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Factors Associated with Late Engagement to HIV Care in Western Kenya: A Cross-Sectional Study

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Abstract

Background: Late presentation of patients contributes significantly to the high mortality reported in HIV -care and treatment programs in sub-Saharan Africa. **Methods:** A cross-sectional study was conducted to assess factors associated with late engagement to HIV care at the Academic Model Providing Access to Healthcare in western Kenya. Late engagement was defined as baseline CD4 $\leq$100 cells/mm^3. **Results:** Of the 10 533 participants included in the analysis, 67% were female and mean age was 36.7 years. Overall, 23% of the participants presented late. Factors associated with late engagement included male gender (adjusted odds ratio [AOR]: 1.54, 95% confidence interval [CI]: 1.35-1.75), older age (AOR: 1.62, 95% CI: 1.02-2.56), and longer travel time to clinic (AOR: 1.18, 95% CI: 1.04-1.34). **Conclusion:** Nearly one-quarter of HIV-infected patients in our setting present with advanced immune suppression at initial encounter. Being male, older age, and living further away from clinic are associated with late engagement to care.

Keywords

HIV, advanced immune suppression, late presentation

Introduction

Late presentation of patients contributes significantly to the high mortality reported in HIV care and treatment programs in sub-Saharan Africa. Patients presenting with advanced immunosuppression (CD4 count $\leq$ 100 cells/mm^3) have an increased risk of opportunistic infections that are responsible for high mortality rates.[1–3] Delays in initiation of antiretroviral therapy (ART) further worsen clinical outcomes.[4–6] In sub-Saharan Africa, only an estimated 59% of those testing positive for HIV are linked to care.[7] Further, there are significant delays between testing positive for HIV and engagement to HIV care. The success of ART programs in sub-Saharan Africa will largely depend on efforts to ensure that transition from HIV testing to medical care is made less complicated and less prone to delays.[8] Factors responsible for late engagement in the era of free ART have not been well studied.

An estimated 30% to 40% of patients initiating HIV care in sub-Saharan Africa are late presenters.[9–11] Late presentation to HIV care is associated with significantly higher health care–related costs compared with early presentation.[12] This is due to the high cost of treatment for opportunistic infections in patients with advanced immunosuppression. Further, late patient presentation is likely to be a major impediment in the control of the HIV epidemic, even as new evidence shows that early treatment (test and treat) is an effective prevention strategy.[13,14] Factors that have been linked to late engagement to care include unemployment, being unmarried, and lower education level.[9] Others include perception that HIV care is unnecessary until one falls sick, denial of one's HIV status, nondisclosure, long distance to health facilities, and not receiving help in making HIV care appointments.[15–18]

In 2010, the World Health Organization (WHO) revised its recommendations to the timing of ART initiation in HIV-infected adults. The CD4 count threshold was raised to

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350 cells/mm^3, up from the previously recommended 250 cells/mm^3.[19] This recommendation was adopted by the Kenya National ART guidelines and specifically at the Academic Model Providing Access to Healthcare (AMPATH) program in western Kenya. Despite adopting these recommendations, patients continued to present with advanced immunosuppression at their initial encounter at the clinics. To address the problem of late presentation to care, AMPATH has established a home-based counseling and testing (HBCT) program.[20] This entails community-based door-to-door counseling and testing for HIV and linkage to the nearest ART clinic. HBCT was initiated in 2007 and has covered most of the catchment population of AMPATH. Data from HBCT have shown that patients who are linked to care through it have less advanced disease than those accessing care through provider-initiated testing and counseling (PITC) or tuberculosis (TB) clinics.[21]

Overall, in this setting, there has been a trend toward higher median baseline CD4 count for new enrollees between 2001 and 2009.[22,23] However, we continue to see patients who present with advanced immunosuppression within our clinics. The latest WHO HIV treatment guidelines released in June 2013 recommend initiating ART at a CD4 count threshold of 500 cells/mm^3 for individuals with asymptomatic HIV infection.[24] To successfully implement these recommendations, a thorough understanding of factors that contribute to late engagement to care is important in order to formulate strategies that promote early testing and treatment. We examined the factors that contribute to late engagement to care at AMPATH clinics in western Kenya.

