HIV/AIDS - Research and Palliative Care

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ORIGINAL RESEARCH

Determinants of Late HIV Diagnosis and Advanced HIV Disease Among People Living with HIV in Tanzania

Anderson Bendera[1], Deogratias Mugisha Baryomuntebe[2], Nwanna Uchechukwu Kevin[3], Miisa Nanyingi[4], Patience Bemanya Kinengyere[5], Salaam Mujeeb[6], Esther Jachi Sulle[7]

[1]Department of Radiology and Medical Imaging, Monduli District Hospital, Arusha, Tanzania; [2]Faculty of Nursing, Fins Medical University, Kampala, Uganda; [3]Department of Community Health, University of Rwanda, Kigali, Rwanda; [4]Department of Health Sciences, Uganda Martyrs University, Kampala, Uganda; [5]AiKA Health Consults, Kampala, Uganda; [6]Department of Pathology, Islamic University in Uganda, Kampala, Uganda; [7]Credit Department, WEDAC Microfinance Institution Ltd, Arusha, Tanzania

Correspondence: Anderson Bendera, Department of Radiology and Medical Imaging, Monduli District Hospital, P. O. Box 12, Arusha, Tanzania, Email andybendera@gmail.com

Background: About half of people infected with Human Immunodeficiency Virus (HIV) often present late for care, resulting in higher healthcare costs, undesired treatment outcomes, and ongoing HIV transmission. This study aimed to assess the prevalence and determinants of late HIV diagnosis and advanced HIV disease (AHD) in Tanzania.

Methods: Data were obtained from the 2016–17 Tanzania HIV impact survey. We included 677 newly diagnosed people living with HIV. Late HIV diagnosis and AHD were defined as having a CD4 cell count below 350 cells/μL or 200 cells/μL at diagnosis, respectively. Bivariate and multivariable logistic regression models were fitted to identify the determinants of late HIV diagnosis or AHD.

Results: The mean age of the participants was 37.8 years (SD, 12.4). About two-thirds were women (62.6%). The prevalence of late HIV diagnosis was 42.4%, whereas the prevalence of AHD was 17.7%. Factors associated with late HIV diagnosis included age 31–40 years (adjusted odds ratio [aOR] = 1.72, 95% confidence interval [CI]: 1.14–2.60), age ≥41 years (aOR = 1.79, 95% CI: 1.16–2.76), male sex (aOR = 1.88, 95% CI: 1.29–2.73), and active syphilis infection (aOR=2.63, 95% CI: 1.20–5.76). Factors associated with AHD were age 31–40 years (aOR = 2.12, 95% CI: 1.18–3.81), age ≥41 years (aOR = 2.42, 95% CI: 1.32–4.41), male sex (aOR = 1.77, 95% CI: 1.09–2.87), formal education (aOR = 0.49, 95% CI: 0.30–0.81) and active syphilis infection (aOR = 2.49, 95% CI: 1.07–5.77).

Conclusion: Late HIV diagnosis and AHD are prevalent among newly diagnosed people living with HIV in Tanzania. Specific subgroups are more likely to present late for HIV care, including middle-aged and older adults, men, illiterate individuals, and those with active syphilis and HIV co-infection. Therefore, we recommend expanding HIV testing services and implementing targeted interventions to improve early access and enrollment in HIV care.

Keywords: advanced HIV disease, HIV/AIDS, HIV care, late presentation, Tanzania

Introduction

About half of people infected with Human Immunodeficiency Virus (HIV) often present late for care worldwide.[1,2] They often present with Acquired Immunodeficiency Syndrome (AIDS)-defining illnesses such as miliary tuberculosis, Kaposi's sarcoma, or non-Hodgkin's lymphoma.[3] Presenting late is associated with increased healthcare costs, poor treatment outcomes, higher rates of HIV transmission, and increased morbidity and mortality.[4,5] On the other hand, timely initiation of antiretroviral therapy (ART) maximises treatment outcomes, improves the preventive benefits of ART, and reduces ongoing HIV transmission.[1,6]

Cluster of differentiation 4 (CD4) cell count is a critical indicator of HIV prognosis and patient survival. Assessing the immune system status and the risk of opportunistic infections is best done with this indicator in people living with

