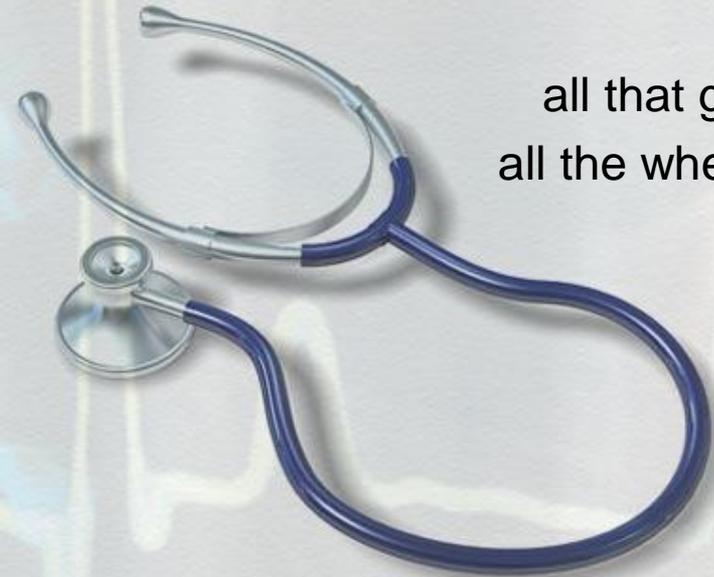


# Respiratory Problems in Children

A/Prof Alex Tang

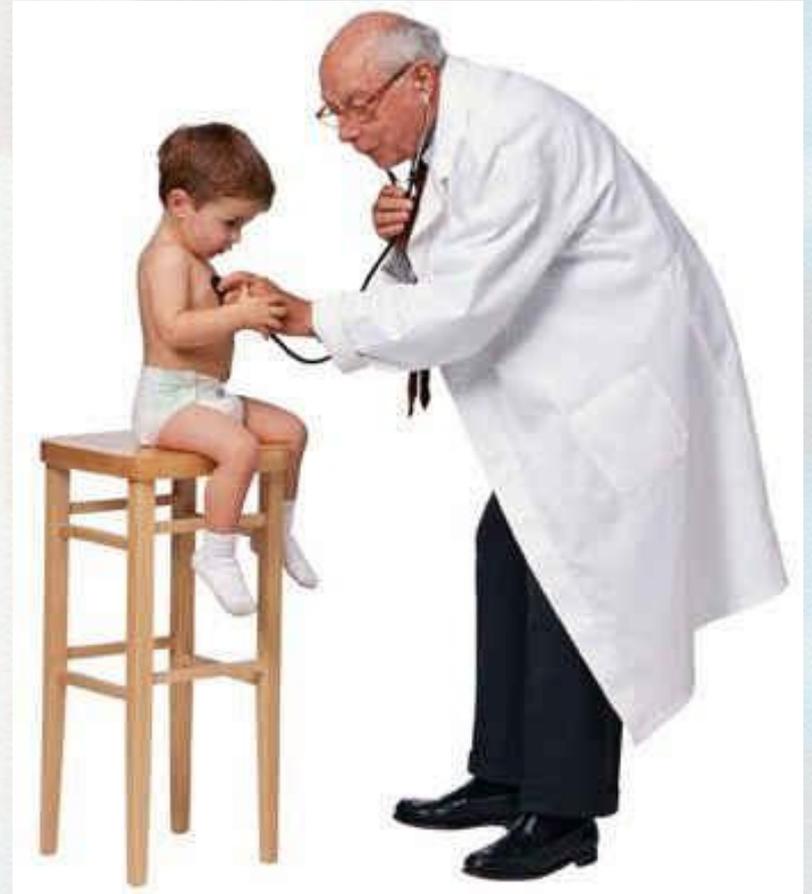
all that glitters is not gold,  
all the wheezes is not asthma



**MONASH**  
University

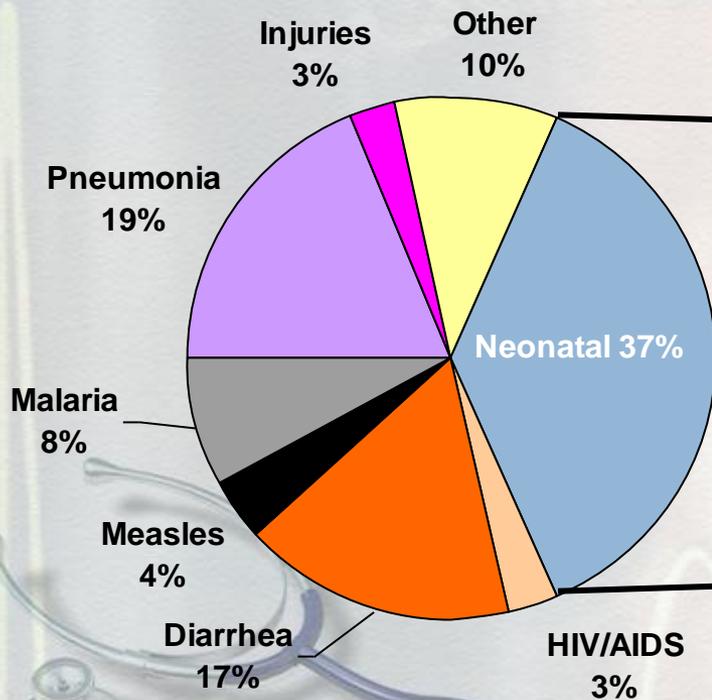
# Objective

- Describe an overview of respiratory problems in children
- Define common respiratory problems in childhood and their management

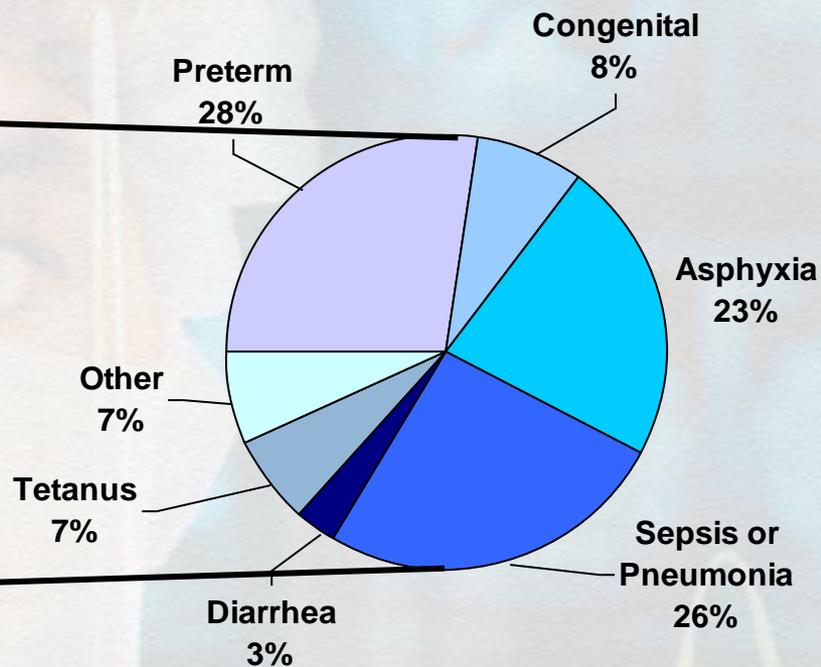


# Major Causes of Death in Children <5 Years of Age and in Neonates

Major Causes of Death in Children <5 Years of Age



Major Causes of Death in Neonates



# Respiratory system

## Observation

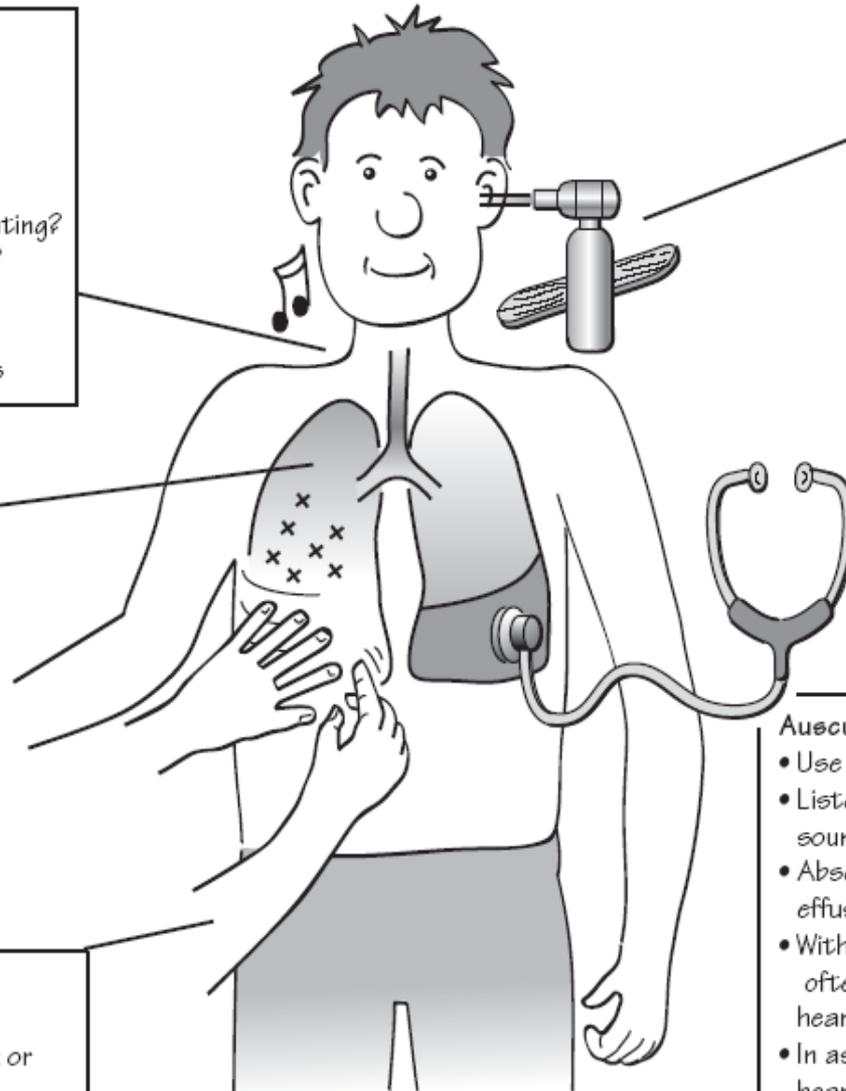
- Is there respiratory distress?
  - nasal flaring, recession
  - use of accessory muscles
- Count the respiratory rate
- Is there wheeze, stridor or grunting?
- Is the child restless or drowsy?
- Is there cyanosis or pallor?
- Is there finger clubbing?
  - cystic fibrosis, bronchiectasis

## Chest wall palpation

- Assess expansion
- Check trachea is central
- Feel apex beat
- Is there chest deformity?
  - Harrison's sulcus: asthma
  - barrel chest: air-trapping
  - pectus excavatum: normal
  - pigeon chest: congenital heart disease
- May 'feel' crackles

## Percussion

- Resonant: normal
- Hyper-resonant: pneumothorax or air-trapping
- Dull: consolidation (or normal liver in right lower zone)
- Stony dull: pleural effusions



## Ear, nose and throat

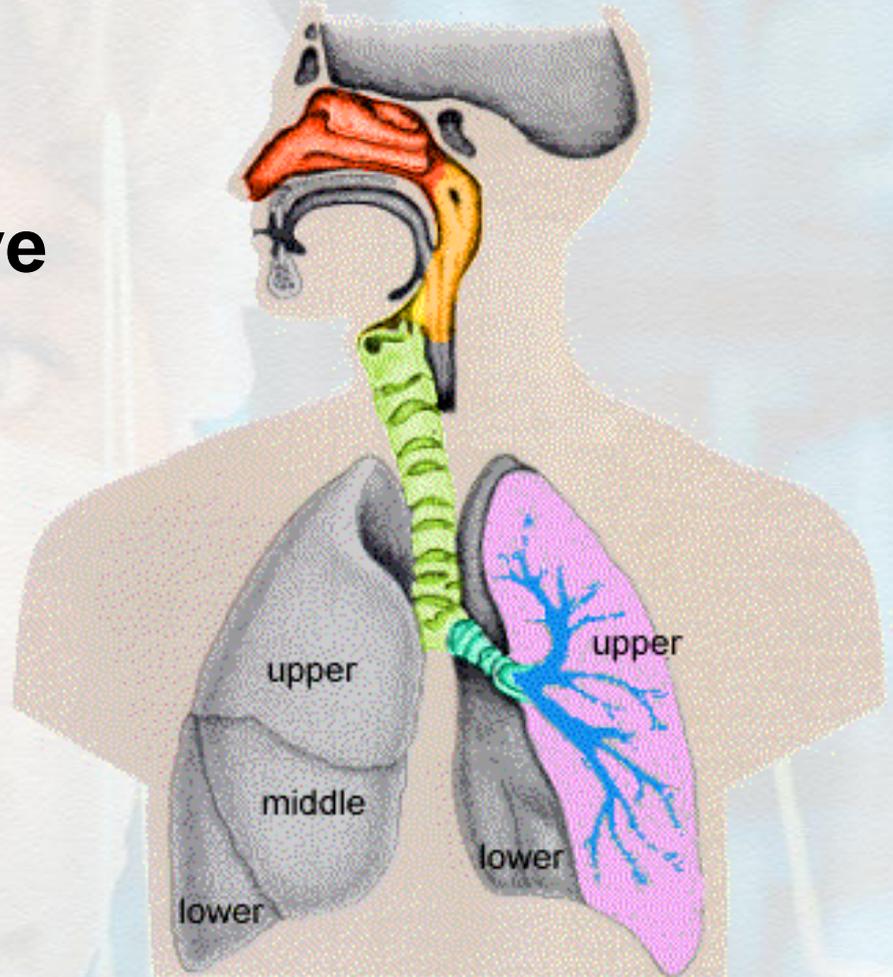
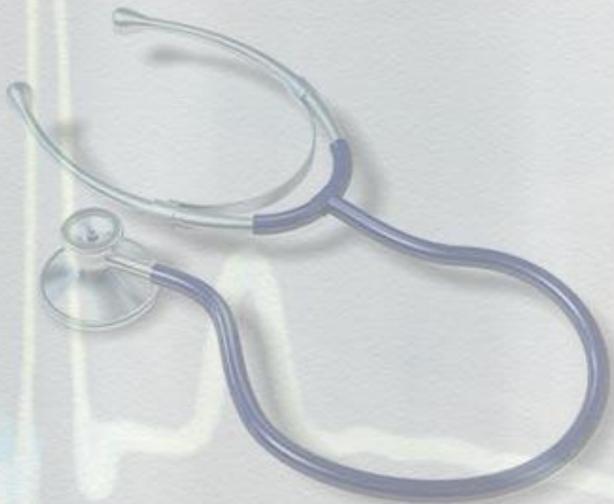
- Examine eardrums using an auroscope
  - grey and shiny: normal
  - red and bulging: suggests otitis media
  - dull and retracted: chronic secretory otitis media (glue-ear)
- Examine nostrils for inflammation, obstruction and polyps
- Examine pharynx using tongue depressor (leave this until last!)
  - Are the tonsils acutely inflamed (red +/- pustules or ulcers) or chronically hypertrophied (enlarged but not red)
- Feel for cervical lymphadenopathy

## Auscultation

- Use an appropriately sized stethoscope
- Listen in all areas for air entry, breath sounds and added sounds
- Absent breath sounds in one area suggests pleural effusion, pneumothorax or dense consolidation
- With consolidation (e.g. pneumonia) there is often bronchial breathing with crackles heard just above the consolidated lung
- In asthma and bronchiolitis expiratory wheeze is heard throughout the lung fields
- In young children upper airway sounds are often transmitted over the whole chest. Asking the child to cough may clear them

# Respiratory problems in Children

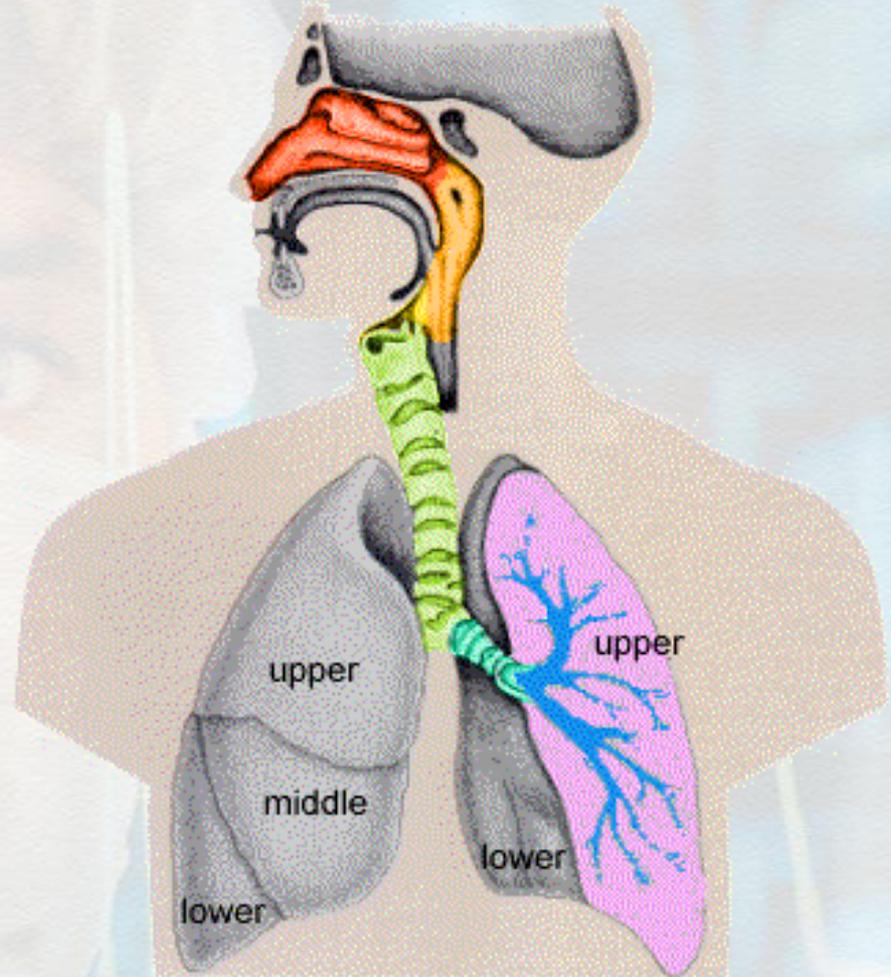
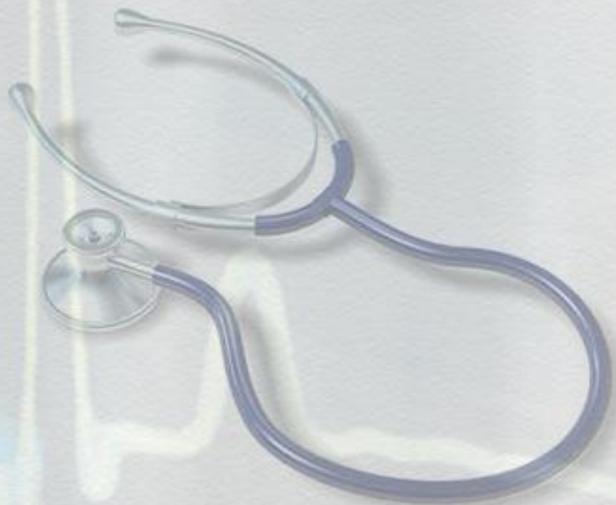
**What are the common infective agents?**

