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UNIVERSITY OF GHANA

FACTORS INFLUENCING ADHERENCE TO ANTIRETROVIRALS (ARVS) AMONG PERSONS LIVING WITH HIV IN THE EASTERN REGIONAL HOSPITAL, GHANA.

BY

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DECLARATION

I hereby declare that this thesis is the product of my original and independent research conducted in the Eastern Regional Hospital, Ghana under the supervision of Professor Kwasi Torpey. I affirm that this work has neither been published nor submitted in whole or in part to any institution for any academic award. All references made to the works of other researchers have been duly acknowledged.

24.04.2023

Antoinette Arna Dela Wordi (MPH Candidate) Date

26-04- 2023

Professor Kwasi Torpey (Principal Supervisor) Date

ABSTRACT

Background: Sub-Saharan Africa continues to bear the brunt of new and prevailing HIV infections and several countries in this region were unable to meet the UNAIDS 90-90-90 target by 2020. Antiretrovirals are free and readily accessible in Ghana yet adherence levels continue to be suboptimal. There is the need to explore the factors that account for adherence to ARVs in order to capitalize on them and improve adherence levels and ultimately achieve the 95-95-95 agenda by 2030.

Objectives: The aim of this study was to determine factors that influence adherence to antiretrovirals among adult PLHIVs in the Eastern Regional Hospital in Ghana. **Method:** This study was a cross sectional one involving 330 participants who were attendants at the ART clinic of the Eastern Regional Hospital, Koforidua. Questionnaires employed in the study were pretested and participants were selected over a 4-week period using consecutive sampling. Factors influencing adherence were categorized as individual, economic, treatment-related and health system factors. Adherence was determined using the self-report 3-day recall and 7-day recall methods. The most recent viral loads of these participants were also recorded and the association between the viral load measurement and the adherence level was determined using the crude odds ratio and the adjusted odds ratio. Level of significance for the study was set at a value of $p < 0.05$.

Results: With a response rate of 100%, a majority (77%) of the respondents were females and the dominant age group was the 40 – 49 age bracket. A majority of the respondents (84.2%) had some form of formal education. Though most of the respondents denied missing their ARVs, those who missed some of their medications cited forgetfulness as the reason for missing their medications. Using the 7-day recall method, adherence was capped at 85% and 84% of respondents were found to have achieved virological suppression with values <1000 copies/ml. Social support, pleasant and professional attitude of health care workers as well as short hospital waiting time were found to have a positive effect on drug adherence. All the

respondents were on the single pill combination of tenofovir/lamivudine/dolutegravir and side effects attributable to the ARVs were not found to affect the adherence levels. There was a positive association between adherence and virological suppression with an adjusted odds ratio of 2.811.

Conclusion: Ghana has made strides when it comes to HIV care. There is however room for improvement and this study has revealed that strong social support, decentralization of HIV care with resultant reduced hospital waiting time, professionalism among health workers in the HIV sector and reduced pill burden will improve upon ARV adherence.

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I thank God foremost for successfully seeing me through this study. I thank Professor Torpey, my supervisor who has been patient, very responsive and helpful in guiding me to complete this study. To the participants of this study, thank you for making time to participate in the interview sessions and here is to hoping we can find a cure to HIV soon enough!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AIDS – Acquired Immune Deficiency Syndrome

ART – Antiretroviral Therapy

ARV – Anti-retroviral

DOT – Directly Observed Therapy

HAART – Highly Active Anti-Retroviral Therapy

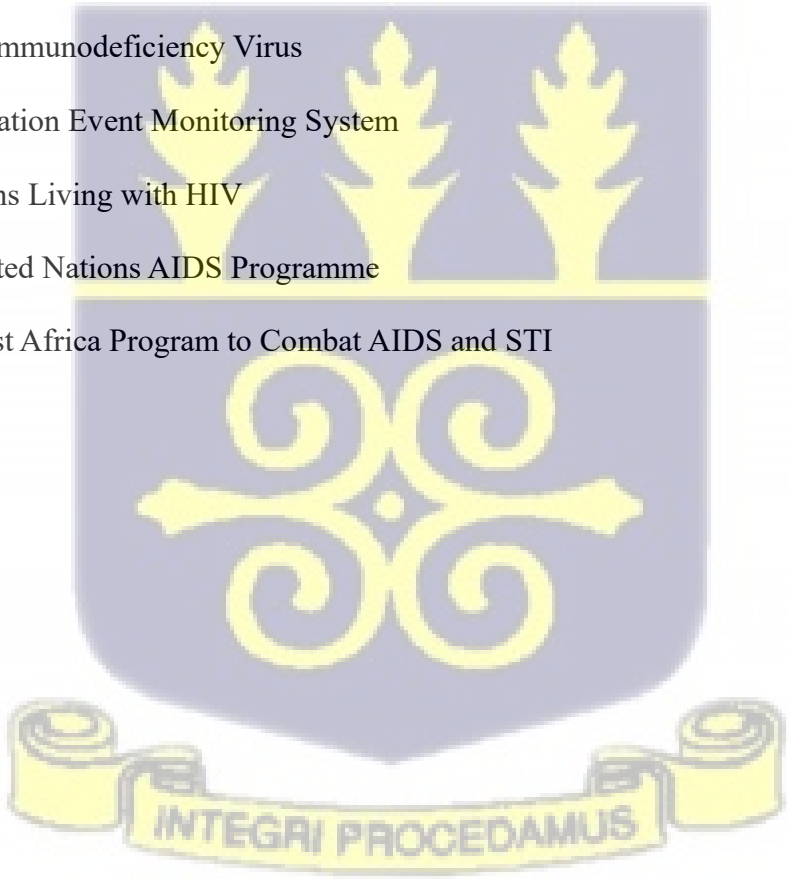
HIV – Human Immunodeficiency Virus

MEMS - Medication Event Monitoring System

PLHIV – Persons Living with HIV

UNAIDS – United Nations AIDS Programme

WAPCAS - West Africa Program to Combat AIDS and STI



CHAPTER ONE

INTRODUCTION

1.1 Background

Sub-Saharan Africa is being burdened with increasing numbers of non-communicable diseases at a point in time where communicable diseases have not yet been fully addressed. This double burden of communicable and non-communicable diseases has made healthcare in sub-Saharan Africa a challenging sector to run effectively, not even considering the existing gaps in the health system. One communicable disease that has plagued the region with considerable morbidity and mortality since the 1980s is HIV. Though strides have been made in HIV care over the past 30 years, much is left to be desired concerning optimum HIV management. HIV is an infection caused by the Human Immunodeficiency Virus, an RNA virus belonging to the lentiform family of retroviruses (Center for Disease Control and Prevention, 2021). It acts by significantly weakening the host's immune system over time resulting in increased susceptibility to opportunistic infections with debilitating effects. If left untreated, HIV can advance to AIDS which is characterized by an increased incidence of opportunistic infections, hospital admissions, poor quality of life and high mortality. AIDS is the fourth leading cause of death worldwide (Arabi et al., 2013). There is no cure for HIV currently and persons who test positive for the virus are required to be on lifelong treatment with antiretroviral drugs.

Though sub-Saharan Africa is home to a mere 12% of the world's population, 53% of the world's population of adult HIV patients as well as 90% of HIV positive children reside in the region (UNAIDS, 2019). Several interventions have been put in place over the years to reduce new infection and make HIV treatment accessible and feasible for all persons infected. Africa still has a long way to go, however, when compared to other continents.

Ghana is a country in West Africa with an HIV prevalence of 1.7% (UNAIDS, 2020) and even though this depicts a generalized epidemic, this rate is relatively low as compared to

other sub-Saharan countries such as South Africa which has a prevalence of 19.1% as of 2020 (UNAIDS, 2020). Ghana however has key populations and specific geographical areas with higher HIV prevalence rates and the National HIV & STI control programme, under the auspices of the Ghana Health Service/Ministry of Health, is continuously revising the treatment modalities in HIV care with an emphasis on patient-centredness. Routine tests such as viral load measurements are used to monitor treatment success. Screening for TB using the Gene Xpert for detection of tuberculosis with subsequent sensitivity to rifampicin, as well as antiretroviral drugs in Ghana are fully funded by the government and other bodies such as the World Health Organization (WHO) and the Global Fund. This has made ARVs accessible and affordable to all persons living with HIV in the country. Ghana has also adopted the principle of multi-month dispensing of ARVs to reduce the frequency of hospital visits for refills in otherwise stable patients. These ARVs are often single pills with once-daily dosing to ensure that persons living with HIV can have some semblance of normalcy in their routine lives. The country still struggles with adherence to ARVs amongst her populace and several factors are implicated in determining adherence.

The Eastern region of Ghana currently has an HIV prevalence of 2.4% which is higher than the national prevalence of 1.7% (UNAIDS, 2020). The Eastern Regional Hospital of Ghana is located in Koforidua, the regional capital city, which has an HIV prevalence of 3.6% as of 2020. Per the hospital's database, the hospital has 3536 persons living with HIV on treatment as of December 2021 yet only 79% of these persons have been able to achieve virological suppression. Adherence to ARVs is imperative to achieve virological suppression and also to reduce the incidence of drug resistance as much as possible. Current WHO guidelines recommend viral load as the preferred monitoring strategy to assess ART effectiveness (WHO, 2016). Viral load tests are done 6 months after initiating therapy and then annually. A value of less than 1000 copies is regarded as virological suppression. The international community has devised several strategies over the years to tackle the menace of HIV. Some of these strategies include the 15 by 15 initiative in 2012, getting to zero initiative also in

2012, the 90-90-90 agenda in 2014 (Halasa-Rappel et al., 2021), and more recently, the 9595-95 agenda which is an extension of the previous 90-90-90 agenda. These initiatives guide donors' responses to the HIV/AIDS epidemic. This study sought to identify factors influencing adherence to ARVs among persons living with HIV in the Eastern Regional Hospital of Ghana. Identifying these factors will guide health workers and policymakers on strategies and innovative ways to tackle these barriers with the aim of achieving virological suppression and eventually, the 95-95-95 agenda by 2030.

1.2 Problem Statement

With the intent of ending the AIDS pandemic, the UNAIDS held a conference in 2015 which was attended by several world leaders. This conference gave birth to the 90-90-90 agenda which states that by 2020, 90% of persons living with HIV should know their status; 90% of these persons with HIV should have access to and be maintained on antiretrovirals. Finally, 90% of persons on treatment should achieve viral suppression within a year of starting treatment (UNAIDS, 2020). Ghana and several other countries did not achieve this 90-90-90 agenda by the close of 2020. On the contrary, some sub-Saharan African countries such as Namibia were able to meet this set target with recorded values of 95-89-92 in 2018 (Halasa-Rappel et al., 2021). At the end of 2020, Ghana's status regarding the 90-90-90 agenda was 63-95-73 (Ghana AIDS Commission, 2020). The UNAIDS set the bar higher at the close of 2020 however and the aim currently is to achieve 95-95-95 status by 2030. Adherence to ARVs is incorporated in the second 95 and is a major determinant in achieving the third 95. Ghana should not be left behind in this drive to end the AIDS pandemic by 2030 hence this study aimed at identifying factors that influence adherence to ARVs. Once these factors are brought to the limelight, policies and protocols concerning HIV management in Ghana will be targeted at addressing these factors. It is hoped that with the proper protocols in place,

medication adherence will increase amongst persons living with HIV. This has several benefits such as markedly reducing the incidence of drug resistance, and making Ghana inch closer to achieving the 95-95-95 agenda by the year 2030.