Methods

Ethical Approval

This study was approved by the Moi University/Moi Teaching and Referral Hospital (MTRH) Institutional Research and Ethics Committee and Indiana University School of Medicine Institutional Review Board. Patient-informed consent was waived by the regulatory bodies since these data are collected for the conduct of clinical care and de-identified prior to analysis.

Setting

This study was conducted at the AMPATH program in western Kenya. This is a well-established ambulatory HIV care and treatment program that serves a catchment population of 4 million people in western Kenya. Academic Model Providing Access to Healthcare is a collaboration between Moi University School of Medicine, MTRH, and a consortium of North American Universities led by Indiana University. Since its inception in 2001, AMPATH has enrolled over 150 000 HIV-infected patients of whom over 90 000 have initiated ART. Academic Model Providing Access to Healthcare has established 80 regional HIV treatment clinics in county and subcounty hospitals as well as in health centers across the region. Patient data are captured and stored in the AMPATH Medical Record System, an electronic database that served as the sampling frame for this study.[25] The HIV prevalence in the region is 7.1%.[26]

The adult ART guidelines in use during the period of this study recommended initiation of treatment for patients with a CD4 count of $\leq$350 cells/mm^3 or with WHO clinical stage 3 or 4 disease. Antiretroviral therapy, HIV-related laboratory tests, antituberculous medications, isoniazid- and cotrimoxazole-preventive therapy, therapeutic food supplements, multivitamins, and hematinics were provided free of charge by the program during the course of this study.

Study Population

We included patients aged 14 years and older enrolled into the AMPATH clinics between December 1, 2010, and December 31, 2011. The initial date mentioned previously coincided with the local adoption of the ART guidelines recommending initiation of ART at a CD4 count threshold of $\leq$350 cells/mm^3.

Study Design and Data Sources

We performed a retrospective analysis of prospectively collected data from an HIV clinical program. Data were extracted from the database of AMPATH electronic medical records. All participants meeting the inclusion criteria mentioned previously were included in the analysis.

Data Analysis

Variables included. The baseline CD4 count was considered the dependent variable. A CD4 count of $\leq$100 cells/mm^3 was used as a surrogate for late engagement. An a priori decision was made to include the following explanatory variables suspected to be associated with late engagement to care in this analysis: travel time to clinic (<1 versus $\geq$1 hour), gender (male or female), age (<19, 19-24, and >24 years), education (number of school years completed), disclosure status (yes and no), and economic status (employed versus unemployed). Others were social support (living with partner versus not having a partner), alcohol use (yes and no), presence versus absence of psychiatric illness, presence or absence of TB at baseline, having clinical symptoms at baseline, and point of entry into care (voluntary counseling and testing [VCT] or PITC/TB clinic versus HBCT/prevention of mother-to-child transmission [PMTCT] clinic).

Statistical analyses. Parametric and nonparametric descriptive statistics were employed to summarize both categorical and continuous variables. For continuous variables, mean and median together with standard deviation (SD) and interquartile range (IQR) were calculated. The chi-square test was used to test for associations between categorical/dichotomous variables. *T* test was also used to compare means across the groups (early versus late engagement to care).

Table 1. Baseline Demographic Characteristics of the Study Patients.[a]

Variable	n (%), Mean
Mean age (SD)	36.7 (10.98)
Gender	
Male	3497 (33.2)
Female	7036 (66.8)
Body mass index, median (IQR), kg/m^2	20.2 (18.14-22.64)
Social support	
Living with partner	4810 (45.7)
Not having a partner	4268 (40.5)
Missing	1455 (13.8)
Employed outside home	
Yes	1939 (18.4)
No	8508 (80.8)
Missing	86 (0.8)
HIV disclosure	
Yes	7730 (73.4)
No	2803 (26.6)
Presence of clinical symptoms	
Yes	9626 (91.4)
No	907 (8.6)
Education level (n = 9117), mean years of schooling (SD)	8.25 (3.09)
WHO stage within 3 months of enrollment 3 or 4	3506 (33.3)

Abbreviations: IQR, interquartile range; SD, standard deviation; WHO, World Health Organization.
[a]N = 10 533.