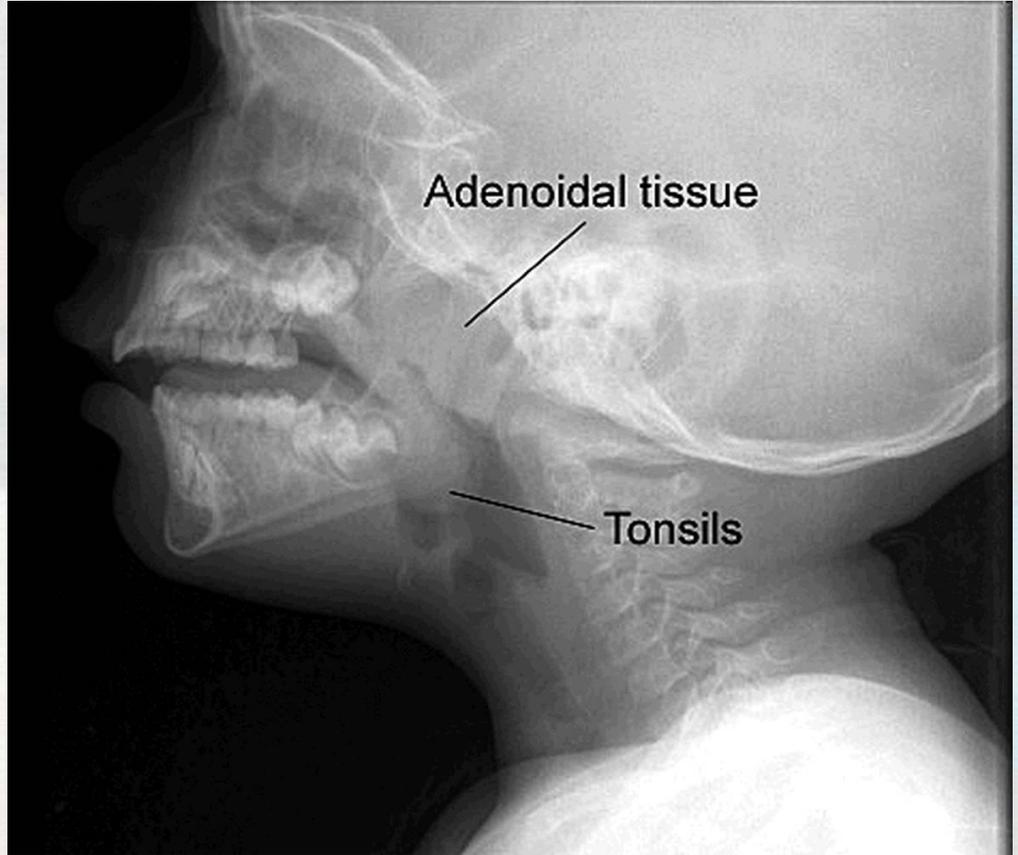


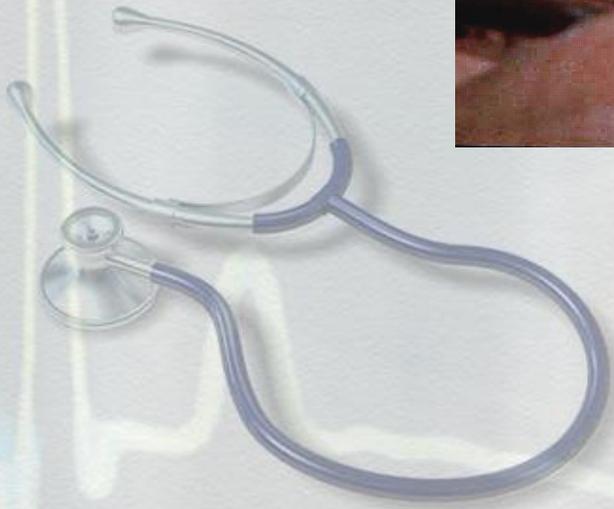
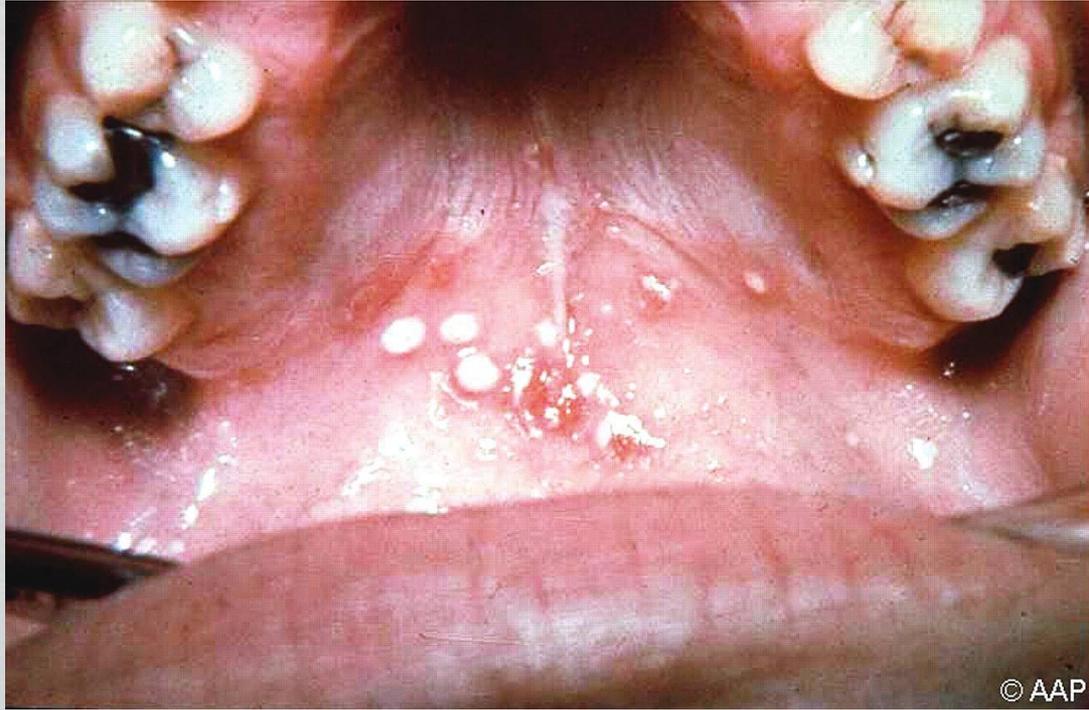
Age	Pathogens
Newborn	<i>Group B streptococcus, E.coli, Klebsiella species, Enterobacteticeae</i>
1–3 mo	<i>Chlamydia trachomatis, respiratory syncytial virus (RSV), other respiratory viruses, Bordetella pertussis</i>
2-5 yo	Respiratory viruses, <i>S. pneumoniae, Hib, NTHI, M. pneumoniae, Chlamydia pneumoniae</i>
6-18 yo	<i>M. pneumoniae, S. pneumoniae, C. pneumoniae,</i> NTHI, influenza A or B, adenovirus, other respiratory viruses

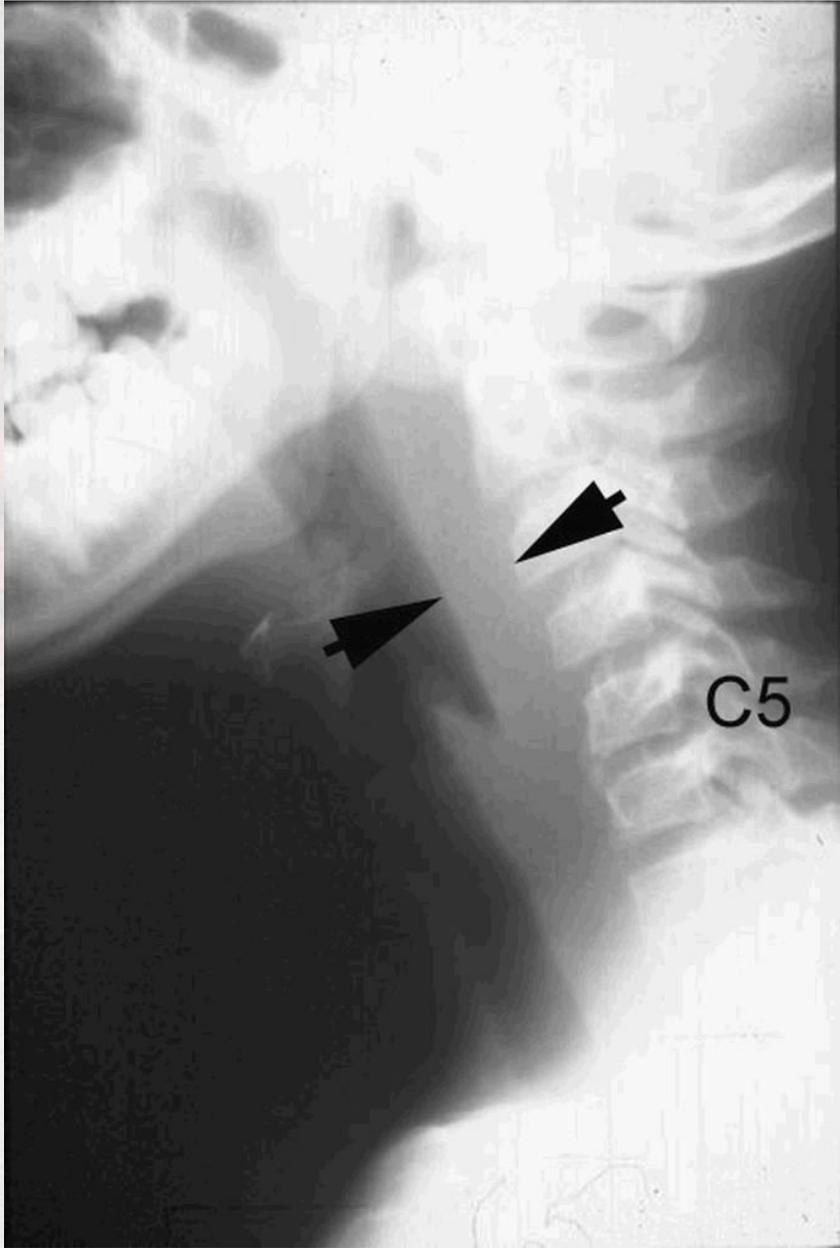
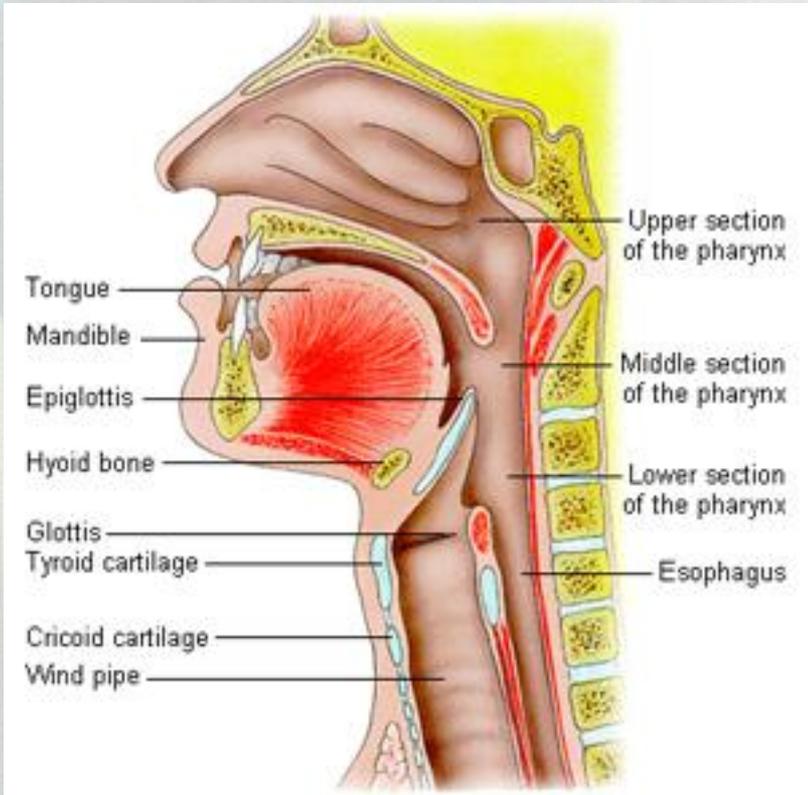
# Respiratory problems in Children

- Throat



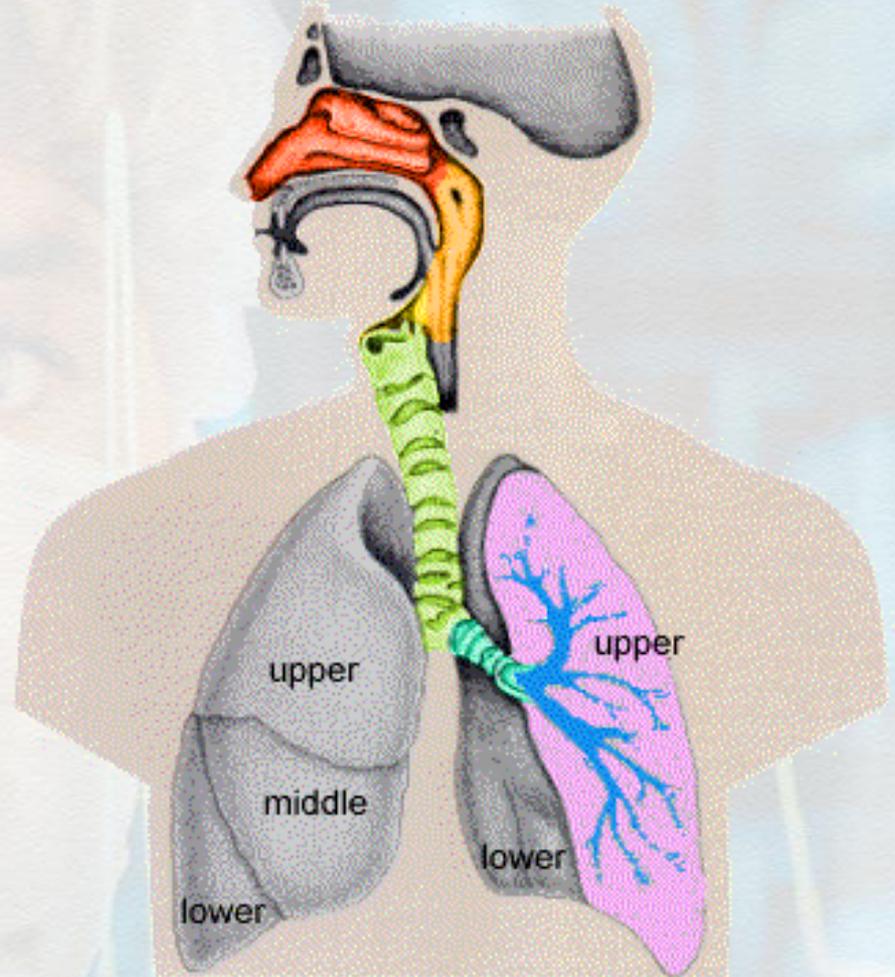






# Respiratory problems in Children

- Throat
- Nose



# Nasopharyngeal Colonization

- *S. pneumoniae* can be a normal inhabitant of the nasopharynx<sup>1</sup>
- Global nasopharyngeal (NP) colonization/carriage ranges:
  - ▶ 10% to 85% in children <5 years of age<sup>2,3</sup>
  - ▶ 4% to 45% in adults<sup>2-4</sup>

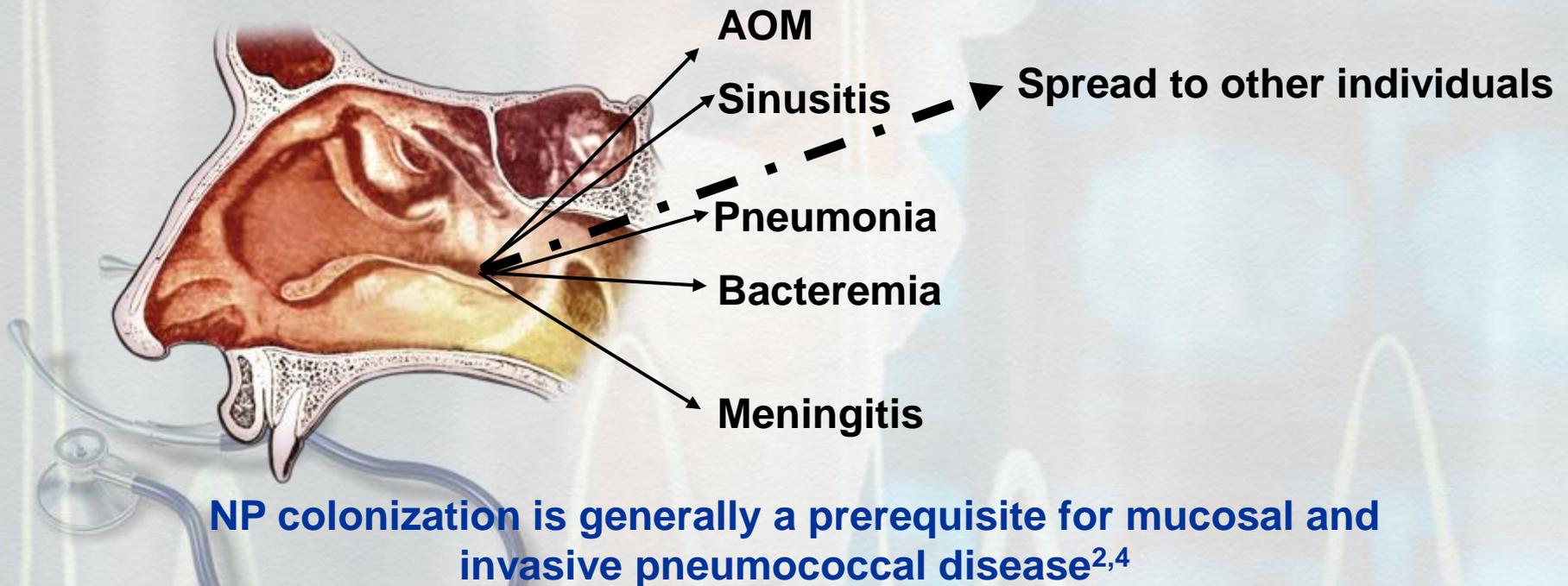


Image adapted from: <http://www.1911encyclopedia.org/images/f/f4/Olfactorysystem-2.jpg>.

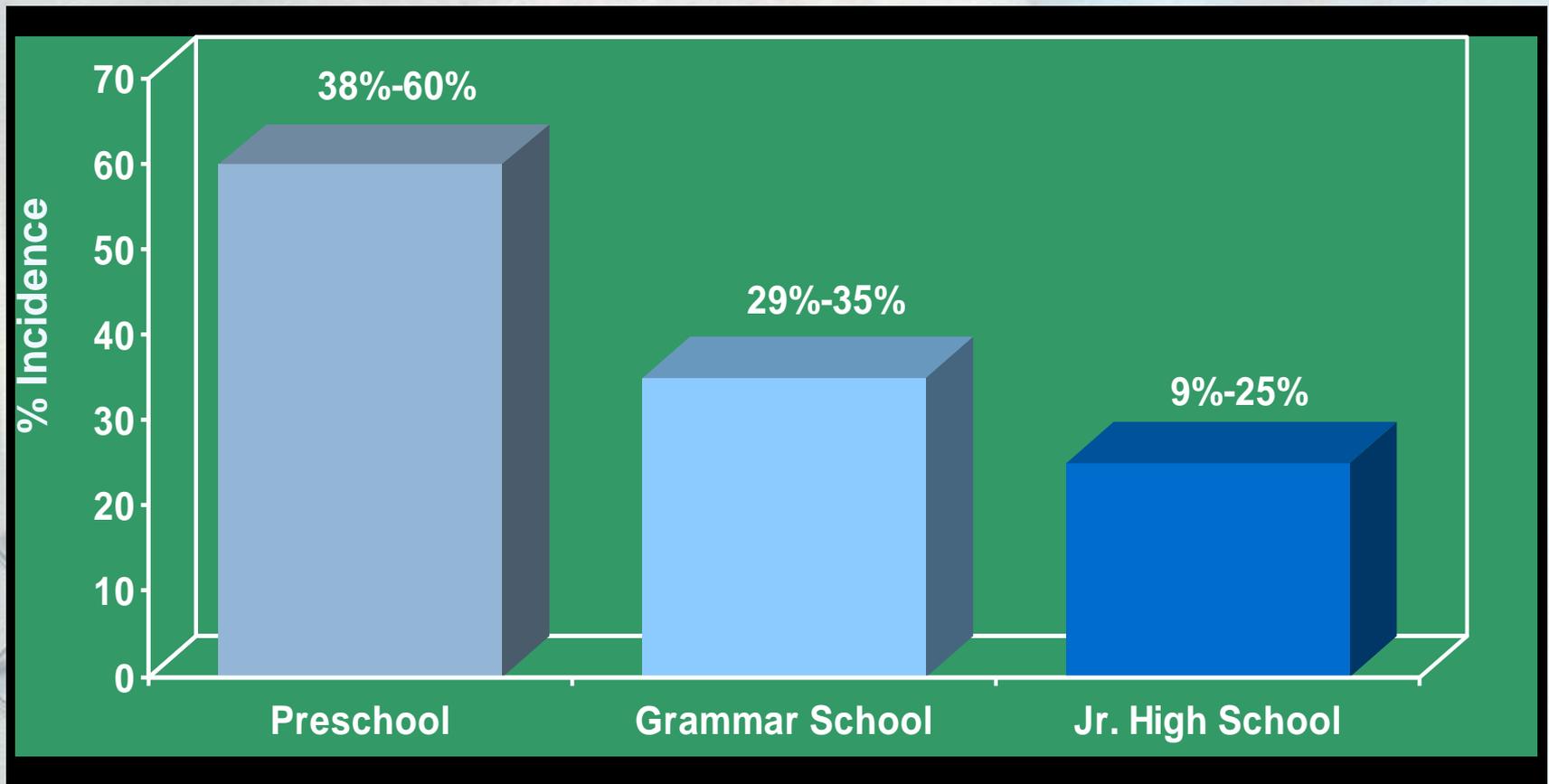
1. Hull MW, et al. *Infect Dis Clin North Am.* 2007;21:265-282.

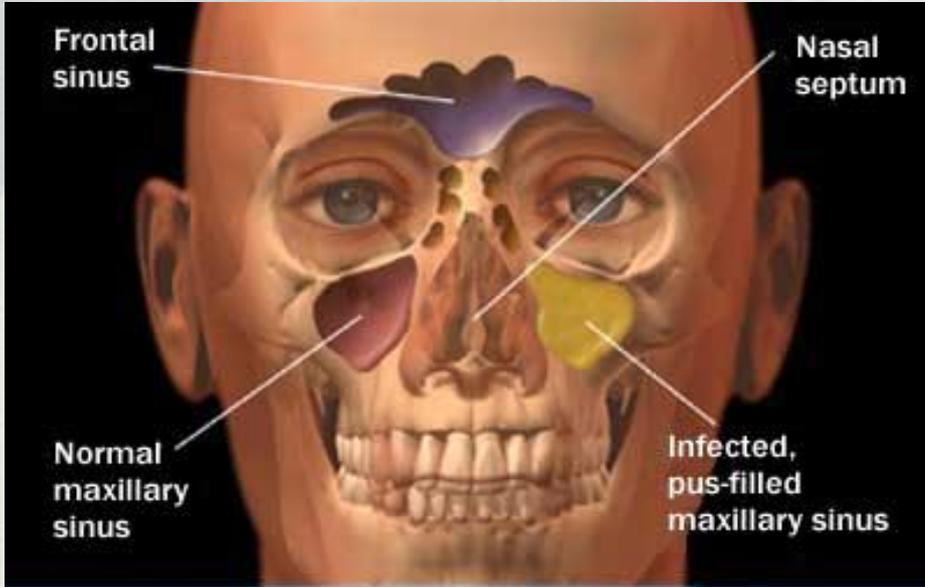
2. Cardozo DM, et al. *Braz J Infect Dis.* 2006;10:293-303.