1.3 Justification

The AIDS pandemic has been ongoing since the mid-1980s and almost forty years on, no definite cure or vaccine has been developed for HIV even though over 37.9 million people are living with HIV globally (UNAIDS, 2019). HIV care is cost-intensive and the disease is associated with high rates of morbidity and mortality even though groundbreaking long-term treatment options exist. The determinants of HIV adherence will empower Ghana to make more significant strides in the battle against this pandemic. Achieving the 95-95-95 agenda will not be farfetched and overambitious as it is currently thought to be. It is important to identify factors influencing adherence in order to propose strategies that will result in long-term adherence to antiretrovirals.

1.4 AIM AND OBJECTIVES

1.4.1 Aim

To determine factors that influence adherence to antiretrovirals among adult persons living with HIV in the Eastern Regional Hospital of Ghana.

1.4.2 Objectives

General Objective

- To determine factors that influence adherence to antiretrovirals among adult PLHIVs under study.

Specific Objectives

1. To determine the level of adherence to ARVs
2. To identify factors influencing adherence among HIV clients under study
3. To determine the association between adherence and virological suppression

1.5 Research Questions

- What is the level of adherence to antiretroviral therapy? • What are the factors that influence adherence to ARVs?
- What is the association between antiretroviral adherence and virological suppression?

1.6 Conceptual Framework

The Anderson Healthcare Utilization Model was adopted to develop a conceptual framework for this study. This model is a reliable tool for the study of health services utilization and it best suited the study and met the specific objectives of the study. This model may be employed in characterizing factors that influence adherence to ARVs into three main groups – socio-demographic factors, economic factors and health outcomes factors (Li et al., 2016). For sociodemographic factors, client knowledge about HIV has been shown to increase the general level of adherence (Mannheimer & Hirsch-Moverman, 2015). The educational level of a patient plays a role similar to HIV knowledge level with adherence being directly proportional to level of education. The study hoped to see disparities in adherence amongst age and sex groups. Patients who are married may have some social support which will increase adherence in this group of persons as compared to single patients. Religious beliefs can positively or negatively influence adherence; persons who believe that their disease is spiritual hence cure has to be sought spiritually may not adhere to their medications. Others

who fall in this category may be non-adherent as a result of instructions from pastors and spiritual leaders to stop taking their medications (Dzansi et al., 2020). Those who believe that medications are inspired by divine knowledge and therefore beneficial may adhere to their medications. Clients who have been HIV positive for a longer duration are expected to be more adherent to their medications than recently diagnosed persons as they are more likely to have observed benefits of ARVs (Dzansi et al., 2020). The absence of family support coupled with perceived stigma and long waiting times in the health facilities will result in nonadherence to ARVs (Lall et al., 2015). Advanced disease and high transport costs to the health facility will be expected to have a similar effect on adherence. Even though first line ARV regimen is mainly a single pill with a once-daily dosing, persons on regimens which include protease inhibitors are less adherent compared to those on other regimens (Mannheimer & Hirsch-Moverman, 2015). These factors being investigated may also interact with each other to influence adherence and ultimately virological suppression. This study sought to explore how these factors stated above will influence adherence to ARVs among PLHIVs in the Eastern Regional Hospital.

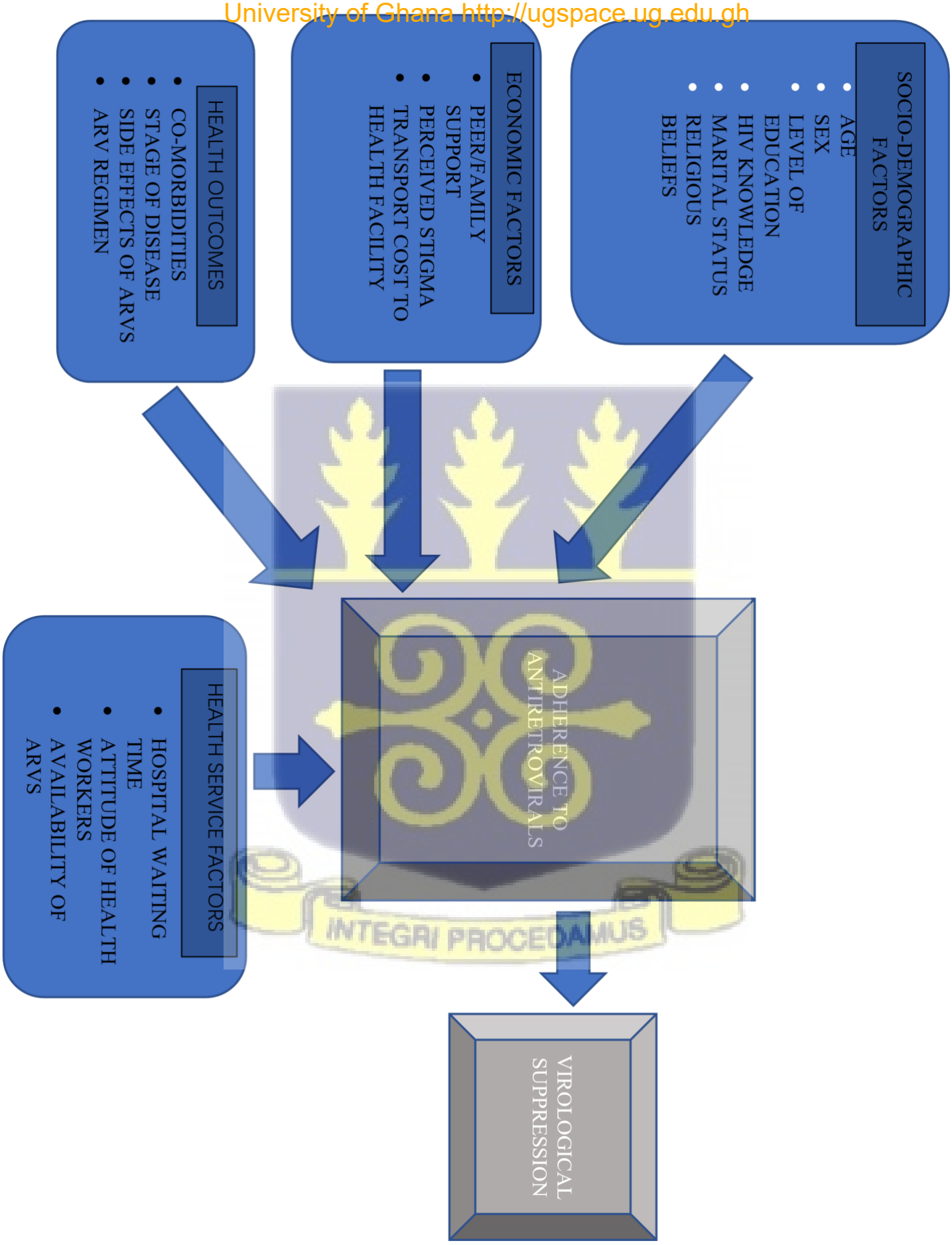


Figure 1: Conceptual framework

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

When HIV was first discovered, several mortalities resulted from the disease with many dreading its other sequelae which include increased incidence of opportunistic infections, frequent and prolonged hospital admissions and reduction in the quality of life. Currently, over 37.9 million persons worldwide are living with HIV, 52% of whom reside in subSaharan Africa (Heestermans et al., 2016). In Ghana, HIV was first confirmed at the Nouguchi Memorial Institute for Medical Research in 1986 (Yawson et al., 2014). The number of clients receiving antiretroviral therapy in Ghana has increased over 200-fold from 197 in 2003 to over 45,000 in 2010 (Obirikorang et al., 2013). As of 2017, there were 310,000 Ghanaians living with HIV (Ali et al., 2019) and several interventions have been proposed to increase the quality of life of PLHIV. One of such interventions is the introduction of Highly Active Anti Retrovirals (HAART). HAART was found to save people diagnosed with AIDS from the brink of death, reducing AIDS-related mortality by up to 80% in high-income countries and it was thus christened the Lazarus drug (Tompsett, 2020) due to its dramatic effect of changing the status of an infected person from moribund to living with a chronic illness. This new drug combination was introduced in 1996 and has been shown to reduce mortality and morbidity if taken appropriately with evidence of virological suppression amongst adherent HIV clients (Fogarty et al., 2001). These medications have thus changed the clinical profile of HIV infection from a subacute lethal disease to a chronic ambulatory disease (Yeni, 2006). Non-adherence has been implicated in treatment failure and this chapter seeks to delve into HIV adherence, its measurement, factors influencing adherence, and virological suppression in the light of adherence.

2.1 HIV Adherence

Adherence is defined as a patient's ability to follow a treatment plan, take medications at prescribed times and frequencies, and follow restrictions regarding food and other medications (Sahay et al., 2011). This definition is multi-faceted and suggests that adherence can be looked at from many operational subunits; following treatment plans, taking medications at prescribed times and frequencies, and following restrictions. Highly Active Antiretroviral Therapy (HAART) is highly effective but needs to be taken precisely, on a routine basis for it to be effective. This precise and routine basis has birthed the discussion on adherence and its relevance in HIV treatment. Predictors and risk factors for ART adherence have been shown to differ across populations hence context-specific development of adherence profiles is necessary in order to provide tailored care to PLHIV (Heestermans et al., 2016). It is important to talk about adherence because non-adherence is responsible for the development of resistance to antiretroviral therapy and suboptimal outcomes in patients (Obirikorang et al., 2013). Even minor deviations from prescribed regimens provide the virus with replication opportunities, leading to increased drug resistance and subsequent treatment failure (Harrigan et al, 2005). This poses a problem not only for HIV but also for persons with other chronic diseases such as diabetes and hypertension. Adherence is measured as a proportion rather than as an absolute value and several studies have identified a cap of 95% to be optimum adherence (Achappa et al., 2013; Adjei, 2019; Sahay et al., 2011). (Byrd et al., 2019) opined that an adherence level as low as 82% may be enough to yield virological suppression with the advent of newer antiretrovirals. This level is similar to the adherence level of 80% required for treatment success in chronic diseases like hypertension and hypercholesterolaemia (Byrd et al., 2019). Non-adherence to antiretroviral therapy in the adult HIV-infected population worldwide is estimated to be between 33 – 88% (Sahay et al., 2011). Several studies have yielded varying levels of adherence with most of these values being less than the stipulated 95% (Adjei, 2019; Bongfen et al., 2021; Obirikorang et al., 2013). The unique characteristics of HIV, however, require near-perfect adherence (Fogarty et

al., 2001). This means that drug-resistant strains will be on the rise with increased transmission of drug resistant strains of HIV. This will lead to new drug-resistant HIV infections in antiretroviral naïve patients who unfortunately have slimmer treatment options for their condition. Concerning the 95-95-95 agenda which seeks to end the AIDS pandemic by 2030, adherence to antiretrovirals addresses the second 95 and this requires a concerted effort between HIV patients, their support systems and health workers. Being abreast with the factors that facilitate or impede drug adherence will enable health workers, support systems and policymakers to intervene appropriately with an aim of increasing the proportion of clients adherent to their antiretrovirals. This knowledge will also empower health workers and counsellors to be able to offer constructive and relevant counselling to HIV patients in the hospital setting to cause behavioural changes and improve adherence. The results of these interventions will include reduced frequency of hospital admissions, virological suppression, fewer levels of drug resistance, and of course, fewer transmission rates of drug-resistant strains of antiretrovirals.

