HIV Testing Among Pregnant Women Who Attend Antenatal Care in Malawi

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Abstract: Malawi adopted the Option B+ strategy in 2011. Its success in reducing mother-to-child transmission depends on coverage and timing of HIV testing. We assessed HIV status ascertainment and its predictors during pregnancy. HIV status ascertainment was 82.3% (95% confidence interval: 80.2 to 85.9) in the pre-Option B+ period and 85.7% (95% confidence interval: 83.4 to 88.0) in the Option B+ period. Higher HIV ascertainment was independently associated with higher age, attending antenatal care more than once, and registration in 2010. The observed high variability of HIV ascertainment between sites (50.6%–97.7%) and over time suggests that HIV test kit shortages and insufficient numbers of staff posed major barriers to reducing mother-to-child transmission.

Key Words: PMTCT, HIV testing, antenatal care, supplies, Malawi

(*J Acquir Immune Defic Syndr* 2015;69:610–614)

Received for publication May 27, 2014; accepted March 6, 2015.

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Supported by NIH Grants: U01 AI0699 24 AID-OAA-A-11-00012; The Bill and Melinda Gates Foundation (Global Health Grant number opp1090200). O.K. and J.E. were supported by a PROSPER fellowship Grant to O.K. from the Swiss National Science Foundation (number 150934). The Malawi MOH HIV/AIDS Program is funded by The Global Fund and the President's Emergency Plan for AIDS Relief (PEPFAR). Also Supported by the National Institute of Allergy and Infectious Diseases (NIAID) and the Eunice Kennedy Shriver National Institute for Child Health and Human Development (NICHD) (IeDEA Southern Africa Grant number U01 AI0699 24) and the USAID-NIH initiative http://sites.nationalacademies.org/PGA/dsc/peerhealth/index.htm Partnership for Enhanced Engagement in Research (PEER) Health (NIH/PEER) Grant number AID-OAA-A-11-00012.

The authors have no conflicts of interest to disclose.

The content is solely the responsibility of the authors and does not necessarily represent the official views of the sponsors.

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BACKGROUND

UNAIDS and other agencies have called for the virtual elimination of mother-to-child transmission (EMTCT) of HIV. The 2011 global EMTCT plan[1] established strategies for accomplishing this goal and requires that 90% of all HIV-positive women have access to antiretroviral therapy (ART), so that new infections can be reduced to <5%. But, in many African countries, far fewer than 90% of pregnant women are tested for HIV. In Malawi, just more than 70% of pregnant women had their HIV status ascertained during antenatal care (ANC) in 2010.[2] Many women are tested for the first time during pregnancy, and HIV testing rates vary substantially between settings.[3]

Until August 2011, pregnant HIV-positive women in Malawi were managed under the 2006 World Health Organization (WHO) prevention of mother-to-child transmission guidelines. These guidelines recommended women with a CD4 count ≥350 cells per microliter and women in WHO stages 1 and 2 to start on antiretroviral prophylaxis in the third trimester (28 weeks). Lifelong ART was only recommended for women with a CD4 cell count <350 cells per microliter and those in WHO stages 3 or 4.

In September 2011, Malawi was the first country to introduce the Option B+ strategy, which calls for lifelong ART for all pregnant and breastfeeding women, irrespective of CD4 count and clinical status.[4] Option B+ is intended to streamline access to treatment and care for HIV-positive women, but its success depends on testing a sufficient percentage of pregnant women. We sought to determine the coverage, timing, and predictors of HIV testing among pregnant Malawian women who attended ANC.

