Multidimensional Vulnerability Profiles and Antiretroviral Therapy Engagement Among Women Living with HIV in Kenya

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The objective of this research is to examine the influence of structural, relational, and psychosocial elements on the adherence to antiretroviral therapy (ART) among HIV-positive women in Kenya. We analyzed 332 HIV-positive females aged 15 to 49 who took part in the nationally representative Kenya Demographic and Health Survey in 2022, employing a multidimensional outcome that integrates indicators of antiretroviral therapy (ART) utilization alongside evaluations of internalized stigma and experiences of harassment. Person-centered cluster analysis and multivariate logistic regression were employed to categorize different susceptibility profiles and discern traits that contributed to heightened engagement. The results indicate that women with a background of anxiety and those in impoverished conditions had significantly reduced chances of attaining enhanced ART engagement, even though ART is broadly accessible and affordable. The results of the cluster analysis suggest that women undergoing ART may still experience social and psychological fragility if they possess structural, psychosocial, and reproductive vulnerabilities. This research illustrates that mere access to biomedical information is inadequate to encourage patients to engage proactively in their healthcare. Interventions targeting poverty, mental health, stigma, and domestic violence are essential to ensure that women in Kenya persist in their engagement with ART.

Keyword: Antiretroviral therapy (ART); involvement in HIV treatment; vulnerability; and HIV-positive Kenyan women

Introduction:

In the last decade, Kenya has advanced in managing the HIV epidemic due to community-driven initiatives, rapid testing and treatment proliferation, and diverse service offerings [1]. Approximately 1.3 to 1.4 million individuals in the nation are HIV/AIDS positive, exhibiting a prevalence rate of 3.2% to 3.3% within the 15 to 49 age demographics. The disparity in gender regarding exposure and care participation is underscored by the elevated incidence of female cases (4.3-4.5 percent) in contrast to male cases (2.1-2.2 percent) [2][1]. Despite a 75% reduction in new HIV infections in Kenya since 2010, there remain between 17,000 and 20,000 new cases each year, suggesting ongoing transmission, particularly among women and adolescent girls [3][4]. The prevalence of female cases is greater (4.3-4.5 percent) compared to male cases (2.1-2.2 percent), highlighting a distinct disparity in exposure and healthcare engagement [2][1]. Notwithstanding a 75% reduction since 2010, Kenya continues to document between 17,000 and 20,000 new HIV infections each year. This signifies continuous transmission, especially among adolescent females and their mothers [3][4]. At the national scale, considerable advancements have been attained in reaching the 95-

95-95 objectives. Roughly 96% of people with HIV are cognizant of their infection, 94% to 96% undergo antiretroviral therapy (ART), and 90% to 91% attain viral suppression (UNAIDS 2024, n.d.-a). Notwithstanding national data, significant inequalities exist, as fewer than 50% of sex workers, intersex males, intravenous drug users, and transgender individuals have access to antiretroviral therapy. Notwithstanding extensive initiatives aimed at preventing mother-to-child transmission (PMTCT), which have attained success rates of 89 to 90%, transmission persists at 8 to 9%, exceeding the 5% elimination goal and highlighting issues such as postponed antenatal care registration, challenges with adherence, and disjointed perinatal services.[5] [6]

The epidemic's effects exhibit considerable regional disparity within the Lake Victoria basin. In regions such as Homa Bay, Migori, Kisumu, and Siaya, the adult HIV prevalence generally exceeds 9–11 percent, exceeding the national average by over threefold. These counties collectively represent a significant portion of the nation's HIV demographic [2]. The historical elements affecting this epidemic encompass structural, behavioral, and health-system aspects such as heightened population mobility linked to the fishing and trade sectors, intricate sexual networks, gender-specific economic vulnerabilities, and enduring socioeconomic inequalities. Consequently, the prevalence of the epidemic is apparent. Gender disparity and localized transmission dynamics are interconnected, as demonstrated by the significantly elevated incidence of females in these high-burden regions, potentially exceeding 12–14% [2].

The degree of women's involvement in ART is shaped by these epidemiological metrics and societal allocations, which carry considerable social, economic, and health consequences. Vulnerable and significant populations are adversely affected by social determinants that hinder access to antiretroviral treatment and viral control, including stigma and discrimination associated with HIV [7]. From a financial perspective, individuals with HIV encounter considerable interruptions in their earnings and a lack of food resources. Research in Kenya indicates that a significant number of affected households experience acute food insecurity, which correlates with suboptimal adherence to HIV treatment and disruptions in care. [8] assert that HIV adversely affects labor supply, efficiency, and the cultivation of enduring human capital. Moreover, women possess a diminished capacity compared to men to engage in employment while attending to caregiving responsibilities. [9] assert that intergenerational challenges persistently affect subsequent generations. These concerns encompass the increasing population of children orphaned by AIDS, escalating family dependency ratios, and the significant caregiving obligations.