2.2 Measurement of Adherence

There is currently no gold standard for measuring adherence but three main measurement modules exist. These can be classified as subjective, objective and physiological methods (Fogarty et al., 2001). The subjective method of measurement of adherence involves self-reporting data which could be done weekly, monthly or annually. This method is ideal in resource-limited settings and is memory-dependent (Achappa et al., 2013). Respondents may also provide socially acceptable answers which may not be veritable (Sahay et al., 2011). One way to curb these biases may be to ensure patient confidentiality during the interview sessions. The objective method involves pharmacy refill data, directly observed therapy (DOT) or Medication Event Monitoring System (MEMS). Pharmacy refill data refers to the

adherence measurement tool that calculates the medication possession ratio for the period from index fill to the next refill (Osterberg & Blaschke, 2005). This method is ideal in facilities with optimum pharmaceutical record keeping, otherwise known as a closed pharmacy system. One disadvantage of this method is that refill does not equate to medication ingestion as some patients may honour refill appointments but not necessarily be adherent to their antiretrovirals. Pharmacy refill data is also more resource-intensive as compared to the subjective method, and the recall bias associated with the subjective method is not observed here. Directly Observed Therapy, as the name implies, involves the healthcare provider observing the patient take their medication. This is a good measurement tool as the timing of taking medications can also be documented. It is however burdensome to the healthcare provider and tends to be expensive to implement. In Ghana, this method is mostly employed in multidrug-resistant tuberculosis management with the help of community health nurses who double as treatment supporters. The Medication Event Monitoring System is a medication bottle cap with a microprocessor that records the occurrence and time of each bottle opening. The MEMS has been used in a variety of populations with medical disorders (Diaz et al., 2001). The physiological method involves CD4 count and viral load as these are biomedical markers of treatment success which is a sequela of treatment adherence. With the introduction of the Treat-All policy, CD4 count is not routinely used in HIV treatment in Ghana currently as its significance has been replaced by the viral load. There usually exists discrepancies between self-reported adherence and these biomedical markers (Sahay et al., 2011) which corroborates the issue of bias observed with the self-reported adherence measurement technique. Using a single method to assess adherence may be inadequate and impractical (Sahay et al., 2011) so it is best to employ at least two of the abovementioned methods when measuring adherence. Resource constraints may be a preventing factor for the use of two or more methods for measuring adherence. Optimum adherence is capped at 95% using the formula stated below:

$$\frac{\text{Total number of medications taken}}{\text{Total number of medications prescribed}} * 100\%$$

The Figure below is a depiction of the common methods employed in measuring adherence, their advantages and disadvantages.

Table 1. Methods of Measuring Adherence.

Test	Advantages	Disadvantages
Direct methods		
Directly observed therapy	Most accurate	Patients can hide pills in the mouth and then discard them; impractical for routine use
Measurement of the level of medicine or metabolite in blood	Objective	Variations in metabolism and "white-coat adherence" can give a false impression of adherence; expensive
Measurement of the biologic marker in blood	Objective; in clinical trials, can also be used to measure placebo	Requires expensive quantitative assays and collection of bodily fluids
Indirect methods		
Patient questionnaires, patient self-reports	Simple; inexpensive; the most useful method in the clinical setting	Susceptible to error with increases in time between visits; results are easily distorted by the patient
Pill counts	Objective, quantifiable, and easy to perform	Data easily altered by the patient (e.g., pill dumping)
Rates of prescription refills	Objective; easy to obtain data	A prescription refill is not equivalent to ingestion of medication; requires a closed pharmacy system
Assessment of the patient's clinical response	Simple; generally easy to perform	Factors other than medication adherence can affect clinical response
Electronic medication monitors	Precise; results are easily quantified; tracks patterns of taking medication	Expensive; requires return visits and downloading data from medication vials
Measurement of physiologic markers (e.g., heart rate in patients taking beta-blockers)	Often easy to perform	Marker may be absent for other reasons (e.g., increased metabolism, poor absorption, lack of response)
Patient diaries	Help to correct for poor recall	Easily altered by the patient
When the patient is a child, questionnaire for caregiver or teacher	Simple; objective	Susceptible to distortion

Figure 2: Methods of measuring adherence

Source: Osterberg & Blaschke, 2005

2.3 Factors Influencing Adherence

Several chronic conditions require the ingestion of medications on a daily basis for protracted periods. HIV is one such illness which requires lifelong management with HAART. Proper adherence to HAART has been shown to improve patient outcomes with improved morbidity and decreased HIV-related mortality. The precise application of recommended HAART regimens has been shown to cause a degree of virological suppression that makes transmission of HIV extremely unlikely (Rintamaki et al., 2019). This is an extension of the UNAIDS Undetectable = Untransmissible initiative which states that persons living with HIV are unlikely to infect their sexual partners if their viral loads depict undetectable levels of HIV (UNAIDS, 2018). Several factors are responsible for adherence and non-adherence and this write-up is not exhaustive of the identifiable factors that influence adherence to HAART. These factors can however be summarized as patient-related/individual factors, treatment-related factors and socioeconomic factors (Bijker et al., 2017).

2.3.1 Individual Factors

Persons living with HIV have lives outside of their diagnosis and are involved in various occupations with different family dynamics and social habits which will collectively influence their levels of adherence. Social support, stigma, knowledge of HIV and benefits of HAART, unwanted change in body image, conflicting work schedules, and forgetfulness have been found to affect adherence among HIV-positive patients. In a study done in geographically remote areas, strong social support was identified as an enabler for HIV patients to overcome existing economic and structural barriers to adherence (Lankowski et al., 2014) and thus the reverse may be true. Stigma is defined as a mark of disgrace associated with a particular circumstance, quality or person (dos Santos et al., 2014). Few illnesses have been as stigmatized around the globe as HIV (Rintamaki et al., 2019) and several studies have shown a strong inverse relationship between stigma and adherence to HAART (Heestermans

et al., 2016; Obirikorang et al., 2013; Rintamaki et al., 2019). Even though the actual mechanism is opaque, some participants in a study expressed some level of discomfort when faced with the challenge of taking their antiretrovirals in the public eye (Rintamaki et al., 2019). Some participants in a focus group discussion also expressed fear of being seen taking their antiretrovirals and would rather forgo their medications when in the public eye in a bid to conceal their HIV status (Rintamaki et al., 2019). Patients with a history of stigma and those who did not disclose their HIV status were less likely to adhere to treatment (Kasumu & Balogun, 2014). A recent study done in Zambia revealed that HIV patients with a high concern for HIV stigma were found to be 1.7 times more likely to report non-adherence compared to those with low concern for HIV stigma (Jones et al., 2020). Another older study done in Louisiana showed that HIV-positive patients with high HIV stigma concerns were 3.3 times more likely to be non-adherent to their antiretrovirals (Rintamaki et al., 2006). Knowledge of HIV patients about their condition and treatment options available to them has been shown to determine their levels of adherence. Patients with chronic diseases such as asthma and type I diabetes mellitus were found to have high levels of adherence when they have ample knowledge of their condition (Shahin et al., 2019). Poor knowledge 8 weeks after treatment initiation was predictive of poor adherence (Raberahona et al., 2019). Even though some studies on HIV have shown that knowledge about HIV makes a person more adherent to their antiretrovirals (Heestermans et al., 2016), other studies have shown that there is no identifiable relationship between a patient's knowledge and their level of adherence (Heestermans et al., 2016; Kahema et al., 2018). Social habits such as recreational drug use and alcohol intake, have been found to lead to increased incidences of forgetfulness and subsequent non-adherence to antiretrovirals (Heestermans et al., 2016).

2.3.2 Treatment-related Factors

Treatment-related factors that influence adherence to HAART include pharmacy stock-outs, antiretroviral therapy regimen complexity, pill burden with regards to existing co-morbidities and side effects experienced with the use of HAART. First-line treatment for adult HIV in Ghana involves a once-daily single-pill combination of Tenofovir, Lamivudine and Dolutegravir but some patients may be on other regimens which involve more than one pill or increased frequency of pill intake and this can impair their levels of treatment adherence. Patients on regimens that involve protease inhibitors, for instance, are required to take more than one pill daily and this group of persons have been found to have lower levels of adherence compared to those on Integrase strand transfer inhibitors (INSTI) - containing single-pill regimens (Cheng et al., 2018; Mannheimer & Hirsch-Moverman, 2015). The presence of co-morbidities with similar chronic illnesses such as sickle cell disease, hypertension, diabetes and other autoimmune illnesses will also result in an increased pill burden with similar effects. HIV-positive patients on treatment who are clinically stable have been found to have higher levels of adherence to their ARV compared to those who are ill or are battling with AIDS-defining illnesses (Heestermans et al., 2016).

2.3.3 Health Services and System Factors

Health services and system factors that have been found to affect adherence to medications include hospital waiting time, attitude and competence of health workers, missing patient records, confidentiality and privacy of patients when visiting a health facility. Long hospital waiting time has been found to increase levels of non-adherence especially among patients who are employed as they need to take time off for their routine hospital visits (Dzansi et al., 2020; Heestermans et al., 2016). A study done in Zimbabwe however revealed that long waiting time does not affect adherence to ARV (Gonah & Mukwirimba, 2016). When healthcare workers are regarded as rude, lacking confidentiality or unprofessional with a

disconnect between them and their patients, these patients will be found to be non-adherent (Heestermans et al., 2016; Mannheimer & Hirsch-Moverman, 2015). The outpatient setting in some hospitals in Ghana is overburdened, leaving much to be desired; one consulting room will serve about two to four clinicians simultaneously and patients will be seen in the same room at the same time which compromises their right to confidentiality. If the same format is being used in HIV clinics, HIV-positive patients will feel uncomfortable during their hospital visits and will hide vital information or opt to miss appointments and subsequently ARVs which will lead to non-adherence.