Table 2. Bivariate Association between Early versus Late Engagement to Care among HIV-Infected Adult Patients.

Covariates	Early	Late	*P* Value
Age at enrolment	36.2 (11.1)	38.3 (10.4)	<.0001[a]
Gender			
Male	2432 (30.0)	1065 (44.0)	
Female	5680 (70.0)	1356 (56.0)	<.0001[a]
Education level, mean years of schooling (SD)	8.2 (3.0)	8.5 (3.2)	<.0001[a]
Travel time to clinic			
≥1 hour	2157 (26.6)	756 (31.2)	
<1 hour	5955 (73.4)	1665 (68.8)	<.0001[a]
HIV disclosure			
Yes	5937 (73.2)	1793 (74.1)	
No	2175 (26.8)	628 (25.9)	.394
Presence of clinical symptoms			
Yes	7424 (91.5)	2202 (91.0)	
No	688 (8.5)	219 (9.1)	.3848
With TB at baseline			
Yes	865 (10.7)	709 (29.3)	
No	7247 (89.3)	1712 (70.7)	<.0001[a]
Alcohol use			
Yes	1376 (17.4)	369 (15.9)	
No	6518 (82.6)	1955 (84.1)	.0803
Social support			
Living with partner	3693 (45.5)	1117 (46.1)	
Not having a partner	3228 (39.8)	1040 (43.0)	
Missing	1191 (14.7)	264 (10.9)	.2008
Employed outside home			
Yes	1399 (17.4)	540 (22.5)	
No	6650 (82.6)	1858 (77.5)	<.0001[a]

Abbreviations: SD, standard deviation; TB, tuberculosis.
[a]significant *p* value ($p < 0.05$)

The main outcome variable was late engagement to care. The explanatory and dependent variables were coded as binary/categorical variables or left at their continuous scale prior to fitting in the final model. For late engagement to care this meant that 1 = participants with baseline CD4 count ≤100 cells/mm^3 (late engagement) and 0 = if otherwise. Initially, explanatory variables were included in the model one at a time to examine their bivariate association with late engagement to care. Univariate logistic regression models were performed to determine the variables that were associated with late engagement to care. For both univariate and multivariate logistic regression models, the following predictor variables were considered: age, gender, years of schooling, HIV disclosure, travel time to clinic, presence of clinical symptoms, TB status, alcohol use, social support, and employment status. Multivariate logistic regression model was used to model the effects of all the variables simultaneously or those hypothesized a priori to be strong predictors of late engagement to care. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported. All the analyses were carried out by using SAS® version 9.3 (SAS Institute Inc., Cary, NC).

Results

Of the 10 533 participants included in the analysis, 67% were female. The mean age at enrollment was 36.7 years (SD 11.0). Only 25% had completed secondary school education. The median baseline CD4 count was 258 cells/mm^3 (IQR 111-437). Overall, 2421 (23%) participants presented late (baseline CD4 count ≤100 cells/mm^3). Of these, 1413 (58%) had baseline CD4 count ≤50 cells/mm^3. Among the late presenters, the median CD4 count was 41 cells/mm^3 (IQR 17-70). Other baseline demographic characteristics are shown in Table 1. As illustrated, over 80% of the participants were unemployed and over 70% had disclosed their HIV status. Among ART-eligible patients, the median time from program enrollment to ART initiation was 28 days (IQR 14-44).

Results of bivariate association between early versus late engagement to care among HIV-infected adult patients are shown in Table 2. As illustrated, factors significantly associated with late engagement to care included male gender, older age, longer travel time, having TB, and being employed.