The utilization of antiretroviral therapy (ART) by women is shaped by various interconnected factors, such as disparities in economic and educational levels, gender power imbalances in romantic partnerships, HIV-related stigma, intimate partner violence (IPV), and unaddressed mental health issues. These elements coexist and bolster various facets of women's experiences, particularly regarding endurance and adherence during gestation and breastfeeding. We perceive women's participation in ART as a multifaceted phenomenon shaped by the interplay of structural, interpersonal, communal, healthcare system, and individual elements. We examine the interplay of these elements to formulate vulnerability profiles that influence care engagement over time, employing socio-ecological HIV frameworks and Bronfenbrenner's Ecological Systems Theory [10][11].

This research addresses a significant knowledge deficiency regarding Kenya's effective yet inconsistent HIV response by analyzing the co-occurrence and clustering of variables. It transcends basic elucidations by pinpointing profiles that facilitate county-specific targeting, tailored service provision, and cohesive PMTCT-maternal mental health-GBV services in regions of utmost necessity [12]. Consequently, it aligns with Kenya's decentralized methodology and the current planning instruments that prioritize regions and demographics facing significant challenges, providing pragmatic guidance on resource allocation and the

incorporation of projects into national frameworks. In summary, the study offers a scalable approach to assess disparities via national estimation platforms and integrates ecological viewpoints into program formulation to enhance equity in long-term antiretroviral therapy results by linking vulnerability profiles to measurable outcomes (such as viral suppression, retention, and mother-to-child transmission)[13].

Conceptual Structure:

According to Bronfenbrenner's Ecological Systems Theory, intimate interpersonal settings as well as larger systemic and policy contexts are examples of interrelated and layered systems that influence individual outcomes [10]. Based on this, socio-ecological HIV frameworks investigate how socioeconomic inequity, stigma, gender norms, and healthcare systems interact to affect HIV vulnerability, treatment accessibility, and health outcomes. Instead of focusing only on medication compliance, the five-tiered framework [14][15][16] considers ART involvement as the result of interrelated influences across structural, health system, community, interpersonal, and individual dimensions. This ecological viewpoint influenced both the ensuing literature review and analytical methodology.

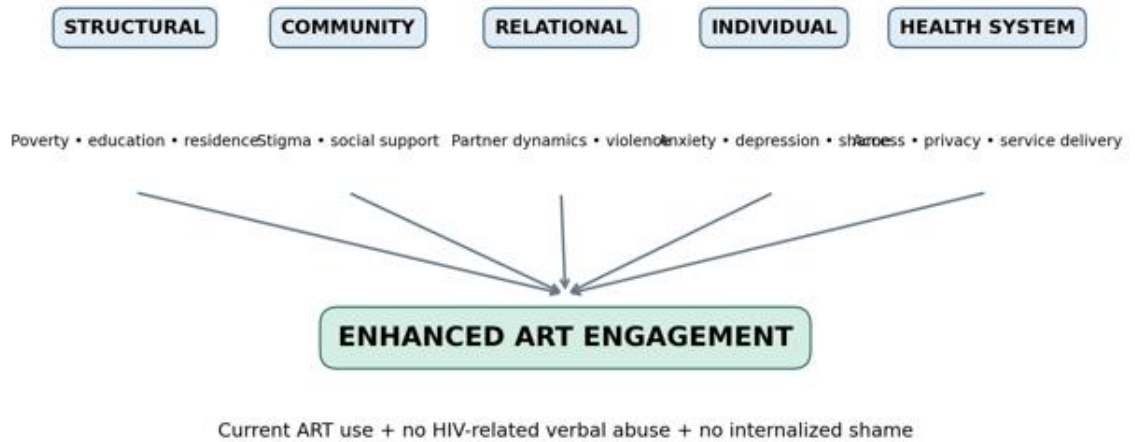


Figure 1. Socio-ecological framework of ART engagement

Structural Framework: Economic Deprivation, Gender Disparity, Educational Access, and Policy Environments:

In Kenya, women's involvement in HIV care is fundamentally influenced by economic adversity, gender disparity, and legal-political structures. Data that is nationally representative from the 2022 Kenya Demographic and Health Survey (KDHS) indicates that women with HIV are disproportionately found in rural regions and among the lowest wealth quintiles (Kenya National Bureau of Statistics)[17]. This is attributable to the reality that these communities experience the most significant barriers to care associated with poverty. Economic deprivation constrains women's capacity to autonomously decide regarding their health, complicates their access to transportation for medical services, and heightens their vulnerability to food scarcity, potentially diminishing their medication tolerance. Numerous individuals afflicted with HIV, particularly women, encounter severe food scarcity, as indicated by studies conducted in western Kenya. [18] assert that this issue is intricately associated with missed medical appointments and inadequate treatment compliance.

These problems are intensified by disparities in gender. Sustained HIV treatment is challenging for women in sub-Saharan Africa and Kenya to prioritize because of various impediments, including inadequate educational levels, restricted opportunities for self-sustenance, and imbalanced negotiating power within families. Women not only endure an inequitable burden of unpaid labor and caregiving duties that limit their availability to visit clinics, but also face imbalanced power dynamics in relationships that hinder their capacity to reveal their HIV status or negotiate adherence [19][20][21].

