Challenges in Management and Control of Childhood Pneumonia

Shally Awasthi
Professor of Pediatrics
Chhatrapati Shahuji Maharaj Medical University, Lucknow

Challenges at a Glance

- Magnitude of problem
- Misclassification of pneumonia
- Inappropriate use of antibiotics
- Inadequate Surveillance for Etiological Agents
- Development of AMR
- Non-availability of Oxygen at Health Facilities
- No standard definition of Clinical Failures
- High Risk groups
- Inadequate Referral Linkages
- Ineffective Implementation of Public Health strategies

Childhood Pneumonia: Global Mortality

- Childhood pneumonia is a major cause of under-five mortality
- Globally ~ 9 Million deaths in children < 5 years
- Of these, 1.6 Million (18%) deaths due to pneumonia

(Lancet 2008; 375: 1965 – 1987)

Childhood Pneumonia: Mortality in India

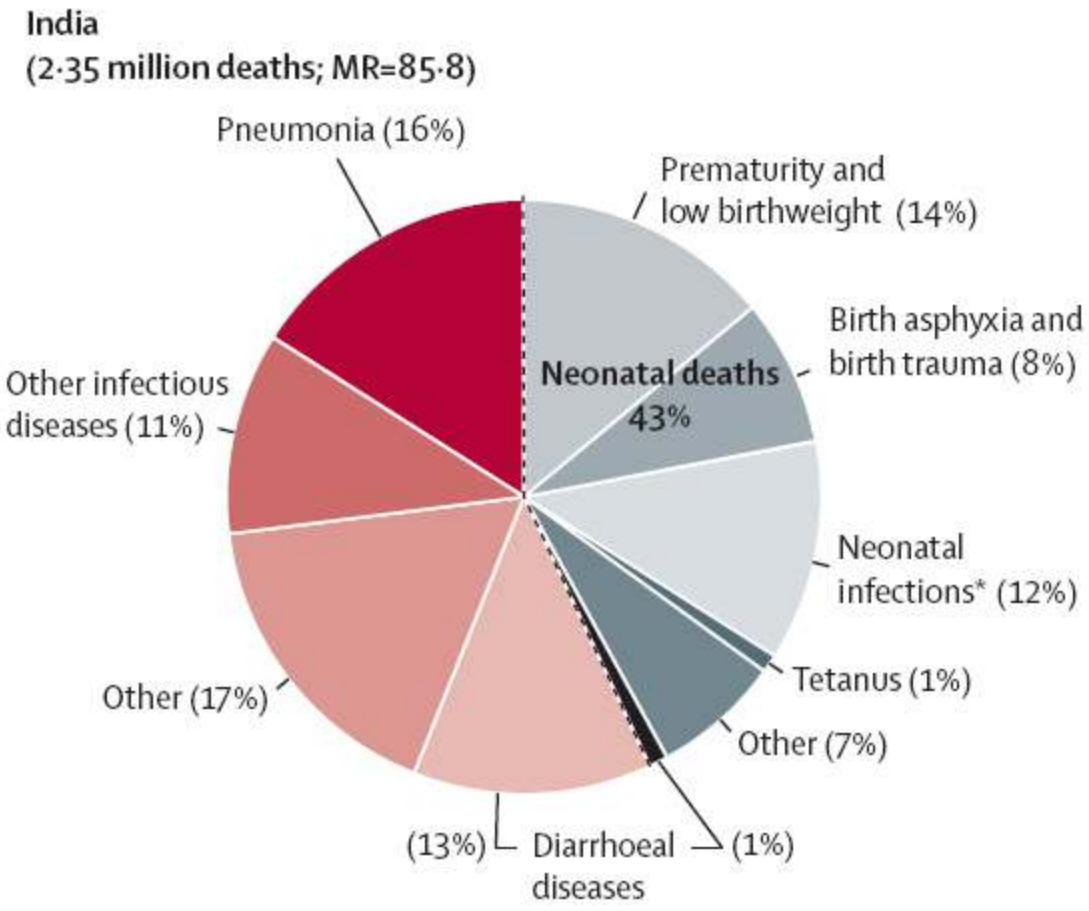
- In India in 2005, pneumonia and diarrheal diseases accounted for 50% (0·67/1·34 M) of all deaths at 1–59 months:

- Pneumonia (0·37 M, 99% CI 0·35 – 0·39)
- diarrhoeal dis. (0·30 M, 99% CI 0·28 – 0·32)

- Wide regional differences
- Wide gender differences

(Lancet 2010; 376: 1853–60)

Causes of death in children aged 0–4 years in India, 2005



(Lancet 2008; 375: 1965 – 1987)

Pneumonia case management

- WHO Pneumonia case management strategy has been implemented since early 1980s
- This strategy reduced pneumonia-specific mortality by 35-40%

Essentials In Effective Management of CAP

- Early Dx
- Rational Use of Antibiotics
- Appropriate Case Management
  - Timely and Appropriate Referral
  - Monitoring
  - Follow-up

Delay in Diagnosis

- Poor Health Seeking behavior
  - Don't visit health facility due to low awareness, inconvenience, bad experience, low trust
- Care from untrained health care providers
- No active case finding by trained providers
  - Incomplete clinical examination
  - Don't expose to count RR/look for LCI
  - Less time/patient

Rational use of antibiotics-1

LOW Antibiotics used in children with pneumonia

- 19% in early 1990s (27 country data: *UNICEF 2006*)
- 8.6% in India NFHS-3
- Two-thirds of children dying due to pneumonia NEVER taken to a health facility

Rational use of antibiotics-2

OVERUSE of antibiotics in children with pneumonia

- Indiscriminate use in URTI
- Misclassification of LRT diseases as pneumonia:
  - bronchiolitis,
  - croup,
  - bronchial asthma

- VIRAL vs BACTERIAL INFECTIONS DIFFICULT TO DIFFERENTIATE

Etiology of Pneumonia

- In the ISCAP trial, in nasopharyngeal aspirates of 2188 <5 Yrs with non-severe pneumonia
-
  - 878 (40.4%) isolates of *S. pneumoniae* , (66.6% resistant to Cotri)
  - 496 (22.8%) isolates of *H.influenzae,* (54.4% resistant to Cotri)
  - 513 (23.4%) tested positive for RSV
- RSV +ve not associated with *S pneumoniae* or *H.influenzae* isolation

(BMJ 2004;328(7443):791)

