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Correlates of internalized stigma and antiretroviral therapy adherence among people living with HIV in the Volta region of Ghana

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Abstract

Objective HIV-related stigma is a major public health concern compromising the rights and health outcomes of many people living with HIV (PLWH). Its reduction is said to be critical in strengthening the continuous efforts targeted at preventing and controlling HIV, as it directly impacts antiretroviral treatment adherence. This study examines the association between HIV-related stigma and adherence to antiretroviral therapy (ART) among PLWH in one of the 16 administrative regions of Ghana, Africa.

Methods This descriptive cross-sectional study employed a survey to assess the factors affecting the utilization of ART among PLWH ($n = 155$) in the Volta region. The Center for Support Evaluation adherence index and internalized stigma of AIDS Tool were used to collect data on medication adherence and stigma, respectively. Data was analyzed using R statistical analysis software. Logistic regression models were performed to ascertain the predictors of ART utilization among PLWH.

Results A greater proportion (70%) of the study's participants reported adherence to ART. We found a positive association between HIV-related internalized stigma and medication adherence such that reporting high levels of stigma on average was associated with high levels of medication adherence [OR = 1.08, 95% CI: 1.01, 1.15]. Older age was related to higher adherence while reporting more depressive symptoms was associated with low medication adherence.

Conclusion Our findings show that stigma may serve as a facilitator instead of a barrier to adhering to antiretroviral medication. Although this contradicts common narratives about stigma's destructive effect, it is possible to promote good health-seeking behavior when the fear component of stigma is considered. To encourage medication adherence towards meeting UNAIDS' 95-95-95 agenda and better understand stigma's role, further research is required.

Keywords Internalized stigma, Antiretroviral therapy, People living with HIV, Volta region, Ghana

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Introduction

The Human Immunodeficiency Virus (HIV) is a leading cause of mortality and morbidity worldwide that has claimed the lives of about 40.1 million people globally since its discovery in the early 1980s [1, 2]. There is presently no cure for HIV, but the infection can be managed with antiretroviral therapy (ART) so that people living with HIV (PLWH) can live a long and healthy life. Despite the effectiveness of ART, HIV infection can increase risk of other comorbidities like cancer, depression, anxiety, and opportunistic infections, especially for those who are non-adherent to ART [3–6]. In sub-Saharan Africa (SSA), which is home to two-thirds of the 38.4 million PLWH [1, 7, 8], good progress has been made to link PLWH to ART through efforts like the Joint United Nations Program on HIV/AIDS' (UNAIDS) 90-90-90 agenda to diagnose 90% of PLWA, link 90% to treatment, and achieve viral suppression among 90% of those on treatment [9]. Remarkable gains in HIV testing and treatment have been made across countries in SSA, despite reported gaps among certain demographic groups [10–12]. In a recent systematic review reporting progress across selected sociodemographic groups in SSA, Green et al. [10] found that the median treatment progress achieved by PLWH aged 15 to 24 years was lower (60–49–81) than for PLWH aged 25 years or older (70–63–91). Additionally, compared to women (79-76-89), men exhibited poorer median treatment cascade achievement (66-72-85).

In the West African nation of Ghana, about 350,000 people are living with HIV, representing a prevalence of 1.7% [46]. Many HIV stakeholders in Ghana are rethinking current interventions and identifying barriers and facilitators to testing and treatment to help manage the surge [47]. One of the key barriers to HIV prevention and care in Ghana is stigma, which has been identified as a leading contributor to the upsurge in infection rates [48–51].

Stigma related to HIV is a multidimensional widespread public health and human rights concern that refers to unfavorable perceptions, labelling, ridiculing, categorizing, discrediting, stereotyping, discounting, devaluing, prejudicing and discrimination of PLWH [52–54]. Two major forms of HIV-related stigma have been measured and studied in literature: enacted or externalized and felt or internalized [50, 55]. According to Mumin et al. [50], the enacted component of stigma takes the form of discrimination, marginalization, human rights violations, withdrawal of social support and humiliation targeted at PLWHIV. The internalization of guilt, blame, hopelessness, shame, and fear of discrimination causes the stigma to be felt [50]. Both stigma types have been linked to the onset of mental health problems among PLWH who report high levels of stigma and elevated

levels of anxiety, depression and substance use [56–59]. Internalized stigma is additionally associated with low HIV testing, disclosure of status, treatment seeking and access, and medication adherence [48, 60–65]. In the pathway to clinical outcomes, internalized HIV-related stigma may be more proximal to HIV care outcomes than other interpersonal dimensions of stigma such as anticipated or perceived stigma, perhaps because internalized stigma has greater implications for affective, cognitive, and mental health outcomes of PLWH [50, 66, 67].