2.3.4 Economic Factors

With the ever-increasing cost of living, costs incurred in the HIV treatment cascade will influence the adherence levels of HIV-positive patients. Transport costs to the health facilities and the cost of medications fall under the economic factors that will influence adherence to HAART. With the multi-month dispensing system currently in use in health facilities across Ghana, patients can receive up to 4 months' supply of antiretrovirals if no other medical concerns arise. This means stable HIV patients will only have to visit the hospital thrice a year for their medication refills. This was borne out of the fact that HIV clients are less likely to adhere if the cost of transportation to their health facilities is burdensome for them (Heestermans et al., 2016). HAART is expensive (Sarkar et al., 2019) but in several countries including Ghana, these medications are not for sale as they are program medications fully funded by the Global Fund. Ancillary medications such as folic acid, fluconazole and sulphamethoxazole combination, also referred to as septrin or cotrimoxazole are covered by the National Health Insurance Scheme so insured patients pay a subsidized amount for these medications. Adherence is not likely to be affected by the cost of antiretrovirals as these are fully funded. Routine laboratory investigations such as full blood count, renal function test and chest x-ray will have to be paid for by the patients when indicated resulting in late

diagnosis of certain opportunistic infections and increased morbidities. Viral load and gene Xpert investigations are also fully funded in Ghana so HIV-positive patients do not have to pay for these investigations to be done. There is however the issue of stock-out of reagents and breakdown of machines needed to run these tests and this creates a gap in the optimum management of HIV patients in Ghana. Though HIV clinics are ubiquitous in Ghana, some clients prefer to attend clinics in locations far from their places of abode or workplaces due to the issue of perceived stigma. This will likely affect adherence in light of increased transportation costs to these clinics.

2.4 Virological Suppression

According to the WHO, a viral load of less than 1000 copies/ml is regarded as virologic suppression with virologic failure being defined as at least 1000copies/ml (WHO, 2015). A person who is virologically suppressed can be said to have undetectable levels of the virus when viral load yields less than 20 copies/ml (WHO, 2015). This blood test is the preferred monitoring approach to diagnose and confirm treatment failure (UNAIDS, 2014) and is carried out at 6 months and 12 months after initiating ARVs, then every 12 months thereafter if the patient is stable on ARVs. Attaining virological suppression is necessary for controlling vertical and horizontal transmission of HIV in the population (Lokpo et al., 2020). Less than half of the global population on HAART has achieved virological suppression (UNAIDS, 2020) with Ghana's proportion of virologically suppressed individuals standing at 72.97% as of 2020 (Ghana AIDS Commission, 2020). In a recent study done in Ho, the capital city of the Volta region of Ghana, viral suppression rates stood at 69.7% (Lokpo et al., 2020) which is similar to the aforementioned national estimate. Several studies have shown that optimum adherence to antiretrovirals is imperative for the achievement of virological suppression (Gonah & Mukwirimba, 2016; Heestermans et al., 2016; Lokpo et al., 2020; Mannheimer & Hirsch-Moverman, 2015). On the contrary, a study done among adolescents living with HIV

in some health facilities in Cameroon showed that a significant proportion of adolescents who were non-adherent on their antiretrovirals managed to be virologically suppressed (Bongfen et al., 2021). This phenomenon was attributed to the somewhat forgiving nature of the newer antiretrovirals which is effective even in the face of adherence levels of less than the stipulated 95%.

2.5 Consequences of Poor Adherence

An adherence level of at least 95% is indicative of optimum adherence and this has been shown to have numerous benefits for both patients and health managers (Achappa et al., 2013; Adjei, 2019; Sahay et al., 2011). Poor adherence is the primary reason for suboptimal clinical benefits and it causes medical and psychosocial complications of the disease, reduces patients' quality of life, and wastes health care resources (Sabaté & World Health Organization., 2003). This makes it difficult for health systems to achieve set population health-related goals. Poor adherence is associated with ineffective treatment, delayed remission, increased incidence of drug resistance, prolonged or recurrent hospital admissions with a resultant increment in treatment cost, and ultimately, high mortality rates (Byrd et al., 2019; Dzansi et al., 2020; Gonah & Mukwirimba, 2016). Optimum adherence is beneficial to not only the individual as it also protects at-risk individuals from getting infected with HIV and other opportunistic infections especially if these persons are already immunosuppressed. Donor organizations and the government will also save money that is usually incurred in managing conditions that usually result from poor adherence as the sequelae of poor adherence are expensive to manage.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This section looks at how the study was conducted in terms of the study type, study site description, study population, sample size, eligibility criteria, adherence calculation, sampling procedure and ethical considerations.

3.2 Type of Study

A descriptive cross-sectional study was used in this study as it measures both exposure and outcome simultaneously. This study design brought out the factors that influence adherence amongst the study population of interest.

3.3 Study Site Description

The study was conducted in the Eastern Regional Hospital which is located in Koforidua, in the New Juaben Municipality of the Eastern region. This municipality was established in 1988 and lies between longitudes 1030' West and 0030 East and latitudes 60 and 70 North, covering an area of 110km^2 (Ghana Statistical Service, 2014). New Juaben Municipality has a youthful population of 183,727, with 93.3% of this population residing in urban areas. The capital of New Juaben Municipal is Koforidua which is home to about 65% of the municipal's population (Ghana Statistical Service, 2014).

The Eastern Regional Hospital can be found close to the central business district in Koforidua with a digital address of EN-011-7825. This facility, established in 1926, is a secondary level referral facility for the Eastern region and also doubles as a municipal hospital for the New Juaben Municipal. With a staff strength of about 900 and an average daily attendance of 826,

the hospital offers various services including antiretroviral therapy services (Eastern Regional Hospital, 2017). The ART unit of the hospital has been in existence since 2005 and at the time of the study, there were about 3536 registered persons living with HIV and on treatment. The facility has 18 testing points that offer HIV testing and counselling services to both in and out patients. Some clients who attend the ART clinic reside in neighbouring regions due to the fear of stigma if they attend ART centres close to their places of residence. The opt-out method is being employed at the antenatal clinics and there is an office that runs on weekdays to cater for walk-in testing and counselling services as well as information and testing for sexually transmitted infections. The unit works with other organizations such as WAPCAS, Prolink and Aurum Ghana to identify key populations in the municipal and offer ART services to them. The key populations identified currently include female sex workers, men who have sex with men, and high-risk men. The ART clinic runs three days in a week with an average daily attendance of 90 clients.

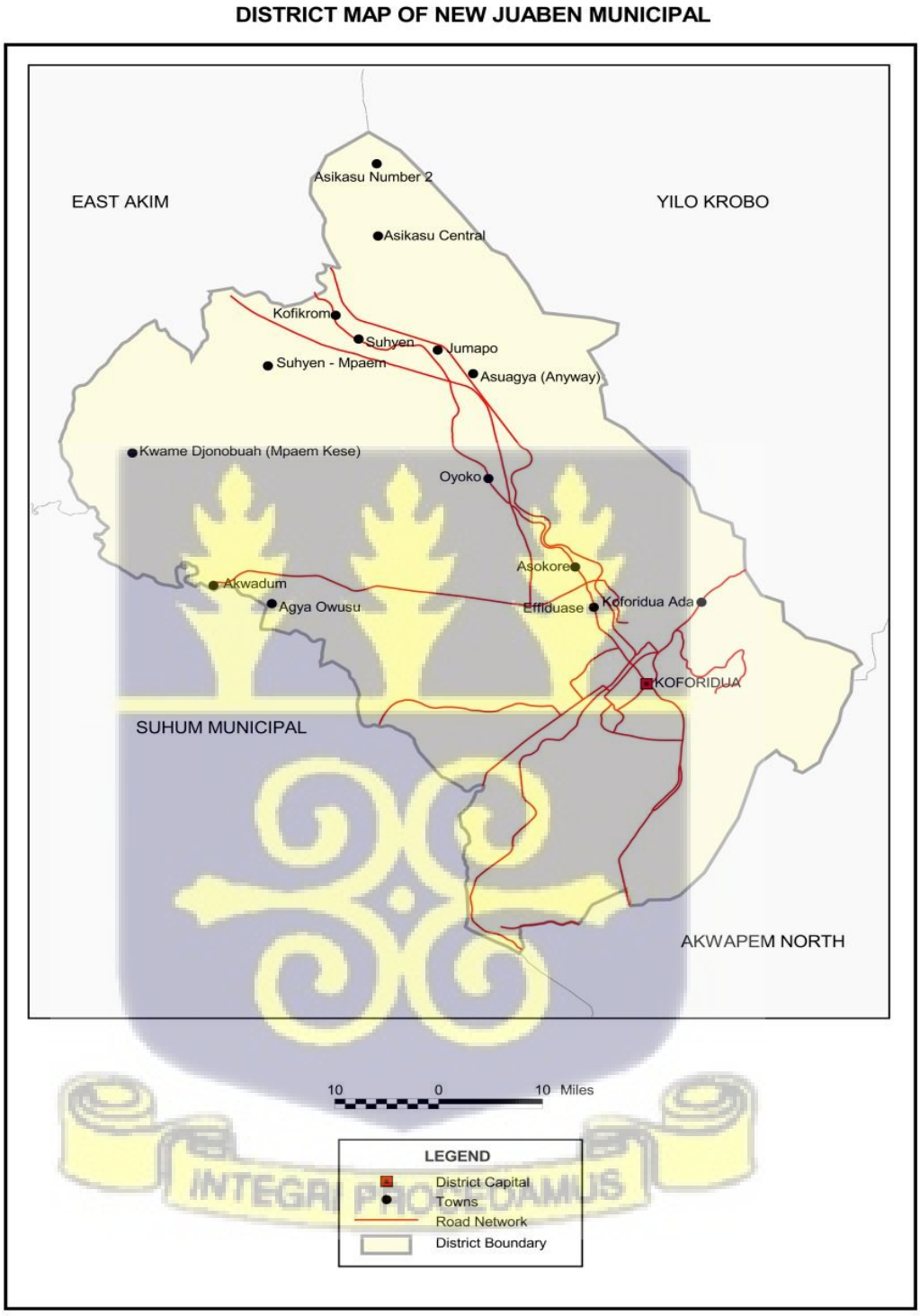


Figure 3: Map of New Juaben Municipal

Source: Ghana Statistical Service

3.4 Study Population

Male and female HIV patients above age 18 who had been on ARVs for not less than 2 years and were attendant at the ART clinic of the Eastern Regional Hospital in Koforidua.

3.5 INCLUSION AND EXCLUSION CRITERIA

3.5.1 Inclusion Criteria

The study included persons living with HIV above the age of 18 years who were attendants at the ART clinic of the Eastern Regional Hospital and had been on antiretrovirals for at least 2 years. The study only included persons who consented to participate in the study.

3.5.2 Exclusion Criteria

HIV positive clients who were pregnant, less than 18 years or had been on ARVs for less than 2 years were excluded from the study.