3. Regev-Yochay G, et al. *Clin Infect Dis.* 2004;38:632-639.

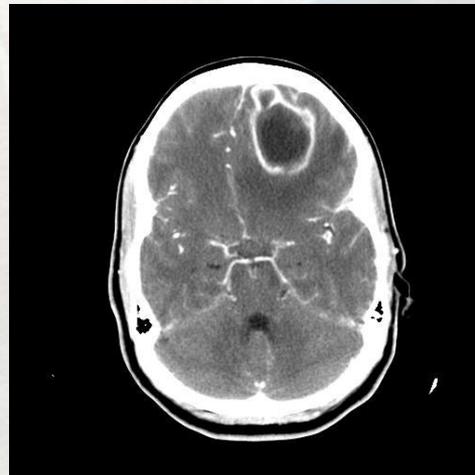
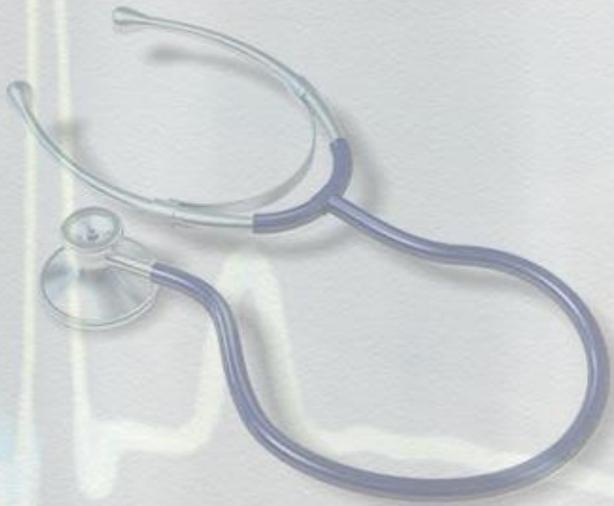
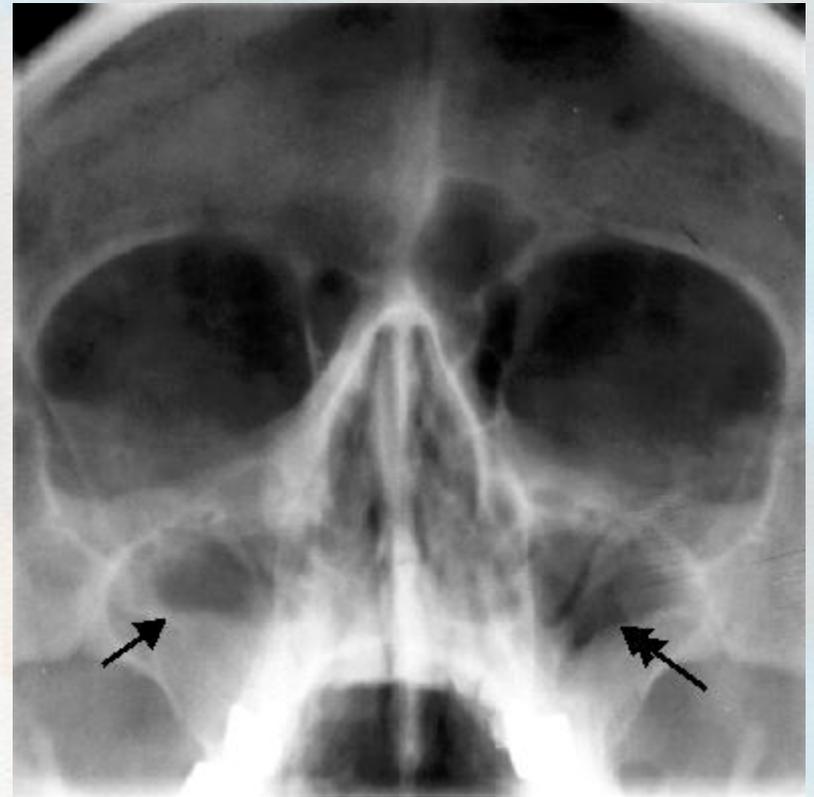
4. Chi DH, et al. *Am J Rhinol.* 2003;17:209-214.

# Nasopharyngeal Carriage rates in Children



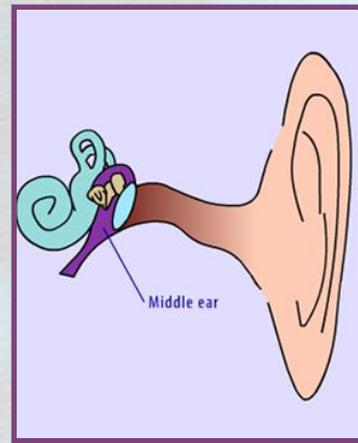


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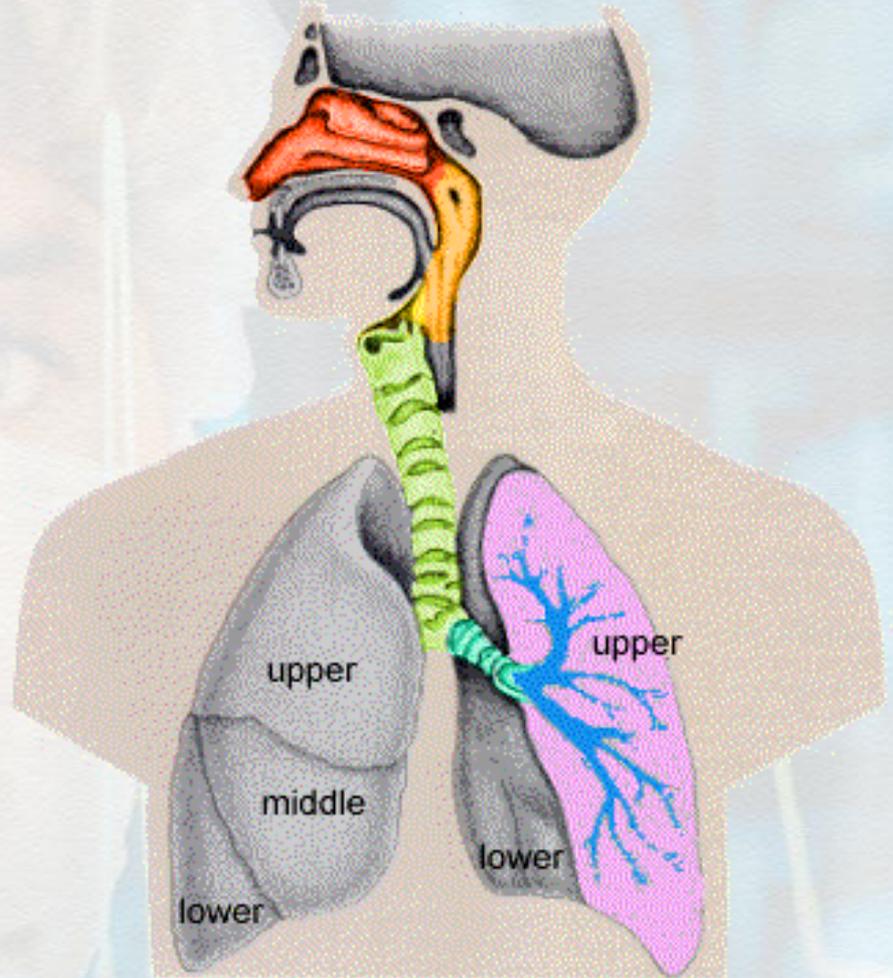
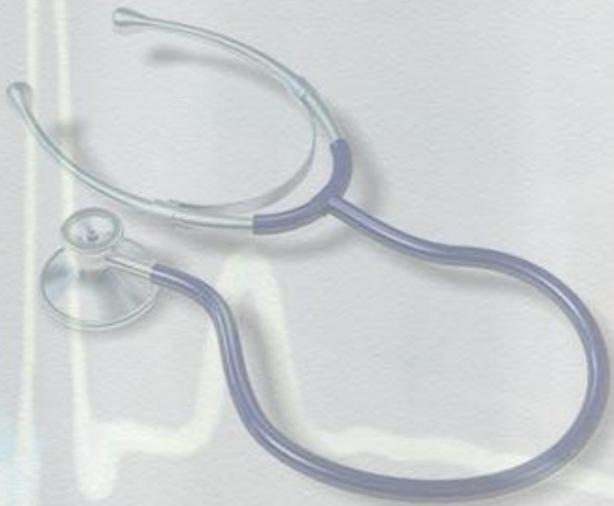
# Acute Otitis Media

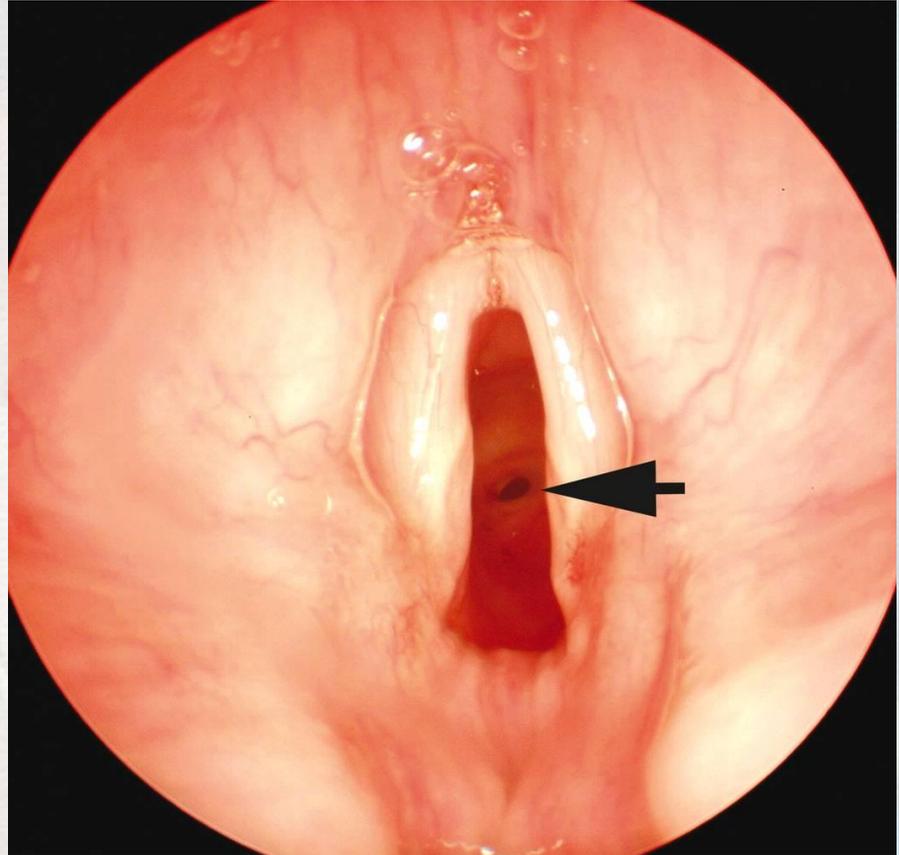
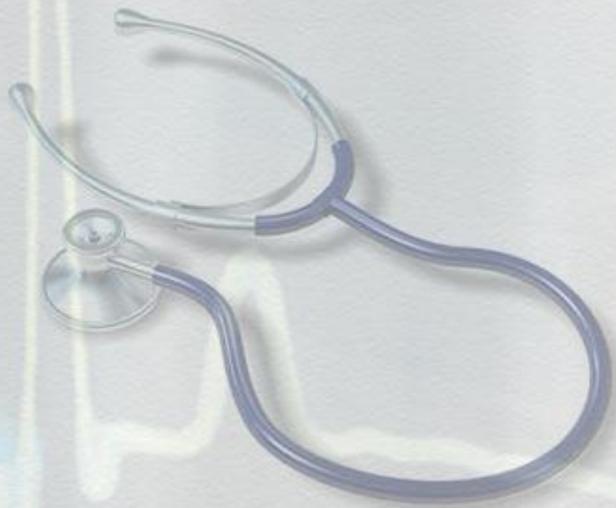
- Acute otitis media is an inflammation of the middle ear
  - It is one of the most common infectious diseases in children
- Symptoms of otitis media can include:
  - Ear pain
  - Discharge from the middle ear
  - Difficulty hearing
- Nonspecific symptoms include: fever, irritability, headache, apathy, lack of appetite, vomiting, and diarrhea

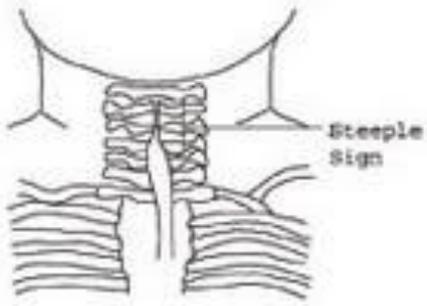


# Respiratory problems in Children

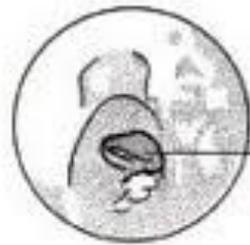
- Throat
- Nose
- Larynx







Steeple Sign



Subglottic narrowing

Masby items and derived items © 2004 by Masby, Inc.



## Chronic stridor

### Laryngomalacia

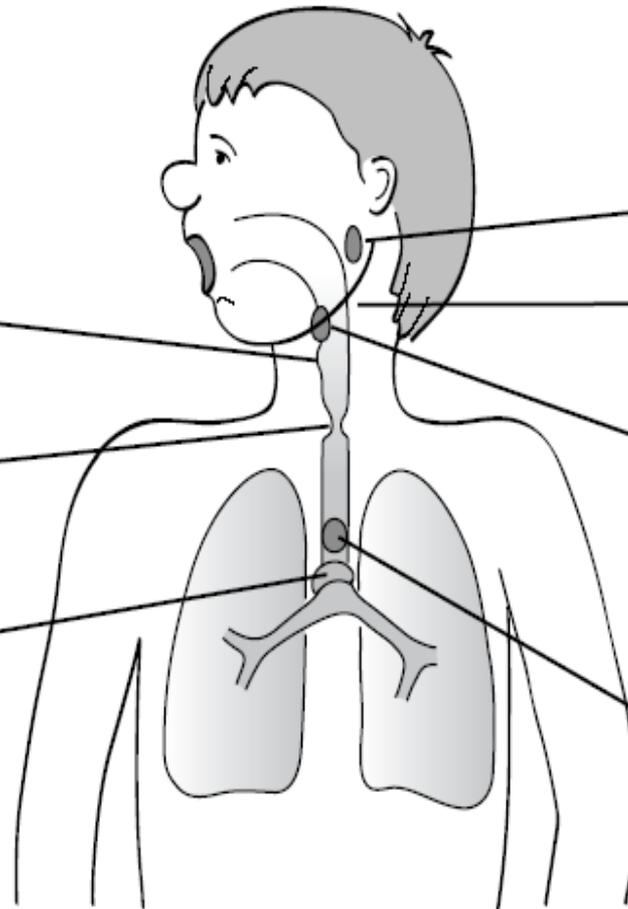
- Present from birth
- Worse on crying
- Improves with age
- Well, thriving child

### Subglottic stenosis

- Previous intubation
- Worse with URTI

### Vascular ring

- Congenital defect of great vessels
- Worsens over time
- Barium swallow may show indentation



## Acute stridor

### Croup

- Barking cough
- Coryzal illness

### Tonsillar abscess (quincy)

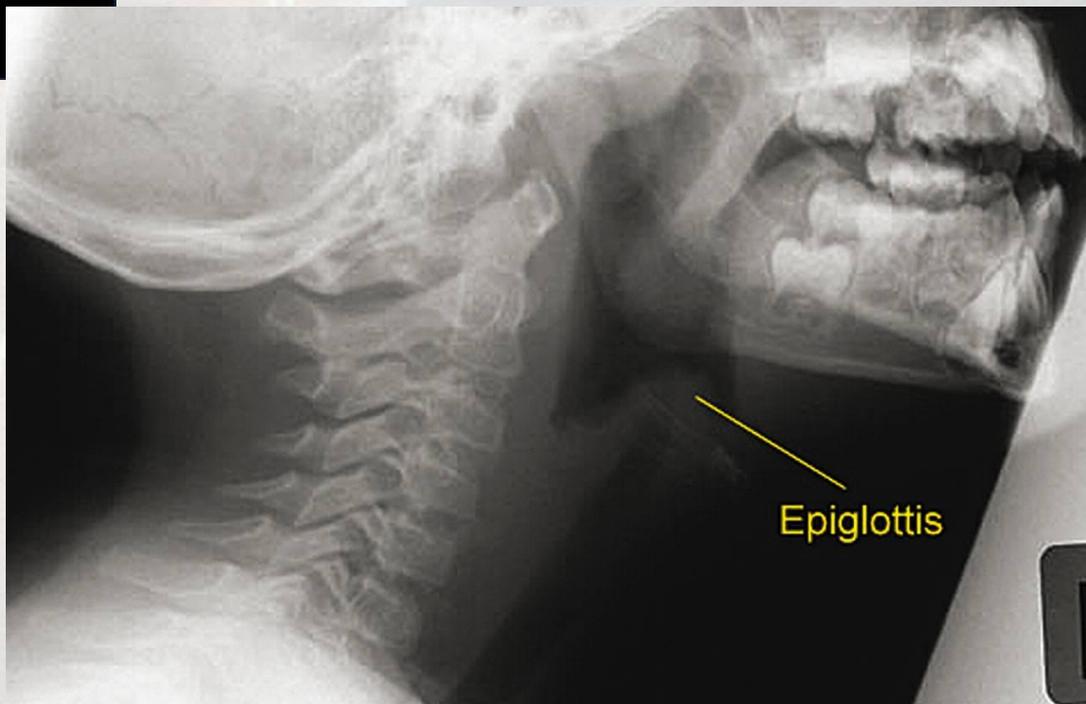
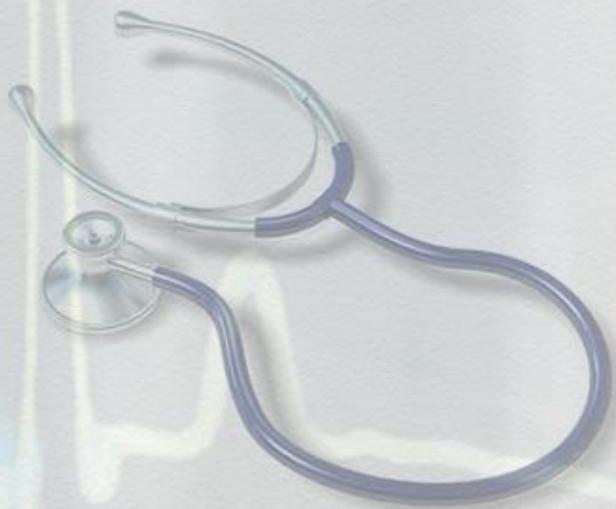
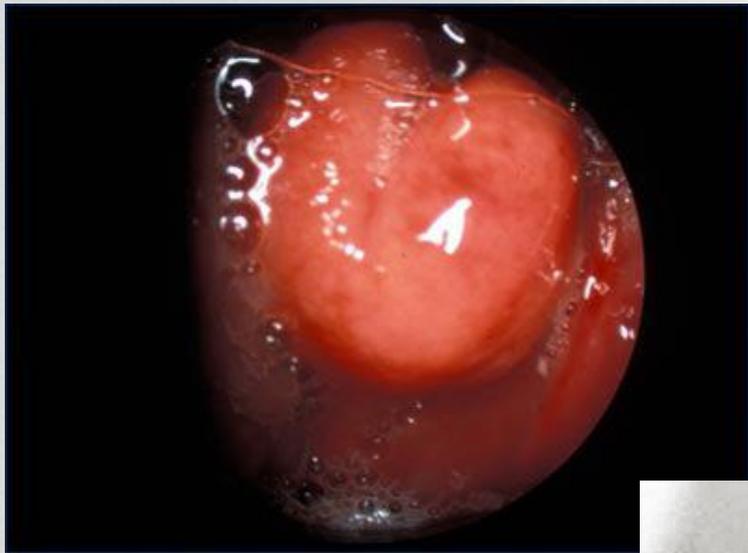
### Anaphylaxis