Ambiguity is exacerbated by the legal and policy structures regulating property rights, social welfare, and succession. Although Kenyan legislation formally acknowledges women's rights to property and inheritance, entrenched cultural customs frequently lead to the dispossession of housing and disinheritance for widows and divorced women, especially those affected by HIV. Research conducted in high-prevalence regions of western Kenya indicates that widowed women face significant economic hardships, compulsory displacement, and increased vulnerability to the virus, with projected HIV prevalence among hereditary widows surpassing 60% [19]. These disturbances exacerbate instability in housing, income, and social support systems, thereby threatening the continuity of care. The health system, the community, interpersonal relationships, and the individual are various levels at which these systemic factors influence ART participation.

Community Level: Normative Stigma, Disclosure Expectations, and Social Support:

A significant barrier within the community is the prevailing stigma associated with HIV. Over 40% of women with HIV are apprehensive about unintentional exposure, and over a third of these women have encountered stigmatizing perceptions within their communities, as reported by the Kenya National Bureau of Statistics. In isolated regions where privacy is scarce, this stigma becomes more apparent. Research in western Kenya indicates that dominant social norms like confidentiality, rumor-mongering, and monitoring diminish women's propensity to engage in public clinic visits or adhere to antiretroviral therapy (ART) [18]. [21] discovered that when women in sub-Saharan Africa express apprehension regarding disclosure, their adherence and viral suppression frequently diminish.

Nonetheless, community-oriented assistance can mitigate these hazards. Investigations carried out in Kenya and various other African countries have demonstrated that community ART groups, peer networks, and decentralized prescription refill systems significantly aid women encountering relational and systemic obstacles to ART therapy. Such measures mitigate stigma exposure, improve retention, and promote ongoing adherence [22]. Consequently, communities serve a significant moderating function, either exacerbating the risks linked to stigma or offering women the collective support necessary to persist in caregiving.

Intimate Partner Violence and Widowhood:

Intimate partner violence (IPV) has been linked to reduced autonomy, psychological discomfort, and disruptions in HIV treatment, according to several research [23][21][24]. The unique interpersonal fragility of widowhood is often accompanied by economic downturns, social exclusion, and increasing stigmatization [25]. These interpersonal interactions have a substantial impact on women's capacity to maintain ART adherence by connecting larger institutional disparities to everyday lived realities.

Individual Level: Mental Health, Internalized Stigma, Reproductive Intentions, and Treatment Literacy:

The involvement of women in ART is influenced by numerous structural, social, and interpersonal elements rather than solely by personal characteristics (Bronfenbrenner 1979). Depression and anxiety exhibit a substantial correlation within the realms of poverty, food scarcity, and gender-based violence, resulting in interruptions in treatment and inadequate adherence among HIV-positive women in Kenya [26][27][28]. Internalized stigma arises from societal standards and previous encounters with discrimination, which in turn diminishes self-efficacy, hinders disclosure, and promotes treatment cessation [29]. [30] along with.

[31] discovered that societal pressures linked to reproduction can result in ambivalence regarding treatment use, particularly during pregnancy and the postpartum phase when worries about financial insecurity, stigma, and vertical transmission intersect. Treatment literacy is deficient in Kenya, especially among women with limited educational backgrounds or those newly diagnosed with HIV. This encompasses a lack of awareness that HIV is a long-term

condition necessitating antiretroviral therapy (ART) [32].

Women in Kenya engage in ART for life due to a multitude of interconnected factors. The ability of women to consistently obtain and finish therapy is influenced by various elements, such as deficiencies in the healthcare system, societal stigma, disparities in interpersonal power relations, and individual psychosocial challenges. Given that the majority of prior research has concentrated on these elements individually, there is insufficient comprehension of their interactions in the daily lives of women. This research investigates the interplay of these variables in generating distinct susceptibility profiles and their association with the outcomes of ART involvement through an ecological systems framework. The application of multivariate methodologies and representative national datasets to elucidate the intricate, interconnected realities of women's encounters with HIV care.

Materials and Methods:

Study Design and Data Source:

We conducted a cross-sectional secondary analysis of the 2022 Kenya Demographic and Health Survey (KDHS) to derive population-level estimates for women aged 15 to 49. This survey effectively reflects the entirety of Kenyan households and employs a stratified two-stage cluster sampling technique. The KDHS Final Report has been published by the Kenya National Bureau of Statistics and the DHS Program, outlining the methodologies for fieldwork, sampling strategies, and quality assurance protocols. The Individual Women's Recode File was utilized for this research due to its comprehensive data on women's health, reproductive background, sociodemographic characteristics, and additional personal information.

Study Population:

In 2022, a representative sample of Kenyan women aged 15 to 49 was examined as part of the Kenya Demographic and Health Survey (KDHS). A total of 32,156 females participated in the survey. This examination utilized the Individual Recode (IR) dataset, encompassing data from individual participants. A total of 13,757 individuals submitted test results from HIV biomarker assessments.

The present study concentrated on women who received a positive HIV diagnosis in the biomarker module (n = 332). Women who either did not receive their test results (n = 68) or tested negative for HIV (n = 13,357) were excluded from consideration. The analytical sample consisted of respondents who tested positive for HIV and provided data on ART usage, stigma indicators, mental health traits, and other covariates included in the multivariate logistic regression model.