Received: 30 April 2024
Accepted: 17 August 2024
Published: 26 August 2024

HIV (PLHIV).[7] After HIV infection, the CD4 cell count initially drops but then gradually increases over the following months, although it remains lower than the pre-infection level.[8] Individuals diagnosed during this temporary period of low CD4 cell count are often incorrectly considered late presenters.[9,10] Therefore, people with evidence of recent infection (ie, being diagnosed during seroconversion) should be classified as "not late".[11]

Getting tested for HIV is the first step towards receiving a diagnosis and accessing medical care. Factors influencing HIV testing include social, cultural, geographical, psychosocial, behavioural, legal, and health system factors.[12] To enhance HIV testing services, taking advantage of the factors that facilitate testing and reducing the barriers that hinder it is essential. Sociodemographic characteristics associated with late HIV diagnosis include older age,[13] male sex,[14] illiteracy,[15] unemployment,[16] and rural residency.[4] The predisposing factors towards late diagnosis include poor understanding of HIV and ART, being tested because of illness,[6] perceived HIV stigma,[17] having symptoms at the time of diagnosis,[5] disability,[18] and low-risk perceptions.[19] Health system factors include missed opportunities during client interactions with healthcare providers and limited access to healthcare services.[19,20]

The first cases of HIV/AIDS were reported in Tanzania in 1983. In 2017, the prevalence of HIV in Tanzania was 4.9% (6.3% females and 3.4% males) among adults, corresponding to 1.4 million PLHIV.[21,22] To scale up HIV testing, the government introduced provider-initiated testing and counselling, home-based HIV counselling and testing, community-based HIV testing, HIV self-testing, and index testing.[23,24] Despite these efforts, nearly half of PLHIV are diagnosed late.[22] This study aimed to assess the prevalence of late HIV diagnosis and AHD in Tanzania and to identify their determinants.

Methods

Sampling and Design

This study utilised nationally representative data from the 2016–17 Tanzania HIV Impact Survey. The 2016–17 survey was the fourth population-based HIV impact survey in the country. The initial survey was conducted in 2003–04, followed by subsequent surveys in 2007–08 and 2011–12. These surveys track the progression of HIV indicators across the country. The 2016–17 survey employed a stratified multistage probability sampling design. The 31 regions of the country defined the strata. The sampling frame comprised over 100,000 enumeration areas and about 9.3 million households. In the first stage, 526 clusters were selected using the probability proportional to size method. In the second stage, an average of 30 households (range 15─61) were selected in each cluster. All eligible participants aged 15 years and above were included from the sampled households. The response rate in occupied households was 98.2%, while the biomarker response rate for eligible individuals was 80.0%.[22]

Variables and Data Collection

Late HIV diagnosis and AHD were defined as a CD4 cell count of less than 350 cells/μL or less than 200 cells/μL at diagnosis, respectively.[25,26] Individuals with evidence of recent infection were considered "not late".[11] Explanatory variables included age, sex, residence, marital status, formal education, employment status, wealth, shame, disability, condom use, attitude towards PLHIV, HIV knowledge, and active syphilis infection.

Sociodemographic information was collected using a standard adult interview questionnaire.[22] Shame was assessed by asking the participants if they agreed or disagreed with the following statement, "I would be ashamed if someone in my family had HIV". Those who responded "yes" were considered ashamed; otherwise, they were not ashamed.[27] Attitude towards PLHIV was assessed based on two questions: 1) Would you purchase fresh vegetables from a vendor if you knew this person had HIV? 2) Do you believe that HIV-positive children should be allowed to attend school with children who are HIV-negative? Those who answered "yes" to both questions were categorised as having a positive attitude; otherwise, a negative attitude.[28]

Disability was defined as having difficulties or limitations in vision, hearing, walking, self-care, remembering, or communication.[29] The HIV knowledge variable was computed by scoring five questions regarding participants' understanding of HIV prevention. Two questions were asked about preventing sexual transmission of HIV,

and three questions were related to common misconceptions about contracting HIV. Each correct and incorrect response was scored 1 and 0, respectively. Individuals who scored above the sample mean were considered to have good knowledge, while those who scored below were considered to have poor knowledge.[6] Wealth status was assessed using ownership of household assets. The assets were analysed using principal component analysis to create a wealth index. The first component was used to classify the wealth index into wealth tertiles by ranking.[30]

