876 Modeling the Performance and Cost of Early Infant HIV Diagnosis at Birth

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Background: Untreated HIV-infected infants are at high risk of death in the first year of life. WHO recommends early infant diagnosis (EID) using virological testing (VT) from 6 weeks, but coverage is poor. Testing at birth (BT) was hypothesized to improve EID coverage and reduce mortality by earlier initiation of ART, although VT has poorer sensitivity at birth. We modelled the performance and cost of BT against the current WHO algorithm. We present preliminary results of the model applied to South Africa.

Methodology: A decision tree cohort simulation model was developed and applied to infants born in a prevention of mother to child transmission of HIV (PMTCT) program setting. Infants enter the model at birth with a risk of in-utero, intra- and post-partum transmission. In the BT algorithm, children are tested at birth (0-3 days), 12 wks, 9 and 18 months vs. testing at 6 wks, 9 and 18 months in the WHO algorithm. Both algorithms include testing at end of breastfeeding. The model runs up to 24 months of age. HIV-infected children have a probability of diagnosis, referral for HIV care, ART initiation or pre-ART death (Table 1). Outcomes of interest were positive predictive value (PPV), negative predictive value (NPV) of VT, cost per diagnosis, proportion of HIV-infected children correctly diagnosed, initiated on ART and pre-ART deaths.

Results: PPV and NPV was 88.5% and 97.6% in BT and 90.8% and 97.6% in the WHO algorithm, respectively. Cost per HIV-infected diagnosis was $1,379 and $458, respectively. The proportion of HIV-infected children diagnosed by 24 months was 69.2% in BT vs 54.9% in WHO algorithm. However, the proportion of HIV-infected children starting ART was more comparable at 37.0% vs 32.4%; and pre-ART deaths was 24.9% vs 26.7% respectively. In scenario analyses, assuming improved EID coverage, retention and referral for ART (90%) the proportion starting ART rose to 70.2% vs. 68.5%, and pre-ART deaths fell to 17.1% and 18.1% respectively. In contrast, if we assumed current coverage/referral rates but higher sensitivity of BT (98%), the proportion of HIV-infected diagnosed rose to 75.2%, but with modest improvements in proportions starting ART(40.7%) and pre-ART death (23.1%).

Conclusions: EID at birth would potentially increase the proportion of HIV-infected children diagnosed, but has lower PPV; if not accompanied by improved retention and referral for ART, it offers limited improvements in proportion starting ART or in reducing pre-ART mortality.

Table 1. Key model parameters and assumptions

Parameter	Estimate	Source/Comment
No. HIV-exposed infants born per year	258,000	S.African EID report 2012
Coverage of PMTCT (excluding single dose nevirapine)	95%	UNAIDS 2012
Risk of transmission in the PMTCT setting (assuming access to ART, include late presenters/defaulters)	3% in-utero, 1.3% intra partum, 0.2% per month breastfeeding	Guided by Sherman & Lilian 2012 (cumulative MTCT 7.9% If breastfeed for 18 months)
Infant diagnosis coverage	88% at birth (facility birth); 54.7% at <2 months;50% at 9months / end breastfeeding, 30% at 18 months	SA UNDP Maternal health 2009;South Africa EID report 2012; Assumption
Sensitivity of DNA PCR	67% at birth; 98.8% at 6 weeks; 99.2% >90 days	Shapiro et al. IAS 2011; S. Africa EID report 2012; WHO 2010.
Specificity of DNA PCR	99.09% at birth; 99.4% ≥ 6 weeks	Shapiro et al. IAS 2011; WHO 2010.
Rate of return for EID results	60%	Rollins et al. 2009
Referral to / initiate ART	67% if diagnosed <2mo;60% in older children	Hsiao et al. 2013