

Antimicrobial resistance in lower respiratory tract infections of children: a systematic review and meta-analysis



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Background

- Lower respiratory tract infections (LRTIs) are the leading infectious cause of death in children globally¹
- In 2016, LRTIs accounted for over 0.6 million deaths in children under the age of 5 years²
- The World Health Organization (WHO) recommends amoxicillin as the first-line drug in the empirical treatment of LRTIS in children³
- Non-adherence to these guidelines had been reported due to frequent treatment failure resulting from increasing antimicrobial resistance (AMR) to amoxicillin

Objectives

- To estimate global prevalence of resistance to antimicrobial agents commonly used in treatment of LRTIs in children
- To estimate spatial and temporal trends of resistance to commonly used antimicrobials in etiological agents isolated from children with LRTIs across six WHO regions

Methods

- Search (up to August, 2017): (children) AND (LRTIs) AND (antimicrobials) AND (AMR)
- Databases: Medline, EMBASE, Global Health, PubMed, Web of Science

Inclusion criteria:

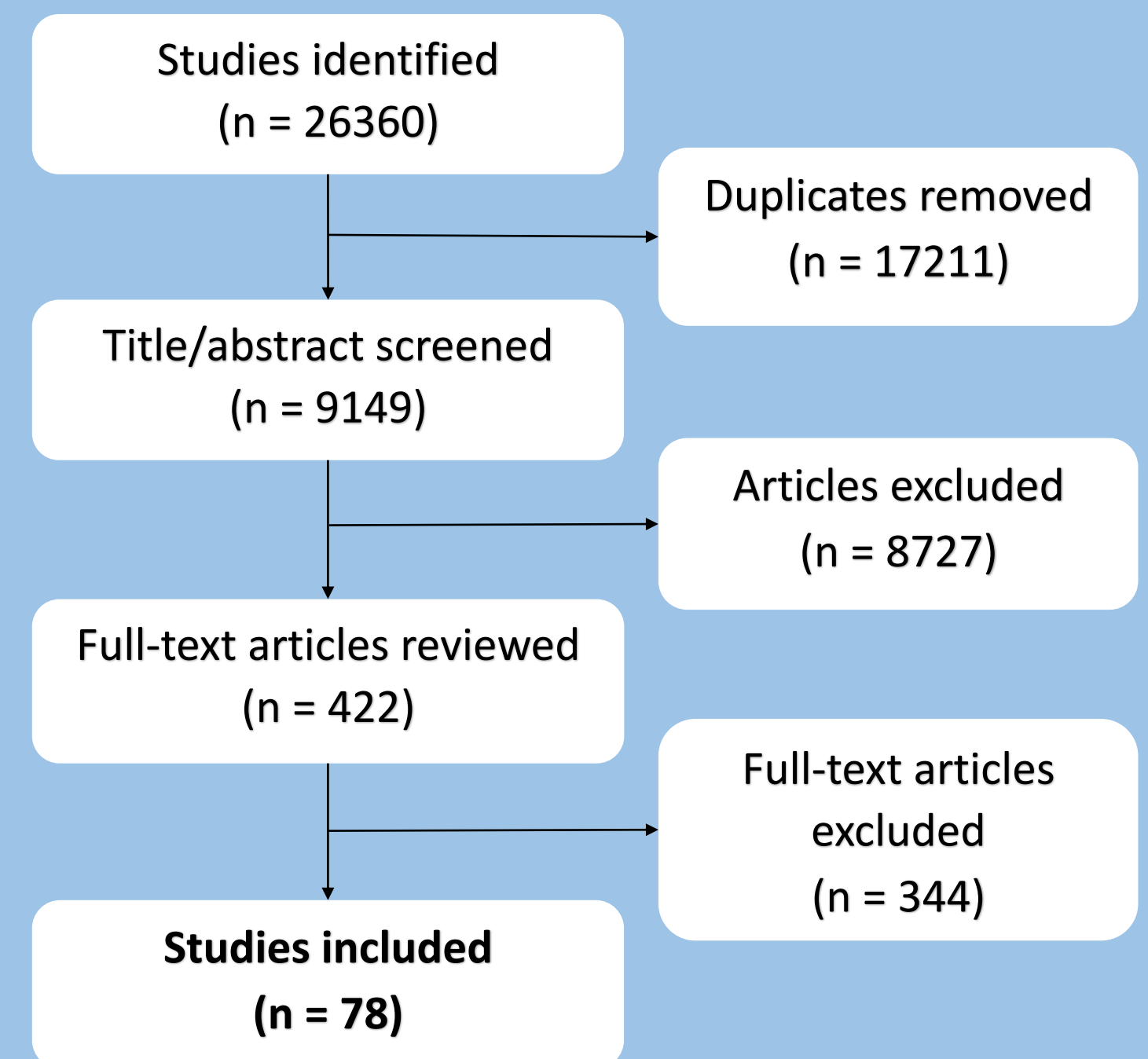
- ✓ Observational studies
- ✓ English language
- ✓ Children ≤ 18 years
- ✓ Previously healthy children diagnosed with LRTIs