Results of the logistic regression model of factors associated with late engagement to care are presented in Table 3. As illustrated, factors that were associated with late engagement to care included male gender (AOR: 1.54, 95% CI: 1.35-1.75), older age (AOR: 1.62, 95% CI: 1.02-2.56), and more than 1-hour travel time to clinic (AOR: 1.18, 95% CI: 1.04-1.34). In addition, individuals with TB tended to present late for care compared with those without (AOR: 2.77, 95% CI: 2.40-3.19). Point of entry into HIV care was also an important factor. Participants who accessed care through VCT were more likely to present late compared to those who accessed care through

Table 3. Unadjusted and Adjusted Logistic Regression Models of Factors Associated with Late Engagement to Care.

	Unadjusted			Adjusted		
Covariates	*P* Value	OR	95% CI	*P* Value	OR	95% CI
Age category						
19-24 versus <19[a]	.2095	0.75	0.48-1.18	.2557	0.74	0.44-1.25
>24 versus <19[a]	.0013	1.91	1.29-2.84[b]	.0401	1.62	1.02-2.56[b]
Gender						
Male	<.0001	1.82	1.65-2.01[b]	<.0001	1.54	1.35-1.75[b]
Female[a]		1			1	
Years of schooling (per year of school)	<.0001	1.04	1.03-1.06[b]	.064	1.02	0.99-1.04[b]
Type of health facility						
Urban	<.0001	1.32	1.20-1.46	.2709	1.07	0.95-1.21
Rural[a]		1				
Travel time to clinic						
≥1 hour	.0003	1.22	1.10-1.35[b]	.0128	1.18	1.04-1.34[b]
<1 hour[a]		1			1	
HIV disclosure (Yes versus no[a])	.6450	1.03	0.92-1.14	.5440	1.04	0.91-1.20
Presence of clinical symptoms (yes versus no[a])	.3293	0.92	0.78-1.09	.7785	0.97	0.79-1.19
With TB at baseline (yes versus no[a])	<.0001	3.42	3.04-3.85[b]	<.0001	2.77	2.40-3.19[b]
Alcohol use (yes versus no[a])	.0681	0.88	0.77-1.01	<.0001	0.67	0.57-0.80[b]
Social support (yes versus no[a])	.2092	0.94	0.85-1.04	.0363	0.88	0.78-0.99[b]
Employed outside home (yes versus no[a])	<.0001	1.40	1.24-1.57[b]	.0831	1.14	0.98-1.32
Point of entry category						
PMTCT versus HBCT[a]	.3249	1.20	0.84-1.70	.0668	1.48	0.97-2.26
VCT versus HBCT[a]	<.0001	4.33	3.36-5.57[b]	<.0001	3.23	2.38-4.39[b]
PITC/TB versus HBCT[a]	<.0001	5.04	3.94-6.45[b]	<.0001	4.03	3.00-5.43[b]
Other versus HBCT[a]	<.0001	4.13	3.16-5.42[b]	<.0001	2.98	2.15-4.13[b]

Abbreviations: CI, confidence interval; HBCT, home-based counseling and testing; PITC, provider-initiated testing and counseling; PMTCT, prevention of mother-to-child transmission; TB, tuberculosis; VCT, voluntary counseling and testing.
[a]Reference category.

HBCT (AOR: 3.23, 95% CI: 2.38-4.39). Similarly, those who accessed care through PITC/TB clinic were more likely to present late compared to those who accessed through HBCT (AOR: 4.03, 95%CI: 3.00-5.43).

HIV disclosure and years of education were not significantly associated with late engagement to care. Unexpectedly, alcohol use was associated with reduced likelihood of late engagement to care (AOR: 0.67, 95% CI: 0.57-0.80).