Measures:

Outcome Variable:

The primary outcome revealed a binary indication of heightened ART engagement, serving as a valuable metric for treatment compliance and significant psychosocial elements that facilitate ongoing care involvement. A woman was deemed to fulfill the enhanced engagement criterion if she indicated that she was presently undergoing antiretroviral therapy (ART), had not faced verbal abuse due to her HIV status, and had not internalized stigma, characterized by an absence of shame concerning her HIV status. Any individual who did not meet any of the three criteria was assigned a code of 0. Research indicates that psychosocial settings devoid of harassment and minimal stigma significantly influence women's ability to initiate and sustain HIV treatment. Consequently, the outcome is perceived as a multifaceted engagement phenotype rather than merely an assessment of medication adherence. The result is categorized as a binary variable since it indicates whether participants simultaneously fulfilled all criteria of the augmented engagement phenotype. Despite employing logistic regression to assess relationships with the outcome, the metric fails to encapsulate hierarchical tiers of engagement, as participants either fulfilled all criteria or did not.

Independent Variables:

Independent variables were established based on recognized structural and ecological elements that affect HIV-related outcomes. The ages of the respondents, their residence in urban or rural settings, their educational attainment (none, primary, secondary, and tertiary), and the wealth quintile of their households as assessed by the DHS wealth index were included as sociodemographic variables. Individuals' marital status was categorized as either never in a partnership, married, cohabiting, widowed, separated, or divorced. Reproductive history was assessed through parity and subsequently categorized as having 0, 1, 2, 3, 4, or 5 or more offspring. Emotions of shame, verbal maltreatment, unintentional revelation of HIV status, anticipated stigma (the assumption that others will disparage the individual due to HIV), and stigma within healthcare environments were among the numerous indicators of HIV-related stigma. Every indicator was allocated a binary classification in alignment with DHS standards.

The psychological well-being of participants was evaluated by inquiring about their previous diagnoses of anxiety or depression and their current medication usage for these disorders. Regression analyzes omitted variables that served as independent predictors to formulate the composite outcome.

Statistical Analysis:

A persistent trend of disadvantage was evident throughout the socioeconomic spectrum. Although 6.6% were classified in the lowest income quintile and 20.5% in the highest, 21.4% were situated in the lowest quintile, 25.0% in the middle quintile, and 26.5% in the overall lowest category. The birth rate was remarkably elevated. Among the women surveyed, 22.9% reported having at least one child, while 6.9% indicated they had no children.

Among the residual population, 20.2% had three offspring, 20.8% had four, and 29.2% had five or more. Diverse marital statuses were relatively prevalent. 49.4% of the female participants were wed at the time of the survey. 5.1% of individuals cohabited, while 11.7% had never entered into matrimony. Significantly, 18.7% of the cohort encountered widowhood. 12.0% of individuals are in a state of separation, whereas 3.0% of individuals are legally divorced.

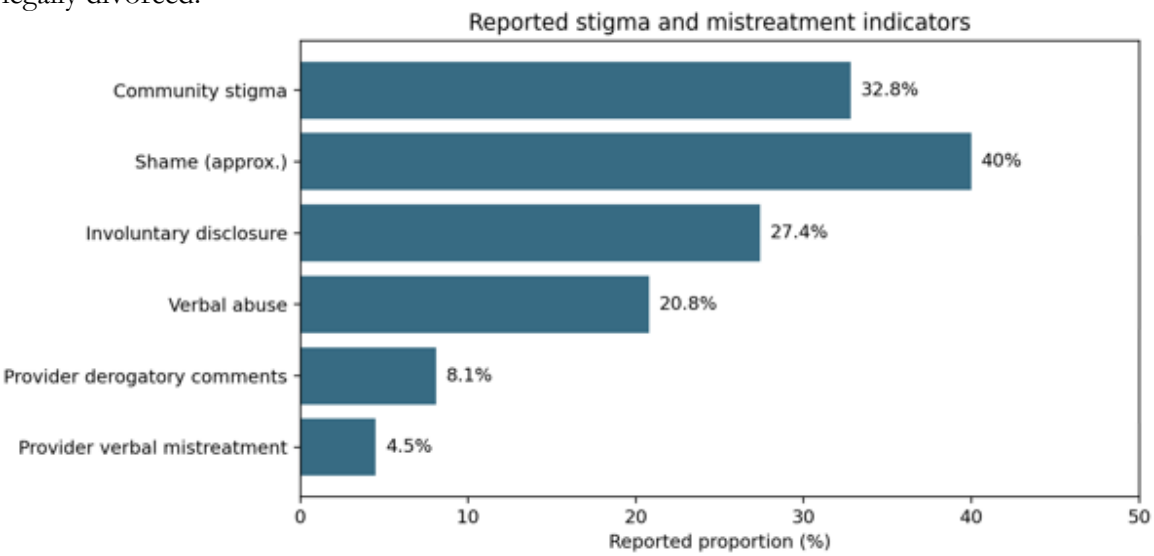


Figure 2. Reported HIV-related stigma and mistreatment indicators

Stigma was widespread across numerous domains. 32.8% of individuals in the study reported encountering stigma from their community due to their diagnosis, while almost 40% expressed feelings of shame regarding their HIV status. A significant discovery revealed that 27.4% of participants had undergone involuntary disclosure, wherein an individual revealed their HIV status without permission. Moreover, 20.8% of women reported experiencing verbal abuse or intimidation due to HIV. In medical environments, instances of stigmatizing

conduct were infrequent; 4.5% indicated experiencing verbal mistreatment from a provider, while 8.1% noted disparaging comments from healthcare practitioners.

