

Knowledge of HIV Status and Seropositivity after a Recently Negative Test in Malawi

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BACKGROUND

- In 2015, Malawi had an estimated 980,000 people living with HIV (PLHIV), an HIV prevalence of 9.1% among adults aged 15-49 years, and 27,0000 AIDS-related deaths^{1,2}
- In 2004, the Malawi Demographic Health Survey (MDHS) reported that 83% of adults had never been previously tested for HIV, and among those never tested, HIV prevalence was 12.6%³
- Since then, the Government of Malawi, with support from the United States President's Emergency Plan for AIDS Relief (PEPFAR) has scaled-up HIV counseling and testing (HCT), with the 2010 MDHS reporting a prior testing rate of 73% in females and 53% in males; however, self-reported HIV status based on prior HIV testing was poorly correlated with actual serostatus as determined by the survey⁴
- Prior studies have defined awareness of one's HIV status as having a prior test and received the result,⁴⁻⁵ however recent seroprevalence testing conducted in conjunction with demographic health or AIDS Indicator Surveys provide an opportunity to compare self-reported previous test results with current serostatus⁶⁻⁹



OBJECTIVE

- Given the recent scale-up of HCT in Malawi, we analyzed data from the most recent MDHS (2010) to assess accurate knowledge of HIV status among adults, and to identify risk factors for current seropositivity among those who reported most recently negative results

METHODS

- We analyzed data from the 2010 MDHS, a large, nationally representative, cross-sectional survey of adults from 27,307 households:⁴
 - The 2008 Malawi Population and Housing Census was used as a sampling frame
 - Sample was selected using a stratified, two-stage cluster design
 - All eligible women aged 15-49 (n=23,748), and a subsample of men aged 15-59 in a third of households (n=7,783) were interviewed
 - 1/3 households were selected for HIV testing: 87% eligible respondents were interviewed and consented to testing. Overall testing coverage was 91% for women and 84% for men
 - Dried blood spots tested using the Vironostika® HIV Uni-Form I Plus-O (Biomerieux) ELISA test. A non-reactive test considered negative. Positive results confirmed by a 2nd ELISA assay, Enzygnost® Anti-HIV 1/2 Plus (Dade Behring). Discordant results retested by both methods and, if again discordant, with Western Blot 2.2 (Abbott Labs).
- The 2010 MDHS survey questionnaire dataset and HIV laboratory dataset were merged, and the combined dataset analyzed using survey procedures in STATA 13.0® to account for stratification, sample weighting and clustering within the MDHS' complex survey design.
- Frequencies and weighted proportions with 95% confidence intervals (CI) were calculated for variables including HIV prevalence and prior testing
- A domain analysis was performed on the subpopulation of patients aged 15-49 who were ever sexually active to characterize those who reported a negative HIV test within 12 months
- Statistical significance for cross tabulations was conducted using the Rao-Scott Chi-squared test
- Accurate knowledge of HIV status was defined as concordance between a self-reported result from a most recent prior HIV test and the MDHS HIV test result
- A multivariable model (constructed separately for females and males) was used to determine factors independently associated with being HIV-positive after reporting a most recently negative test result within 12 months.

RESULTS

- Of 13,910 adults tested for HIV, 11,649 of the unweighted sample (83.7%) were aged 15-49 and ever sexually active
 - Within this study subpopulation, HIV prevalence was 12.0% (95% CI: 11.1-13.0)
- Prior HIV Testing:**
- 69% (95% CI: 67.8-70.3) of this subpopulation reported ever having had a prior HIV test: 97.9% (95% CI: 97.5-98.1) said they had received their test result, and HIV seroprevalence among these was 13.3% (95% CI: 12.1-14.5)
 - Among those who reported never testing, 93.2% said they knew where to get tested, and HIV seroprevalence was 8.9% (95% CI: 7.8-10.2)

Accurate Knowledge of HIV Status (Table 1):

Table 1: A Comparison of "Awareness" Versus "Accurate Knowledge" of HIV Status among Sexually Active Adults Aged 15-49 in Malawi

