Pediatric Community-Acquired Pneumonia: the high-income countries perspective.

Second Webinar

on behalf of ERS & PATS

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15th April 2021

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DEFINITION

WHAT IS C.A.P.?

It is a clinical diagnosis of pneumonia caused by a community acquired infection in a previously healthy child.

EPIDEMIOLOGY

- Overall **INCIDENCE**: 10-15/1000/year

Paediatr Respir Rev 2005;6:76-82

- Overall **HOSPITALIZATION RATE**: 1-4/1000/year
(both ↑↑ in < 2 yy children, but ↓ > 5 yy of age)

Acta Paediatrica 2009;98:332-336

- **MORTALITY RATE**: 0.1/1000/year
(in low-income countries 10 times greater)

Bull World Health Organ 2008;86:408-16

RISK FACTORS

- low socioeconomic levels;
- underlying chronic disease

  (e.g. sickle cell disease, bronchopulmonary dysplasia, gastroesophageal reflux, asthma, cystic fibrosis, congenital heart diseases, immunodeficiency syndromes, neuromuscular diseases, seizure disorders);
- exposition to cigarette smoking.

Pediatr Rev 2008;29:147-158

ETIOLOGY

WHY SO DIFFICULT TO REACH?

N Engl J Med 2002;346:429-437
Thorax 2002;57:1-24

- blood or pleural cultures: paucity of positive findings;
- antigenic tests (e.g. urine samples): low specificity;
- dependence of Ab response on age;
- sputum samples: difficulty to obtain in children;
- URT samples: scarce utility of culture (normal flora);
- LRT samples (e.g. lung biopsy, bronchoalveolar lavage, pleural aspiration): invasive examinations uncommonly indicated and feasible for sever cases only.

ETIOLOGY

INFLUENCING VARIABLES

- study design (specific epidemics, ambulatory / hospital setting, inclusion / exclusion criteria);
- age distribution;
- severity of disease;
- test panel for pathogens (the more tests are available, the more potential causes emerge).

Pediatr Infect Dis J 2000;19:293-8
Paediatr Drugs 2003;5:821-32

ETIOLOGY

COMMON & UNCOMMON CAUSES OF CAP IN OTHERWISE HEALTHY CHILDREN

VIRUSES	Respiratory syncytial virus (RSV), Influenza virus A or B, parainfluenza viruses 1,2 or 3, adenovirus, rhinovirus, measles virus*
ATYPICAL BACTERIA	*M. pneumoniae, C. trachomatis, C. pneumoniae*
TYPICAL BACTERIA	*S. pneumoniae, S. aureus*, H. influenzae type b*,*
M. TUBERCULOSIS	(in low-income countries)

VIRUSES	Varicella-zoster virus (VZV), coronavirus, enterovirus, cytomegalovirus (CMV), Epstein-Barr virus (EBV), mumps virus, herpes simplex virus (HSV), hantavirus
CHLAMYDIA	*C. Pittaci*
COXIELLA	*C. burnetii*
BACTERIA	*S. pyogenes, anaerobic mouth flora, non-typable H. influenzae, B. pertussis, K. pneumoniae, E. coli, L. monocytogenes, N. meningitidis, Legionella, Pseudomonas pseudomallei, F. tularensis, Brucella abortus, Leptospira*
FUNGI	Coccidioides immitis, Histoplasma capsulatum, Blastomyces dermatitidis

N Engl J Med 2002;346:429-437

ETIOLOGY

RESPIRATORY VIRUSES

- Viral ped CAP common not only in low-income *(Br Med Bull 2002;61:247-62)* but also in high-income countries *(Pediatr Infect Dis J 2008;27:939-41)*
- Respiratory viruses
  - account for 14-35% of all ped CAP cases
  - account for 30-67% of hospitalized cases
  - more frequently found in children from 4 mm to 4 yy of age
- RSV accounts for 30% of viral etiology.

Eur J Pediatr 2009;356:1429-36

ETIOLOGY

BACTERIAL CAUSES

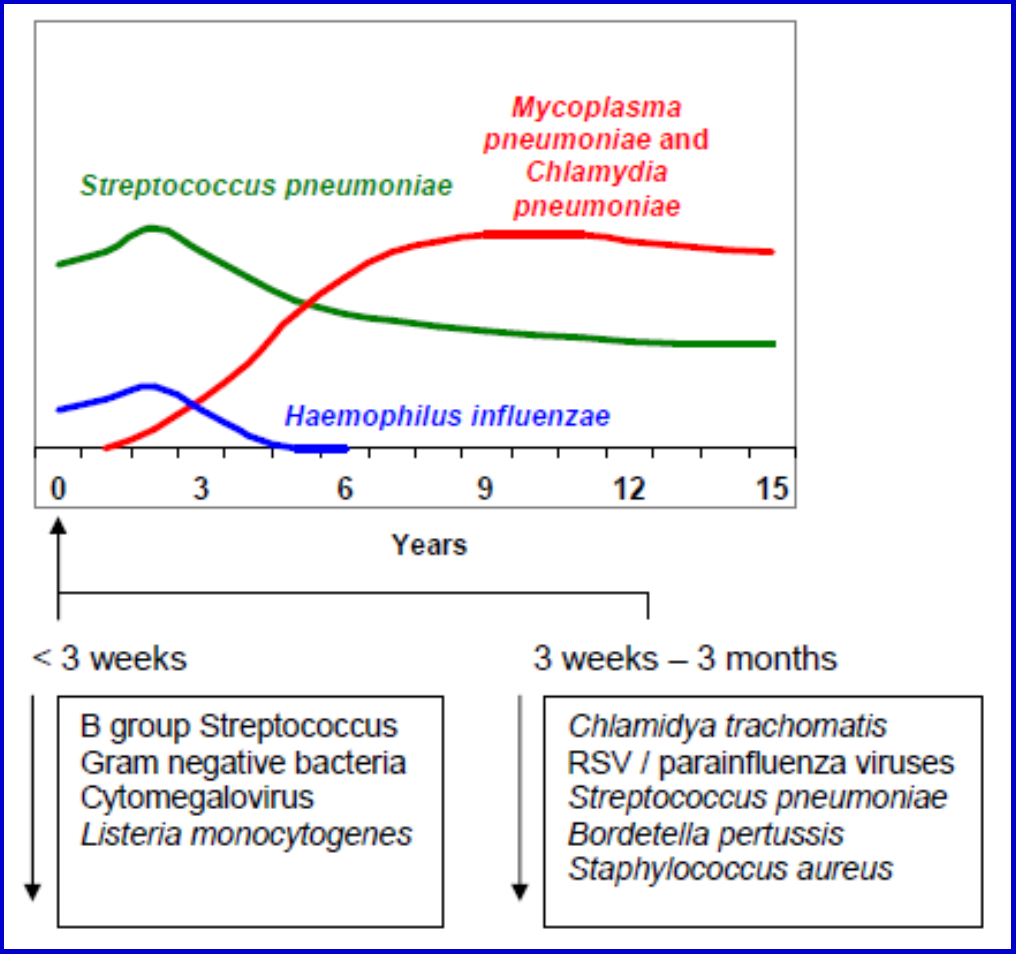
- *S. pneumoniae* is the commonest bacterial cause of ped CAP (16-40%) across all ages, followed by *M. pneumoniae* (4-39%), *C. pneumoniae* (0-20%), *H. influenzae* (5%) and *M. catarrhalis* (1.5%-3%).

Thorax 2002;57:1-24
Eur J Pediatr 2009;356:1429-36

- Typical - atypical bacteria co-infections are common→ *S. pneumoniae* and *M. pneumoniae* should be taken into account when starting antibiotics for children with CAP.

Respirology 2004;9:109-114
Arch Dis Child 2000;83:413-4

ETIOLOGY



ETIOLOGY
in relation to age

(it correctly predicts the likely etiology of CAP in children)

N Engl J Med 2002;346:429-437

CLINICAL FEATURES

- Fever
- Tachypnoea
- Breathlessness or difficulty in breathing
- Cough
- Chest and/or abdominal pain
- Vomiting
- Headache

- vary with age
- not specific for diagnosis

Thorax 2002;57:1-24

Tachypneoa as only clinical sign→ the highest sensitivity (74%) and specificity (67%) for Rx-defined ped CAP (but not in the first 3 days of illness)

Arch Dis Child 2000;82:41-45

CLINICAL FEATURES

Large overlapping of clinical findings in viral and bacterial CAP, anyway…

	Bacterial CAP	Viral CAP	Atypical CAP
Patients		Infants and young children	School children
Signs & symptoms	Cough +/-, «unwell / toxic» appearance	Wheezing	Cough, wheezing, classical signs
Fever	>38.5°C	<38.5°C	Variable
Respiratory rate	Raised	Normal or raised	
Chest wall recessions	Present	Marked	
Rx signs	Consolidation	Hyperinflation till to lobar collapse when severe	Lobar consolidation, interstitial infiltrates, hilar adenopathy

