Estimating the impact of new vaccine introduction in Chad, Guinea, Somalia, and South Sudan

Pneumococcal conjugate vaccine (PCV) and rotavirus vaccine

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Pneumonia and diarrhea remain the leading infectious causes of global childhood deaths, responsible for an estimated 1.3 million deaths annually in children under five years of age.[1] The availability of pneumococcal conjugate vaccine (PCV) and rotavirus vaccine products as well as widespread evidence of their safety and efficacy, make a compelling case to ensure wide access to these life-saving preventative measures, particularly in countries where there are multiple challenges such as high child mortality, disease outbreaks, geopolitical conflict, and climate-related disasters. Quantifying the potential impact of new vaccine introduction on saving children's lives and reducing the suffering due to pneumonia and diarrhea provides vital impetus for informed decision-making on introduction and scale-up of PCV and rotavirus vaccines.

KEY FINDINGS

▷ When implementing the immunization strategy of PCV + PCV catch-up vaccination + rotavirus vaccines across the four countries, it is estimated that approximately **87,023 lives could be saved cumulatively from 2024 to 2030**.

▷ This immunization strategy has the potential to **avert nearly 3.95 million cases of pneumococcal pneumonia and meningitis, as well as rotavirus-related diarrhea among under-5 children** cumulatively from 2024 to 2030 across Chad, Guinea, Somalia, and South Sudan.

Analysis was conducted using national estimates for four countries in Africa - Chad, Guinea, Somalia, and South Sudan. Considerations included:

- **Routine PCV** - three PCV doses given in the first year of life.
- **PCV catch-up vaccination** - single dose of PCV for children 12 to 59 months of age who have not received prior doses of PCV.
- **Routine rotavirus vaccine** - two or three doses of rotavirus vaccine according to the manufacturer's schedule.

The analysis presents four unique modeling scenarios for each of the four countries:

I. Routine PCV only;
II. Routine PCV + PCV catch-up vaccination;
III. Routine rotavirus vaccine only;
IV. Routine PCV + PCV catch-up vaccination + rotavirus vaccine.

Table 1: Potential lives* saved and potential cases* of severe pneumococcal pneumonia, meningitis, and rotavirus diarrhea averted among children aged 1 month to 59 months cumulatively from 2024 to 2030 for each country and scenario.

Country	I. PCV only		II. PCV + PCV catch-up vaccination		III. Rotavirus vaccine only		IV. PCV + PCV catch-up vaccination + rotavirus vaccine	
	Lives saved	Cases averted	Lives saved	Cases averted	Lives saved	Cases averted	Lives saved	Cases averted
CHAD	25,964	145,349	27,655	170,590	6,694	1,169,319	34,348	1,343,584
GUINEA	10,184	82,298	10,827	97,469	2,497	685,760	13,318	784,653
SOMALIA	21,439	152,397	22,709	179,669	6,269	1,126,638	28,974	1,309,326
SOUTH SUDAN	7,729	60,118	8,323	70,435	2,064	440,580	10,383	511,950
TOTAL	65,316	440,162	69,514	518,163	17,524	3,422,369	87,023	3,949,513

* deaths and cases attributed to pneumococcal pneumonia and meningitis, and rotavirus diarrhea among children 1-59 months of age.

The findings underscore a compelling case for immediate action in Chad, Guinea, Somalia, and South Sudan to introduce PCV and rotavirus vaccines.

The projections indicate significant mitigation of the burden of three major childhood diseases, and warrant serious consideration by policymakers and international stakeholders. **The incorporation of PCV and rotavirus vaccines into the national immunization schedules is a pivotal step toward enhanced child health and well-being**, not only within these countries but across the spectrum of public health globally.

Figure 1: Potential lives saved of children aged 1 month to 59 months cumulatively from 2024 to 2030 with PCV + PCV catch-up + rotavirus vaccine

