

Modeling Changes to the South African PMTCT Programme

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BACKGROUND

Prevention of mother to child transmission (PMTCT) is an effective HIV prevention strategy and a major entry point for treatment of HIV-positive women.

The success of PMTCT programs is determined by factors including:

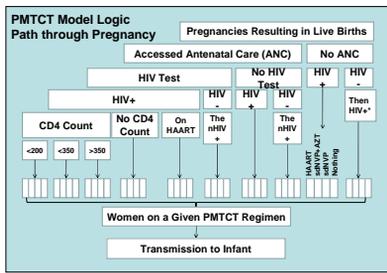
- HIV testing rates among pregnant women
- National PMTCT guidelines
- Compliance of the health system with guidelines

In South Africa, PMTCT guidelines recommend HAART for CD4 <200 and single-dose nevirapine and AZT for women with a CD4 >200. WHO guidelines recommend HAART for women with CD4 < 350 and a WHO 3 clinical condition. HIV testing rates and compliance with national guidelines vary between provinces and clinics.

In Gauteng, 190,000 live births were registered in 2007. Using this data, the prescribed path of pregnant women, and parameters from the literature, colleagues, and our own data, we can describe the path through pregnancy of HIV+ women and the origin of HIV+ infants.

METHODS

To model the path of HIV+ mothers through pregnancy, the PMTCT system, and origin of HIV+ infants, a freely available and open source model was built in MS Excel. This model has three key modifiable parameters: HIV testing rates, PMTCT guidelines, and compliance with guidelines.



Model Inputs: Gauteng Province – 190,000 live births (2007)

Accessing Antenatal Care (ANC)	95%
Antenatal HIV Testing Rate (baseline)	68%
Antenatal HIV Prevalence	30.3%
Pregnant Women Already on HAART	3.5%
Pregnant Women Who Test HIV- and Then Test HIV+	3%
Pregnant Women Who Receive CD4 Count Results (baseline)	70%
CD4 count of Pregnant Women	
<200	22.5%
200-350	24.5%
>350	53%
MTCT Transmission Rates	
On HAART	2%
sdNVP+AZT	5%
sdNVP	12%
No PMTCT Regimen	20%
No PMTCT Regimen, Women Who Test HIV- and Then HIV+	31.2%

Input: Regimens for Baseline Scenario - Current Compliance to Guidelines

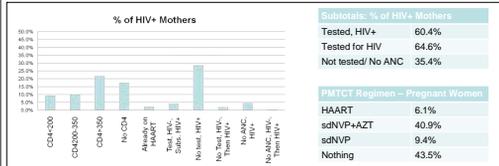
PMTCT Regimen	Percentage of Women in Each Path Receiving a Given PMTCT Regimen									
	CD4 <200	CD4 200-350	CD4 >350	No CD4 results	Tested, Then HAART	Tested, Then HIV+	No test, Then HIV+	No test, Then HIV-	No ANC, Then HIV+	No ANC, Then HIV-
HAART	40%	3%	0%	0%	100%	0%	0%	0%	0%	0%
sdNVP+AZT	40%	77%	80%	70%	0%	0%	0%	0%	0%	0%
sdNVP	10%	10%	10%	20%	0%	2%	5%	5%	5%	5%
Nothing	10%	10%	10%	10%	0%	98%	95%	95%	95%	95%

RESULTS

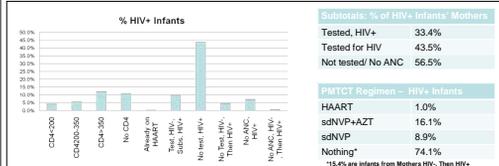
Model Output: Using this model we are able to map the path through pregnancy of HIV+ women, determine the services that are accessed, PMTCT regimen, if any, that is received, and where HIV+ infants are born within the system.