Discussion

Despite the changing epidemiology of HIV (increasing median CD4 count at presentation), we still have a large number of patients presenting late. Compared to earlier studies in the same setting (in the 2001 to 2004 period), the median CD4 count at ART initiation has increased significantly from 86 to 258 cells/mm^3 in this study.[22,23] Our study demonstrates that nearly one-quarter of new enrollees continues to be severely immunosuppressed when they engage with care. Those most likely to engage in care late in their disease are men, those who are older, those who live further from clinics, or those have TB. In addition, those who access care through entry points other than HBCT or PMTCT are likely to present late. Our findings are generally in keeping with data from other programs in sub-Saharan Africa as discussed subsequently.

Our study confirmed findings from previous studies that male gender is an independent predictor of late engagement to care.[9,10,23,27,28] It is presumed that African males tend to seek health care much later compared to their female counterparts because of masculine ideas of strength, pride, and time constraints among working breadwinners.[29,30] In addition, health care systems in Africa have failed to address challenges that hinder men's access to care. For instance, many ART programs in Africa have documented poorer access and higher mortality among men compared to women, but there has not been any policy framework targeted at improving men's access to health care.[31] Many programs concerned with gender equality have brought to the fore issues affecting women and children but often fail to address problems affecting men.

We found that older patients had a higher likelihood of late presentation compared to younger patients. Similar observations have been made in other studies.[32–35] Older patients are perceived to be at low risk for HIV infection and are not frequently offered HIV testing by health care practitioners.[36] Indeed, heterosexual individuals older than 50 years are hardly a target of HIV prevention efforts.[37] Psychological factors such as depression, which is more common in older adults, may also hinder access to health care.[38]

We observed that patients with TB presented later for care than those without. HIV-associated TB can occur at diverse CD4 counts, including the upper end of the spectrum.[39]

However, TB tends to be more common at CD4 counts <200 cells/mm^3.[38,40,41] Thus, this observation may simply reflect colinearity between low CD4 count and susceptibility to TB. However, another possible explanation is that patients with TB delay seeking HIV care because of perceived stigma fueled by the dual epidemic.[42–51] Alternately, the observed association between TB and late presentation may be attributed to the fact that TB infection in itself leads to rapid progression of HIV disease.[52,53]

In our program, there are minimal delays in the initiation of ART among enrolled participants who are known to be eligible for ART. The median duration between enrolment into care and initiation of ART was 28 days (IQR 14-44). This is a much shorter period compared with a study in Uganda, which reported a median of 105 days.[54] Our data show that patients who access HIV care through HBCT tend to present earlier than their counterparts who access care through VCT, PITC, or TB clinics.

Study Limitations and Strengths

The main limitation of this study is that we used baseline CD4 count as a surrogate marker for late engagement into care. Since the HIV virus has a different trajectory in each host, an individual with low baseline CD4 count may not necessarily have had a longer duration of HIV infection compared to one with higher CD4 count. Another limitation is that since this was a retrospective review, we were not able to conduct interviews with patients to establish the impact of factors such as stigma and health beliefs on health-seeking behavior. The main strength of this study is that it was conducted in routine (non-research) clinical setting and included a large sample size. The results are therefore a true reflection of HIV care programs in similar settings.

Conclusion and Recommendations

Nearly one-quarter of HIV-infected patients in our setting presents with advanced immune suppression at initial encounter. Being male, older in age, living further away from clinic, having TB, and accessing care through VCT or PITC as opposed to HBCT are associated with late engagement to care. There is an urgent need to identify innovative ways to engage males in testing, target older individuals, establish more satellite clinics, expand HBTC coverage, and ensure that TB clinics are testing for HIV at presentation into care.