"Awareness" (denoted in italics)	%	95% CI
Reports a previous HIV test and receipt of the result	68.1	66.7-69.4
Reports a previous HIV test but no receipt of the result	1.0	0.8-1.3
Reports never having a previous HIV test	30.8	29.5-32.2
Previous testing status unknown	0.1	0-0.1
Total	100	-

"Accurate Knowledge" (denoted in italics)	%	95% CI
HIV-positive and previous test reported to be positive	4.1	3.7-4.7
HIV-negative and previous test reported to be negative	57.6	56.2-59.0
HIV-positive and previous test reported to be negative	4.7	4.2-5.4
HIV-negative and previous test reported to be positive	0.2	0.1-0.3
Reports never having a previous HIV test	32.2	30.9-33.6
Previous test result unknown	1.1	0.8-1.4
Total	100	-

*"Awareness" of HIV status defined as having prior test and receiving result. "Accurate knowledge" defined as concordance between self-reported most recent test result and MDHS test result.

- Of those with a prior HIV test result documented, 7.1% (95% CI: 6.3-8.0) were seropositive but incorrectly thought they were HIV-negative based on their last test
- Of those found to be HIV-positive in the MDHS:
 - 35.2% (32.1-38.6) reported a previously positive test
 - 23.5% (20.7-26.5) reported no prior testing
 - 40.3% (36.8-43.8) reported a most recently negative test, of which 49.7% (43.1-56.3) were tested within 12 months

HIV Seropositivity within 12 Months of a Reportedly Negative HIV Test (Table 2):

- HIV prevalence within this group of sexually active adults aged 15-49 who reported a most recently negative HIV test within 12 months was 6.2% (95%CI: 5.2-7.5)

Table 2: Factors* Associated With Seropositivity among Sexually Active Adults Reporting a Negative HIV Test within 12 Months