According to Thorax 2011;66:ii1-ii23, modified

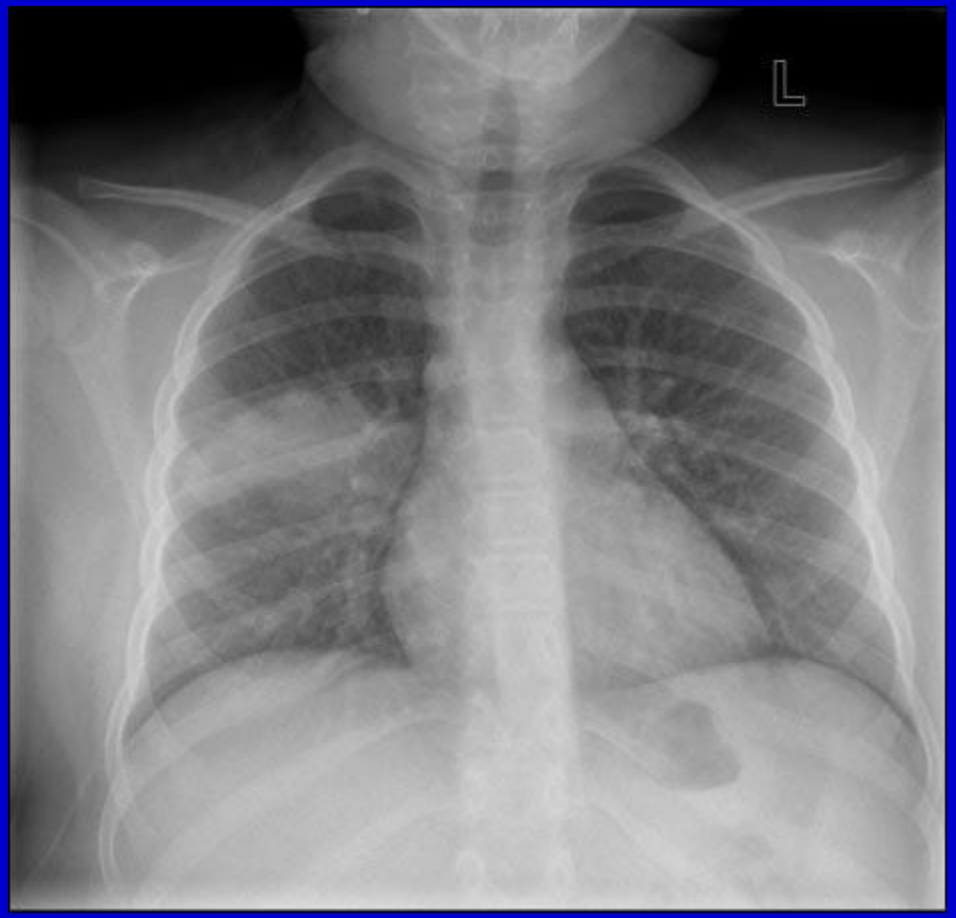
RADIOLOGICAL, GENERAL AND MICROBIOLOGICAL INVESTIGATIONS

CHEST X-RAY (CXR)

- **Not** to consider as **a routine investigation** in children thought to have CAP nor in an outpatient setting, but only in severe cases or when a complication is suspected;
- **Lateral CXR** should not be performed routinely;
- **Follow-up CXR**:
  - NO in case of previously healthy children and positive clinical course
  - YES in case of round pneumonia, collapse or persisting symptoms;
- CXR **not sensitive** to establish **CAP aetiology** (viral vs bact).

Thorax 2011;66:ii1-ii23

RADIOLOGICAL, GENERAL AND MICROBIOLOGICAL INVESTIGATIONS



CHEST X-RAY (CXR)

Radiographic findings of pneumococcal pneumonia:

- “rounded area of airspace consolidation in the superior segment of the right lower lobe;
- few air bronchograms are present medially”.

Pediatr Rev 2008;29:149-160

RADIOLOGICAL, GENERAL AND MICROBIOLOGICAL INVESTIGATIONS

LUNG ULTRASOUND (LUS)

- Present GL from EUROPE and the U.S.A.→ no LUS for the diagnosis of CAP and its use limited for pleural effusions only

Thorax 2011;66:ii1-ii23
Clin Infect Dis 2011; 53: e25−76
Thorax 2005; 60 Suppl 1: i1-21

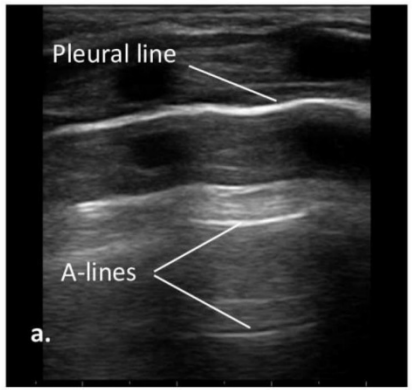
- **PRO**: simple, rapid, repeatable, non-invasive, point-of-care tool, spare of ionizing radiation, simple follow-up;
- **CONS**: aerated lung and the skeletal component of the rib cage, under pleural consolidations, areas difficult to reach (supraclavicular, axillary, subscapularis regions), sonologist's inexperience;

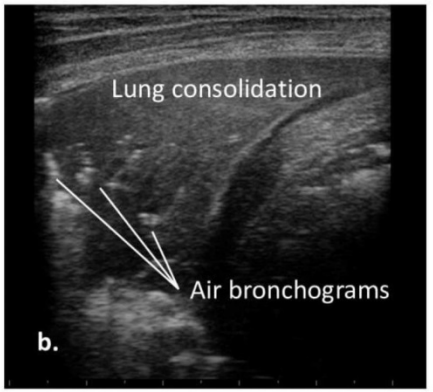
Intensive Care Med 2012; 38: 577-91
JAMA Pediatr 2013; 167: 119-125
Eur J Radiol 2014;83:1487-1494

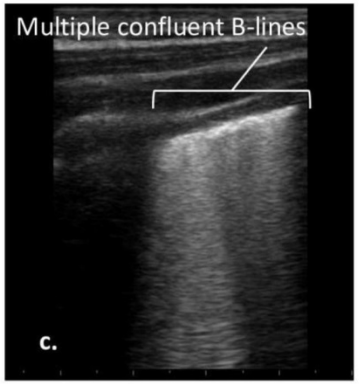
- Recent tendency to consider LUS in the diagnostic evaluation of pediatric alveolar infiltrations as an important complementary imaging tool nearby CXR

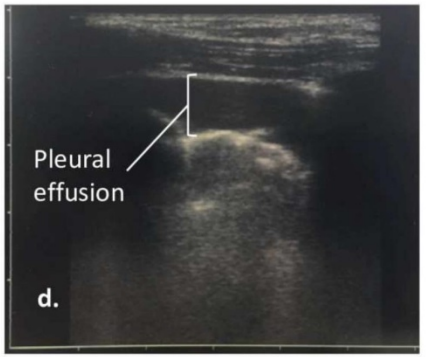
At least 22 recent references

RADIOLOGICAL, GENERAL AND MICROBIOLOGICAL INVESTIGATIONS









LUNG ULTRASOUND (LUS)

- normal lung pattern on LUS (a)
- sonographic signs for CAP (b, c, d)

Personal images

RADIOLOGICAL, GENERAL AND MICROBIOLOGICAL INVESTIGATIONS

GENERAL INVESTIGATIONS

- **history**→ underlying conditions
- **physical examination**→ assess severity
- **pulse oximetry**→ hypoxaemia correlates with death risk*
- **acute phase reactants** (wbc, ESR, PCR, PCT):
  - not useful to distinguish bacterial from viral CAP
  - not indicated in case of uncomplicated CAP
  - useful to guide and manage complicated CAP

Thorax 2011;66:ii1-ii23
** Ann Trop Paediatr 1998;18:31-40*

RADIOLOGICAL, GENERAL AND MICROBIOLOGICAL INVESTIGATIONS

MICROBIOLOGICAL INVESTIGATIONS

- **In the COMMUNITY: not** to consider as **a routine investigation**
- **In HOSPITAL:**
  - not to consider routinely in milder CAP but in severe or complicated cases;
  - **for bacterial CAP**: blood culture (+ in <10% of CAP), pleural fluid (for culture, microscopy, PCR, biochemistry, cytology), paired serology, urinary pneumococcal Ag (↑ sens, ↓ spec above all in young children), PCR (in blood, pleural fluid and resp. secretions);
  - **for atypical CAP**: paired serology, PCR;
  - **for viral CAP**: viral culture, Ag detection, paired serology, PCR (nose-throat swabs/nasopharyngeal aspirates).

Thorax 2011;66:ii1-ii23

SEVERITY ASSESSMENT

	Mild to moderate	Severe
Infants	Temperature <38.5°C Respiratory rate <50 breaths/min Mild recession Taking full feeds	Temperature >38.5°C Respiratory rate >70 breaths/min Moderate to severe recession Nasal flaring Cyanosis Intermittent apnoea Grunting respiration Not feeding Tachycardia* Capillary refill time ≥2 s
Older children	Temperature <38.5°C Respiratory rate <50 breaths/min Mild breathlessness No vomiting	Temperature >38.5°C Respiratory rate >50 breaths/min Severe difficulty in breathing Nasal flaring Cyanosis Grunting respiration Signs of dehydration Tachycardia* Capillary refill time ≥2 s

*Values to define tachycardia vary with age and with temperature.[67(ii)]

manageable safely in the community

hospital-based care

RISK FACTORS FOR HOSPITAL ADMISSION, apart from age:

- chronic conditions (eg. congenital heart disease, chronic lung disease of prematurity, chronic respiratory conditions leading to infection - CF, bronchiectasis, immunodeficiency, severe cerebral palsy);
- history of severe or recurrent pneumonia;
- parental anxiety.