3.6 VARIABLES

Table 1: Dependent and independent variables

VARIABLE	OPERATIONAL DEFINITIONS	TYPE OF VARIABLE	SCALE OF MEASUREMENT	DATA SOURCE
Virological suppression	Viral load < 1000 copies/ml	Distal dependent	Categorical (Yes/No)	Laboratory measurement
Adherence to antiretrovirals	MPR & 30-day recall > = 95%	Proximal dependent	Categorical	Interview/questionnaire
Age of participant	Age at last birthday	Independent	Categorical	Interview/questionnaire

VARIABLE	OPERATIONAL DEFINITIONS	TYPE OF VARIABLE	SCALE OF MEASUREMENT	DATA SOURCE
Sex of participant	Sex of participant	Independent	Binary	Interview/questionnaire
Level of education of participant	Highest level of education attained by participant	Independent	Categorical (Ordinal)	Interview/questionnaire
Occupation of participant	Occupation of participant	Independent	Categorical (Nominal)	Interview/questionnaire
Marital status	Marital status	Independent	Categorical (Nominal)	Interview/questionnaire
Co-morbidities	Co-morbid conditions	Independent	Categorical (Nominal)	Interview/questionnaire
Attitude of health workers	Perceived attitude of health workers ranging from very bad to very good	Independent	Categorical (Ordinal)	Interview/questionnaire
Antiretroviral factors				
Distance to the ART clinic	Distance from home to ART clinic	Independent	Categorical (Ratio)	Interview/questionnaire
ARV regimen	ARV combination of study participant	Independent	Categorical (Nominal)	Interview/questionnaire

VARIABLE	OPERATIONAL DEFINITIONS	TYPE OF VARIABLE	SCALE OF MEASUREMENT	DATA SOURCE
Duration on ARVs	Number of completed months on ARVs	Independent	Categorical (Interval)	Interview/questionnaire
Side-effects of ARVs	Side-effects encountered on ARVs	Independent	Categorical (Nominal)	Interview/questionnaire

3.7 Sample Size Calculation

Sample size calculation was done using Cochrane's formula for determining sample size for cross-sectional studies as shown below:

$$n = \frac{(Z\frac{\alpha}{2})^2\, p(1-p)}{(e)^2}$$

Where:

Z = 1.96 at the level at which □ = 0.05 *p*

= expected level of adherence = 73% *e*

= Margin of error = 0.05

$$\frac{(1.96)(1.96) * [0.73(1-0.73)]}{0.05(0.05)}$$

$$= \quad 3\frac{8416*0.1971}{0.0025}.$$

$= 302.87 = 303$

With an anticipated 10% non-response rate, the sample size was adjusted upwards to **330** participants.

The expected level of adherence was set at 73% based on a similar study conducted in the Cape Coast Metropolis of Ghana (Prah et al., 2018).

3.8 Sampling

Consecutive sampling method was used to select participants from the ART clinic for the study. Based on the average daily attendance of 90 at the ART clinic, it was anticipated that a period of 4 weeks would suffice for data collection. Any patient in the queue at the ART clinic who met the eligibility criteria was registered as a participant in the study, once informed consent had been sought.

3.9 Adherence

For the purpose of this study, adherence refers to the degree to which a patient is able to take their prescribed medications. Prescribed medications were restricted to ARVs in this case. The self-report method was employed in this study. This was done using the 7-day and the 30-day recall methods where participants were asked how many times they had missed their medications in the last 7 days and 30 days respectively. Adherence was calculated as the proportion of pills taken based on the number of pills prescribed. Participants with a score of at least 95% were considered adherent.

3.10 Determination of viral load

For viral load, values of less than 1000 copies/ml were considered as virological suppression.

This information was obtained from the patients' ART records and the most recent values, preferably less than a year old, were employed in this study.

3.11 Data Collection Method

Potential study participants were briefed on the study whilst in the queue at the ART clinic. Informed consent was endorsed by signature or thumbprint with each participant keeping a copy of their informed consent. Interviews were conducted using a structured questionnaire structured as a Google Form which was administered by the researcher by means of a face-to-face interview. Each questionnaire was reviewed for completeness and errors.

3.12 Data Analysis

Preliminary data obtained from the study was entered in a Google Form on a Google account that was password protected and accessible to the principal investigator alone. Participant confidentiality was ensured throughout the study process. Data entered into the Google form were exported to STATA version 17 for analysis. The proximal and distal dependent variables in this study were adherence to antiretrovirals and virological suppression respectively. Independent variables employed in this study were sociodemographic characteristics of participants, drug regimen, side effects, co-morbidities and distance from their homes to the ART clinic. Pearson's chi-square test of association was used to perform an unadjusted analysis between the independent categorical variables and adherence. Independent variables that were found to be statistically significant with regards to the outcome, adherence to ARVs, were further analyzed using the multivariate logistic regression. Statistical significance was capped at a p value of less than 0.05 i.e. $p < 0.05$.

3.13 Ethical Considerations and Issues

3.13.1 Administrative and Ethical Approval

The Ethics Review Committee of the Ghana Health service was consulted for ethical clearance to conduct the study. Once the ethics committee gave approval for the study to be conducted, an introductory letter from the University of Ghana School of Public Health was submitted to the Medical Director of the Eastern Regional Hospital, Koforidua. Data collection commenced once the medical director gave authorization for the exercise to be conducted.

3.13.2 Informed Consent

Prior to being interviewed, all potential participants were briefed on the purpose of the study, eligibility criteria, benefits and potential risks involved in the study. A written informed consent was given to each potential participant to endorse their signatures or thumbprint before being interviewed. Each participant received a copy of their signed informed consent forms whilst the principal investigator kept a second copy for future reference.

3.13.3 Privacy

Interviews were conducted in a private room at the ART clinic to ensure maximum confidentiality during the interview process. This was conducted during the waiting period between consultation and medication refill at the pharmacy.

3.13.4 Benefits

Participants were informed that there were no direct benefits for participating in the study.

Opting out of the study in no way affected the quality of care they received at the ART clinic. They were however be informed that the findings of the study will be communicated to the hospital's administration and other stakeholders so that recommendations may be made in order to increase adherence amongst these clients.

3.13.5 Risks

Partaking in the study did not pose any physical risks to the participants. They however spent about 15 minutes more than their usual hospital time for the purpose of filling the questionnaires.

3.13.6 Right to withdraw

Participating in the study was entirely voluntary and study participants had the option of completely withdrawing consent or leaving some questions unanswered as they deemed fit during the course of the interview. This in no way affected the quality of care they received at the ART clinic during their visit.

3.13.7 Compensation

There was no compensation offered to participants recruited to be a part of the study.

3.13.8 Timeline

The study was conducted over a period of 6 months, from September 2022 to February 2023.

CHAPTER FOUR

RESULTS

4.0 Introduction

Chapter 4 presents the results of the study and is divided into four sections. The first section presents the demographic characteristics of the respondents. The second section presents the level of adherence and the reasons for non-adherence to ARVs. The third presents the factors associated with adherence to ARVs including economic factors, health factors, health service factors. The fourth section presents the association between adherence and viral suppression.

4.1 Demographic Characteristics

The study involved a total of 330 adult PLHIVs, with 77% of the participants being female and 23% being male. The age range of the participants was diverse, with the majority of participants falling in the 40-49 and 50-59 age groups, accounting for 29.70% and 29.40% respectively. The lowest percentage of participants was in the < 20 age group, at only 0.90%.

The majority of participants identified as Christian, at 90.30%, while 9.40% identified as Muslim and 0.30% identified as having no religion. The majority of participants were either married (40.90%) or single (33.90%), while only 1.50% were co-habiting, 8.20% were divorced/separated and 15.50% were widowed.

The majority of participants had either junior high (51.80%) or no formal education (15.80%), while 24.50% had completed primary education, 5.80% had completed senior high and only 2.10% had completed tertiary or vocational education. In terms of occupation, 86.36% were self-employed, with smaller percentages being teachers (1.52%), students (3.94%), retirees (2.12%) and unemployed (6.06%).

Table 2: Demographic Characteristics of Respondents

Characteristics	Categories	Frequency	Percentages
Gender	Female	254	77.00
	Male	76	23.00
Age	<20	3	0.90
	20-29	18	5.50
	30-39	52	15.80
	40-49	98	29.70
	50 -59	97	29.40
	60 and above	62	18.80
Religion	Christian	298	90.30
	Muslim	31	9.40
	Nothing	1	0.30
Marital Status	Co-habiting	5	1.50
	Divorced/Separated	27	8.20
	Married	135	40.90
	Single	112	33.90
	Widowed	51	15.50
Highest Level of Education	Junior High	171	51.80
	No formal education	52	15.80
	Primary	81	24.50
	Senior High	19	5.80
	Tertiary/Vocational	7	2.10
Occupation	Self Employed	285	86.36
	Teachers	5	1.52
	Students	13	3.94
	Retiree	7	2.12
	Unemployed	20	6.06

The high proportion of female participants in the study may indicate that HIV disproportionately affects women. The diverse age range of participants suggests that HIV affects people of different ages, and the majority of participants being married or single may indicate that HIV affects people of all marital statuses. The majority of the participants being self-employed may suggest that HIV affects people of all occupations and socio-economic backgrounds. The high proportion of participants with little formal education may indicate that a lack of education can be a barrier to adherence to antiretroviral treatment.

4.2 Analysis

This aspect is broken into the specific objectives. The analysis of the data collected in this study aimed to determine factors that influence adherence to antiretrovirals among adult PLHIVs. As discussed in chapters 2 and 3, data were analyzed using descriptive statistics and chi-squared tests to explore the relationship between adherence and economic, health related and health service factors. The results of the analysis provide insight into the level of adherence to antiretrovirals among PLHIVs and the factors that may influence adherence. The analysis also examines the association between adherence and viral suppression and provides information on the odds of viral suppression in relation to adherence. The findings of the analysis will be discussed in detail in the subsequent sections, providing a contextual understanding of the factors that influence adherence to antiretroviral among adult PLHIVs.

4.2.1 The Level of Adherence to Antiretrovirals

According to Table 3, the majority of the participants, 308 out of 330 (93.03%), reported not missing any pills on the day before the survey was conducted and 22 participants (6.67%) reported missing 1 pill. Similarly, for the 2 days prior to the survey, 304 participants (92.12%)

reported not missing any pills, 23 participants (6.97%) reported missing 1 pill and 3 participants (0.91%) reported missing 2 pills. “None”, “One”, “Two”, “Three”, “Four”, “Five”, “Six” and “Seven” are used to represent the number of pills missed as shown in the Table.