VARIABLE	Female			Male		
	HIV prevalence	OR [CI]	AOR [CI]	HIV prevalence	OR [CI]	AOR [CI]
Age Group						
15-24 (n=1,320)	6.1 [3.9-9.3]	Reference	--	1.7 [0.8-3.5]	Reference	--
25-34 (n=1,366)	8.2 [5.7-11.6]	1.38 [0.79-2.40]	--	4.9 [3.2-7.4]	3.00 [1.26-7.14]	1.30 [0.48-3.53]
35-49 (n=944)	7.4 [4.9-11.2]	1.24 [0.65-2.36]	--	10.7 [6.7-16.6]	7.00 [2.81-17.40]	2.00 [0.73-5.47]
Region						
Northern (n=702)	3.3 [1.7-6.4]	Reference	--	3 [1.6-5.4]	Reference	--
Central (n=1,309)	5 [3.2-7.7]	1.55 [0.68-3.56]	1.53 [0.65-3.57]	4.8 [2.9-7.9]	1.64 [0.73-3.71]	1.43 [0.62-3.31]
Southern (n=1,619)	10.7 [7.9-14.4]	3.51 [1.63-7.56]	3.17 [1.46-6.88]	6.4 [4.5-9.0]	2.21 [1.07-4.57]	2.21 [1.01-4.80]
Residence						
Urban (n=489)	15.9 [10.1-24.3]	Reference	--	9 [5.6-14.2]	Reference	--
Rural (n=3,141)	5.3 [4.1-6.9]	0.29 [0.16-0.53]	0.57 [0.29-1.11]	4.1 [3.0-5.6]	0.44 [0.24-0.80]	0.45 [0.20-0.99]
Education						
Primary or less (n=2,543)	5.1 [3.8-6.8]	Reference	--	6.3 [4.3-9.1]	Reference	--
Secondary or more (n=1,087)	14.7 [10.0-21.1]	3.20 [1.89-5.41]	2.58 [1.37-3.85]	3.7 [2.3-5.8]	0.57 [0.29-1.10]	0.48 [0.21-1.10]
Marital Status						
Married or living together (n=2,637)	8.3 [4.5-14.7]	Reference	--	0.6 [0.3-1.5]	Reference	--
Never married (n=674)	6.2 [4.5-8.5]	1.37 [0.65-2.87]	0.29 [0.08-1.00]	6.8 [5.0-9.3]	0.09 [0.03-0.22]	0.05 [0.01-0.25]
Widow, divorced, not liv tog (n=319)	12.7 [7.9-19.9]	2.20 [1.18-4.11]	1.10 [0.48-2.53]	12.2 [5.4-25.3]	1.88 [0.73-4.85]	1.78 [0.53-5.90]
Wealth Index Quintile						
Poorest (n=592)	4.3 [2.1-8.5]	Reference	--	3.7 [1.8-7.3]	Reference	--
Poorer (n=708)	2.9 [1.5-5.5]	0.68 [0.25-1.83]	0.71 [0.25-2.03]	3.8 [2.1-6.7]	1.03 [0.40-2.67]	0.92 [0.32-2.61]
Middle (n=759)	4.7 [2.8-7.8]	1.11 [0.45-2.75]	1.29 [0.50-3.31]	5.8 [3.1-10.5]	1.62 [0.61-4.28]	1.41 [0.54-3.65]
Richer (n=774)	7 [4.0-11.8]	1.69 [0.66-4.30]	1.45 [0.57-3.69]	3.3 [1.7-6.0]	0.89 [0.36-2.17]	0.94 [0.31-2.28]
Richest (n=797)	15 [10.9-20.3]	3.96 [1.74-9.00]	2.49 [0.95-6.53]	7.9 [4.7-13.2]	2.27 [0.90-5.70]	3.44 [1.15-10.26]
Knows Condoms Reduce HIV Risk						
No (n=928)	8.9 [5.8-13.3]	Reference	--	3.6 [2.0-6.3]	Reference	--
Yes (n=2,695)	6.6 [5.1-8.5]	0.73 [0.45-1.17]	0.62 [0.39-0.99]	5.8 [4.2-7.8]	1.65 [0.84-3.23]	1.68 [0.83-3.43]
Knows Monogamy Reduces Risk						
No (n=454)	5 [2.6-9.6]	Reference	--	1.9 [0.7-5.2]	Reference	--
Yes (n=3,169)	7.5 [5.8-9.8]	1.54 [0.72-3.31]	--	5.7 [4.3-7.6]	3.06 [1.07-8.73]	2.95 [1.02-8.55]
Age at First Intercourse						
≤15 (n=1,005)	7.6 [4.8-11.7]	Reference	--	7.4 [4.2-12.6]	Reference	--
16-17 (n=680)	9.2 [5.8-14.3]	1.24 [0.61-2.50]	--	5 [2.7-9.0]	0.66 [0.26-1.69]	0.69 [0.31-1.55]
18-19 (n=646)	8.2 [4.6-14.4]	1.09 [0.49-2.43]	--	4.6 [2.7-7.8]	0.61 [0.26-1.46]	0.37 [0.16-0.88]
≥20 (n=1,299)	5.7 [3.9-8.4]	0.74 [0.39-1.40]	--	3.6 [2.3-5.6]	0.47 [0.22-1.00]	0.32 [0.14-0.72]
Lifetime Sexual Partners						
1-2 (n=2,473)	5.7 [4.4-7.5]	Reference	--	3.5 [2.2-5.4]	Reference	--
3-4 (n=740)	15 [9.3-23.3]	2.89 [1.66-5.04]	1.80 [1.01-3.21]	7.3 [4.6-11.3]	2.18 [1.11-4.29]	1.31 [0.62-2.78]
≥5 (n=396)	32.9 [12.7-62.5]	8.06 [2.27-28.63]	4.44 [1.17-16.88]	6.1 [3.6-10.1]	1.82 [0.89-3.72]	1.13 [0.47-2.73]
Lifetime Unions						
0-1 unions (n=2,959)	5.8 [4.4-7.7]	Reference	--	4 [2.7-5.8]	Reference	--
>1 union (n=659)	12.4 [8.3-18.0]	2.28 [1.40-3.71]	2.64 [1.59-4.39]	11.7 [7.8-17.2]	3.21 [1.76-5.84]	2.23 [1.23-4.02]
Recent Sexual Activity						
Active within 4 weeks (n=2,268)	5.4 [3.9-7.3]	Reference	--	4.9 [3.5-6.7]	Reference	--
Not active within 4 weeks (n=1,362)	10.4 [7.6-14.2]	2.05 [1.33-3.17]	1.72 [0.94-3.14]	5.7 [3.4-9.5]	1.18 [0.61-2.27]	2.14 [1.13-4.06]
#Extramarital Partners in 12 Months						
0 (n=3,017)	7.2 [5.5-9.3]	Reference	--	6.3 [4.7-8.3]	Reference	--
≥1 (n=613)	8.2 [4.1-15.8]	1.17 [0.53-2.59]	--	2.2 [1.0-4.7]	0.33 [0.14-0.77]	1.07 [0.37-3.14]
Condom Each Time, Last Partner						
No (n=2,834)	6.1 [4.5-8.3]	Reference	--	6.2 [4.5-8.4]	Reference	--
Yes (n=334)	14.5 [7.3-26.6]	2.60 [1.12-6.00]	2.61 [0.86-7.91]	1.7 [0.6-4.3]	0.26 [0.09-0.73]	0.63 [0.20-1.96]
No sex in 12 months (n=436)	12.5 [7.7-19.5]	2.19 [1.18-4.07]	1.75 [0.79-3.89]	3.8 [1.7-8.4]	0.61 [0.24-1.52]	2.12 [0.57-7.86]