HIV status was established through home-based HIV counselling and testing using SD Bioline HIV-1/2 followed by Uni-Gold. Indeterminate results were resolved in the laboratory using Geenius HIV 1/2 assay. Evidence of recent HIV infection was determined using the HIV-1 recent infection testing algorithm (LAg/VL algorithm). Measurement of CD4 cell count was done using the Pima™ CD4 Analyzer. Syphilis was tested using the Chembio DPP Screen and Confirm Assay, which distinguishes between active and previous infection. Screening for detectable ARVs in the blood was done using high-performance liquid chromatography coupled with tandem mass spectrometry. Tablet computers were used to collect data securely transferred to the central server.[22]

Selection of Study Participants

The Tanzania HIV Impact Survey included 33,004 participants aged 15 years and older. HIV testing was conducted for all participants, and CD4 cell count tests were subsequently administered to those confirmed to be living with HIV. The inclusion criteria for this study required a confirmed HIV diagnosis, a documented baseline CD4 cell count, and complete data for all relevant variables. Baseline CD4 cell count was defined as the CD4 count at the time of diagnosis. CD4 counts from participants with a prior HIV diagnosis were classified as post-baseline because they were recorded after the initial diagnosis. To identify participants with a prior HIV diagnosis, both self-report and ARV detection in blood samples were used. All participants who either self-reported as HIV-positive or had detectable ARVs in their blood were classified as having a prior HIV diagnosis. Of the 1,827 participants with confirmed HIV diagnosis, 1146 had a prior HIV diagnosis, and 4 had missing data on variables of interest. After excluding these individuals, the final sample for this study comprised 677 newly diagnosed individuals living with HIV who met all inclusion criteria and had complete information for all relevant variables.

Statistical Analysis

Descriptive statistics were summarised using frequency and percentage or mean and standard deviation (SD) where appropriate. Pearson's chi-square tests were used to determine whether there is an association between the outcome and explanatory variables.[31] Bivariate and multivariable logistic regression models were fitted to identify the determinants of late HIV diagnosis or AHD. The bivariate analysis examined each explanatory variable individually. The multivariable analysis included all explanatory variables regardless of their statistical significance in the bivariate analysis.[32] Results are presented using odds ratio (OR) and adjusted odds ratio (aOR), along with their 95% confidence intervals (CIs) and p-values.

The Hosmer-Lemeshow test was used to determine the goodness of fit of the multivariable models.[33] The model for late HIV diagnosis was a good fit, $X^2(514) = 534.4$, $p = 0.258$, and correctly classified 61% of the cases. The model for AHD was also a good fit, $X^2(514) = 563.6$, $p = 0.064$, and correctly classified 82.3% of the cases. Statistical significance was set at p-values <0.05. Data was prepared and analysed using Stata version 14.0 (Stata Corp LP, College Station, Texas, USA).

Results

Baseline Characteristics

We included 677 newly diagnosed individuals living with HIV, with a mean age of 37.8 years (SD 12.4). The majority were women (62.6%) and married (58.1%). Most lived in rural areas (64.0%) and had a primary education level (65.6%) (Table 1).

Prevalence of Late HIV Diagnosis and AHD

The prevalence of late HIV diagnosis was 42.4%, whereas the prevalence of AHD was 17.7% (Tables 1 and 2). A higher prevalence of late HIV diagnosis was observed among participants aged 31–40 years (45.9%), ≥41 years (49.2%), men (51.8%), people with disability (52.5%), and patients with active syphilis infection (63.3%) (Table 1). Higher prevalence rates of AHD were observed among participants aged 31–40 years (19.3), ≥41 years (23.4%), men (21.0%), those with no formal education (24.7%) and those with active syphilis infection (30.0%) (Table 2).