Table 3: Level of Adherence to Antiretrovirals among Adults PLHIVs

Number of Pills missed	Frequency	Percentage
Number of pills missed yesterday		
None	308	93.33
One	22	6.67
Number of pills missed 2 days ago		
None	304	92.12
One	23	6.97
Two	3	0.91
Number of pills missed 3 days ago		
None	296	89.70
One	31	9.39
Two	2	0.61
Three	1	0.30
Number of pills missed 1 week ago		
None	280	84.85
One	27	8.18
Two	13	3.94
Three	5	1.52
Five	2	0.61
Seven	3	0.91

Over a period of 3 days prior to the survey, 296 participants (89.70%) reported not missing any pills, giving a level of adherence of 100%; 31 participants (9.39%) reported missing 1 pill, 2 participants (0.60%) reported missing 2 pills and 1 participant (0.30%) reported missing 3 pills. Using the self-report method over a period of 1 week prior to the survey, 280 participants (84.85%) reported not missing any pills, 27 participants (8.18%) reported missing 1 pill, 13 participants (3.94%) reported missing 2 pills, 5 participants (1.52%) reported missing 3 pills, 2 participants (0.60%) reported missing 5 pills, and 3 participants (0.91%) reported missing 7 pills.

The Table suggests that the majority of participants were somewhat adherent to their antiretroviral treatment regimen, with a large percentage of participants reporting not missing any pills on the days prior to the survey. However, there are still a small number of participants who missed some pills, which could affect their overall treatment outcomes. The data also indicates that there are some participants who are consistently missing more pills, which could indicate a need for enhanced adherence counselling and additional support to improve adherence.

According to Table 4, the majority of participants (75.76%) reported that they always take their antiretroviral medications as prescribed. However, 15.45% of participants cited forgetfulness as a reason for missing their medications. This is the most common reason reported among the participants. Other reasons for missing medications include falling sick (0.91%), running out of medications (5.15%), shyness about taking medications in public (0.30%), and work or school demands (0.30%). A small number of participants (0.30%) reported that they do not think they need the antiretroviral medications anymore.

Table 4: Reasons for Non adherence to Antiretrovirals

What best explains my reason(s) for missing medications	Frequency(n= 330)	Percentage
Forgetfulness	51	15.45
Forgetfulness; Always take drug	1	0.30
Forgetfulness; I am shy taking my medications in public; Work/school demands	1	0.30
Forgetfulness; I fell sick	3	0.91
Forgetfulness; I ran out of medications	2	0.61
Forgetfulness; Work/school demands	1	0.30
I am shy taking my medications in public	1	0.30
I am shy taking my medications in public; Work/school demands	1	0.30
I do not think I need the ARVs anymore	1	0.30
I fell sick	1	0.30
I ran out of medications	17	5.15
Always Take Drugs	250	75.76

The Table suggests that forgetfulness is a common reason for non-adherence among PLHIVs. This could indicate that strategies to improve medication reminders or strategies to improve memory may be beneficial. Additionally, the data suggests that some participants may be struggling to access their medications, which could indicate a need for improved medication access or support.

4.2.2 Self-Report ARV Adherence

Participants with an adherence level of 95% and above were considered as adherent to their ARVs whilst those with adherence levels less than 95% were considered as non-adherent. This was done using the 7-day recall method where adherence was calculated as a proportion of the number of pills taken to the number of pills prescribed within a period of 7 days. 280 (84.85%) respondents were adherent to their ARVs and 50 (15.15%) respondents were found to be nonadherent from the calculation. Self-reported adherence level in this study was found to be 85% as shown in Figure 4.

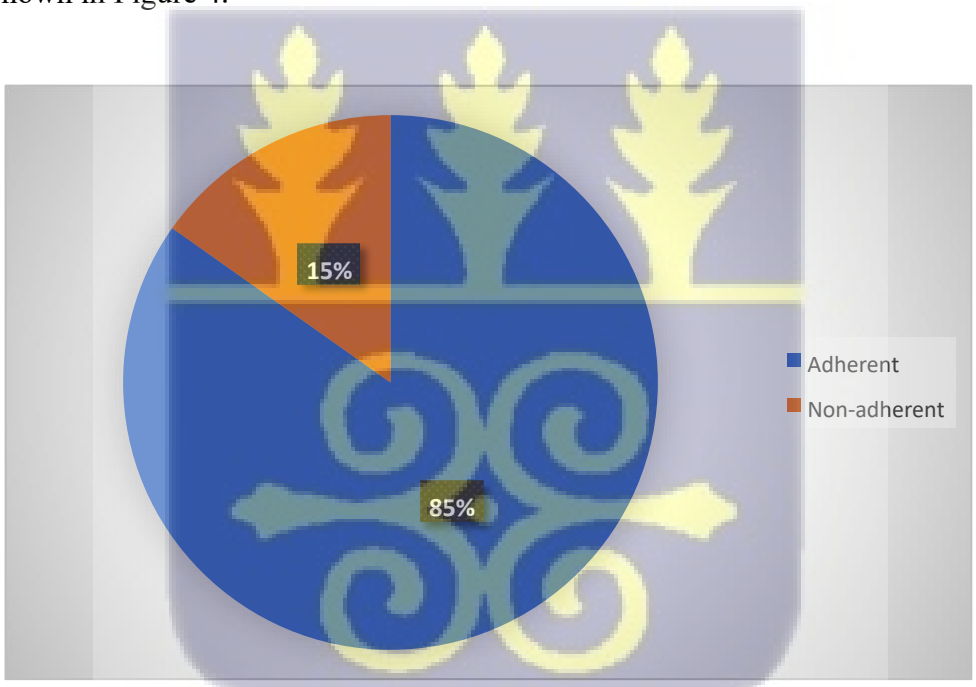


Figure 4: Self-Reported adherence level

4.2.3 Factors influencing adherence among HIV clients

Economic Factors

According to Table 5, the data suggest that income and mode of transportation to the hospital may have an influence on adherence to antiretroviral treatment among PLHIVs. In terms of

income, participants with an income between 100-500 cedis had the highest percentage of participants who did not miss any medications (87.7%). However, the chi-squared test suggests that there is no significant difference in adherence between income levels. In terms of mode of transportation to the hospital, participants who use a bicycle had the highest percentage of not missing any medications (100%), and the chi-squared test suggests that there is a significant difference in adherence between mode of transportation (p value=0.007). Participants who use taxi/trotro/tricycle had the highest percentage of missing medications once (8.7%) in the past 7 days. Participants who walk had the highest percentage of participants who missed medications more than once (7%).

The data also suggest that family support may have an influence on adherence to antiretroviral treatment among PLHIVs. Participants who had family support had the highest percentage of participants who did not miss any medications (84.4%), and the chi-squared test suggests that there is a significant difference in adherence between family support (p-value=0.002) and its absence. Participants who did not have family support had the lower percentage of participants who missed medications more than once (6%).

Overall, the Table suggests that mode of transportation to the hospital and family support may have an influence on adherence to antiretroviral treatment among PLHIVs. However, more research is needed to fully understand the relationship between these factors and adherence.

Table 5: Economic Factors Influencing Adherence

Number of pills missed 1 week ago	None (%)	Once (%)	More than once(%)	χ^2	P-value
Income				13.282	**0.056**
100-500 (n=212)	186(87.7)	14(6.6)	12(5.7)		
501-1000 (n=107)	86(80.4)	13(12.1)	8(7.5)		
1001-1500 (n=9)	7(77.8)	0(0.0)	2(22.2)		
>1500 (n=2)	1(50)	0(0.0)	1(50)		
Mode of Transportation to Hospital				17.856	**0.007**
Bicycle (n=1)	1(100)	0(0.0)	0(0.0)		
Private car (n=1)	0(0.0)	0(0.0)	1(100)		
Taxi/trotro/tricycle (n=310)	264(85.2)	27(8.7)	319(6.13)		
Walking (n=18)	15(83.3)	0(0)	3(16.7)		
Family Support				0.8678	0.648
Yes (n= 243)	205(84.4)	22(9.1)	16(6.6)		
No (n=84)	74(88.1)	5(6.0)	5(6.0)		

Health Factors

According to Table 6, the data suggests that HIV symptoms, side effects, and herbal medication intake are unlikely to have an influence on adherence to antiretroviral treatment among PLHIVs. In terms of HIV symptoms, participants who reported having HIV symptoms had a higher percentage of participants who did not miss any medications (74.4%) compared to those who did not report any HIV symptoms (86.4%). However, the chi-squared test suggests that

there is no significant difference in adherence between those who reported HIV symptoms and those who did not (p-value=0.083).

In terms of side effects, participants who reported experiencing side effects had a higher percentage of participants who did not miss any medications (88.9%) compared to those who did not report experiencing side effects (84.5%). The chi-squared test suggests that there is no significant difference in adherence between those who reported experiencing side effects and those who did not (p-value=0.768).

In terms of herbal medication intake, participants who reported taking herbal medication had a similar percentage of participants who did not miss any medications (86.2%) compared to those who did not report taking herbal medication (84.6%). The chi-squared test suggests that there is no significant difference in adherence between those who reported taking herbal medication and those who did not (p-value=0.586).

Overall, the Table suggests that HIV symptoms, side effects, and herbal medication intake may not have an influence on adherence to antiretroviral treatment among PLHIVs. However, more research is needed to fully understand the relationship between these factors and adherence.

Table 6: Health Factors Influencing Adherence

Number of pills missed 1 week ago	None(%)	Once(%)	More than once(%)	χ^2	p value
HIV Symptoms				4.982	**0.083**
Yes (n=43)	32(74.4)	7(16.3)	4(9.3)		
No (n=287)	248(86.4)	20(7.0)	19(6.6)		
Side Effect				0.528	0.768
Yes (n=27)	24(88.9)	2(7.4)	1(3.7)		
No (n=303)	256(84.5)	25(8.3)	22(7.3)		
Herbal Medication Intake				1.069	0.586
Yes (n=58)	50(86.2)	3(5.2)	5(8.6)		
No (n=272)	230(84.6)	24(8.8)	18(6.6)		

Health Service Factors

According to Table 7, the data suggest that time spent at the hospital, friendliness of health workers and having access to all HIV medications at the hospital may have an influence on adherence to antiretroviral treatment among PLHIVs. In terms of time spent at the hospital, participants who spent <1 hour at the hospital had a lower percentage of participants who did not miss any medications (55.6%) compared to those who spent 1-2 hours (84.3%) and those who spent more than 2 hours (88.0%). However, the chi-squared test suggests that there is not a significant difference in adherence between time spent at the hospital (p-value=0.130). In terms of friendliness of health workers, participants who reported that health workers were always friendly had a higher percentage of participants who did not miss any medications

(85.3%) compared to those who reported that health workers were friendly most of the time (85.7%), never (100%) and some of the time (0%). The chi-squared test suggests that there is a significant difference in adherence between friendliness of health workers (p-value=0.001). In terms of having access to ARVs at the hospital, participants who reported that they always had access to ARVs at the hospital had a higher percentage of participants who did not miss any medications (89.4%) compared to those who reported that they had access most of the time (81.5%), never (78.2%), and some of the time (84.8%). The chi-squared test suggests that there is a significant difference in adherence between having access to ARVs at the hospital (p value=0.007).