Despite launching countless anti-HIV stigma campaigns through community-level advocacy and sensitization programs at workplaces and healthcare facilities, stigma remains a major barrier to HIV health outcomes in Ghana. Regarding medication adherence in particular, qualitative and quantitative studies in urban and rural areas of Ghana suggest that stigma is associated with high levels of ART non-adherence among the general PLWH population [68–70] and specific subgroups like adolescents [71, 72], postpartum women living with HIV [73], and men who have sex with other men [74, 75]. For instance, a recent cross-sectional study conducted on 349 participants (aged 18–45 years) from the Ashanti region found that PLWH who reported high levels of stigma were more likely to report poor medication adherence [70]. Stigma is suggested to act on medication adherence through multiple factors, including a lowered sense of self-esteem, heightened sense of shame, fear of suffering discrimination, all of which lead to engaging in avoidance behaviors such as status non-disclosure, taking medication in secrecy, and attending healthcare at different locations away from home [50, 68]. Turan et al. [67], supporting this assertion, found that reduced medication adherence was directly predicted by perceived community stigma through internalized stigma, which in turn predicted anticipated community stigma. Zeng et al. [76] also found that high stigma levels corresponded to reports of lowered ART self-efficacy, leading to poor medication adherence of PLWH in Guangxi, China.

Ghana has, over the years, regressed in HIV outcomes, and our study aims to contribute empirical data on factors that may be shaping this regression, such as stigma. In the Volta Region, a combination of cultural, healthcare, and social factors influences both the stigma associated with HIV and the ability of people living with HIV to adhere to ART. These factors include cultural beliefs, access to health care, food security, water sources, sanitation, access to toilet facilities, and sociodemographic factors such as age, gender, rurality, monthly income, as well as depressive symptoms [19–21, 65]. In many parts of the region, myths and misconceptions about HIV, such as it being a death sentence or that certain foods or practices can cure it, can perpetuate stigma. These misconceptions

can prevent people from seeking proper care and adherence to treatment, as they may believe HIV is not something they can live with or manage long-term. We, therefore, examine whether internalized stigma plays a role in shaping medication adherence of PLWH living in the Volta region of Ghana, a region ranking sixth with a high PLWH rate of around 21,000 people and representing 6.03% of the national proportion of individuals living with HIV as of 2020 [46]. Existing research targeting this subpopulation has instead investigated other subject matters, including quality of life [77, 78], viral suppression load [79], quality of ART services [80], the prevalence of comorbid infections [81], with the closest related research being on the association between stigma and status disclosure [48]. Internal stigma has the potential to impact psychological distress, fear of disclosure, or self-efficacy leading to poor treatment outcomes. We hypothesize that internalized stigma will negatively be associated with ART adherence in a sample of adults living with HIV in the Volta region of Ghana. Findings from this study could inform future interventions, particularly in reducing stigma and improving ART adherence.

Methods

Study setting and design

This was a cross-sectional survey of PLWH receiving ART for at least 6 months before the data collection. The study was conducted at the Ho Teaching Hospital (HTH), a referral facility with an operational ART clinic in the Volta region of Ghana. The detailed method was described elsewhere [14]. 6% of Ghana's estimated population resides in the Volta region, one of the country's 16 administrative regions. The region is located in the south-eastern part of Ghana, bordered by Togo to the east and the Atlantic Ocean to the south. The Volta region has a diverse landscape with forests, rolling hills, and the Volta River which is vital in local agriculture and transport in the region. The region has a mix of urban and rural areas, with Ho where the study hospital is located as its capital. Agriculture, particularly cocoa, yam, and maize farming, is the main livelihood, while traditional customs and ceremonies are important cultural aspects.

