

Preventing hearing loss with vaccination



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Many avoidable causes of hearing loss, particularly in low- and middle-income countries (LMICs), are infectious diseases that can be prevented by existing vaccines. This is why the 2017 World Health Assembly Resolution on the prevention of deafness and hearing loss¹ urges Member States 'to ensure the highest possible vaccination coverage against rubella, measles, mumps and meningitis'. The greatest progress to date in preventing severe to profound sensorineural hearing loss can be attributed to the measles and rubella vaccines, and the bacterial meningitis vaccines (targeting *Haemophilus influenzae* type b, pneumococcal and meningococcal disease).²

Many of these vaccines are included in the World Health Organization (WHO)'s Expanded Programme on Immunisation (EPI). Immunisation programmes are now routinely reaching over 80% of children under one year of age and, since 2000, the Global Alliance for Vaccination and Immunisation (GAVI) has contributed to a steady increase in vaccine coverage in poorer countries.

Vaccine-preventable diseases causing hearing loss

Rubella: Rubella is usually a mild viral disease affecting susceptible children and young adults worldwide. Rubella infection in early pregnancy may result in miscarriage, foetal death or serious congenital defects (including severe or profound sensorineural hearing loss), known as congenital rubella syndrome (CRS).³ Large-scale rubella vaccination during the last decade has drastically reduced or practically eliminated rubella and CRS in many high-income countries and in some LMICs. Countries should consider starting rubella vaccination only if they can achieve a coverage level of 80% or greater.

Tuberculosis (TB): Sensorineural hearing loss is estimated to occur in 10–30% of tuberculous meningitis survivors. It may also occur following treatment with streptomycin, an ototoxic antibiotic (not now used in first-line TB treatment). The BCG vaccine, which protects against TB, was first used in 1921. BCG vaccination of infants should be done at or soon after birth.

Measles: Measles virus infection manifests as fever, rash, conjunctivitis, and bronchitis, with about 1% of infected children developing severe complications such as encephalitis in LMICs. It may lead to high mortality, especially in young children. The hearing loss due to measles is sensorineural and is usually in both ears. It may be moderate or profound. Measles vaccine is given either alone, or in a measles-rubella (MR), measles-mumps-rubella (MMR), or measles-mumps-rubella-varicella (MMRV) combination.

Mumps: Mumps virus infection causes fever, rash, parotitis and orchitis and is occasionally complicated by aseptic meningitis. Mumps likely causes sensorineural hearing loss through labyrinthitis which is often unilateral (80%).

Meningococcal meningitis: Meningitis, particularly meningococcal meningitis, is a recognised cause of severe and profound deafness as well as other neurological sequelae.⁴ Meningococcal meningitis is largely vaccine-



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Vaccination against certain diseases helps prevent hearing loss

preventable and several vaccines are available for protection from the most common serogroups causing disease.

Pneumococcal disease and otitis media:

Pneumococcal disease affects a large proportion of all populations. Clinical manifestations of infection include sepsis, bacteraemia, meningitis, pneumonia, bronchitis, sinusitis, otitis media, arthritis, and osteomyelitis. The association with hearing loss is most likely to occur through meningitis and otitis media. Out of over 90 serotypes, only a small minority cause most disease. There are two available pneumococcal conjugate vaccines (PCV) that target either 10 or 13 of the most prevalent serotypes. WHO recommends their inclusion in childhood immunisation programmes worldwide.⁵

Haemophilus influenzae type b (Hib): Manifestations of infection with Hib include sepsis, bacteraemia, meningitis, epiglottitis, pneumonia, cellulitis, arthritis, and osteomyelitis. The association with hearing loss is most likely to occur through meningitis and associated inflammation of the cochlea. Hib meningitis is complicated by sensorineural hearing loss in around 3–8% of affected children. WHO recommends the inclusion of Hib vaccines in all routine infant immunisation programmes.⁶

Future developments

Malaria: Malaria is a life-threatening disease, particularly amongst infants and children in Africa, and its complications, especially cerebral malaria, may cause hearing loss in survivors. Malaria treatment drugs such as quinine and chloroquine are ototoxic and may also cause hearing loss.

There is currently no commercially available malaria vaccine, but over 20 vaccine constructs are currently being evaluated in clinical trials or are in advanced preclinical development⁷ and it was recently announced from early vaccine trials that the R21/Matrix-M was the first malaria vaccine in children aged 5–17 months to reach the 75% efficacy target set by WHO.⁸

Otitis media: Worldwide, the majority of mild and moderate conductive hearing loss is associated with otitis media, which is to some extent a vaccine-preventable disease. The development, in the future, of otitis media vaccines that protect against common respiratory pathogens could greatly reduce the frequency of mild and moderate hearing loss in young children.²

References

- 1 70th World Health Assembly, Geneva, 22–31 May 2017. Resolution WHA.70.13. Prevention of deafness and hearing loss. <https://bit.ly/3CqxSNF>
- 2 Morris P and Leach A. The role of immunization in the prevention of hearing loss. In: Prevention of Hearing Loss. Newton VE et al. (eds). New York: Nova Science Publishers, 2012. Chapter 6. <https://bit.ly/3EnS7ff>
- 3 Smith A et al. (1988). Sequelae of epidemic meningococcal meningitis in Africa. *Trans R Soc Trop Med Hyg* (1988); 82: 312–320. <https://bit.ly/3bjQ2oh>
- 4 Smith A et al. (1988). Sequelae of epidemic meningococcal meningitis in Africa. *Trans R Soc Trop Med Hyg* (1988); 82: 312–320. <https://bit.ly/3mpR6gR>
- 5 <https://bit.ly/3mo7bDD>
- 6 <https://bit.ly/3mo7bDD>
- 7 <https://bit.ly/3mo7bDD>
- 8 Medical Express. 5 May 2021. <https://bit.ly/2ZvkZmE>