breathing before disturbing the child, you probably have to place your ears close to the child chest/mouth and you should always use the stethoscope.

# Wheeze: auscultation

**No  
audible  
wheeze**



# **When there is wheeze look for other signs.....**

- **Longer to breathing out (prolonged expiration)**
- **Chest in-drawing (Recession)**
- **Effort in breathing out: difficulties talking, drinking and feeding**
- **Blue discolouration of lips/mucous membranes**
- **Use of accessory muscles: neck and abdomen**

**Look carefully, do not expect to see all these signs in every child with wheeze**

# Oxygen Saturation measurement

All children with wheeze  
and  
respiratory distress



# The wheezing Child: Goals of Initial Evaluation

- Confirm symptoms: wheeze
- **Assess for symptom pattern c/w asthma**
- Screen for “red flags” :
  - Screen for alternate clinical problems which might cause wheeze, or make asthma control difficult

# Tools for Evaluation

- A Good History: Onset, Triggers, pattern, H/O allergy, Other associated symptoms
- A good physical examination
- (+/- Targeted investigations...)



# An approach to wheezing Children

- Yes there is wheeze? ✓
- Is it recurrent? Episodic? Persistent?

# **Wheeze: Single (First) episode**

- 1) VIRAL**
- 2) “First event” asthma presentation**
- 3) Others.....**

**Wait...Time will tell....**

# Wheeze: Recurrent, episodic or persistent

- **Recurrent:** No standard definition, some define this as  $> 1$  episode (Recurrent cough as  $\geq$  two episodes) in the previous 12 months.
- **Episodic:** Comes and goes, there is symptoms free intervening periods, usually in association with viral infections
- **Persistent:** all the time

**Wait...Time will tell....**

# An approach to wheezing Children

- Yes there is wheeze? ✓
- Is it recurrent? Episodic? Persistent? ✓
- What are the triggers of the wheeze?

# Wheeze: triggers

- ❑ Wheezes only during a cold (viral infection), **OR**
- ❑ Wheezing with other triggers (i.e. between infections):
  - Cigarette smoke
  - Allergens
  - Exercise, laughing or crying (In infants and toddlers, crying and laughing are an exercise equivalent)
- ❑ Eating
- ❑ During sleep i.e. when lying down
- ❑ It never changes \*
- ❑ Began following choking episode
- ❑ “No apparent reason”

# Wheeze: Triggers and the likelihood of asthma

- ❑ **Viral infections (episodic) no interval symptoms**
- ❑ **Multi-triggers wheeze:**
  - Wheezing during discrete exacerbations **and** intervals between viral infections, possibly due to other triggers such as crying, laughter and exercise.
- ❑ The likelihood of asthma is much higher with multiple-trigger wheeze , who wheezed during and in between episodes of viral infections (interval symptoms).

# An approach to wheezing Children

- Yes there is wheeze? ✓
- Is it recurrent? Episodic? Persistent? ✓
- What are the triggers of the wheeze? ✓
- What are the associated symptoms and the “red flags”?

# Wheeze: The associated symptoms

- Eczema, H/F
- Cough: wet, sputum
- Choking
- Feeding difficulties
- Vomiting
- Diarrhoea
- Failure to thrive
- Others.....





# **Initial Assessment: look for “Red Flags”**

- **Initial symptoms associated with choking episode**
- **Feeding difficulties and Vomiting**
- **Productive/wet cough**
- **Clubbing**
- **Chronic diarrhoea**
- **Poor growth**
- **Findings suggestive of heart failure**
- **Monotonous wheezing**
- **Truly “present from birth”**



# Red flags

## Requiring further evaluation.

- Symptom onset from birth or neonatal period.
- Respiratory symptoms associated with feeds or vomiting
- Recurrent productive cough.
- Initial symptoms associated with choking episode
- Truly “present from birth”
- Failure to thrive, chronic diarrhoea
- Monotonous wheezing
- Failed therapeutic trial with conventional therapy.
- Clinical findings suggesting alternative diagnoses, e.g. finger clubbing, heart murmurs or focal lung signs.
- Underlying neurodevelopmental disease.
- Parental anxiety or need for reassurance.



# Cough

- Common problem, may be episodic, persistent, recurrent
- Wheeze is commonly associated with cough
- A clinical diagnosis of asthma is often considered in a child with prolonged cough, particularly if there is associated wheezing and chest tightness.

# An approach to wheezing Children

- Yes there is wheeze?
- Is it recurrent? Episodic? Persistent?
- What are the triggers of the wheeze?
- Are there associated symptoms and red flags?
- What is the cause of the wheeze?

# **Wheeze: the causes**

**The wheezing Syndromes....  
Diagnostic label.....!**

# The Wheezing Syndromes

- The medical literature contains a myriad of labels for wheezing syndromes.
- For example in asthma alone these include:
  - Viral wheezing
  - Pre-school wheeze
  - Episodic viral wheeze
  - Multiple trigger wheeze
  - Allergic wheeze
  - No-allergic wheeze
  - Early, Late and Persistent wheezers



- **Are these different conditions?**

# The Wheezing Syndromes

- **These labels exist in an attempt to identify phenotypic groups that may benefit from a different treatment approach.**
- **In clinical practice, few children sit neatly under a single diagnostic label; most occupy a spectrum with symptoms of varying severity as illustrated in the following case study.**



# Case Presentation-at 10 months of age

- Sarah is a 10 months old and has a history of cough and wheeze since birth that seemed to worsen on and off with colds and coryzal symptoms.
- She also has had a history of frequent vomiting noticed soon after birth for which she has been on Gaviscone.
- At 3 months of age Sarah was admitted into the hospital for 3 days with acute RSV positive bronchiolitis.
- She has 2 older siblings 5 and 6 years old.



**Q. What is the possible diagnoses (D>D? And why?)**  
**Discuss in pairs**



# Possible causes: D.D

- 1) In this case, the history of wheeze from birth suggests the possibility of tracheomalacia or bronchomalacia.
- 2) History of frequent vomiting suggests the possibility of aspiration from GOR.
- 3) Sporadic coryzal symptoms raises suspicion of intercurrent viral lower respiratory tract infections (LRTIs), older siblings brings viruses to her from school....!

# Case Presentation-at 14 months of age

**By 14 months of age  
Sarah's chest seemed to improve**



# Case Presentation- at 3 years of age

- At 3 years of age Sarah presents with a 6-month history (corresponding with colder months) of repeated episodes of wheeze, especially when active.
- The child's mother had observed a regular wet cough and sporadic coryzal symptoms over this time, but is unsure of their exact duration.



**Q. What is the possible diagnoses (D>D? And why?)**  
**Discuss in pairs**

- Sarah has current eczema, her mother had a history of childhood asthma, father has current H/F and an older sibling has eczema.
- Sarah is happy and thriving, and has a wet sounding cough in clinic but no audible wheeze or respiratory distress on examination.

# Possible causes: D.D

- 1) Sporadic coryzal symptoms raises suspicion of intercurrent viral lower respiratory tract infections (LRTIs)
- 2) Moist cough for months is suggestive of protracted bacterial bronchitis.
- 3) The family history asthma/atopy and wheezing when active raises the possibility of early asthma

# Common Causes of Childhood Wheezing

- Recurrent Viral infections (++++++)
- Asthma, Asthma , Asthma (+++++)
- Infective endobronchitis (++)
- Bronchomalacia (++)
- Aspiration GOR (+)
- Foreign body (+)
- Others (+/-)

**“Not all wheeze is Asthma”**

# Uncommon Causes of Childhood Wheezing

## Large airway obstruction

### □ Congenital:

- Tracheomalacia
- Vascular ring
- Tracheal stenosis

### □ Acquired:

- Foreign body
- Mediastinal mass
- Endobronchial tumor

- Abnormal GI - airway anatomy
- Persistent airway infection states
  - Cystic fibrosis
  - Immunoglobulin deficiency
  - Dysmotile cilia syndromes
- Cardiac failure
- Others...

# Common Causes of Childhood Wheezing

- Recurrent Viral infections (++++++)
- Asthma, Asthma , Asthma (+++++)
- Infective endobronchitis (++)
- Bronchomalacia (++)
- Aspiration GOR (+)
- Foreign body inhalation (+/-)
- Others (+/-)

**“Not all wheeze is Asthma”**

# In Summary

Although **asthma is a common cause** of cough and wheeze in children and the leading cause of childhood morbidity,  
**episodic cough and wheezing is also common in non-asthmatic children especially in association with viral infections.**



# Wheeze: is it asthma?

About 40% of all young children worldwide have at least one episode of asthmatic symptoms (wheezing, coughing or dyspnoea)

**ONLY 30% of pre-schoolers with recurrent wheezing diagnosed with asthma at the age of 6 years**

i.e. 70% of children with asthma-like symptoms do not have asthma

# Making the right diagnosis is important

- Without a clear diagnostic label there is no single correct treatment approach.....!
- **Right diagnosis: right treatment**
- Appropriate advice to parents
- Clearer prediction of outlook
  
- **Avoid under-diagnosis**
- **Over-diagnosis**
- **Wrong diagnosis**

# **Is it Asthma or Viral induced wheeze?**

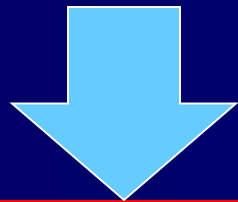
**The 2 most common causes of wheeze in in the under 5 years is:**

- 1) Viral induced wheeze**
- 2) Asthma**

# Is it asthma? or is it a viral infection?

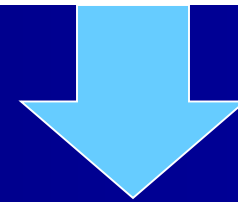
## Infection

- Episodic/recurrent
- Inflammation
- Increased secretions
- Muscle spasm
- Caused by infection



## Asthma

- Episodic/recurrent
- Inflammation
- Increased secretion
- Muscle spasm
- May be triggered by infection



**Wheeze, Cough and breathlessness**

# Onset of Symptoms in Children With Asthma



# **The HRV: The Human Rhinovirus and Asthma**

HRV accounts for a significant portion of acute respiratory illness (15–48.5%) in the general paediatric population

**BUT**

**Children with asthma, have more HRV infections especially during acute exacerbation.**

# Viruses and asthmatic children

During Asthma exacerbations:

Viral detection  
(80–90%)

HRV detection  
2/3<sup>rd</sup>

Outside of asthma exacerbations

Viral detection  
(12–41%)

HRV detection  
(12–28%)

**Suggesting a strong correlation between viruses/HRV and asthma exacerbations.**

# Is all wheeze the same?

## The Wheezing Phenotypes

Three categories of wheezing have been described in children 5 years and younger:

Transient early wheezing (before age 3).

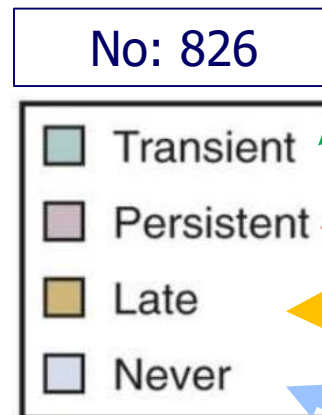
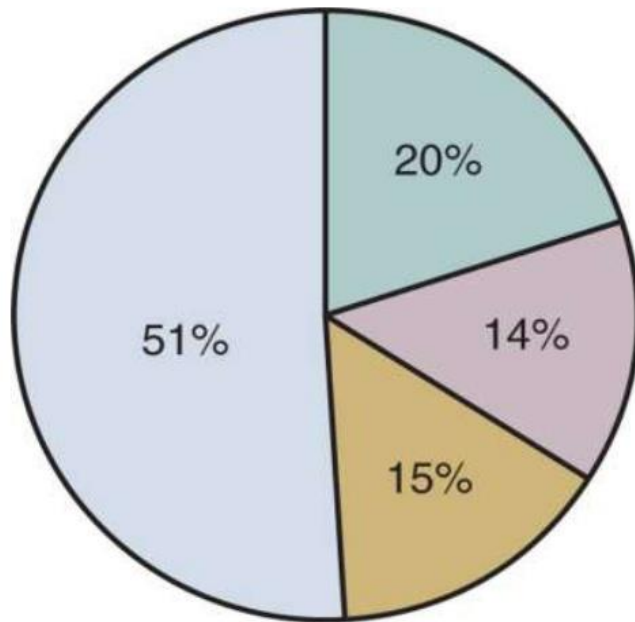
Persistent early-onset wheezing (before age 3).