Sampling and recruitment procedure

We included PLWH in the study if they were age 18 years or older, enrolled in ART for at least 6 months, and identified by the clinic staff as either high or low compliance to the services (defined by more or less than 50% clinic attendance in the last 6 months) or low (defined by 50% or less clinic attendance in the last 6 months). We excluded PLWH who were seriously ill and defined as hospitalized in the past month. PLWH who met inclusion criteria were identified by their attending healthcare

worker and approached to explain the study. A trained research assistant blinded to the patient's attendance history contacted patients who consented to learn more about the study. The patient was then enrolled in the project after the research assistant told the potential participant about the study and got a completed consent form. After the interview, each participant received \$10 as compensation for their time and travel expenses. The chain-referral sampling method, snowball sampling, was used to recruit PLWH who were not routinely attending the ART clinic. This method was necessary for us to include a diverse pool of participants who are regular and non-regular clinic attendants. We maintained confidentiality throughout the data collection process. Particularly, interview participants in the high attendance group were asked to share the study contact information with individuals they may know who do not frequently visit the clinic but are registered client in the clinic. Precipitants recruited through chain-referral was proximately 10% of the total sample. A total of 181 participants completed the survey, but data from 155 participants was used for the present study. The response rate for the study is 100%. Participants' demographic characteristics are as follows: 56% were males, 48% had completed up to primary levels of education, 40% were in a relationship or living with a partner, 50% resided in urban areas, and 54% were unemployed. The mean age of participants was 46.5 (SD = 12.43, range 18–85). See Supplementary File 1 for the questionnaire used for this study.

Prior to the data collection, the data collection tool was pilot tested in the Ho Municipal. The study team met to discuss and address issues identified during the pilot testing prior to the data collection.

Sample size determination

Given our interest in understanding the impact internalized stigma on ART adherence among PLWH, we assumed $\alpha = 0.025$, a Bonferroni correction for two tests. Using Stata/IC v16.1 [15] and assuming a depression prevalence of 30%, with 150 people, the minimum detectable odds ratio is 3.1, equivalent to an approximately medium effect size [16].

Measures

Outcome variable

The outcome variable in this study was medication adherence, which was measured using the Center for Support Evaluation (CASE) adherence index—a simple 3-item self-report scale which assesses an individual's level of adherence to antiretroviral therapy [17]. We chose this index because it has been used in other settings similar to our own [18]. The scale asks participants to rate their medication adherence on the following items: difficulty

taking medications on time, average number of days/weeks at least one dose was missed, and finally last time at least one dose was missed. Scores on the scale ranged from 3 to 16, and a total index score of 10 or less indicated suboptimal adherence whereas above 10 indicated optimal adherence. Following recommended scoring procedure [17], optimal adherence was recoded into a dichotomous variable with “0” assigned to the suboptimal group and “1” assigned to the optimal group. Cronbach’s alpha (α) for the CASE adherence index is 0.83.

Predictor variable

The predictor variable of interest was internalized stigma. The variable was measured using the Internalized Stigma of AIDS Tool which is a 10-item 5-point Likert scale that asks participants to rate their feelings towards themselves since their HIV diagnosis [66]. We chose this scale because it has been used in other settings like our own. Responses ranged from strongly disagree to strongly agree to questions like, “Having HIV infection is like being branded with shame” and “I feel that I need to hide my illness.” Scores on the scale range from 10 to 50, with higher scores indicating higher levels of internalized stigma. The computed reliability of the scale using Cronbach’s alpha was $\alpha = 0.86$.

Covariates

Depressive symptoms, participant age, monthly income, food security status, sanitation status, type of water source, gender, place of residence, education and access to restroom facilities, all of which are well-known correlates of stigma and medication adherence in the literature, were selected as covariates [19–21, 65].

Depressive symptoms measured with the validated Center for Epidemiologic Studies Depression (CES-D) Scale were included as a covariate [22]. CES-D is a

20-item 4-point Likert scale (0 = “rarely” to 3 = “most or all of the time”) that measures depressive symptoms by having participants answer how frequently they experienced the symptoms in the past week. Scores range from 0 to 60, with scores of ≥ 16 indicating a need for referral and clinical assessment and scores of ≥ 23 indicating severe symptoms of depression requiring intervention.