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References

1. Lewthwaite P, Wilkins E. Natural history of HIV/AIDS. *Medicine*. 2009;37(7):333–337.
2. Mindel A, Tenant-Flowers M. Natural history and management of early HIV infection. *BMJ*. 2001;322(7297):1290–1293.
3. Siika AM, Ayuo PO, Sidle MJE, Wools-Kaloustian K, Kimaiyo SN, Tierney WM. Admission characteristics, diagnoses and outcomes of HIV-infected patients registered in an ambulatory HIV-care programme in western Kenya. *East Afr Med J*. 2008; 85(11):523–528.
4. Mills EJ, Bakanda C, Birungi J, Yaya S, Ford N. The prognostic value of baseline CD4(+) cell count beyond 6 months of antiretroviral therapy in HIV-positive patients in a resource-limited setting. *AIDS*. 2012;26(11):1425–1429.
5. Nansera D, Bajunirwe F, Elyanu P, Asiimwe C, Amanyire G, Graziano FM. Mortality and loss to follow-up among tuberculosis and HIV co-infected patients in rural southwestern Uganda [Internet]. *Int J Tuberc Lung Dis*. 2012;16(10):1371–1376. Web site. http://www.ncbi.nlm.nih.gov/pubmed/22863182.
6. Argemi X, Dara S, You S, et al. Impact of malnutrition and social determinants on survival of HIV-infected adults starting antiretroviral therapy in resource-limited settings. *AIDS*. 2012;26(9): 1161–1166.
7. Rosen S, Fox MP. Retention in HIV care between testing and treatment in sub-Saharan Africa: a systematic review. *PLoS Med*. 2011;8(7):e1001056.
8. Gruber D, Campos P, Dutcher M, et al. Linking recently diagnosed HIV-positive persons to medical care: perspectives of referring providers. *AIDS Care*. 2011;23(1):16–24.
9. Kigozi IM, Dobkin LM, Martin JN, et al. Late-disease stage at presentation to an HIV clinic in the era of free antiretroviral therapy in sub-Saharan Africa. *J Acquir Immune Defic Syndr*. 2009; 52(2):280–289.
10. Drain PK, Losina E, Parker G, et al. Risk factors for late-stage HIV disease presentation at initial HIV diagnosis in Durban, South Africa. *PLoS One*. 2013;8(1):e55305.
11. Lahuerta M, Ue F, Hoffman S, et al. The problem of late ART initiation in sub-Saharan Africa: a transient aspect of scale-up or a long-term phenomenon? *J Health Care Poor Underserved*. 2013;24(1):359–383.
12. Krentz H, Auld M, Gill M. The high cost of medical care for patients who present late (CD4 < 200 cells/mm^3) with HIV infection. *HIV Med*. 2004;5(2):93–98.
13. Cohen MS, Gay CL. Treatment to prevent transmission of HIV-1. *Clin Infect Dis*. 2010;50(suppl 3):S85–S95.
14. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med*. 2011; 365(6):493–505.

