

# MMed and DCH Lectures

## Pneumonia and bronchiolitis in children

February 8<sup>th</sup>, 2021

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# Pneumonia and bronchiolitis

- Causes
- Clinical signs
- Predictors of poor outcome – risk assessment
- Treatment
- Complications

# Causes of pneumonia in PNG

Category	Pathogen	Percentage
Bacteria 30-40%	<b><i>Streptococcus pneumoniae</i></b>	<b>20%</b>
	<b><i>Haemophilus influenzae</i> type B and non-typeable Hi</b>	<b>15-20%</b>
	<i>Staphylococcus aureus</i>	5%
	Group A streptococcus / GBS / enteric Gram-negative bacilli	5%
	<i>Mycobacterium tuberculosis</i>	5-10%
Virus 40-50%	<b>Respiratory Syncytial Virus (RSV)</b>	<b>30-35%</b>
	Influenza A and B	5%
	Parainfluenza	7-10%
	Adenovirus	2-4%
Other 5%+	<i>Mycoplasma pneumoniae</i>	5%
	Chlamydia	5%
	<i>Pneumocystis jiroveci</i>	HIV

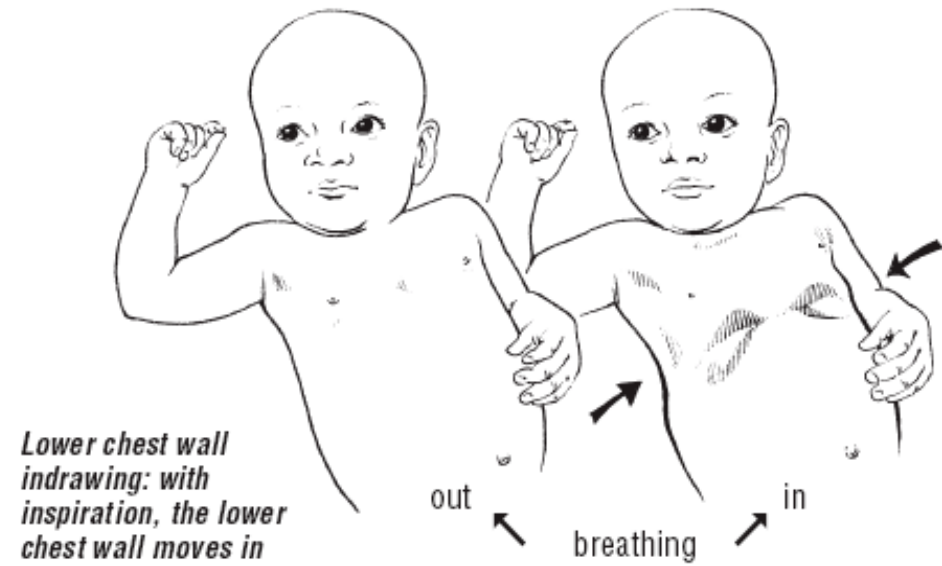
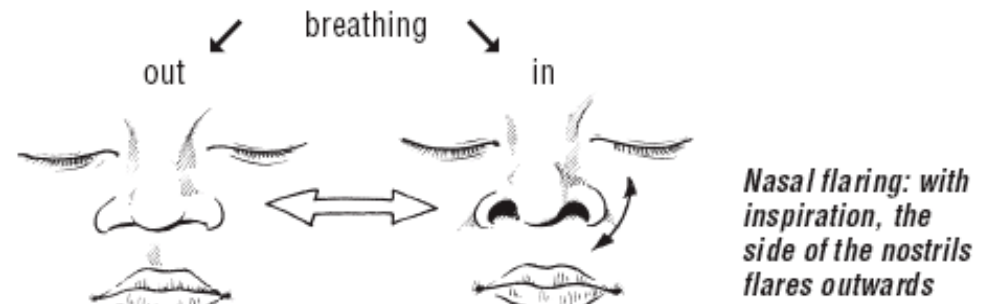
# Complex aetiology of ALRI

- Often not just one pathogen
- Usually a virus, followed by drip aspiration of nasopharyngeal bacteria
- Most recover fully with antibiotics (some don't need them)
- The patient with “recurrent pneumonia”
  - Most often recurrent viruses: multiple RSV infections can occur in the one season
  - Sometimes ALRI followed by **bacterial bronchitis** – “chronic wet cough”: haemophilus. Or staph / Klebsiella / pseudomonas if hospitalised, debilitated, immune compromised
  - Tuberculosis

# Pneumonia classification: PNG (WHO equivalent)

Cough and difficult breathing plus...

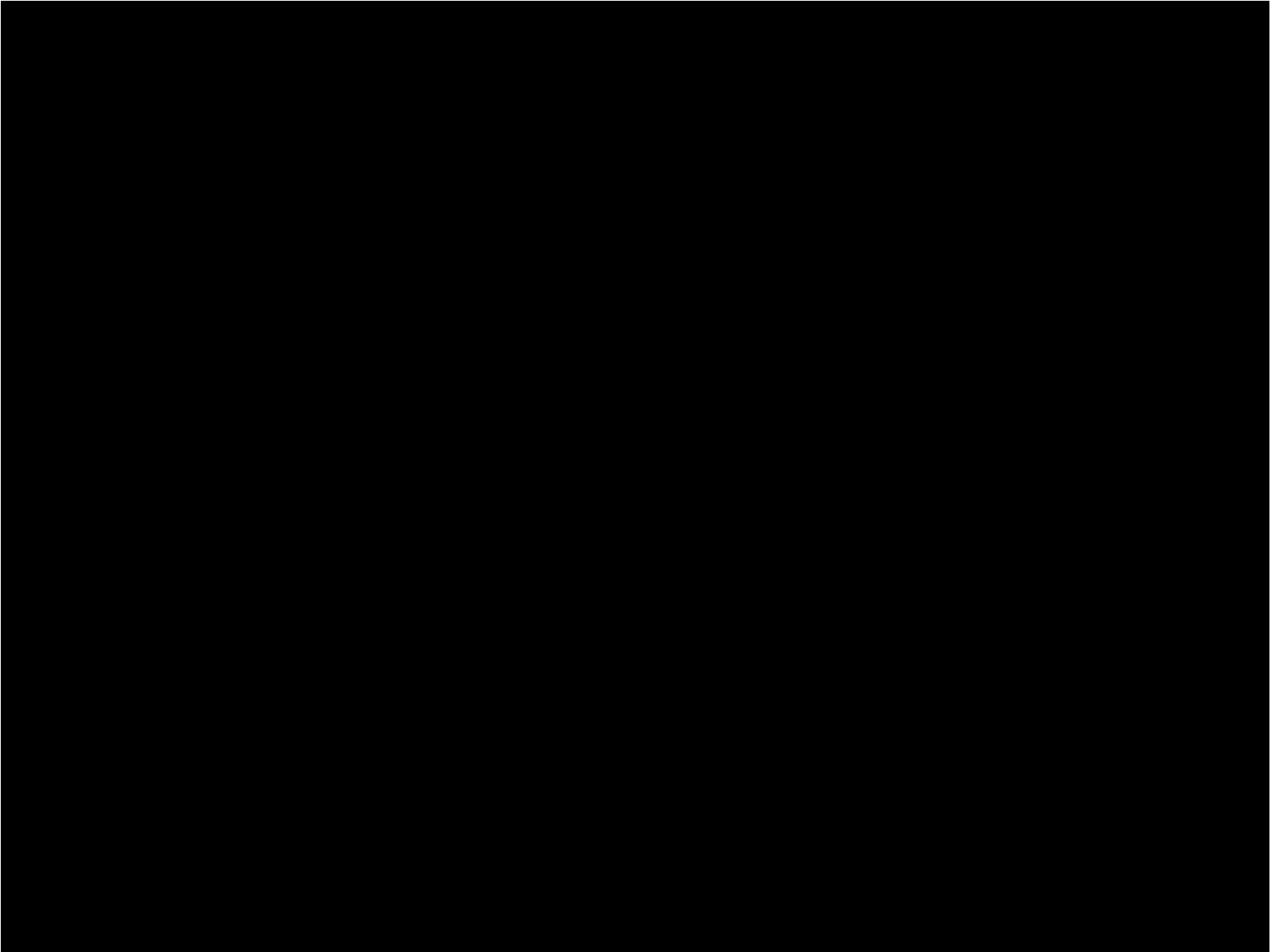
Classification	Signs	Treatment
<b>Severe pneumonia (Severe pneumonia)</b>	Danger signs or hypoxaemia (SpO <sub>2</sub> <90%) or cyanosis	Admit, give oxygen, benzyl penicillin (or ampicillin) and gentamicin intravenous  If cough persist more than 14 days assess for tuberculosis
<b>Moderate pneumonia (Pneumonia with chest indrawing)</b>	Chest indrawing, but no danger signs or hypoxaemia	Admit, benzylpenicillin intravenous for 24 hours, if improved then change to amoxicillin for 5 days  If cough persist more than 14 days assess for tuberculosis
<b>Mild pneumonia (Pneumonia)</b>	Fast breathing, but no chest indrawing, danger signs or hypoxaemia	Home on oral amoxicillin
<b>Simple cough</b>	Normal respiratory rate, no chest indrawing and no danger signs	Home with symptomatic treatment only (maintain oral fluids, continue breast feeding, e.g. paracetamol if febrile)











