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FACTORS AFFECTING VIRAL SUPPRESSION AMONG HIV POSITIVE ADULTS ON ART AT THE 37 MILITARY HOSPITAL

BY

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DECLARATION

I, Edna Aryee, do hereby declare that apart from references made to other people's works and which have been duly acknowledged, this work was done by me under supervision. I further declare that this work has not been submitted for the award of any degree neither in this university nor elsewhere.

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DEDICATION

This study is dedicated to my beloved husband, Nii Aryee Lartey, who has been extremely supportive of my decision to pursue this course. I dedicate it once more to my mother, father, siblings, and children.

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ABSTRACT

Background: HIV has affected more than 38 million globally with more than 25 million living in SSA. There have been interventions to address and end the HIV/AIDS epidemic by 2030, one of which is ART which facilitates viral suppression levels among PLWHAs. It is expected that, 95% of PLWHAs on ART achieve viral suppression by 2030 in order to achieve the goal of ending the AIDS epidemic. Ghana missed the viral suppression target in 2020 and intensified efforts are required to close the gap and achieve the goal by 2030. It is critical to identify factors affecting viral suppression and address bottlenecks to enhance changes of achieving sustained viral suppression in Ghana, which formed the main objective of this study.

Methods: A cross-sectional study with retrospective quantitative analysis of ART and viral load data was conducted at the 37 Military Hospital in Ghana. A census of all HIV positive adults initiating treatment from April 1, 2018 to June 30, 2020 was used for the study. Additional data was collected with a structured questionnaire. Chi square test of independence was used to determine the association of independent variable with viral suppression. However, Fisher's exact P-values were reported for variable with count items less than 5. The exact logistic regression analysis was further used to determine the main factors affecting viral suppression (significant at α=0.05)

Results: A total of 257 patients participated in the study. The mean age of respondents was 40 years (±10.7). Sex distribution was 63% females and 37% males. The adherence rate based on the MMAs-8 was 75.5%. From the study, 61.1% of respondents had undetectable levels of viral load whereas 31.1% and 2.3% had viral load of 20-200copies/ml and 201-999copies/ml respectively. The overall rate of viral suppression was 94.6% among HIV positive adults on ART. The factors affecting viral suppression were adherence to ARTs (AOR = 4.83; 95% CI = 1.35, 17.2; p=0.015) and clinic attendance (AOR = 4.83; 95% CI = 1.35, 17.2; p=0.015).

Conclusion: Viral suppression rate observed from the 37 Military Hospital was high among HIV positive adults on ART. It is important to strengthen activities that promote adherence to ARTs to sustain viral suppression levels among PLWHA accessing treatment at the hospital.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AIDS	-	Acquired Immune Deficiency Syndrome
ART	-	Anti-Retroviral Therapy
ARV	-	Anti-Retroviral
CDC	-	Centre for Disease Control and Prevention
eMTCT	-	Elimination of Mother-to-Child Transmission
GAC	-	Ghana AIDS Commission
HIV	-	Human Immunodeficiency Virus
HSS	-	HIV Sentinel Survey
LMIC	-	Low- and Middle-Income Countries
MAR-Scale	-	Medication Adherence Reasons Scale
MMAS	-	Morisky Medication Adherence Scale
NACA	-	National Advisory Commission on AIDS
NACP	-	National HIV/AIDS/STIs Control Programme
NRTI	-	Nucleoside Reverse Transcriptase Inhibitors
NNRTI Inhibitors	-	Non-Nucleoside Reverse Transcriptase
NSF	-	National Strategic Framework
PEPFAR	-	US President's Emergency Plan for AIDS Relief
PI	-	Protease Inhibitors
PLWHA	-	People Living With HIV/AIDS
SDG	-	Sustainable Development Goals
SSA	-	Sub-Saharan Africa
TB	-	Tuberculosis
UNAIDS	-	United Nations
UNICEF	-	United Nations Children Education Fund
WHO	-	World Health Organization

CHAPTER ONE

INTRODUCTION

1.0 Background

The Human Immunodeficiency Virus (HIV) responsible for causing Acquired Immune Deficiency Syndrome (AIDS) remains an important public health issue in the world (WHO, 2020a). HIV has infected more than 38 million people globally, out of which 25.4 million are on treatment (UNAIDS, 2020b). Majority of the cases have been reported in sub-Saharan Africa (SSA) where HIV prevalence remains up to about 9% (Leyva-Moral et al., 2019). HIV mortality has been declining considerably since the introduction of effective drugs and interventions, resulting in about 800,000 deaths in 2018 compared with 1.5 million deaths in 2000 (Dzansi et al., 2020; WHO, 2020c).

