Effects of Geographic and Economic Heterogeneity on the Burden of Rotavirus Diarrhea and the Impact and Cost-Effectiveness of Vaccination in Nigeria

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Background
Child mortality from rotavirus gastroenteritis remains high in Nigeria, representing 14% of all rotavirus deaths worldwide. This study examines the potential impact and cost-effectiveness of introducing two rotavirus three-dose vaccines in geographic and economic subpopulations of Nigeria, providing insight into where vaccination would have the greatest impact and informing strategies that maximize the benefits of vaccines.

Method
We used a spreadsheet-based model to project health and economic outcomes of rotavirus vaccination in children over the first five years of life. We used national survey data on rotavirus mortality risk factors and vaccination coverage to predict burden and impact across regional and wealth quintile subpopulations within Nigeria. Our base case considered costs from the government perspective assuming Gavi subsidies for the first five years of introduction with ROTAVAC® and ROTASIIL®. Cost-effectiveness was presented as Incremental Cost-Effectiveness Ratios (ICERs). Uncertainty was estimated using Monte Carlo simulation to assess the effect of input variables on outcomes, reported as 95% uncertainty limits (UL). One-way sensitivity analysis was used to estimate the effect of individual input variables.

Results
Rotavirus enteritis was estimated to cause 43,994 [UL: 36,949; 53,374] child deaths per year, with approximately 80% of the national burden concentrated in the three northern regions. Rotavirus vaccination would prevent 5,319 [3,634; 7,096] deaths, 12% [10%; 13%] of the national annual RV burden. National ICERs for ROTAVAC and ROTASIIL vaccination from the Nigeria government perspective were US$82 [67; 111] and US$91 [67; 124] per DALY averted, respectively. Regional percent reduction from ROTAVAC ranged from 6% [4%; 8%] in North West to 35% [24%; 42%] in South East with ICERs that ranged from (US$36 [21; 64] per DALY averted) in NW to (US$125 [79; 212] per DALY averted) in South South. Vaccine efficacy had the greatest effect on ICERs in every region in sensitivity analyses, followed by estimated administrative costs and rotavirus mortality.

Conclusion
Due to high, persistent, and inequitable burden of rotavirus in Nigeria, routine vaccination with either ROTAVAC® or ROTASIIL® could be an impactful and cost-effective strategy in reducing child mortality. Disparities in reduction are largely driven by inequality in vaccination coverage across regions and between socioeconomic subpopulations.