Late-onset wheezing/asthma (at 6 years)



# Wheezing phenotypes in children

Wheezing phenotypes in children  
12 Longitudinal birth cohorts  
Original Tucson Group (Taussig L et al 1985)



Wheeze < 3 yrs, no wheeze at 6 yrs old

Wheeze < 3 yrs and at 6 yrs. old

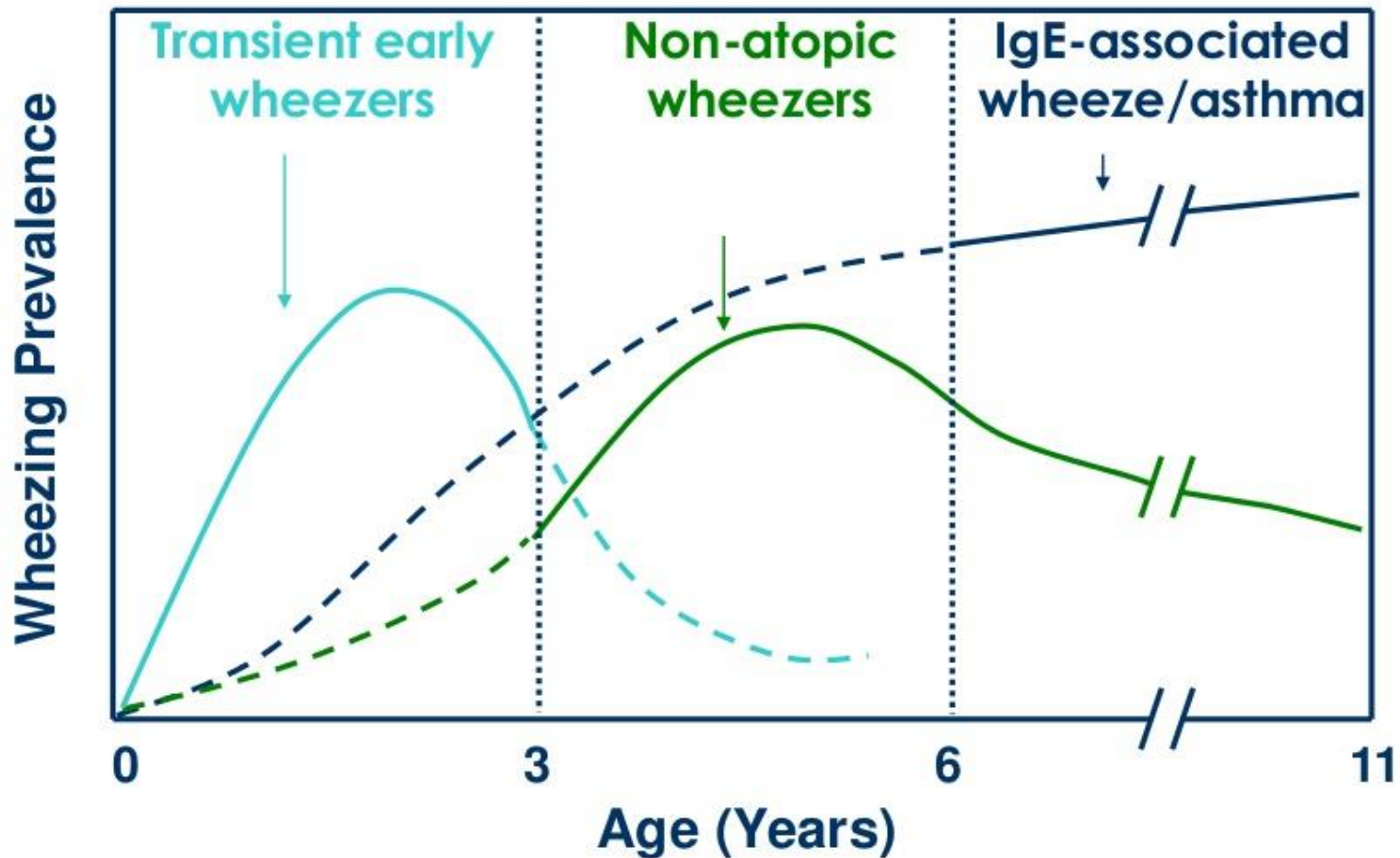
No Wheeze < 3 yrs, wheeze at 6 yrs. old

No Wheeze by 6 yrs. age

# There different types of wheeze?

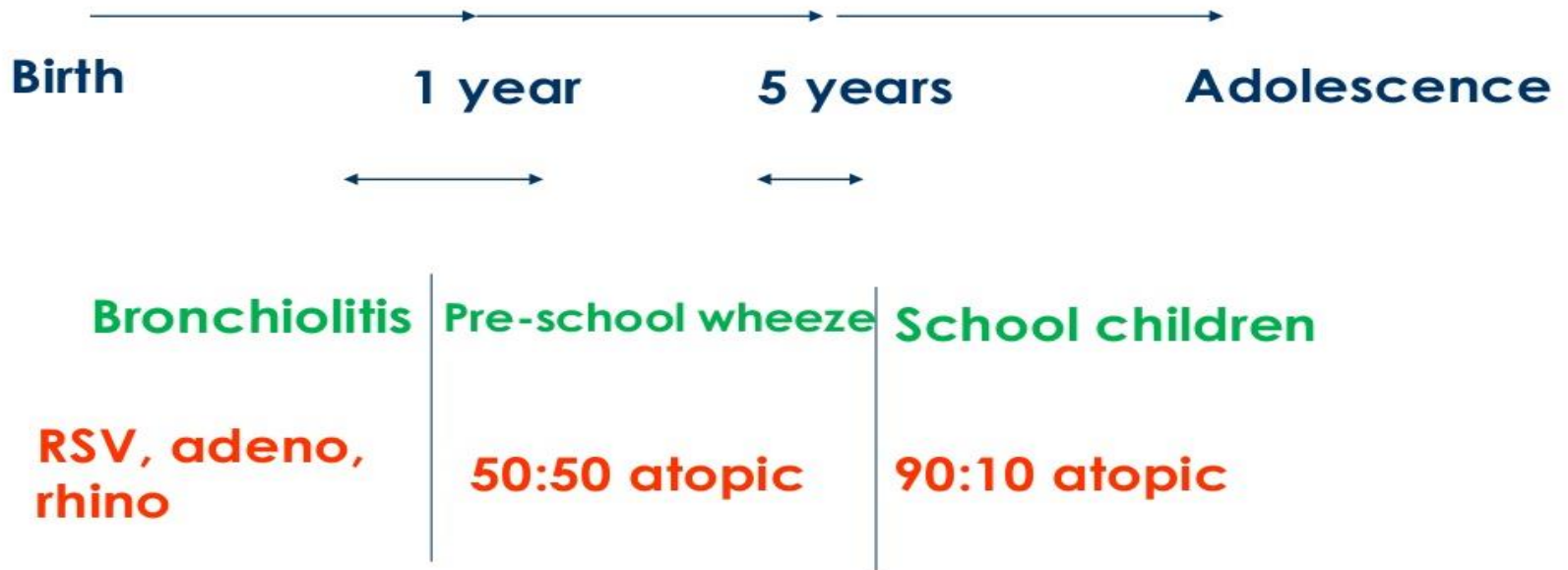
- What is special about these phenotypes?
- Clearly they are different
  
- Can we identify young children with wheeze who will not grow out of their wheeze?
- Can we identify young children with wheeze who will develop asthma?

# Natural History of Childhood Wheeze



# Spectrum of wheezing disorders in children

## Spectrum of disorders



# Which children outgrow this phenomenon?

## Age of onset

The majority who wheezed at a young age stop by wheezing by the age of 6 yr.

From 6 years of age onwards, only 1 in 5 outgrow their symptoms by the age of 19 years i.e. 20%.

## Children who did not outgrow their wheeze tended to:

Have allergies to furry animals

Greater severity of symptoms and

More persistent symptoms.

➤ **How to predict the likelihood of asthma in children with recurrent wheeze?**

**“Look for clinical features consistent with asthma”**

# Is it Asthma?

- ✓ Recurrent frequent episodes of symptoms
- ✓ Variability of symptoms
- ✓ Documented observation of wheeze
- ✓ Troublesome cough at night
- ✓ Cough or wheeze after exercise
- ✓ Symptoms after exposure to airborne allergens or pollutants
- ✓ Colds “go to the chest” or take more than 10 days to clear
- ✓ Personal and family history of atopy
- ✓ Symptoms improved by appropriate asthma treatment?
- ✓ Absence of alternative diagnosis

# Symptoms highly suggestive of Asthma

- Frequent episodes of wheeze
- Variability of symptoms
- Activity-induced cough or wheeze,
- Nocturnal cough in periods without viral infections,
- Absence of seasonal variation in wheeze
- Symptoms that persist after age 3.
- No alternative diagnosis



**Clinical pattern  
C/W asthma**

**Associated features increase the probability of asthma:**

- Eczema
- family History of atopy,
- Response to trial of asthma treatment

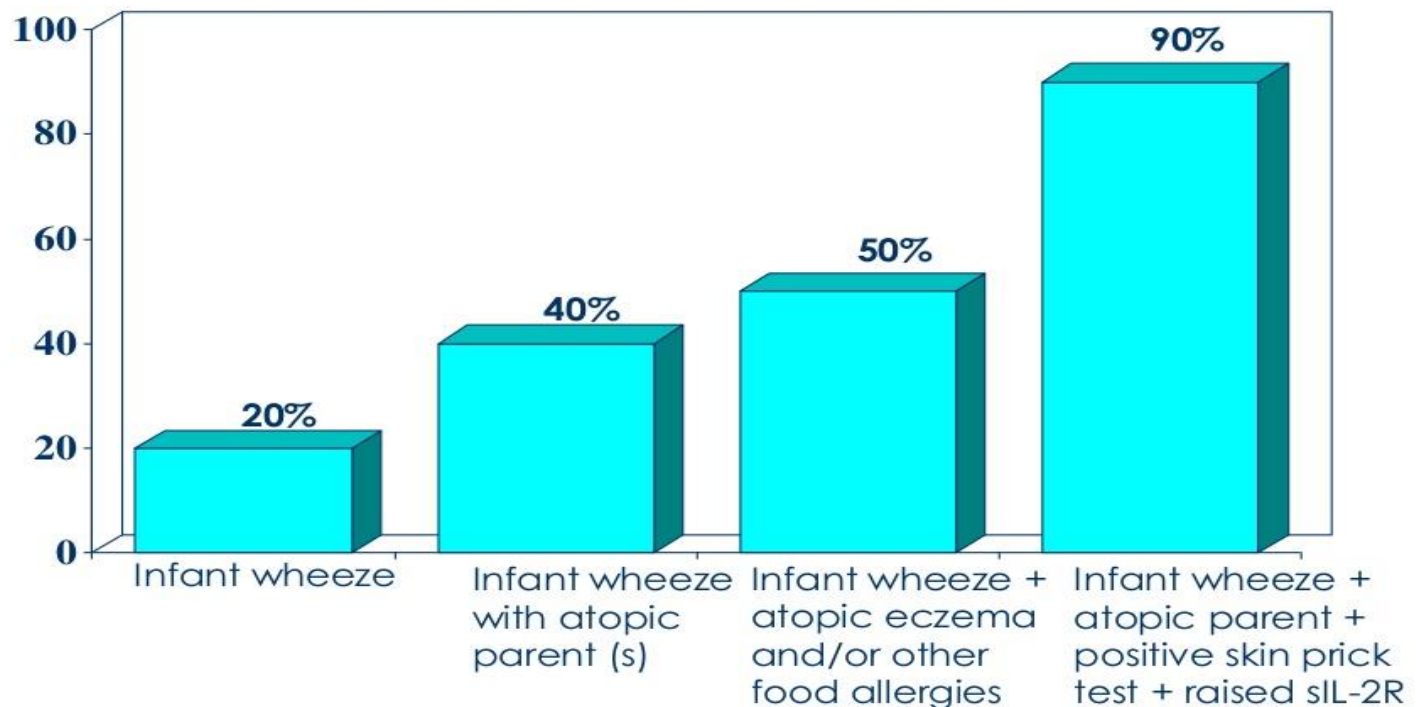


# Asthma in young infants..!

- Can we predict asthma from infancy?
- **Strongest predictor for wheezing continuing into asthma is atopy....**