### Epiglottitis

- Sudden onset
- Septic
- Drooling
- Unable to speak
- No Hib vaccination

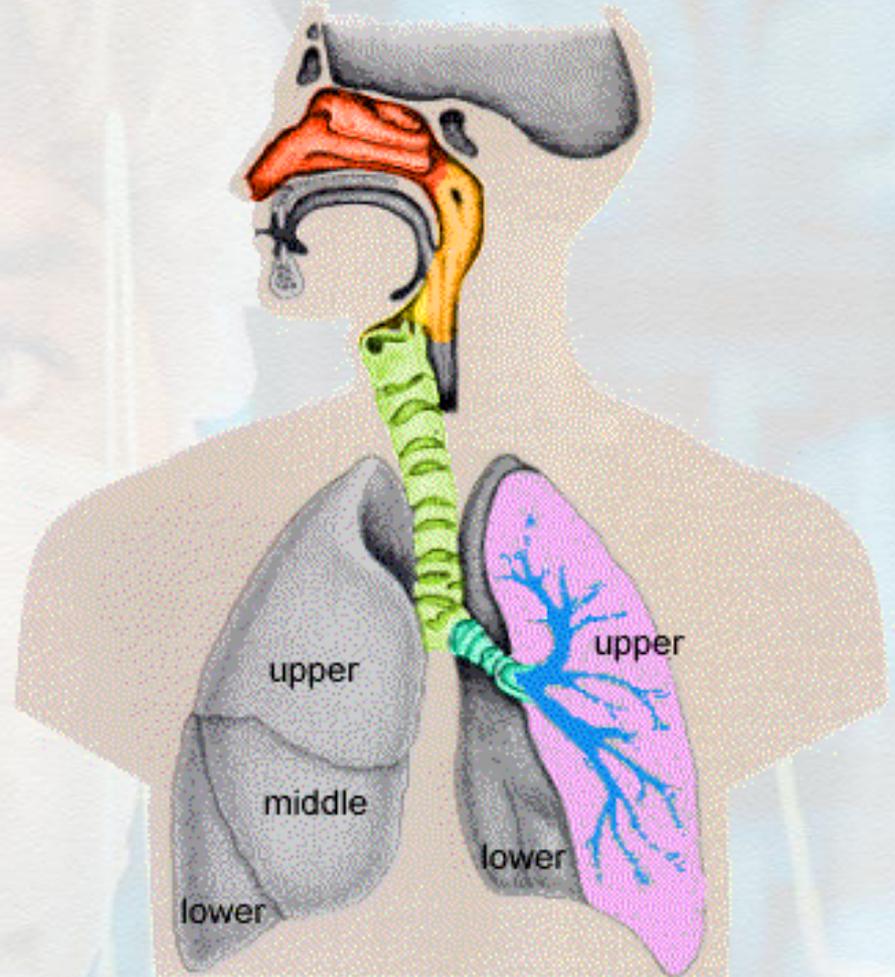
### Inhaled foreign body

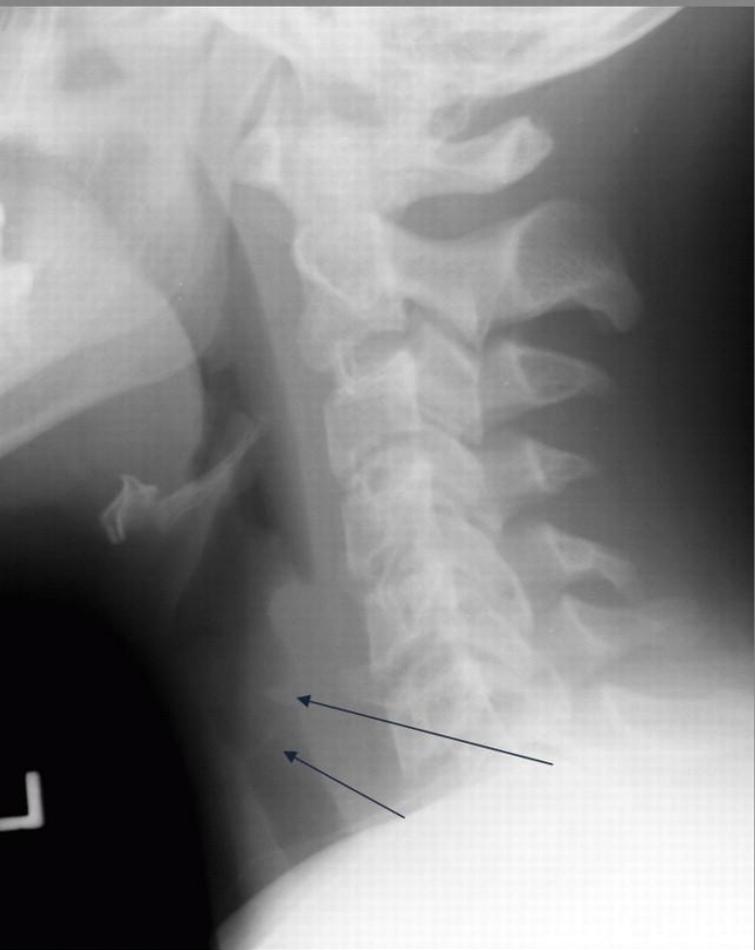
- Toddlers
- Sudden onset
- History of choking
- Unilateral signs
- Requires bronchoscopy



# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea

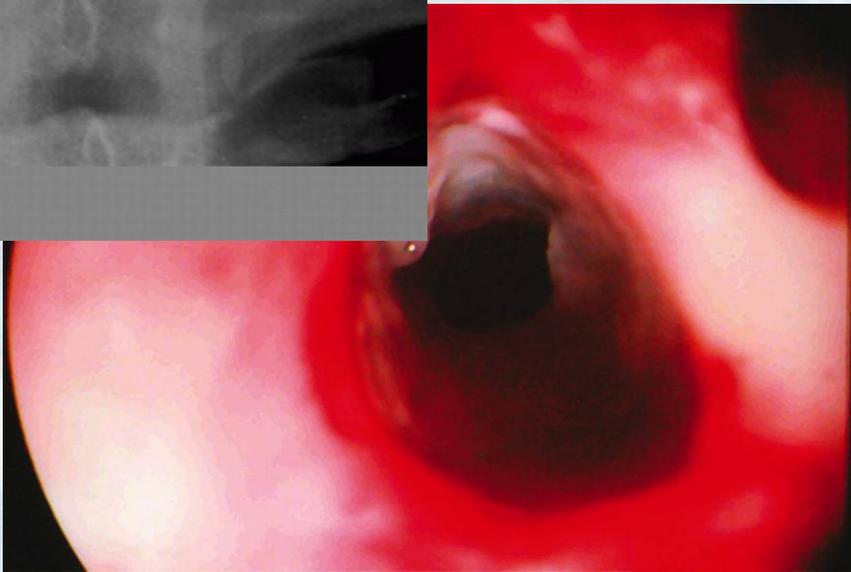


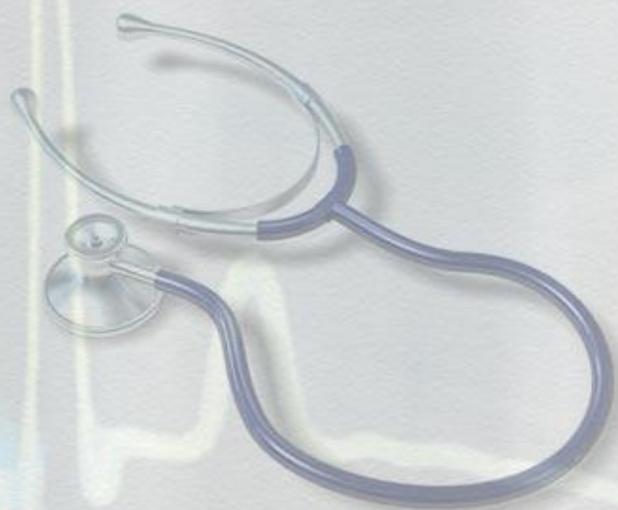
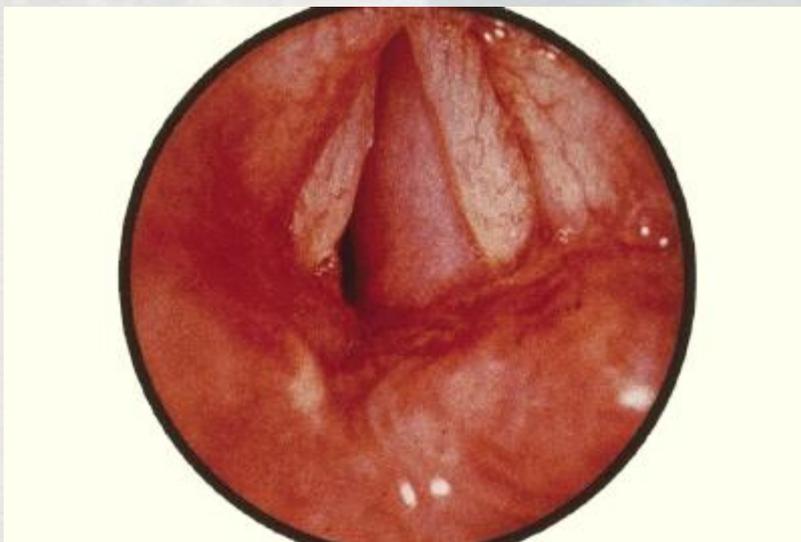


A



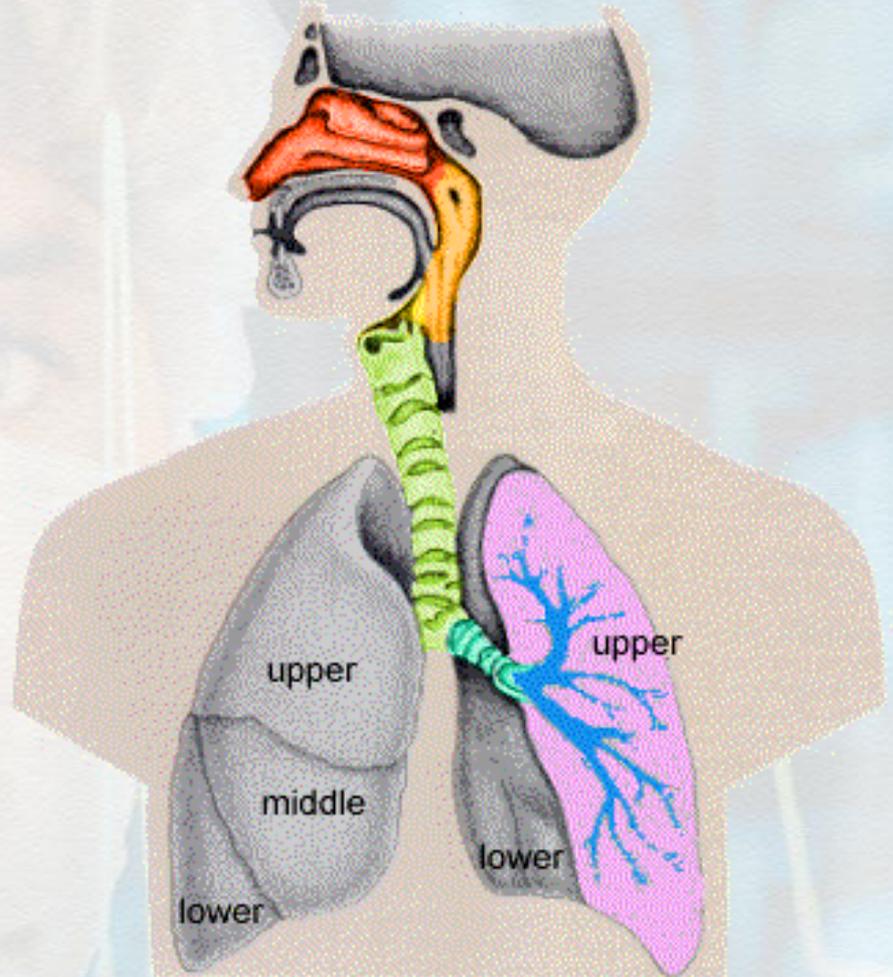
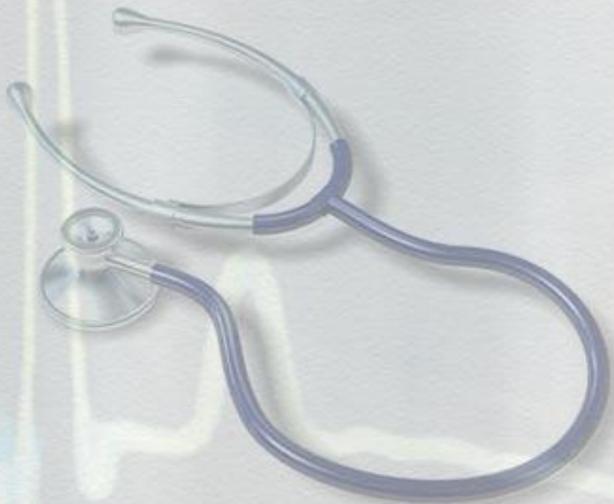
B





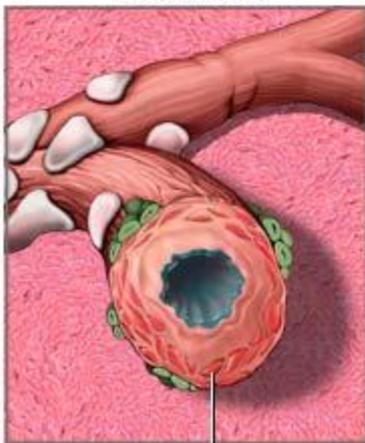
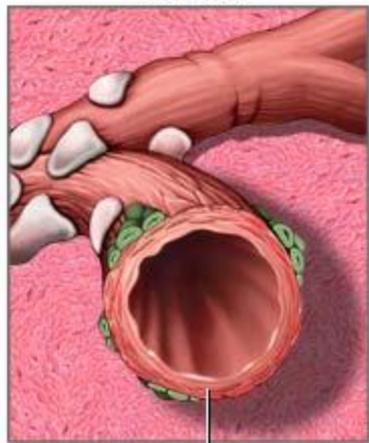
# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus

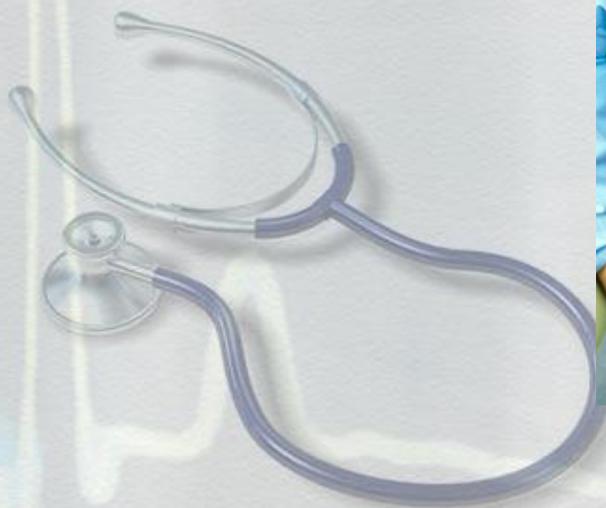
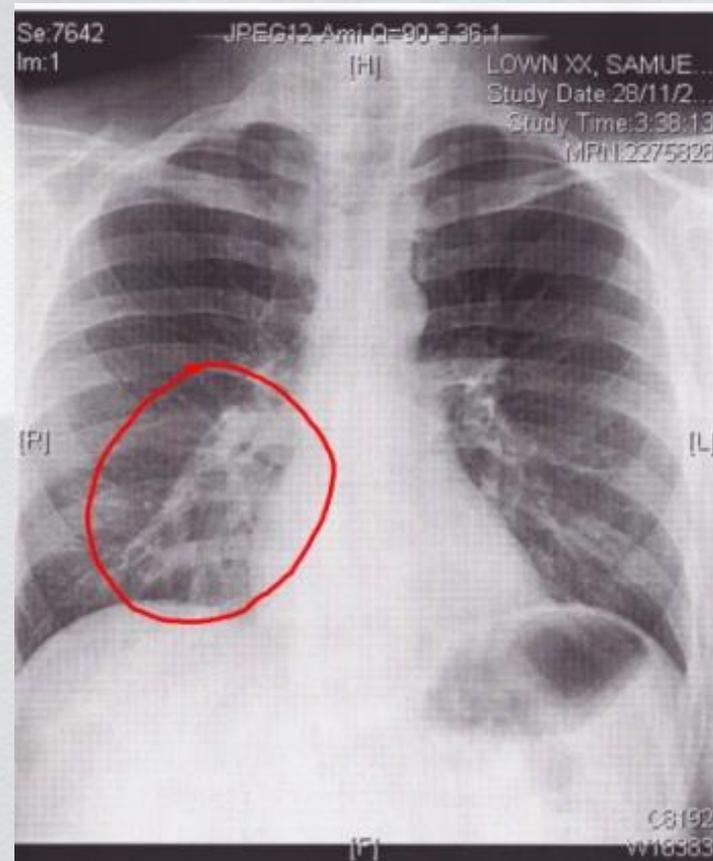


Normal

Bronchitis

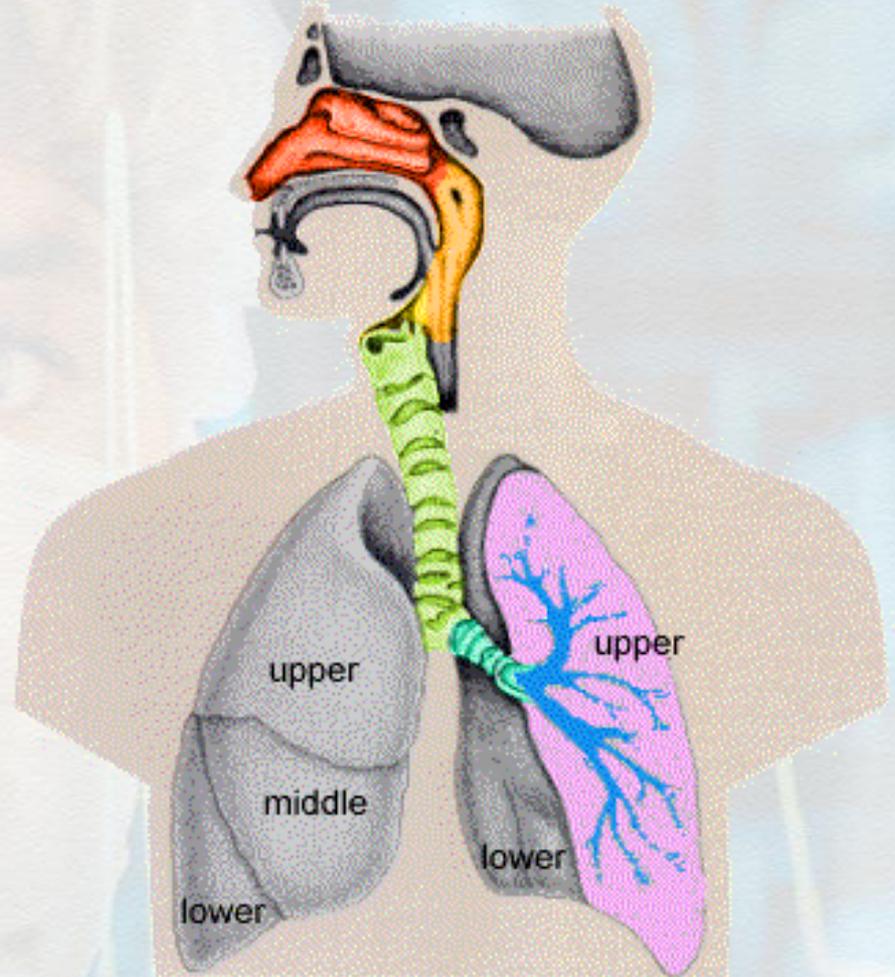
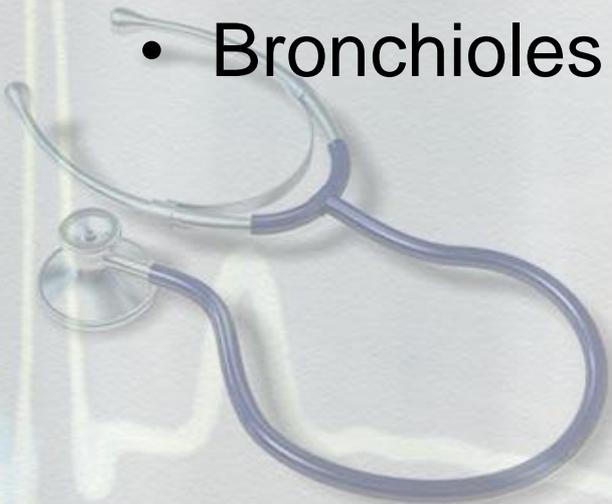


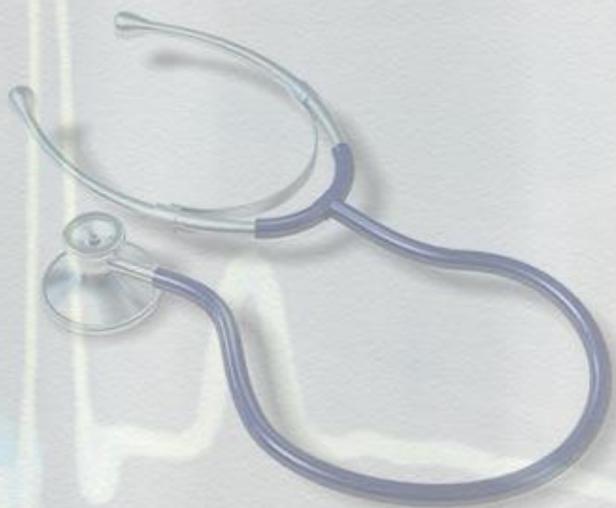
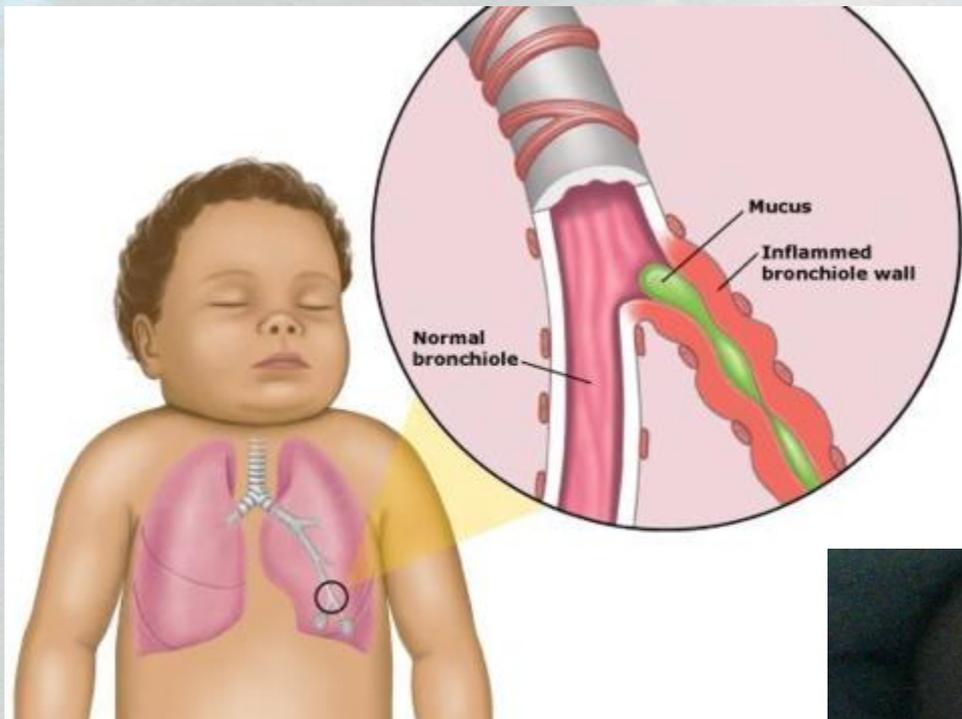
Tertiary bronchi