Chad: 34,348
Guinea: 13,318
Somalia: 28,974
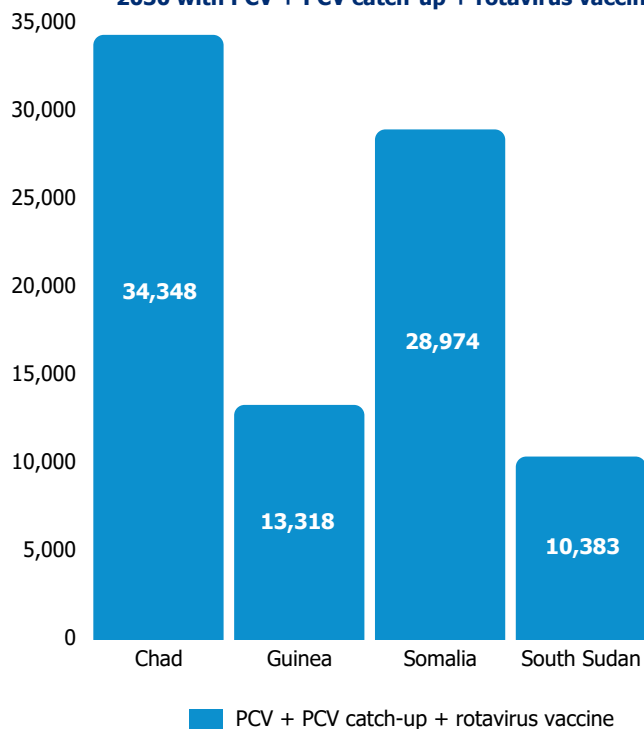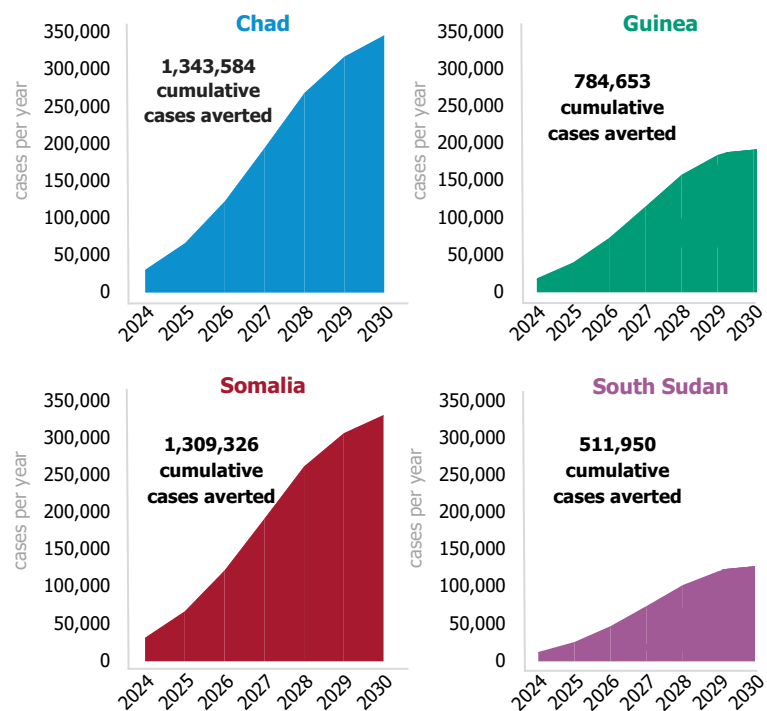South Sudan: 10,383

■ PCV + PCV catch-up + rotavirus vaccine

Figure 2: Potential cases of severe pneumonia, meningitis and diarrhea averted in children aged 1 month to 59 months by year with PCV + PCV catch-up + rotavirus vaccine

Chad: 1,343,584 cumulative cases averted
Guinea: 784,653 cumulative cases averted
Somalia: 1,309,326 cumulative cases averted
South Sudan: 511,950 cumulative cases averted

METHODS

The Lives Saved Tool (LiST) was to estimate the number of lives saved and cases averted due to new introductions of PCV and rotavirus vaccines in four countries - Chad, Guinea, Somalia and South Sudan. LiST is a linear, deterministic, mathematical disease modeling tool that estimates the impact of scaling up maternal, newborn, child health and nutrition interventions calculating changes in cause-specific mortality driven by changes in intervention coverage and intervention effectiveness.[2] The model assumes that routine vaccines are introduced in 2024 and scaled up to 90% coverage by 2030. For the present analysis, the model used the following inputs:

- **Mortality and risk estimates:**
  - Under-five mortality rate per 1,000 live births - Chad: 107.07, Guinea: 98.73, Somalia: 111.78, and South Sudan: 98.69.[3]
  - Proportion of pneumonia deaths in under-five children - Chad: 30%, Guinea: 23%, Somalia: 26%, and South Sudan: 29%.[4]
  - Attributable fraction for Streptococcus pneumoniae (pneumococcus) pneumonia deaths: 0.245[5] and meningitis deaths: 0.213[6]; Attributable fraction for diarrhea deaths due to rotavirus: 0.268.[7]
- **Vaccine efficacy:**
  - PCV efficacy for vaccine-type invasive pneumococcal disease (VT-IPD): 80%[8] and vaccine-type pneumococcal meningitis (VT-meningitis): 84%[9] and rotavirus diarrhea: 46%.[10]
  - PCV catch-up efficacy of single dose against VT-IPD: 58% (lower bound of 95%CI of 3-dose PCV): 58%.[8]
- **Vaccine coverage:** The model assumes 2024 as the base year when PCV and rotavirus vaccine are introduced into the national routine immunization schedule. Vaccination coverage is assumed to rapidly increase in the first four years (from 2024 to 2027) as seen in countries in the region of Sub-Saharan Africa. From 2027 to 2030, coverage is linearly scaled up to 90% in 2030, aligned with the Immunization Agenda 2030 goals. For PCV catch-up vaccination, the model assumes coverage of the eligible population (children 12-59 months who have not received prior PCV) each year is assumed to be 58%[11] within the routine immunization system at 5% coverage of the eligible population.

1 UNICEF. The State of the World's Children 2023
2 Lives Saved Tool. https://www.livessavedtool.org/
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4 Maternal Child Epidemiology Group (MCEE) 2017
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