15. Fagan JL, Beer L, Garland P, et al. The influence of perceptions of HIV infection, care, and identity on care entry. *AIDS Care*. 2012; 24(6):737–743.
16. Govindasamy D, van Schaik N, Kranzer K, Wood R, Mathews C, Bekker L-G. Linkage to HIV care from a mobile testing unit in South Africa by different CD4 count strata. *J Acquir Immune Defic Syndr*. 2011;58(3):344–352.
17. Pollini RA, Blanco E, Crump C, Zúñiga ML. A community-based study of barriers to HIV care initiation. *AIDS Patient Care STDS*. 2011;25(10):601–609.
18. Losina E, Bassett IV, Giddy J, et al. The ''ART'' of linkage: pre-treatment loss to care after HIV diagnosis at two PEPFAR sites in Durban, South Africa. *PLoS One*. 2010;5(3):e9538.
19. World Health Organization. WHO|antiretroviral therapy for HIV infection in adults and adolescents—2010 revision [Internet]; 2012. Web site. http://www.who.int/hiv/pub/arv/adult2010/en/index.html. Accessed August 14 2012; published July 15, 2010.
20. Kimaiyo S, Were MC, Shen C, et al. Home-based HIV counselling and testing in western Kenya. *East Afr Med J*. 2010;87(3): 100–108.
21. Wachira J, Kimaiyo S, Ndege S, Mamlin J, Braitstein P. What is the impact of home-based HIV counseling and testing on the clinical status of newly enrolled adults in a large HIV care program in Western Kenya? *Clin Infect Dis*. 2011;54(2):275–281.
22. Wools-Kaloustian K, Kimaiyo S, Diero L, et al. Viability and effectiveness of large-scale HIV treatment initiatives in sub-Saharan Africa: experience from western Kenya. *AIDS*. 2006; 20(1):41–48.
23. Geng EH, Hunt PW, Diero LO, et al. Trends in the clinical characteristics of HIV-infected patients initiating antiretroviral therapy in Kenya, Uganda and Tanzania between 2002 and 2009. *J Int AIDS Soc*. 2011;14(1):46.
24. World Health Organization. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach [Internet]; 2013. Web site. www.who.int. Accessed December 18, 2013; published June 30 2013.
25. Tierney WM, Rotich JK, Hannan TJ, et al. The AMPATH medical record system: creating, implementing, and sustaining an electronic medical record system to support HIV/AIDS care in western Kenya. *Stud Health Technol Inform*. 2007;129(pt 1):372–376.
26. Kenya Aids Indicator Survey; 2007. Web site. http://www.nacc.or.ke/nacc%20downloads/official_kais_report_2009.pdf. Accessed December 18, 2013, published September 24, 2009.
27. Diero LO, Shaffer D, Kimaiyo S, et al. Characteristics of HIV infected patients cared for at ''academic model for the prevention and treatment of HIV/AIDS'' clinics in western Kenya. *East Afr Med J*. 2006;83(8):424–433.
28. Kanters S, Nansubuga M, Mwehire D, et al. Increased mortality among HIV-positive men on antiretroviral therapy: survival differences between sexes explained by late initiation in Uganda. *HIV AIDS (Auckl)*. 2013;5:111–119.
29. Parrott FR, Mwafulirwa C, Ngwira B, et al. Combining qualitative and quantitative evidence to determine factors leading to late presentation for antiretroviral therapy in Malawi. *PLoS One*. 2011; 6(11):e27917.
30. Taylor-Smith K, Tweya H, Harries A, Schoutene E, Jahn A. Gender differences in retention and survival on antiretroviral therapy of HIV-1 infected adults in Malawi. *Malawi Med J*. 2010;22(2): 49–56.
31. Cornell M. Gender inequality: Bad for men's health. *South Afr J HIV Med*. 2013;14(1):12–14.
32. Iwuji CC, Churchill D, Gilleece Y, Weiss HA, Fisher M. Older HIV-infected individuals present late and have a higher mortality: Brighton, UK cohort study. *BMC Public Health*. 2013; 13(1):397.
33. Camoni L, Raimondo M, Regine V, Salfa MC, Suligoi B; the regional representatives of the HIV Surveillance System. Late presenters among persons with a new HIV diagnosis in Italy, 2010–2011. *BMC Public Health*. 2013;13(1):281.
34. Bai F, Tincati C, Merlini E, et al. Reduced central memory CD4+ T cells and increased T-cell activation characterise treatment-naive patients newly diagnosed at late stage of HIV infection. *AIDS Res Treat*. 2012;2012:1–10.
35. Ndiaye B, Salleron J, Vincent A, et al. Factors associated with presentation to care with advanced HIV disease in Brussels and Northern France: 1997-2007. *BMC Infect Dis*. 2011;11(1):11.
36. Blanco JR, Caro AM, Pérez-Cachafeiro S, et al. HIV infection and aging. *AIDS Rev*. 2010;12(4):218–230.
37. Althoff KN, Gebo KA, Gange SJ, et al. CD4 count at presentation for HIV care in the United States and Canada: are those over 50 years more likely to have a delayed presentation? *AIDS Res Ther*. 2010;7:45.
38. Heckman TG, Heckman BD, Kochman A, Sikkema KJ, Suhr J, Goodkin K. Psychological symptoms among persons 50 years of age and older living with HIV disease. *Aging Ment Health*. 2002;6(2):121–128.
39. Gupta RK, Lawn SD, Bekker LG, Caldwell J, Kaplan R, Wood R. Impact of human immunodeficiency virus and CD4 count on tuberculosis diagnosis: analysis of city-wide data from Cape Town, South Africa. *Int J Tuberc Lung Dis*. 2013;17(8): 1014–1022.
40. Addis Alene K, Nega A, Wasie Taye B. Incidence and predictors of tuberculosis among adult people living with human immunodeficiency virus at the University of Gondar Referral Hospital, Northwest Ethiopia. *BMC Infect Dis*. 2013;13:292.
41. Batista J d'Arc L, de Albuquerque M de FPM, Maruza M, et al. Incidence and risk factors for tuberculosis in people living with HIV: cohort from HIV referral health centers in Recife, Brazil. *PLoS One*. 2013;8(5):e63916.
42. Courtwright A, Turner AN. Tuberculosis and stigmatization: pathways and interventions. *Public Health Rep*. 2010;125(suppl 4):34–42.
43. Peltzer K, McHunu G, Tutshana B, Naidoo P, Matseke G, Louw J. Predictors of non-uptake of human immunodeficiency virus testing by tuberculosis public primary patients in three districts, South Africa. *Iran J Public Health*. 2012;41(11): 19–26.
44. Buregyeya E, Nuwaha F, Wanyenze RK, et al. Utilization of HIV and tuberculosis services by health care workers in Uganda: implications for occupational health policies and implementation. *PLoS One*. 2012;7(10):e46069.