Additional Causes

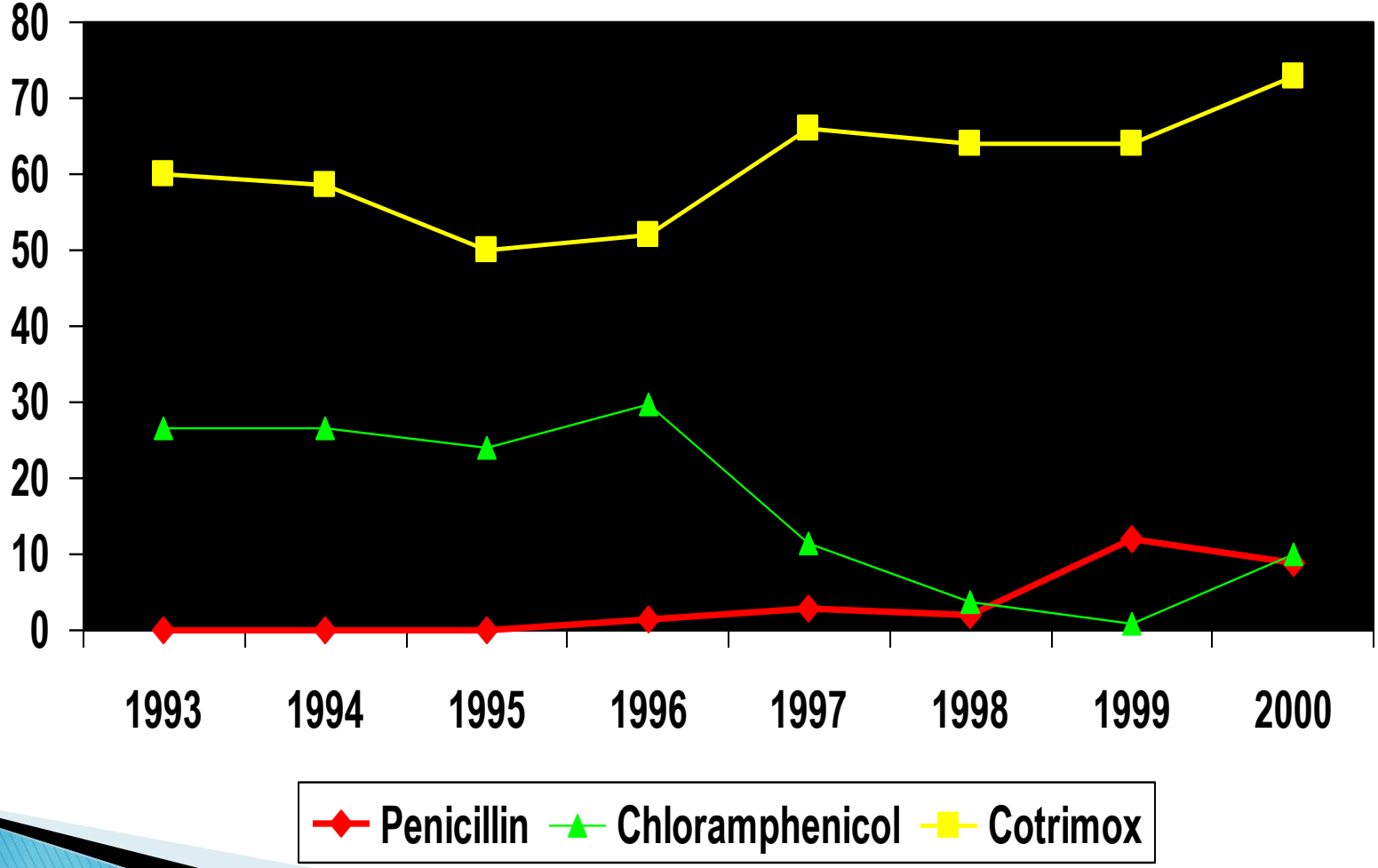
- *Staphylococcus* isolated in 42% cases of very severe pneumonia *(BMJ 2008; 336: 80-84)*
- *M.pneumoniae* positive in 10% *(Trop Doct 2009; 39: 109-11)*
- Other bacterial/viral pathogens and oppurtunistic infections in high risk groups

Recommended antibiotics

- Bacterial etiological agents
- Severity of pneumonia determines route of administration and choice of Ab
- Recommended & commonly used Abs are
  - Co-tri
  - Amoxicyllin
  - Ampicillin + Gentamicin or Amoxiclavulinic acid
  - 3rd generation cephalosporins
  - Vancoumyecin etc.

