Childhood Bacterial Meningitis Surveillance in Southern Vietnam: Trends and Vaccination Implications from 2012 to 2021

Background: Bacterial meningitis is a significant global public health concern, particularly in under-five children, ranking sixth among the leading causes of health burden worldwide. *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Neisseria meningitidis are* the most common causative pathogens of bacterial meningitis, causing remarkably morbidity and mortality in children, especially in developing countries with limited access to pneumococcal conjugate vaccines (PCV). This study aimed to conduct hospital-based surveillance to assess the epidemiology, trends of causative pathogens, and distribution of serotypes causing pneumococcal meningitis among under-five children with bacterial meningitis in southern Vietnam.

Methods: Between 2012 and 2021, sentinel surveillance was implemented at Children's Hospitals 1 and 2 in Ho Chi Minh City. Cerebrospinal fluid samples were collected from under-five children with suspected bacterial meningitis and tested through latex agglutination, culture, and real-time Polymerase Chain Reaction for *S. pneumoniae, H. influenzae,* and *N. meningitidis*. Serotyping of *S. pneumoniae* was conducted.

Results: Of the 2,560 probable bacterial meningitis cases, 158 (6.2%) were laboratory-confirmed. The prevalence of bacterial meningitis was higher in children aged 1-11 months during the dry season. Most of the confirmed bacterial meningitis cases were

unvaccinated or had an unknown vaccination history for Hib, PCV, and meningococcus vaccines, with 84.8%, 98.1%, and 100%, respectively. Bacterial meningitis positivity decreased during the 10-year study, and *S. pneumoniae* was the most common pathogen causing bacterial meningitis (86.1%), followed by *H. influenzae* (7.6%) and *N. meningitidis* (6.3%). The case fatality rate was 8.2%, with *S. pneumoniae* responsible for 92.3% of these deaths. Pneumococcal serotypes 6A/B, 19F, 14, and 23F were common and the proportion of pneumococcal meningitis cases caused by the 10-valent pneumococcal conjugate vaccine serotypes decreased from 96.2% to 57.1% during the PCV eras.

Conclusion: *S. pneumoniae* has emerged as the leading cause of bacterial meningitis in under-five children in southern Vietnam over the last decade. The study findings provide evidence for policymakers to consider introducing PCVs into the Expanded Program on Immunization, particularly in developing countries with limited access to PCVs, to prevent and control bacterial meningitis more effectively.

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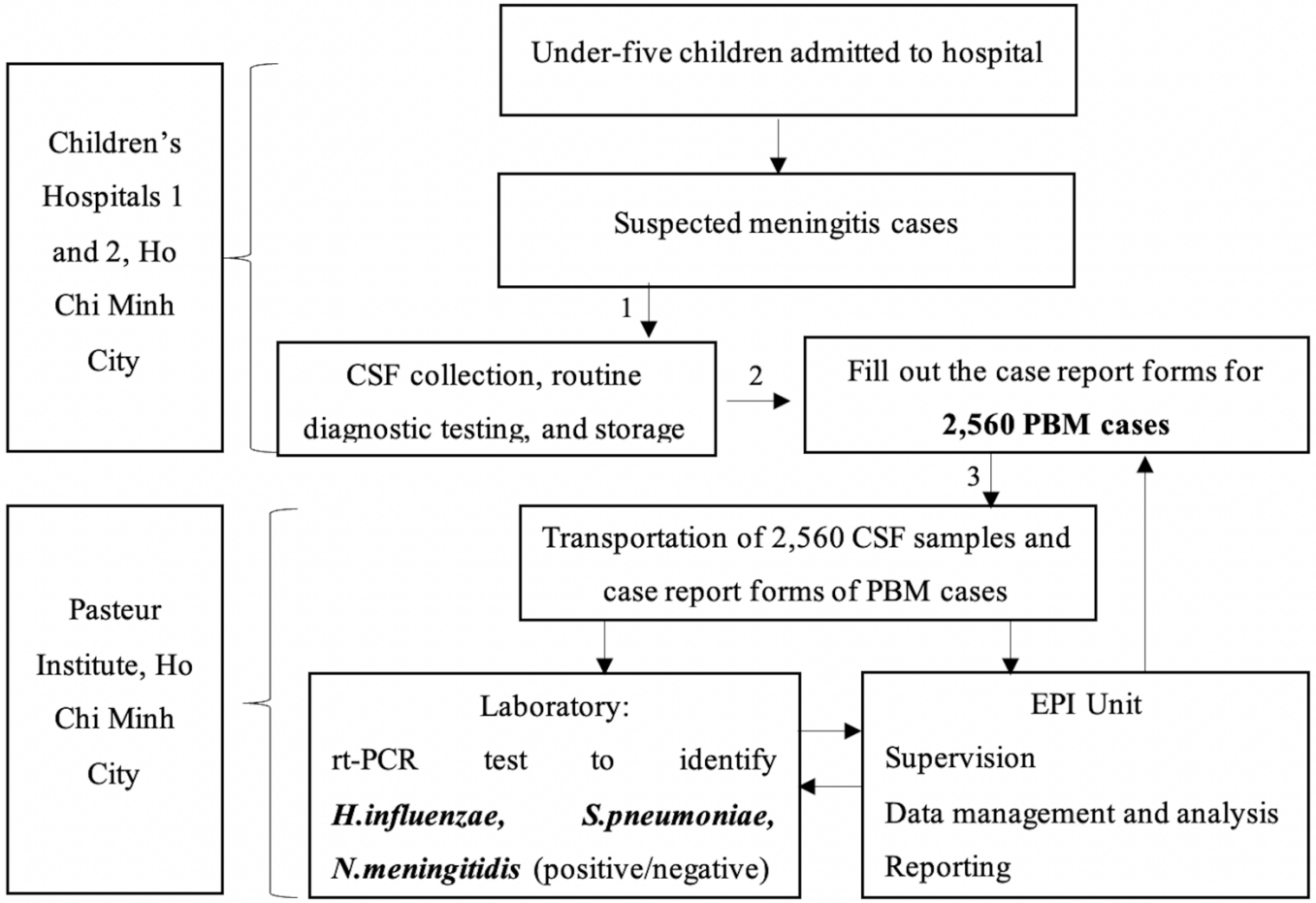
Figure 1. Summary of bacterial meningitis case recruitment and diagnostic testing performed over 10 years, from 2012 to 2021.



CSF, cerebrospinal fluid; PBM, probable bacterial meningitis; rt-PCR, real-time Polymerase Chain Reaction, EPI, Expanded Program on Immunization;

Figure 2. The bacterial meningitis positivity rate and pathogens distribution by month and year. **(A)** The yearly trend of pathogens causing bacterial meningitis**. (B)** Distribution of bacterial meningitis positivity by seasonality. **(C)** Distribution of pathogens causing bacterial meningitis by year.