Exclusion criteria:

- ✗ Diagnosis of tuberculosis
- ✗ Immunocompromised individuals
- ✗ No. of bacterial isolates tested for susceptibility not reported
- ✗ Antimicrobial resistance profile of isolates not reported

- **Statistical analysis:** Meta-analysis to calculate pooled prevalence estimates for each antibiotic-bacterium combination (proportion of resistance were calculated by dividing total no. of resistant isolates to total isolates tested)

Figure 1: Study Selection Flowchart



Results

- **Location:** 38 in Western pacific, 14 in Europe, 11 in Americas, 5 in South-east Asia, 4 in Africa, 3 in Mediterranean
- Penicillin resistance in gram-negative 0.45 (95% CI: 0.35-0.54)
- Macrolide resistance in gram-positive 0.42 (95% CI: 0.27-0.57)
- Cephalosporin resistance in gram-positive 0.12 (95% CI: 0.06-0.21)

- Penicillin resistance in gram-positive: 51 studies
- Penicillin resistance in gram-negative: 27 studies
- Macrolide resistance in gram-positive: 26 studies
- Cephalosporin resistance in gram-positive: 26 studies
- Penicillin resistance in gram-positive increased from 15% in 1985 to 60% in 2015
- Penicillin resistance in gram-negatives increased from 20% in 1980s to 60% in 2010