The measurement of participant age, monthly income, food security status, sanitation status, type of water source, and access to restroom facilities were based on questionnaires from the Demographic Health Survey [23]. The covariates were measured as age (18–24 / 25–29 / 30–34 / 35–39 / 40–44 / 45–49 / 50+), gender (male / female), place of residence (urban / rural), education level (no education / primary / secondary / post-secondary), income (below 1000 Ghana Cedis / 1001–2000 Ghana Cedis / 2001–3000 Ghana Cedis / Above 3000 Ghana Cedis), Sanitation (piped sewer system / septic tank / pit latrine / elsewhere).

Data analysis

Means, standard deviation, and frequency scores were computed to describe the variables. Normality check (i.e., Skewness and Kurtosis) was performed. Table 1 shows that all variables, except for improved water (a categorical variable), were within acceptable ranges of ± 2 . The strength and direction of the relationships between the variables were examined using the Pearson product-moment correlation. As seen in Table 1, none of the correlations between the variables exceeded 0.70, thus suggesting no multicollinearity issues. Two separate binary logistic regression models using the generalized linear model function were estimated, one testing the relationship between stigma and medication adherence without covariates and the other testing the same relationship holding the effects of covariates. Data was

Table 1 Correlations between outcome variable, predictor, and covariates (N=155)

	M (SD)	1	2	3	4	5	6	7	8	9
1. Stigma	25.87 (8.70)	—								
2. Depressive symptoms	8.79 (8.78)	.67***	—							
3. Age	47.12 (12.45)	-0.11	0.04	—						
4. Medication adherence	0.70 (0.46)	0.04	-0.11	0.21**	—					
5. Monthly income (>1000 Cedis)	0.15 (0.36)	-0.08	-0.07	-0.07	0.07	—				
6. Food security (secured)	0.61 (0.49)	-0.43***	-0.56***	0.02	0.01	0.18*	—			
7. Improved sanitation (improved)	0.84 (0.37)	-0.03	-0.12	-0.07	-0.02	0.08	0.08	—		
8. Improved water (improved)	0.90 (0.30)	-0.01	-0.03	0.002	-0.07	0.01	-0.08	0.09	—	
9. Access to toilet facility (Yes)	0.83 (0.38)	-0.08	-0.05	-0.12	0.04	0.14	0.16*	0.49***	-0.04	—
10. Skewness		-.028	1.071	.38	-.898	1.99	-.47	-1.86	-2.75	-1.74
11. Kurtosis		-.87	.19	.23	-1.21	2.02	-1.80	1.48	5.66	1.02

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

cleaned to handle missing data, create composite scores of the various scales, remove duplicates and inconsistencies. Missing data on any variables used in the analyses were dropped before estimating the models. Binary logistic regression was deemed appropriate given the binary nature of the outcome variable, as logistic regression allows for modeling the probability of taking medication as a function of the predictor variable and/or covariates. In the first model, medication adherence was regressed on stigma without controlling the effects of the covariates. In model 2, the covariates were added to the model to adjust the effects of stigma on medication adherence. The models are expressed in the equations below as

$$\text{logit} [\text{Pr}(y_i = 1|x_{1i})] = b_0 + b_1.stigma \tag{1}$$

where $\text{Pr}(y_i = 1|x_{1i})$ is the predicted probability that y_i equals 1; b_0 is the intercept and predicted log-odds when stigma=0; b_1 is the slope and predicted difference in the log-odds for a one-unit increase in stigma. Equation 1 was further expanded to include the covariates with their respective slopes as shown in Equation two below.

$$\begin{aligned} \text{logit} [\text{Pr}(y_i = 1|x_{1i} \dots x_{ki})] = & b_0 + b_1.stigma + b_2.depressive\ symptoms \\ & + b_3.age + b_4.monthly\ income + b_5.food\ security \\ & + b_6.improved\ sanitation + b_7.improved\ water \\ & + b_8.access\ to\ toilet\ facility \end{aligned}$$

The log odds were exponentiated to generate odds ratios alongside their 95% confidence intervals for ease of interpretation. All models were estimated using the binomial family within the ‘glm’ package in R. Goodness-of-fit tests were performed to verify the appropriateness of statistical models and ensuring that they represent the data accurately.