Factors Associated with Late HIV Diagnosis and AHD

Individuals between the ages of 31–40 who tested positive for HIV were more likely to receive a late diagnosis compared to those aged between 15 and 30 years (aOR = 1.72, 95% CI: 1.14–2.60). Similarly, those aged 41 and older were more likely to receive a late diagnosis than those aged 15–30 years (aOR = 1.79, 95% CI: 1.16–2.76). Men were roughly twice as likely to receive a late diagnosis as women (aOR = 1.88, 95% CI: 1.29–2.73). Furthermore, individuals with both HIV

Table 1 Prevalence of Late HIV Diagnosis Based on Participants' Characteristics

Variable	Total (%)	Late HIV diagnosis	p-value
N	677 (100%)	287 (42.4%)	
Age, mean (SD)	37.8 (12.4)	40.0 (12.3)	
Age group			<0.001
15–30 years	226 (33.4)	72 (31.9)	
31–40 years	207 (30.6)	95 (45.9)	
≥ 41 years	244 (36.0)	120 (49.2)	
Sex			<0.001
Female	424 (62.6)	156 (36.8)	
Male	253 (37.4)	131 (51.8)	
Residence			0.228
Urban	244 (36.0)	96 (39.3)	
Rural	433 (64.0)	191 (44.1)	
Marital status			0.215
Never married	73 (10.8)	26 (35.6)	
Currently married	393 (58.1)	177 (45.0)	
Divorced/widowed	211 (31.2)	84 (39.8)	
Education			0.761
No formal education	162 (23.9)	72 (44.4)	
Primary education	444 (65.6)	187 (42.1)	
Secondary/higher	71 (10.5)	28 (39.4)	
Work status			0.827
Not working	334 (49.3)	143 (42.8)	
Working	343 (50.7)	144 (42.0)	
Wealth			0.683
Lowest	216 (31.9)	93 (43.1)	
Middle	258 (38.1)	113 (43.8)	
Highest	203 (30.0)	81 (39.9)	
HIV knowledge			0.874
Poor	250 (36.9)	105 (42.0)	
Good	427 (63.1)	182 (42.6)	

(*Continued*)

Table 1 (Continued).

Variable	Total (%)	Late HIV diagnosis	p-value
Attitude towards PLHIV			0.566
Negative	199 (29.4)	81 (40.7)	
Positive	478 (70.6)	206 (43.1)	
Condom use			0.444
No	449 (66.3)	195 (43.4)	
Yes	228 (33.7)	92 (40.3)	
Shame			0.238
No	582 (86.0)	252 (43.3)	
Yes	95 (14.0)	35 (36.8)	
Syphilis infection			0.018
No	647 (95.6)	268 (41.4)	
Yes	30 (4.4)	19 (63.3)	
Disability			0.095
No	616 (91.0)	255 (41.4)	
Yes	61 (9.0)	32 (52.5)	

Abbreviations: PLHIV, people living with HIV; SD, standard deviation.

Table 2 Prevalence of Advanced HIV Disease Based on Participants' Characteristics

Variable	Total (%)	Advanced HIV disease	p-value
N	677 (100%)	120 (17.7)	
Age, mean (SD)	37.8 (12.4)	41.2 (12.1)	
Age group			0.001
15–30 years	226 (33.4)	23 (10.2)	
31–40 years	207 (30.6)	40 (19.3)	
≥ 41 years	244 (36.0)	57 (23.4)	
Sex			0.090
Female	424 (62.6)	67 (15.8)	
Male	253 (37.4)	53 (21.0)	
Residence			0.373
Urban	244 (36.0)	39 (16.0)	
Rural	433 (64.0)	81 (18.7)	
Marital status			0.223
Never married	73 (10.8)	9 (12.3)	
Currently married	393 (58.1)	67 (17.1)	
Divorced/widowed	211 (31.2)	44 (20.9)	
Education			0.018
No formal education	162 (23.9)	40 (24.7)	
Primary education	444 (65.6)	66 (14.9)	
Secondary/higher	71 (10.5)	14 (19.7)	
Work status			0.171
Not working	334 (49.3)	66 (19.8)	
Working	343 (50.7)	54 (15.7)	

(*Continued*)

Table 2 (Continued).