Figure 2: Penicillin resistance in gram-positive bacteria

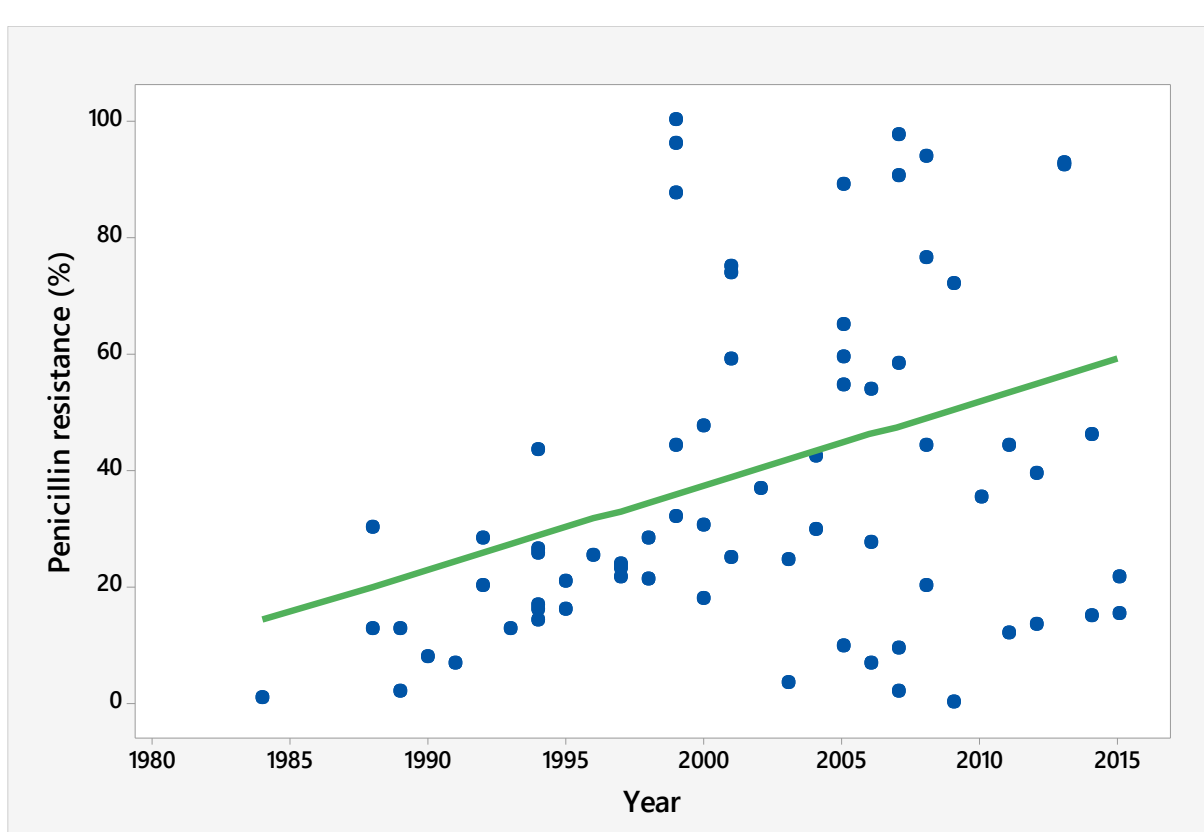
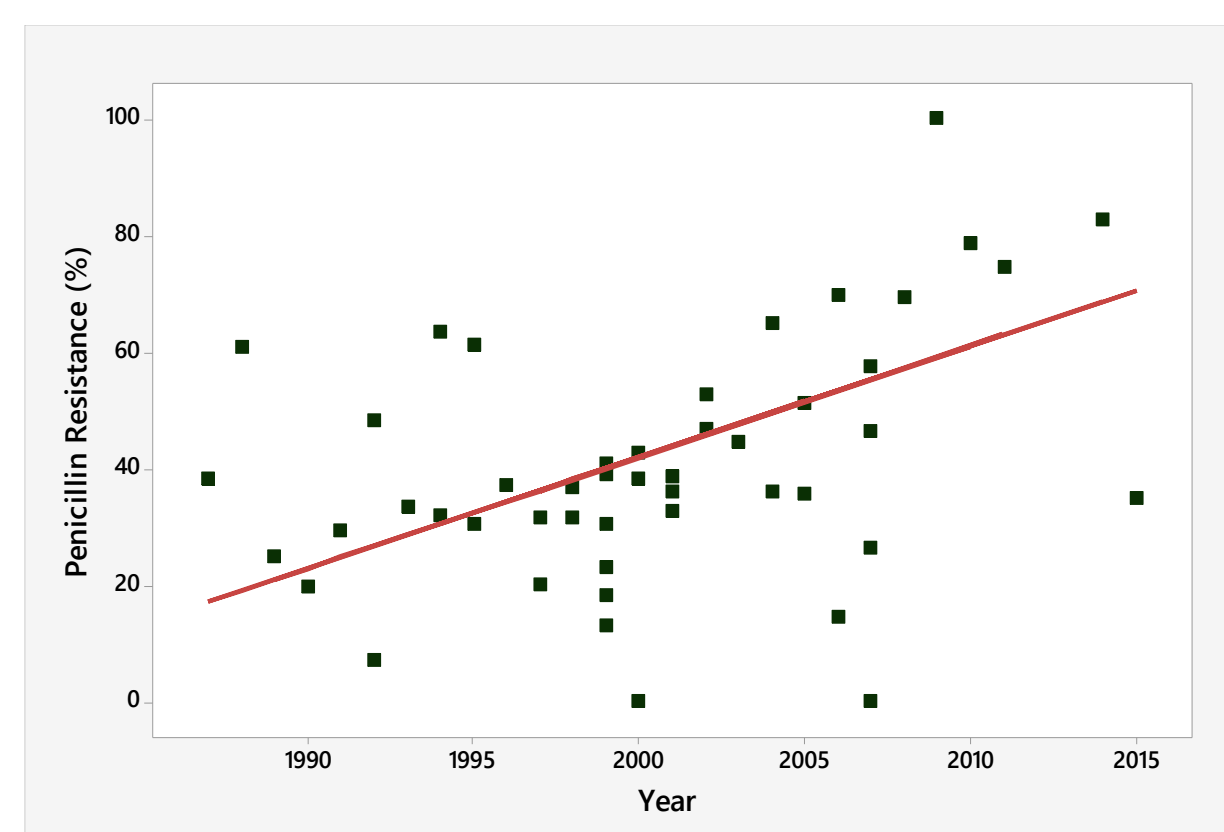


Figure 3: Penicillin resistance in gram-negative bacteria



Penicillin resistance in gram-positive bacteria
Pooled prevalence: 0.43 (95% CI: 0.33-0.53)