The high burden of HIV/AIDS has over the years called for implementation of independent and complementary interventions to halt progression (Avert, 2019d; UNAIDS, 2020b). These have included strategies to limit transmission through heterosexual contacts, prevent mother to child transmissions (MTCT), ensure safe blood transfusion and detect and treat cases promptly (NACP, 2001). The WHO has spearheaded the provision of effective and tolerable antiretroviral therapy (ART) for controlling the spread of HIV based on convenience, availability of fixed dose combinations, compatibility with co-morbidities treatment, and use across populations (WHO, 2015b).

According to the 2020 Global AIDS update however, committed funding to HIV has been dwindling, leading to widening gaps especially for low- and middle-income countries (UNAIDS, 2020b). Notwithstanding these challenges, interventions by the global community have usually been accompanied with measurable targets to monitor progress. One of such has been the Joint United Nations Programme on HIV 90-90-90 targets, which was set to combat

HIV by the year 2020 (Lee et al., 2017; Kim et al., 2018). The targets were aimed at achieving 90% of people living with HIV/AIDS (PLWHA) knowing their status; 90% of people who know their status accessing treatment; and 90% of those receiving treatment achieving viral suppression (UNAIDS, 2014). This target is expected to reach 95-95-95 by 2030 (Avert, 2019d; UNAIDS, 2020b).

Efforts to cut down new infections are therefore, more important now than ever. One strategy is to ensure viral suppression among those who are HIV positive (Gebrezgabher et al., 2017). Viral suppression refers to the level at which HIV viral load in the body is reduced to very low levels, enabling the body's immune system to function effectively and prevent illness (CDC, 2022). According to the CDC, (2022), achieving viral suppression among HIV positive individuals is the critical in ensuring the effective control for HIV and constitutes treatment for prevention.

The Government of Ghana among other low- and middle-income countries (LMICs) adopted the 90-90-90 targets and presented a five-year plan to achieving the targets in 2016 (Lee et al., 2017; WHO, 2019b). The successful implementation of the plan largely depended on the contribution of health system structures such as hospitals and other health facilities providing HIV-related services, including the provision of ART (Addo et al., 2018). Although, the 90-90-90 targets could not be achieved in 2020, the goal of ending HIV/AIDS by 2030, where 95% of those on ART would achieve viral suppression remains an important consideration for Ghana. Therefore, identifying and addressing bottlenecks to achieving viral suppression at all levels of the health system remains crucial for the country.

1.1 Problem Statement

Globally, progress has been made in the fight against the HIV/AIDS pandemic, saving about 14 million lives between 2000 and 2018 (WHO, 2020c). This progress is however too slow to

achieve the Sustainable Development Goal (SDG) target of ending the epidemic by 2030 (WHO, 2020c). One of the key strategies to achieving the HIV/AIDS-related SDG target is viral suppression among PLWHA (UNAIDS, 2014; Lee et al., 2017). Indeed, reaching viral suppression among 90% of those receiving ART is the third target of the agenda 90-90-90, which was expected to be achieved by 2020 (Avert, 2019d).

Recent global data however show that only about half of the people living with HIV/AIDS and who are on ART have experienced viral suppression levels sufficient enough to limit HIV transmission (Lokpo et al., 2020; UNAIDS, 2020b). This is clearly far below the expected target, which was set to be achieved in 2020. In Ghana, the total number of PLWHA by the end of 2019 were 342,307, with 20,068 new infections (Ghana AIDS Commission, 2020a). According to the Ghana AIDS Commission (2020), the overall estimated antiretroviral therapy (ART) coverage among PLWHA 15 years and above in 2019 was 46.6%, leaving a huge gap of unreached adults.

The problem is compounded by inadequate progress towards the 90-90-90 target. For instance, the Ghana AIDS Commission indicates that only 55% of PLWHA in Ghana know their status. Furthermore, only 68% of those on ART have achieved viral suppression (Ghana AIDS Commission, 2020a; NACP, 2020a). At the current viral suppression rate, the 2030 target of 95-95-95 and the goal of ending the HIV epidemic in Ghana may not be possible. The collective efforts of health facilities such as the 37 Military Hospital will contribute to the achievement of the overall viral suppression rate.