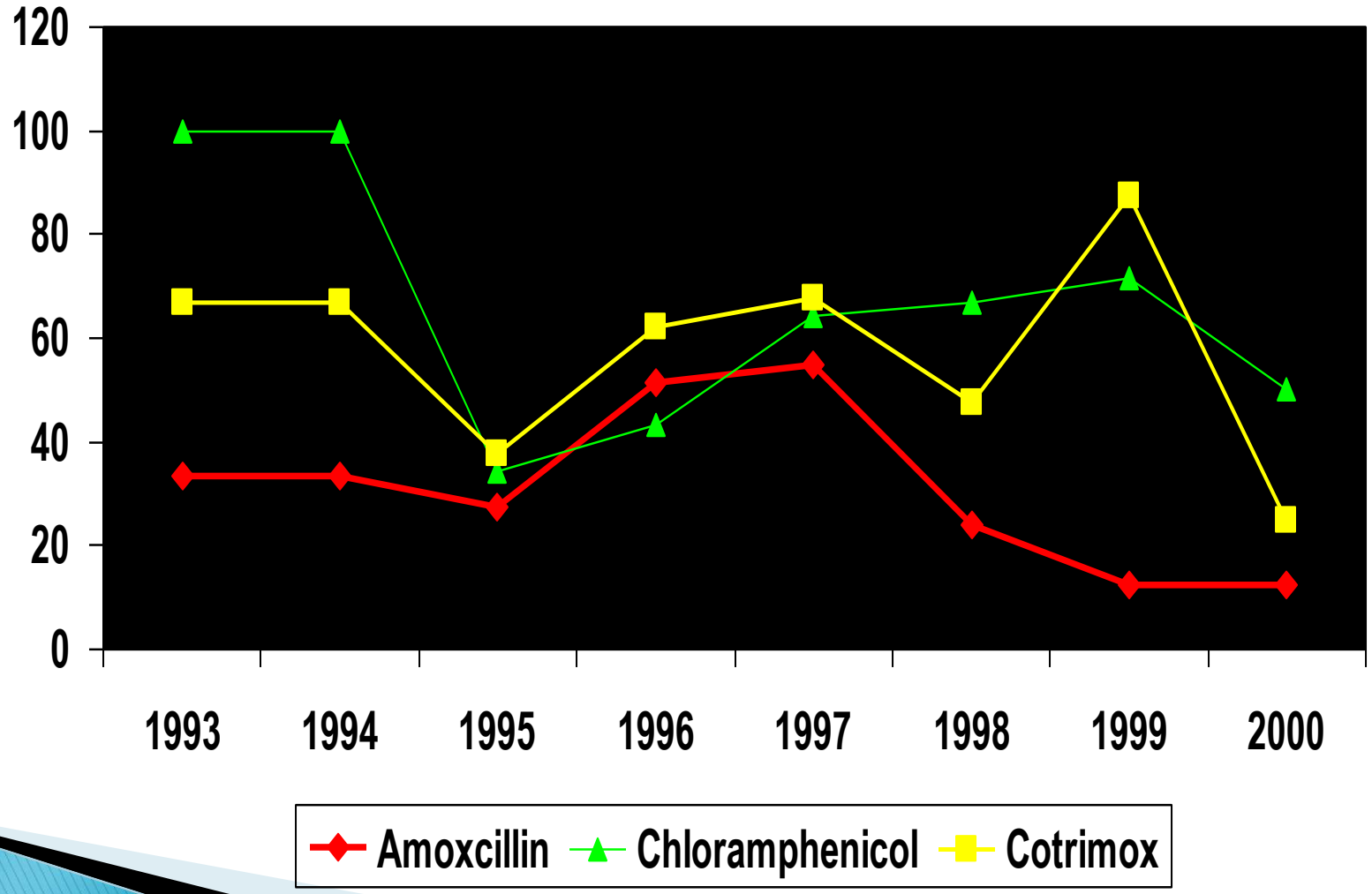
AMR Over Time – *S.pneumonia*

(Lancet 1999; 353: 1216 – 1231 & addl. data courtsey Thomas K)



AMR Over Time - *H.influenza*

(Lancet 1999; 353: 1216 – 1231 & addl.data courtsey Thomas K)



In vivo vs. *vitro* resistance

- Even with reports of in-vitro resistance to cotri, in patients with non-severe pneumonia in 7 PHCs in India, clinical failure with oral amoxycillin and cotrimoxazole similar (abs diff = 0.04; 95% CI: -0.035 to 0.12)

(J Trop Ped 2008; 54: 382-9)

Clinical deterioration in pneumonia

- Rapid, especially among young infants.
- Due to hypoxaemia and septicaemia leading to death.
- Essential to have accurate recognition of severe pneumonia & prompt referral to a facility for parenteral antibiotics and oxygen

Hypoxaemia

- Definition: O2 saturation of arterial Hb measured by pulse oximetry (SpO2) < 90% at sea-level, requiring treatment
- Occurrence: ~ 20% of children with pneumonia seen in hospitals, with marked geographical differences in prevalence
- Risk: associated with increased risk of death
- Monitor: **Pulse oximetry** – to determining the need for and response to oxygen therapy
  (clinical monitoring not very useful)

Lack of availability of O2

Remote and rural facilities do not often have oxygen for treatment of pneumonia

Definition of treatment failure

- No standard definition
- Failure to improve on different clinical criteria, measured 2–5 days after beginning treatment
- In clinical practice physicians tend to change Ab if no evidence of improvement within 48 hrs

Risk factors for treatment failure

- Young age
- Viral pneumonia
- Wheeze
- Poor adherence to treatment
- Immunosuppression (e.g. HIV or malnutrition)
- Development of empyema
- Prior antibiotic use
- Antibiotic resistance
- Alternative diagnosis (e.g. malaria, foreign body).