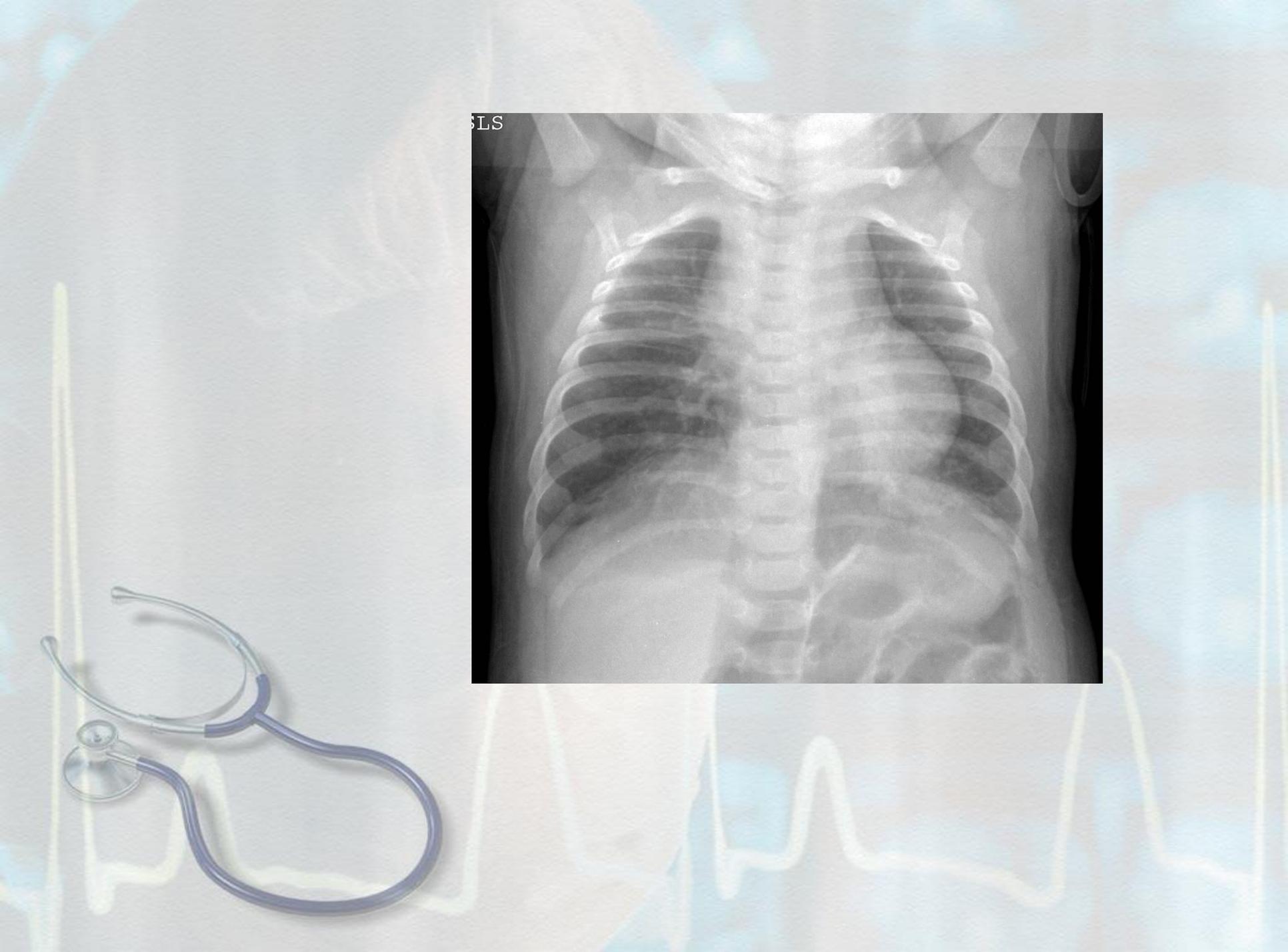
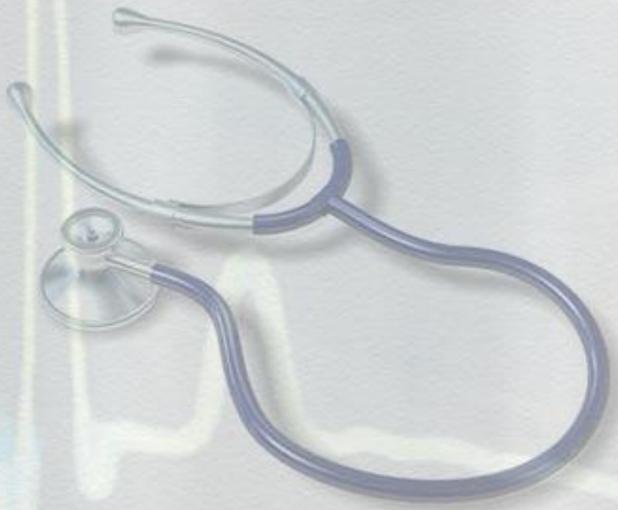
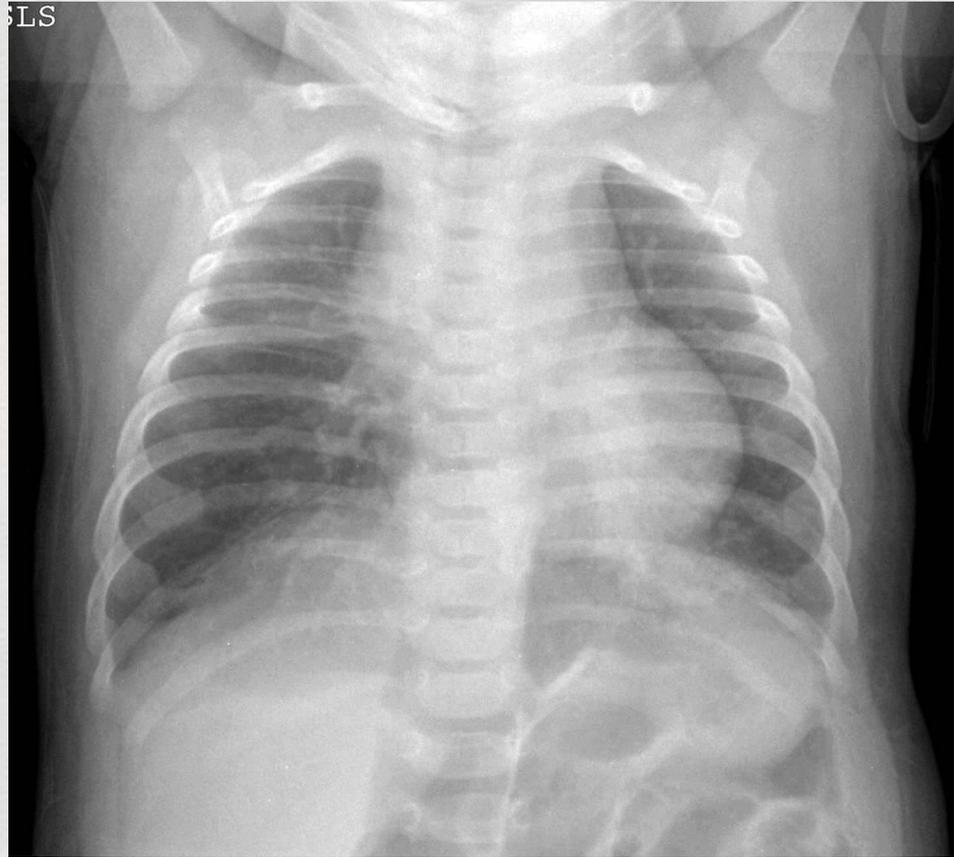


# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles

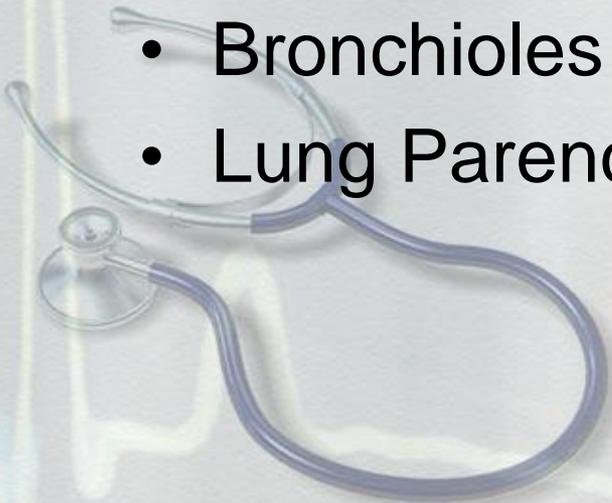
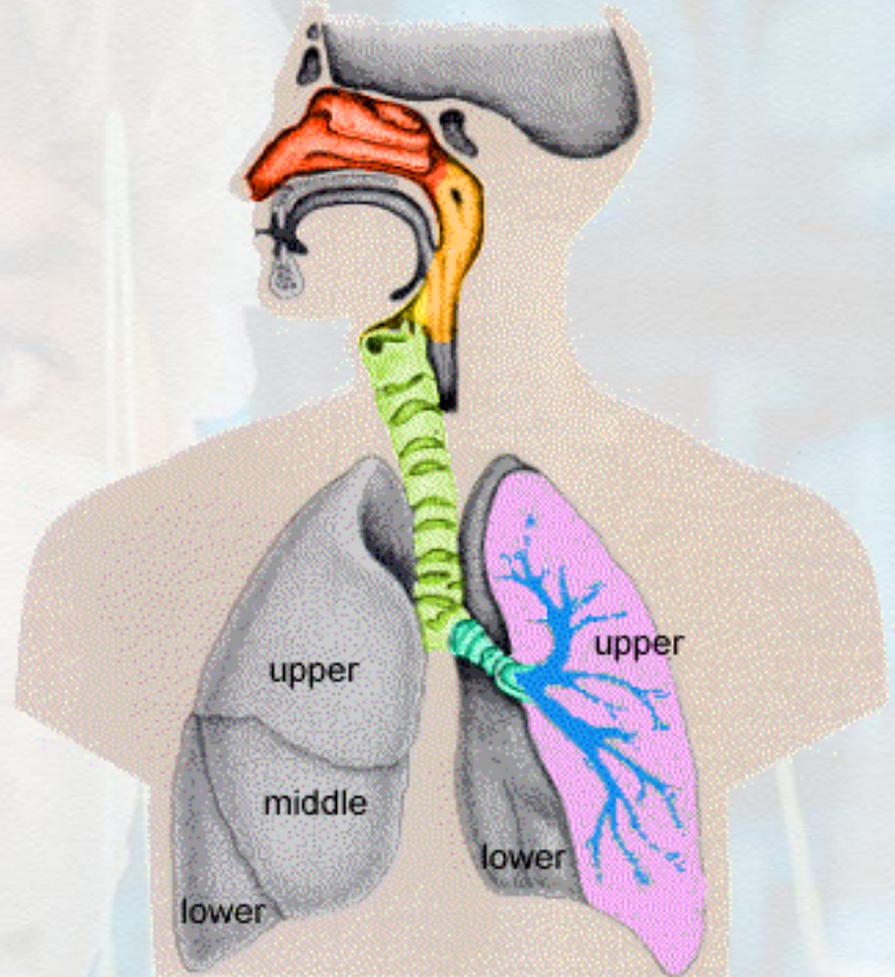


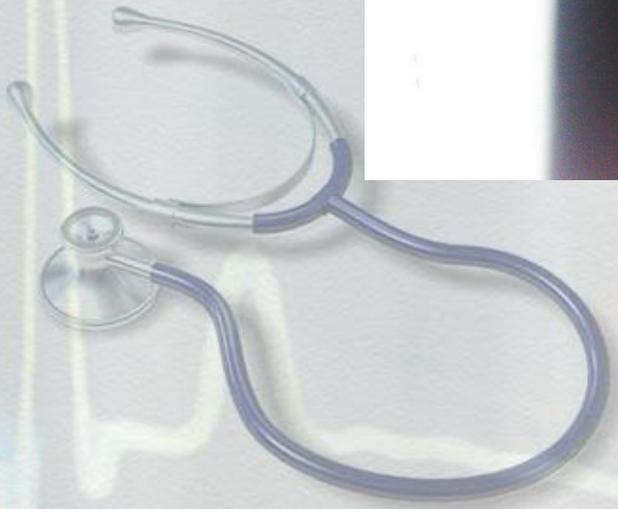
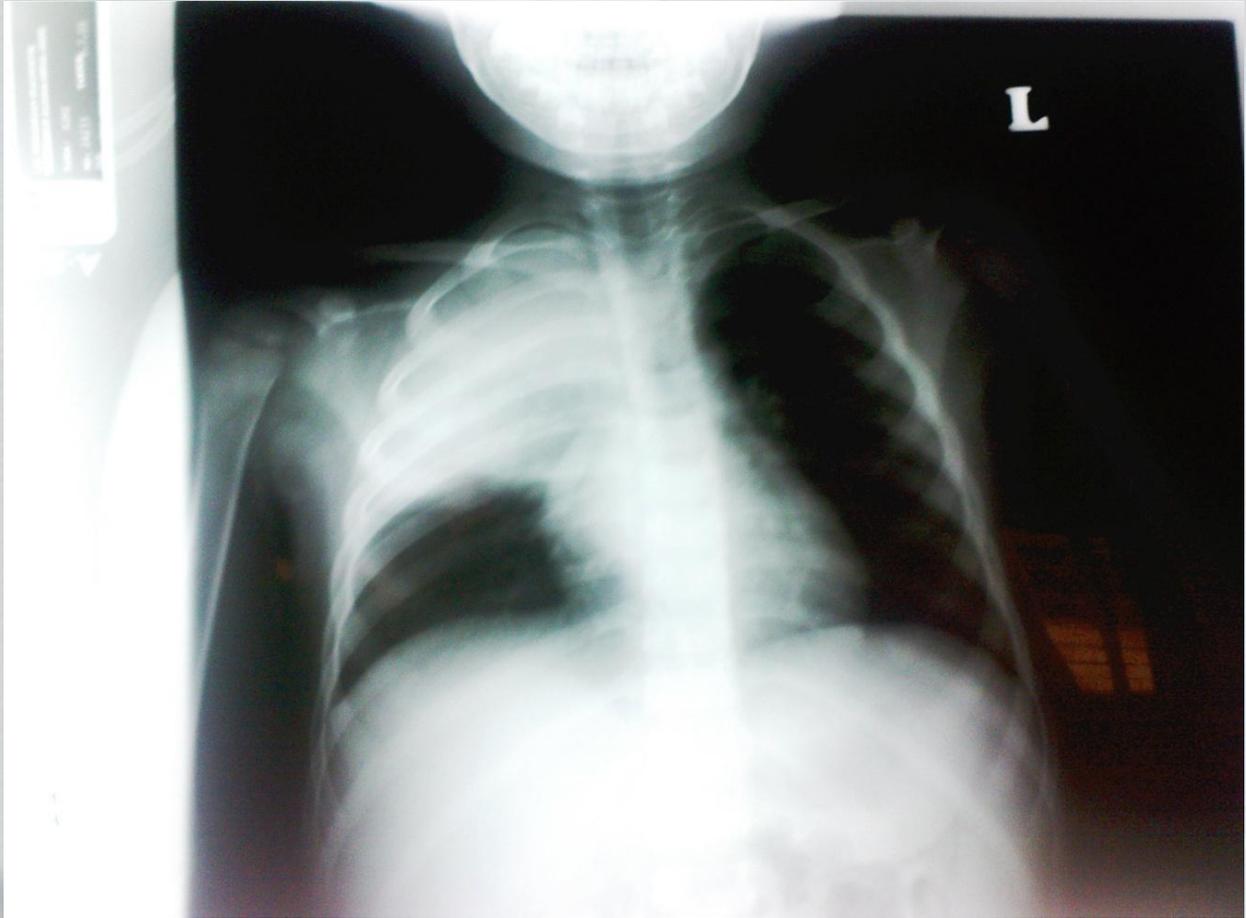


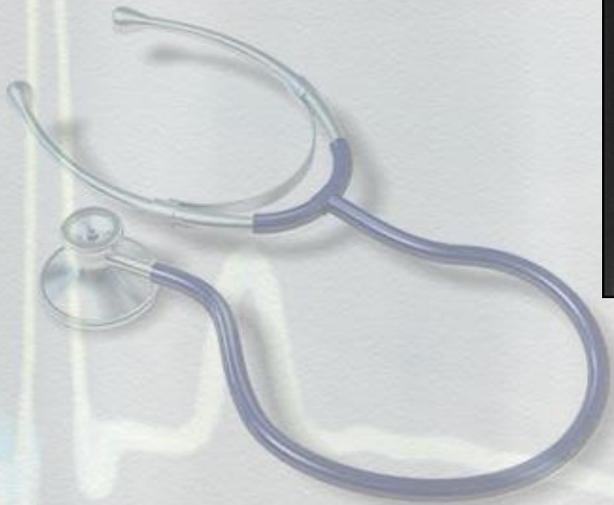
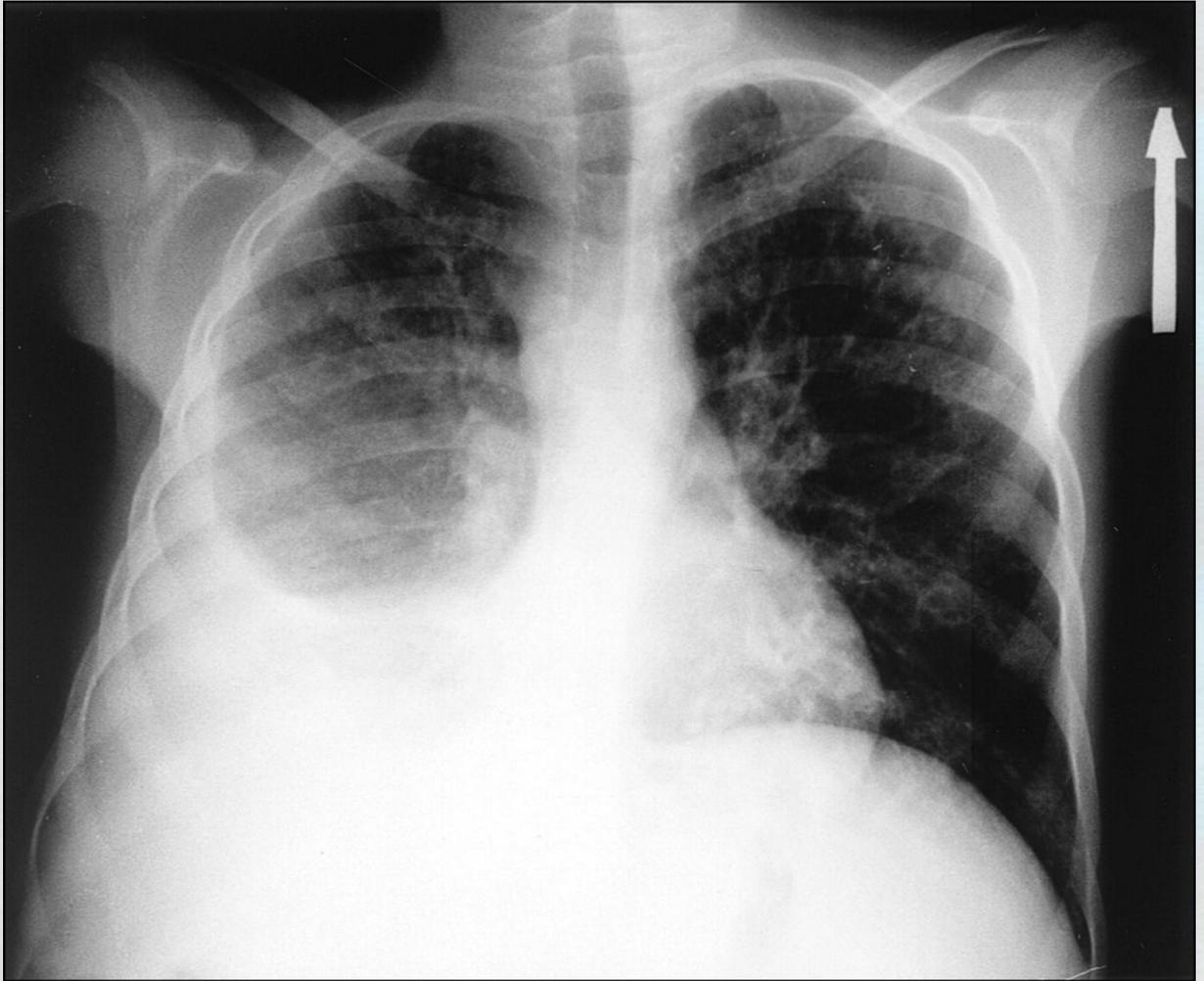


