RESEARCH ARTICLE

Impact of antiretroviral therapy regimens adherence on perceived health and wellbeing status among adults living with HIV in Ghana [version 1; peer review: 2 approved with reservations]

AWOLU ADAM ^{1,2}, ADAM FUSHEINI ^{2,3}, FAITH A AGBOZO ¹, GEOFFREY ADEBAYO ASALU¹, MARTIN AMOGRE AYANORE ⁴, NORBERT AMUNA¹, PRINCE KUBI APPIAH ¹, SENAM ABENA KLOMEGAH¹, FRANCIS BRUNO ZOTOR¹

¹Department of Family and Community Health, University of Health and Allied Sciences, School of Public Health, Ho, Ghana

²Center for Health Literacy and Rural Health Promotion, Accra, P. O. Box GP1563, Ghana

³Department of Preventive and Social Medicine, University of Otago, Dunedin, New Zealand

⁴Department of Health Policy and Planning, University of Health and Allied Sciences, School of Public Health, Ho, Ghana

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Abstract

Introduction

The efficacy of antiretroviral medicines to improve health outcomes and wellbeing depends largely on how soon they are prescribed and how PLHIV adhere to their prescribed regimens. The objectives of this cross-sectional study were to examine adherence to antiretroviral therapy (ART) and to assess perceived health and wellbeing among people living with HIV(PLHIV) in two regions in Ghana.

Methods

Quantitative data were collected from 301 PLHIV at three HIV clinics in Volta and Oti regions in Ghana using descriptive cross-sectional study design. Data collected included sociodemographic characteristics, ART initiation and adherence, and perception of health and wellbeing and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Demographic and categorical variables were analyzed using descriptive statistics while Chi-squared analyses and binary logistics regression were used to determine variables that correlated with adherence to ART regimen. A Mann-Whitney U-test was used to measure differences in perception of health and wellbeing between male and female participants.

Results

80% initiated ART within a month following diagnosis and 97.3% reported adhering to their ART regimens consistently. A Pearson χ^2 revealed that the availability of alternatives to the current ART medications showed a significant association with ART adherence (χ^2

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1. **Raphael Z. Sangeda** , Muhimbili
University of Health and Allied Sciences, Dar
es salaam, Tanzania

2. **Esmail Mehraeen** , Khalkhal University
of Medical Sciences, Khalkhal, Iran

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=12.078, $p=0.002$). 90% reported improvement in their health and personal wellbeing. High ART adherence and positive perceived health and wellbeing were found.

Conclusion

Regular supply of ART and investment in LA-ART to ensure more effective, efficient, and stress-free adherence to ART for PLHIV regardless of their residence in the country.

Keywords

Antiretroviral, adherence, HIV, PLWHA, Ghana, wellbeing

Corresponding author: AWOLU ADAM (aawolu@uhas.edu.gh)

Author roles: **ADAM A:** Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Resources, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing; **FUSHEINI A:** Conceptualization, Investigation, Resources, Validation, Writing – Original Draft Preparation, Writing – Review & Editing; **AGBOZO FA:** Data Curation, Methodology, Resources, Writing – Review & Editing; **ASALU GA:** Formal Analysis, Methodology, Resources, Visualization, Writing – Review & Editing; **AYANORE MA:** Data Curation, Formal Analysis, Methodology, Resources, Writing – Review & Editing; **AMUNA N:** Data Curation, Investigation, Resources, Validation, Writing – Review & Editing; **APPIAH PK:** Formal Analysis, Investigation, Methodology, Resources; **KLOMEGAH SA:** Data Curation, Investigation, Project Administration, Resources; **ZOTOR FB:** Conceptualization, Data Curation, Project Administration, Resources, Supervision, Writing – Review & Editing

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Introduction

HIV remains a major global public health issue since its emergence, having claimed an estimated 36.3 million (27.2–47.8 million) lives and over 38 million people living with HIV (PLHIV) by the end of 2020 (World Health Organization, 2021). Of these numbers, over two-thirds (25.4 million) are in the WHO African Region (World Health Organization, 2021). In Ghana, there were an estimated 342,307 PLHIV (36% male, 64% female) by the end of 2019, with 20,068 new infections, and 13,616 AIDS-related deaths (Ghana AIDS Commission, 2019).