Results

Summary of descriptives and correlation

The descriptive characteristics of 155 participants were reported here after dropping cases with missing data. A greater proportion (70%) of the study’s participants reported optimal ART adherence. Many were food-secured (61%), had improved sanitation (84%), had improved sources of water (90%), and had access to toilet facilities (83%), while a few earned more than 1,000 cedis (15%). As seen in Table 1, we see small to highly significant associations between the study variables. Stigma ($M = 25.87, SD = 8.70$), for instance, had a moderate and positive association with depressive symptoms ($M = 8.79, SD = 8.78; r = .67, p < .001$), as well as a moderate and negative association with food security ($r = -.43, p < .001$).

Association between stigma and medication adherence

Table 2 presents the results from the models estimating stigma’s prediction of medication adherence with and without controlling for covariates. Reporting high levels of stigma was not significantly related to increases in the probability of adhering to taking HIV medication (OR = 1.01, 95% CI: -0.03, 0.05). However, after controlling the effects of the covariates, we see that persons in our study who reported more experience of HIV-related stigma were more likely to report more ART adherence (OR = 1.08, 95% CI: 1.01, 1.15), holding all else.

Of note are the effects of age and depressive symptoms. Age was significantly related to medication adherence in that the older the person, the more likely to report optimal adherence (OR = 1.05, 95% CI: 1.01, 1.15), holding all else. Depressive symptoms also significantly predicted medication adherence, indicating that participants reporting higher depressive symptoms were less likely to adhere to taking medication (OR = 0.91, 95% CI: 0.85, 0.97), holding all else. The

(2)

Table 2 ART adherence regressed on internalized stigma with and without covariates

	B (SE)	OR [95% CI]
Model 1		
Intercept	0.38 (0.58)	1.46 (-0.75, 1.54)
Internalized Stigma	0.01 (0.02)	1.01 (-0.03, 0.05)
Model 2		
Intercept	-2.25 (1.48)	0.11 (0.01, 1.96)
Stigma	0.08 (0.03) *	1.08 (1.01, 1.15)
Depressive symptoms	-0.09 (0.03) **	0.91 (0.85, 0.97)
Age	0.05 (0.02) **	1.05 (1.01, 1.15)
Monthly income (> 1000 Cedis)	0.55 (0.57)	1.73 (0.59, 5.85)
Food security (secured)	-0.37 (0.50)	0.69 (0.25, 1.83)
Improved sanitation (improved)	-0.56 (0.62)	0.57 (0.16, 1.85)
Improved water (improved)	-0.45 (0.72)	0.64 (0.13, 2.40)
Access to toilet facility (Yes)	0.66 (0.58)	1.93 (0.61, 6.11)

Model Estimates

Model 2 $R^2 = 0.17$

Goodness of fit test (Model 2): Chi-square = 4.2695, $df = 8$, p -value = 0.832

Model comparison (Model1-Model2): Chi-square = 19.46, $df = 7$, p -value = 0.006863

* $p < .05$; ** $p < .01$, *** $p < .001$

significant value of the model comparison in Table 2 suggests that the adjusted model with eight covariates fits the data significantly better than the crude model. Additionally, the results of the goodness-fit-test indicate that the logistic regression is a good fit to the observed data for model 2. In interaction analysis, stigma and depressive symptoms do not show significant effects on ART adherence (Supplemental Table S1).

Finally, monthly income, food security, and sanitation are not significantly associated with ART adherence.

Discussion

Our objective was to examine whether internalized HIV stigma was associated with ART adherence of PLWH residing in the Volta region of Ghana. Our sample's overall medication adherence prevalence rate was 70%, which is comparable with rates of 45–80% reported in existing studies from other parts of the country [13, 24–26]. PLWH, who reported high levels of internalized stigma on average, was related to high medication adherence. Two covariates, including age and depressive symptoms, were also related to medication adherence. While older age was related to higher adherence, reporting more depressive symptoms was related to low medication adherence. The discussion outlines the rationale behind the findings and offers suggestions for further research.