# Atopy and risk of developing asthma

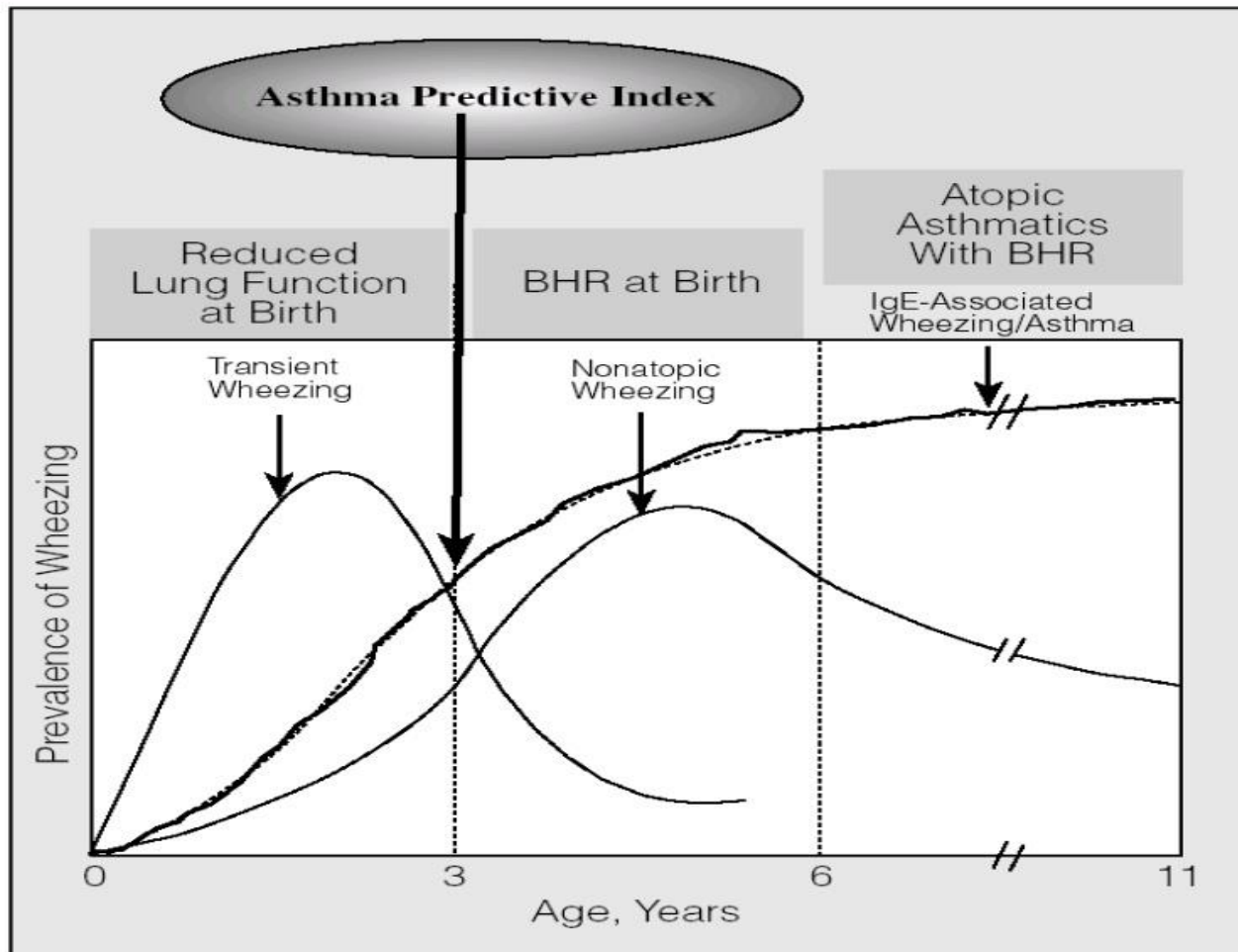
## % OF INFANTS SUBSEQUENTLY DEVELOPING ASTHMA



# Personal and family history of atopy is important

Important risk factors for the development of asthma in preschool children who wheeze. Maternal asthma was shown to be an independent risk factor for persistent wheezing. Personal and family history of atopy are strongly associated with the risk of early-onset persistent asthma. The presence of atopic dermatitis, allergic rhinitis and parental asthma, and wheezing apart from colds are used as major and minor criteria in the Asthma Predictive Index (API) which has been shown to predict the presence of asthma in later childhood. Studies has shown that a child with a positive API has a 4- to 10-fold greater chance of developing asthma between the ages of 6 and 13 years, while 95% of children with a negative API remained asthma-free. A modified version of the index, the modified API (mAPI), applies the criteria in children with four or more wheezing episodes per year to predict the risk of developing asthma at schoolgoing age. The mAPI can aid clinical decision-making in assessing future asthma risk in preschool-age children.

# Wheezing phenotypes and Asthma prediction



# The risk of Asthma in Wheezing Children

## Modified Asthma Predictive index (mAPI)

In the past 12 months, >3 exacerbations of wheezing with at least 1 physician-diagnosed exacerbation **PLUS**

### 1 Major Criterion

- Parental history of asthma
- Physician-diagnosed atopic dermatitis
- Allergic sensitization to  $\geq 1$  aeroallergen\*

**OR**

### 2 Minor Criteria

- Wheezing unrelated to colds
- Blood eosinophils  $\geq 4\%$
- Allergic sensitization to milk, eggs, or peanuts

House dust mite, cockroach, dog, cat, mold, grass, tree, and weed.

1. Castro-Rodriguez JA et al. *Am J Respir Crit Care Med.* 2000;162:1403-1406.
2. Guilbert TW et al. *J Allergy Clin Immunol.* 2004;114:1282-1287.

# The risk of Asthma in Wheezing Children

## Asthma Predictive Index

- Identify high risk children (2 and 3 years of age):
- $\geq 4$  wheezing episodes in the past year (at least one must be physician diagnosed)

**PLUS**



### **One major criterion**

- 1) Parent with asthma
- 2) Atopic dermatitis
- 3) Aero-allergen sensitivity

***OR***

### **Two minor criteria**

- Food sensitivity
- Peripheral eosinophilia ( $\geq 4\%$ )
- Wheezing not related to infection



# Positive mAPI result is associated with the highest risk of persistent asthma

## MODIFIED ASTHMA PREDICTIVE INDEX

*Guilbert JACI 2004; 114: 1282*

➤ 4 wheezing episodes/year

+

1 major criteria  
or  
2 minor criteria

65% probability  
of asthma

no criteria

5% probability  
of asthma

# Tests to confirm asthma in the under 5 years.

- No easily available tests
- Diagnosis is primarily clinical
  
- As detailed so far.....



# Investigation of possible causes: Targeted

- CXR: can demonstrate the presence of a foreign body, structural anomalies, an enlarged heart, masses and pulmonary infiltrates.
- Sweat chloride test for cystic fibrosis.
- Allergy testing-blood/Skin
- PH studies/endoscopy for GER
- Barium swallow for tracheo-oesophageal fistula and other anomalies, Videofluoroscopy
- Bronchoscopy
- **Spirometry in children aged over 5 years.**
- Further investigations may be needed for rarer causes – e.g. echocardiogram, MRI/CT scan of the chest, etc.

# **Take home message: Wheezing children <5 years**

- ❑ Clinical pattern C/W asthma
- ❑ **4 or more wheezy episodes during last 12 months Plus**
- ❑ Personal history of atopy
- ❑ Parental history of atopy
- **High risk for developing asthma and would lend support to a trial of asthma treatment**
- **Adequate response to treatment provide further support to a diagnosis of possible asthma..**

# Diagnosing asthma in children <5yrs

“Asthma is a clinical diagnosis”

BUT

Try to step down and stop treatment and if patients are still on asthma treatment, then asthma should be confirmed by objective tests

at 5 years of age

Diagnosis: Suspected Asthma



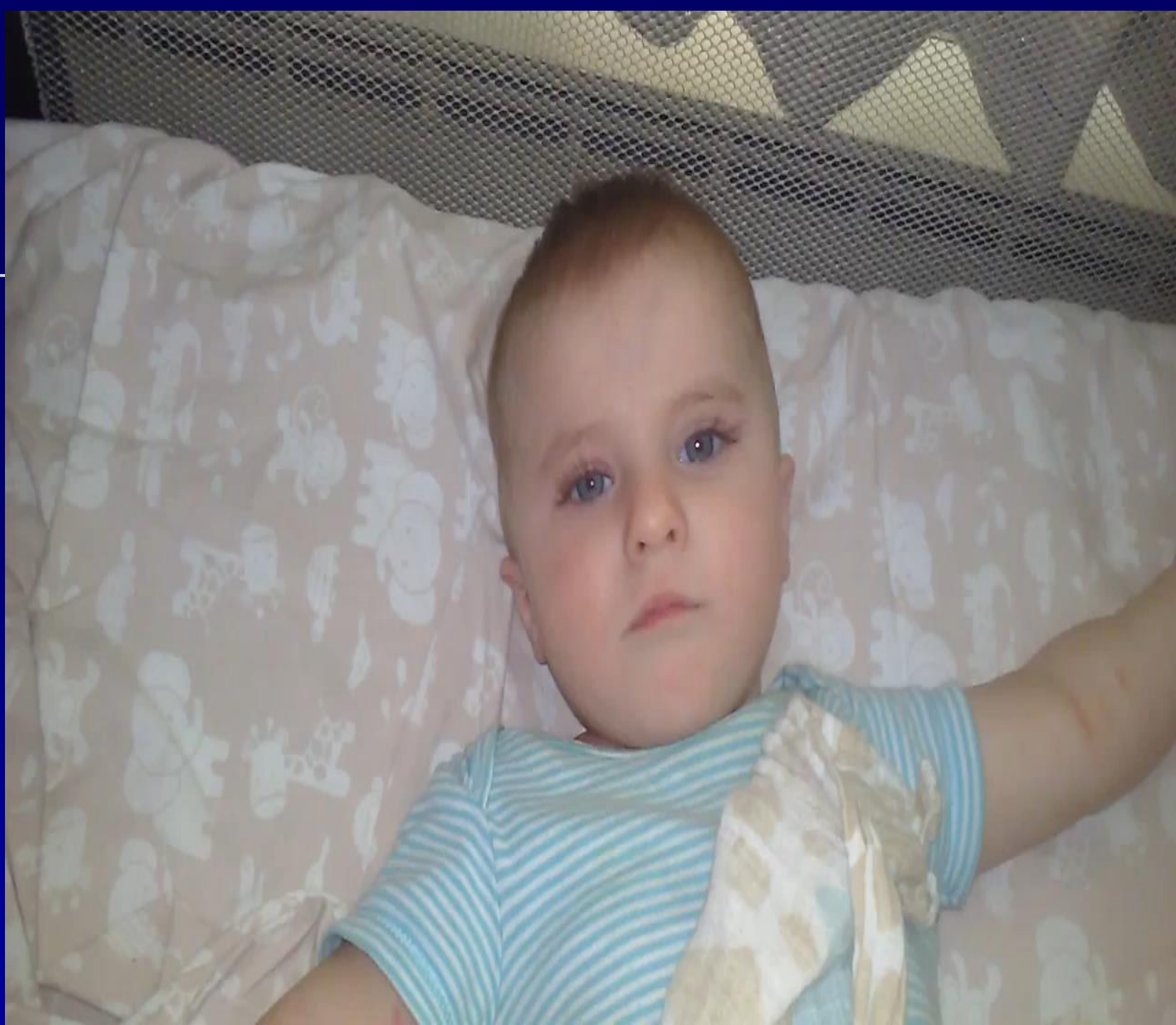
**Any Questions**

**Not all noises are wheeze and  
not all wheeze is asthma**

# Common Causes of Childhood Wheezing

- Recurrent Viral infections (++++++) ✓
- Asthma, Asthma , Asthma (+++++) ✓
- Infective endobronchitis (++)
- Bronchomalacia (++)
- Aspiration GOR (+)
- Foreign body (+)
- Others (+/-)