It was evident that this group exhibited psychological challenges. Anxiety and depression were identified in 4.8% and 9.6% of female instances, respectively. Despite factoring in these expenses, the reimbursement for treatment was alarmingly inadequate. Only 22.2% of individuals surveyed reported having pursued treatment for depression or anxiety.

Table 1. Reported stigma and mental-health indicators

Indicator	Reported percentage
Community stigma	32.8%
Internalized shame	Almost 40%
Involuntary disclosure	27.4%
HIV-related verbal abuse/intimidation	20.8%
Provider verbal mistreatment	4.5%
Derogatory provider comments	8.1%
Anxiety	4.8%
Depression	9.6%
Sought treatment for anxiety/depression	22.2%

Ethical Considerations:

The protocol for the 2022 Kenya Demographic and Health Survey (KDHS) received approval from the Kenya Medical Research Institute Scientific and Ethics Review Unit (KEMRI-SERU) and the ICF Institutional Review Board, adhering to national and international standards for research involving human participants (Kenya National Bureau of Statistics). We ensured that every participant provided their documented informed consent prior to the initiation of interviews or the collection of biomarkers.

The DHS Program exclusively provides de-identified datasets that have had all direct identifiers eliminated and cluster coordinates geo-displaced to safeguard participant confidentiality. The research utilized publicly accessible, de-identified secondary data and was categorized as non-human subjects research, thus exempting it from further institutional review board approval.

Results:

The sociodemographic details of the 332 HIV-positive women who participated in the study. Women between the ages of 35 and 49 made up the majority of the sample. At 65.4% of the sample, the majority of participants lived in rural areas. Just 34.6% of the participants were from cities. There was a general lack of academic success. Just 6% of women had never attended school, 65.4% had completed elementary school, 24.4% had finished secondary school, and 4.2% had earned a college degree.

Table 2. Study population and reported sample characteristics

Characteristic	Reported result
Women surveyed in KDHS	32,156
Women with HIV biomarker results	13,757
HIV-positive women included	332
Rural residence	65.4%
Urban residence	34.6%
No formal education	6.0%
Primary education	65.4%
Secondary education	24.4%
Tertiary education	4.2%
Married	49.4%
Widowed	18.7%

A consistent trend of disadvantage was evident throughout the entire socioeconomic spectrum. 21.4% were classified in the lowest quintile, 25.0% in the middle quintile, and 26.5% in the lowest overall category, while 6.6% occupied the lowest income quintile and 20.5% the highest. The natality rate was remarkably elevated. Among the women surveyed, 6.9% indicated they had no offspring, while 22.9% stated they had at least one child. 20.2% of the residual population possessed three offspring, 20.8% had four, and 29.2% had five or more. Various marital statuses were notably common. At the moment of the survey, 49.4% of the female participants were wed. 11.7% of individuals had never entered into matrimony, while 5.1% cohabited. Widowhood impacted a significant 18.7% of the cohort. 3.0% of individuals are divorced, whereas 12.0% are separated.

In numerous domains, stigma was prevalent. Approximately 40% of study participants indicated feelings of shame regarding their HIV status, while 32.8% reported facing stigma from their community due to their diagnosis. One notable finding was that 27.4% of participants had undergone involuntary disclosure, meaning their HIV status was revealed by another individual without their permission. Furthermore, 20.8% of women indicated that they had encountered verbal abuse or intimidation related to HIV. Stigmatizing actions were infrequent in medical environments; 8.1% indicated derogatory comments from healthcare practitioners, while 4.5% experienced verbal mistreatment from a provider.

This cohort evidently exhibited psychological issues. Anxiety was identified in 4.8% of females, while depression was identified in 9.6% of females. The reimbursement for treatment was astonishingly insufficient despite accounting for these costs. Merely 22.2% of respondents indicated they sought treatment for anxiety or depression.

Multivariable Logistic Regression Analysis:

The factors associated with higher ART participation were found using multivariate logistic regression. These included the ongoing use of antiretroviral medications, the absence of verbal abuse, and the absence of HIV stigma. There were no negative correlations between the independent variables, according to the multicollinearity assessment. The overall model demonstrated a statistically significant improvement over the null model, with a classification accuracy of 56.9% ($\chi2(10) = 19.14$, $p = 0.039$). Numerous predictors demonstrated strong correlations with the adherence outcome, despite the poor model fit (Nagelkerke R2 = 0.075). The odds ratios and associated 95% confidence intervals for both crude and adjusted values for every variable under study.