Due to significant advancement in the development and access to more effective therapeutics, improvement in the care and management of PLHIV today is different from three decades ago. WHO reported that in 2020, 27.5 million (26.5–27.7 million) PLHIV were receiving antiretroviral therapy (ART). This equates to a global ART coverage rate of 73% (56–88%) (World Health Organization, 2021). This has led to an almost 59% suppression of the virus with minimal risk of infecting others in 2019 (UNAIDS, 2020). In Ghana, close to 68% of PLHIV receiving ART have achieved viral suppression (Ghana AIDS Commission, 2016). Between 2000 and 2019, new HIV infections fell by 39% and HIV-related deaths fell by 51%, with 15.3 million lives saved due to ART (World Health Organization). These improvements have been attributable to increased concerted efforts of national interventional programs and international funding. Thus, this indicates a remarkable improvement in the health and longevity of HIV-diagnosed persons compared with the 1980s and early 1990s.

Improvements in ARTs, counseling and other HIV/AIDS care have been game-changers in the fight against the HIV pandemic. There is sufficient evidence that ART adherence and maintenance of viral suppression improve the health of PLHIV who maintain viral suppression; however, viral suppression also prevents infection from positive partners to negative sexual partners (World Health Organization, 2018). However, for ART to lead to viral suppression and overall improvement in health and quality of life for PLHIV, there must be sustained adherence to ART regimens; be it first- or second-line prescribed treatment. This is because adherence to the prescribed treatment regimen improves clinical outcomes and reduces chances of mortality (World Health Organization, 2018) while non-adherence is associated with poor health outcomes, frequent hospitalizations, and increased rates of mortality (Vrijens *et al.*, 2012). Promoting ART adherence has, therefore, become one of the main goals of clinicians and professionals who are directly or indirectly caring for PLHIV (DiMatteo, 2004). With consistent adherence to ART, economic wellbeing improved significantly among adults in study participants in South Africa. This reduced their inability to perform required job activities from 56% to 6% and reduced dependence on caretakers from 81% to less than 1% over a five-year period (Rosen *et al.*, 2014). Also, among other factors, poor ART adherence has been linked to malnutrition, under-nutrition, and food insecurity among PLHIV in different settings (Gebremichael *et al.*, 2018; Negessie *et al.*, 2019; Weldehaweria *et al.*, 2017). On the other hand, non-adherence is associated with poor health outcomes, frequent hospitalizations, and increased rates of mortality (DiMatteo, 2004). Promoting ART adherence has, therefore, become one of the main goals of clinicians and professionals who are directly or indirectly caring for PLHIV (Weiser *et al.*, 2017).

Many studies have been conducted to evaluate ART adherence in various countries and there have been mixed results. While some studies reported good adherence, others report poor adherence. For instance, it was reported that only 55% of PLHIV globally adhere to ART indicating a poor global adherence index (Saber *et al.*, 2015). Poor ART adherence, ranging between 30% and 50% has also been reported in the USA (Marcum *et al.*, 2013). Dalmida and colleagues indicated that among adults in the US receiving ART, only 25% have viral suppression, which suggests that poor ART adherence may partly be to blame for the low viral suppression (Dalmida *et al.*, 2017). However, Kim *et al.* and Yu *et al.* have reported 70.4% and 86% adherence rates among PLHIV in Korea and China respectively (Kim *et al.*, 2018; Yu *et al.*, 2018).

In Ghana, the Ghana Aids Commission (GAC) reported a 77% sustained ART adherence among PLHIV leading to 68% viral suppression (GAC, 2019). Lokpo *et al.*, and Afrane *et al.* have also reported 69% and 61.6% viral suppression among adults and children respectively in two cities in Ghana (Afrane *et al.*, 2021; Lokpo *et al.*, 2020). However, other studies in Ghana have reported lower ART adherence among various groups of PLHIV in the country (Abrokwa, 2018; Anokye-Kumatia *et al.*, 2018; Nichols *et al.*, 2019).