**“Not all wheeze is Asthma”**

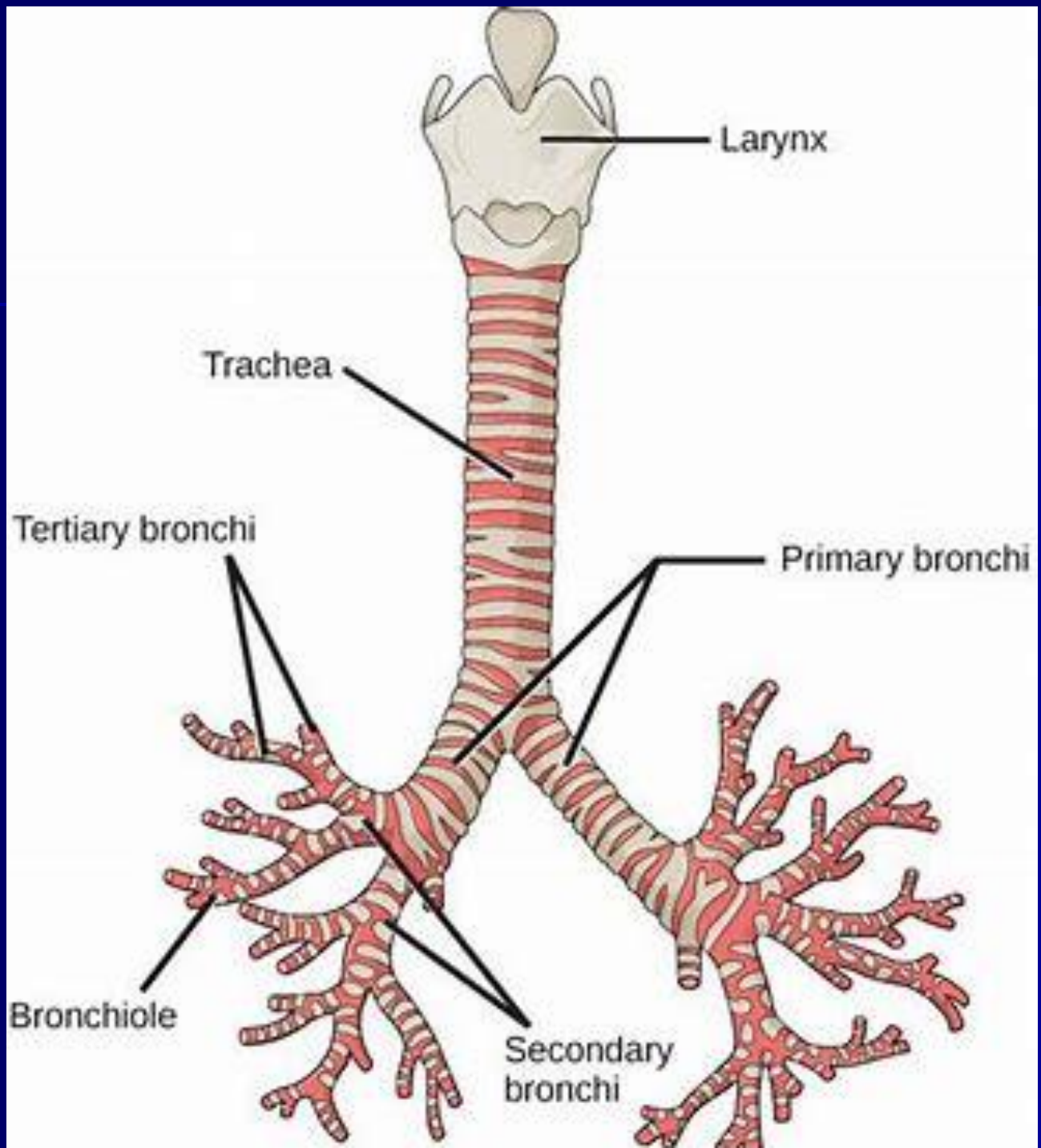




**Stridor**

**+/-**

**wheeze**





# **Airways malacia (airways floppiness)**

- **Either tracheomalacia (stridor) and/or bronchomalacia (wheeze)**
- **Usually present soon after the neonatal period with wheeze, stridor, cough and rattling;**
- **Children are usually well and often labelled as 'happy wheezers'**
- **Bronchoscopy usually diagnostic but not necessary in most cases.**

# **Airways malacia (airways floppiness)**

- Majority outgrow it by age 2 years
- Secondary PBB can occur, presumably from poor cough clearance
- Treatment rarely required
- If there are worsening symptoms or failure to thrive, specialist referral is indicated

# Wet cough



Here is an example

[CoughyCup.com](http://CoughyCup.com)

- **Protracted Bacterial Bronchitis (PBB)**
  - **Persistent Bacterial Bronchitis**
    - **Infective endobronchitis**

# Protracted Bacterial Bronchitis (PBB)

- Probably common, but exact incidence Unknown
- Chronic wet cough (typically >4 weeks).
- **Concurrent wheeze and/or rattily breathing is common, Wheeze is documented in 50–75% of these children**
- Bronchoscopy may assist diagnosis, but usually unnecessary
- CXR-usually normal or non-specific
- If left untreated, will cause wet cough for months or years and **bronchiectasis** may develop.

# Protracted Bacterial Bronchitis (PBB)

- Usually: *Haemophilus influenzae*, *Streptococcus pneumoniae* or *Moraxella catarrhalis*
- 2–6 week course of antibiotics
- Commonly amoxicillin/clavulanic acid
- Response usually within 2 weeks of antibiotics, if prolonged symptoms a further 4 weeks is required to allow for airways healing.
- Later recurrence and need for repeat treatment is required in common.
- Majority resolve with 1–2 courses of Antibiotics.

# Gastro-eosophageal reflux (GER) and asthma

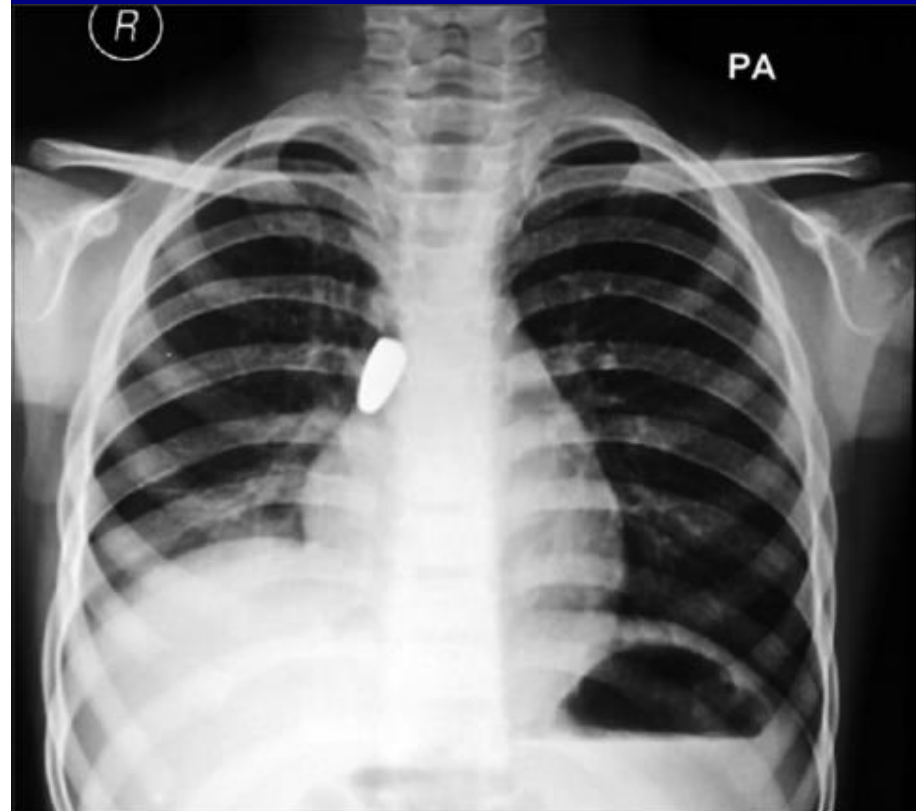
- Asthma-like symptoms are increased in patients with GER.
- GER reflux is common in patients with asthma
- GER is identified as a potential trigger for asthma
- GE reflux is a comorbidity associated with severe or difficult-to-treat asthma.
- GER is thought to affect asthma through the activation of vagal reflexes and/or microaspiration.
- Look for GER symptoms and consider trial of anti-reflux treatment in difficult to control asthma





# Foreign body ingestion

- Suggestive features: witnessed episode, sudden onset of coughing or choking, recent history of playing/eating small objects.
- Unilateral localised unchanged chest signs





# **Diagnosis of asthma in children with wheeze**

# Age of onset is important

**> 5years**

- Older school aged children

# Scale of the problem: Prevalence of asthma

10-15%. Approximately 1.1 million children in the UK are currently receiving treatment for asthma.

The UK has among the highest prevalence rates of asthma symptoms in children worldwide.<sup>1</sup>

The National Review of Asthma Deaths, published in 2014, found that:

- **The overall standard of care for young children and young people was inadequate, and was well below expected standards in almost one-half of asthma deaths in children.<sup>2</sup>**