Overall, the table suggests that friendliness of health workers and having access to all HIV medications at the hospital may have a significant influence on adherence to antiretroviral treatment among PLHIVs. Participants who reported that health workers were always friendly and who had access to all HIV medications at the hospital had a higher percentage of participants who did not miss any medications. The time spent at the hospital does not have a significant influence on adherence. Interventions that could help improve the friendliness of health workers and access to all HIV medications at the hospital could potentially improve adherence to antiretroviral treatment.

Table 7: Heath Service Factors Influencing Adherence

Number of pills missed 1 week ago	None (%)	Once (%)	More than once (%)	χ^2	p value
Time Spent at Hospital				7.106	0.130
<1 hour (n=9)	5(55.6)	2(22.2)	2(22.2)		
1-2 hours (n=204)	172(84.3)	17(8.3)	15(7.4)		
>2 hours (n=117)	103(88.0)	8(6.8)	6(5.1)		
Friendliness of health workers				28.257	**0.000**
Always (n=320)	273(85.3)	27(8.4)	20(6.3)		
Most of the time (n=7)	6(85.7)	0(0.0)	1(14.3)		
Never (n=1)	1(100)	0(0.0)	0(0.0)		
Some of the time (n=2)	0(0.0)	0(0.0)	2(100)		
Having Access to all HIV medications at the Hospital				17.618	**0.007**
Always (n=188)	168(89.4)	11(5.9)	9(4.8)		
Most of the time (n=54)	44(81.5)	7(13.0)	3(5.6)		
Never (n=78)	61(78.2)	6(7.7)	11(14.1)		
Some of the time (n=10)	7(70.0)	3(30.0)	0(0.0)		

4.2.4 Viral Load Measurement

In total, 330 viral load results were obtained from patient records and the most recent viral load was used in this study. Viral load ranged from "target not detected" to 5,677,211 copies per ml. Virological suppression was defined as viral load less than 1000 copies per ml. Based

on this classification, 276 (84%) respondents had achieved virological suppression whilst 54 (16%) respondents were not suppressed. Figure 2 shows a summary of this result.

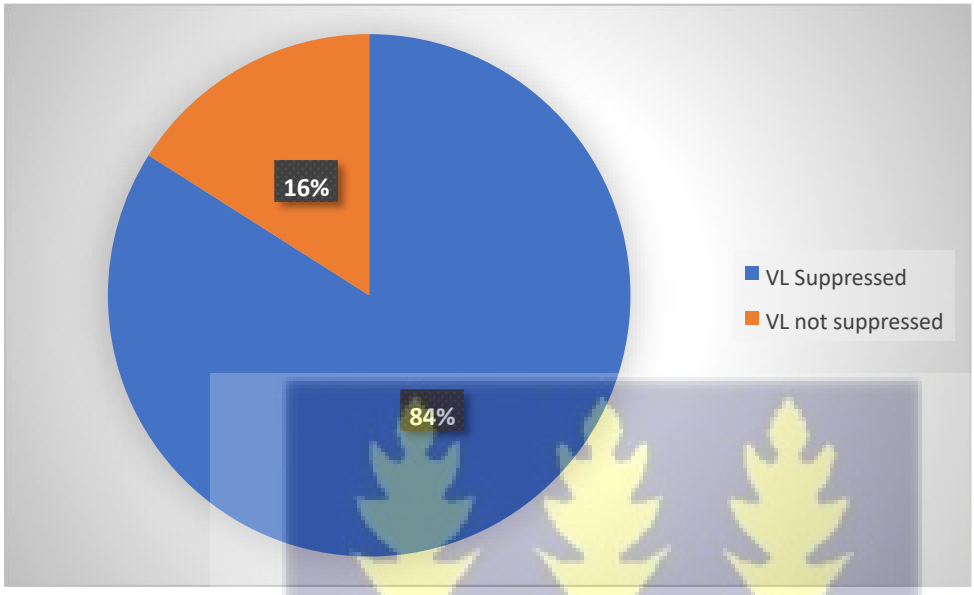


Figure 5: Virological Suppression

4.2.4 Association between Adherence and Viral Suppression

Table 8 shows the association between adherence to antiretrovirals and viral suppression among the participants in the study. The study used two measures of association, the crude odds ratio (COR) and the adjusted odds ratio (AOR). The baseline category, those who missed their pill more than once, with 23 participants (7.0%) was used as the reference group for the analysis.

The results show that there was a significant association between adherence and viral suppression, as indicated by the low P-value (0.000) for the COR. Participants who never missed ARV pills had an 8.333 times higher odds of having a suppressed viral load compared to participants who missed pills more than once.

The AOR was also calculated to control for other confounding factors (HIV symptoms, friendliness of health workers and access to HIV medications), and the results showed that participants who never missed ARV pills had 2.811 times higher odds of having a suppressed

viral load compared to participants who missed pills more than once, but this association was not statistically significant as indicated by the P-value of 0.053.

On the other hand, participants who missed pills once had 5.75 times higher odds of having a suppressed viral load compared to participants who missed pills more than once, as indicated by the low P-value (0.001) for the COR. The AOR showed that participants who missed pills once had 1.785 times higher odds of having a suppressed viral load, but this association was not statistically significant as indicated by the P-value of 0.436.

Table 8: Association Between Adherence and viral suppression

	n(%)	COR	P-value	AOR	P-Value
Number of times pills were missed in 1 week					
More than Once (Ref)	23(7.0)	1.00		1.00	
None	280(84.8)	8.333	**0.000**	2.811	0.053
Once	27(8.2)	5.75	**0.001**	1.785	0.436

Overall, the table suggests that adherence to antiretroviral treatment is positively associated with viral suppression among PLHIVs. It is likely that maintaining high levels of adherence to antiretroviral treatment can lead to better viral suppression among PLHIVs. This highlights the importance of interventions to improve adherence to antiretroviral treatment in order to achieve better viral suppression among PLHIVs.

CHAPTER FIVE

DISCUSSION

This chapter delves into the findings of the study and how they relate with similar studies. It is structured on the study objectives, similar to chapter 4 with focus on the level of adherence, factors influencing adherence, virological suppression rates and how these rates are linked to adherence.

5.1 Level of adherence

The first specific objective of the study sought to determine the level of adherence to ARVs. Three methods of measurement were used to calculate the levels of adherence to ensure accuracy of the results obtained. These were the 3-day recall, 7-day recall and the most recent viral load value methods. The 3-day recall estimated adherence to be 89.7%, whilst the 7-day recall method resulted in an adherence level of 84.9%. With the viral load method, adherence was 84%. These levels were all lower than the optimum adherence level of 95% as stipulated by a study done by (Achappa et al., 2013). A similar subjective study conducted in the same municipality in 2019 however recorded adherence levels of 39% (Adjei, 2019), which is significantly lower than adherence levels observed in this study. This may suggest that more PLHIVs are taking their ARVs now in the municipality than previously due to increased HIV awareness and the employment of differentiated service delivery in HIV care in Ghana. Obirikorang et al., 2013 recorded an adherence level of 91% in the Upper West Region of Ghana which is closer to the optimum level of adherence than values recorded in this study. Adherence levels calculated in this study however showed a slight improvement over that of studies done in the Cape Coast Metropolis (73%) and the Volta Regional Hospital (63%) (Okotah & Korbuvi, 2014; Prah et al., 2018).

5.2 Factors influencing adherence

Per the literature review, factors that were thought to influence adherence to ARVs were classified under four main headings:

1. Individual factors
2. Economic factors
3. Treatment-related factors
4. Health system factors

5.2.1 Individual factors

Social support in terms of status disclosure to a close relation with emotional support from these individuals was found to influence the adherence of respondents to their ARVs. 84.4% of clients who had some form of family support were adherent to their ARVs which is in consonance with a 2014 study conducted in sub-Saharan Africa which revealed that social support was strong enough to overcome other potential barriers to adherence (Lankowski et al., 2014). Obiri-Yeboah et al., 2016 recorded a lower disclosure rate of 78.4% whilst advocating for increased partner disclosure as it was found to improve lifelong adherence. The increase in disclosure rate observed in this study may be due to a steady increase in strategies targeted at female empowerment as well as increased awareness on sexual and reproductive health issues.

5.2.2 Economic Factors

None of the respondents in the study paid for their ARVs. They however had different modes of transport to the hospital ranging from walking to driving private vehicles. The study revealed that respondents who reported walking to the hospital for their ARVs had the highest percentage of study participants who had missed their ARVs more than once in the last 7

days. Participants who walk may be low-income earners who cannot afford alternative means of transport to the hospital and are likely to miss their hospital reviews and medication doses. A number of clients who attend the ART clinic in the study site do not necessarily reside in the municipality but opt to travel long distances for their ARVs to avoid HIV-related stigma in their communities. To address this issue, community pharmacies spanning the country should be equipped with patient details for clients to have ARV refills without necessarily having to travel long distances for medication refills.

5.2.3 Treatment-related factors

All the participants of the study were on first line treatment for HIV which comprises a single pill of Tenofovir, Lamivudine and Dolutegravir. This combination is generally more tolerable with fewer side effects and increased likelihood of adherence as compared to the protease inhibitors (Cheng et al., 2018). The study revealed that side effects attributed to ARVs, as well as comorbidities did not significantly have an effect on participants' adherence to their ARVs. This is contrary to a similar study done which revealed that persons missed their medications when they experienced side effects, mostly gastrointestinal symptoms, that were attributable to their ARVs (Bongfen et al., 2021). Fonsah et al., 2017 also found out that persons in Cameroon with comorbidities such as hypertension and diabetes were less likely to adhere to their ARVs due to the pill burden. This was however not observed in the study.

5.2.4 Health system factors

Though the difference in adherence was found to be statistically not significant, participants who spent less than an hour in the hospital had a small percentage of non-adherent respondents compared to those who spent more than an hour. This finding is similar to that of Dzansi et al., 2020; Heestermans et al., 2016 which found out that persons who spend long waiting time in the hospitals were likely to be non-adherent especially if these persons were

gainfully employed. In Zimbabwe however, Gonah & Mukwirimba, 2016 reported that hospital waiting time does not affect the level of adherence to ARVs. Increased decentralization of HIV care and the optimum utilization of the differentiated service delivery model will help to significantly reduce patient waiting times in the hospital and subsequently improve upon adherence.

Unpleasant attitude of health workers was found to negatively influence adherence to ARVs. Though the study did not assess what behaviours constituted unpleasant attitudes, Heestermans et al., 2016 and Mannheimer & Hirsch-Moverman, 2015 reported that health workers who were regarded as rude, unprofessional, unable to connect with their patients or those who did not provide confidential services were partly to blame for patients being nonadherent to their ARVs. Health workers particularly in the field of HIV care, need to be constantly trained and retrained on the need for confidentiality, good rapport and professionalism when attending to PLHIVs. The practice of having two to four clients each being attended to in one consulting room simultaneously should be a thing of the past to enable clients to open up to their health workers without fear of prejudice or stigmatization. Some participants in the study reported stockouts of medications when they presented for refills. This was found to negatively affect adherence to their ARVs. The relevance of community pharmacies in enhancing adherence cannot be overemphasized especially in the light of economic difficulties.