DISCUSSION

High rate of undiagnosed HIV in Malawi

- Dramatic increase in reported HIV testing in Malawi 2004-2010 however, of those found to be HIV-positive in 2010, a quarter reportedly had never been previously tested³⁻⁴
- This missed opportunity reinforces the need for continued scale-up of HCT to reduce the number of undiagnosed HIV infections in Malawi, increase the number of PLHIV on ART, and align with universal test and treat strategies for HIV prevention

Reported prior testing overestimates accurate knowledge of current serostatus

No surprising risk factors for recent HIV infection elucidated

- Our analyses did not reveal additional factors that distinguish people more likely to acquire HIV after a recently negative test beyond those suggested by the general Malawi population⁴
- Other findings could also be expected based on known risk factors for HIV acquisition: more than one lifetime union, not knowing the benefits of condoms, early sexual debut, etc.

High-quality post-test prevention counseling for patients who test negative is critical

- We found a high prevalence of newly identified HIV infection among the survey population with a most recently negative HIV test, as soon as within 12 months

Annual retesting may be necessary even in people not traditionally defined as "high-risk" by WHO re-testing guidelines, if HIV incidence within the general population is high enough

- 2015 WHO guidelines state that, for patients who test negative but admit high recent or ongoing risk of exposure, HIV retesting can be considered within 6-8 weeks, and is recommended at least annually while at continued high risk⁹
- High risk defined by WHO as people who inject drugs, sex workers, men who have sex with men, recent sexually transmitted infections (STIs) or high-risk or HIV-positive partners⁹

Limitations: data and HIV tests from 2010; survey response bias; no viral loads or HIV incidence assays used to distinguish incidence from prior false-negative results; MDHS survey not designed to assess HIV prevalence and risk factors among small but high-risk populations

REFERENCES

- UNAIDS. The Gap Report, 2015.
- UNAIDS. Malawi: HIV and AIDS Estimates, 2015.
- National Statistical Office (Malawi) and ORC Macro. Malawi Demographic and Health Survey, 2004.
- National Statistical Office (Malawi) and ORC Macro. Malawi Demographic and Health Survey, 2010.
- Kenyon CR, et al. Who Knows Their Partner's HIV Status? Results From a Nationally Representative Survey in Uganda. *JAIDS*. 2015; 69: 92-97.
- Kimanga DO, et al. Prevalence and Incidence of HIV Infection, Trends, and Risk Factors Among Persons Aged 15-64 Years in Kenya: Results From a Nationally Representative Study. *JAIDS*. 2014; 66: S13-S26.
- Cherutich P, et al. Lack of Knowledge of HIV Status a Major Barrier to HIV Prevention, Care and Treatment Efforts in Kenya: Results from a Nationally Representative Study. *PLoS One*. 2012; 7(5): e36797.
- Ng'ang'a A, et al. The Status of HIV Testing and Counseling in Kenya: Results from a Nationally Representative Population-Based Survey. *JAIDS*. 2014; 66: S27-S36.
- WHO. Consolidated Guidelines on HIV Testing Services, 2015.