Varying factors have been reported for adherence and non-adherence of ART among PLHIV in different parts of the world. The most common factors reported for non-adherence to ART included fear of stigma, gender, non-disclosure of HIV status, younger age, and depression among PLHIV (Kim *et al.*, 2018; Madiba & Josiah, 2019; Yu *et al.*, 2018). Other predictors of non-adherence reported include race, alcohol use, and low socio-economic status (SES) (Amirkhanian *et al.*, 2018; Corless *et al.*, 2017). In Ghana, similar factors, such as gender, age, and fear of stigma in addition to financial difficulties, clinic attendance, educational status, and shortage of antiretroviral medications have also been reported to predict ART adherence (Anokye-Kumatia *et al.*, 2018; Nichols *et al.*, 2019; Poku *et al.*, 2020).

In recent years, there has been an increasing interest in ART adherence and the issues of quality of life and wellbeing among PLHIV (Ghiesvand *et al.*, 2019). However, in Ghana, and the Volta and Oti regions, in particular, there has been little quantitative analysis of ART adherence and perception of wellbeing among PLHIV. This study sets out to assess the self-reported adherence of ART and perceptions of wellbeing among PLHIV receiving ART at three HIV clinics in the Volta and Oti regions of Ghana.

Methods

Study design and population

This study is part of a broader HIV/AIDS study on stigmatization and discrimination among PLHIV in Ghana. The first part of the study, which focused on HIV stigma and status disclosure in three Municipalities in Ghana has been published (Adam *et al.*, 2021). A descriptive cross-sectional study was employed to collect data from a sample of 301 PLHIV at HIV/AIDS clinics in Hohoe, Kpando, and Dodi Papase municipalities in the Volta and Oti regions.

Sample size determination and Sampling procedure

The sample size calculation was based on the PLHIV population approximation of 2,500 at the study sites based on registered number of patients at the clinics. This sample size was derived using the sample determination formula by Kothari and Nachmias (Frankfort-Nachmias & Nachmias, 2007; Kothari, 2004). The formula recommended a sample size of 384 people, which we further increased by 10% to 423 to account for non-response rate. However, due to non-response and missing data, 301 (73.2%) was used in the analysis. Convenience sampling was used to sample participants into the study. The inclusion criteria for the study were being diagnosed with HIV, registered at the one of the clinics, receiving ART, and aged from 18 years and above.

Data collection and analysis

The target population was PLHIV registered and receiving ART treatment in these three municipalities. The inclusion criteria were that a participant had to be clinically diagnosed with HIV and receiving ART at the HIV clinics. We used a semi-structured questionnaire to collect data from the participants. The questionnaire was written in simple and in lower-grade English language for easy understanding and response and administered by trained research assistants. Many of the data collectors were native speakers of Ewe, the predominant language in the study areas, and Akan is also commonly spoken. For those participants who did not understand the English language, translation was provided into Ewe and Akan. The questionnaire was pretested with some HIV-positive patients at the Hohoe municipal hospital and corrections were made accordingly. Those who participated in the pretest were not included in the actual data collection.

Data collected included socio-demographics, HIV status disclosure, factors for disclosure and nondisclosure, HIV stigma, ART adherence, and associated factors, and perception of wellbeing. Two outcome variables measured in this study were ART adherence and perception of personal wellbeing. ART adherence referred to the consistency of taking prescribed medication according to doctors' recommendation while perception of personal wellbeing is how the participant assesses his or her physical health, social, and economic wellbeing. The data were analyzed and presented using a statistical package for social science (SPSS) version 20. Categorical variables were reported as frequencies, percentages, and a pie chart. A Chi-squared (χ^2) analysis and a binary logistic regression model was used to determine factors correlated with ART adherence, HIV status disclosure and internalized HIV-related stigma. A Mann-Whitney U-test was used to measure the difference in perception of wellbeing between male and female participants. The confidence level for all statistical analyses was set at 95% (0.05).

Ethical review and clearance

This study strictly adhered to the required ethical standards and procedures. The study received ethical approval from the Ghana Health Service Ethics Review Committee (GHSERC) with approval number GHSERC09/04/17. Permission was also received from the management of all the three health facilities involved in the study. The study participants were provided with an information sheet that explained the details of the study. This was to ensure that potential participants clearly understood the purpose, nature, and procedures involved in the study. The study adhered to the ethical principles of privacy and confidentiality of study participants as well as voluntary participation and withdrawal without any penalty. Above all, participants signed or thumb printed their signature before being recruited to be part of the study.