Variable	Total (%)	Advanced HIV disease	p-value
Wealth			0.953
Lowest	216 (31.9)	37 (17.1)	
Middle	258 (38.1)	47 (18.2)	
Highest	203 (30.0)	36 (17.7)	
HIV knowledge			0.784
Poor	250 (36.9)	43 (17.2)	
Good	427 (63.1)	77 (18.0)	
Attitude towards PLHIV			0.872
Negative	199 (29.4)	36 (18.1)	
Positive	478 (70.6)	84 (17.6)	
Condom use			0.114
No	449 (66.3)	87 (19.4)	
Yes	228 (33.7)	33 (14.5)	
Shame			0.266
No	582 (86.0)	107 (18.4)	
Yes	95 (14.0)	13 (13.7)	
Syphilis infection			0.072
No	647 (95.6)	111 (17.2)	
Yes	30 (4.4)	9 (30.0)	
Disability			0.676
No	616 (91.0)	108 (17.5)	
Yes	61 (9.0)	12 (19.7)	

Abbreviations: PLHIV, people living with HIV; SD, standard deviation.

and active syphilis co-infection had a higher chance of receiving a late diagnosis for HIV than those without (aOR = 2.63, 95% CI: 1.20–5.76) (Table 3).

Individuals who were newly diagnosed with HIV and aged between 31 and 40 years were found to be twice as likely to be diagnosed with AHD as compared to those aged 15 to 30 years (aOR = 2.12, 95% CI: 1.18–3.81). Likewise, those aged 41 years or above were also more likely to present with AHD as compared to those aged between 15 to 30 years (aOR = 2.42, 95% CI: 1.32–4.41). Men were found to have a higher likelihood of presenting with AHD as compared to

Table 3 Factors Associated with Late HIV Diagnosis in Tanzania, n=677

Variables	Categories	Crude OR	Adjusted OR
Age group	15–30 years	1	1
	31–40 years	1.81 (1.22, 2.68)**	1.72 (1.14, 2.60)*
	≥41 years	2.07 (1.42, 3.01)***	1.79 (1.16, 2.76)*
Sex	Female	1	1
	Male	1.84 (1.35, 2.52)***	1.88 (1.29, 2.73)**
Residence	Urban	1	1
	Rural	1.21 (0.88, 1.67)	1.19 (0.78, 1.83)
Marital status	Never married	1	1
	Currently married	1.48 (0.88, 2.48)	1.13 (0.63, 2.02)
	Divorced/widowed	1.19 (0.68, 2.07)	0.96 (0.51, 1.81)

(*Continued*)

Table 3 (Continued).

Variables	Categories	Crude OR	Adjusted OR
Education	No formal education	1	1
	Primary education	0.91 (0.63, 1.31)	0.85 (0.57, 1.27)
	Secondary/higher	0.81 (0.46, 1.43)	0.91 (0.46, 1.79)
Work status	Not working	1	1
	Working	0.97 (0.71, 1.31)	0.84 (0.61, 1.17)
Wealth	Lowest	1	1
	Middle	1.03 (0.72, 1.48)	1.13 (0.76, 1.69)
	Highest	0.88 (0.57, 0.99)*	1.29 (0.75, 2.23)
HIV knowledge	Poor	1	1
	Good	1.02 (0.75, 1.41)	1.03 (0.72, 1.48)
Attitude towards PLHIV	Negative	1	1
	Positive	1.10 (0.79, 1.54)	1.15 (0.78, 1.68)
Condom use	No	1	1
	Yes	0.88 (0.63, 1.21)	0.78 (0.54, 1.14)
Shame	No	1	1
	Yes	0.76 (0.48, 1.20)	0.86 (0.54, 1.38)
Syphilis infection	No	1	1
	Yes	2.44 (1.14, 5.21)*	2.63 (1.20, 5.76)*
Disability	No	1	1
	Yes	1.56 (0.92, 2.64)	1.28 (0.73, 2.25)

Notes: ***p<0.001; **p<0.01; *p<0.05.
Abbreviations: OR, odds ratio; PLHIV, people living with HIV.

women (aOR = 1.77, 95% CI: 1.09–2.87). People with primary education were less likely to present with AHD than those without formal education (aOR = 0.49, 95% CI: 0.30–0.81). Additionally, participants with co-infection of HIV and active syphilis were found to be around 2.5 times more likely to present with AHD as compared to those with HIV infection only (aOR = 2.49, 95% CI: 1.07–5.77) (Table 4).