Stigma (irrespective of the type) is a well-known global impediment to health-seeking behavior, participation in care, and treatment/medication adherence across a variety of health issues [27]. Related HIV/AIDS literature across the world and in Ghana have consistently attested to this evidence about stigma's deleterious effect on antiretroviral medication adherence, suggesting that PLWH who report high levels of stigma are more likely also to report poor medication adherence [68, 70, 72]. However, this appears not to be the case for our sample, as stigma was found to be rather protective, sustaining medication adherence. In other words, PLWH who reported high levels of internalized stigma were more likely to report high levels of medication adherence. Although this contradicts common narratives about stigma's destructive effect, it is plausible when the fear component of internalized stigma is considered. Moderate fear of being stigmatized is suggested in some cases to motivate health behavior, and this is supported by a study reporting willingness to vaccinate, which was predicted by a higher fear of COVID-19 after 14 months [28]. In more related research, low, moderate, and high perceived risk of HIV infection in Brazilian men who have sex with men was found to increase their acceptability of taking daily oral pre-exposure prophylaxis (PrEP) [29]. It is, therefore, possible that PLWH are adhering to

their medication regimen out of fear of being discriminated against, shamed, and/or discovered. However, this explanation is speculative at best, and we recommend that more research to be conducted to understand better the potential protective (or lack thereof) role of stigma in our sample.

Furthermore, in the Volta region, high internalized stigma among PLWH might drive strong adherence to ART due to cultural and social dynamics that emphasize responsibility, self-discipline, and community expectations. The region has tight-knit communities, where individuals often feel compelled to conform to social norms and fulfill family or community roles. In this context, people with HIV may internalize the belief that adhering to ART is a way to prove their responsibility and worth to others. Additionally, local health education may encourage ART adherence to overcome stigma, positioning it as a sign of strength and resilience.

Depression is one of the common mental health comorbidities affecting PLWH, accounting for a global prevalence of 31% [63]. For PLWH in Ghana, about 27–29% of prevalence rates were reported in a sample of adolescents ages 13–19 years [31] and adults ages 20–80 years [32]. Our results suggest that the probability of medication adherence is 0.91 times lower in PLWH, who reported high levels of depressive symptoms after controlling for other variables. This result aligns with previous findings [33–39], arguing that depressed PLWH experience interrupted positive thoughts (e.g., self-doubt and poor decision-making) and low mood with helplessness, which lowers their motivation to take care of themselves as well as reduces their ability to maintain adequate adherence. Other researchers have argued in the inverse, stating that the cost of adhering to medication can be daunting on PLWH, which in turn can impose mental health deficits [35]. Following this, we argue that increased levels of depression may have an adverse effect on antiretroviral adherence by lowering our sample's capacity for seeking out motivation and self-efficacy to put into practice the behavioral abilities necessary for them to follow their medication regimens [36].

Our study also showed that the older a person, the better their medication adherence, which is supported by findings from other studies [40–44]. In one study examining age-associated predictors of adherence, Barclay et al. [40] found that older individuals, in comparison to younger people, had a rate of poor adherence that was twice as low (33% vs. 68% respectively), suggesting that older people in their study were more likely to achieve a higher adherence rate than younger people. Several possible explanations have been proposed for this finding. First, it is possible that taking medication has become a common practice and involves fewer lifestyle

modifications. Aging co-occurs with various health changes that often require medication to manage the health conditions. Having this experience, older people may be more acclimated to the medication routine and so may have no problem maintaining adherence. Thus, older people are less burdened by the lifestyle changes required for successful adherence since they may find it easier to incorporate taking medication into their daily lives [40]. Secondly, it is also possible that older people are well-informed, better understand and appreciate the benefits of adhering and the consequences of non-adherence, and thus are more likely to adhere. These explanations similarly apply to our sample. Future studies could explore tailored adherence support programs for younger individuals, including peer support networks or technology-based reminders to fit their lifestyles.