Thorax 2011;66:ii1-ii23

SEVERITY ASSESSMENT

Basic MEDICAL REASSESSMENT in case of:

- **Fever**: swinging or persistent (≥48 h after treatment starts)
- **Effort of breathing** (↑ RR and chest recession)
- **Effect of breathing** (agitated and distressed child)
- Vital signs

In the community

In hospital

Thorax 2011;66:ii1-ii23

SEVERITY ASSESSMENT

CLINICAL SCENARIOS FOR TRANSFER TO P.I.C.U.:

- severe respiratory failure requiring assisted ventilation
- pneumonia complicated by septicaemia

KEY FEATURES FOR TRANSFER TO P.I.C.U.:

- failure to maintain SaO_2 >92% in FIO_2 >0.6;
- shock;
- ↑ RR and ↑ HR with clinical evidence of severe respiratory distress and exhaustion, with or without a ↑ $PaCO_2$;
- recurrent apnoea or slow irregular breathing.

Thorax 2011;66:ii1-ii23

GENERAL MANAGEMENT IN…

…COMMUNITY

- management of fever;
- identifying signs of:
  - dehydration
  - deterioration
  - complication;
- "safety net";
- written info on clinical course;
- follow-up appointment.

…HOSPITAL

- idem for community plus…
- **oxygen therapy** (when SaO2 <92% in ambient air)
- **fluid therapy** along with daily **electrolyte monitoring** in case of:
  - breathlessness
  - emesis
  - severely illness condition.

Thorax 2011;66:ii1-ii23

ANTIBIOTIC MANAGEMENT

GENERAL CONSIDERATIONS

- **All children** with a clear diagnosis of CAP should receive an **antibiotic** course;
- **Potential exception**: CAP, in a fully vaccinated child ≤ 2 years old (anti-pneumo included), with mild symptoms, is unlikely to be bacterial, so antibiotics are not required, unless symptoms become more severe.

ANTIBIOTIC CHOICE

- **Amoxicillin**: first line therapy (macrolides as first line in penicillin allergy)
- **Co-amoxiclav***: pneumonia associated with influenza
- **Macrolides** can be added at any age if:
  - no response to first line therapy;
  - suspected *Mycoplasma* or *Chlamydia* etiology;
  - severe disease.

** Pediatrics 2008;122:805-811*
Thorax 2011;66:ii1-ii23

ANTIBIOTIC MANAGEMENT

ROUTE OF ADMINISTRATION

- **Oral antibiotics**: safe and effective, with even severe CAP.
- **Intravenous antibiotics** in case of:
  - concerns about oral absorption (vomit);
  - signs of septicaemia or complicated pneumonia.
- **Recommended intravenous antibiotics for severe pneumonia** (to be rationalised after a microbiological diagnosis)**:** amoxicillin, co-amoxiclav, cefuroxime, cefotaxime or ceftriaxone.

SWITCH AND DURATION OF ANTIBIOTIC THERAPY

- **switch from iv to os**: only when clear evidence of clinical improvement;
- **optimal duration**: 3-5-7 days *(depending on literature's evidences)*

Thorax 2011;66:ii1-ii23

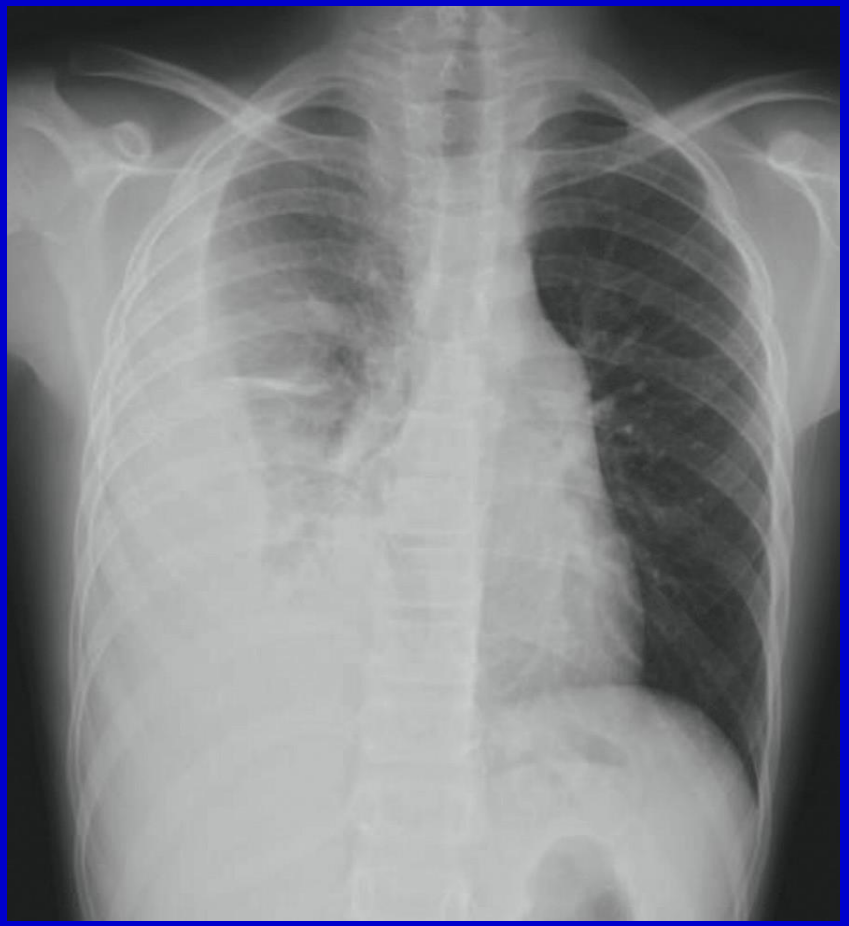
COMPLICATIONS AND FAILURE TO IMPROVE

EMPYEMA

- **epidemiology**: the most common complication;
- **risk factors**: age >3 yy, recent varicella infection;
- **symptoms**: persistent fever >7 days, fever not settling after 48 h of antibiotic therapy, pleuritic chest pain, severe CAP symptoms;
- **signs** (evidence of effusion): ↓ chest expansion, dullness on percussion, ↓ or ø breath sounds, ± cyanosis;
- **investigations**: LAB, microbiology, CXR, LUS, possible chest TC;
- **treatment**: referral to tertiary centre, high dose IV antibiotic, ± thoracentesis or decortication, ± fibrinolytic therapy, oral antibiotics for further 1-4 weeks.

Thorax 2005;60(Suppl 1):i1e21
Thorax 2011;66:ii1-ii23

COMPLICATIONS AND FAILURE TO IMPROVE



EMPYEMA

CXR of large right-sided pleural effusion complicating CAP.

Lancet 2020;396:786-798

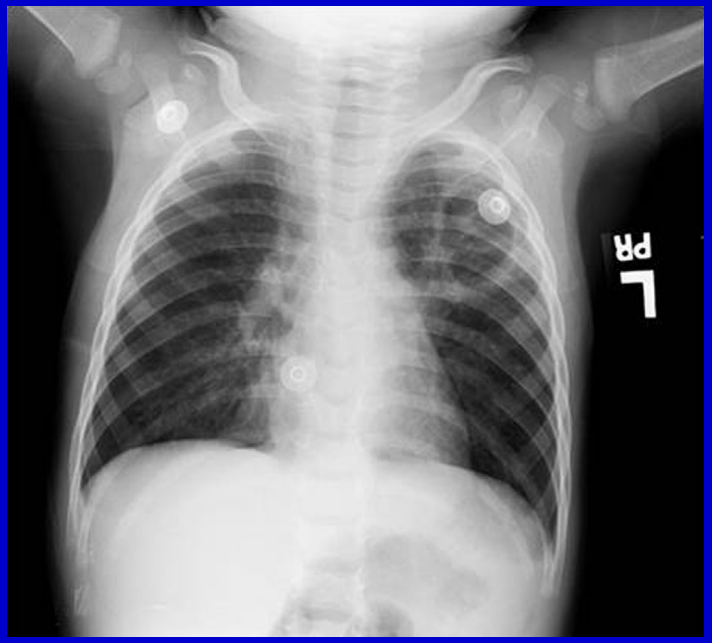
COMPLICATIONS AND FAILURE TO IMPROVE

NECROTIZING PNEUMONIA

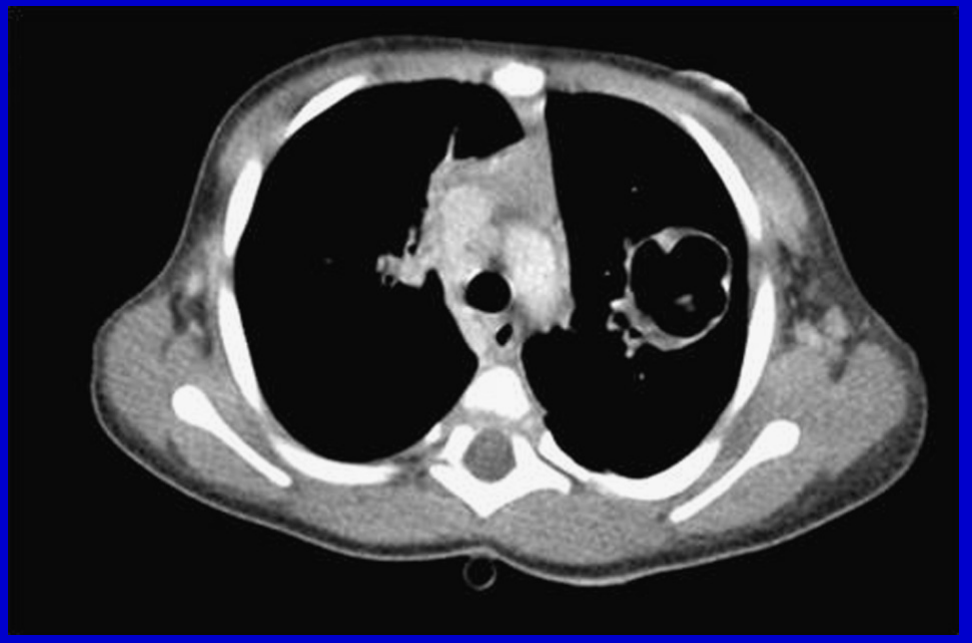
- **epidemiology**: rare complication;
- **risk factors**: congenital lung abnormalities, bronchiectasis, immunodeficiency, neurological disorders, Staphylococcal aureus with PVL toxin;
- **symptoms**: insidious onset, persistent fever, night sweats;
- **signs:** productive foul smelling sputum, weight loss, pleuritic chest pain;
- **investigations**: LAB, microbiology, CXR→ chest TC;
- **treatment**: referral to tertiary centre, high dose IV antibiotics (2-3 week course), prolonged oral antibiotic course ± surgical intervention.

