

Reducing infections,
Reducing resistance:

The value of universal pneumococcal vaccination

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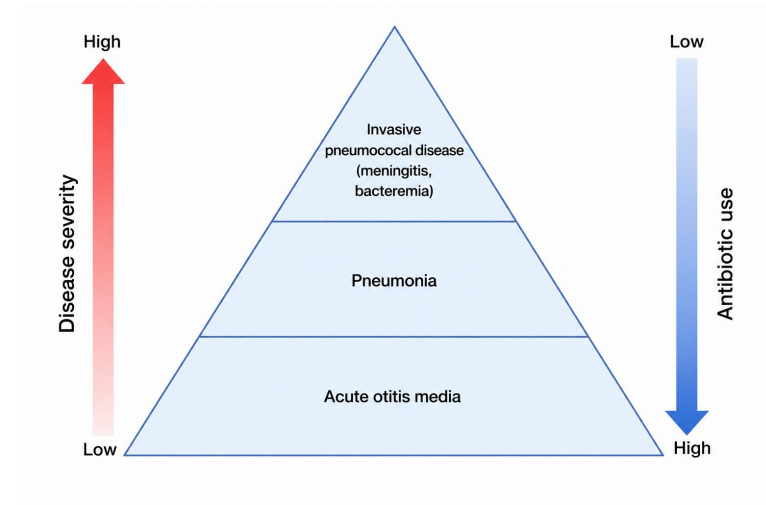
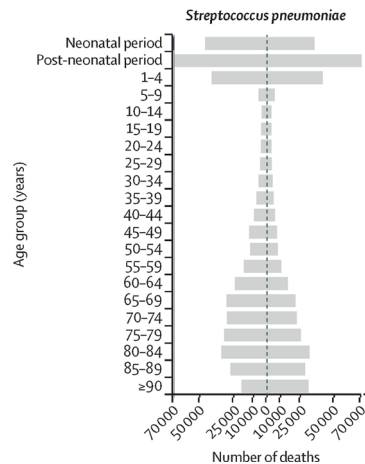
Source photo CDC website
<https://www.cdc.gov/pneumococcal/php/drug-resistance/index.html>



Streptococcus pneumoniae

- Globally over 4.5 million deaths associated with AMR
- *S. pneumoniae* among the six leading pathogens associated with AMR
- Affects mainly children below 2 yrs and 65+ yrs

- Clinical presentation IPD, pneumonia, meningitis, and sepsis, and AOM
- Asymptomatic colonisation nose and throat

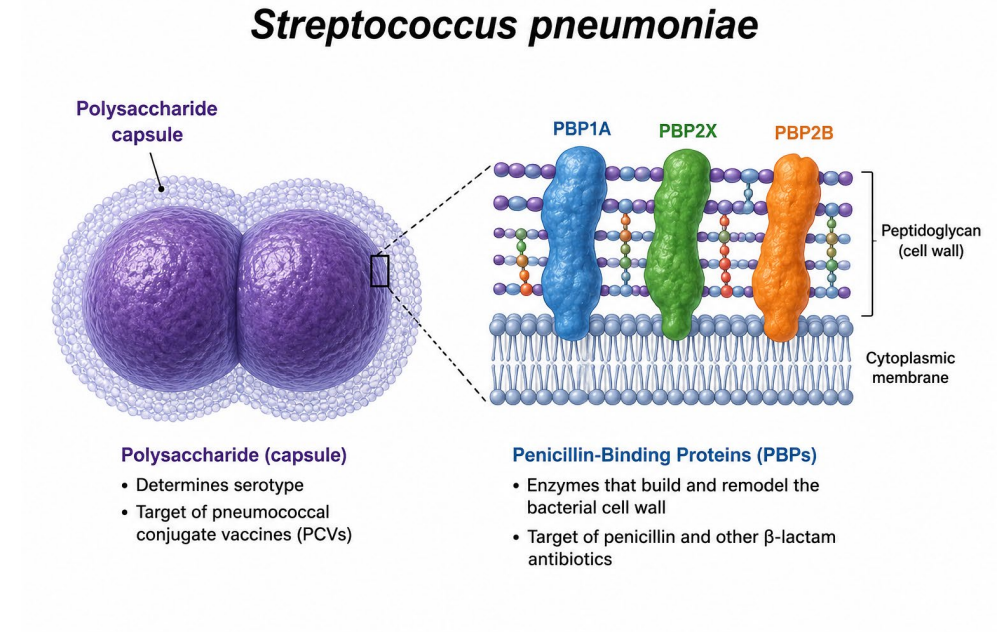


Source GBD 2019 Antimicrobial Resistance Collaborators. doi: 10.1016/S0140-6736(22)02185-7.