Findings

Demographic characteristics of research participants

From Table 1, 244 (74.4%) of the study participants were female and only 77 (25.6%) were males. The majority, 139 (46.1%), of the participants were married and lived with their partners, 71 (23.5%) had never married and 91 (30.1%) were either separated or divorced. For educational attainment, 270 (89.7%) of the participants attained at least primary education. More than half, 160 (53.1%), attained junior high school (JHS) while 31 (10.2%) had no formal education.

Table 1. Demographic characteristics of study participants.

Variable	Frequency	Percentage
Gender/sex		
<i>Male</i>	77	25.5
<i>Female</i>	224	74.4
Marital status		
<i>Single</i>	71	23.5
<i>Married</i>	139	46.1
<i>Separated</i>	30	9.9
<i>Divorced</i>	61	20.2
Religious background		
<i>Christian</i>	272	90.3
<i>Muslim</i>	25	8.3
<i>African traditionalist</i>	4	1.3
Educational attainment		
<i>No formal education</i>	31	10.2
<i>Grade school/primary</i>	54	17.9
<i>Junior high/basic education</i>	160	53.1
<i>Senior high</i>	41	13.6
<i>Tertiary</i>	15	4.9
Ethnic group		
<i>Ewe</i>	233	77.4
<i>Akan</i>	15	4.9
<i>Guan</i>	29	9.6
<i>Northerner</i>	7	2.3
<i>Foreign national</i>	5	1.6
<i>Others</i>	12	3.9
Employment/occupation		
<i>Self-employed</i>	173	57.4
<i>Government employee</i>	21	6.9
<i>Private company employee</i>	21	6.9
<i>Unemployed</i>	86	28.5
Age distribution		
<i>Under age 20</i>	4	1.3
<i>20-29</i>	25	8.3
<i>30-39</i>	74	24.5
<i>40-49</i>	98	32.5
<i>50-59</i>	61	20.2
<i>60-69</i>	32	10.6
<i>70-79</i>	5	1.7
<i>80+</i>	2	.7

The majority of the participants were between the ages of 30 and 59 with 74 (24.5%), 98 (32.5%), and 61 (20.2%) being between ages 30–39, 40–49, and 50–59 respectively. 29 (9.6%) of the participants were under age 30. Other important demographic characteristics are presented in the table.

Initiation of ART

The time of initiation of ART is critical for the management of HIV including viral suppression and living a healthy life. The majority (181 (60%)) reported that they started ART immediately after they were tested and diagnosed of being HIV positive. We also found that 59 (19.6%), 44 (14.6%), and 17 (5.6%) started their ART within a month, within four months, and after one year of HIV diagnosis, respectively. Most (293 (97.3%)) of the participants reported that they take their prescribed medication consistently according to their ART regimen and only eight (2.7%) did not take their medication regularly. However, 76 (25.2%) reported they ever missed taking their medication with 44 (57%) of them missing their medication in the last four weeks before the study. The predominant reason given for missing their medication was forgetfulness (10.6%). The results are summarized in [Table 2](#).

Determining factors of ART adherence

With the high rate of ART adherence, we wanted to determine the factors that had significant associations with ART. We computed the χ^2 test of independence with various variables including socio-demographic variables, HIV status disclosure, self-internalized HIV, and social support among others. A Pearson χ^2 revealed that only the availability of an alternative to the current ART medications showed a significant association with ART adherence in this study sample ($\chi^2=12.078$, $p=0.002$). In cross tabulation, those who took their anti-retroviral medication because they did not have an alternative were more likely to miss taking their medication compared to those who were satisfied with the current ART regimen for their HIV management. However, in a logistic regression model, none of the predictor variables significantly predicted ART adherence as shown in [Table 3](#).

Self-assessment of the impact of ART on health and personal wellbeing

Ten Likert questions were included in the questionnaire to assess the perception of health status and wellbeing among the participants following ART. For this analysis, four response categories for each of the questions (strongly agree, agree, disagree, and strongly disagree) were collapsed into agreeing and disagreeing. The questions covered access to HIV medication, effects of the medication, and general satisfaction of health and personal wellbeing. The results are presented in [Table 4](#). ART is supposed to be free for all PLHIV who are attending the HIV clinics. Most (273 (91%)) reported that they receive their medication regularly and 251 (83.4%) do not consider their medication to be too many. For general health effects, 282 (94%), 274 (91%), and 250 (83%) felt that their ART helped them to eat well, gave them energy for their daily activities, and helped them to sleep well, respectively. On personal wellbeing, the majority (225 (75%)) reported that with ART, their HIV status did not limit their ability to work while 213 (71%) indicated that

Table 2. ART initiation and consistency.