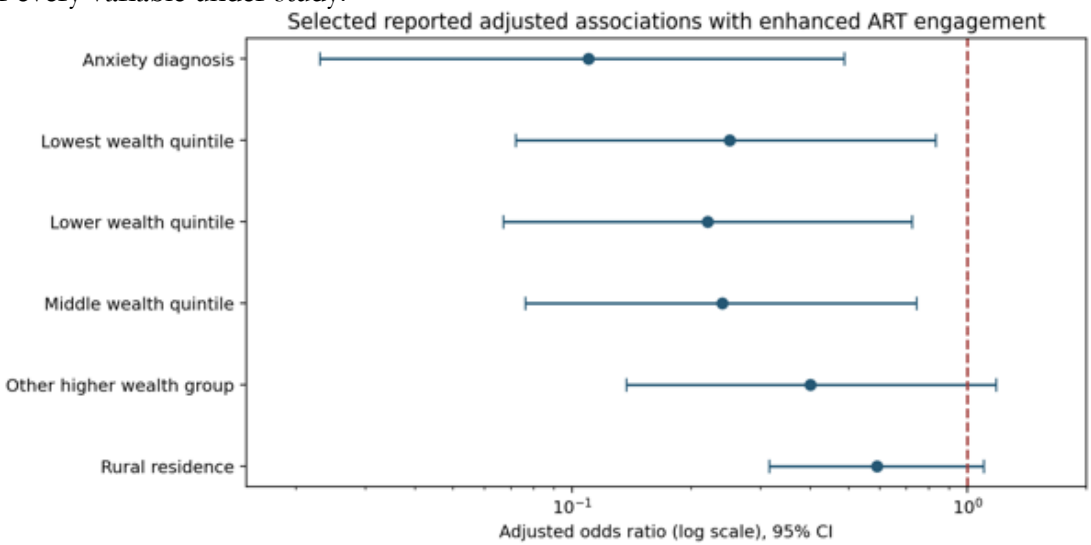


Figure 3. Adjusted associations with enhanced ART engagement

A diagnosis of anxiety was notably associated with a reduced probability of engaging in ART. Women identified with anxiety demonstrated a markedly diminished probability of

meeting the elevated adherence standards compared to their non-anxious counterparts (AOR = 0.11; 95% CI: 0.023–0.488; p = 0.005). Socioeconomic status demonstrated a stratified relationship with ART involvement. Females in the lowest (AOR = 0.25; 95% CI: 0.072–0.830; p = 0.024), lower (AOR = 0.22; 95% CI: 0.067–0.723; p = 0.013), and middle (AOR = 0.24; 95% CI: 0.076–0.743; p = 0.013) wealth categories demonstrated significantly diminished likelihoods of engaging in ART compared to those in the highest wealth category. The wealthy group demonstrated a similar trend, but the association did not reach statistical significance (AOR = 0.40; 95% CI: 0.137–1.183; p = 0.098). Other sociodemographic variables did not demonstrate a notable association with ART participation in the adjusted analyzes. Residing in rural regions suggested a possible but statistically negligible reduction in ART involvement (AOR = 0.59; 95% CI: 0.315–1.099; p = 0.093), whereas educational attainment showed no evident correlation across primary, secondary, or tertiary categories.

Table 3. Selected adjusted regression results

Predictor	Adjusted OR	95% CI	p-value
Anxiety diagnosis	0.11	0.023–0.488	0.005
Lowest wealth category	0.25	0.072–0.830	0.024
Lower wealth category	0.22	0.067–0.723	0.013
Middle wealth category	0.24	0.076–0.743	0.013
Other higher wealth category	0.40	0.137–1.183	0.098
Rural residence	0.59	0.315–1.099	0.093

Cluster Analysis:

Two Step cluster analysis identified seven distinct profiles within a group of 332 HIV-positive women; the dimensions of the clusters ranged from 16 (4.8%) to 88 (26.5%), indicating significant diversity in stigma, mental health, socioeconomic status, reproductive duties, and ART engagement. A notable vulnerability route that emerged was stigma-induced susceptibility (Cluster 4; 11.4%). Alongside experiencing the highest levels of verbal maltreatment and heightened shame, this cohort also exhibited a substantial ART uptake rate of 97%. This suggests that although considerable stigma exposure can weaken the psychosocial conditions necessary for continued ART usage, it does not invariably prevent individuals from utilizing it.

Cluster 5 demonstrates a 4.8% occurrence of mental health vulnerabilities despite universal adherence to ART, with a small subgroup showing 50% prevalence of depression and 75% prevalence of anxiety. This suggests that significant psychosocial hazards may accompany pharmacological treatment, potentially threatening continuity if left unaddressed. Cluster 7 (18.4%) exhibited the most elevated levels of internalized shame alongside complete adherence to ART, indicating that internalized stigma and systemic deprivation coexist despite the recognition of treatment. This group was entirely agricultural and financially impoverished. Cluster 2, consisting of a smaller proportion of urban women, exhibited reduced stigma and increased ART adoption, whereas Cluster 1, which included 26.5% of urban women, experienced a minimal mental health burden alongside a remarkable ART uptake rate of 96.6%. A notable association between high parity and reduced stigma was observed alongside universal access to ART and minimal psychosocial strain in Cluster 3, which consists of women with extraordinarily high parity (100 percent or more offspring). Cluster 2 (rural, low stigma stability; 14.2%) and Cluster 6 (rural, high parity with diverse ART; 14.8%) represent two additional clusters exhibiting intermediate or mixed risk profiles.