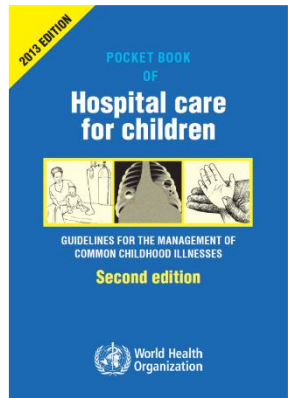
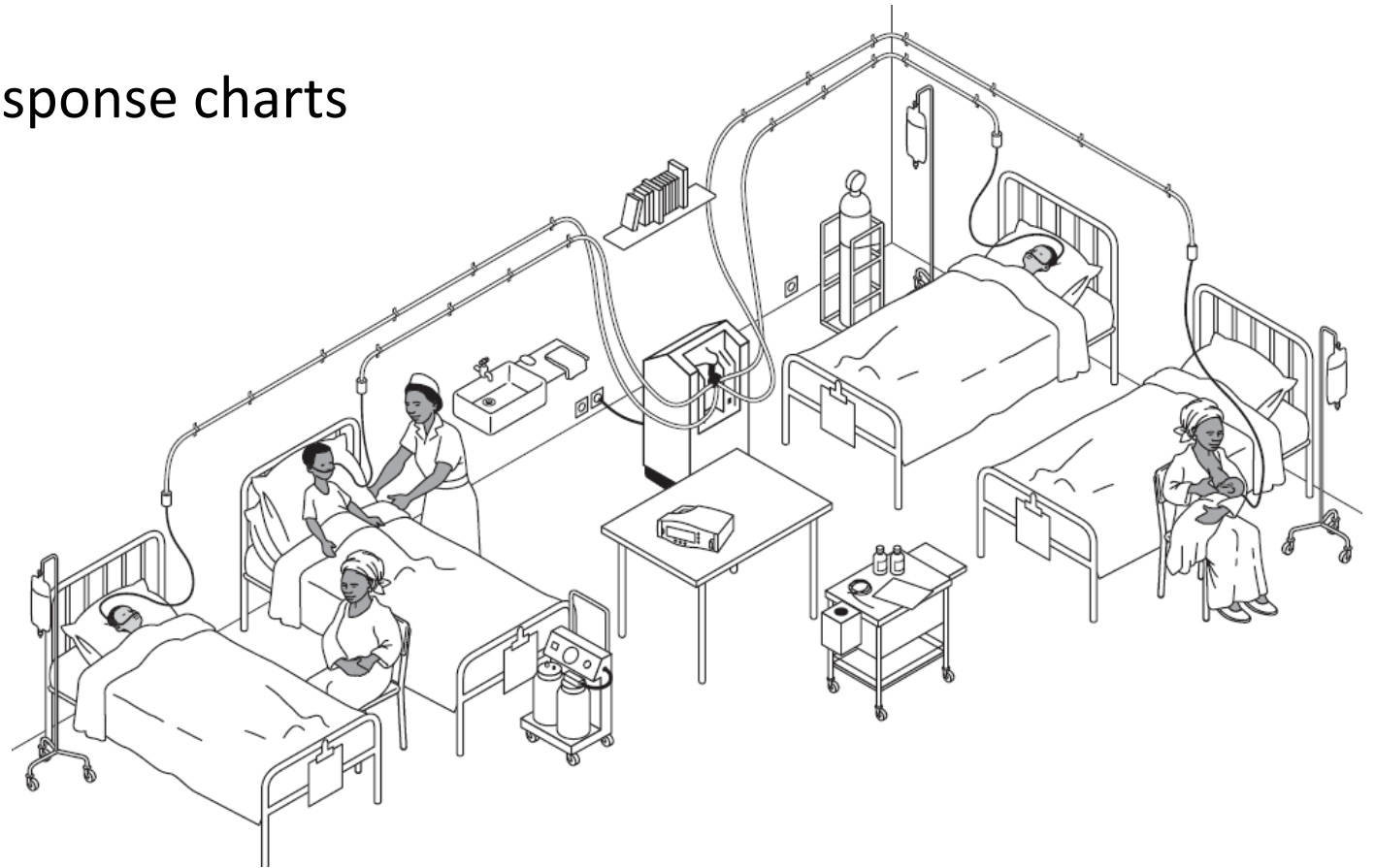


# Bronchiolitis

- Viral
- Self limiting (but can be severe)
- Infants, usually relatively well looking, fast breathing and happy
- Chest hyperinflation
- Prolonged expiratory phase
- Wheeze *and crackles*
- (Apnoea in neonates)
- Worse on days 1-3, then improves days 4-7
- Usually not associated with *high* fever