Am J Roentgenol 1998;170:1627-31
Clin Infect Dis 2007;45:315-21
J Pediatr Surg 2002;37:643-7
Thorax 2011;66:ii1-ii23

COMPLICATIONS AND FAILURE TO IMPROVE



CXR: cavitary lesion in the left upper lobe with peribronchial thickening and areas of perihilar atelectasis in the right upper and right middle lobes.



Axial chest CT scan (mediastinal window): large cavitary lesion in the left upper lobe.

Pediatr Emerg Care 2017;33:112-115

COMPLICATIONS AND FAILURE TO IMPROVE

OTHER CAP COMPLICATIONS

- **septicaemia and metastatic infection** (osteomyelitis or septic arthritis, above all by *S. aureus*);
- **haemolytic uraemic syndrome** (suspect in case of paleness, anaemia, anuria; above all by *S. pneumoniae*);
- **bronchiectasis** (following severe or complicated CAP).

Thorax 2011;66:ii1-ii23

PREVENTION AND VACCINATION

Vaccination→ major impact on pneumonia and child mortality worldwide

Bull World Health Organ 2008;86:365-72

Pneumococcal conjugate vaccine (PCV)
PCV13→ wider coverage and more effective prevention than PCV7 against pneumococcal carriage and mucosal (AOM and CAP) as well as invasive (IPD) pneumococcal diseases.

J Immunol Res 2015;2015:591580

Haemophilus influenzae type B (Hib) conjugate vaccine
summary effect on clinical pneumonia of 4%, on clinical severe pneumonia of 6% and on radiologically confirmed pneumonia of 18%.

Int J Epidemiol 2010; Suppl 1:i172-85

THE END

THANK YOU
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DANKE
TERIMA KASIH
DANK U
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OBRIGADO

REDUCING THE BURDEN OF COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN WHAT INTERVENTIONS WORK?

Ameena Goga
HIV Prevention Research Unit, SAMRC
Department of Paediatrics, University of Pretoria

saMRC advancinglife

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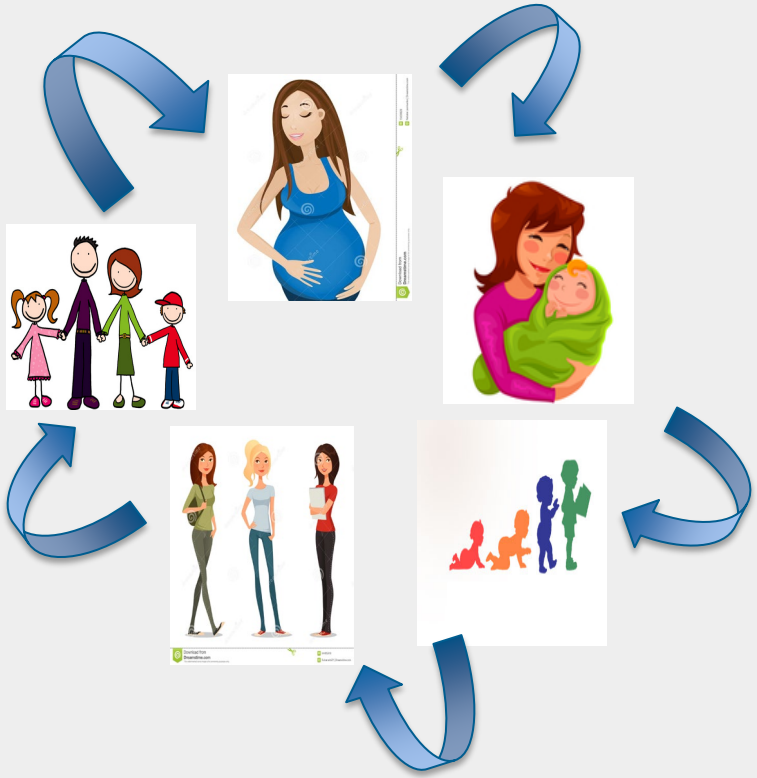
OUTLINE OF TALK

- Context
- Interventions for prevention of pneumonia:
  - Community/Public level
  - Primary health care level
  - Hospital level
- Summary
- Framework to reduce burden of CAP in children



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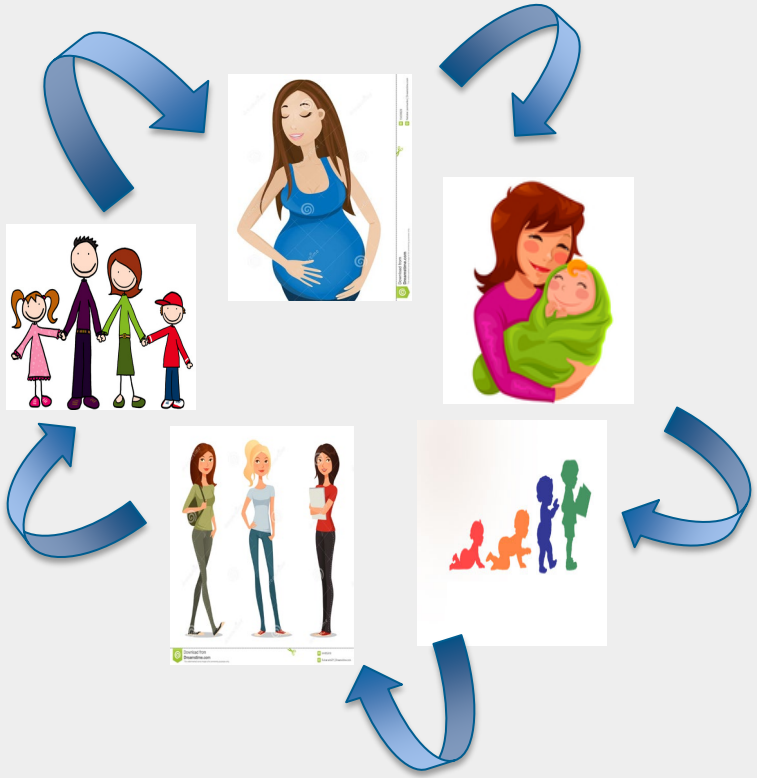
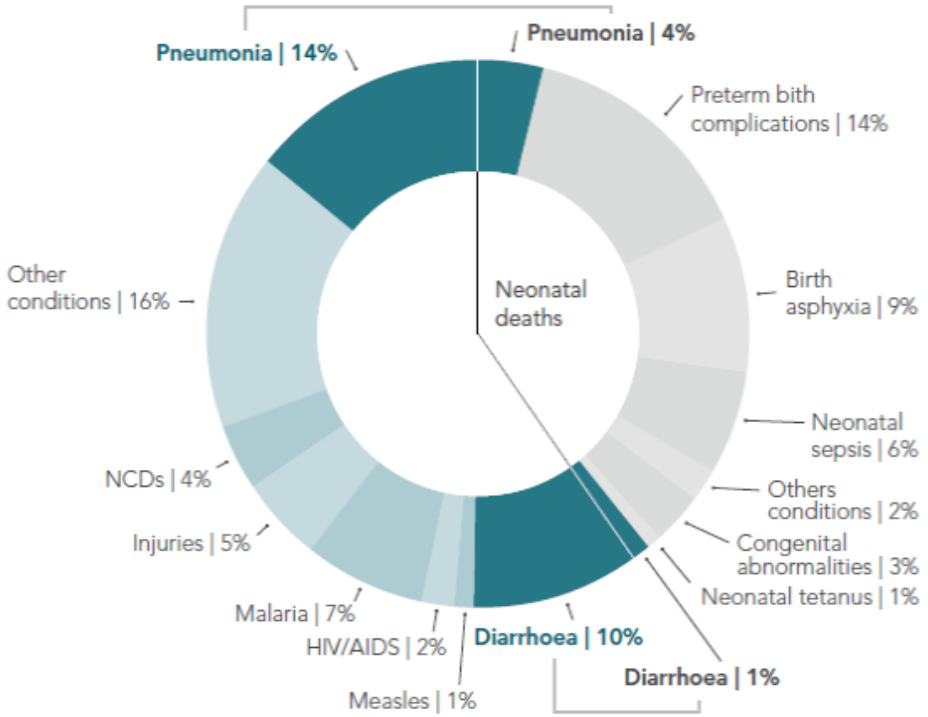


MORTALITY FROM CHILDHOOD PNEUMONIA



Thirty-five percent of deaths in children less than five years of age are associated with malnutrition.'