Regression coefficients merely provide a partial representation of vulnerability and resilience patterns, as corroborated by person-centered research. These patterns are influenced by unique constellations of structural, community, interpersonal, and individual elements.

Discussion:

This research enhances our comprehension of antiretroviral therapy (ART) adherence among HIV-positive women in Kenya by demonstrating that multiple factors, such as biomedical accessibility and various interconnected structural, psychological, and relational vulnerabilities, influence ART adherence. The present research aimed to examine the synergistic impacts of these elements on significant participation in art therapy, utilizing nationally representative data and an analytical approach that integrated person-centered cluster modeling with variable-centered regression analysis. These methods demonstrate that women's encounters with HIV care are not limited to a singular trajectory, but are varied and shaped by distinct vulnerability profiles.

The multivariable regression analysis identified anxiety and financial hardships as the primary factors associated with reduced enhanced ART participation. These elements influence her capacity to deliver consistent, secure, and dependable care while adhering to her prescribed medication regimen. Our research indicated that women in the lowest, middle-, and lowest-income quintiles exhibited a 75% to 80% diminished probability of fulfilling the study's enhanced ART engagement standards compared to women in the highest income quintile. A discernible wealth gradient was present in this correlation, indicating that increased engagement correlated with elevated income. It is crucial to acknowledge that, notwithstanding the availability of free ART, these inequalities endure in numerous contexts, suggesting that merely providing access to medication does not substantially enhance patient involvement. Transportation expenses, food scarcity, and the conflicting obligations of caregiving or work are among the obstacles that disadvantaged women may encounter in their efforts to attend clinic appointments and comply with treatment protocols [18]. These results indicate that women with HIV utilize various distinct routes to obtain care instead of following a singular experience.

It is unequivocal that both systemic inequity and mental health influenced the rise in ART adoption. Women with a prior history of anxiety exhibited nearly a 90% reduced likelihood of improved ART engagement compared to those without anxiety (AOR = 0.11). This variable surpassed education, marital status, and location as predictors in the model. Individuals with anxiety might find it more challenging to attend medical appointments, complete essential treatment tasks, reveal their HIV status, and confront stigma. Mental health disorders significantly hinder long-term care participation, alongside being complications of HIV [33][34][35].

The cluster analysis further enhances understanding by highlighting the interconnected dimensions of the challenges encountered by women. Significantly, the clusters illustrate those elevated levels of ART usage do not consistently correlate with sustained engagement. In principle, women who are "on ART" may still remain highly susceptible. Essential limitations such as destitution and distress influence both ART compliance and the contexts in which it is delivered. Notwithstanding the evident extensive application of ART, certain demographics exhibit notably elevated levels of poverty, stigma, or mental health issues that could hinder adherence to treatment. The subgroup of structural vulnerability within Cluster 7 comprised economically disadvantaged rural women who exhibited elevated levels of internalized stigma. Although the utilization of ART is elevated, most individuals in this demographic face stigma, reside in rural locales, and experience poverty, suggesting that engagement may significantly rely on institutional assistance like food banks, transport subsidies, or decentralized service provision. In the absence of these protections, minor economic disturbances may lead to postponements in treatment.

Cluster 5, distinguished by mental health challenges, comprised women utilizing ART who exhibited elevated anxiety and depression levels. The regression findings indicate that anxiety considerably diminishes the probability of increased engagement. These women remain impervious to pharmaceutical intervention. To ensure sustained, long-term

engagement of women in HIV care environments, it is essential to incorporate mental health evaluations, counseling, and psychosocial assistance.

Stigmatization also escalated for another cohort, cluster 4, consisting of women who experienced frequent verbal harassment. Although they frequently utilize ART, they may experience emotional turmoil and disconnection owing to the persistent stigma within their community. For these women, programs aimed at reducing stigma within the community, confidential service delivery models, and peer support networks are especially vital.

Alternative clusters demonstrated heightened resilience. Cluster 1 females, distinguished by their urban environment and reduced stigma, alongside Cluster 3 females, noted for their stability and increased parity, exhibited substantial ART adoption and a diminished psychosocial burden. These profiles illustrate how women can surmount systemic barriers when they are in nurturing environments, possess more stable home circumstances, or have greater awareness of the healthcare system. The subsets illustrate the variety of support requirements among women.

The results indicate that a multifaceted interplay of structural, interpersonal, community, and individual elements affects ART engagement and reinforces socio-ecological viewpoints on HIV therapy [10]. The integration of cluster and regression analyzes underscores these as significant vulnerability factors and illustrates the distinct impacts of poverty and mental health within the wider social and experiential frameworks of women's lives.