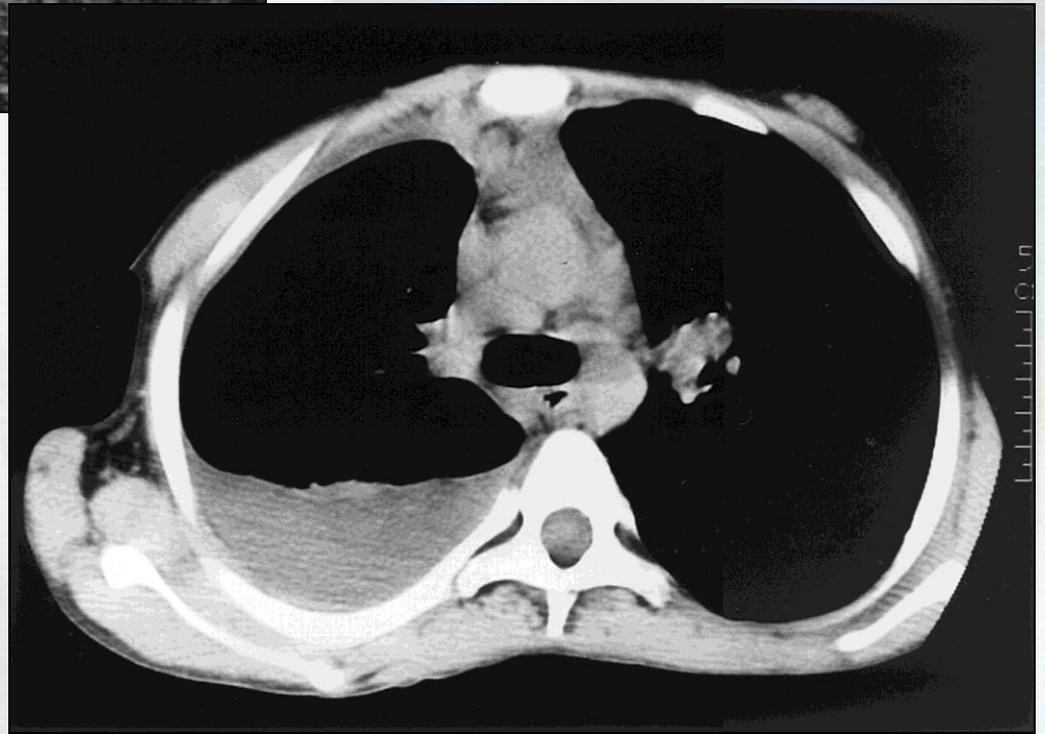
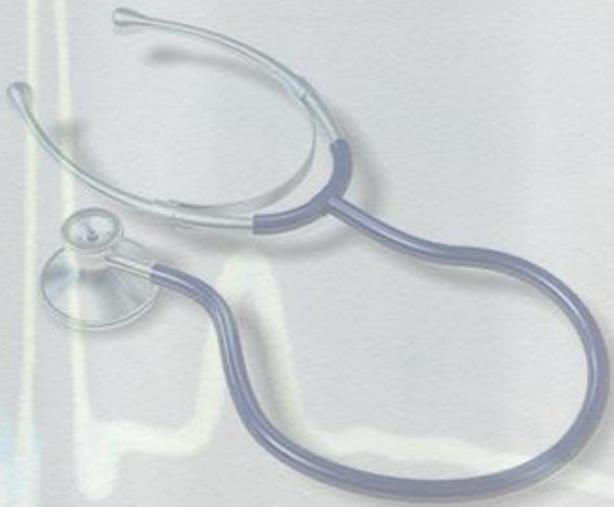
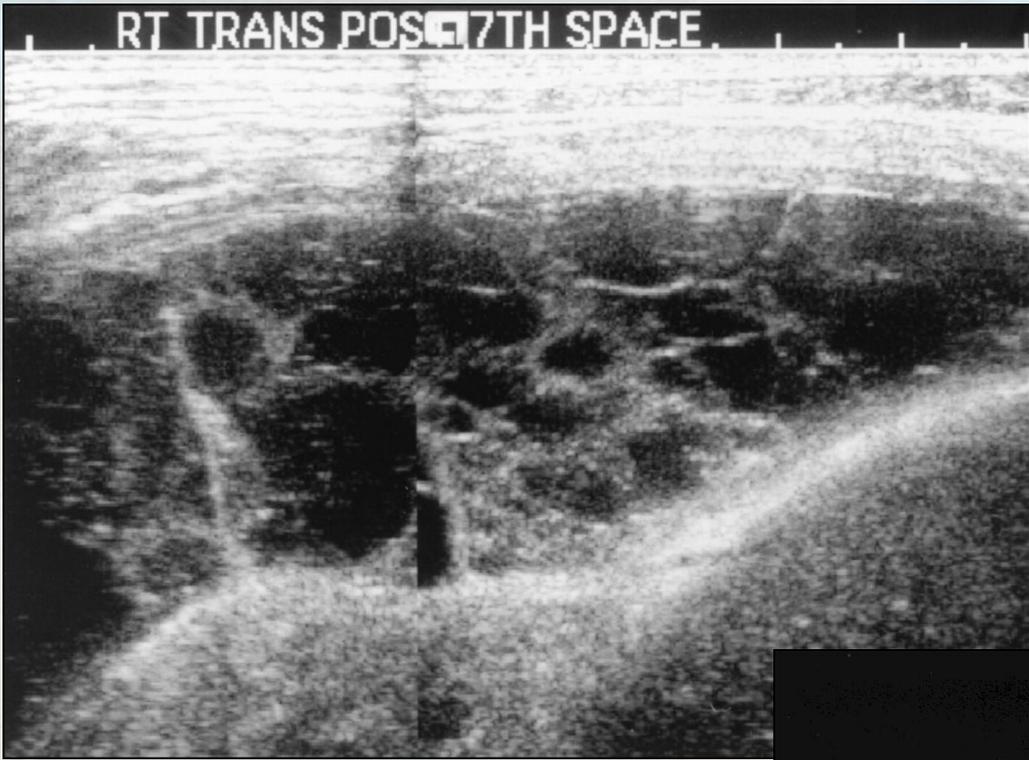
# Respiratory problems in Children

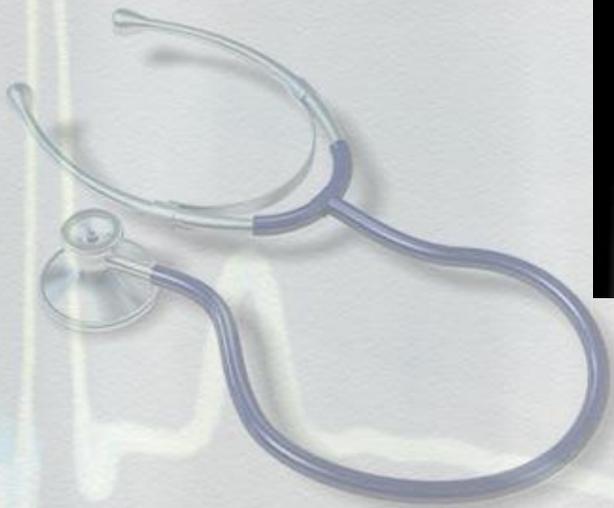
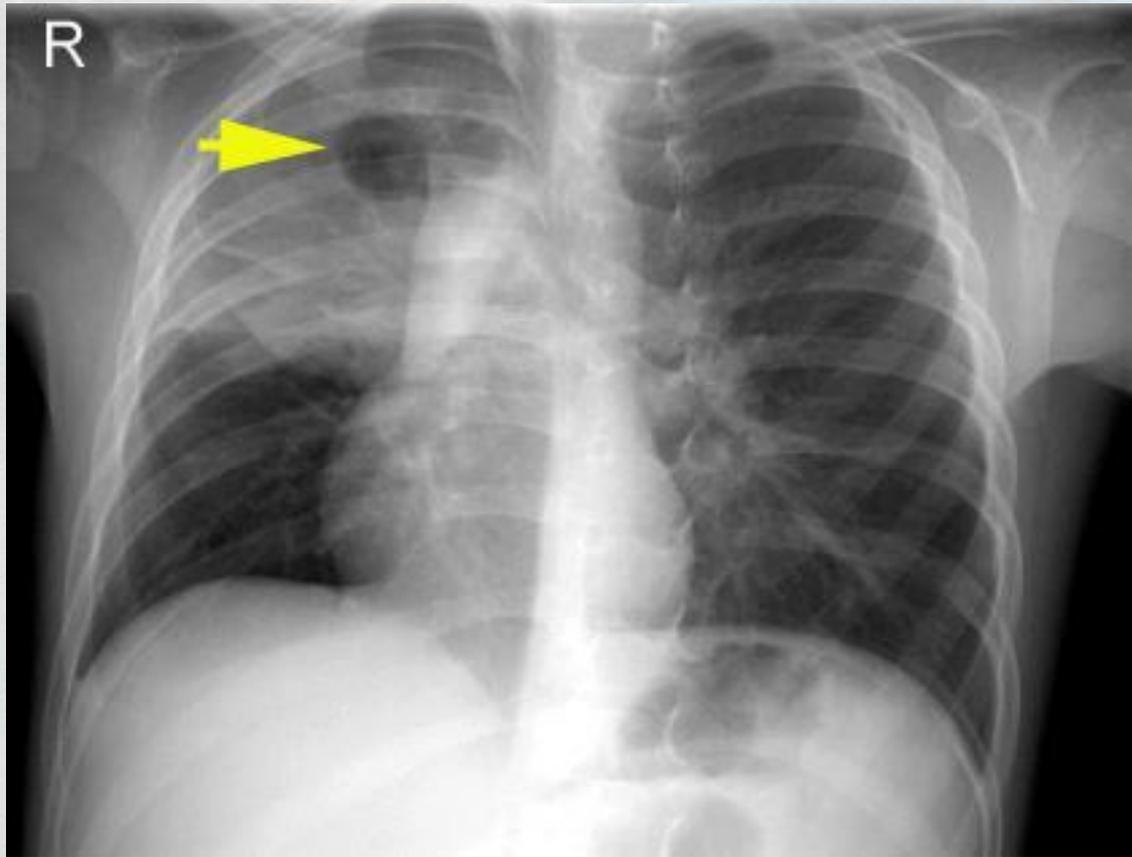
- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma

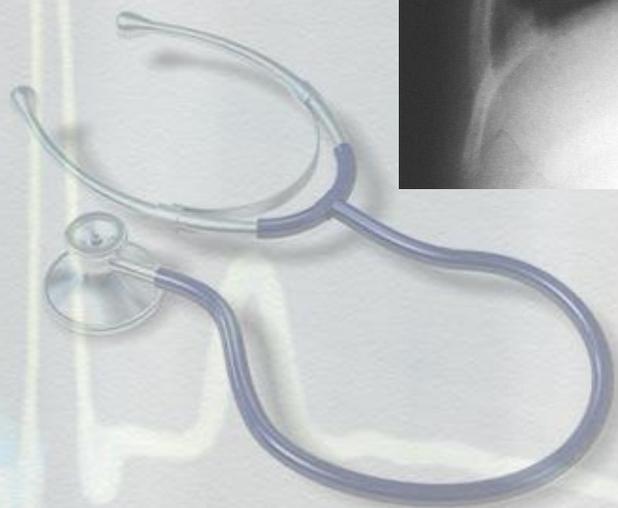
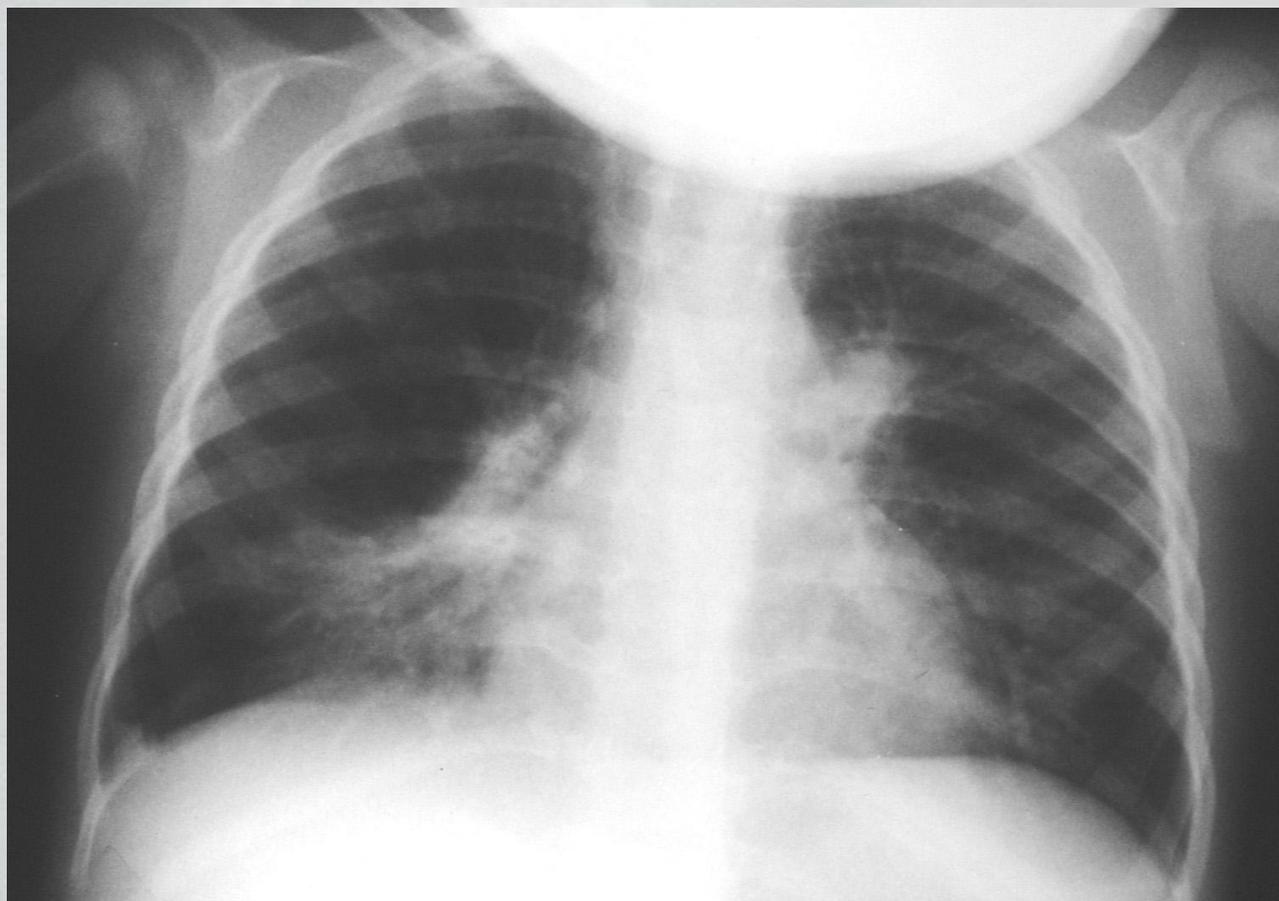








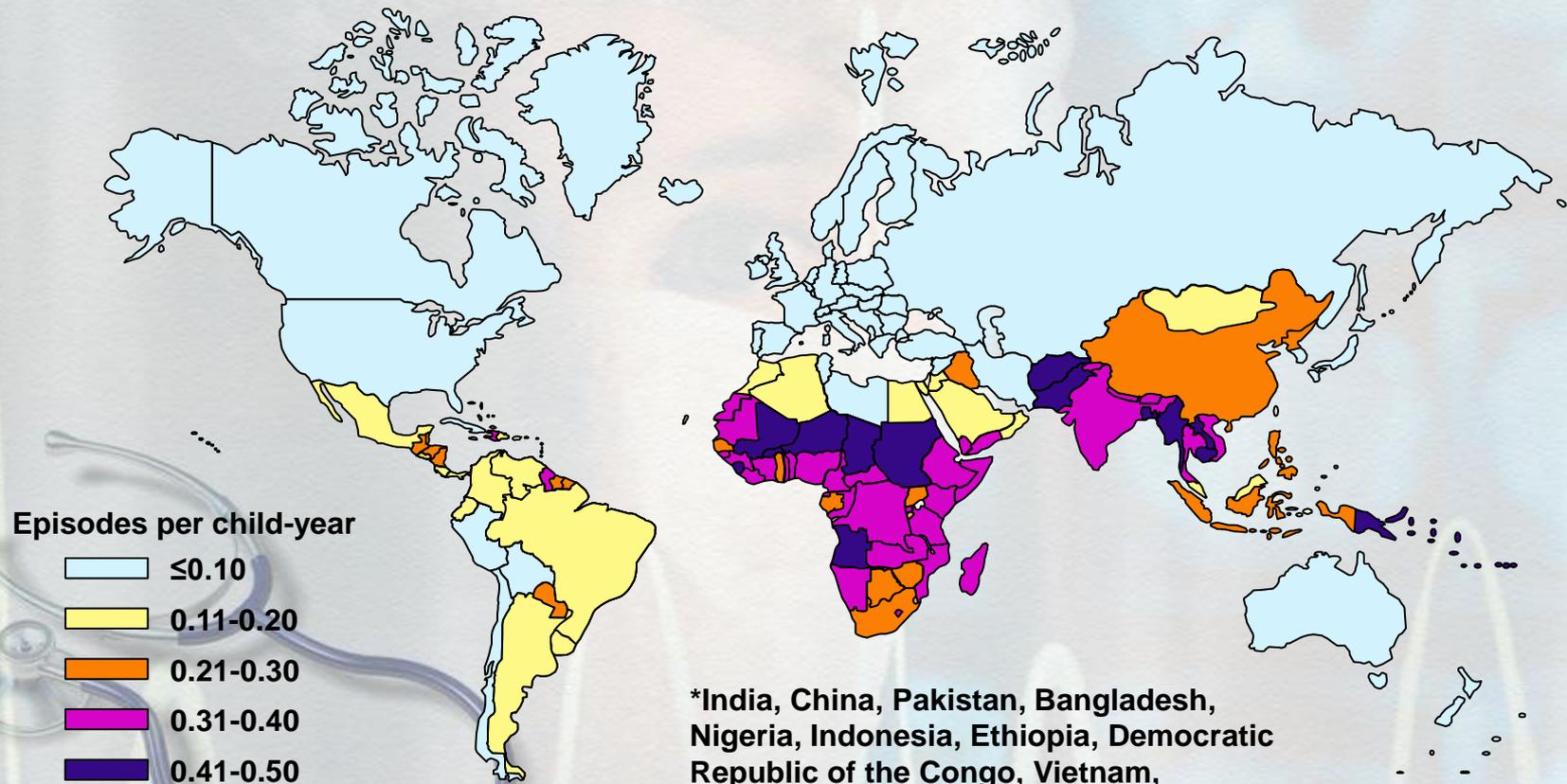






# Pneumonia Episodes per Child-year Worldwide (WHO Estimate)

Nearly three-quarters of all pneumonia episodes worldwide in children <5 years of age occur in just 15 countries\*

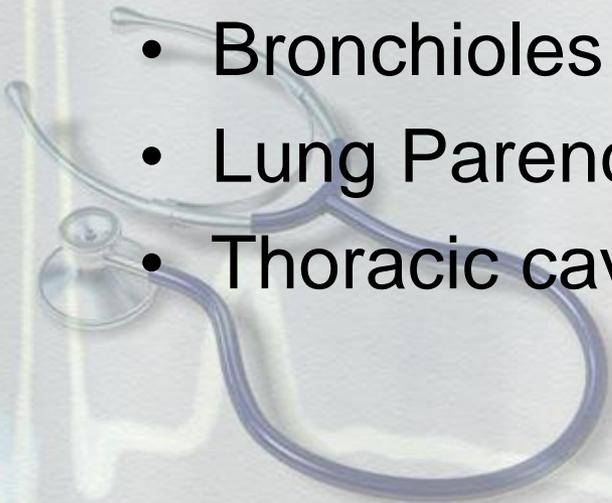
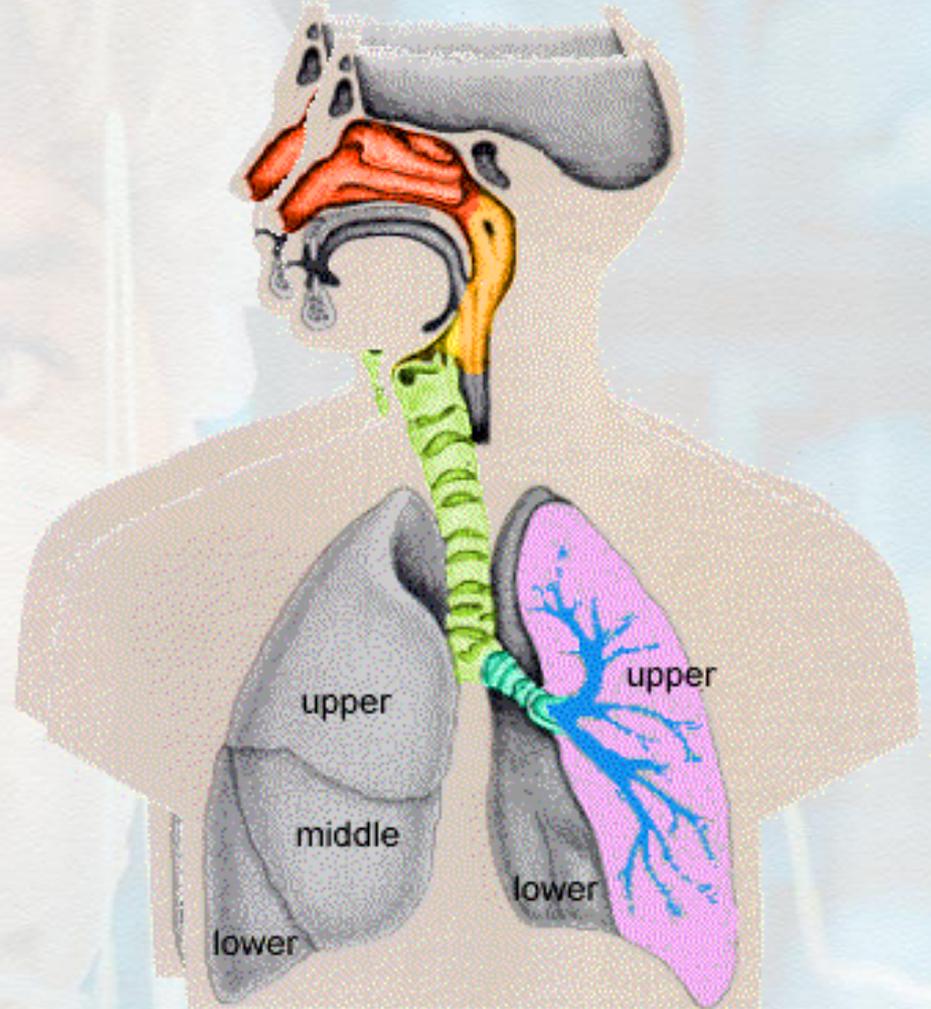