METHODS

The prevention of mother-to-child transmission service cascade starts at the ANC clinic, which is usually part of an integrated maternal and child health service. On registration at the clinic, a woman's baseline data, including age, parity, gravidity, gestational age, treatment history, preventive medicines (ie, tetanus vaccine and malaria prophylaxis), and previous HIV test results, are recorded in paper-based registers. Follow-up data are recorded at every visit thereafter and include HIV testing status, preventive medications, and body weight. Each woman is followed for

6 months from registration, after which ANC outcomes are determined. During this follow-up period, the woman is expected to make at least 4 scheduled visits. ART data are collected in paper-based registers at smaller health facilities while facilities with more than 2500 patients use an electronic medical record system.[5]

Our primary measure was HIV ascertainment among pregnant women who attended ANC between January 1, 2010, and March 31, 2014, in Southern and Central Malawi. We included all sites that had an electronic medical record ART system in April 2011, the time when data entry started. Women were classified as HIV negative if their records included a negative HIV test within the last 3 months before the antenatal visit. They were classified HIV positive if their record showed a positive HIV test or if there was written evidence that they were on ART. Secondary outcomes were gestational age at the first ANC visit, percentage of women tested for HIV during the first trimester among all women who attended ANC, and percentage of HIV-positive women among all women whose HIV status had been ascertained. We analyzed individual records of HIV tests extracted from the paper-based ANC registers for the pre-Option B+ period (January 1, 2010, until June 30, 2011) and aggregated facility data for the whole time period (January 1, 2010, until March 2014).

We entered the individual-level ANC records into an electronic database. We calculated, by facility, the percentage of women whose HIV status had been ascertained and combined the results in a random-effect meta-analysis. Among women whose HIV status was unknown at ANC initiation, we calculated, for each facility, the percentage that was given rapid HIV tests. The percentage of women tested at clinics with at least 10 ANC attendees was calculated for each week. We used univariable and multivariable random-effect logistic regression models to identify demographic and facility-level characteristics associated with ascertaining HIV status. We considered the following variables: age ($<$20, 20–34, and $\geq$35 years); parity (0, 1, and $>$1); gestational age at the first ANC visit (first trimester versus thereafter); number of ANC visits (1 and $>$1); and year of ANC registration (2010 and 2011). We also included the following facility-level characteristics: facility location (urban and rural); zone (central east, central west, southeast, and southwest); type of facility (health center, Christian Health Association of Malawi hospital, district hospital, and central hospital); and the mean number of women registered at ANC per month ($<$300 and $\geq$300 women). We did a complete case analysis and an analysis with multiple imputations. Missing data concerning gestational age, HIV ascertainment, parity, and age were imputed using multiple imputation with chained equations.[6] We imputed values dependent on HIV ascertainment, parity category, gestational age category, and the other predictor variables from the multivariable analysis. We created 15 imputed datasets and combined results using Rubin's rule.[7]

We used the aggregated facility-level data to compare the proportion of women with ascertained HIV status during the pre-Option B+ and the Option B+ period.

The National Health Sciences Research Committee granted ethical approval for the study (approval number 962). All data analyses were performed with STATA software (version 13.1, Stata Corp, College Station, TX).

RESULTS

A total of 100,515 women from 19 sites were included in the individual-level data analysis and 194,345 women from the same sites were included in the aggregated data analysis. There were 13 district hospitals, 3 Christian Health Association of Malawi hospitals, 2 central hospitals, and 1 health center. Five of the 19 sites were located in urban areas, whereas other 5 sites served more than 300 new ANC women every month. Five sites were located in the central-west zone, 4 in the central-east zone, 6 in the southeast zone, and 4 in the southwest zone.

Individual-Level Data

The characteristics of these women are shown in Table 1. Only few women (5641; 5.6%) made their first antenatal visit in the first trimester (ranged from 1.6% to 14.7% between facilities). We had missing data of 5370 women (5.3%) on HIV ascertainment, 10,254 (10.2%) on gestational age at the first ANC visit, and 3319 (3.3%) on parity.