5.3 Viral load measurements

In this study, 84% of the respondents had achieved virological suppression with viral load cut off of less than 1000 copies/ml. This contradicts the report by (UNAIDS, 2014) which revealed that less than half of the population studied at the time had achieved virological suppression. In addition to the fact that this report was released close to a decade ago, the

contrasting findings may be as a result of the difference in sample size used for these studies. In Ho, another regional capital, viral suppression rates stood at 69.7% (Lokpo et al., 2020) which is lower than the viral suppression rates determined in this study. The study ultimately revealed that high adherence to ARVs is important for the achievement of viral suppression. Bongfen et al., 2021 however reported that virological suppression was achievable even with low adherence levels and this was attributable to the newer ARVs which had a more "forgiving nature". The definition for viral load suppression cut off differs across countries and Ghana is currently advocating for a revision in the definition of viral suppression from less than 1000 copies/ml to less than 50 copies/ml. If this is implemented, viral suppression rates will be lower than what is currently being recorded. It is thus imperative for health workers need to impress on their clients the need to adhere to their ARVs in order to achieve the 95-95-95 benchmark by 2030.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Ghana is on an upward trajectory when it comes to improved HIV care and this needs to be improved upon and sustained if the country is to meet the UNAIDS 95-95-95 targets. Strategies that have been found to improve adherence like social support, reduced hospital waiting times, improving patient confidentiality and professional behaviours of health care workers should be employed to better the current adherence level of 84%.

6.2 Recommendations

1. Support from close relations has been shown to improve upon adherence to ARVs. HIV clients should be encouraged at each visit to disclose their status to close relatives to enhance adherence. Clients who attend ART clinics with their support systems should be applauded and encouraged to continue this practice.
2. Forgetfulness was cited as one of the major reasons for non-adherence. The use of pill boxes and routine text messages or phone calls will prompt clients to take their ARVs as prescribed. Clients can also be aided to incorporate their ARV intake into a routine activity such as breakfast, brushing of the teeth or exercising, based on the client's schedule. Tying medication intake to a routine activity will reduce the likelihood of skipping doses due to forgetfulness.
3. Some respondents admitted that they were non-adherent because they had run out of their ARVs before their next appointment was due. Hospital pharmacies should routinely serve medications in slight excess to cater for pills that may be rendered unwholesome due to factors such as vomiting after taking meds. Clients should also be encouraged to report to their ART clinics before they run out of their medications, even if their appointment dates are not due. Alternatively, community pharmacies should be allowed to offer ARV refills to

registered HIV clients who have run out of their meds prior to their scheduled appointment dates.

4. It was realized in the study that most clients were not aware of their viral load results. HIV clients should have their viral load results communicated to them and those who have achieved virological suppression should be lauded as a form of positive reinforcement. This will prompt them to be intentional about their adherence to ARVs.

5. Health workers, especially those in ART clinics, need to be trained continuously on ways to attend to HIV clients devoid of discrimination and prejudice. Training sessions should highlight the need for friendliness, respect and patient confidentiality as this will lead to better rapport between clients and health workers. Attendants at the ART clinics will thus feel comfortable to voice their opinions and reservations about their treatment plans, allowing for treatment to be tailored to the needs of these clients which will increase adherence in the long run.

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APPENDIX A

INTERVIEW GUIDE

Factors influencing adherence to ARVs study

Questionnaire Code …….		Date of Interview ……
SECTION 1 – RESPONDENT BIODATA		
Age at last birthday (In years)		……..
Gender	1. Male 2. Female	
Religion	1. Christian 2. Muslim 3. Traditional 4. Other (please specify)	……
Marital Status	1. Single 2. Married 3. Co-habiting 4. Divorced/Separated 5. Widowed	
Highest Level of Education	1. No formal education 2. Primary 3. Junior High 4. Senior High 5. Tertiary/Vocational	

Occupation		……..

SECTION 2 – ECONOMIC FACTORS		
Level of Income (monthly)	1. GHs 100.00 – GHs 500.00 2. GHs 501.00 – GHs 1000.00 3. GHs 1001.00 – GHs 1500.00 4. > GHs 1500.00	
Mode of Transport to the Hospital	1. Walking 2. Bicycle 3. Taxi/Trotro/Pragyia 4. Private car 5. Other (Please specify)	……..
Duration of transport to the hospital	1. < 30 minutes 2. 30 mins – 1 hour 3. > 1 hour	
Do I pay for the ARVs at each visit?	1. Yes 2. No	
If yes, is it challenging raising funds for the cost of ARVs?	1. Yes 2. No	
At least one family member knows about my HIV status	1. Yes 2. No	

Is this family member supportive?	1. Yes 2. No	

I feel uncomfortable telling family about my HIV status	1. Yes 2. No	
I feel guilty about my HIV status	1. Yes 2. No	
I do not want people to know I am HIV positive	1. Yes 2. No	
SECTION 3 – HEALTH FACTORS		
How long have I been on ARVs (in months)?		……..
Am I having any symptoms attributable to HIV?	1. Yes (please specify) 2. No	…….
I know the name(s) of my HIV medications	1. Yes 2. No	
If yes, please specify		……..
How often do I take my HIV medications?	1. Once daily 2. Twice daily 3. Other (please specify)	…….

I am currently experiencing side effects of the ARVs?	1. Yes (please specify) 2. No	……

I have been diagnosed with other medical conditions besides HIV (please specify)?	1. Yes 2. No	……..
How many other medications am I taking besides the ARVs?		……
Do I take herbal medications?	1. Yes 2. No	
SECTION 4 - HEALTH SERVICE FACTORS		
How long do I spend at each hospital visit?	1. < 1 hour 2. 1 – 2 hours 3. > 3 hours	
Do I think this amount of time can be shortened?	1. Yes 2. No	

I am worried about health workers disclosing my HIV status without my permission	1. Never 2. Some of the time 3. Most of the time 4. Always	

I am discriminated against by the health workers at each visit	1. Never 2. Some of the time 3. Most of the time 4. Always	
Health workers are pleasant and professional during my visits	1. Never 2. Some of the time 3. Most of the time 4. Always	
I am able to get all my HIV medications at each hospital visit	1. Never 2. Some of the time 3. Most of the time 4. Always	
SECTION 5 - HIV ADHERENCE		
How many times did I miss my HIV medications in the past 30 days?		……..

How many times did I miss my pills: a. Yesterday? b. 2 days ago? c. 3 days ago? d. 1 week ago?		…… …… …… ……
What best explains my reason(s) for missing medications (choose all that apply)	1. Forgetfulness 2. I am shy taking my medications in public 3. I ran out of medications 4. Unpleasant side effects 5. Work/school demands 6. Religious beliefs 7. I fell sick 8. I do not think I need the ARVs anymore 9. Other (please specify)	……..
What can be done differently to increase adherence in my opinion?		……..
Most recent viral load		……

Thank you.

APPENDIX B

PARTICIPANT INFORMATION SHEET

TITLE OF STUDY - FACTORS INFLUENCING ADHERENCE TO ANTIRETROVIRALS AMONG ADULT PLHIVs IN THE EASTERN REGIONAL HOSPITAL, GHANA.

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P.O. Box CE 11367, Tema.

General Information about Research

This information sheet contains information about the above titled research. In a bid toensure that you are well informed prior to participating in this research, we ask that you read (or have read to you) this information sheet. You will be asked subsequently to append your signature or thumbprint this consent form once you are done reading. A copy of this signed form will be made available to you. Some terms used in this form may be unfamiliar to you; kindly feel free to ask us for explanations and clarifications.

The purpose of this study is to identify reasons why HIV medications are not taken the way they are supposed to and how this relates to viral suppression.

If you do agree to partake in this study, you will be required to fill out a questionnaire. This will not take more than 15 minutes of your time. Your most recent viral load results will also be used in the study. No blood samples will be required of you during the study process.

Potential risks: Partaking in this study will not pose any physical risk to you. You are however at liberty to skip questions or withdraw consent if you feel uncomfortable or get emotionally upset during the process of answering the questionnaire.

Potential benefits: This study has no direct benefits. Participating in this study however will enable healthcare workers and counsellors to improve upon the quality of care given in order to increase adherence to the HIV medications.

Cost: With the exception of time spent answering the questionnaire, no additional cost incurred in taking part in this study.

Confidentiality: Your information is important to us and priority will be given to confidentiality and ensuring its security. Names, phone numbers and other personal identifiable data will not be used in the study. Filled questionnaires will be stored under lock and key with access restricted to the principal investigator. Data obtained from the study will be stored on a password protected device. The results of this study may be used in reports and other presentations. These results will in no way reveal your identity or personal details.

Compensation: Unfortunately, there will be no compensation for participants of the study.

Voluntary participation/withdrawal: Participation in this study is entirely voluntary. You have the right to withdraw at any point in the study should you choose to. This will in no way affect the quality of care that will be provided at the ART clinic.

Funding Information: funding of this study will be borne by the principal investigator.

Sharing of participants' information/data: Data generated during the research process will be owned by the University of Ghana School of Public Health.

Outcome and Feedback: Results of this study will be communicated to clients at the ART clinic as well as the hospital administration. Modifiable factors that negatively affect adherence will be scrutinized in order to improve quality of care.

Conflict of Interest: There is no conflict of interest on the part of the investigators for the study.

Contacts for additional information

You can ask any of the study staff questions as and when they arise at any point of the study.

Kindly contact the following for further clarifications and enquiries:

1. Dr Antoinette D. Wordi – Principal investigator

   0269783498. amawordi@gmail.com

2. Nana Abena Apatu - Ghana Health Service Ethics Review Committee

Administrator 0503539896. ethics.research@ghsmail.org

APPENDIX C

CONSENT FORM

STUDY TITLE: FACTORS INFLUENCING ADHERENCE TO ANTIRETROVIRALS AMONG ADULT PLHIVs IN THE EASTERN REGIONAL HOSPITAL, GHANA.

PARTICIPANTS' STATEMENT

I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and all questions satisfactorily explained to me in a language I understand (… …….) language. I fully understand the contents and any potential implications as well as the right to change my mind (ie withdraw from the research) even after I have signed this form. I voluntarily agree to be part of this research.

Name of Participant Participant's Signature/Thumbprint

…… ……..

Date:

……

APPENDIX D

INTERPRETERS' STATEMENT

I interpreted the purpose and contents of the Participants' Information Sheet to the afore named participant to the best of my ability in the (… .....) language to his/her proper understanding.

All questions, appropriate clarifications sort by the participant and answers were also duly interpreted to his/her satisfaction.

Name of Interpreter

……..

Signature of Interpreter

……..

Date

……..

Contact Details

…….