Limitations and strengths

There are a few limitations with this study that should be taken into account when planning future research. First, a combination of purposive and snowballing sampling, as opposed to a random sample, was used to choose our participants. Although it is impossible to assess, some bias was probably introduced into the results because a non-random selection technique was used to sample participants. Additionally, data for this study was obtained via self-report measure. Although we urged participants to be completely honest with their responses, it has been demonstrated that self-reported measures used to collect personal data, such as adherence behavior, can be biased by socially desirable responses, which could have overestimated the outcome. Furthermore, we only recruited participants from two significant referral hospitals, which may limit our findings' generalizability to other PLWH receiving care from other types of health facilities, such as community health centers. Lastly, cross-sectional data was used in this study, constraining our results to understand only the association between stigma and medication adherence and not establish causality. The next step towards establishing a causal relationship would require conducting a repeated measures study to determine whether stigma will likely impact medication adherence over a protracted period.

Despite its limitations, to our knowledge, this study is the first to examine the link between stigma and adherence among PLWH in the Volta region of Ghana. Future studies are needed to understand better stigma's role in the health behavior of PLWH in the Volta region. In doing this, more robust methodologies such as longitudinal designs, objective measures, or random sampling strategies should be used to determine if similar results exist. Future studies could use robust methodologies to

examine what factors could account for the relationship between stigma and ART adherence. For example, future studies could incorporate objective adherence measures (e.g., pill counts, electronic monitoring) to supplement self-reported data of adherence. Additionally, they could examine how stigma's impact on medication adherence differs between males and females and PLWH residing in rural and urban areas.

Conclusion

Our study highlights a seemingly contradictory impact of internalized stigma on ART adherence, which has significant implications for public health practice and policy. We unexpectedly found that stigma is associated with higher ART adherence. While our finding is inconsistent with previous literature about stigma's role in Ghana, it may suggest that a fear appeal approach to anti-stigma campaigns could be useful to enhance medication adherence amongst PLWH. However, it is important to know that the effectiveness of such fear appeal campaigns hinges on self-efficacy. Without high efficacy in PLWH the campaign messages may fail to elicit its potential beneficial effect of promoting health behaviors [28, 45]. There is a need for more research into the effects of stigma to understand better the role stigma plays in shaping the attitudes and behaviors of PLWH. Also, the results emphasize the need to implement systems to regularly screen patients' levels of stigma and depression when they attend ART clinics and to make available and accessible psychological remedies to alleviate those found to be high in distress. This calls for more and improved initiatives to supplement existing anti-HIV stigma campaigns as stigma reduction is noted to be an "essential ingredient" to resolving the rampant upsurge in infections and meeting the goals of agenda 95-95-95 by the end of 2030 [82]. The noted relationship between age and medication adherence suggests that any effort to improve health behaviors may be more successful when they are directed toward younger PLWH in the Volta region and policies by GAC should consider the influence of age in HIV health outcomes. It is important to note that our study may not be generalizable to other parts of the country due to the cultural and context specific factors in the Volta region. In all, the rise in recent cases in Ghana necessitates a renewed effort to rethink and reinforce anti-HIV stigma campaigns towards achieving UNAIDS' three 95 agenda.

Acknowledgements

We would like to extend our gratitude to Dr. Emmanuel Senyo Kasu, Madam Emma Akubia of Ho Teaching Hospital ART Center, the research assistants (Emmanuel Doe and Atsu Kpordorlor), and the study participants.

Authors' contributions

JJO provided conceptualization direction, manuscript write-up and supervised the study; AOG and RKA conducted literature search, supervised data collection and participated in the initial draft; NEYD analyzed the data and drafted the results; RGAT participated in the manuscript write-up, read and peer reviewed the manuscript based on their respective technical knowledge and expertise. All authors read and approved the manuscript for publication.

Funding

This work was supported by University of California, San Francisco AIDS Research Institute under Grant number ARI7504666.

Data availability

All data supporting the results and conclusion of this paper are included in the article.

Declarations**Ethics approval and consent to participate**

The study was conducted in accordance with the Declaration of Helsinki for research involving human subjects. Ethical approval for the study was obtained from the University of Health and Allied Sciences (UHAS) Research Ethical Committee with reference number UHAS-RECA.6 [1] 20–21 and the University of California San Francisco Institutional Review Board with reference number 20-32955. Permission was also sought from management of the Ho Teaching Hospital and the HIV Clinic. Confidentiality was ensured at all stages of the process. Informed consent was obtained from the participants before the interview.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 10 September 2024 Accepted: 16 January 2025

Published online: 27 January 2025

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