HIV status was ascertained for 82,714 (82.3%) of women, but this percentage varied widely across sites, from 50.6% to 97.7%. In 8 of the 19 facilities (42.1%), at least 90% of women had their HIV status ascertained during pregnancy. Most of the women (70,879; 85.7%) whose HIV status was ascertained had no previous valid HIV test result at the start of ANC and thus took a rapid HIV test, but the percentage ranged from 55.0% to 99.0% between facilities. Among women with known HIV status, 12.8% (10,596 of 82,714) were HIV positive; this percentage varied from 1.4% to 19.5% between facilities.

Table 1 shows the predictors of HIV ascertainment of the imputed analyses. In the unadjusted analysis, the likelihood of ascertained HIV status increased with age, parity, and the number of ANC visits. There was no difference between women who started ANC during the first trimester and those who started later. Women who were registered in 2011 were less likely to have ascertained HIV status. Health facilities in urban areas, that were health centers, located in southern zones, and that had $\geq$300 women registered per month were less likely to have high ascertained levels than health facilities in rural areas, located in central zones, that were not health centers, and that served $<$300 women per month. In multivariable analyses, age, registration year, and number of ANC visits remained independently associated with HIV ascertainment.

Figure 1 top panel shows weekly percentages of women whose HIV status was unknown at their first ANC visit and who were subsequently tested during pregnancy.

The proportion of women tested during pregnancy declined over time. In many facilities, testing rates fluctuated widely, and there were often weeks in which almost no women were tested. In only 1 site, there was HIV testing coverage $>$90% throughout the whole period examined.

TABLE 1. Patients and Facility Characteristics Associated With HIV Status Ascertainment Among Pregnant Women Attending ANC in Selected Health Facilities in Malawi

	No. Women	Women With Ascertained HIV Status	Imputed			
			Unadjusted		Adjusted	
	N	%	OR (95% CI)	*P*	OR (95% CI)	*P*
Clinic burden, women/mo						
≤300	50,252	87.4	1	<0.001	1	0.928
>300	50,263	77.2	0.45 (0.43 to 0.47)		0.78 (0.21 to 2.91)	
Facility type						
Health center	7470	50.6	1	<0.001	1	0.155
CHAM hospital	10,738	82.2	2.94 (2.72 to 3.19)		1.44 (0.12 to 16.86)	
District hospital	75,062	84.4	2.69 (2.54 to 2.85)		2.39 (0.26 to 22.19)	
Central hospital	7245	92.7	11.25 (9.66 to 13.11)		8.61 (0.61 to 121.43)	
Gestational age at first visit, wks						
≤12	5641	80.7	1	0.481	1	0.605
>12	84,620	81.1	1.03 (0.95 to 1.12)		0.98 (0.89 to 1.07)	
Unknown	10,254	92.6				
Parity						
Never given birth	26,195	81.9	1	0.008		0.825
1 birth	21,911	82.2	1.00 (0.94 to 1.05)		1.00 (0.93 to 1.07)	
>1 births	49,090	83.1	1.06 (1.01 to 1.11)		0.98 (0.92 to 1.05)	
Unknown	3319	74.5				
Age, yrs						
<20	19,219	81.2	1	<0.001	1	0.005
20–35	69,371	83.0	1.15 (1.10 to 1.21)		1.10 (1.03 to 1.17)	
>35	7278	84.4	1.21 (1.12 to 1.32)		1.15 (1.04 to 1.28)	
Unknown	4647	73.6				
Registration year						
2011	65,084	77.2	1	<0.001	1	<0.001
2010	35,431	85.1	1.67 (1.61 to 1.73)		1.77 (1.70 to 1.85)	
Facility location						
Rural	34,983	84.0	1	0.516	1	0.745
Urban	65,532	79.0	1 (0.99 to 1.02)		0.77 (0.17 to 3.60)	
Health area zone						
Central east	15,922	87.1	1	<0.001	1	0.947
Central west	38,465	86.3	0.89 (0.83 to 0.95)		0.99 (0.28 to 3.48)	
Southeast	29,301	82.3	0.54 (0.50 to 0.57)		1.34 (0.34 to 5.36)	
Southwest	16,827	68.7	0.46 (0.43 to 0.50)		0.95 (0.26 to 3.46)	
No. ANC visits						
1	27,164	71.1	1	<0.001	1	<0.001
>1	73,351	86.4	2.38 (2.29 to 2.47)		2.65 (2.54 to 2.77)	

Adjusted for all variables are shown in this table.
CHAM, Christian Health Association of Malawi; CI, confidence interval; OR, odds ratio.