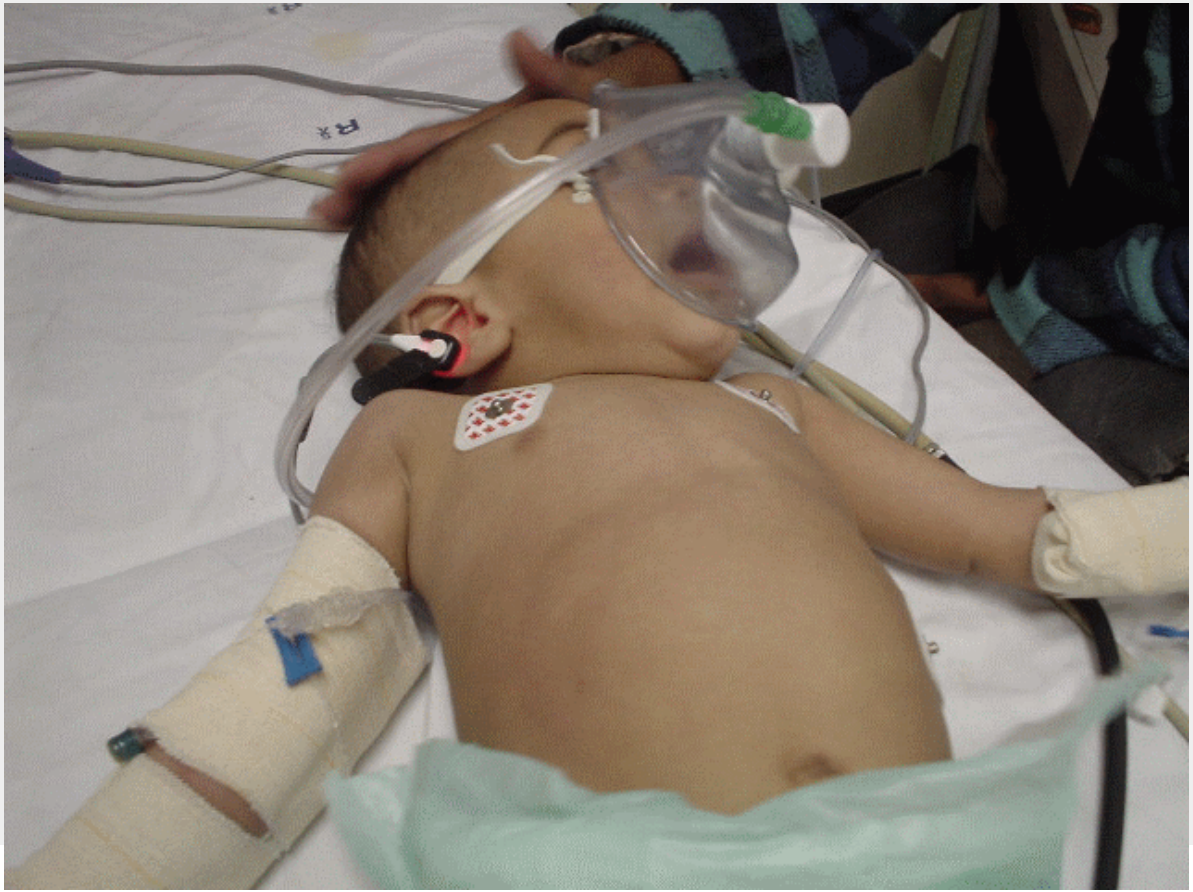
Sources: WHO Global Health Observatory (http://www.who.int/gho/child_health/en/index.html) and 'Black R et al. *Lancet*, 2008, 371:243-260 (5, 6)

2017: 15% of under-5 deaths

Killing ≈800 000 children

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1

CHILDHOOD PNEUMONIA AND LIFE-LONG MORBIDITY



Major sequelae:

Risk:

- 6% after ambulatory event.
- 14% after hospitalization

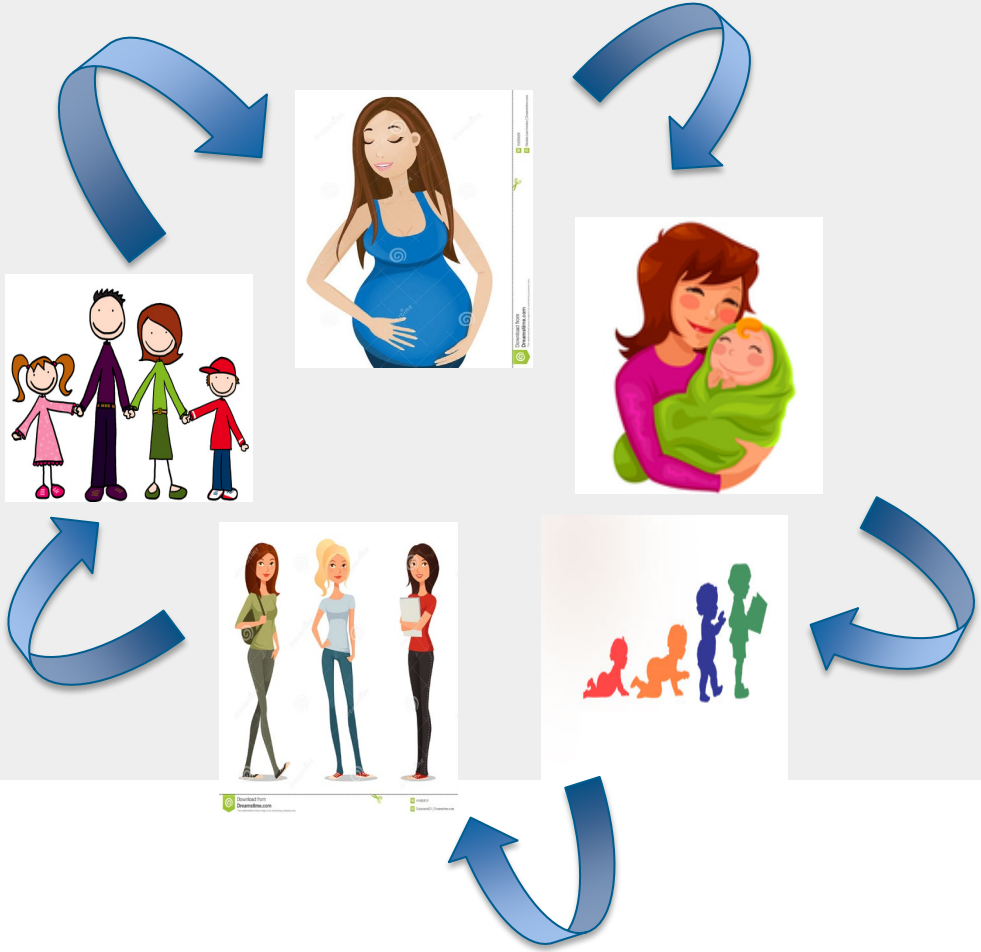
restrictive lung disease, obstructive lung disease, bronchiectasis

Minor sequalae:

chronic bronchitis, asthma, abnormal lung function.

Gray 2016, Svanes 2010, deMarco 2011, Edmond 2012

LIFE CYCLE APPROACH TO PREVENTING CHILDHOOD PNEUMONIA



OUTLINE OF TALK

- Context: Pneumonia burden
- Primary, secondary and tertiary prevention of pneumonia at 3 levels of care :
  - Community/Public level
  - Primary health care level
  - Hospital level
- Summary
- Framework to reduce burden of CAP in children

PRIMARY PNEUMONIA PREVENTION: FEEDING

Intervention	Evidence
Exclusive breastfeeding (EBF) for 6 months 	**23%** reduction in **pneumonia incidence** (Niessen 2009). **Compared with EBF at 0-5 months:** • **1.8x** increased **pneumonia incidence** with predominant breastfeeding (Black 2008) • **2.5x** increased pneumonia mortality with partial breastfeeding (Black 2008)
Continued BF from 6-23 months	3.7x increased risk of all-cause mortality with no breastfeeding at 6-23 months (Black 2008)
Adequate complementary feeding from 6-months	6% reduction in all child deaths, including pneumonia (Jones 2003)

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1, Niessen 2009,

PRIMARY PREVENTION OF PNEUMONIA: MICRONUTRIENTS

Intervention	Comment
Vitamin A supplementation	23% reduction in all cause mortality (Beaton 1993)
Vitamin D	Vitamin D-deficient children are at increased risk for CAP, supplement with vitamin D 400 IU daily
Zinc	Zinc 10 mg (for infants) and 20 mg (for older children) daily significantly reduces the risk of pneumonia particularly in malnourished children

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1, Niessen 2009, Zar 2020

PRIMARY PREVENTION OF PNEUMONIA

Intervention	Comment
Hand hygiene	Infuenza, RSV, SARS-CoV-2
Environmental decontamination	
Isolation of infected people	
Reducing household air pollution and improving living conditions	Halving household air pollution exposure through a chimney stove reduced severe pneumonia by 33%. Large exposure reductions may further reduce risk **(Smith 2008)**
Maternal care	Optimising maternal health from pregnancy onwards including adequate antenatal care