Treatment Failure: Important to recognize

Important to distinguish between “benign” treatment failure due to viral infection and “true” treatment failure indicating worsening pneumonia or developing complications

Better to use objective signs of clinical severity and pulse oximetry rather than persistence of tachypnoea

Children with Wheeze

- Common in severe and non-severe pneumonia
- In 46% (1605/3487) cases of non-severe pneumonia with wheeze RR normalized with just bronchodilators *(PLOS One 2008,3,4 e1991)*
- In 62%-82% of severe pneumonia with wheeze RR normalized with bronchodilators *(Lancet 2008; 371: 49-56)*

Use of Bronchodilators

- WHO recommends use of bronchodilators in a wheezing child before deciding to treat as pneumonia

- However
  - Doctors seldom auscultate children
  - Health care workers not trained to auscultate
  - Bronchodilators, nebulizers/spacers not available in Primary and secondary level of care facilities

Management of “at-risk” groups

- Neonatal pneumonia
- HIV-related pneumonia
- Severely malnourished children

Neonatal pneumonia

- Young infants (< 2 months)
- Causes a large proportion of neonatal deaths
- Classified as severe as they are at higher risk of hypoxaemia, apnoea and mortality
- Difficult to define due to less specific clinical S/S: clinical overlap with “neonatal sepsis” and with non-infective conditions causing respiratory distress.

Neonatal pneumonia

- Important pathogens : *streptococci* and a wide range of Gram-negative bacteria such as *Escherichia coli* or *Klebsiella* spp.

- A major case-management challenge is difficulty of providing adequate supportive care such as hydration, nutrition and oxygen in resource-limited settings.

HIV-related pneumonia

- HIV prevalence > 50% in children hospitalized with very severe pneumonia in some settings in sub-Saharan Africa.

- Incidence of pneumonia much higher for HIV-infected children than for HIV-uninfected children.

- Similar bacterial pathogens PLUS additional

HIV-related pneumonia

- Opportunistic infections such as *P. jiroveci* and cytomegalovirus
- Pulmonary tuberculosis is common
- Mixed infections and treatment failure are common

HIV-related pneumonia

- Case-fatality rates are reported to be 3-8 times higher than in HIV-uninfected children even when current guidelines are applied
- Prevention of mother-to-child transmission, co-trimoxazole preventive therapy and antiretroviral therapy to reduce the burden and case-fatality of pneumonia in HIV-endemic countries

Severely malnourished children

- Pneumonia is more common and more fatal than in well nourished children
- Caused by a wider range of bacteria and opportunistic pathogens
- Clinical presentation is less specific and overlaps with septicaemia

Severely malnourished children

- Management challenges regarding supportive care, especially nutrition
- Cover for Gram-negative bacilli is included in first-line antibiotics
- Pulmonary tuberculosis should be considered if they do not respond
- HIV testing to be routine

Challenges in Implementation of Pneumonia Control Program

- Health-seeking behavior,
- Barriers to accessing health services,
- Quality and extent of training of health providers,
- Health-care worker retention,
- Secure antibiotic supply,
- Continued supervision and in-service training, maintenance
- Lack of adequate equipment
- Repair of equipment and clinical audit

POTENTIAL REDUCTIONS IN PNEUMONIA MORBIDITY AND MORTALITY WITH SELECTED INTERVENTIONS (ASSUMING NEAR-UNIVERSAL COVERAGE)