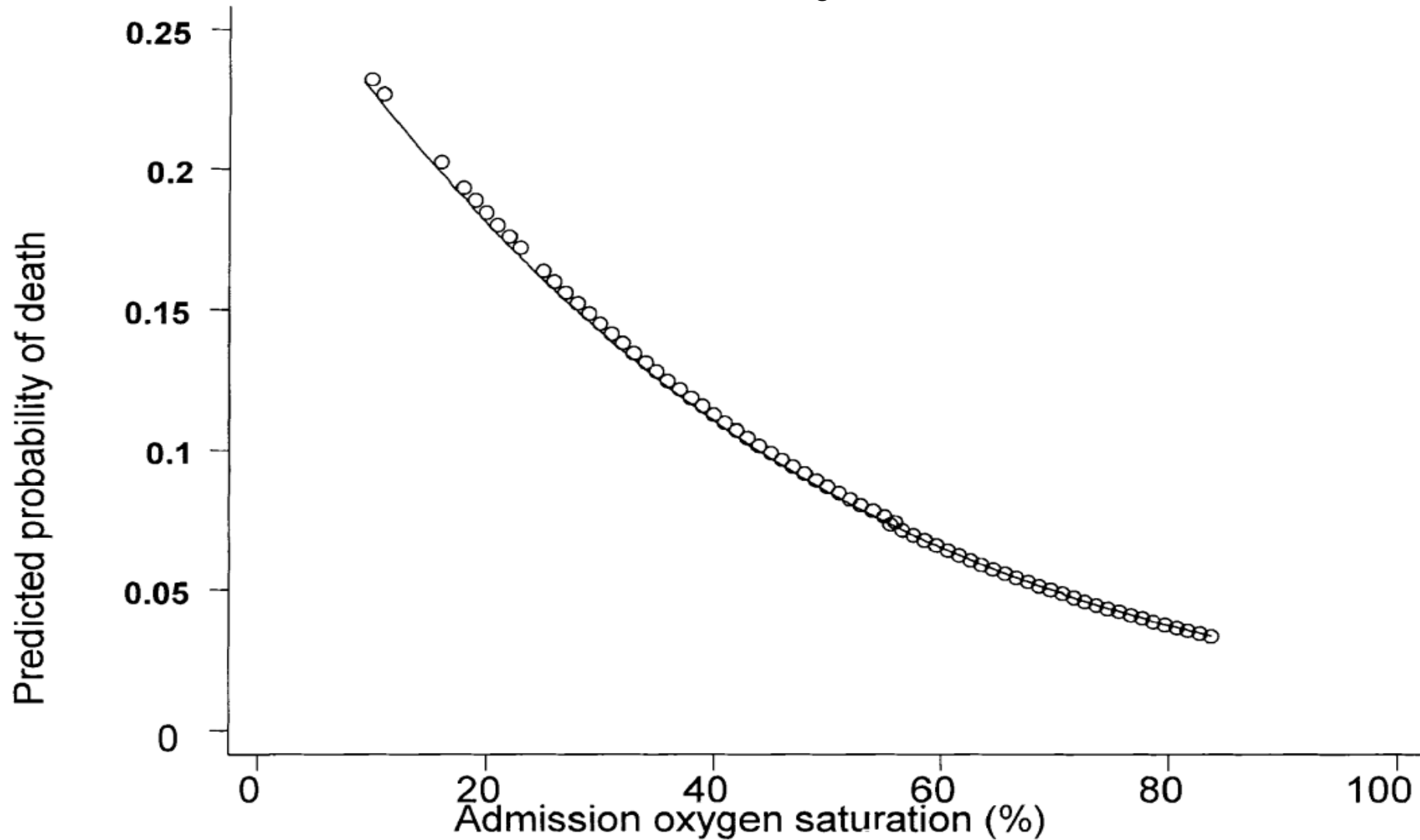
# Hospital care for severe pneumonia

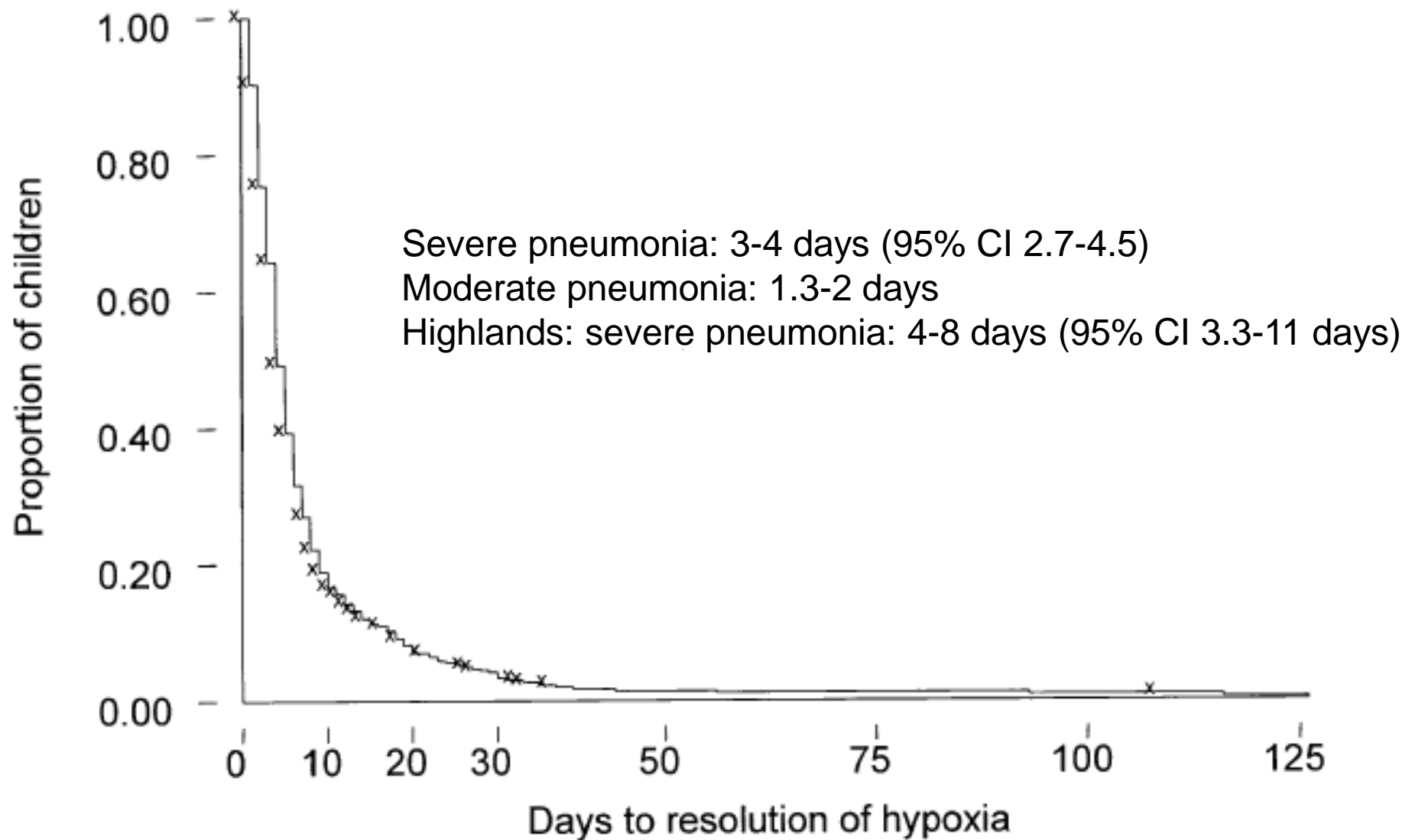
- Antibiotics - Standard Treatment
- Oxygen therapy
- Monitoring – monitoring and response charts
- Supportive care
  - Nutrition, fluids
- Risk assessment
  - Hypoxaemia
  - Malnutrition, anaemia, HIV
  - Neonates
  - Chronic comorbidity
  - Lactate
- Quality improvement program
  - Auditing



# Hypoxaemia and the risk of mortality

Duke T, Int J Tuberc Lung Dis 2001; 5:511-519





**Figure 1** Kaplan-Meier curve showing the time to resolution of hypoxaemia ( $SpO_2 > 89\%$ ). The crosses indicate deaths, which are censored.









Kiripia, WHP





Kainantu, EHP





Bougainville

# Solar-powered oxygen and quality improvement

Era	Pneumonia admissions (36 health facilities)	Pneumonia deaths (36 health facilities)	Case fatality rate (95% CI)
Pre-intervention (2012-15)	10,228	377	3.69 (3.34-4.07)
Solar powered oxygen therapy (2016-19)	8,705	153	1.76 (1.50-2.06)
Total	18,933	530	<b>IRR = 0.50</b> (0.36 to 0.71)

IRR = incidence rate ratio, ratio of the CFR post / CFR pre



# Monitoring and response charts

## Paediatric monitoring and response chart

Name: Ratu

Age: 11 months

Hospital:

Weight: 8.2 kg UR number: 267198



Frequency of observations: 1-2 Hourly

Date	Time	Temp °C	Respiratory Rate (bpm)	SpO <sub>2</sub> (%)	Oxygen L/min	Respirat. distress	Heart rate (bpm)	Cap refill	Blood Pressure (mmHg) (systolic danger range)	AVPU response to stimuli	Pain score (/10)	Blood sugar	Feeds given: volume
15/4	08:00	38.8	X	X		Severe	X	X	110	Alert	1.8		
	09:00	38.8	X	X		Mod.	X	X	110	Alert	4.5		
	10:00	37.8	X	X		Mild	X	X	110	Alert			
	11:00	37.8	X	X		Normal	X	X	110	Alert			
	12:00	37.8	X	X			X	X	110	Alert			
	13:00	37.8	X	X			X	X	110	Alert			
	14:00	37.8	X	X			X	X	110	Alert			
	15:00	37.8	X	X			X	X	110	Alert			
	16:00	37.8	X	X			X	X	110	Alert			

*Handwritten notes:*  
 Oxygen IV dilute Anticoagulant  
 Blood Transfusion Feeds concentrated (NG)

