

RESEARCH BRIEF

March 2019

PCV10 vaccine significantly reduced childhood pneumonia in Kilifi, Kenya

Summary

The introduction of 10-valent Pneumococcal Conjugate Vaccine (PCV10) led to a substantial reduction in the number of children hospitalized with pneumonia in Kilifi, Kenya. This brief presents results from the Pneumococcal Conjugate Vaccine Impact Study (PCVIS) on incidence of clinically-diagnosed and radiologically-confirmed pneumonia and highlights areas for further research.

Results and further research

PCV10 immunization program coverage

- 80 percent of 2-11 month old infants received PCV10 within the first year of vaccine introduction, and coverage remained consistently high throughout the program.

PCVIS Results

- Since pneumonia is one of the most common causes of admission to hospital among children under five years, the introduction of PCV10 has had a substantial beneficial impact in reducing childhood hospitalizations.
- Following introduction of PCV10, hospital admissions of children with radiologically-confirmed pneumonia reduced by a half, a diagnosis that is specific for bacterial pneumonia.

- Hospital admissions of children with clinical pneumonia reduced by over a quarter, a broad diagnosis that includes many cases of non-bacterial pneumonia.

Further research is needed to

- Find ways of reducing the per-child cost of PCV10 to make the vaccine program sustainable once Kenya transitions from Gavi The Vaccine Alliance support and has to pay the full cost of the vaccine.

About Kenya's PCV10 vaccine program

In 2011 Kenya was the first African country to include PCV10 in its childhood immunization schedule, with support from Gavi. Children under 12 months of age were given three doses of the vaccine, and, in Kilifi County, children under five were given two doses through a catch-up campaign. The catch-up campaign aimed to give children under five the same protection as if they had received the vaccination in infancy. In the first year of vaccine introduction, coverage for infants aged 2-11 months reached 80 percent and remained high thereafter.

About the Pneumococcal Conjugate Vaccine Impact Study

The Pneumococcal Conjugate Vaccine Impact Study (PCVIS) is one of the first field studies to provide population-level evidence of the impact of PCV10 on IPD and carriage in a lower-middle income country. PCVIS is the largest and longest before-after study of PCV impact in tropical Africa.

PCVIS has collected data in Kenya since 2008 through an integrated system that connects census data from the Kilifi Health and Demographic Surveillance System - the largest demographic surveillance system in Africa - with clinical data from Kilifi County Hospital, laboratory analyses and vaccination coverage data from health facilities throughout Kilifi County.

Results in context

In 2017 the Pneumococcal Conjugate Vaccine Review of Evidence (PRIME) found that only eight impact studies measuring vaccine effect on pneumonia met the inclusion criteria for quality, of which only two were from Africa. The PCVIS results make a major contribution to the available evidence about PCV impact on Pneumonia in Africa.

Photo: Infant being treated for pneumonia, Kilifi County Hospital, Kenya



PCVIS results

PCV10 reduced radiologically-confirmed hospital admissions by 48 percent

Hospital admissions of children under five years with radiologically-confirmed pneumonia reduced by half. X-ray confirmed pneumonia is serious - potentially life-threatening. The diagnosis is relatively specific for pneumococcal pneumonia. Based on the statistical analysis of the data, the rate of admission to hospital with radiologically-confirmed pneumonia was 301/100,000 but three months after vaccine was introduced it had fallen to 157/100,000 - the rate of 'prevented disease' was therefore 144/100,000.

Before the vaccine was introduced radiologically-confirmed hospital admissions were relatively constant, followed by an abrupt 48 percent reduction after the introduction of PCV10.

PCV10 reduced clinically-defined pneumonia hospital admissions by 27 percent

Hospital admissions of children under five years with clinical pneumonia, a broad diagnosis that includes cases of non-bacterial pneumonia, reduced by over a quarter after PCV10 introduction. The rate of admission to hospital with pneumonia was 1,220/100,000 but three months after vaccine was introduced it had fallen to 869/100,000 - the rate of 'prevented disease' was therefore 351/100,000.

Between 2002 and 2015, hospitalizations for clinically-defined pneumonia in Kilifi, Kenya, declined steadily, and by 71 percent overall. Some of this decline may be due to misdiagnosis of malaria, which declined during the study period, since malaria and pneumonia can be difficult to differentiate clinically. However, there was an abrupt additional 27 percent reduction in clinically-defined pneumonia cases after PCV10 was introduced which can be attributed to the vaccine.