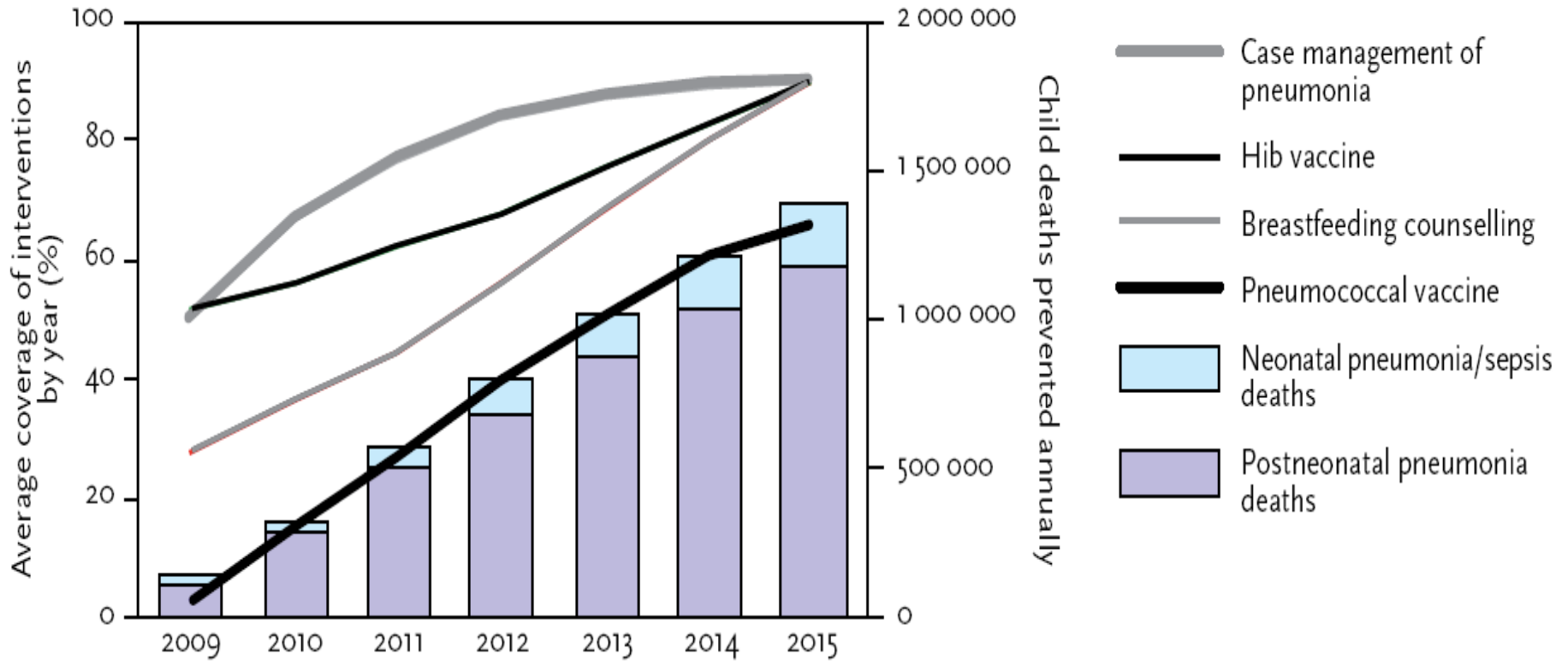
INTERVENTIONS TO TREAT	EVIDENCE OF IMPACT
Health facility case management for very severe cases and vulnerable groups such as newborns, HIV-infected and malnourished children	29–45% reduction in case fatality;[a] 6% reduction in all child deaths[b]
Increasing access to appropriate care through community-based case management	34–50% reduction in neonatal case fatality;[a] reduction in total mortality of 27%, 20%, and 24% among neonates, infants, and children, respectively; reduction in pneumonia mortality in the same groups by 42%, 36%, and 36%[c]

[a] Niessen L et al. Comparative impact assessment of child pneumonia interventions. *Bulletin of the World Health Organization*, 2009, 87:472–480.

[b] Jones G et al. How many child deaths can we prevent this year? *Lancet*, 2003, 362:65–71.

[c] S Sazawal, Black R. Effect of pneumonia case management on mortality in neonates, infants, and preschool children: a meta-analysis of community-based trials. *Lancet Infecious Diseases*, 2003, 3:547–556.

