

## Epidemiology of Invasive Pneumococcal Disease in Adults in India

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Preventable Invasive Pneumococcal Disease (IPD) including meningitis, pneumonia and septicemia contributes significantly to morbidity and mortality in all age groups worldwide. Although there are more than 90 known serotypes based on antigenic differences in capsular polysaccharide of *S. pneumoniae*, 10 most common serotypes cause almost 60% of IPD worldwide<sup>1</sup>. The distribution of serotypes causing IPD varies with age and geographic region<sup>2</sup>. The rates of pneumococcal infections are reported to be highest among young children and elderly<sup>3</sup>.

A 23-valent pneumococcal polysaccharide vaccine is available for use in adults. This vaccine contains pneumococcal serotypes 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19F, 19A, 20, 22F, 23F and 33F. More than 80% of the healthy adults develop antibodies against these serotypes within 2 to 3 weeks after vaccination. The overall effectiveness of the vaccine is 60–70% against adult invasive disease<sup>4</sup>. The adult polysaccharide vaccine is not immunogenic in infants. Conjugate vaccines, in which polysaccharide is chemically conjugated to a protein, have been developed which are immunogenic in infants. The currently available 7-valent conjugate vaccine for use in children includes serotypes 4, 9V, 14, 19F, 23F, 18C and 6B. Ten- and 13-valent conjugate vaccines are being developed for use in children.

The pneumococcal vaccines for adults and children have been developed based on serotype data available from developed countries. Since pneumococcal vaccines are serotype-specific, their effectiveness in controlling the disease in less developed countries will depend upon the serotypes prevailing in these countries. In developing countries, the need for routine use of pneumococcal

vaccines has to be determined based on the epidemiology of IPD in the region or country. The policy decisions for use of pneumococcal vaccines should be based on following key factors: (i) incidence of the pneumococcal disease in the country (ii) distribution of its serotypes in the country and (iii) the anti-microbial resistance pattern of the invasive isolates in that country.

In India, the Invasive Bacterial Infection Surveillance (IBIS) network and South Asian Pneumococcal Alliance (SAPNA) have been involved in collection of important data regarding serotype distribution and antimicrobial resistance of pneumococcal infections for more than 12 years. The program has been funded by INCLEN with financial assistance from United States Agency for International Development (USAID) and the Pneumococcal vaccines Accelerated Developmental and Introduction Plan (PneumoADIP) of the Global Alliance for Vaccine and Immunization (GAVI). The IBIS study was planned to generate evidence that would be useful to policy-makers for decisions regarding use of pneumococcal vaccines in India. Involvement of policy makers and other stake holders was sought so that the results would impact the health policy in the country. Indian Council of Medical Research (ICMR) has also proposed to partly support this effort in future.

The IBIS network included 6 tertiary care hospitals in Vellore, New Delhi, Mumbai, Lucknow, Trivandrum and Chennai. Children and adults presenting to the hospitals with clinical symptoms of pneumonia, meningitis or septicemia were enrolled in the study. The participants were recruited from both in-patient and out-patient settings. Blood, CSF or other fluids from normally sterile sites were collected for identification of *S. pneumoniae* by cultural methods. Serotypes and anti-