Aggregated-Level Data

Aggregated-level data show that HIV ascertainment did not improve in the Option B+ period, whereas it was 82.3% (95% confidence interval: 80.2 to 85.9) in the pre-Option B+ period and was 85.7% (95% confidence interval: 83.4 to 88.0) in the B+ period (Fig. 1; lower panel).

DISCUSSION

We found that EMTCT goal of ascertaining the HIV status of at least 90% of all pregnant women at ANC clinics was not reached in Malawi between 2010 and 2014. Over this period of 51 months, the overall rate of HIV ascertainment was 84.8% and did not change significantly since the introduction of Option B+. Ascertainment rates varied widely between sites and fluctuated tremendously in sites over short time periods. Before Option B+, only 16% of facilities reached or exceeded the target of 90% of testing women with unknown status, but only 1 facility reached 90% every week. Women were more likely to have ascertained HIV status if they were older, registered in 2010, and if they made more than 1 antenatal visit.

Our data suggest that important barriers to achieving the EMTCT goal exist at the facility level. We observed sudden

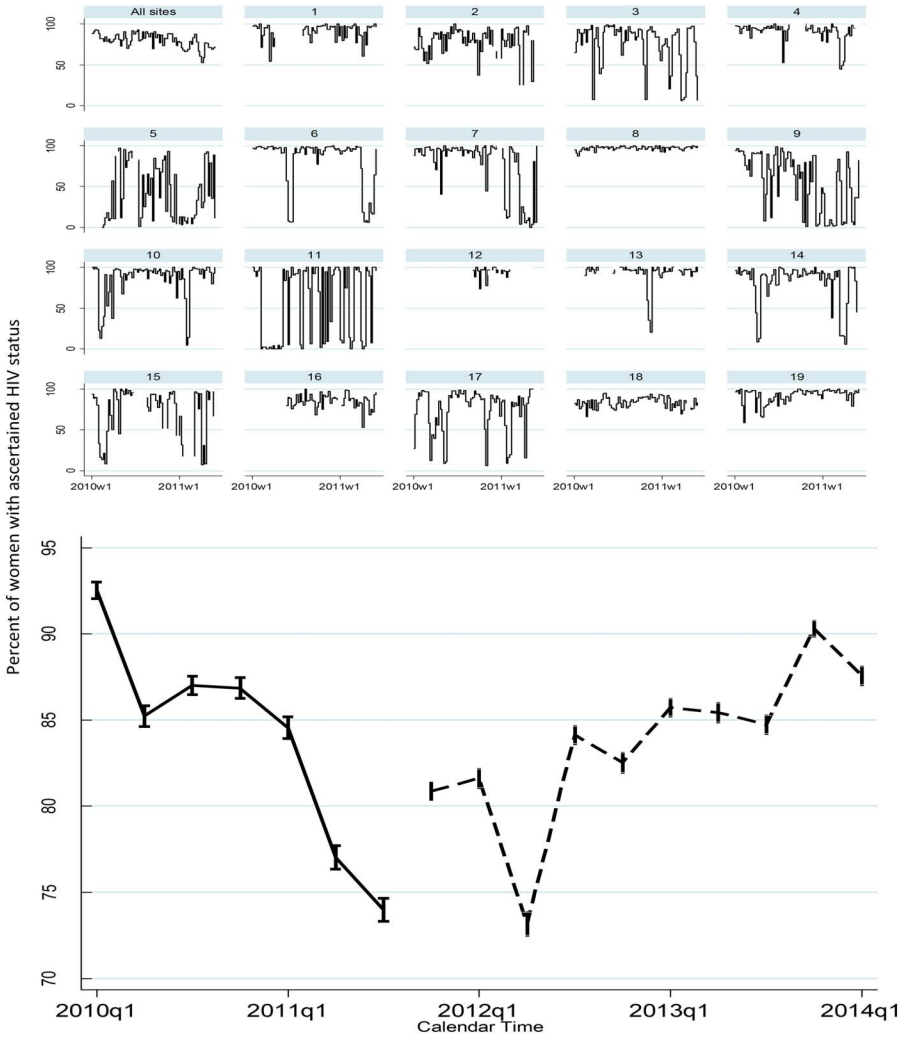

FIGURE 1. Upper panel: Proportion of women with unknown HIV status tested at their first ANC visit (n = 70,879/88,680*); *11,835 women with previous HIV test results have been excluded from the denominator. Lower panel: Percentage of women with ascertained HIV status by quarter for pre-Option B+ (solid) and Option B+ (dash) periods. w1, first week of the year; q1, first quarter of the year (January–March).

decreases over time in the number of women who received a new HIV test, and this is in line with previous findings that showed that temporary shortages of test kit supplies and staff interrupt regular testing of women for HIV during pregnancy.[8–11] Unfortunately, adequate data about the availability of HIV test kits and staff during the period were not available.

Several studies have shown that social and individual factors are associated with low rates of HIV testing. Low uptake of HIV testing has been associated with single motherhood, low level of education, lower socioeconomical class, late ANC attendance, and fewer ANC visits.[3,4,12–16] We also found that women who had more than 1 ANC visit were more likely to have an ascertained HIV status than those who made a single visit probably because multiple visits increased the chance to attend when materials and testing staff were available. Consistent with findings in the Malawi Demographic Health Survey of 2010, we found that women younger than 20 years were less likely to have known HIV status than older women.[17]