Table 4 Factors Associated with Advanced HIV Disease in Tanzania, n=677

Variables	Categories	Crude OR	Adjusted OR
Age group	15–30 years	1	1
	31–40 years	2.11 (1.22, 3.67)**	2.12 (1.18, 3.81)*
	≥41 years	2.69 (1.59, 4.54)***	2.42 (1.32, 4.41)**
Sex	Female	1	1
	Male	1.41 (0.95, 2.11)	1.77 (1.09, 2.87)*
Residence	Urban	1	1
	Rural	1.21 (0.80, 1.84)	1.38 (0.78, 2.43)
Marital status	Never married	1	1
	Currently married	1.46 (0.69, 3.08)	1.13 (0.50, 2.59)
	Divorced/widowed	1.87 (0.87, 4.06)	1.50 (0.63, 3.63)

(*Continued*)

Table 4 (Continued).

Variables	Categories	Crude OR	Adjusted OR
Education	No formal education	1	1
	Primary education	0.53 (0.34, 0.83)**	0.49 (0.30, 0.81)**
	Secondary/higher	0.75 (0.38, 1.49)	0.92 (0.40, 2.14)
Work status	Not working	1	1
	Working	0.76 (0.51, 1.13)	0.69 (0.45, 1.06)
Wealth	Lowest	1	1
	Middle	1.08 (0.67, 1.73)	1.39 (0.83, 2.33)
	Highest	1.04 (0.63, 1.72)	1.88 (0.92, 3.85)
HIV knowledge	Poor	1	1
	Good	1.06 (0.70, 1.60)	1.24 (0.77, 2.00)
Attitude towards PLHIV	Negative	1	1
	Positive	0.97 (0.63, 1.49)	1.02 (0.62, 1.67)
Condom use	No	1	1
	Yes	0.70 (0.45, 1.09)	0.64 (0.39, 1.06)
Shame	No	1	1
	Yes	0.70 (0.38, 1.31)	0.74 (0.39, 1.44)
Syphilis infection	No	1	1
	Yes	2.07 (0.92, 4.63)	2.49 (1.07, 5.77)*
Disability	No	1	1
	Yes	1.15 (0.59, 2.23)	0.82 (0.40, 1.68)

Notes: ***p<0.001; **p<0.01; *p<0.05.
Abbreviations: OR, odds ratio; PLHIV, people living with HIV.

Discussion

This study assessed the prevalence and determinants of late HIV diagnosis and AHD in Tanzania. The prevalence of late HIV diagnosis and AHD were 42.4% and 17.7%, respectively. The prevalence of late HIV diagnosis and AHD varies across East Africa. The prevalence of late HIV diagnosis ranges from 29.6% in Uganda to 53% in Kenya,[4,34–36] and that of AHD ranges from 10.3% in Uganda to 32.9% in Kenya.[34–36] These variations may be due to differences in socioeconomic conditions, social norms, prevalence of HIV/AIDS, HIV testing strategies, and access to HIV testing services.[12,37] In general, these findings suggest that late HIV diagnosis and AHD remain significant public health issues that require our attention.

Consistent with previous studies, we found that middle- and old-aged people were more likely to be diagnosed late or with AHD.[13,14] This may have resulted from a combination of factors related to healthcare providers and the rate of disease progression in this age group.[32,38] As people reach their 40s, the effects of ageing become noticeable and increase with time. Older individuals, in particular, experience more rapid disease progression due to the inability to replace functional T-cells that are being destroyed.[38] Regarding provider factors, clinicians may confuse HIV symptoms with elderly illnesses or assume low risk among older people.[32] To minimise late diagnosis of HIV, clinicians should maintain a high suspicion of HIV infection in all age groups.