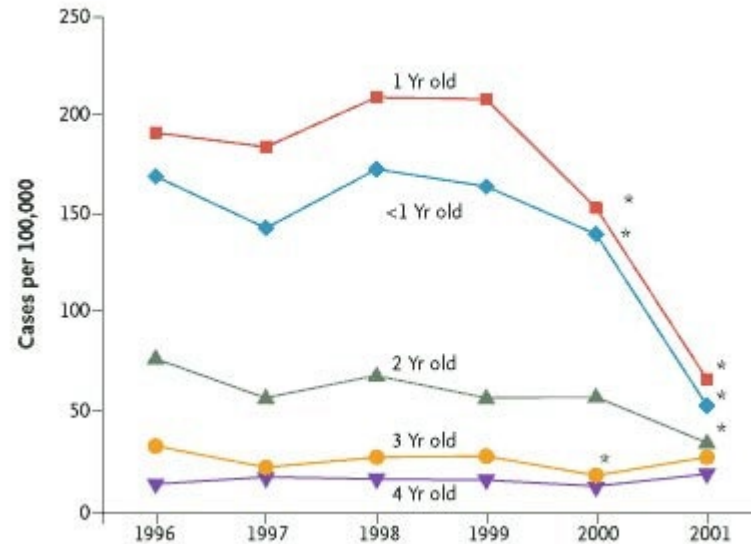
The case of pneumococcus

What makes *S. pneumoniae* unique in the context of reducing AMR

- Universal immunisation programs available
- Competent and highly recombinogenic
- Distinct vaccine and antibiotic targets



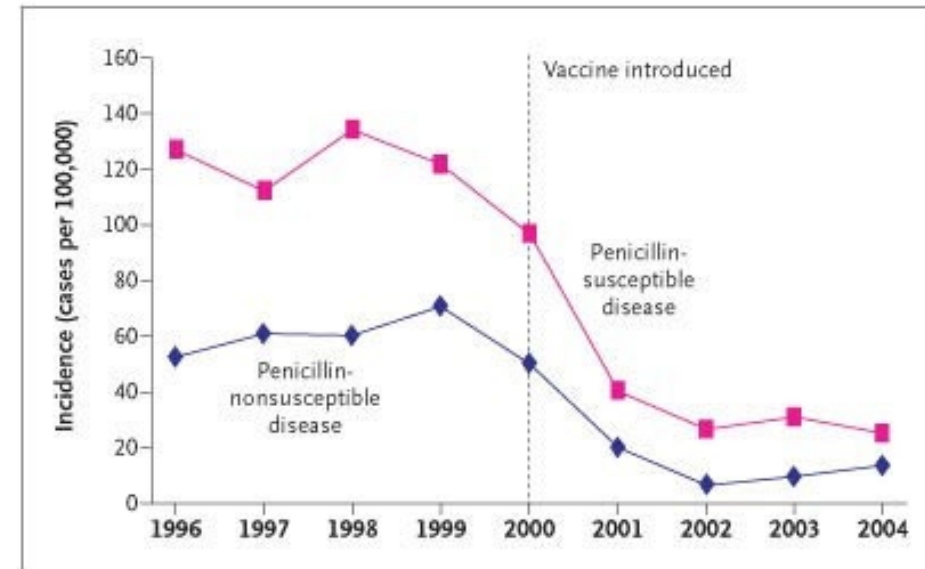
Universal vaccination: Reducing pneumococcal disease and antimicrobial resistance



Rates of invasive pneumococcal disease among children <5 yrs.

Whitney et al, doi: 10.1056/NEJMoa022823.
CDC Active Bacterial Core surveillance data.