# Risk assessment

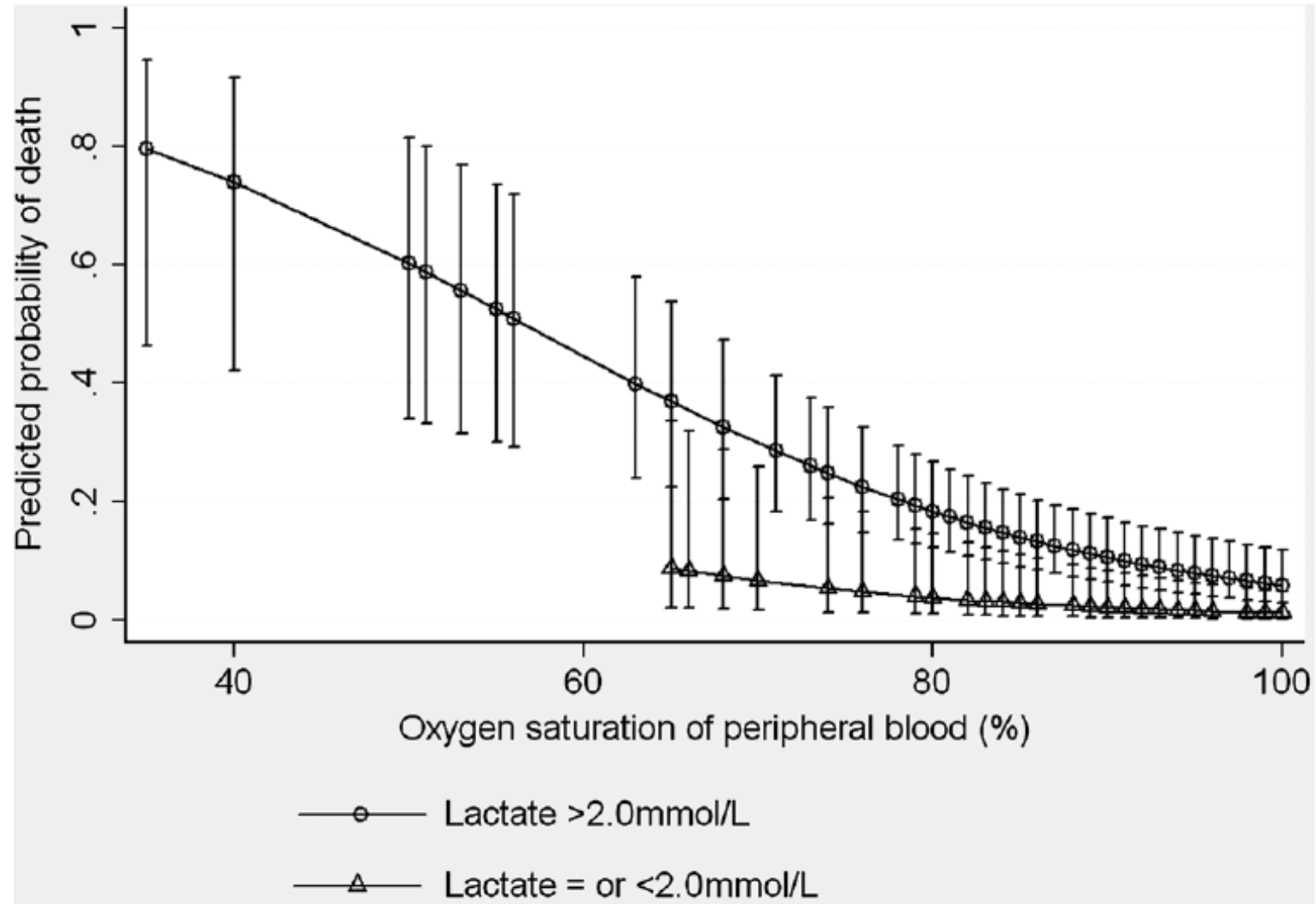
- Hypoxaemia
- Malnutrition, anaemia, HIV
- Neonates
- Chronic comorbidity
- Lactate

# Lactate predicts mortality in pneumonia

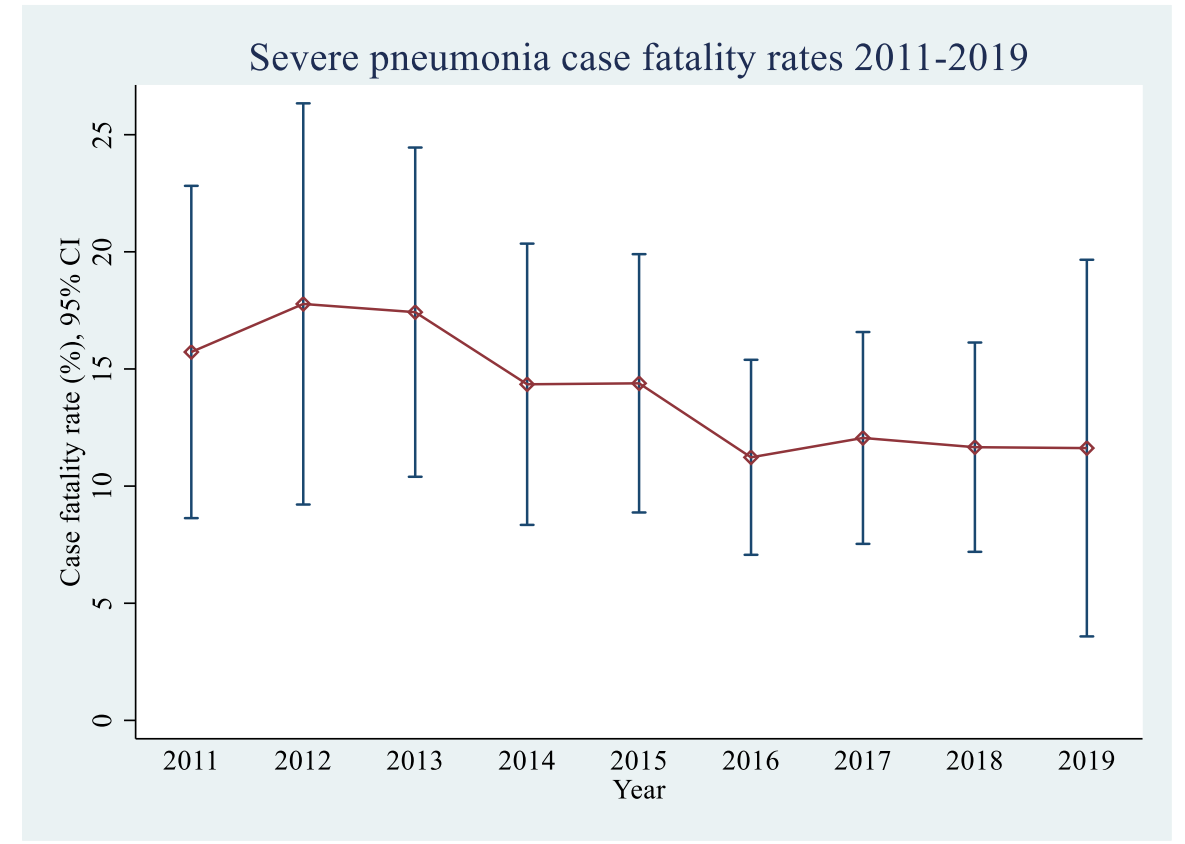
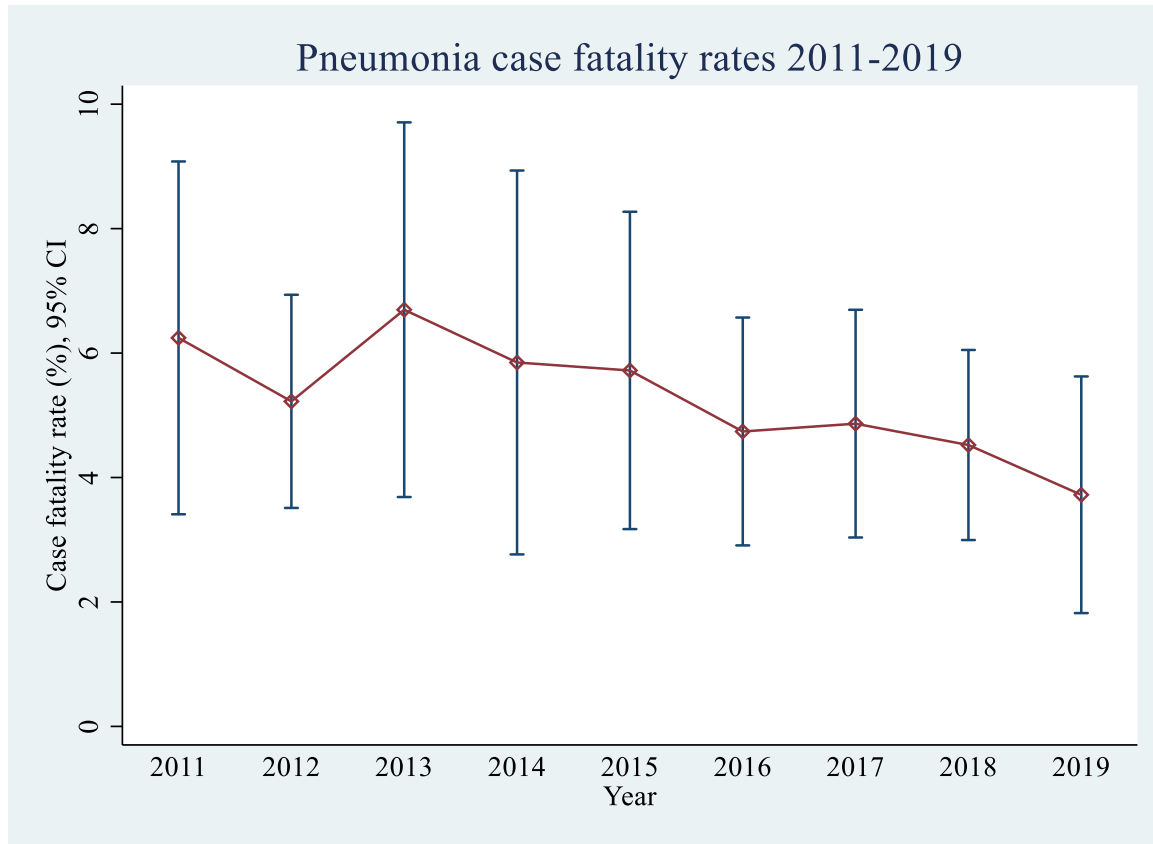
- 233 children in Malawi
- RR of death if lactate >2 mmol/L: **7.5 (1.7-32.6)**
- Sensitivity 92%
- Specificity 39%
- PPV 15%
- NPV 98%
- Multivariable analysis:
  - **Hypoxaemia**
  - **Hyperlactataemia**
  - **Age <12 months**