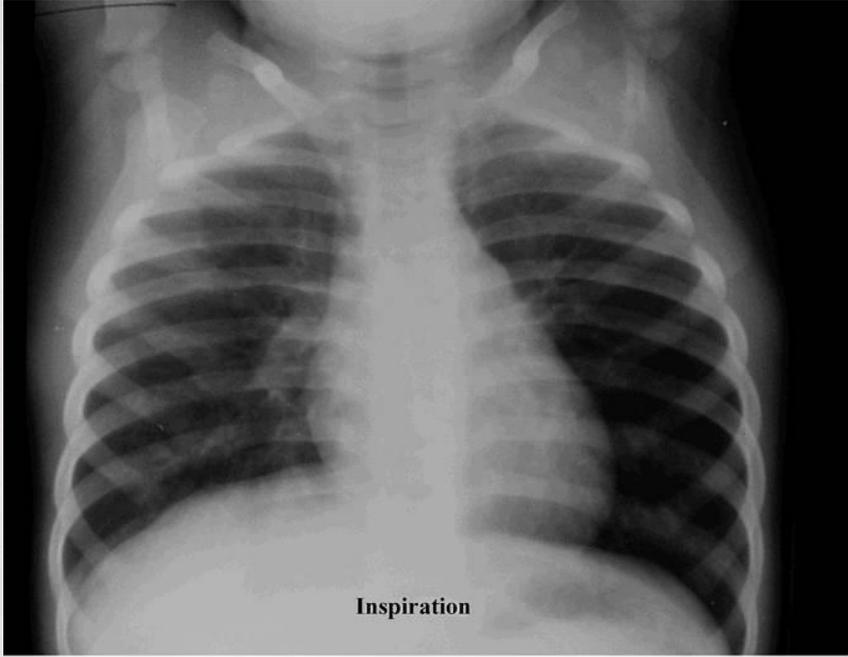
\*India, China, Pakistan, Bangladesh, Nigeria, Indonesia, Ethiopia, Democratic Republic of the Congo, Vietnam, Philippines, Sudan, Afghanistan, United Republic of Tanzania, Myanmar, Brazil

WHO=World Health Organization

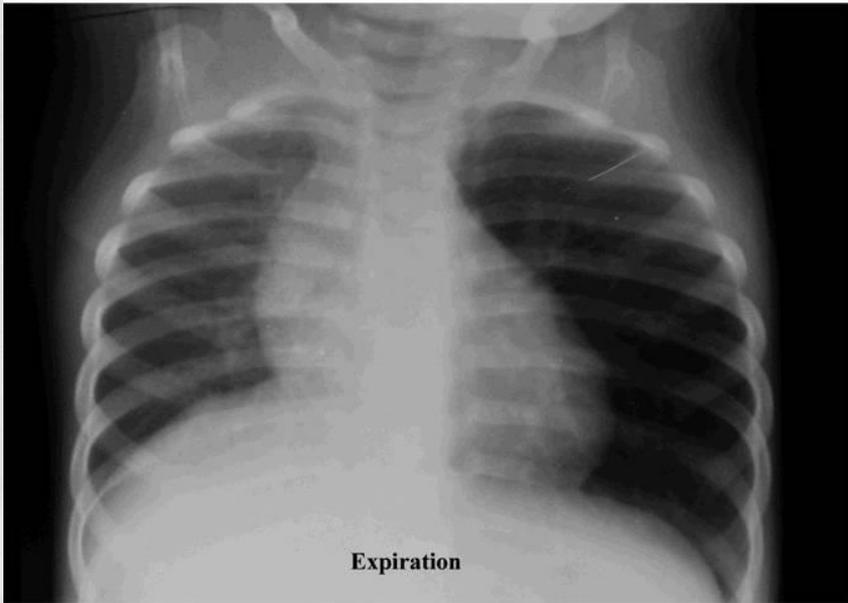
# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma
- Thoracic cavity

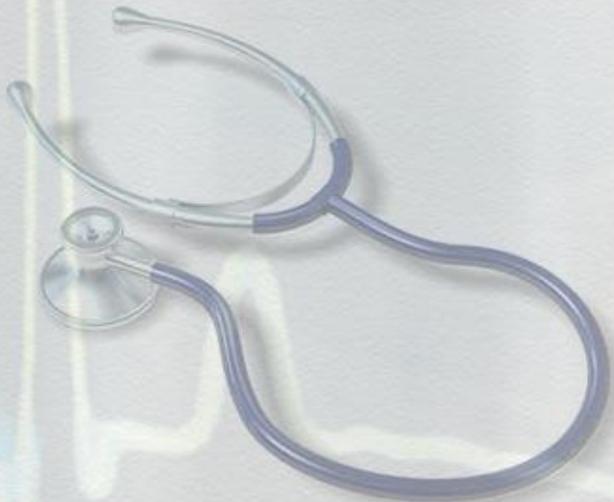


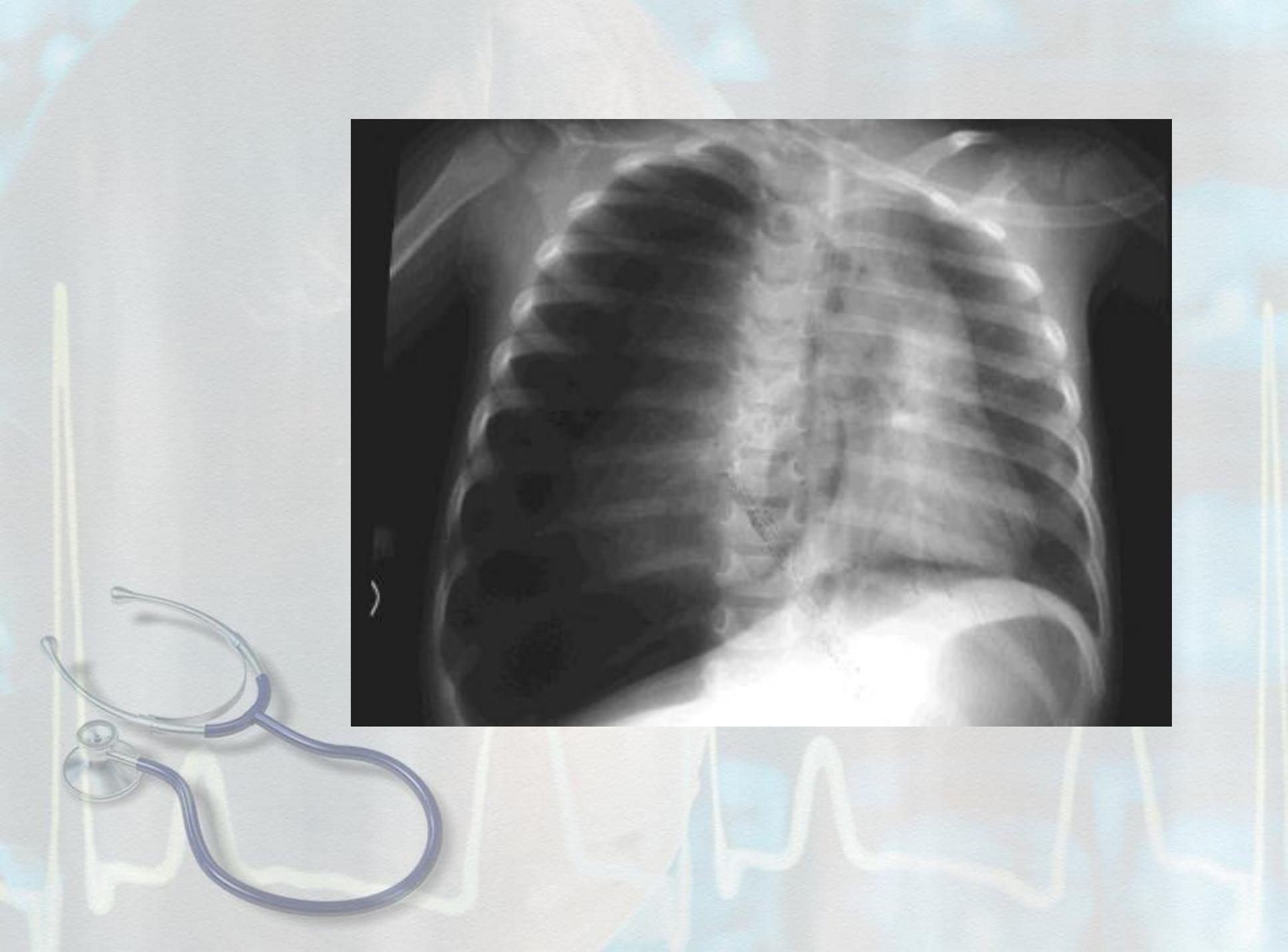


Inspiration



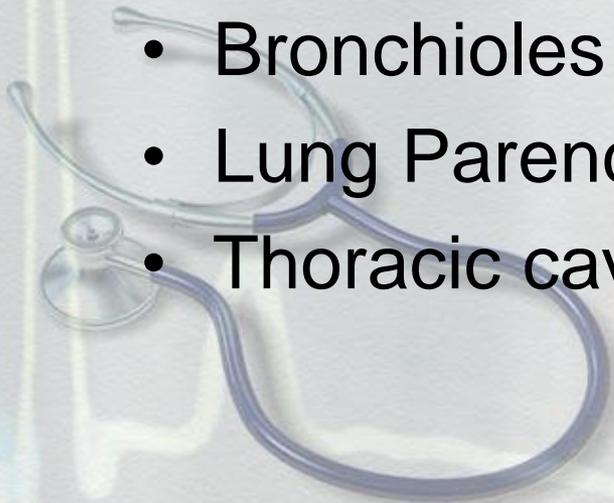
Expiration

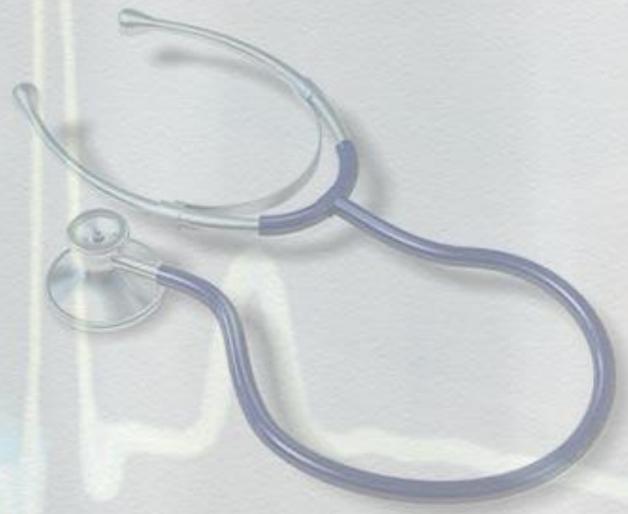
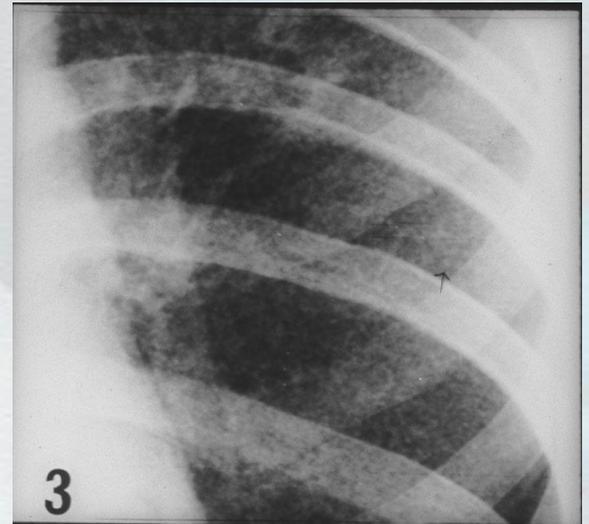


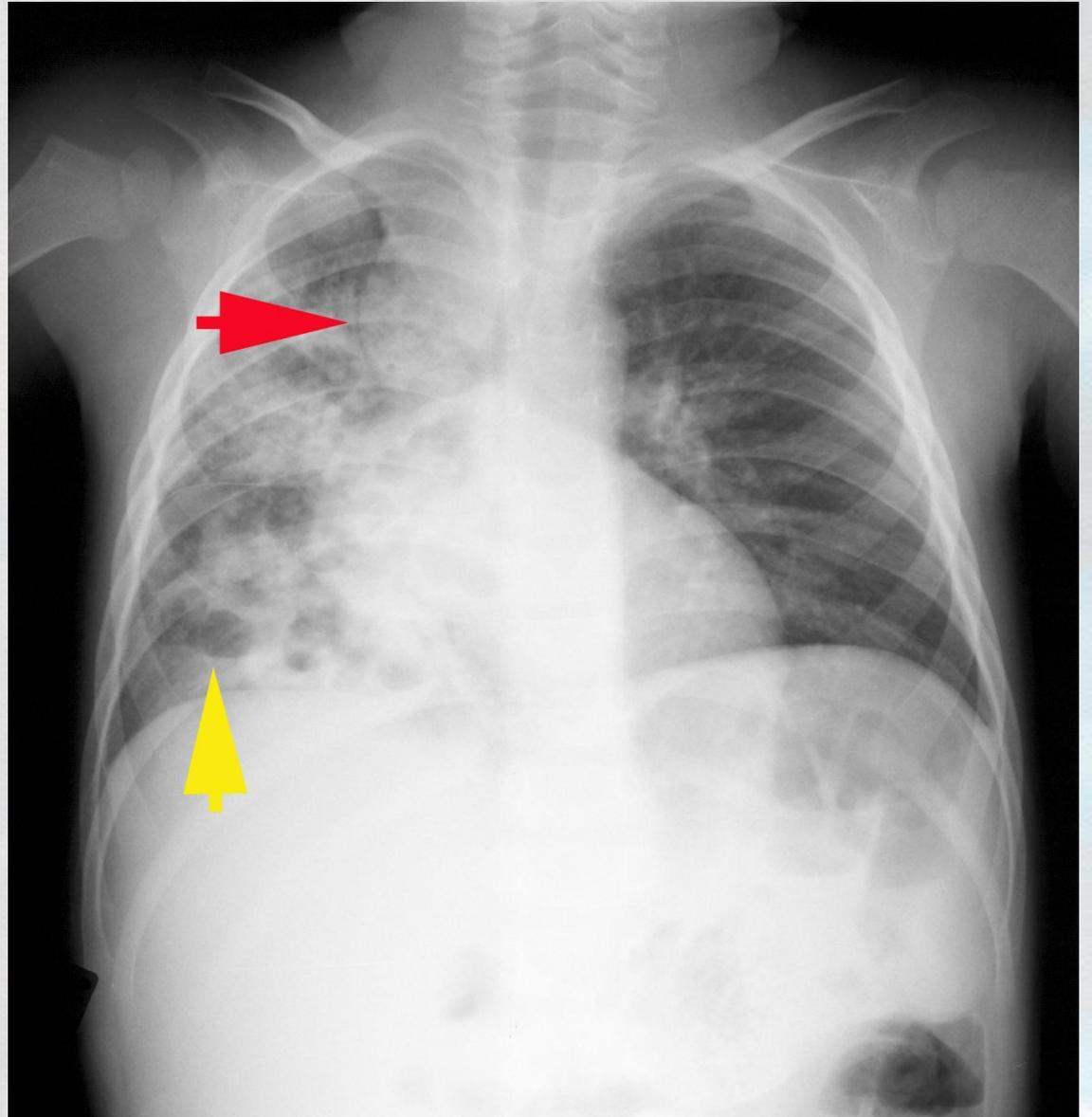
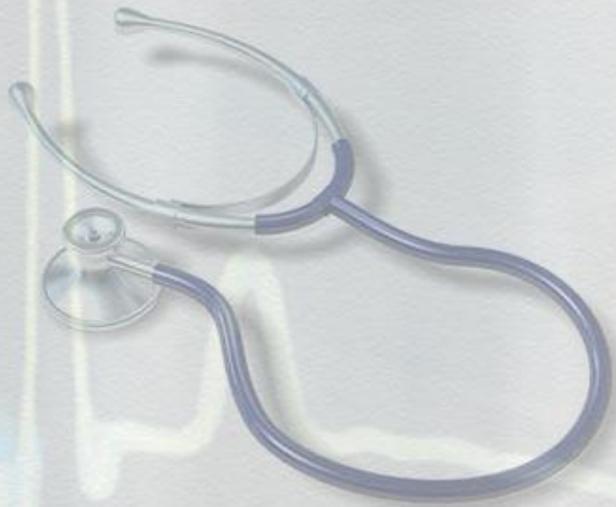


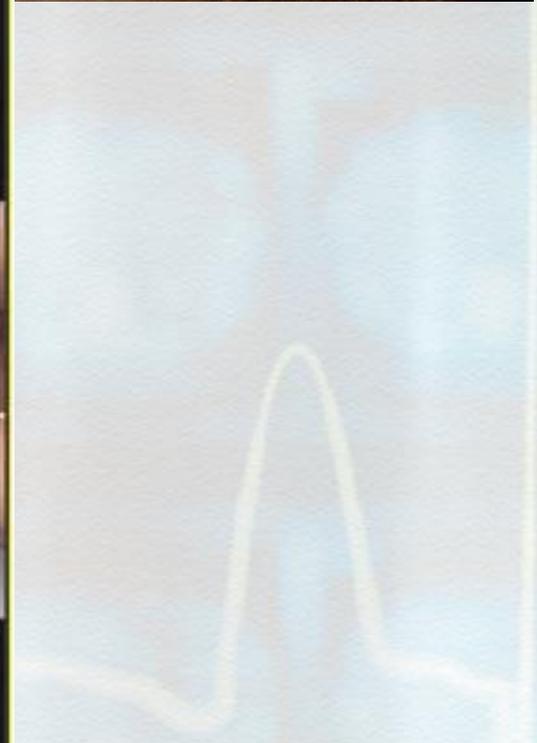
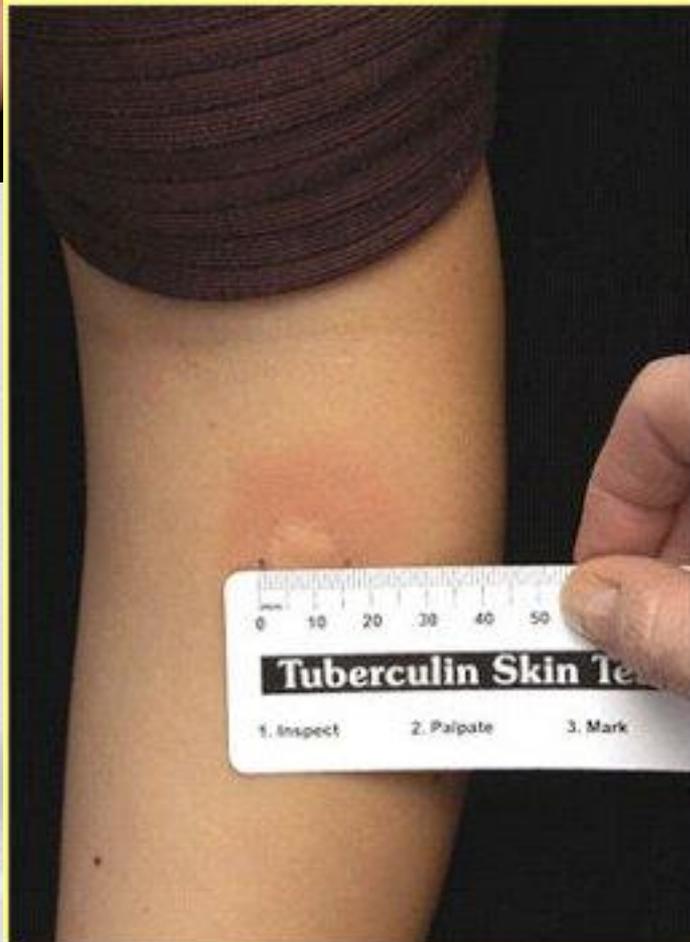
# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma
- Thoracic cavity
- Tuberculosis



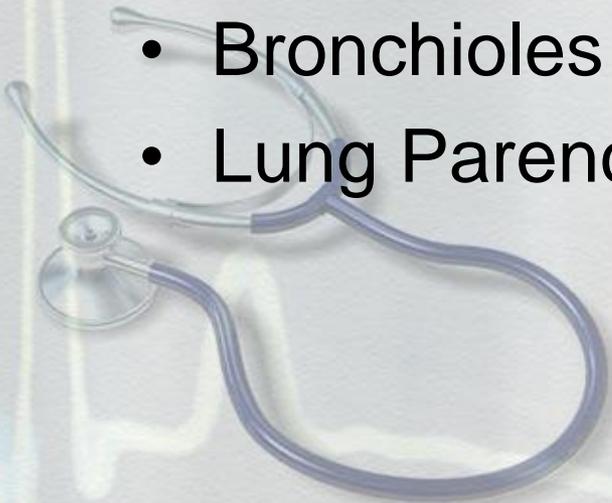






# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma
- Tuberculosis
- Cystic fibrosis



# Cystic Fibrosis

**Ear, nose and throat**

- Nasal polyps

## Recurrent chest infections

- Cough
- Purulent sputum
- Pneumonia
- Chronic pseudomonas infection
- Bronchiectasis
- Chest deformity
- Eventual respiratory failure

## Finger clubbing

- Seen with chronic lung infection

## Liver disease

- Obstructive jaundice in neonatal period (rare)
- Biliary stasis may require treatment with ursodeoxycholic acid
- Eventually liver cirrhosis may develop