Variable	Frequency	Relative percentage
When did you start taking medication after your HIV diagnosis?		
<i>Immediately after my diagnosis</i>	181	60.1
<i>One month after my diagnosis</i>	59	19.6
<i>More than one month after my diagnosis</i>	44	14.6
<i>About one year after my diagnosis</i>	17	5.6
Do you take your HIV medication(s) regularly as prescribed by your doctor?		
<i>Yes</i>	293	97.3
<i>No</i>	8	2.7
Have you ever missed taking your HIV medication?		
<i>Yes</i>	76	25.2
<i>No</i>	225	74.8
If you missed your medication, what made you miss it?		
<i>I forgot</i>	32	10.6
<i>My medication finished</i>	6	2.0
<i>I could not go for my medication</i>	4	1.3
<i>Because of side effects</i>	4	1.3
<i>Other reason</i>	7	2.3

Table 3. Binary logistic regression showing variables used to predict ART adherence.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Sex of participant	-.245	.916	.071	1	.789	.783
	Marital status	.000	.358	.000	1	.999	1.000
	Educational status	-.157	.371	.179	1	.672	.854
	Ethnic background	.181	.170	1.128	1	.288	1.198
	Religious affiliation	1.126	1.351	.694	1	.405	3.082
	Level of internalized stigma	-.250	.405	.380	1	.538	.779
	SSReceived	-.028	.105	.072	1	.789	.972
	Current employment status	.397	.765	.269	1	.604	1.488
	Alternative treatment	-.905	.740	1.495	1	.221	.404
	Constant	-3.316	4.622	.515	1	.473	.036

^aVariable(s) entered on step 1: Sex of participant, Marital status, Educational status, Ethnic background, Religious affiliation, Level of internalized stigma, SSReceived, Current employment status, Alternative treatment.

Table 4. Self-assessment of ART and personal wellbeing.

Variable	Frequency	Relative percentage
I have difficulty getting my HIV medication regularly		
<i>Agree</i>	28	9.3
<i>Disagree</i>	273	90.7
My HIV medications are too many		
<i>Agree</i>	50	16.6
<i>Disagree</i>	251	83.4
My HIV medications make me tired		
<i>Agree</i>	72	24.0
<i>Disagree</i>	229	76.0
My HIV medications help me to eat well		
<i>Agree</i>	282	94.0
<i>Disagree</i>	19	6.0
My HIV medication gives me enough energy for my daily activities		
<i>Agree</i>	274	91.0
<i>Disagree</i>	27	9.0
I have difficulty sleeping when I take my HIV medication		
<i>Agree</i>	51	17.0
<i>Disagree</i>	250	83.0
My HIV status is affecting my ability to work?		
<i>Agree</i>	76	25.2
<i>Disagree</i>	225	74.8
With my HIV medication, I have energy to work		
<i>Agree</i>	242	80.4
<i>Disagree</i>	59	19.6
I am currently working		
<i>Agree</i>	213	71.0
<i>Disagree</i>	88	29.0
My HIV medication helps me to feel happy about myself		
<i>Agree</i>	270	90.0
<i>Disagree</i>	31	10.0

Figure 1. Challenges of PLHIV in adhering to ART.

they were employed at the time of this study. Overall, 270 (90%) reported that their ART participation made them feel happy about themselves.

A Mann–Whitney’s U-test was conducted to determine the difference in the overall happiness about the wellbeing between female and male participants in this study. A Mann–Whitney U-test revealed that female participants scored a higher mean happiness rank of 159.17 than males’ mean rank of 127.23, and this was statistically significant ($U=6793.500$, female=159.17, male=127.23, $p=0.002$). This implies that female PLHIV were more likely to report a higher personal wellbeing than male PLHIV participants on ART.