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1, Niessen 2009, Zar 2020

PNEUMONIA PREVENTION: IMMUNISATION

Immunisation	Comment
BCG vaccination	Birth BCG vaccine prevents disseminated TB in young children average effectiveness 50%; range 0 - 84% effectiveness
Measles vaccination	85% effective to prevent pneumonia before age 1 year
Hib vaccination	6% reduction in severe pneumonia; 18% non-significant reduction in radiologically confirmed pneumonia and 7% reduction in mortality **(Theodoratou, 2010)** with a 23-35% reduction in incidence of radiological pneumonia **(Niessen 2009),**

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1, Niessen 2009, Zar 2020

PNEUMONIA PREVENTION: IMMUNISATION

Immunisation	Comment
PCV vaccination	**Childhood pneumonia mortality:** • 30% effectiveness of PCV in reducing overall **(Webster 2001),** • 18% non-significant reduction in pneumonia specific mortality **(Bhutta 2013)** 29% significant reduction in **radiologically confirmed pneumonia** 11% reduction in **severe pneumonia**
Influenza vaccine 	Annually for children ≥6 months of age at risk for severe influenza, including those with congenital cardiac disease, chronic lung disease, immunosuppression and neuromuscular disease

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1, Niessen 2009, Zar 2020

PRIMARY PNEUMONIA PREVENTION

Prophylaxis	Comment
HIV prevention in children	2% reduction in child deaths **(Jones 2003)**
ARVs in HIV infected children	
Cotrimoxazole prophylaxis for HIV-infected children	22% reduction in AIDS deaths **(Stover 2010)**
TB prevention	• INH 10 mg/kg × 6 months if household TB exposure • HIV infected or underlying immunosuppression with a positive tuberculin skin test - INH × 6 months. This may also be considered for children newly diagnosed with HIV. (max dose 300mg)
RSV prevention	Targeted Palivizumab if limited stock: ex-prems<6 months old, congenital cardiac disease or chronic lung disease <1 year of age monthly during RSV season

WHO. Ending preventable deaths from pneumonia and diarroea: , https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1, Zar, SAMJ 2020

SECONDARY PREVENTION OF PNEUMONIA

Know your counts
Know HOW to count
LOOK
Train Mentor Supervise

Age	Rate
<2 months	60 breaths or more per minute
2 months-12 months	50 breaths or more per minute
12 months to 5 years	40 breaths or more per minute

Challenges: Over-diagnosis: Causes of tachypnoea:

- Decreased compliance of resp apparatus
- Metabolic acidosis
- Fever (5-7 bpm increase per degree >37)
- Anaemia
- Intoxication
- Anxiety
- Psychogenic hyperventilation
- Respiratory rate >40 breaths/min - not strongly associated with pneumonia diagnosis.

http://apps.who.int/iris/bitstream/10665/43640/1/9280640489_eng.pdf, Shah JAMA 2017

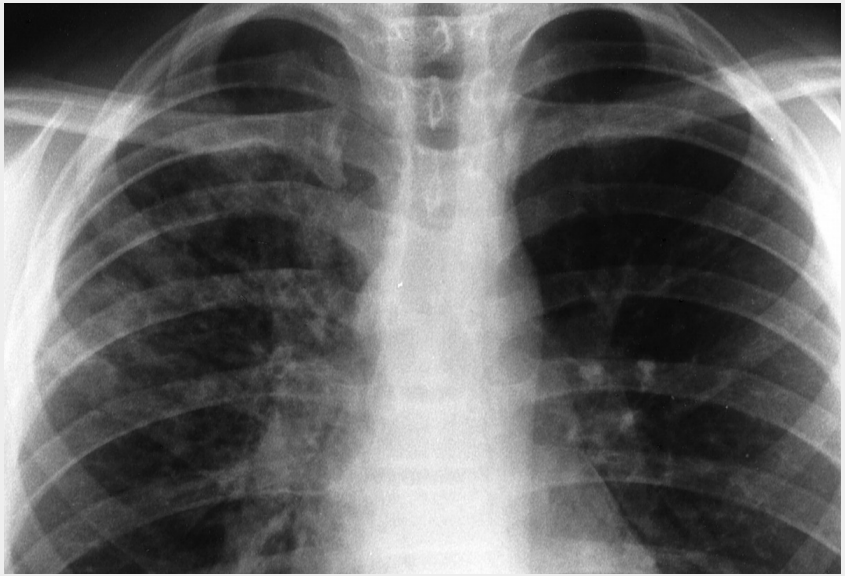
PULSE OXIMETRY

- ✓ Rwanda: Oxygen saturation better than respiratory rate (ROC 0.68 versus 0.58) p = 0.588
- ✓ Malawi 2012-2014

  Oximetry:
  - increased the referral rate for severely hypoxemic children without chest indrawing or danger signs.
  - increased correctly treated severe cases
  - reduced incorrect treatment with antibiotics.
  - WHO guidelines failed to identify severely hypoxemic children identified on oximetry

Carvalho. Jnl de Pediatra. 2019
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7094337/pdf/main.pdf
McCollum et.al. (2016) Bull World Health Organ.2016;94:893---902

CHEST XRAY: REFER FOR SPECIFIC INDICATIONS



Indications:

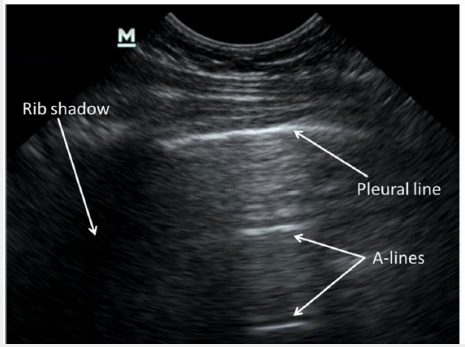
- Hospitalization
- severe hypoxemia or respiratory distress
- failed initial antibiotic therapy
- suspected other diseases (tuberculosis, inhaled foreign body) or complications.

Challenges:

- wide inter- and intraobserver variability,
- differing radiologic manifestations
- possible lack of sensitivity and specificity

Le Roux and Zar 2017

ULTRASOUND



- ✓ radiation free
- ✓ fewer regulatory requirements
- ✓ relatively lower cost than Xray and available at the bedside
- ✓ can scan on caregivers lap or breastfeeding
- ✓ good pooled sensitivity (96% (94-97) and specificity (93% 90-96%) in meta-analysis and good kappa (0.64-0.89)

Challenges:

- ***needs skilled users – training (1 hr-7 days) with supervision and mentorship***

Stadler et.al. 2017: Pediatr Radiol (2017) 47:1412–1419 DOI 10.1007/s00247-017-3910-1

EVIDENCE FOR INTERVENTIONS TO TREAT PNEUMONIA (TERTIARY PREVENTION)

Intervention	Comment
Health facility management for very severe pneumonia and vulnerable groups	• 29-45%reduction in case fatality (Niessen 2009), • 6% reduction in all child deaths (Jones 2003)
Antibiotics for the management of neonatal pneumonia	Oral or injectable antibiotics at home or in facility and in-patient care reduced all cause neonatal mortality by 25% and neonatal pneumonia mortality by 42% (Bhutta 2013)

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1

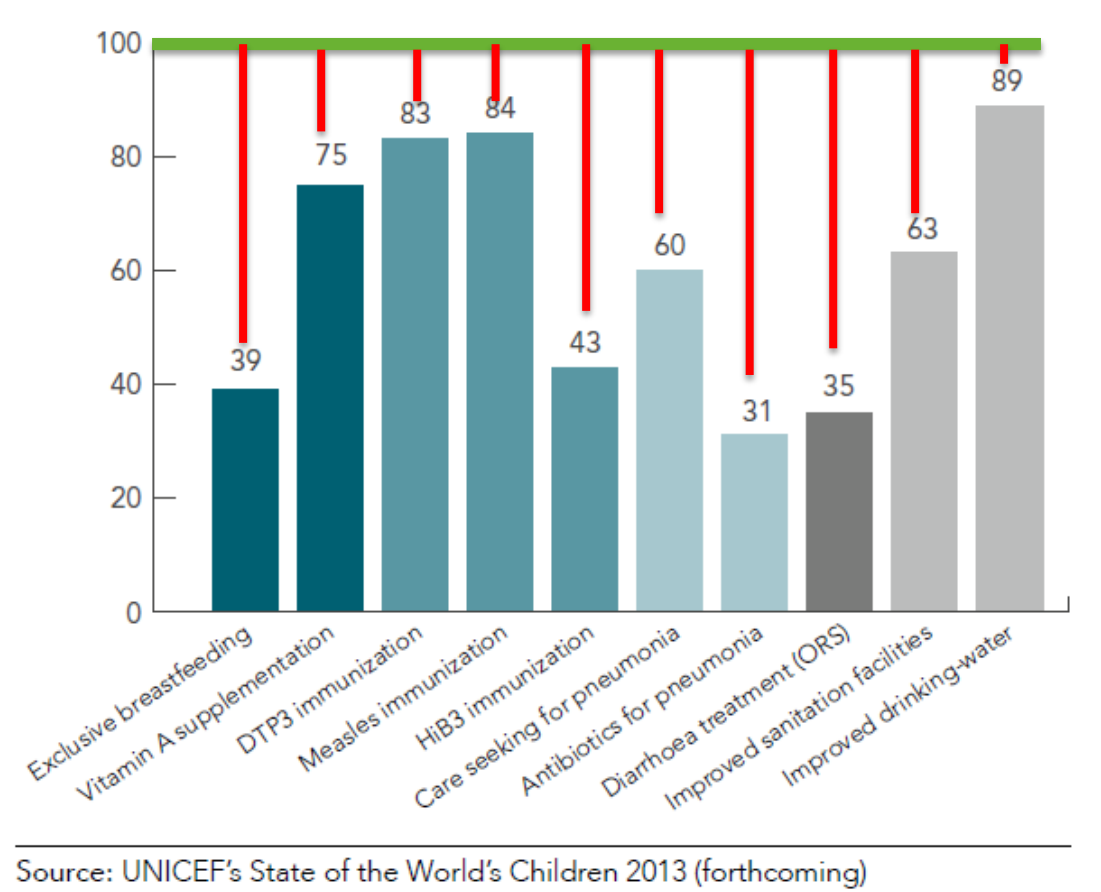
EVIDENCE FOR INTERVENTIONS TO TREAT PNEUMONIA (TERTIARY PREVENTION)