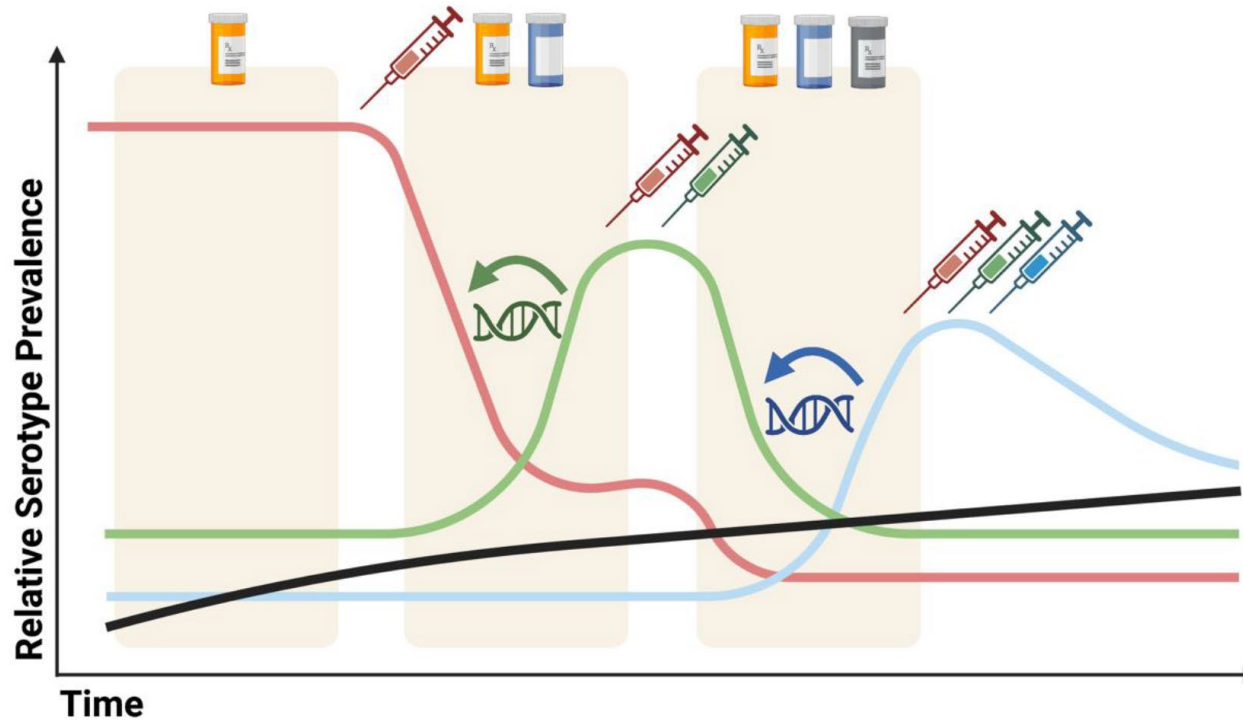
- Reduced bacterial colonisation in the nose and throat and indirect protection
- Adult vaccination programme



Annual Incidence of IPD caused by Penicillin-Susceptible and Penicillin-Nonsusceptible Pneumococci among Children under Two Years of Age, 1996 to 2004.

Kyaw et al doi:10.1056/NEJMoa051642.
CDC Active Bacterial Core surveillance data

Vaccines and Antibiotics: Shape Pneumococcal Population Dynamics



Johnson et al doi: 10.1016/j.chembiol.2023.11.003.