# Lactate predicts mortality in pneumonia



# Pneumonia outcomes in PNG – improving!









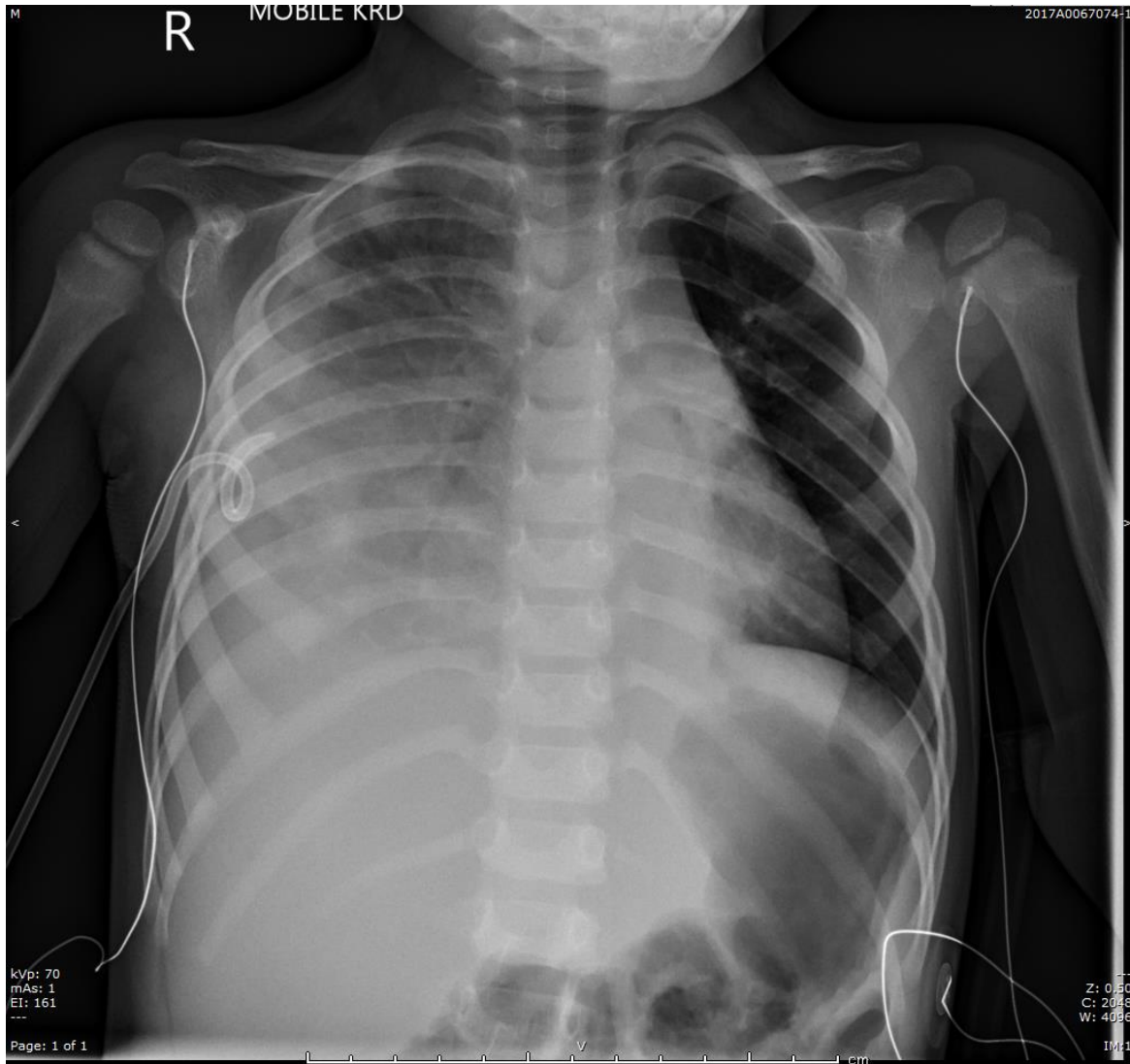
# Pneumonia complications

## Case - Kia

- 3 year old boy, previously well
- 6 days of coryza, cough, high fever
- Seen in primary care – “just a virus”
- Increased lethargy, 1 day of tachypnoea
- Mother treated for TB as a 14 year old



- High fever (T 39.5), tachycardia (175), BP 85/35, communicating but lethargic
- Treatment:
  - Oxygen
  - Ceftriaxone, flucloxacillin



Pleural aspirate:

160 ml thick serous pleural fluid

WCC 11,000, 80% neutrophils

Gram positive cocci on Gram stain of  
pleural fluid

GeneXpert - negative

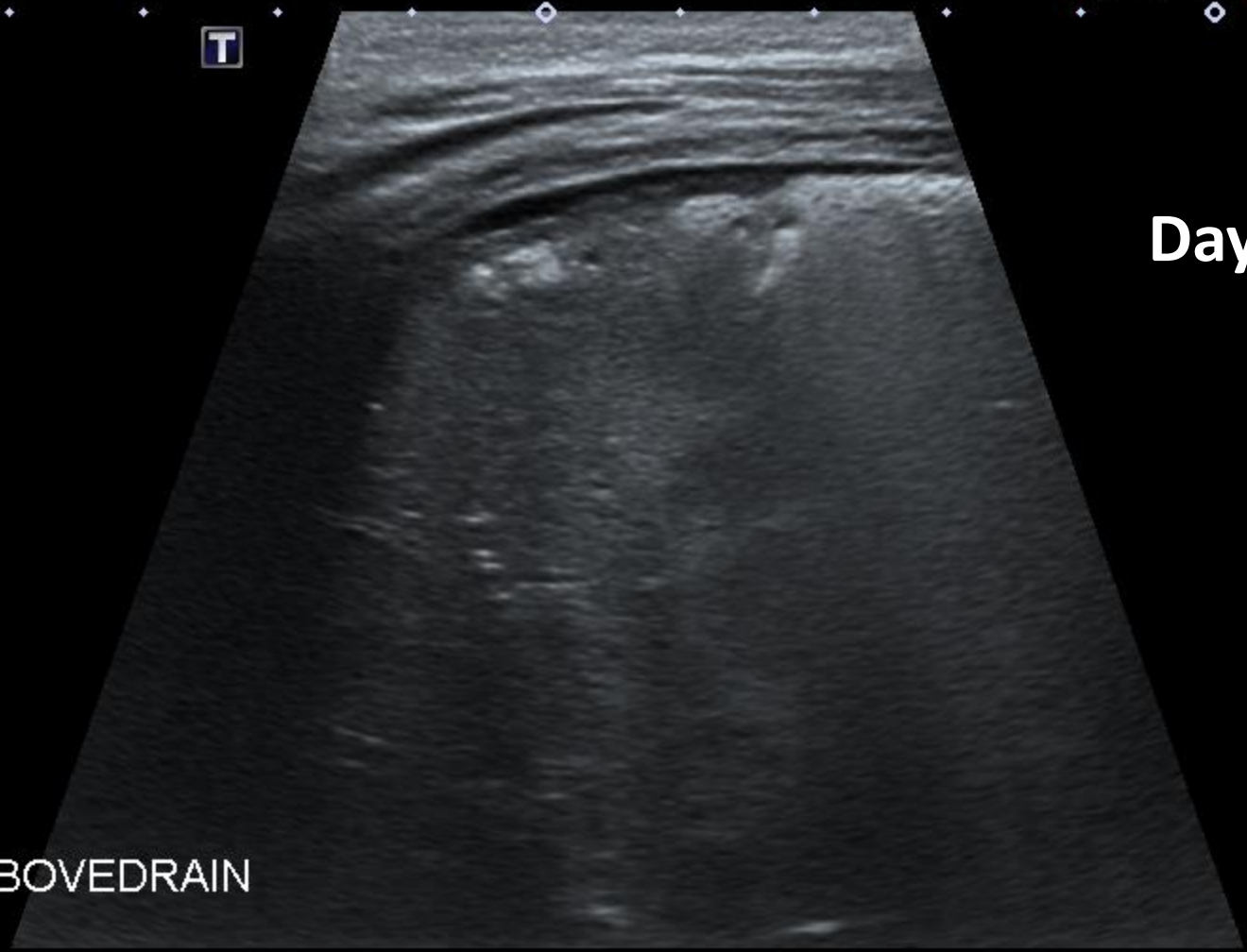
ZN stain - negative

Antibiotics: benzylpenicillin + flucloxacillin



- ◊ 0
- ◊
- ◊
- ◊
- ◊
- ◊
- ◊
- ◊
- ◊
- ◊ 5
- ◊
- ◊
- ◊ 7

T



Day 1

11L3  
diffT9.0  
35 fps  
G:85  
DR:85  
A:5  
P:5

ABOVEDRAIN

RT CHEST LATERAL S-I  
OBLIQUEI



0  
5  
9

T

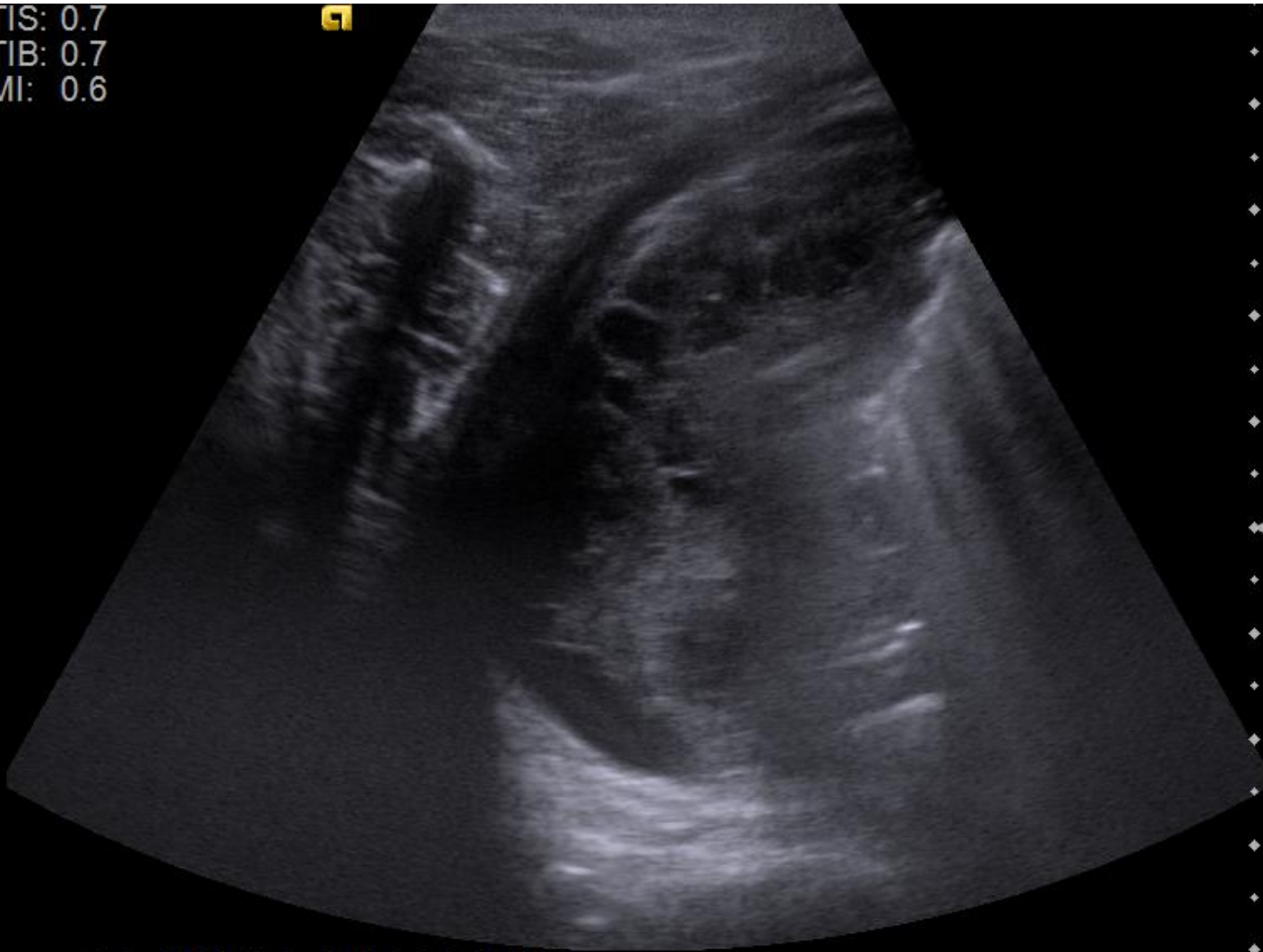


Day 1

10C3  
diff116.0  
17 fps  
G:81  
DR:75  
A:6  
P:6

RT CHEST POSTERIOR TRNS S-I

TIS: 0.7  
TIB: 0.7  
MI: 0.6



**SIEMENS**  
9L4 / \*PAED ABDO  
General  
2D \_\_\_\_\_ 100%  
THI / H7.00 MHz  
10 dB / DR 80  
SC 2 / DTCE H  
Map B / ST 3  
E 2 / P 2  
T 1 / B 0