Challenges in adhering to ART

Participants were asked about challenges they encounter in their adherence to ART regimens as prescribed by their doctors. The majority (162 (53.8%)) indicated that they did not have a challenge in accessing and taking their medication. However, 106 (35.2%) reported that they have transportation challenge in traveling to and from their respective clinics for their medication. Other challenges included medication side effects (12 (4%)), medication shortage (11 (3.7%)), too many medications (seven (2.3%)), and cost of medication (three (1%)). These are presented in [Figure 1](#).

Discussion

The initiation of ART among participants in this study was in line with the WHO 2016 consolidated guidelines on ART that recommends early initiation of ART for adults with HIV and CD4 count below 500 cells/mm², regardless of the clinical stage to optimize positive HIV treatment outcomes and prevent new infections ([World Health Organization, 2016](#)). However, not many findings have reported early initiation of ART especially in developing and resource-limited countries. Meanwhile, in this study, 60%, 19.6%, and 14.6% of participants reported that they initiated ART immediately after their diagnosis, within a month, and within four months, respectively. This indicates that about 95% of the participants in this study enrolled in ART within six months after their HIV diagnosis which is consistent but higher than 53% reported in a systematic review in Australia in 2015 ([McManus et al., 2019](#)). In an analysis of a population-based sample in San Francisco to track early initiation of ART, researchers reported a steady increase from early ART initiation from 2001 to 2015 which peaked at 74% ([Truong et al., 2019](#)).

It was also found in this study that ART adherence was among the highest reported in the literature as reported by the participants in the study. A 55% global adherence rate of ART was reported a few years earlier among PLHIV ([Saber et al., 2015](#)). In this study, most (97%) of the participants reported that they adhere to ART regimens and are consistent with their anti-retroviral medications since initiating ART. This adherence rate is higher than the 78% national adherence rate reported by the Ghana AIDS Commission in Ghana ([Ghana AIDS Commission, 2019](#)). The high adherence rate is also consistent with but higher than 70.4% and 86% reported in Korea and China, respectively

(Kim *et al.*, 2018; Yu *et al.*, 2018). Again, the finding is higher than the 30–50% ART adherence rates reported in the USA earlier (Marcum *et al.*, 2013).

Many factors have been reported to predict or at least to be associated with ART adherence among PLHIV in different environments. In this study, different variables were tested using different statistics and only the availability of alternatives to the current ART had a statistically significant association with ART adherence in χ^2 analysis. Those who took their medication because they did not have alternatives to the current ART regimen were more likely not to adhere to ART compared to those who did not worry about alternatives to the current ART regimen. However, in binary and multinomial regression analysis the same variable did show a significant relationship to ART adherence. This finding is inconsistent with findings in Ghana where gender, fear of stigma, shortage of antiretroviral drugs, and financial difficulties were reported to predict ART adherence (Anokye-Kumatia *et al.*, 2018; Nichols *et al.*, 2019; Poku *et al.*, 2020). Other promoters of ART adherence reported in a teaching hospital in Accra, Ghana; included perception of benefits of ART, awareness of ART regimen, access to food, and transparency on the part of clinicians (Dzansi *et al.*, 2020), which we did not find in this study. The finding is also inconsistent with findings of fear of HIV stigma, gender, and non-disclosure of HIV status, and lower SES (Corless *et al.*, 2017; Kim *et al.*, 2018; Madiba & Josiah, 2019; Yu *et al.*, 2018).

The finding is, however, consistent with emerging evidence in the literature that PLHIV around the world are searching and showing a preference for alternative ARTs and willing to switch from the existing daily pills regimen to long-acting ARTs (LA-ART) including six months injectables, implants, and ART-free HIV remission (Dandachi *et al.*, 2021). For example, in a study to explore the perceptions and viewpoints of PLHIV about LA-ART in France, researchers concluded that LA-ART may be the suitable mode of HIV treatment for some PLHIV (Carillon *et al.*, 2020). In a quantitative study among 282 PLHIV in the USA, Dubé and colleagues reported that 42% and 24% indicated their preference of six-month injectables and ART-free HIV remission respectively over the daily pills (Dubé *et al.*, 2020). Similarly, in Texas, researchers reported that 61% of study participants preferred LA-ART over the daily pills regimen and specifically, 41%, 40%, and 18% preferred a pill for six months, injectables, and implants respectively (Dandachi *et al.*, 2021).