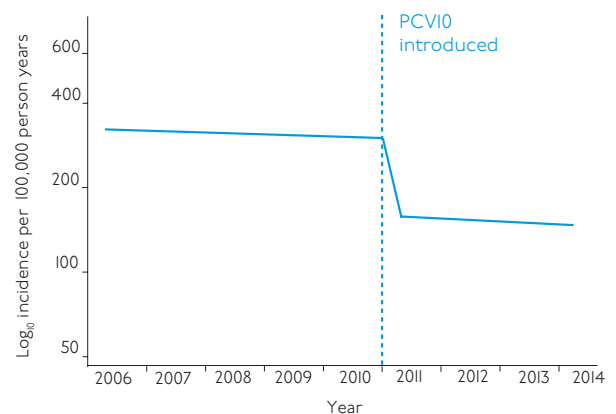
Public health impact: Three fewer under-fives in every 1000 get pneumonia

Before PCV10 introduction 12 children under five years in every 1000 were admitted to hospital per year based on a clinical diagnosis of pneumonia; after vaccination there were only nine diagnoses per 1000 children per year, indicating that the vaccine prevented three cases per 1000 children per year.

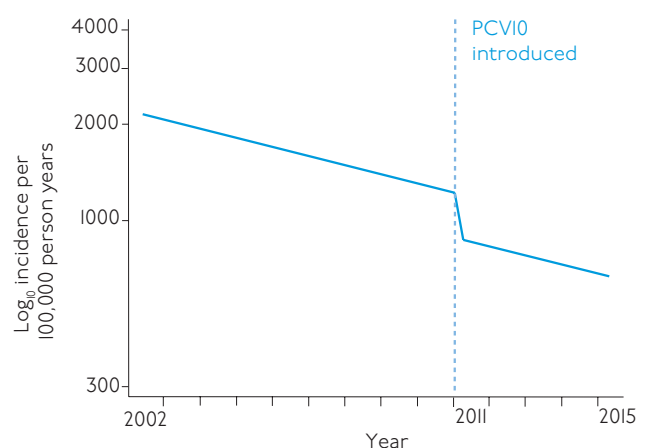
No impact on pneumonia in children aged 5+ years

There was no evidence of reduction in pneumonia in children aged over five years.

Reduction of 48 percent in incidence of radiologically-confirmed pneumonia hospitalizations of children aged between 2-59 months in Kilifi, Kenya after PCV10 introduction



Reduction of 27 percent in incidence of clinically-defined pneumonia hospitalizations of children aged between 2-59 months in Kilifi, Kenya after PCV10 introduction



Further research is needed

The population-level protection provided against vaccine type pneumococcal bacteria justifies continued inclusion of PCV10 in national childhood immunization schedules.

However, further research is needed to:

Find ways to reduce the per-child cost to make the vaccine program sustainable once Kenya graduates from Gavi-support

Currently, PCV10 is the most expensive vaccine in Kenya's immunization program. Options include:

- Developing a cheaper vaccine
- Reducing the dose quantity
- Reducing the number of doses a child receives.

KEMRI Wellcome Trust Research Programme is currently engaged in research in all these areas.

“This study shows considerable improvement in child health associated with the implementation of a PCV10 programme, providing important evidence for policy makers in Africa as they confront the challenge of sustaining immunisation programmes independently”

- Professor Anthony Scott
London School of Hygiene
& Tropical Medicine

References

- This research brief is based on the following paper: Silaba M, Ooko M, Bottomley C et al. Effect of 10-valent pneumococcal conjugate vaccine on the incidence of radiologically-confirmed pneumonia and clinically-defined pneumonia in Kenyan children: an interrupted time-series analysis. **Lancet Global Health**, 2019;7 March: 337-346. DOI: [doi.org/10.1016/S2214-109X\(18\)30491-1](https://doi.org/10.1016/S2214-109X(18)30491-1)
- (October 2017) Pneumococcal Conjugate Vaccine Review of Impact Evidence (PRIME) systematic review summary findings. Available at: www.who.int/immunization/sage/meetings/2017/october/3_FULL_PRIME_REPORT_2017Sep26.pdf (Accessed: 19 March 2019)

For information about PCV impact studies:

- International Vaccine Access Center (IVAC), Johns Hopkins Bloomberg School of Public Health. VIEW-hub [Online]. Available at: www.view-hub.org (Accessed: 19 March 2019)