# **What are the problems caused by undiagnosed [or poorly controlled paediatric asthma?]**

**Asthma attacks: unpredictable, stressful and can be fatal**

**Hospital Admission: cost to child, family & health services**

**School: absence, poor performance**

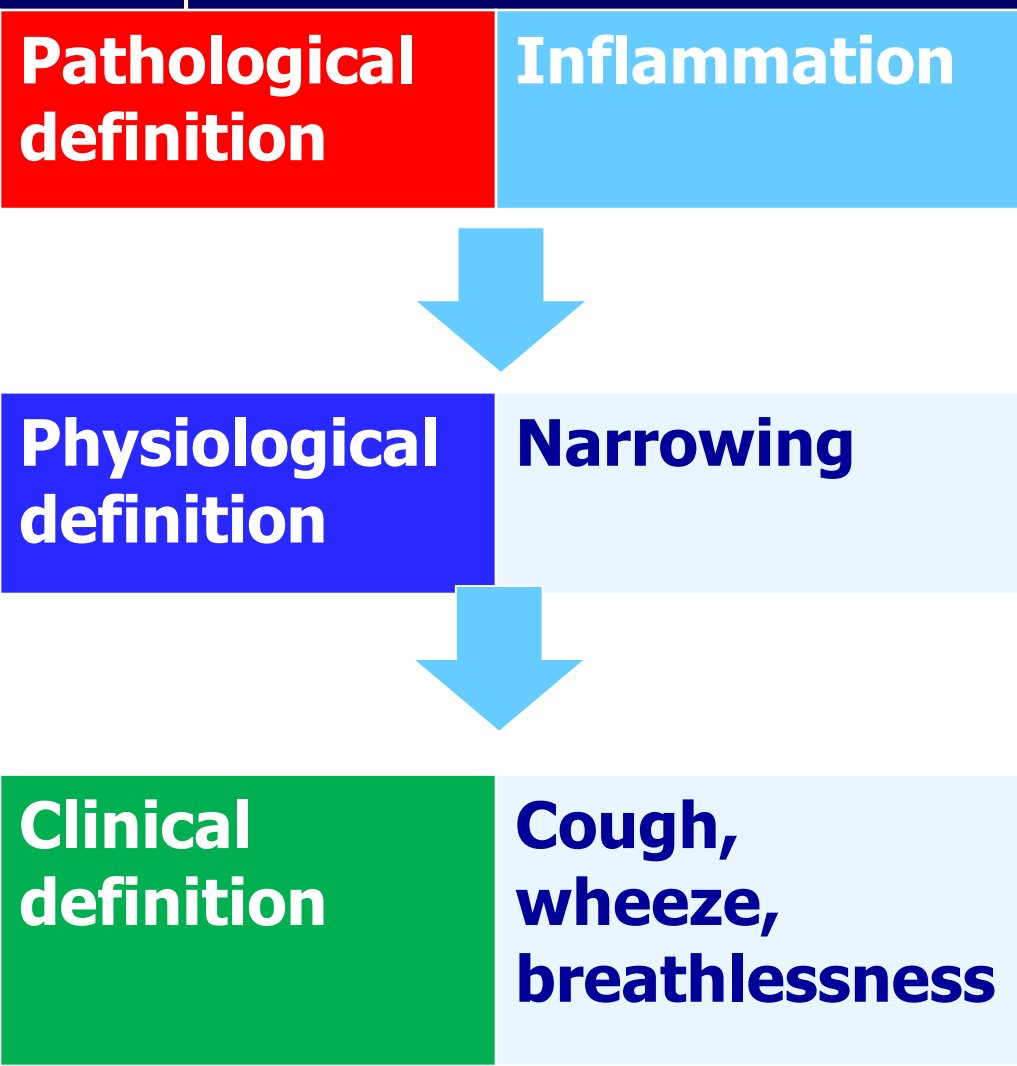
**Physical activities: exclusion**

**Growth and wellbeing**

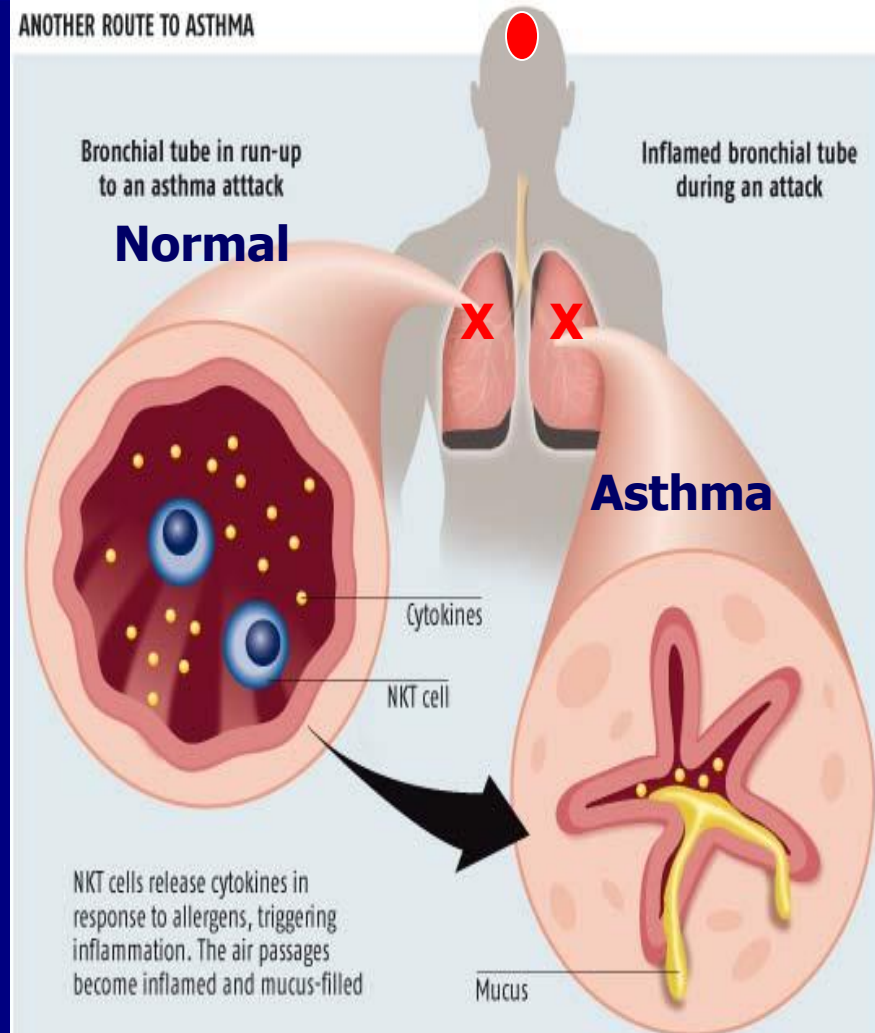
**Psycho-social: blame, social isolation**

# What is asthma?

## [Understanding Patho-physiology]



### ANOTHER ROUTE TO ASTHMA



# To diagnose asthma



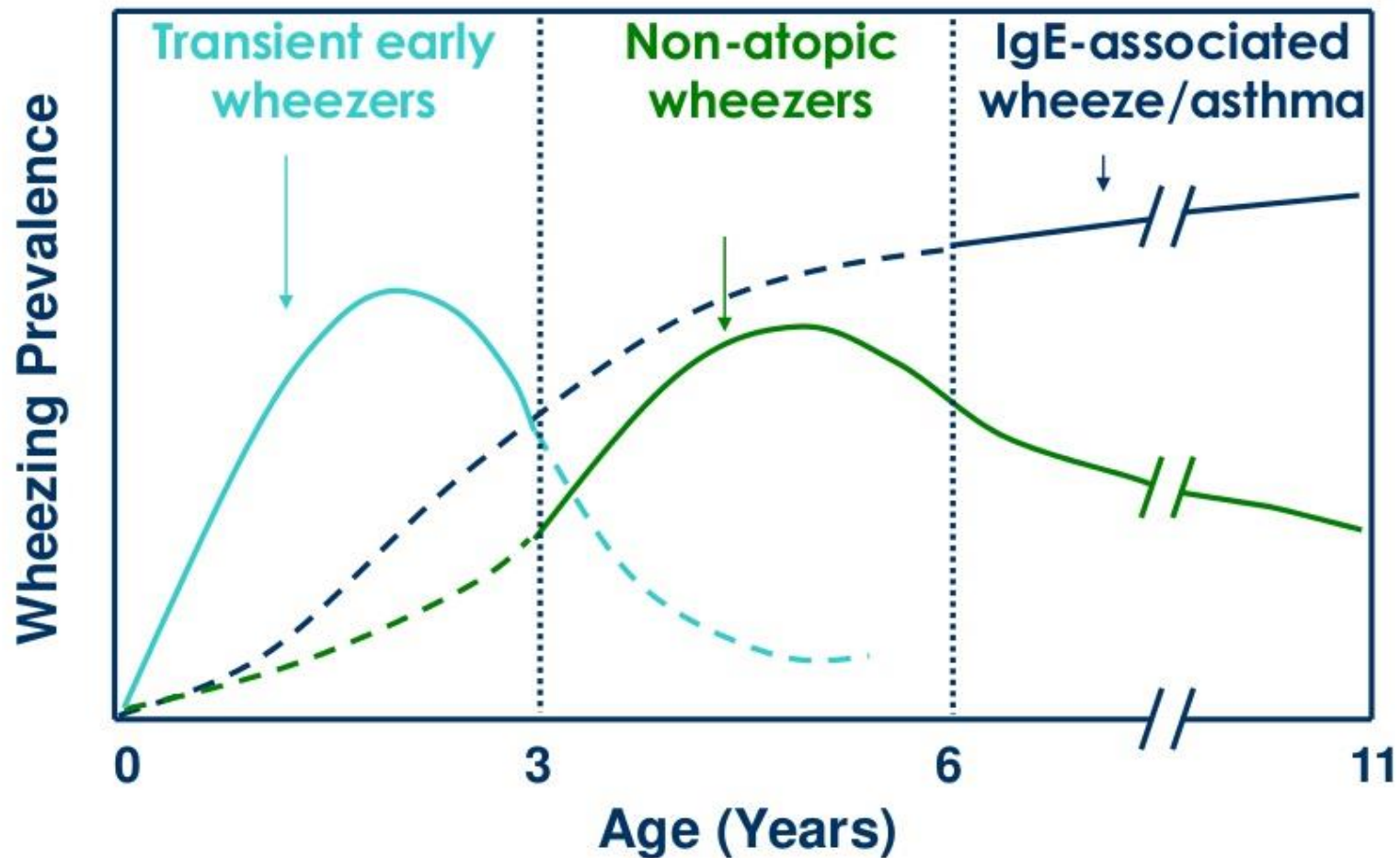
**We need to be proactive and  
not just reactive**

# Correct diagnosis of asthma is important

- Correct diagnosis essential if appropriate drug therapy is to be given.
- **The Challenges we face:**
  - Asthma symptoms may be **intermittent** and their significance may be overlooked by patients and doctors.
  - Asthma symptoms may be **non-specific**, result in misdiagnosis , particularly among children, and lead to inappropriate treatment.
  - **Objective tests for asthma** are **not easily available** in children <5years.

**Under diagnosis**  
**Over diagnosis**  
**Wrong diagnosis**

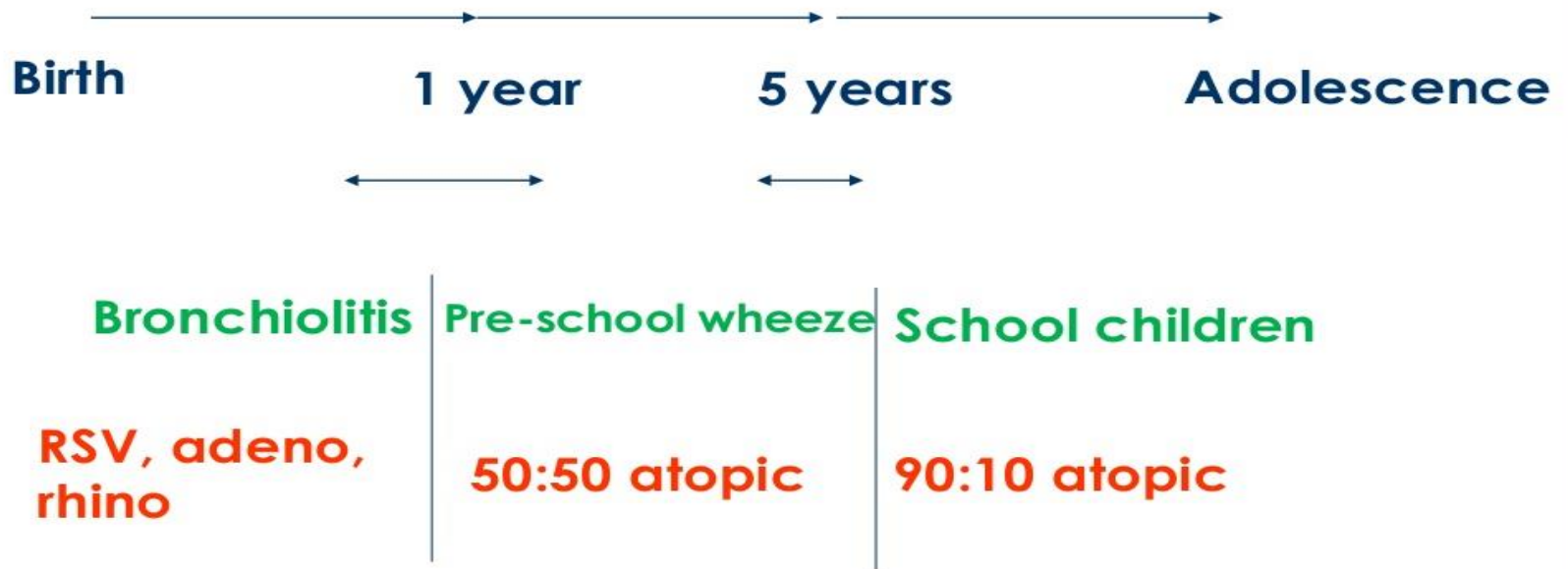
# Natural History of Childhood Wheeze





# Spectrum of wheezing disorders in children

## Spectrum of disorders



# Nationally recommended Asthma guidelines/quality standards

- 1) BTS/SIGN: British guideline on the management of asthma, 2016, review 2019
- 2) NICE Quality standards 2013 update 2018
- 3) **NICE Guidelines: Chronic asthma 2017**

**Asthma is Common and “all”  
Clinicians are expert....!!**

# Is it Asthma?

- Common reason for referral
- Common question from parents

# To diagnose asthma think of the "3R"

- Reactivity
  - Reversibility
  - Recurrence
- +
- (Age....):
    - < 5 Years
    - > 5years

# Diagnosis of Asthma

- **Structured Clinical assessment**
  - **History**
  - **Examination**
- **Investigations**

# Asthma Diagnosis

## Diagnostic uncertainty....!

**Undertake a structured clinical assessment to assess the initial probability of asthma. This should be based on:**

<b>History Recurrent Episodes (attacks)</b>	ideally supported by variable peak flows when symptomatic and asymptomatic
<b>Symptoms variability</b>	Variation of symptoms over time: wheeze, cough, breathlessness and chest tightness
<b>Documented wheeze</b>	Recorded observation of wheeze heard by a healthcare professional
<b>Atopy</b>	Personal/family history of other atopic conditions (in particular, atopic eczema/dermatitis, allergic rhinitis)
<b>Exclusion of other conditions</b>	No symptoms/signs to suggest alternative diagnoses

Possible, Probable, Suspected, Likely, May be, Confirmed Asthma!!