Therefore, the finding in this study may be a signal that alternatives to the current ART regimens in Ghana should be taken into consideration by the Ghana AIDS Commission, Ghana Health Service, and Ghana AIDS Control program in planning and updating HIV/AIDS policies in Ghana.

Many health and social benefits of ART adherence have been reported for those who have consistently adhered to ART regimen; including viral suppression and reduced risk of infecting others, improved quality of life, and reduction in AIDS-related deaths. There seems to be a consensus in the literature that ART adherence has greater health benefits for PLHIV. For instance, the WHO reported that 67% of all those estimated to be living with HIV globally were receiving ART out of which 59% achieved suppression of the HIV with no risk of infecting others (UNAIDS, 2020; World Health Organization, 2021). The Ghana AIDS Commission and Lokpo *et al.* have also reported 68% and 61.6% suppression among different PLHIV groups in Ghana who have sustained ART adherence (Ghana AIDS Commission, 2019; Lokpo *et al.*, 2020). This study was not a clinical one and so viral suppression and CD4+ count were not measured to determine the health outcomes for the participants. However, self-reported health status and wellbeing were assessed whereby 90% of the participants reported being happy with their overall health and personal wellbeing. Specifically, 94%, 91%, 83%, and 75% of the participants rated their nutritional status, energy level, sleep behavior, and ability to work, respectively, significantly improved while on ART. The findings of improvement in personal wellbeing among PLHIV on ART are corroborated by the findings of other studies that show that data from various sources show improved quality of life especially when ART is initiated early such as reported in this study (Ford *et al.*, 2018; Lifson *et al.*, 2017). The risk of early death due to HIV-related causes has also been found to be significantly reduced with early initiation and adherence to ART (Mangal *et al.*, 2019). The findings of improvement in physical, economic, and general wellbeing are also consistent with findings from similar studies. For instance, in a study of perceptions of the benefits of ART among PLHIV in Cote d'Ivoire, Brazil, and Ethiopia, researchers found that participants adhered to ART regimen because they perceived ART to reduce the risk of transmission of HIV, minimize job losses, and improves economic productivity among other benefits (Abebe Weldsilase *et al.*, 2018; Dutra *et al.*, 2019; Hendrickson *et al.*, 2019). These findings imply that the more PLHIV perceive that adhering to ARTs has direct personal health and economic benefits, the more likely they will be consistent in their adherence to ARTs.

Limitations

The findings in this study are based on self-reported data. We encourage caution in drawing further conclusions as the researchers could not substantiate the self-reported information with clinical parameters. We also want to caution that since only the availability of ART alternative had significant association with ART adherence in χ^2 analysis but was

nonsignificant in logistic regression, predicting adherence with that variable is inconclusive. However, achieving 73% of the targeted sample size with a sub-population often difficult to reach due to fear of stigma was a strength worth noting.

Conclusion

The findings from this study showed a high level of ART adherence among PLHIV in the three localities covered and corroborates reports of high and consistent ART adherence by the Ghana AIDS Commission. We also found in this study that availability and accessibility to alternatives to the current ART regimen may be a strong motivator for adherence. Finally, our findings point that initiation and adherence to ART could lead to improvement in health and wellbeing of PLHIV as demonstrated by the self-report of participants. For public health practice, we advocate continuous effort to motivate PLHIV to adhere to their ART regimen through enhanced access to a regular supply of ART. Investment in LA-ART to ensure more effective, efficient, and stress-free adherence to ART for all PLHIV need to be expedited.

Data availability

The data from which the results and conclusions of this manuscript are drawn came from PLHIV who are considered a vulnerable population. As such, every effort was made during the collection, handling, and analysis to protect the personal information and health records of the participants. To continue to ensure that we adhere to the principles of data privacy and confidentiality, we have created a limited dataset which is de-identified and have deposited it in Zenodo with the DOI: 10.5281/zenodo.5914548. A request to the principal investigator or the Head of the Department of Family and Community Health is still required for full access and use of the data.