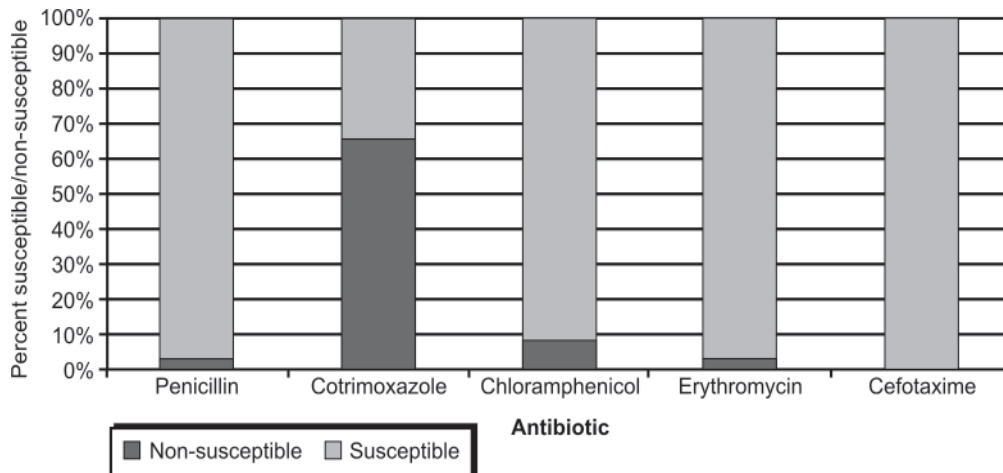


Fig. 1: Antimicrobial susceptibility

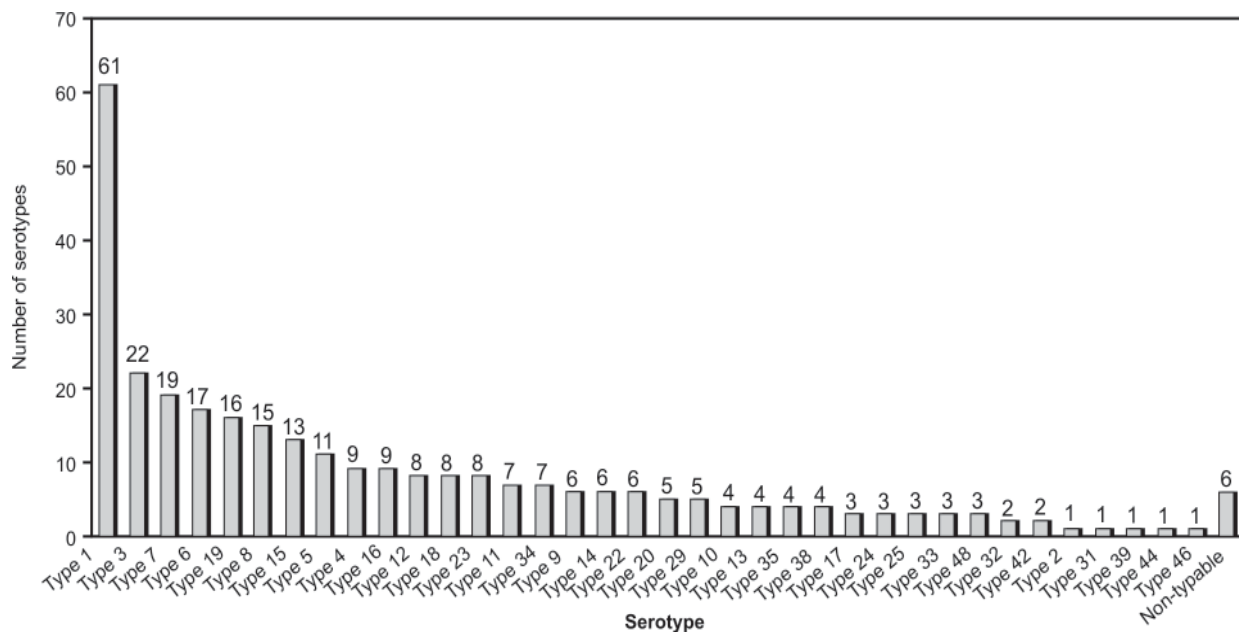


Fig. 2: Serotype distribution in adults

microbial resistance pattern of the isolates were determined at the reference laboratory at Christian Medical College, Vellore.

A total of 564 adults (age range 22–100 years, median age 45 years) were enrolled in the IBIS study over a period of 10 years. Of these, 304 participants had laboratory confirmation of *S. pneumoniae* from normally sterile body fluids. The overall case-fatality rate of IPD in adults was 30%. Resistance to co-trimoxazole was reported to be high (Fig. 1). Serotype 1 and type 3 were common serotypes (Fig. 2) in all age groups (22–50, 51–64, >64 years). It was shown that the 23-valent adult

vaccine covered more than 80% of the serotypes identified in Indian adults (Fig. 3)<sup>5</sup>. The protection offered in different age groups was 77% in 22–50 years, 87% in 51–64 years and 86% in > 64 years age group.

A total of 5893 children below 5 years of age were enrolled in phase I and phase II of the IBIS study. *S. pneumoniae* organisms were isolated from 210 specimens. Serotypes 6 (17%), 1 (12.5%), 5 (9.6%), 14 (9.6%), 19 (7.7%) and 23 (5.8%) were common among children. The IBIS study has shown that the 7-valent conjugate vaccine includes only 47 – 52% of childhood invasive serogroup/ types (STG) that are circulating in

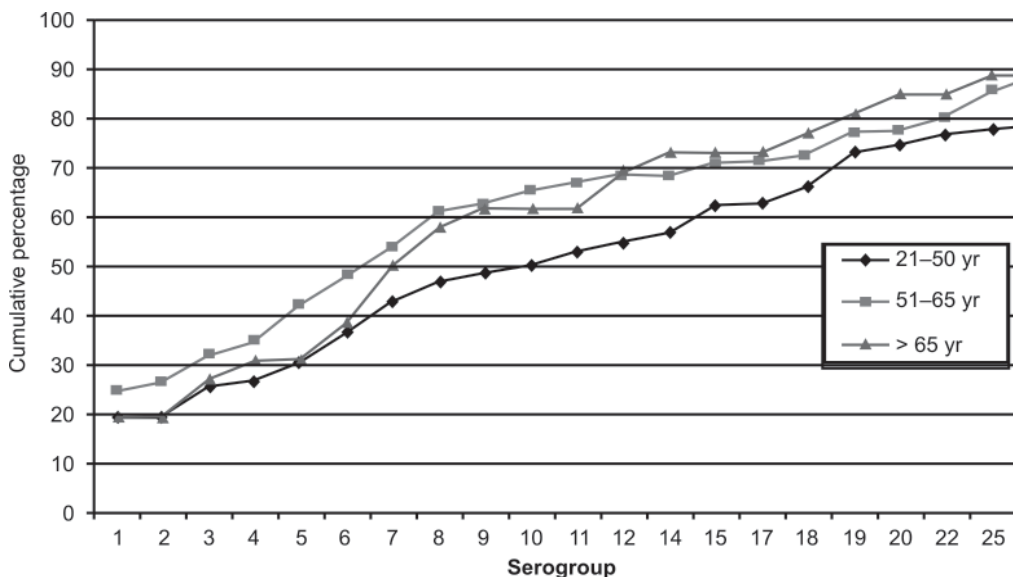


Fig. 3: Cumulative distribution of vaccine serogroups in adults: India 1993-2003

India. Serotypes 5 and 1, which are common among Indian children, are not included in the marketed 7-valent vaccine. Candidate 10 and 13-valent conjugate vaccines are under development for children.

Although the IBIS data has shown a good coverage of adult serotypes in India by 23-valent pneumococcal vaccine, the current utilization of the vaccine in the country is very low. It would be important to increase the routine use of 23-valent polysaccharide vaccine in the elderly and other susceptible adult population. Routine use of this vaccine in high risk population is likely to provide substantial protection in India.

A continued surveillance of IPD in adults is necessary to monitor changes in serotype distribution and antimicrobial resistance pattern overtime in order to determine the vaccine requirements.

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