Implications:

Identifying distinctive vulnerability profiles can significantly influence the planning and execution of HIV initiatives. Initially, the results suggest that various demographics necessitate distinct service delivery models instead of assuming that all women face identical obstacles. Initiatives ought to focus on delivering mobile health units, food assistance, transportation subsidies, or community-oriented reproductive health services to women in rural or disadvantaged regions.

Moreover, due to the significant correlation between anxiety and participation, it is essential to integrate mental health services into HIV initiatives. Research indicates that women undergoing psychological distress significantly benefit from regular assessments for anxiety and depression, alongside counseling or group support [18][33][34][35].

In a similar vein, [36][24][37] assert that the simultaneous presence of HIV and intimate partner violence (IPV) is attributable to systemic vulnerabilities and gender disparity. Women who are widowed and those who have suffered domestic violence may exhibit a reduced propensity to pursue HIV treatment and experience heightened social and economic isolation. Clinics ought to regularly assess for intimate partner violence (IPV), direct these women—particularly widows—to confidential, safe resources, and link them to social and legal assistance to tackle matters such as property or inheritance disputes [19]. Interruption of care caused by anxiety, insecurity, or insufficient support can be mitigated by tackling these concerns.

While monitoring the timing of patients collecting their prescriptions is crucial, it remains essential to explore alternative methods for assessing engagement. The simple presence of a woman being "on ART" does not ensure that she is undergoing secure and efficacious treatment. Our research results indicate the extent to which women engage in environments conducive to their utilization of ART, alongside the lack of harassment and stigma. Programs might employ analogous composite indicators customized for the local context to more effectively monitor significant engagement [18]. Elevated stigma clusters underscore the necessity for peer support networks, community-oriented initiatives, stigma alleviation programs, and policies ensuring clinic privacy and confidentiality.

Ultimately, the results underscore the importance of utilizing multi-faceted

engagement metrics instead of depending solely on ART adoption. If HIV services are provided according to the particular vulnerability profiles outlined in this study, women living with HIV could experience enhanced stability and quality of ART participation. Differentiated service delivery frameworks facilitate care models that are attuned to the specific circumstances of patients instead of presuming identical requirements. Modifying service provision to accommodate the structural, psychosocial, and relational factors that affect engagement can enhance long-term treatment results and sustain ART compliance [38].

Several factors must be taken into account when assessing these results. Initially, the cross-sectional framework complicates the identification of temporal associations among anxiety, poverty, and ART involvement. Certain of these associations may be mutual. The results of our research indicate that women from financially disadvantaged or anxious environments were less inclined to utilize ART. Nevertheless, anxiety and economic difficulties can result in disengagement, and anxiety may correlate with challenges in sustaining care due to stigma, financial obstacles, or inequitable access.

Secondly, the outcomes might have been affected by social desirability or memory distortion as they relied on self-reported information. They might engage more in ART or experience reduced stigma or mental health issues to evade judgment. This possible misclassification may result in an undervaluation of psychosocial obstacles to participation. Significant involvement in care was assessed mainly through the utilization of ART and psychosocial elements like harassment and stigma. While it does not explicitly evaluate clinical adherence or viral suppression, this thorough evaluation provides a wide-ranging overview of the treatment trajectory. Consequently, instead of being exclusively biomedical, the findings ought to be regarded as an illustration of involvement under advantageous circumstances. Fourth, while the sample of 332 women was sufficient for the analyzes, it lacked the statistical power necessary to differentiate between the smaller vulnerability clusters identified in the person-centered analysis. The delineation among clusters was moderate, and certain clusters—such as the one primarily centered on mental health—might possess less accurate estimates. Personal experiences may intersect among groups, and these profiles ought to be regarded not as distinct classifications but as manifestations of resilience and vulnerability. Ultimately, women aged 15 to 49 fulfilled all study parameters. The results may not be relevant to women of varying ages or those omitted due to absent data stemming from diverse engagement patterns and vulnerabilities.

The research possesses several significant benefits, thus it is not entirely unfavorable. A comprehensive analysis of the relational, structural, and psychosocial elements affecting ART participation was facilitated by the ecological framework's evaluation of nationally representative data. ART alone does not ensure participation in protected or long-term care, as evidenced by the application of a multidimensional outcome. In contrast to variable-centered methodologies, person-centered cluster analysis uncovers distinct patterns of susceptibility and fortitude. The integration of these methodological strategies underscores the intricate and context-dependent nature of antiretroviral therapy engagement, providing valuable perspectives for the customization of HIV services to meet the distinct needs of women.

Conclusions:

This research indicates that, despite widespread ART availability in the nation, anxiety and poverty, rather than treatment accessibility, are the main barriers to ART engagement among HIV-positive women in Kenya. The data originates from a sample that accurately reflects the national populace. Analyzes focused on individual experiences reveal that many women continue to utilize ART despite encountering stigma, mental health issues, or systemic disadvantages, suggesting that ART usage alone does not signify sustained involvement in care. Customized, profile-oriented services that amalgamate biomedical treatments with mental

health assistance, stigma reduction, and structural support will be crucial to address persistent engagement disparities.

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