# Is it Asthma?

- ✓ Recurrent episodes of symptoms
- ✓ Variability of symptoms
- ✓ Documented observation of wheeze
- ✓ Troublesome cough at night
- ✓ Cough or wheeze after exercise
- ✓ Symptoms after exposure to airborne allergens or pollutants
- ✓ Colds “go to the chest” or take more than 10 days to clear
- ✓ Personal history of atopy
- ✓ Symptoms improved by appropriate asthma treatment?
- ✓ Absence of alternative diagnosis

# Asthma Diagnosis

- **Clinical features that increase the probability of asthma:**

- More than one of the following symptoms especially if frequent, worse at night/early morning/after exercise/exposure to triggers etc.

- Wheeze

- Cough
- difficulty breathing,
- chest tightness

- Atopic disorder

- FH of atopic disorder/asthma

- Improvement in symptoms or lung function with adequate therapy

- **Clinical features that lower the probability of asthma:**

- Symptoms with URI only
- no interval symptoms
- isolated cough in the absence of wheeze or difficulty breathing
- history of moist cough
- prominent dizziness, light-headedness, peripheral tingling
- repeatedly normal physical examination of chest when symptomatic
- normal PEF/spirometry when symptomatic
- no response to a trial of asthma therapy
- clinical features pointing to alternative diagnosis



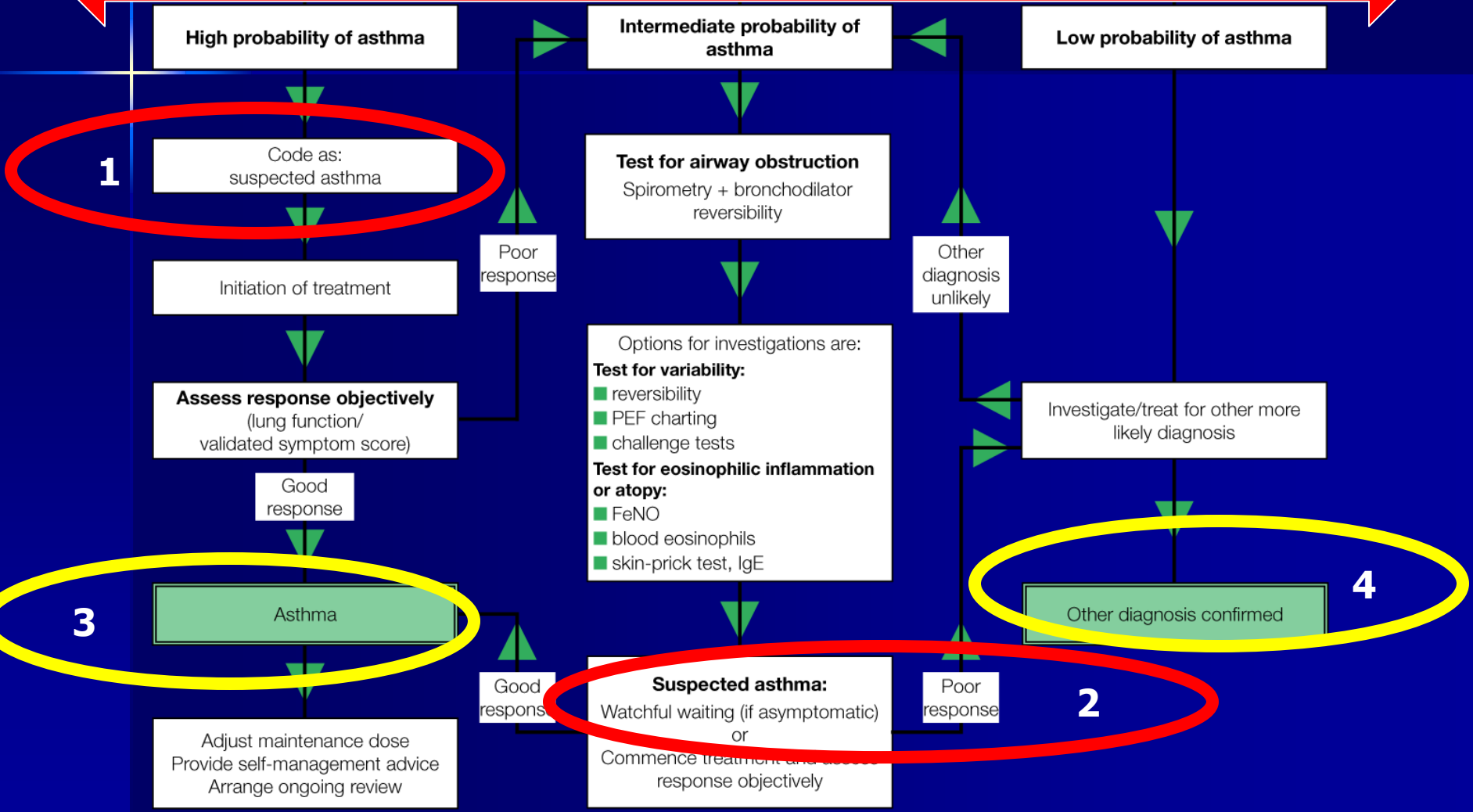
# Structured clinical assessment

(from history and examination of previous medical records)

- recurrent episodes of symptoms
- symptom variability
- absence of symptoms of alternative diagnosis

Look for:

- recorded observation of wheeze
- personal history of atopy
- historical record of variable PEF or FEV<sub>1</sub>



\* In children under 5 years of age, and others unable to undertake spirometry, in whom there is a high or intermediate probability of asthma, the options are monitored initiation of treatment or watchful waiting according to the assessed probability of asthma.

PEF=peak expiratory flow; FEV<sub>1</sub>=forced expiratory volume in one second; IgE=immunoglobulin E; FeNO=fractional nitric oxide concentration in exhaled breath.

