Study shows vaccination leads to decline in pneumococcal disease and antibiotic resistance

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Credit: National Cancer Institute

Wits University and the National Institute for Communicable Diseases (NICD) released a new study, led by Wits academics, showing rates of invasive pneumococcal disease (IPD) - including cases caused by antibiotic resistant bacteria - have fallen substantially in South Africa following the introduction of a pneumococcal conjugate vaccine (PCV)

in 2009.

The release of the results of the study coincides with World Pneumonia Day, commemorated annually on 12 November.

The study, titled: Effects of Vaccination on Invasive Pneumococcal Disease in South Africa, published in the latest edition of the *New England Journal of Medicine* (*NEJM*), compares IPD incidence after the introduction of PCV (post-introduction: 2011 and 2012) to incidence prior to its introduction (2005-2008), focusing on high-risk groups.

Although the majority of childhood pneumococcal deaths occur in Africa, evidence of the potential impact of pneumococcal vaccines in routine use has largely been drawn from high-income countries. However, two recent publications from South Africa have demonstrated PCVs to be effective in preventing pneumococcal disease among South African children, in conditions of routine vaccine use.

"The results show that the vaccine works as rolled out in our immunization program and this supports the hard work of our national and provincial Departments of Health. However, much still remains to be done in South Africa, other countries in Africa and elsewhere to prevent children from developing and dying from pneumonia,"said Dr Anne von Gottberg, lead author of the paper, Clinical Microbiologist, Head of the Centre for Respiratory Diseases and Meningitis at the NICD and Associate Professor in the School of Pathology at Wits.

This study demonstrates significant declines in pneumococcal disease cases caused by bacteria resistant to one or more antibiotics, a phenomenon of growing concern among health professionals. In fact, the rate of infections resistant to two different antibiotics declined nearly twice as much as infections that could be treated with antibiotics. This proportionately greater effect of vaccination on antibiotic-resistant

strains points to a very valuable added benefit of immunization.

"These are very compelling results," said Dr Seth Berkley, CEO of Gavi, the Vaccine Alliance, a Geneva-based global health organization that part-funded the research. "Not only does it add significant weight to the growing body of evidence that PCV prevents disease, but it suggests that vaccines may have a role to play in the fight against antibiotic resistance."

"Vaccination is one of the most effective and underappreciated tools available to reduce antibiotic resistance. The majority of resistant strains of pneumococcus are of types which are included in the vaccine, for this reason, vaccine introduction in South Africa, has led to a substantial decline in antibiotic resistant invasive pneumococcal disease," said Dr Cheryl Cohen, co-author of the paper, Clinical Epidemiologist at the NICD and senior lecturer in the School of Public Health at Wits.

In 2009, South Africa became the first African country - and the first nation in the world with a high HIV prevalence - to introduce PCV7 into its routine immunization program. The current study shows a significant decline in IPD in children and in unvaccinated adults, which demonstrates the indirect protection conferred by herd immunity. Among children under two years of age, overall incidence of IPD declined nearly 70% after PCV introduction, and rates of IPD caused by bacteria specifically targeted by the vaccine plummeted nearly 90%.

A recent study published by the researchers in the Pediatric Infectious Disease Journal found that the risk of IPD in South African children increased with HIV exposure, as well as with underlying medical conditions, malnutrition, tuberculosis, upper-respiratory tract infections and exposure to other children.

"We have shown that HIV-infected and HIV-exposed children

experience a disproportionate burden of pneumococcal disease. The vaccine has also been shown to be highly effective in HIV-exposed children and disease reductions have been observed in both HIV-infected and uninfected children," said Dr Claire von Mollendorf, a medical epidemiologist from the NICD. "This study reinforces what the scientific community has known - that the pneumococcal vaccine saves lives."

Although incidence of HIV among infants is decreasing in South Africa due to improved prevention of the mother-to-child HIV transmission and the use of anti-retrovirals, a large number of HIV-exposed yet uninfected children remain, for whom vaccination against pneumococcal disease may be of particular importance to ensuring reduced risk of life-threatening infections in childhood.

Provided by Wits University