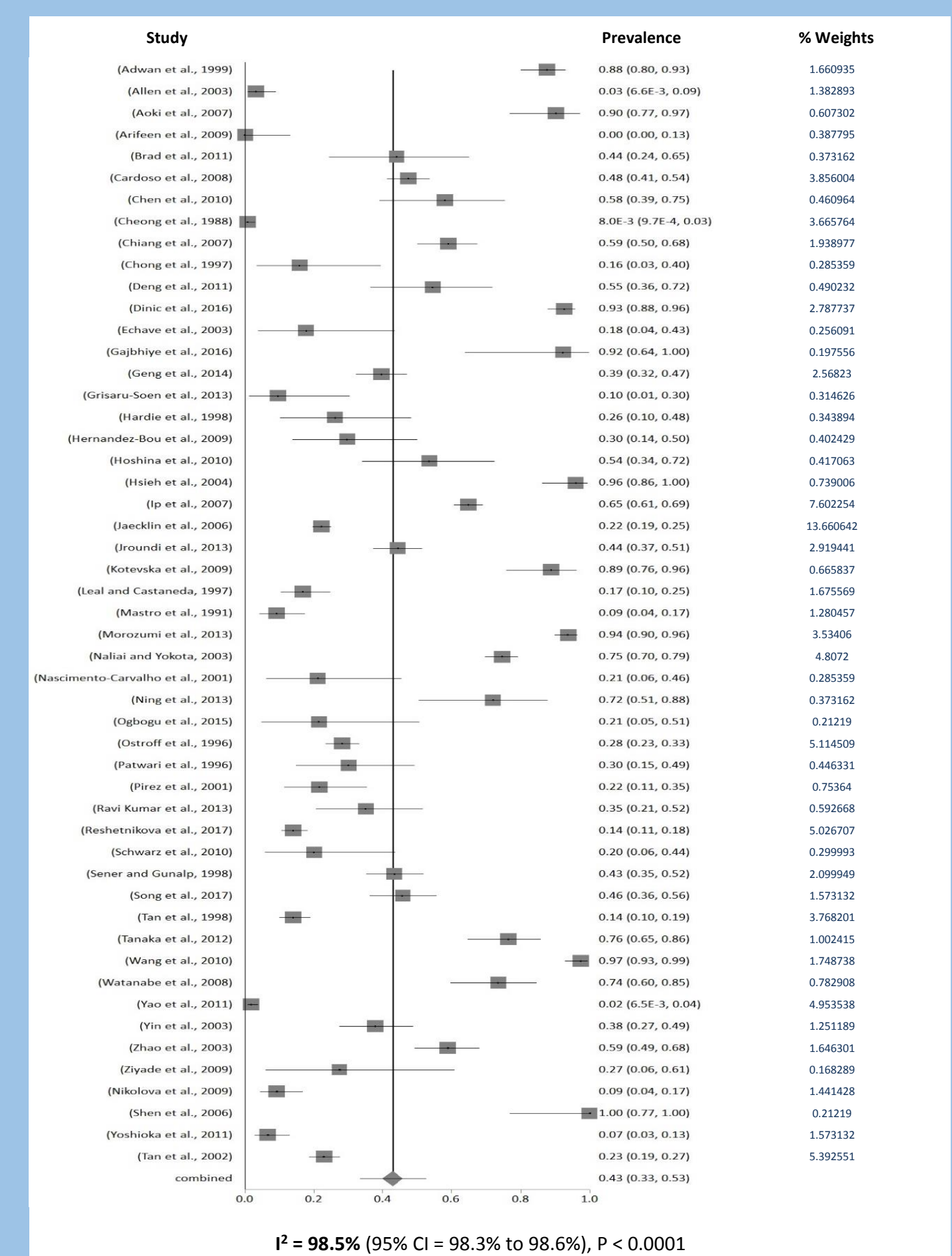


Figure 4: Penicillin resistance in gram-positive bacteria

Conclusions

- High resistance reported to penicillin across all WHO regions questions the effectiveness of WHO empirical therapy guidelines
- Due to the variability in AMR levels within and across WHO regions, regional or national empirical therapy guidelines for treatment of children with LRTIs should be developed after estimating the burden of AMR through further research at regional and national level

References

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3. WORLD HEALTH ORGANIZATION 2014b. Revised WHO classification and treatment of childhood pneumonia at health facilities—Evidence summaries. *Geneva: World Health Organization*.