# After the Initial clinical assessment

## 3 X Don'ts

**Do not exclude asthma if examination results are normal at presentation**

**Do not use symptoms alone without an objective test to diagnose asthma.**

**Do not use a history of atopic disorders alone to diagnose asthma.**

# Diagnosis of Asthma

History of Recurrent Symptoms  
\*Wheeze Cough Shortness of  
breath

Document Presence of  
Airflow Obstruction:  
• Spirometry • PEFr

**Assess airway  
inflammation**

Demonstrate Reversibility  
of Obstruction/Symptoms

**Rule Out  
Other  
Causes of  
Symptoms**

# Objectives Tests for asthma

**1** Respiratory function tests

**2** Airway inflammation test

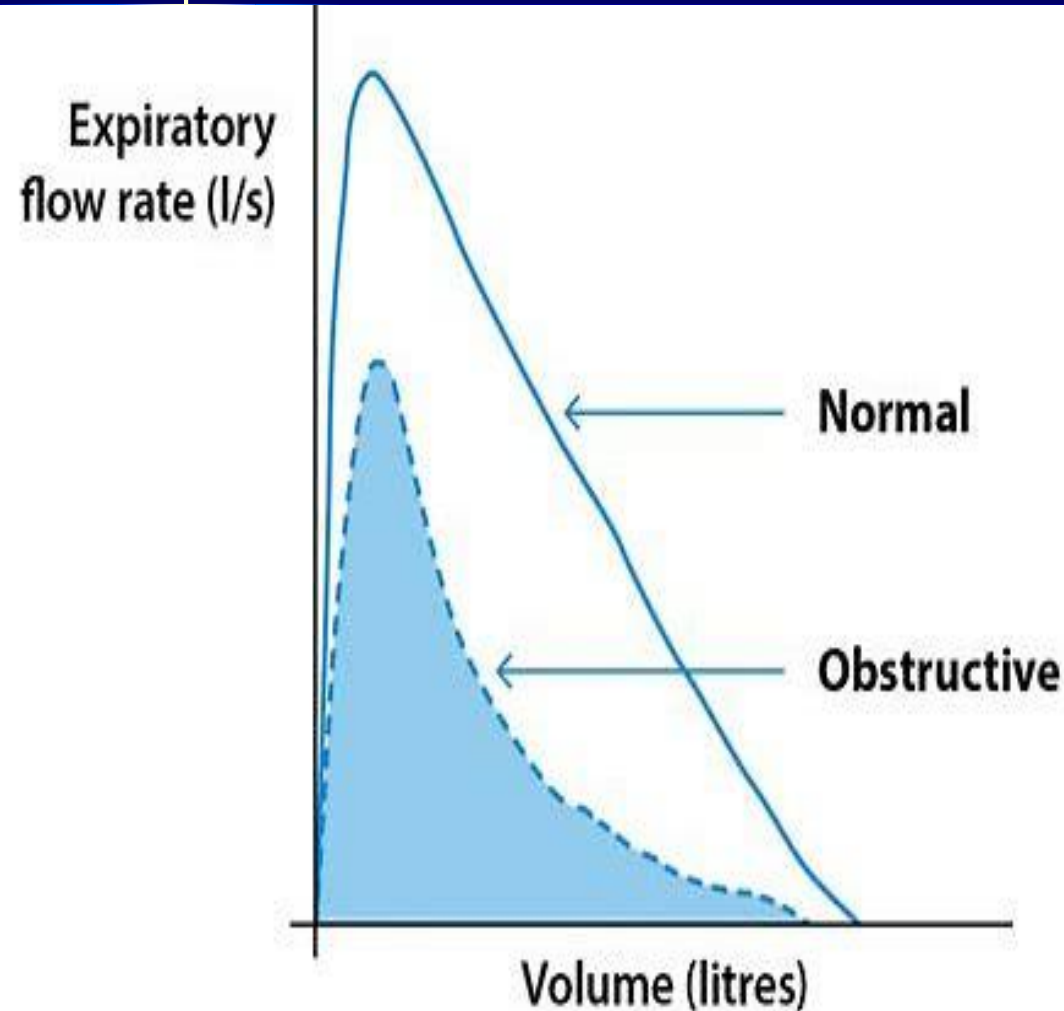
# Lung function tests

**1- Spirometry**

**2- Bronchodilator reversibility**

**3- Peak expiratory flow variability**

# Spirometry: Obstructive Spirometry

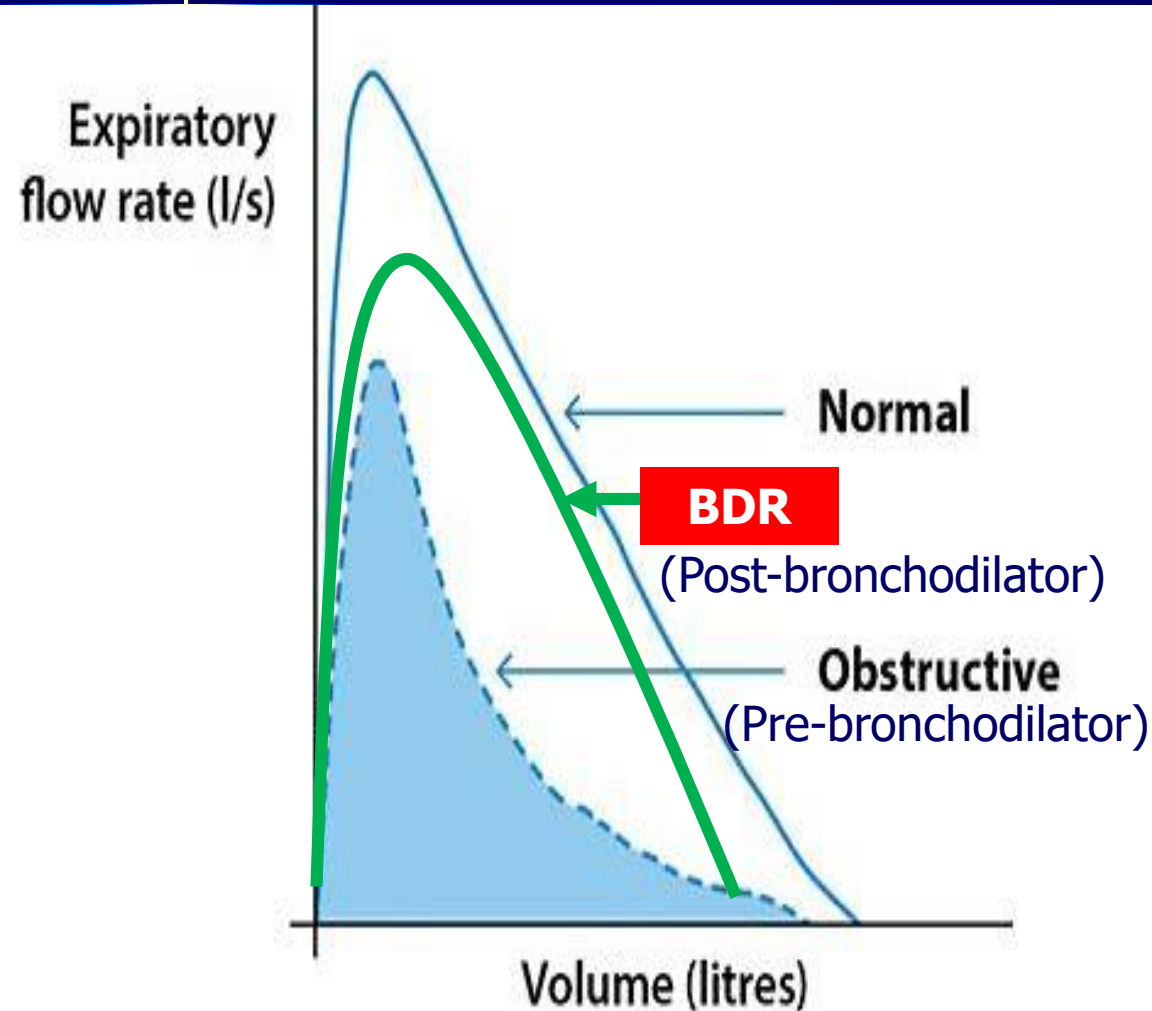


**Positive test threshold:**

**FEV<sub>1</sub>/FVC ratio  
< 70%**

(or below the lower limit of normal if available)

# Spirometry: BronchoDilator Reversibility (BDR)



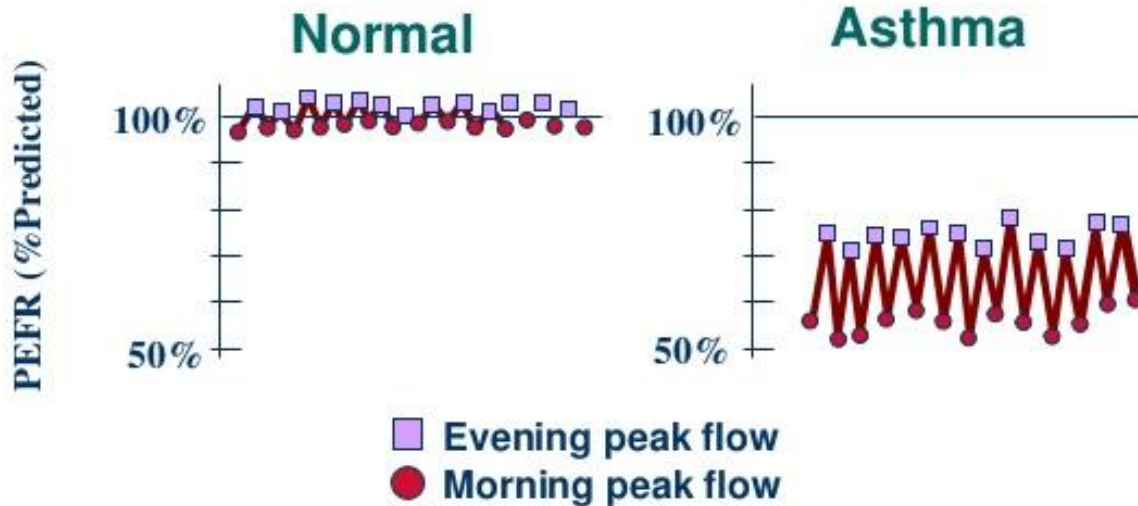
## Positive test thresholds:

Improvement in  
FEV1 of  
12% or more

# Peak Flow Variability

## Circadian Changes in PEFR

PEFR recorded twice-daily over 2 weeks



**PEFR  
diary ?**

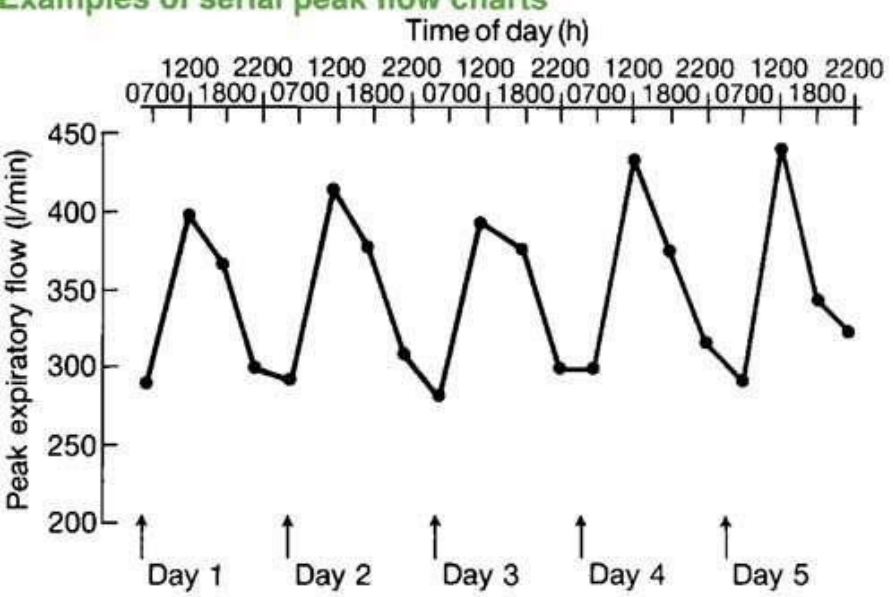


# Peak Expiratory Flow variability

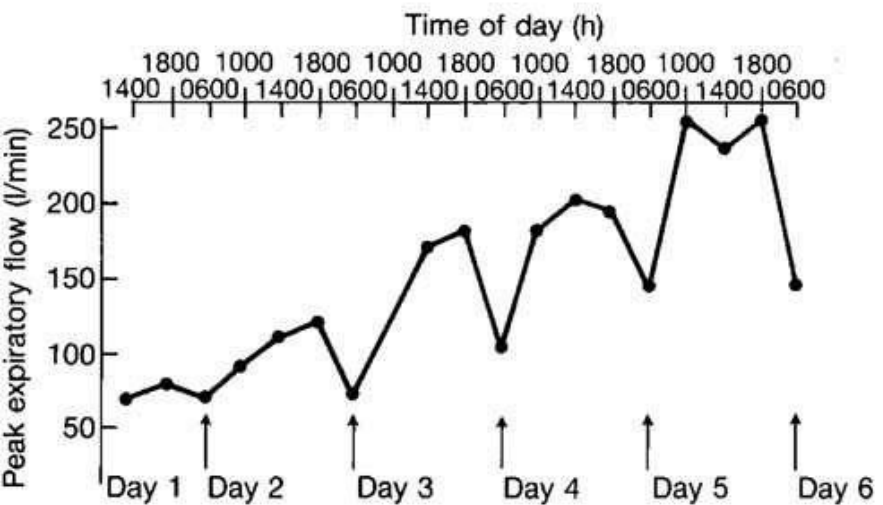
Monitor peak flow variability for 2 to 4 weeks in children and young people (**aged 5 to 16**) if there is diagnostic uncertainty after initial assessment and a FeNO test and they have either:

- Normal spirometry **or**
- Obstructive spirometry, irreversible airways obstruction (negative BDR) and a FeNO level of 35 ppb or more.

**Regard a value of more than 20% variability as a positive test.**



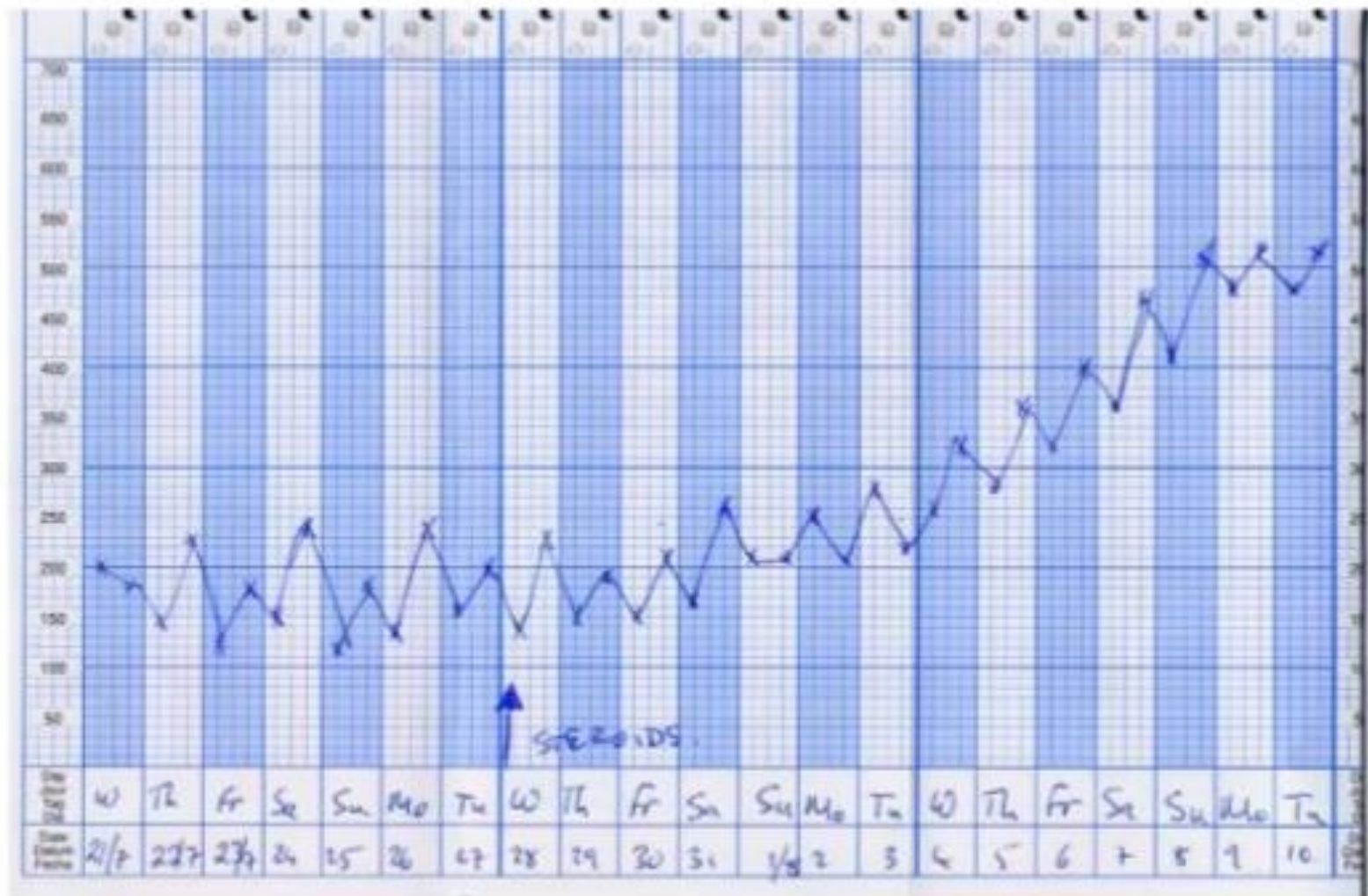
Classical diurnal variation of asthma  
Arrows point to morning 'dips'