Acknowledgements

The workload involved in the conduct of the study was such that without the support of people at different stages and collectively, we would encountered more challenges. A number of important individuals provided critical support for the researchers from start to the end of the study and we would like to acknowledge their immense contributions in conducting the study. The coordinators of the HIV clinics at Hohoe Municipal Hospital, Margarete Marquart Hospital in Kpando, and St. Mary Theresa Hospital at Dodi Papase coordinated the informed consent process, securing permission to conduct the study at their facilities, and supported our data collectors. We also gratefully acknowledge the support of selected students of the School of Public Health who volunteered to be trained as data collectors and who helped significantly in the data collection for the study. We sincerely thank all others who helped in diverse ways to make the study a success.

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Esmail Mehraeen

Khalkhal University of Medical Sciences, Khalkhal, Iran

This manuscript is clear and well organized. However, I may require some comments on the following issues.

Abstract: This section was well-written and easy to understand. In addition, the objective of the study and the state of the art of the study are clear. Furthermore, the keywords should be represented the study. Please match the keywords with the mesh.

Introduction: Based on my review, I recommend that the authors should add various improvements, such as:

- Hypothesis and objectives.
- Add a statement or sentence about whether there are any similar studies that have been done before.
- Add the important issues.

Material and Methods: This section was well-written

Conclusion: In this part of the manuscript, the authors have been successfully established the conclusion of this research. However, it might be useful if the authors mention the suggestion for forthcoming research.

References: The core references are acceptable, but I think the authors should add the latest references in this manuscript. Please mentioned many high-quality COVID-19 related papers, such as^{1,2,3}.

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Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: · Health information technology · Mobile Health · Health informatics · Data mining · Artificial intelligence · Infectious diseases

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 24 October 2022

<https://doi.org/10.5256/f1000research.79236.r151742>

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Raphael Z. Sangeda

Muhimbili University of Health and Allied Sciences, Dar es salaam, Tanzania

The authors of the article "Impact of antiretroviral therapy regimens adherence on perceived health and well-being status among adults living with HIV in Ghana" try to examine adherence to antiretroviral therapy (ART) and the perceived well-being of people living with HIV in two regions

of Ghana.

In my view, the issue of adherence to ART is critical and requires a thorough investigation from time to time. However, the authors must address specific issues to improve the article's readability.

Title

- I suggest the title: "Impact of perceived health and well-being on antiretroviral therapy regimens adherence status among adults living with HIV in Ghana".

Abstract

- Define abbreviations such as PLHIV on first use.
- The methods section mentioning the use of descriptive statistics for demographic and categorical data can be amended for accuracy.
- Please mention in the methods section of the abstract how adherence was measured (questionnaire and how it was scored).
- The results section opening word cannot be a number; change the writing style.
- The word LA-ART is not defined in the conclusion of the abstract.
- At the end of the abstract, mention the country you are referring to.

Introduction

- In the second paragraph of the introduction, therapeutics could be changed to ART, and more use of recent references when citing literature.
- The word ART and other abbreviations should be spelled out on first use.
- The word HIV/AIDS can be changed to HIV to make it more appropriate for the condition in the era of test and treatment.
- In the third paragraph of the introduction, avoid reparations of ideas. Also, make it clear why counseling is part of this writing.
- In the fifth paragraph, delete the words "in the country."

Methods

- In the data collection and analysis section, participants can choose to be interviewed in English or Akan. This language use can introduce bias in your collected data.
- In the fourth paragraph, there is a lack of details on tools used to measure and score adherence.

Results

- In Table 1, the total number (N) for each variable is unclear. Add N to each variable category or the table caption, or both.
- Page 6: The second paragraph reports "high adherence." Where is this cited? Which Table
- Table 3 can be simplified and presented without the statistical software details.
- Figure 1: No values are labeled on each slice of the pie chart.
- The first paragraph on page 8: How was "happiness" measured? Add to the methods before using the data.
- The results showing the impact of regimens/therapies used are missing in this section even though the title and conclusions state the impact of regimens; show the impact of regimens and discuss it.

Discussion

- In the first paragraph of the discussion, the CD4 criteria are no longer used in the test and treatment area.
- In the second paragraph, be cautious that comparing adherence depends on the method used to test compliance.
- Which method was used to measure and score adherence in this study?
- Also, note that adherence assessment in the past years may not be fairly compared with current rates, given the changes in regimens that have taken place over the years.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: ART adherence; Antimicrobial resistance, HIV drug resistance

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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