## High salt losses in sweat

- Salty taste to skin
- Risk of salt-losing crisis during very hot weather

## Poor growth

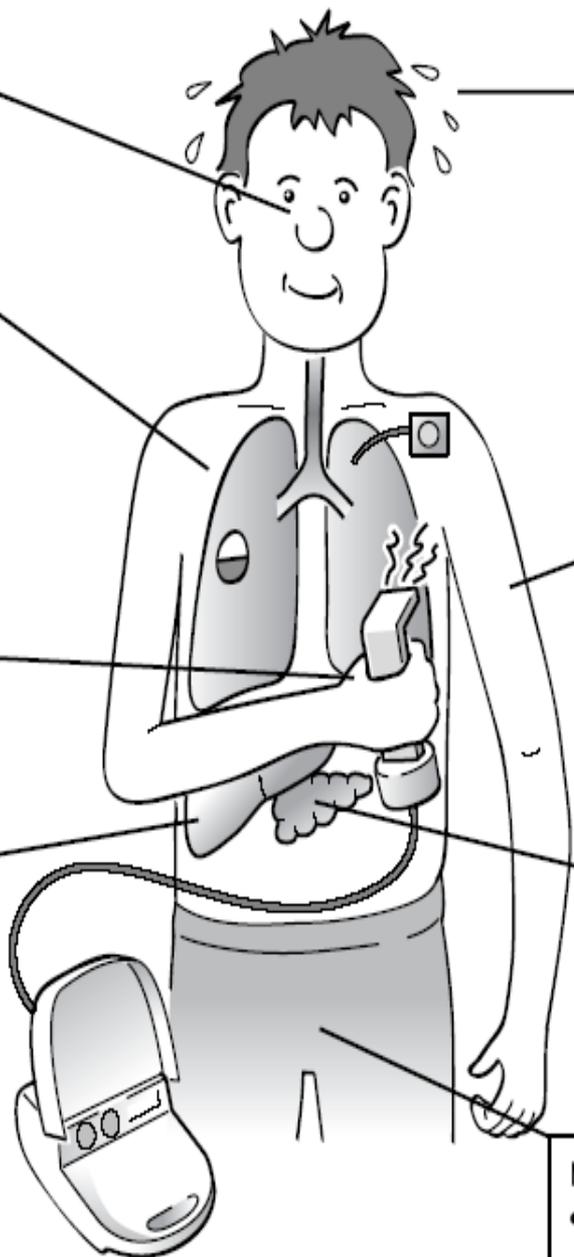
- Require 40% extra energy intake compared with normal child
- Poor weight gain
- Short stature
- Normal growth is achievable with pancreatic replacement, physiotherapy and aggressive treatment of chest infections

## Pancreatic insufficiency

- Poor fat absorption
- Steatorrhoea (fatty stools)
- Distended abdomen
- Rectal prolapse
- Meconium ileus at birth (15%)
- Meconium ileus equivalent—can mimic acute appendicitis
- Need to take pancreatic enzymes with meals
- May develop diabetes

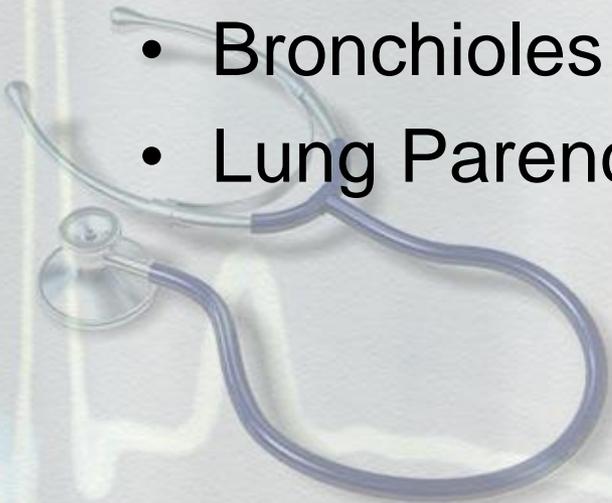
## Male infertility

- Congenital absence of the vas deferens



# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma
- Tuberculosis
- Cystic fibrosis
- Childhood Asthma



## Chronic asthma

### Cough

- Recurrent dry cough
- Worse at night
- Worse with exercise

### Wheeze

- Expiratory noise due to airway narrowing
- Often triggered by viral infections
- Responds to bronchodilators

### Shortness of breath

- Exercise limitation
- Triggers can be exercise, cold, allergens, smoke

### Uncontrolled asthma

- Poor growth
- Chronic chest deformity
- Time off school
- Frequent acute exacerbations

### Pathology

- Environmental triggers cause bronchoconstriction, mucosal oedema and excess mucous production in a genetically predisposed child
- Airway narrowing causes wheeze and shortness of breath



## Acute asthma

### Acute asthma attack

- Acutely short of breath
- Cough and wheeze
- Work of breathing increased
- Child often frightened
- May be triggered by viral illness, exposure to allergens, exercise or cold air

## Assessing severity

### Mild

- Breathless but not distressed
- Peak expiratory flow rate (PEFR) reduced but still >50% of normal

### Severe

- Too breathless to talk or feed
- Respiratory rate >50 breaths/min, pulse >140 beats/min
- PEFR <50% of expected

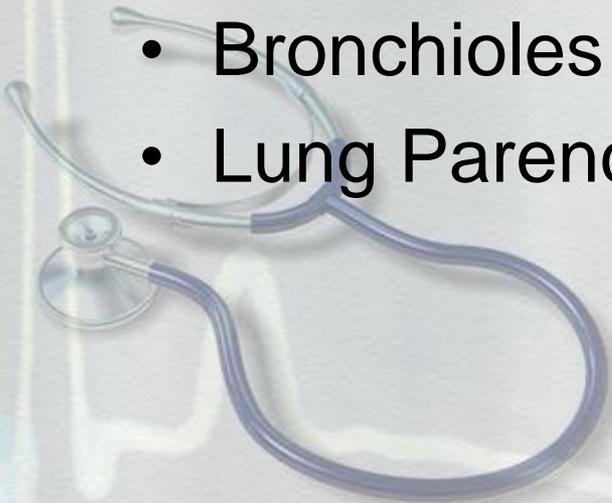
### Life-threatening

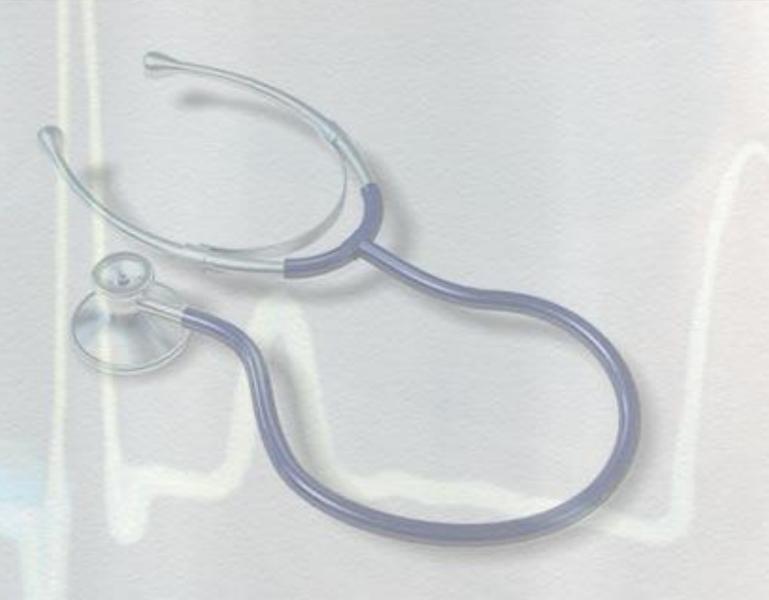
- PEFR <33% of expected
- 'Silent chest' or cyanosis
- Fatigue, drowsiness

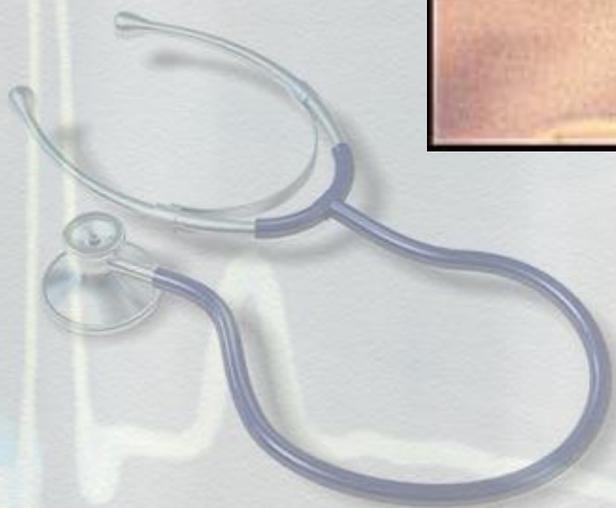
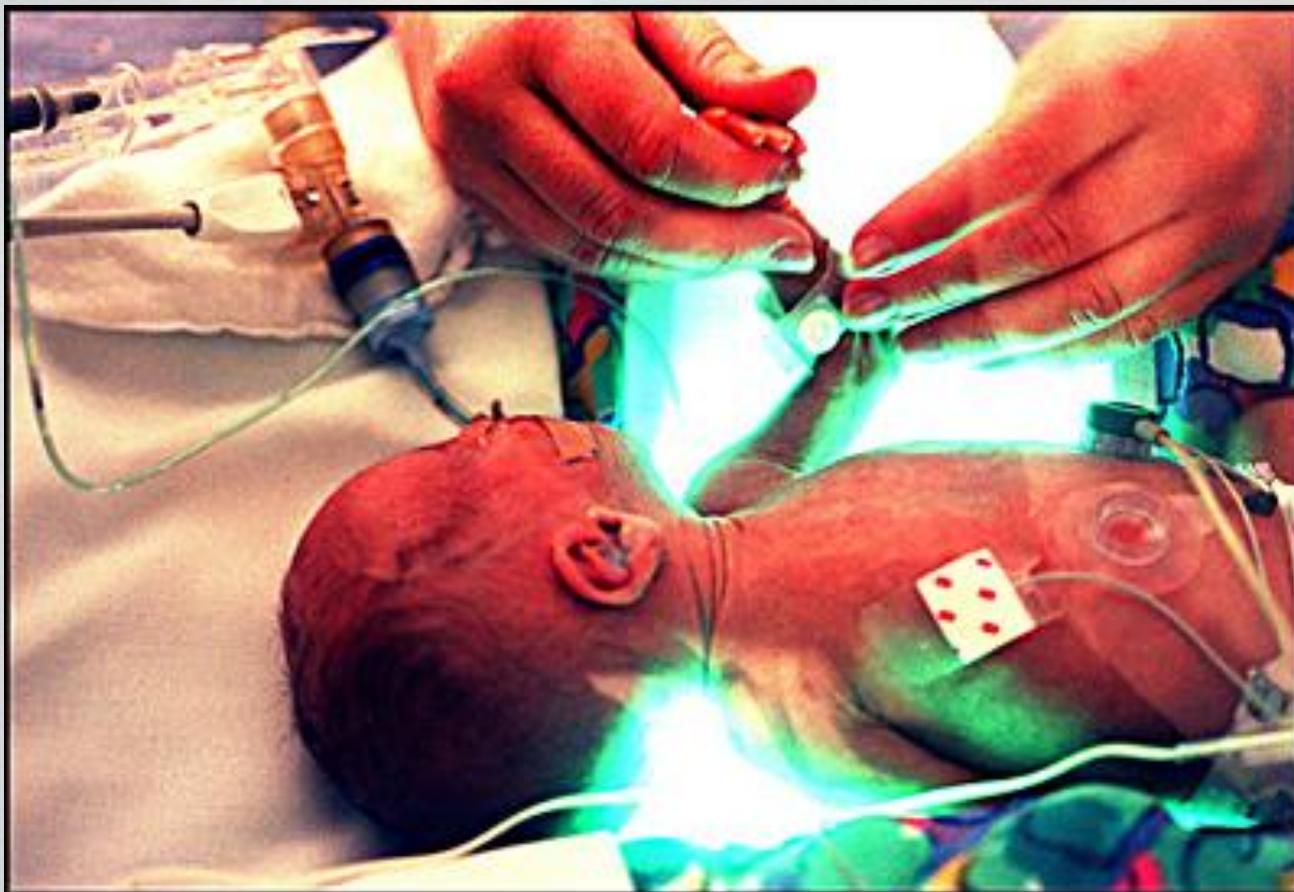


# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma
- Tuberculosis
- Cystic fibrosis
- Childhood Asthma
- Bronchopulmonary Dysplasia (BPD)

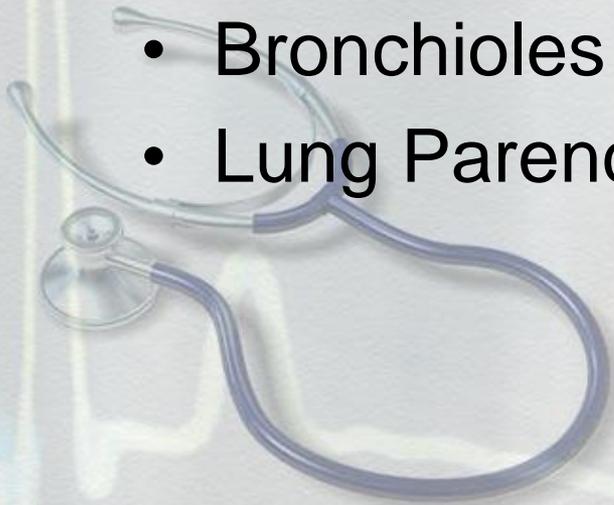




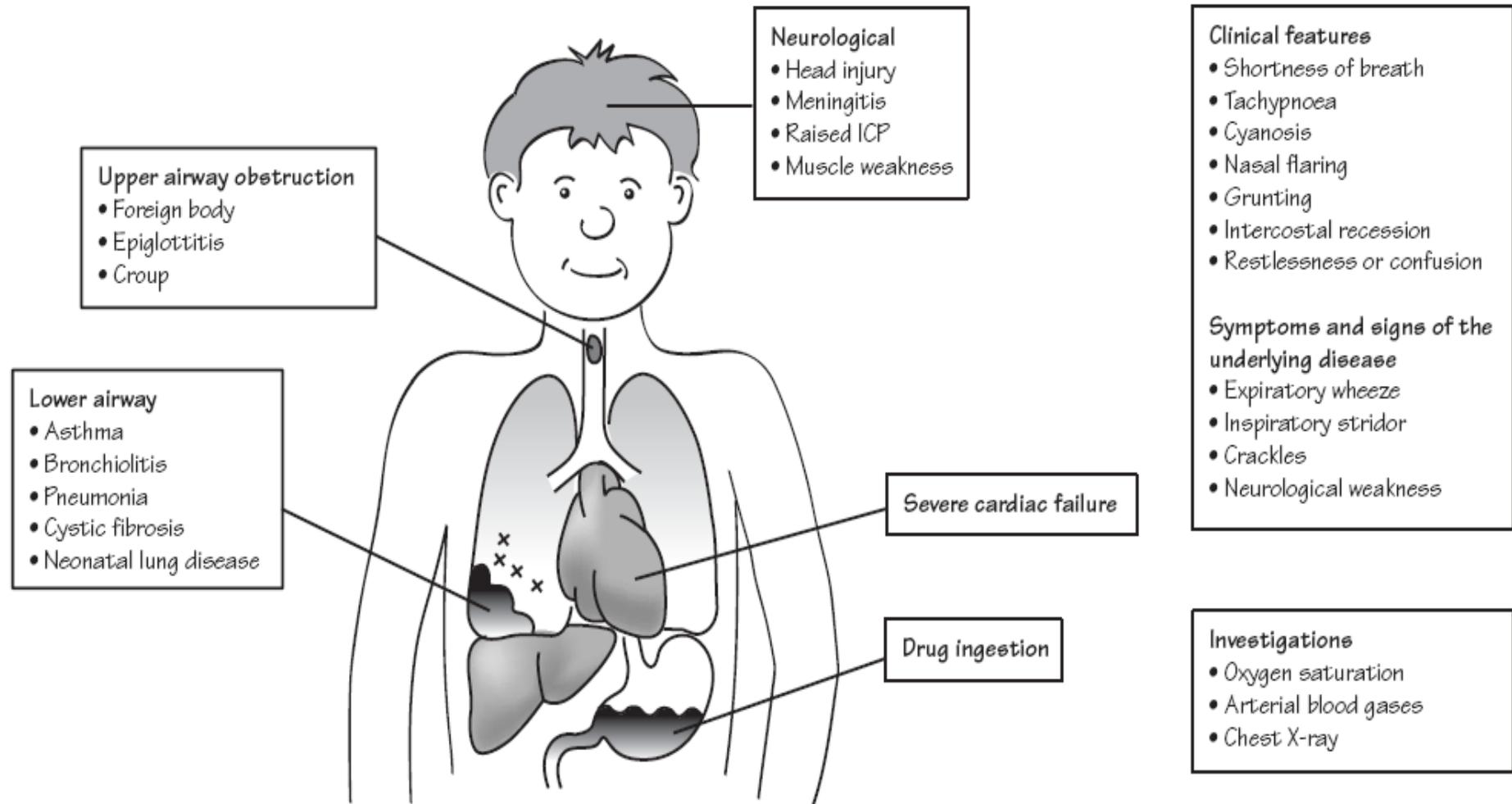


# Respiratory problems in Children

- Throat
- Nose
- Larynx
- Trachea
- Bronchus
- Bronchioles
- Lung Parenchyma
- Tuberculosis
- Cystic fibrosis
- Childhood Asthma
- Bronchopulmonary Dysplasia (BPD)
- Respiratory failure



# Causes of respiratory failure



- Clinical features**
- Shortness of breath
  - Tachypnoea
  - Cyanosis
  - Nasal flaring
  - Grunting
  - Intercostal recession
  - Restlessness or confusion

- Symptoms and signs of the underlying disease**
- Expiratory wheeze
  - Inspiratory stridor
  - Crackles
  - Neurological weakness

- Investigations**
- Oxygen saturation
  - Arterial blood gases
  - Chest X-ray

- Management**
- Assess severity by examination, blood gases and oxygen saturation monitor
  - Give high flow oxygen
  - Intubate and ventilate if rising  $pCO_2$ . (The decision to ventilate is based on clinical criteria, not just blood gases)
  - Treat the underlying cause: antibiotics (infection), bronchodilators and steroids (asthma), remove foreign body

What are the causes of cough and breathlessness in children?



# Causes of cough and breathlessness

**Croup**

- Barking cough
- Stridor

**Pneumonia**

- Fever, cough
- Respiratory distress
- Chest or abdominal pain
- Intercostal recession
- Crackles and signs of consolidation

**Bronchiolitis**

- Age: <2 years
- Coryza
- Respiratory distress
- Difficulty feeding
- Apnoea in young infants
- Wheezing and crackles

**Heart failure**

- Left to right shunts, e.g. ASD, VSD

**Tuberculosis**

- Contact with TB
- Not immunized with BCG

**Acute asthma**

- Known asthmatic
- History of atopy
- Wheeze
- Cough

(See Chapter 52 for details)

**Viral-induced wheeze**

- Wheeze with URTI
- Some progress to asthma
- May respond to bronchodilators

**Whooping cough (pertussis)**

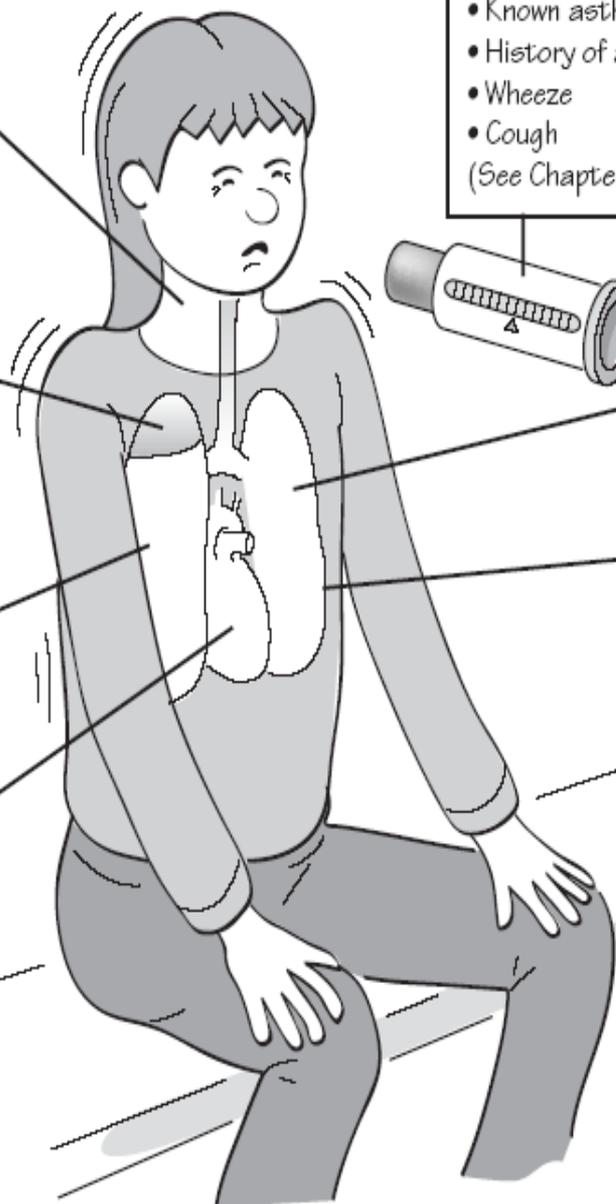
- Paroxysmal cough, followed by vomiting, whoop or apnoea

**Inhaled foreign body**

- Toddlers
- History of choking
- Unilateral wheeze
- Sudden onset

**Cough without breathlessness**

- Gastro-oesophageal reflux
- Post-nasal drip
- Tracheo-oesophageal fistula
- Passive smoking
- Cystic fibrosis



# Light at the end of the tunnel