**Day 3**

RT CHEST LAT TRANS \_

14fps 9cm

100% → Fr54



TIS: 0.7  
TIB: 0.7  
MI: 0.6



**SIEMENS**  
9L4 / \*PAED ABDO  
General  
2D \_\_\_\_\_ 100%  
THI / H7.00 MHz  
10 dB / DR 80  
SC 2 / DTCE H  
Map B / ST 3  
E 2 / P 2  
T 1 / B 0

**Day 3**

RT CHEST LAT/ANT SAG\_

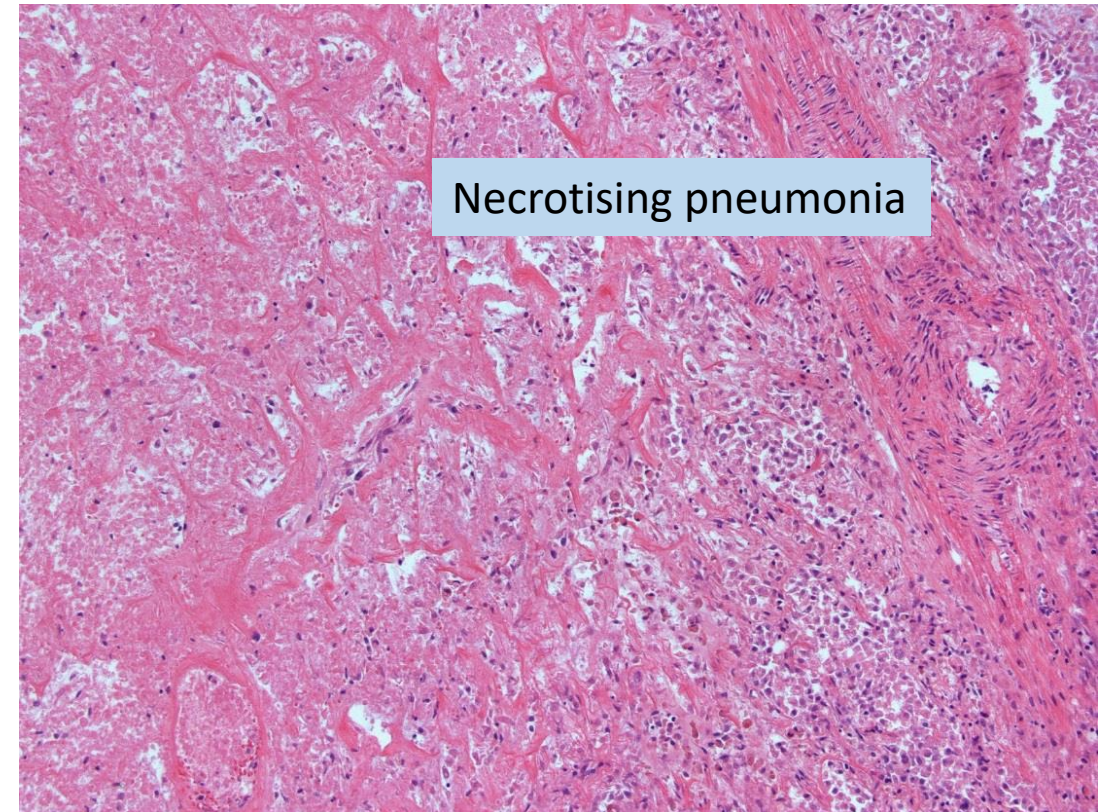
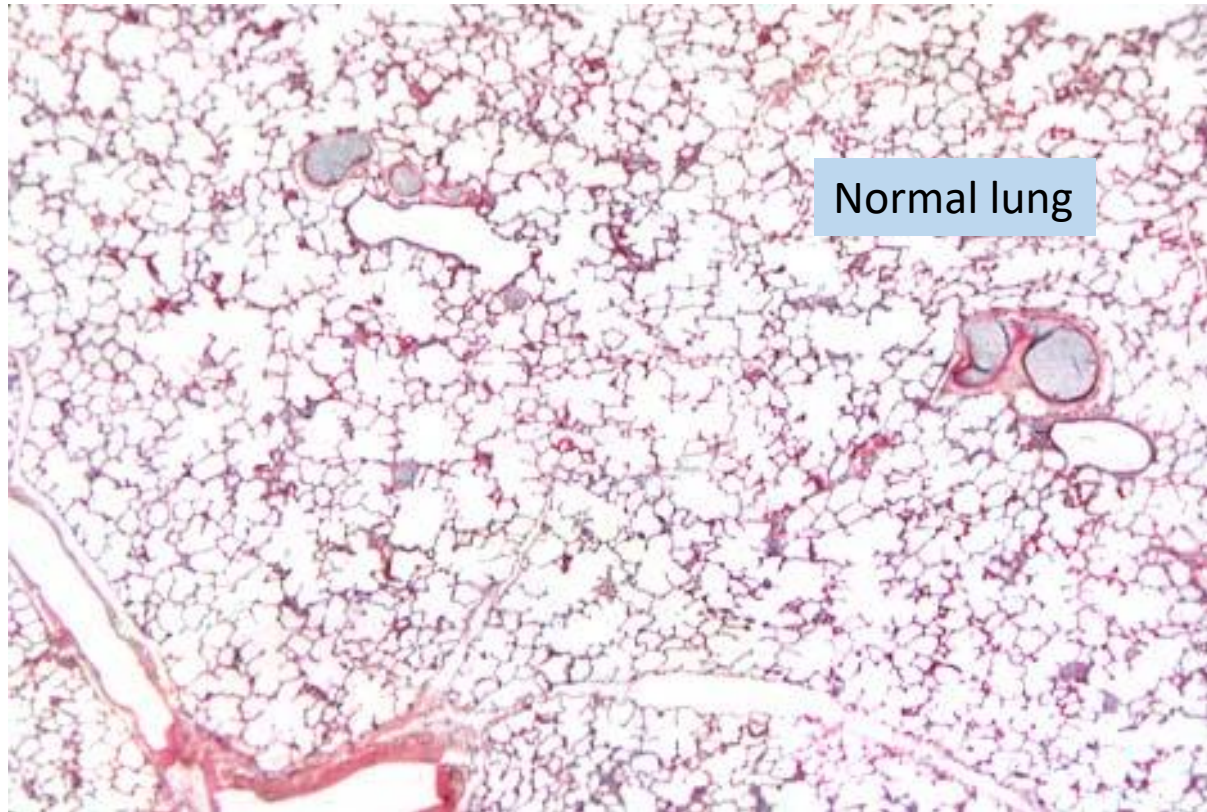
14fps 9cm

100% ← Fr79

# Necrotising pneumonia

- 6-9% of hospitalised pneumonia
- Progressive pneumonia despite appropriate therapy
- Disproportionately sick - persistent fever, respiratory distress and clinical and/or radiographic signs of a non-responding or progressive pneumonia





- Pulmonary inflammation, alveolar consolidation
- Thrombosis of intrapulmonary vessels
- Destruction of lung parenchyma resulting in multiple small, thin-walled cavities
- Empyema +/- bronchopleural fistulae