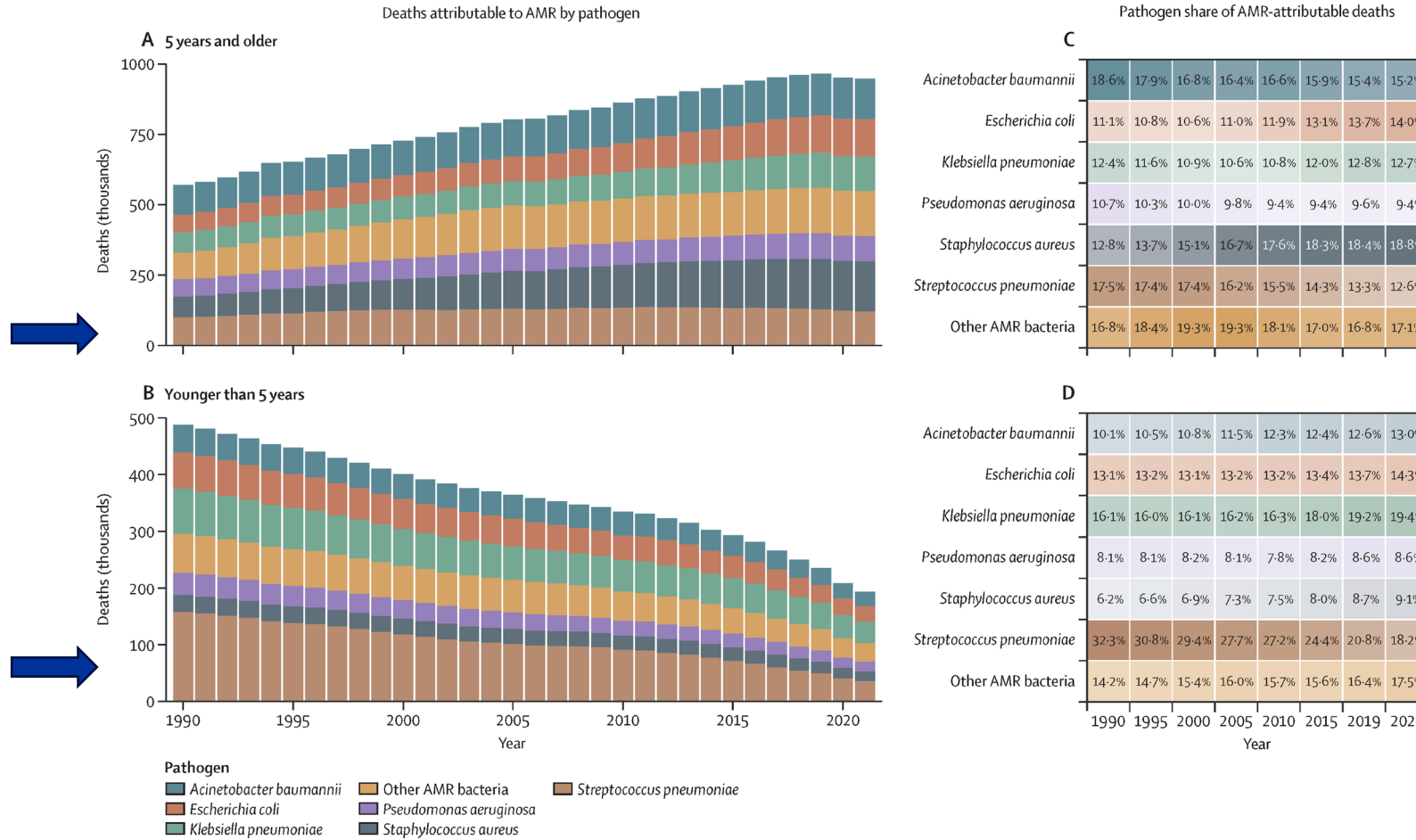
Following the introduction of universal vaccination:

- Vaccine targeted serotypes declined substantially but non-vaccine increased
- Serotype **19A**, frequently associated with penicillin resistance, emerged and expanded
- Penicillin-resistant pneumococcal infections increased

Mechanisms of adaptation allowing resistant strains to emerge and spread under vaccine and antibiotic pressure

- Serotype replacement: exchange genetic material with other pneumococci.
- Non-vaccine and non-encapsulated strains act as reservoirs of antimicrobial resistance genes.
- Changes in penicillin-binding proteins reduce β -lactam susceptibility.

Conclusions and future perspectives



S. pneumoniae

- 5 years and older, rising from 100 000 to 120 000
- <5 years decreased from 160 000 in 1990 to 35 000 in 2021

Source: GBD 2021 Antimicrobial Resistance Collaborators. doi: 10.1016/S0140-6736(24)01867-1



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Thank you

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