45. Murray EJ, Bond VA, Marais BJ, Godfrey-Faussett P, Ayles HM, Beyers N. High levels of vulnerability and anticipated stigma reduce the impetus for tuberculosis diagnosis in Cape Town, South Africa. *Health Policy Plan*. 2013;28(4):410–418.
46. Samrith W, Rahman M, Harun-Or-Rashid M, Sakamoto J. Trends and barriers to HIV testing among tuberculosis patients in Prey Kabas Operational District, Takeo Province, Cambodia[published online May 16, 2012]. *Asia Pac J Public Health*. 2012.
47. Daftary A. HIV and tuberculosis: the construction and management of double stigma. *Soc Sci Med*. 2012;74(10):1512–1519.
48. Buregyeya E, Kulane A, Colebunders R, et al. Tuberculosis knowledge, attitudes and health-seeking behaviour in rural Uganda. *Int J Tuberc Lung Dis*. 2011;15(7):938–942.
49. Heunis JC, Wouters E, Norton WE, et al. Patient- and delivery-level factors related to acceptance of HIV counseling and testing services among tuberculosis patients in South Africa: a qualitative study with community health workers and program managers. *Implement Sci*. 2011;6:27.
50. Barnabas Njozing N, Edin KE, Hurtig A-K. ''When I get better I will do the test'': Facilitators and barriers to HIV testing in Northwest Region of Cameroon with implications for TB and HIV/AIDS control programmes. *SAHARA J*. 2010; 7(4):24–32.
51. Deribew A, Hailemichael Y, Tesfaye M, Desalegn D, Wogi A, Daba S. The synergy between TB and HIV co-infection on perceived stigma in Ethiopia. *BMC Res Notes*. 2010;3:249.
52. Sharma SK, Mohan A, Kadhiravan T. HIV-TB co-infection: epidemiology, diagnosis & management. *Indian J Med Res*. 2005; 121(4):550–567.
53. Jaryal A, Raina R, Sarkar M, Sharma A. Manifestations of tuberculosis in HIV/AIDS patients and its relationship with CD4 count. *Lung India*. 2011;28(4):263–266.
54. Sendagire I, Cobelens F, Kambugu A, Konde-Lule J, Schim van der Loeff M. Frequency and predictors for late start of antiretroviral therapy in primary care clinics, Kampala, Uganda. *J Acquir Immune Defic Syndr*. 2012;61(3):e33–e39.