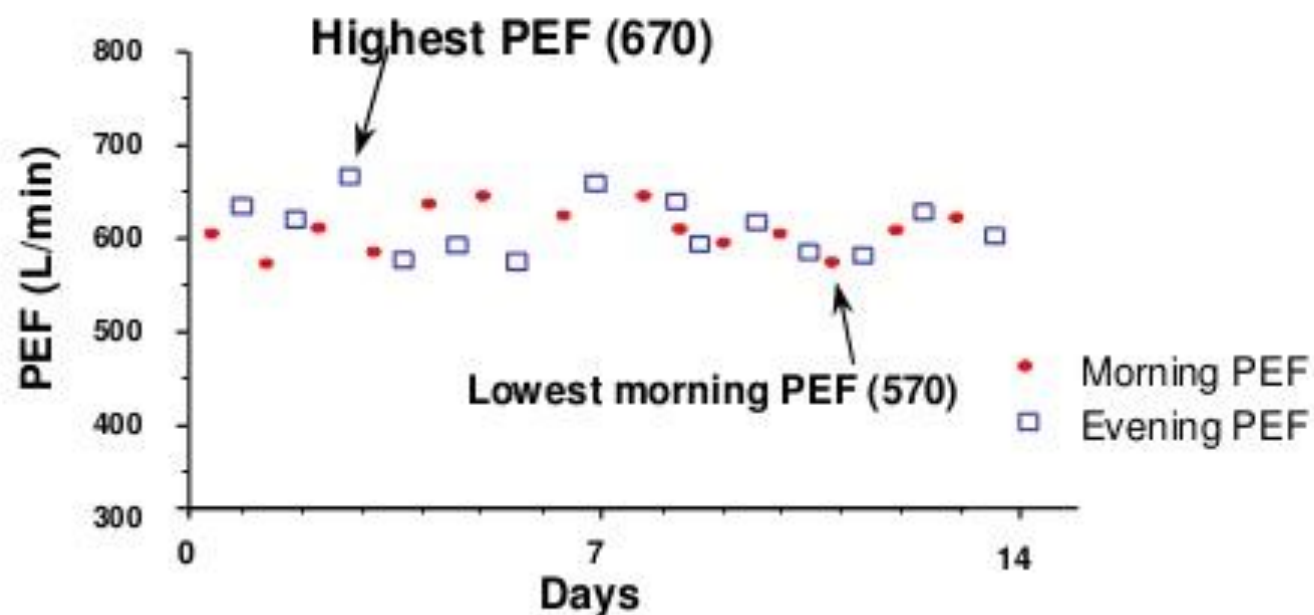
Recovery from severe attack of asthma  
Predicted PEFR was 320 l/min  
Arrows point to early morning 'dips'



# Peak flow variability



# Daily Variability of PEF



Minimum morning PEF ( % recent best):  $570/670 = 85\%$   
(From Reddel, H.K. et al. 1995)

# Airway Inflammation Test (FeNO)



- RACCENO
- BGDH

- Fractional exhaled Nitric Oxide
- Positive test thresholds :  
FeNO: 35 ppb or more



# Order of Objective Asthma Tests



1

## **In children with symptoms of asthma:**

- (1) Spirometry+(2) BDR test if spirometry shows an obstruction

## **If a child is unable to perform objective tests:**

- (1) Treat based on observation and clinical judgement and
- (2) Try doing the tests again every 6 to 12 months

2

**If still diagnostic uncertainty after spirometry + BDR:  
FeNO**

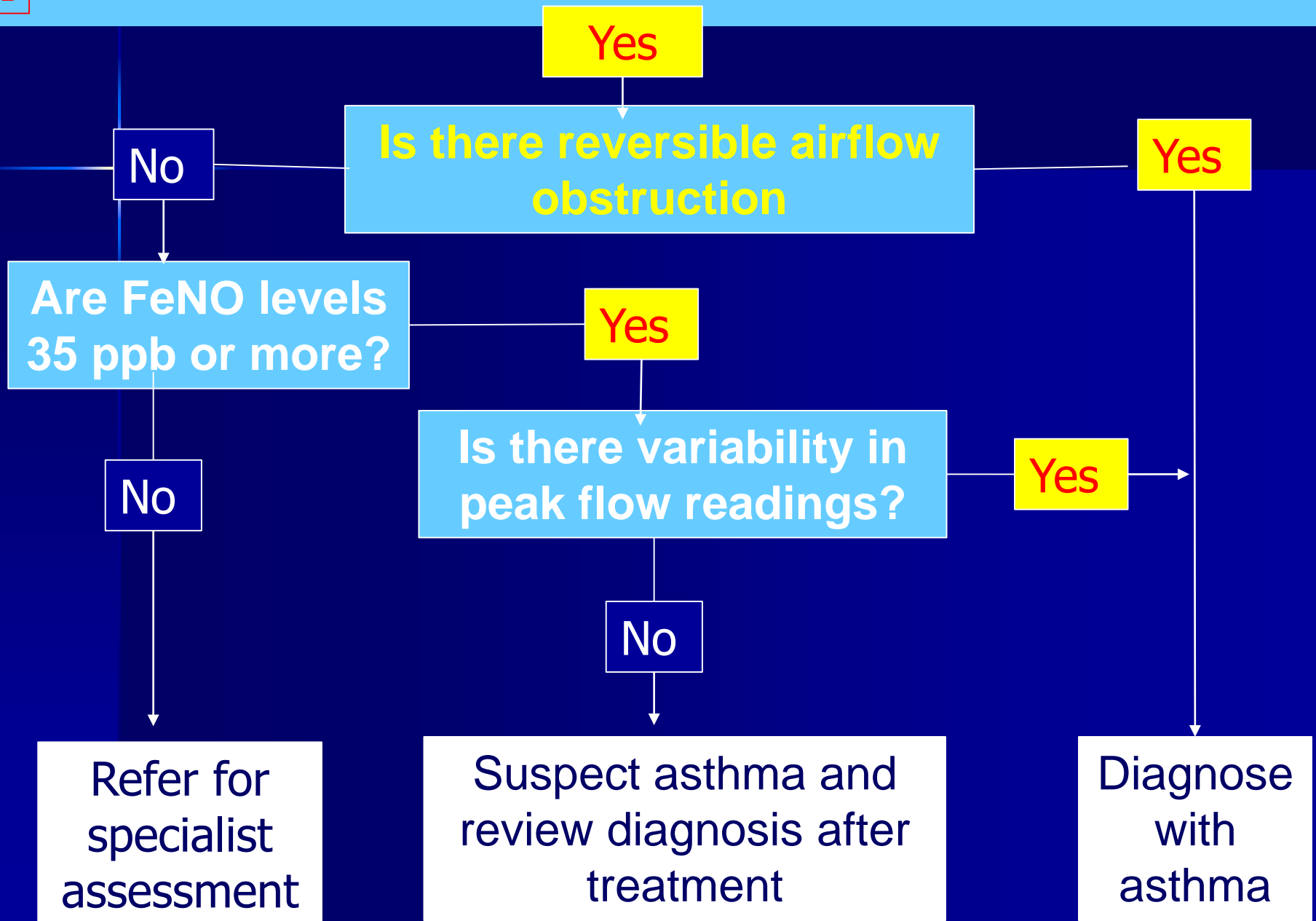
3

**If diagnostic uncertainty remains after FeNO,  
monitor peak flow variability for 2 to 4 weeks**

# Objective tests >5 Years old

If young person or child (>5Years)  
with symptoms suggestive of asthma  
cannot perform a particular test,  
try to perform at least 2 other objective  
tests.

# Does spirometry show an obstruction?





# Does spirometry show an obstruction?

NO

Are FeNO levels 35 ppb or more?

No

Yes

Is there variability in peak flow readings?

Is there variability in peak flow readings?

No

Yes

No

Yes

Consider alternative diagnoses and referral for specialist assessment

Suspect asthma and review diagnosis after treatment

Diagnose with asthma

# Diagnosis in children and young people aged 5 to 16 (1)

## Diagnose Asthma

Symptoms suggestive of asthma and:

Obstructive spirometry and Positive Bronchodilator Reversibility.

**OR**

FeNO level of 35 ppb or more **and** positive peak flow variability

## Suspect Asthma

Symptoms suggestive of asthma and:

a FeNO level of 35 ppb or more with normal spirometry and negative peak flow variability, **OR**

a FeNO level of 35 ppb or more with obstructive spirometry but negative bronchodilator reversibility and no variability in peak flow readings, **OR**

Normal spirometry, a FeNO level of 34 ppb or less and positive peak flow variability.

# Diagnosis in people who are unable to perform an objective test, <5Yr.

**Do tests at 5 years of age if still on asthma treatment ,**

**If still unable then try testing again 6-12 months later**

**Diagnose suspected asthma based on symptoms and any positive objective test results.**

# Diagnosis in children and young people aged 5 to 16 (1)

**“Asthma is not a Clinical Diagnosis”**

**Diagnosis: Asthma**

# Diagnosing asthma in children <5yrs

“Asthma is a clinical diagnosis as objective tests are not readily available”

**BUT**

if patients are still on asthma treatment, asthma should be confirmed by objective tests at 5 years of age

**Diagnosis: Suspected Asthma**

# Diagnostic Hubs (CCG)

Those responsible for planning diagnostic service support to primary care (for example, CCG) should consider establishing asthma diagnostic hubs to achieve economies of scale and improve the practicality of implementing the recommendations in this guideline.

# Good clinical practice in asthma diagnosis

**Record the basis  
for a diagnosis of asthma in a  
single entry in the person's  
medical records, alongside the  
coded diagnostic entry.**

# Nationally recommended Asthma guidelines/quality standards

- 1) BTS/SIGN: British guideline on the management of asthma, 2016, review 2019 ✓
- 2) NICE Quality standards 2013 update 2018
- 3) NICE Guidelines: Chronic asthma 2017



# NICE quality standards

## 5 Quality statements [2013, updated 2018]

- 1) **Patients aged  $\geq 5$  years with suspected asthma have objective tests to support diagnosis.**
- 2) **Patients aged  $\geq 5$  years: discuss and agree a written Personalised Asthma action plan (PAAP)**
- 3) Asthma control is monitored at every asthma review.
- 4) **People who receive treatment in an emergency care setting for an asthma attack are followed up by their general practice within 2 working days of discharge.**
- 5) People with suspected severe asthma are referred to a specialist multidisciplinary severe asthma service.

# NICE Guidelines-Chronic Asthma

**NICE guideline [NG80] Published date:  
(November 2017)**

- This guideline includes recommendations on:
  - Initial clinical assessment
  - **Diagnosing asthma in young children**
  - **Objective tests for diagnosing asthma (including diagnostic algorithms)**
  - Pharmacological treatment
  - Adherence, self-management and decreasing treatment
  - Monitoring asthma control
- **It aims to improve the accuracy of diagnosis**, help people to control their asthma and reduce the risk of asthma attacks.

# Which term to use?

- **Asthma:** for asthma confirmed by objective tests
- **Suspected asthma:** for suspected asthma that is not confirmed by objective tests

# Diagnosis of asthma

**Relevant clinical presentation  
Consistent with asthma**

**>5 Years**

**To diagnose  
asthma,  
objective tests  
are required**

**<5 Years**

**A diagnosis of  
Suspected  
asthma is  
based on  
Clinical picture**



**Any Questions**  
**Dr Ezzedin Gouta, BDGH**