Intervention	Evidence
Community-based case management of pneumonia	reduces pneumonia mortality by 70% (Theodoratou 2010)
Zinc	Associated with a 14-15% reduction in pneumonia incidence (Niessen 2009); 22% reduction in AIDS deaths
Oxygen saturation monitoring and oxygen availability	Pulse oximetry to detect hypoxaemia + oxygen therapy significantly reduced severe pneumonia mortality by 35% (Duke 2008)

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1

COVERAGE GAPS

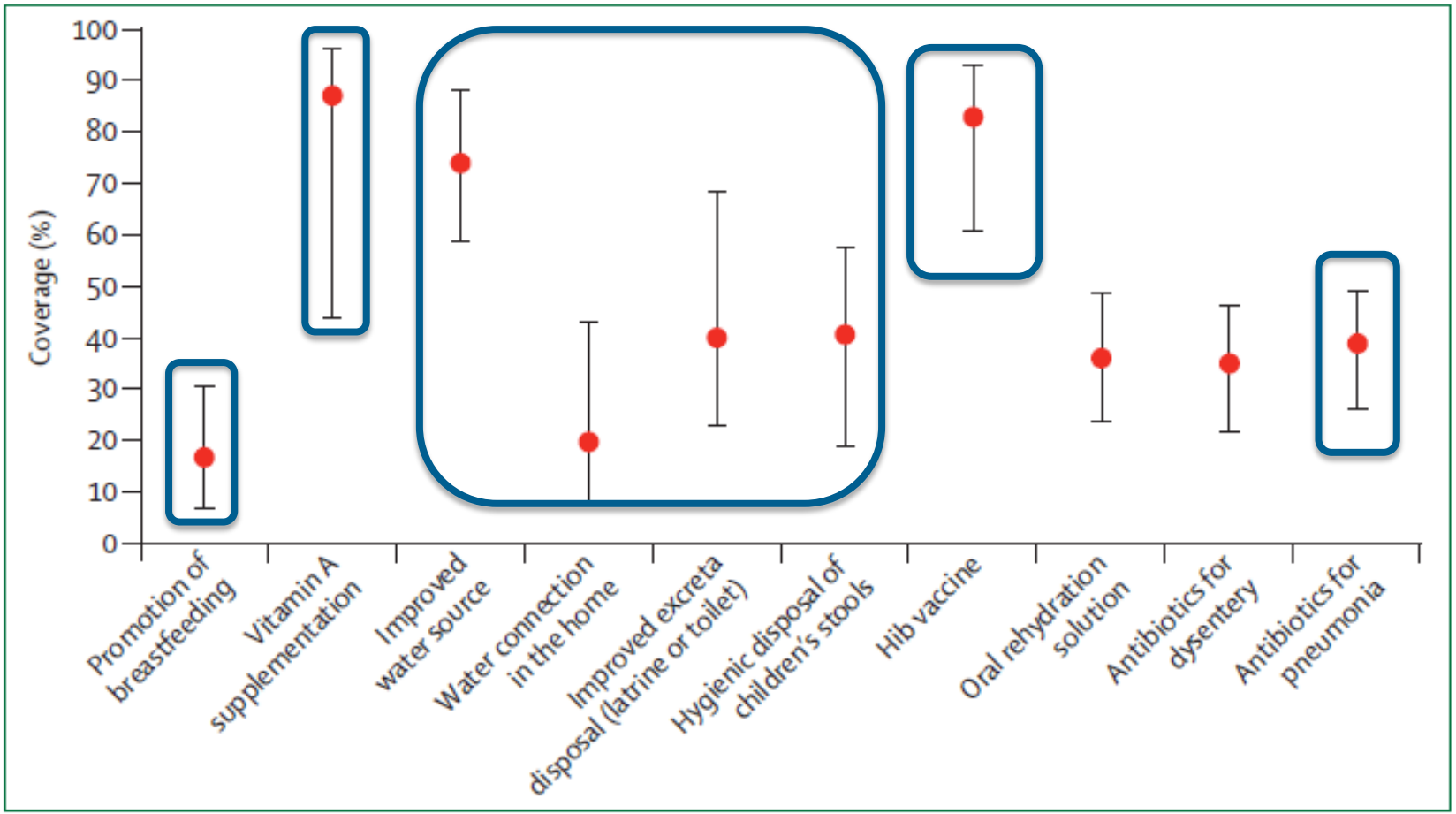
gap



Source: UNICEF's State of the World's Children 2013 (forthcoming)

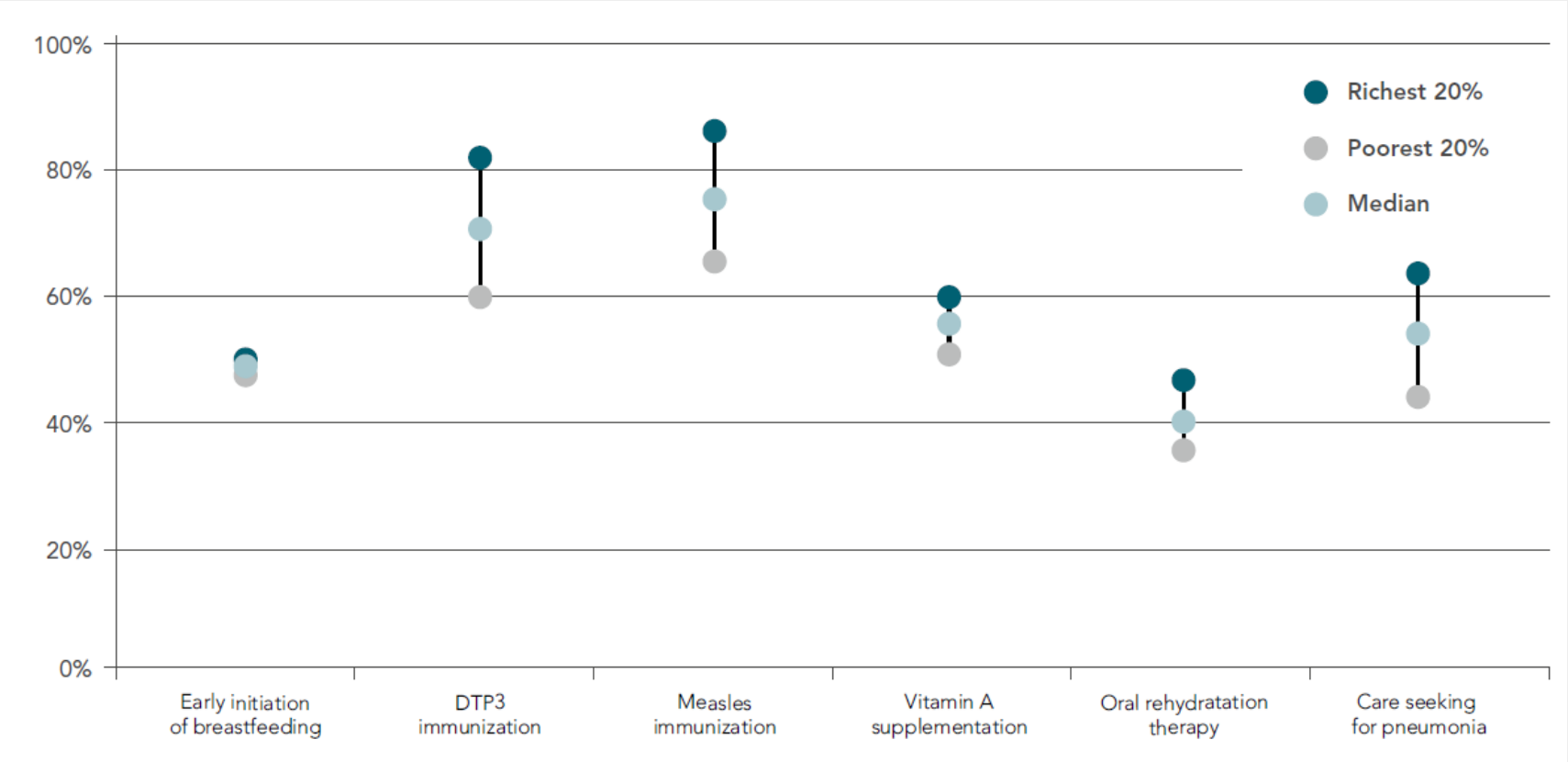
WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1

COVERAGE GAPS



Bhutta 2013

COVERAGE INEQUITY BY INTERVENTION



Source: The Countdown to 2015 equity database

WHO. Ending preventable deaths from pneumonia and diarroea: https://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf?sequence=1