The large number of participants and the diverse group of facilities across the whole country of Malawi allowed us to examine many factors in parallel that can influence HIV ascertainment. Our study also has a number of limitations: If women registered more than once, we would have been unable to identify this. We lacked access to socioeconomic information while this can determine HIV testing status importantly. We had incomplete data on gestational age, age, parity, and HIV testing; however, similar results of the analysis with multiple imputations and the complete case analysis in multivariable modeling suggest that this did not affect outcomes importantly. We were also limited by our inability to determine why individual women were not tested. A Malawian study from 2005 showed that 4.5% of women refused pretest counseling, saying that they wanted to get their husband's consent and then never coming back.[18] We restricted our study to women who attended ANC in a health facility because all but 3% of pregnant women attend ANC[17]; an unknown proportion of women first present only in maternity or during delivery.

CONCLUSIONS

The current level of HIV testing uptake among pregnant women in Malawi is too low to reach the EMTCT targets and

the millennium development goals, and this rate needs to be improved to attain the full benefits that the Option B+ strategy potentially offers. The reasons why some facilities consistently have high ascertainment rates must be determined by future research. Potential barriers such as HIV test kit shortages and an inadequate number of trained staff at clinics need to be tackled with high priority.

ACKNOWLEDGMENTS

The authors thank the following persons who did the data entry: Ashton Mwechumu, Salome Shaba, Bazaliel Nemoni, Clement Nthala, Dorren Makamba, Enock Chauwa, Gomezyani Nayasulu, Gladys Mpacha, Lyton Chimososla, Memory Dzonzi, Alinafe Chingwalu, Takondwa Zidana, Asemenye Nyasulu, Faith Phiri, Mafuno Midiani, Synos Nkhata, Nancy Maosa, and Alinafe Kantambo.

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