CHILD PNEUMONIA DEATHS THAT COULD BE PREVENTED PER YEAR IN 68 "COUNTDOWN" COUNTRIES[a,b]

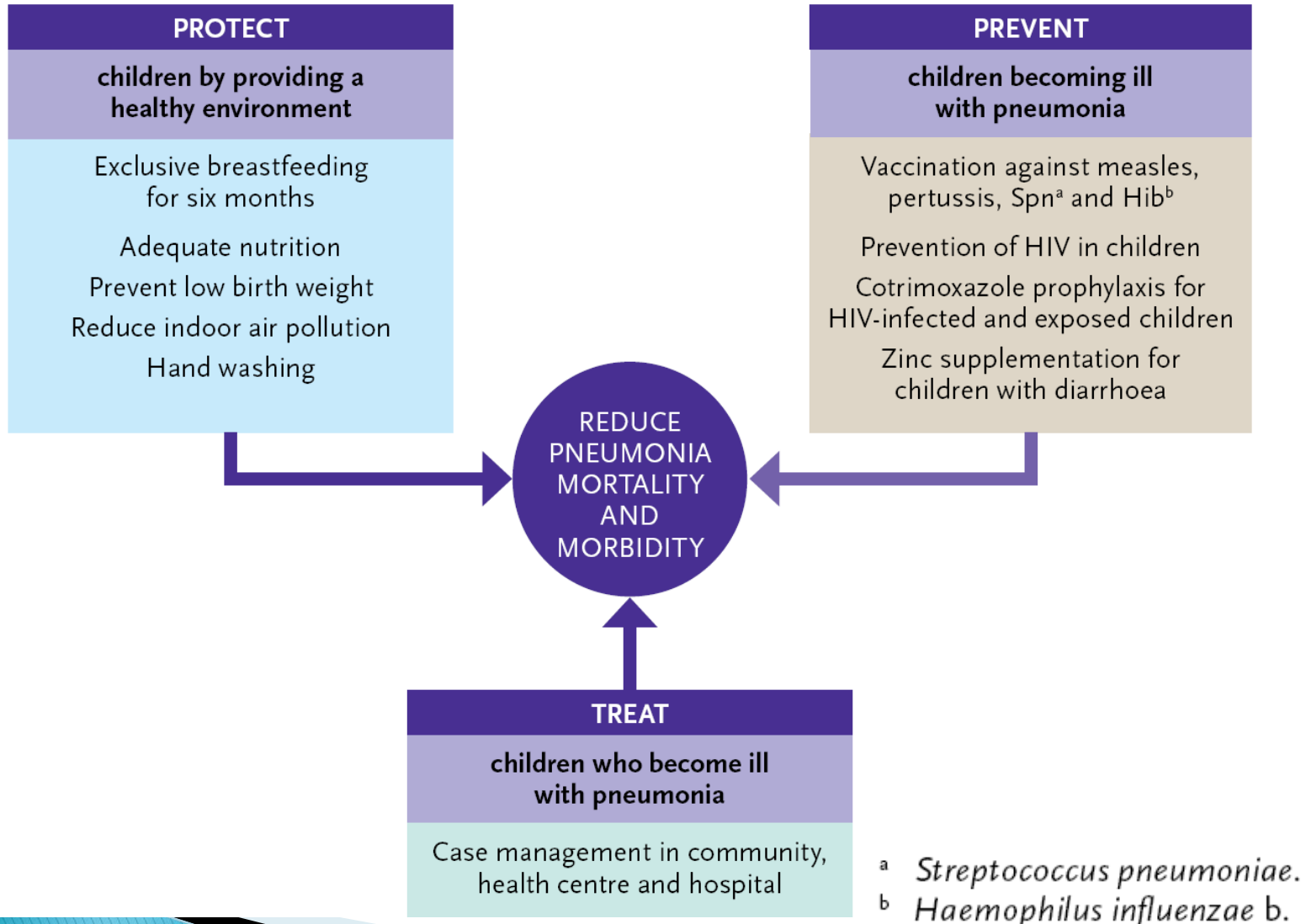


Source: WHO

[a] The impact of scaling up essential interventions for pneumonia was calculated using the Lives Saved Tool (LiST) – a tool that has been developed by the Futures Institute in collaboration with the Child Health Epidemiology Reference Group (CHERG). Deaths averted is estimated as the difference between a scenario where coverage is scaled up to on average 90% in the 68 countries, compared to a scenario where coverage remains at constant levels.

[b] UNICEF. *Countdown to 2015. Tracking progress in maternal, neonatal and child survival: the 2008 report*. New York, UNICEF, 2008.

FRAMEWORK FOR PNEUMONIA CONTROL



[a] *Streptococcus pneumoniae.*
[b] *Haemophilus influenzae* b.

Source: GAPP – WHO,UNICEF