12 Indicators	Definition	Source of data
Hib immunization coverage	% aged 12-23 months who received 3 doses of Hib vaccine	WHO/UNICEF estimates
Measles immunization coverage	% aged 12-23 months immunized with measles-containing vaccine	WHO/UNICEF estimates
DTP3 immunization coverage	% aged 12-23 months who received 3 doses of DTP3 vaccine	WHO/UNICEF estimates
PCV immunization coverage	% aged 12-23 months who received 3 doses of PCV	WHO/UNICEF estimates
EBF for 6 months	% infants 0-5 months who are exclusively breastfed	DHS, MICS, national nutrition surveys
Continued breastfeeding at 1 year	Proportion of children 12-15 months of age who are fed breastmilk	DHS, MICS, national nutrition surveys
Complementary feeding	% children 12-23 months who received a minimum acceptable diet	DHS, national nutrition surveys
Vitamin A supplementary coverage	% children 6-59 months who received 2 annual doses	DHS, MCS
Care seeking for pneumonia	% children 0-59 months with suspected pneumonia taken to an appropriate health care provider	DHS, MCS
Antibiotic treatment for pneumonia	% children aged 0-59 months with suspected pneumonia receiving appropriate antibiotics	DHS, MCS, surveys
ARV prophylaxis amongst HIV positive pregnant women to prevent MTCT	% HIV infected pregnant women who receive ARVs	MCS, national surveys
Household air pollution	% households using clean fuels for cooking	WHO household energy database, HS, living standards measurement study, national surveys and censuses

IF 15 INTERVENTIONS ARE SCALED UP

1. Improved water source
2. Hand washing with soap
3. Improved sanitation
4. Hygienic disposal of stools
5. Breastfeeding promotion
6. Hib
7. Pneumococcal vaccine
8. Rotavirus vaccine
9. Vitamin A
10. ORS
11. Zinc
12. Zinc for diarrhoea
13. Antibiotics for dysentery
14. Antibiotics for pneumonia
15. Case management

	Deaths averted 2011-2025	
	Historical trends	Ambitious scale-up
All deaths		
<5 yrs	26%	34%
Neonatal	11%	12%
1-59 months	15%	21%
Pneumonia deaths		
All deaths	51%	67%
<5 yrs	15%	23%
Neonatal	35%	44%

EXPERT PANEL: 2013

- Affordability of development
- Efficacy / effectiveness
- Deliverablity
- Sustainability
- Maximum effect on mortality reduction
- Acceptable to health workers
- Acceptability to end users
- Positive effect on equity

- Pneumococcal vaccine
- Development of non-liquid and mucosal antibiotics
- Improving existing vaccine uptake: measles, Hib to enable needle free delivery and heat stability
- Maternal immunization
- Improved oxygen system
- Combination vaccinations
- Improving point of care diagnostics
- Indoor air pollution or sanitation
- Vaccines against neonatal bacterial pathogens

World Health Organization

WHO NEW PNEUMONIA KIT 2020

INFORMATION NOTE

Module 1 – Medicines

Contains oral and injectable antibiotics as recommended by **the WHO treatment protocol** for the two categories of pneumonia: "pneumonia" with fast breathing and "pneumonia" chest indrawing or severe pneumonia.

Module 2 – Supply and equipment

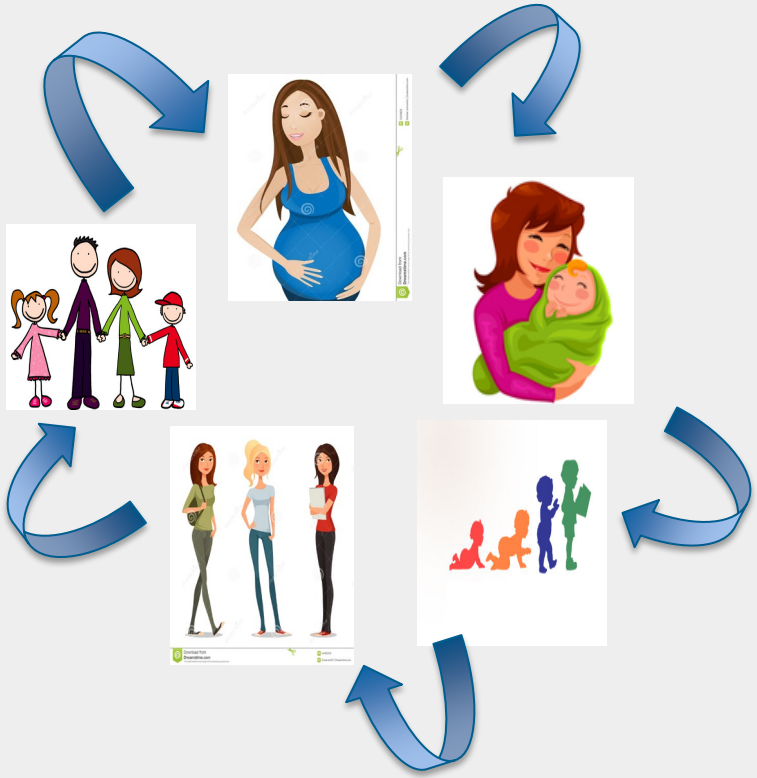
Contains supply such as examination gloves and equipment such as ARI timer, pediatric stethoscope and pediatric finger pulse oximeter.

This kit does NOT contain malaria, TB or HIV medicines.

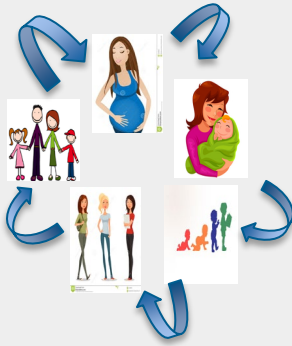
https://www.who.int/docs/default-source/documents/emergencies/pneumonia-kit-17june202090d6c230cb594fd88b73c15644b49e90.pdf?sfvrsn=acb56ad7_1

OUTLINE OF TALK

- Context
- Interventions for prevention of pneumonia:
  - Community/Public level
  - Primary health care level
  - Hospital level
- Summary
- Framework to reduce burden of CAP in children



Summary



- Minimal recent data on reducing burden of CAP
- Scale up general interventions: breastfeeding, complementary feeding, water, sanitation
- Scale up specific prophylaxis: immunisation, Vitamin A, Zinc
- Strengthen early diagnosis and treatment
- Research different models of care and strategies to reduce burden of pneumonia

OUTLINE OF TALK

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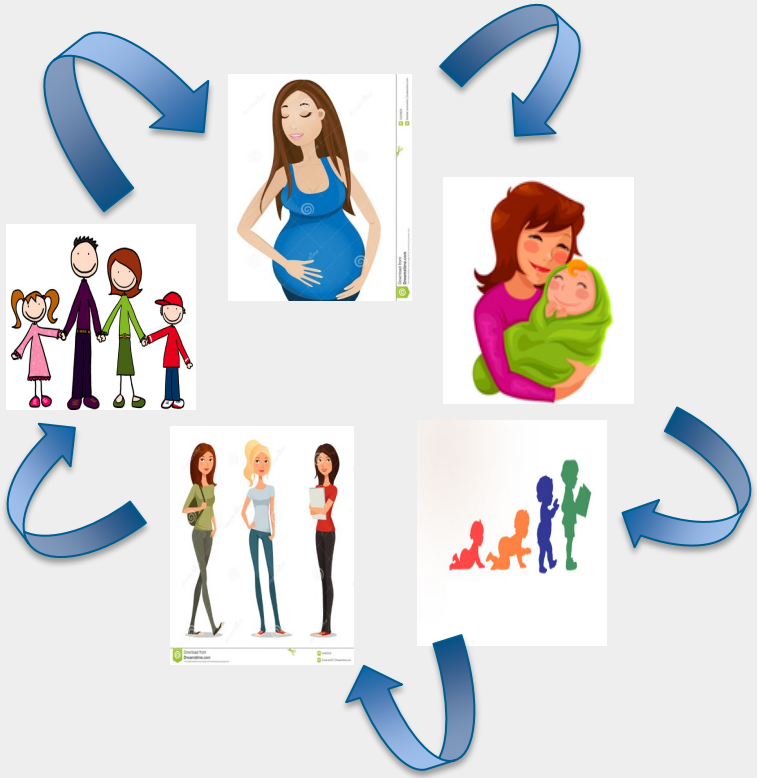
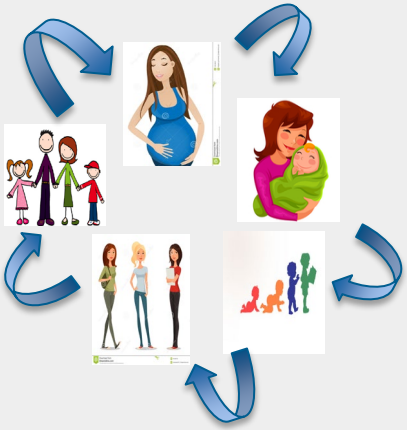


FRAMEWORK FOR REDUCING THE BURDEN OF DISEASE FROM CAP



Antibiotics, Xray, ultrasound, antibiotics

Tertiary level

Health worker training, appropriate care, pulse oximetry early referral

Secondary / hospital level

Breastfeeding, immunization, improved standards of living, reducing air pollution, micronutrient supplementation, community-based management

PHC/ community

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Zar et.al. S Afr Med J 2020;110(8):741-746.

ACKNOWLEDGEMENTS

- Prof Robin Green
- Paeds Pulmonology Team at Steve Biko Academic Hospital

Thank you!

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