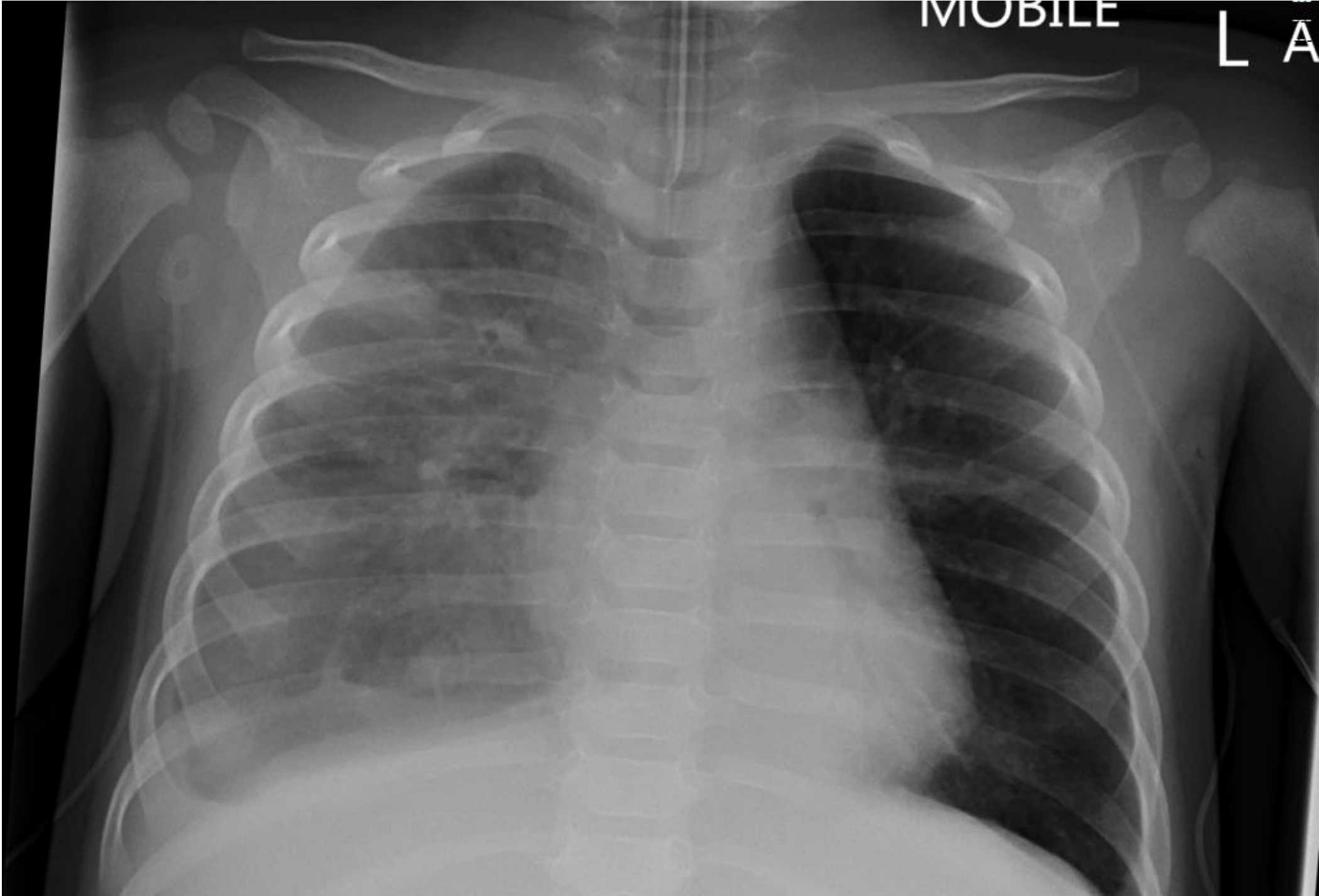
# Pathogens in necrotising pneumonia in children

- **Streptococcus pneumoniae**
- **Staphylococcus aureus**
- Streptococcus pyogenes
- S. anginosus
- Haemophilus influenzae
- Pseudomonas aeruginosa
- Stenotrophomonas maltophilia
- Fusobacterium nucleatum (anaerobic)
- Mycoplasma pneumoniae
- Legionella pneumophila
- Aspergillus species

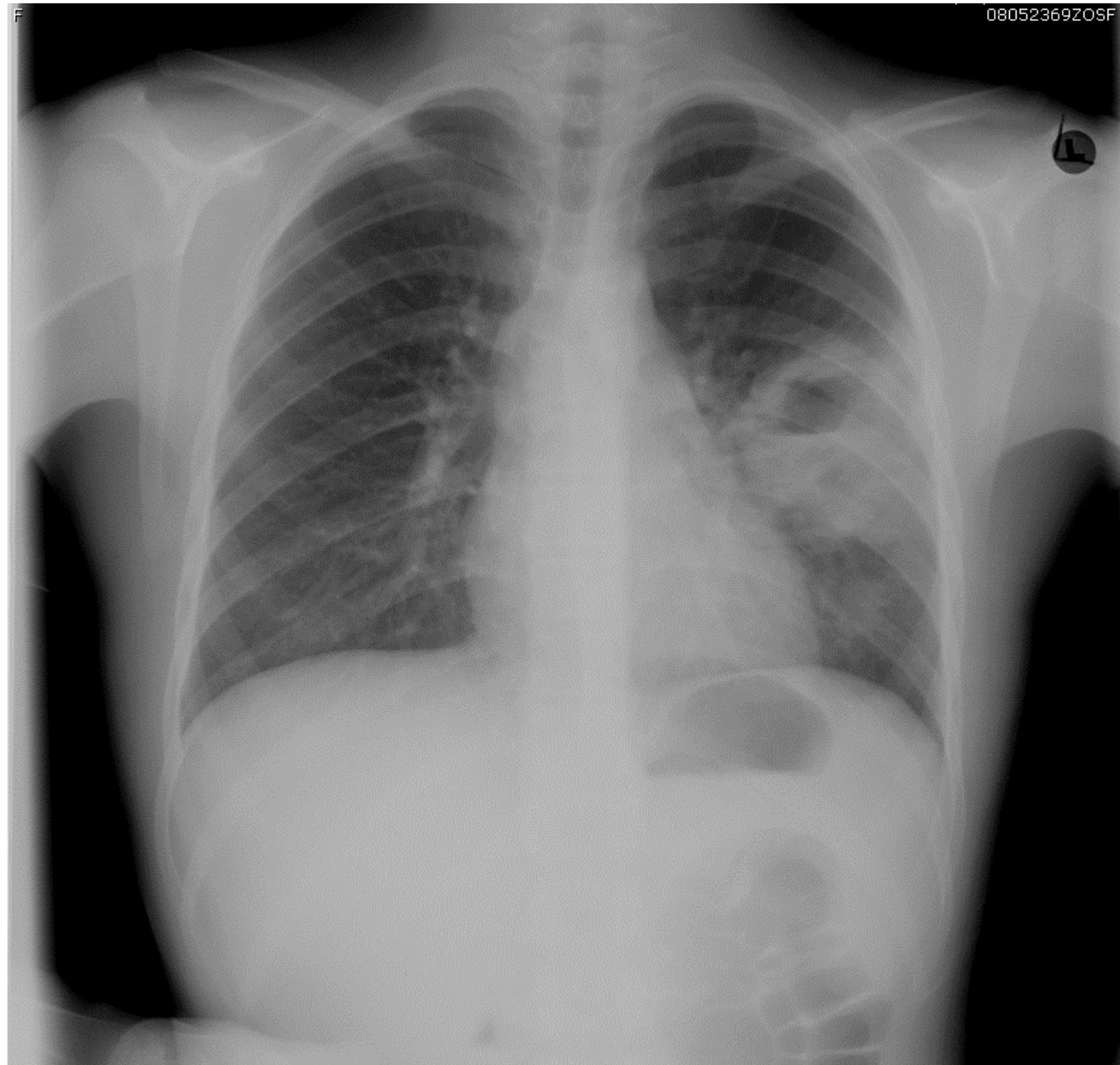


MOBILE

L A







# Comprehensive approach to pneumonia

## Prevention

- Vaccines (Hib, S. pneumoniae, measles, BCG, pertussis)
- Breast feeding and nutrition
- Zinc and vitamin A
- Reducing indoor air pollution
- Hand washing
- Prevention of HIV transmission
- Neonatal
  - Clean deliveries
  - Prevention of LBW
  - Immediate newborn care
  - STI

## Treatment

- Early recognition, care seeking
- Outpatient treatment of moderate pneumonia
- Standardised antibiotic guidelines
- Oxygen therapy, CPAP
- Monitoring and response charts
- Risk assessment
  - Hypoxaemia, emergency signs, lactate
  - Neonates, malnutrition, HIV, anaemia, comorbidity