This study also found that male participants were more likely to be diagnosed late or present with AHD compared to female participants. This may have resulted from masculinity norms and men's lower engagement with the healthcare system.[39,40] Masculinity norms refer to societal expectations regarding the appropriate male roles and behaviours. The expectations society places on men directly influence their attitudes and behaviours towards their health.[41] In the context of late HIV diagnosis and AHD, masculinity norms could be explained by three main

constructs: fear of losing respect, reputation preservation, and maintaining a sense of normality.[39] Generally, women interact with the healthcare system more often than men.[42] Nearly all pregnant women receive antenatal care from skilled providers in Tanzania.[43] Because antenatal care services may facilitate HIV testing,[37] women are more likely to be diagnosed earlier than men. Therefore, interventions aimed at reducing late presentation should prioritise men.

We found that formal education reduced the likelihood of presenting with AHD. This is consistent with previous studies.[15,44] HIV testing is the gateway to HIV diagnosis and care,[12] and education increases the likelihood of HIV testing.[45] The present study found no association between HIV knowledge and late presentation. However, Bonjour et al found that a higher understanding of HIV/AIDS in Venezuela facilitated HIV testing.[20] Moreover, Belay et al found that individuals who had no knowledge of HIV/AIDS were more likely to be diagnosed late compared to those who had an understanding of the disease.[6] Therefore, to reduce late presentation to HIV care, targeted interventions can be directed towards improving health education about HIV.

The present study found that participants with HIV and syphilis co-infection were more likely to present with AHD. Syphilis facilitates the transmission of HIV and vice versa.[46] Syphilis is also associated with a decrease in CD4 cell count and an increase in HIV-RNA.[47] Generally, HIV and syphilis can change the course and progression of either disease.[46,47] It is recommended to screen all individuals diagnosed with HIV for syphilis and vice versa,[48] especially those who seek medical attention at a later stage.

Strengths and Limitations

We assessed the prevalence and determinants of late HIV diagnosis and AHD using a nationally representative sample. To avoid overestimating the disease prevalence, participants with evidence of recent HIV infection were reclassified as "not late" irrespective of their CD4 cell count.[9–11] To minimise misreporting of HIV status, participants with detectable ARVs in their blood were considered to have prior HIV diagnosis, irrespective of their self-report.[22] Despite these strengths, this study had limitations.

The main limitation could arise from sampling bias. This analysis did not apply sampling weights; some regions could have been oversampled or under-sampled. However, a stratified multistage cluster sampling design and adequate sample size secured national representativeness. Unlike longitudinal studies, the cross-sectional design collected data at a single point in time, making it difficult to establish causal relationships between variables.

Conclusion

This study showed that late HIV diagnosis and AHD are prevalent among newly diagnosed PLHIV in Tanzania. The study has also identified specific subgroups of people who are more likely to present late for HIV care, including middle-aged and older adults, men, illiterate individuals, and those with syphilis and HIV co-infection. These findings indicate an urgent need for expanding HIV testing services and implementing targeted interventions aiming at reducing late HIV diagnosis and AHD.

Abbreviations

AHD, advanced HIV disease; HIV, Human immunodeficiency virus; PLHIV, people living with HIV.

Data Sharing Statement

The datasets used in this study can be requested from the PHIA website at https://phia-data.icap.columbia.edu/datasets?country_id=10.

Ethics Approval and Informed Consent

The Tanzania HIV survey obtained approval from the National Institute for Medical Research (NIMR) and the Zanzibar Medical Research and Ethics Committee (ZAMREC). The present study is based on a secondary analysis of an anonymised dataset obtained from the Population-Based HIV Impact Assessment (PHIA) project. Participants who were 17 years old or younger provided informed verbal assent, and their parents or guardians provided verbal permission for their participation. Participants aged 18 and above provided informed verbal consent. The verbal informed consent

process was acceptable and received approval from the ethics committees.[22] All methods applied in this study were by the standards and regulations of the Declaration of Helsinki.[49]

Acknowledgments

The authors thank the PHIA project for granting them access to the 2016-17 Tanzania HIV Impact survey dataset. We would also like to extend our appreciation to the US President's Emergency Plan for AIDS Relief (PEPFAR) through the US Centers for Disease Control and Prevention (CDC) for funding the PHIA project.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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