Model Output: Baseline Scenario, Gauteng Province (see methods)

Path through Pregnancy of HIV+ Women – 61,543 HIV+ Women



Path Resulting in HIV+ Infants – 7,823 HIV+ Infants



HIV Transmission Rate	No. of HIV+ Mothers	% of Total HIV+ Mothers	No. of HIV+ Children	Transmission Rate
Subtotal: Tested/Not Tested for HIV	37190	60.4%	2612	7.0%
Subtotal: Tested for HIV	39757	64.6%	3403	8.6%
Subtotal: Not Tested / No ANC	21786	35.4%	4420	20.3%

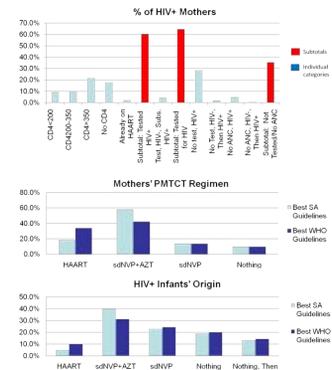
PMTCT Scenarios were modeled for Gauteng province. Changes to guidelines and improving testing and guideline compliance were modeled.

- 1) Baseline scenario: (Current SA guidelines, 68% HIV testing, current compliance to guidelines)
- 2) Baseline, 95% of women testing for HIV, current compliance to guidelines
- 3) Baseline, 68% testing, good compliance to guidelines (90% of women receiving CD4 test results, 90% of women receive CD4-appropriate PMTCT regimen, and 70% of women receiving sdNVP at labour if their HIV status is unknown)
- 4) Baseline, 95% testing, good guideline compliance
- 5) WHO guidelines (HAART for CD4 <350), 68% testing, current guideline compliance
- 6) WHO guidelines, 95% testing, current compliance
- 7) WHO guidelines, 68% testing, good compliance
- 8) WHO guidelines, 95% testing, good compliance

Scenario	Infants Born HIV+		Mothers' Regimens			
	No. of Infants	% Change from Baseline	HAART	sdNVP	sdNVP +AZT	Nothing
Baseline Scenario	7823		6%	41%	9%	56%
Baseline Scenario, 95% Testing	5971	-24%	9%	57%	11%	23%
Baseline Scenario, 68% Testing, Good Compliance	5751	-26%	13%	41%	30%	16%
Best SA Guidelines	4462	-43%	18%	58%	14%	10%

WHO Guidelines, 68% Testing, Current Compliance	WHO Guidelines, 95% Testing, Current Compliance	WHO Guidelines, 68% Testing, Good Compliance	WHO Guidelines, 95% Testing, Good Compliance (Best SA Guidelines)
7791	5927	5544	4174
-0.4%	-24%	-29%	-47%
8%	11%	24%	34%
39%	55%	30%	42%
9%	11%	30%	14%
56%	77%	84%	90%

Best Scenarios: Looking at the best scenarios for current SA guidelines and WHO guidelines, (red boxes) the number of infants born HIV+ having received no PMTCT regimen is significantly decreased compared to baseline but the relative contribution of these children is still greater than 30%. The large number of women with CD4 counts between 200-350 account for the largest category of infants born HIV+.



Retesting at Labour and providing sdNVP to HIV+ women is a proposed intervention to improve MTCT rates. We compare the baseline scenario to providing sdNVP to 70% of HIV+ women who present as HIV- or of unknown status.

Baseline	sdNVP at Labour for 70%
Mothers Receiving No PMTCT	17.7%
Infants Receiving sdNVP	21712
HIV+ Infants (AS)	6252 (-20.1%)

CONCLUSIONS

PMTCT models such as this can help programs identify gaps and direct resources to improve care. Using this model we can gain insight into the relative importance of different components of the path that leads to HIV+ infants as well as assumptions and gaps in our in our knowledge that become more apparent in mapping out systems.

The success of PMTCT programs is often measured by the transmission rate within the PMTCT system. While difficult to measure, it is important to include the mothers and infants that fall outside of this system and intervene where possible.

Using this model, we find that improvements to the percentage of pregnant women who test for HIV or changes to clinic and health systems that would improve guideline compliance have a large impact on both the number of women receiving appropriate antiretroviral therapy and the number of infants that are born HIV+.

Changes to PMTCT guidelines, while important, do not have a large impact on their own and must be done in conjunction with improvements to health systems if their impact is to be realized.

This model's limitations are many, key among them is the fact that post-partum transmission is not accounted for. Future versions of this model, will incorporate this omission and will include resource utilization (human resources, diagnostics and medicines) such that costs can be calculated and programs can more accurately plan for improvements to their PMTCT programs.

If you are interested in obtaining this tool or any of the tools developed by CSHOR, please contact us. www.cshor.org

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