Cost-effectiveness of Broadly Neutralizing Antibodies for Infant HIV Prophylaxis

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BACKGROUND

- Injectable infant prophylaxis with a broadly neutralizing antibody (bNAb) could overcome gaps in the prevention of vertical HIV transmission cascade by providing long-acting protection from postnatal transmission.
- bNAbs are costly; as policymakers consider the potential role of bNAbs as prophylaxis, it is critical to understand whether they could be cost-effective.

OBJECTIVE

- To evaluate the long-term clinical impact and cost-effectiveness of bNAb infant prophylaxis to prevent postnatal HIV transmission in South Africa

METHODS

- Using the Cost-effectiveness of Preventing AIDS Complications (CEPAC)-Pediatric computer model, we simulated two cohorts of children from birth in South Africa:
  - **HE:** All children identified as HIV-exposed
  - **HR-HE:** Children identified as HIV-exposed and high-risk (e.g. mothers with <4 weeks (w) of ART, HIV RNA >1,000 c/mL within 4w of delivery, or incident HIV infection in pregnancy)
- For each cohort, we compared four strategies:
  1) Standard of care infant oral prophylaxis for 6-12 weeks per WHO guidelines (*SOC*)
  2) SOC + Single dose of bNAb: at birth (*1d bNAb*)
  3) SOC + Two doses of bNAb: at birth and 3 months (*2d bNAb*)
  4) SOC + bNAb dose every 3 months (m) while breastfeeding (*Extended bNAb*)
- Modeled outcomes included: pediatric life expectancy, lifetime HIV-related costs, and total perinatal and postnatal transmission (PPT).
- We defined cost-effective as an ICER <$900/YLS based on the CEPAC-generated ICER of two versus one lifetime ART regimen.

Table 1. Model input parameters

Model Inputs	Base Case	Source(s)
Preventive efficacy, %	*SOC*: 90 *bNAb*: 80*	Coovadia Lancet 2012, Nakamura AIDS 2013
Duration of bNAb effect with each dose, m	3	McFarland CROI 2019 Abstract 45
Prophylaxis costs	*SOC*: $7-11/m *bNAb*: $60/dose	Global Fund 2019, Assumption**
Breastfeeding duration, mean (SD), m	6 (6)	Myer PLoS Med 2018
Prophylaxis uptake, %/m***	*SOC*: 50-86 *bNAb*: 54-96	Desmond BMC Peds 2015, DHS 2016
PPT risks (range by maternal ART, CD4, and virologic suppression status) Perinatal transmission, one time % Postnatal transmission, %/m	 0.18-19.7 0.01-0.89	Myer HIV Med 2017, Mandelbrot CID 2015, Iliff AIDS 2005, Shapiro NEJM 2010, Petra Lancet 2002, Ngoma JIAS 2015

*Effect of SOC + bNAb calculated as applying 90% risk reduction, then applying an additional 80% risk reduction.
**Based on prior HIV vaccine modeling studies: *Harmon PLoS One 2016* and *Moodley Medicine 2016,* as well as *Voronin JAIDS 2017* ($10/g, dose 80-100mg).
***Uptake of bNAbs based on uptake of immunizations in South Africa.

Infant HIV prophylaxis with a low-cost broadly neutralizing antibody (bNAb) given at birth and throughout breastfeeding is likely to be a cost-effective approach to prevent postnatal pediatric HIV in South Africa.

RESULTS

Table 2. Base case results

	Total PPT (%)	LE from birth (life-years)	HIV-related costs (2019 USD)[a]	ICER ($/YLS)
All known children who are HIV-exposed (HE)				
SOC	3.7	61.27	300	*Ref*
1d bNAb	3.4	61.37	330	Dominated[b]
2d bNAb	3.2	61.50	340	Dominated[b]
Ext. bNAb	3.0	61.60	350	**420**
Only known high-risk children who are HIV-exposed (HR-HE)				
SOC	14.1	56.26	990	More costly, lower LE
1d bNAb	12.5	57.02	930	*Ref*
2d bNAb	12.3	57.13	940	Dominated[b]
Ext. bNAb	12.1	57.26	950	**290**

PPT: Perinatal and postnatal transmission, USD: United States dollars, ICER: incremental cost-effectiveness ratio, YLS: years of life saved, LE: life expectancy. [a]Costs discounted at 3%/year. [b]Has a higher ICER than another more effective strategy.

- *Extended bNAb* was the preferred strategy for both HE and HR-HE.

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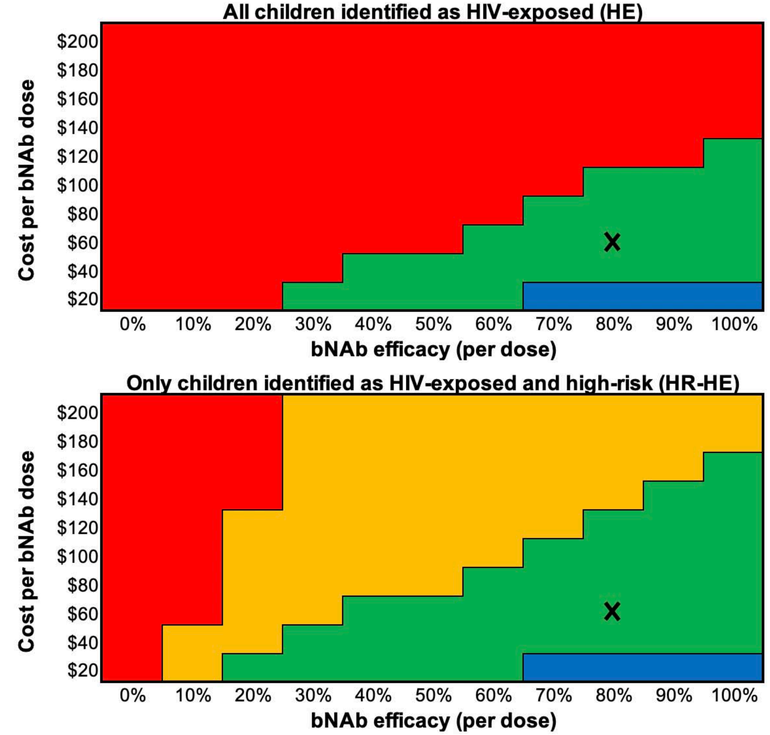
RESULTS (CONTINUED)

Figure 1. Sensitivity analysis of the preferred strategy for infant prophylaxis at a cost-effectiveness threshold of ICER <$900/YLS



- For HE, *Extended bNAb* remained the preferred strategy unless bNAb efficacy was <60% or costs exceeded $100/dose.
- For HR-HE, *Extended bNAb* remained the preferred strategy unless bNAb efficacy was <40% or costs exceeded $120/dose.

LIMITATIONS

- There is considerable uncertainty in long-term projections.
- More data on bNAb infant prophylaxis efficacy and costs are needed.

CONCLUSIONS

- At current estimates of efficacy and costs as high as $100/dose, bNAb prophylaxis given at birth and throughout breastfeeding for children who are HIV-exposed would be a cost-effective strategy to prevent HIV transmission in South Africa.