The 37 Military hospital, one of the largest Quasi-Government Hospitals in Accra, provides HIV- related services to a wide-range of clients. The ART centre, which became operational in December 2006, currently provides ART to about 1,660 adults. Over the more than a decade in providing ART services, no study has been conducted to determine viral suppression achievements and associated factors in order to provide contextual recommendations to address

bottlenecks. In order to fully realize treatment potentials, efforts to maximize the achievement of viral suppression remains critical and barriers to achieving this goal need to be explored and adequately addressed (WHO, 2016c).

At the moment however, there is limited contextual empirical data on viral suppression and associated factors in Ghana (Lokpo et al., 2020). If nothing is done in identifying and addressing bottlenecks to the problem, the challenge of patients who do not achieve viral suppression following ART will translates into several new infections, drug resistance from non-adherence, increased mortality and loss to economic life leading to poverty (WHO, 2016; Kim et al., 2018; Altice et al., 2019). To support Ghana's effort at preventing further HIV transmission and achieving the 2030 target of 95-95-95, it is critical that contextually relevant research is done to generate needed data or evidence. This study seeks to fill the current knowledge gap by examining viral suppression and associated factors among HIV positive adults on ART at the 37 Military Hospital.

1.2 Research Questions

1. What are the characteristics of HIV positive adults accessing ART at the 37 military Hospital?
2. What proportion of the HIV positive adults on ART at the 37 military Hospital have achieved viral suppression?
3. What factors influence viral suppression among HIV positive adults on ART at the 37 military Hospital?

1.3 Research Objectives

1.3.1 General Objective

The general objective of the study is to examine the factors influencing viral suppression among HIV positive adults on ART at the 37 Military Hospital.

1.3.2 Specific objectives

The specific objectives are to:

1. Identify the characteristics of adult HIV patients accessing ART at the 37 Military Hospital.
2. Estimate the proportion of HIV positive adults on ART who have achieved viral suppression.
3. Assess the factors affecting viral suppression among HIV positive adults on ART.

1.4 Justification

One of the most important goals of the HIV care and treatment programme is to achieve lower levels of viral load (Ministry of Health, 2002). Increased use of ART is expected to reduce HIV related deaths and further limit transmission of HIV (Ali & Yirtaw, 2019; Bahemana et al., 2020). It is therefore, crucial to identify associated factors to achieving durable viral suppression levels. This study could help reveal programme implementation gaps at the 37 Military hospital and the factors that affect viral suppression among adults on ART. The findings of this study could also provide evidence to influence policy directions on the administration of ART and target programme implementation to improve opportunities for achieving viral suppression targets at the 37 Military Hospital and beyond. The study will further contribute to existing knowledge on HIV care and associated factors to achieving viral suppression. It could also serve as a reference material for future studies.

1.5 Chapter Summary and outline of the dissertation

This chapter has provided the background and problem of the study as well as the study objectives and research questions. In chapter two, a review of relevant literature to the study will be done. Chapter three will describe the methods that will be employed to answer the

research questions. This will be followed by the presentation of the study results in chapter four. Chapter five will provide a discussion to the study findings. Finally, in the sixth chapter, the conclusion and recommendations based on the study findings will be presented.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature on the epidemiology of HIV as well as the global response to HIV. It also broadly discusses HIV programmes in Africa and narrows to prevention programmes in Ghana and viral suppression as an important indicator to be achieved as part of HIV programming. It further discusses rate of viral suppression and the factors that influence viral suppression. A conceptual framework for understanding factors affecting viral suppression is also outlined and discussed.

2.2 Epidemiology of HIV/AIDS

The human immunodeficiency virus (HIV) is an infection that targets the immune system, specifically CD4 cells, which are white blood cells. HIV weakens a person's immunity to infections like tuberculosis and certain cancers by destroying CD4 cells (WHO, 2020a). When a person's CD4 cell count drops below 200, their immunity is significantly weakened, making them more vulnerable to infections (WHO, 2016b). Acquired immunodeficiency syndrome (AIDS) is diagnosed when the CD4 count falls below 200 (WHO, 2005).

Globally, HIV has caused the death of over 33 million people (WHO, 2020a). There are about 38 million people currently living with HIV with about 1.7 million new infections occurring in 2019 (Kaiser Family Foundation, 2021). About 13.6% of people living with HIV/AIDS (PLWHA) are children between 0-19 years (UNICEF, 2020). Between 2015 and 2020, approximately 3.5 million cumulative new infections were recorded, with about 820,000 AIDS-related deaths (UNAIDS, 2020b). HIV infections declined by 39% from 2000 to 2019, with deaths declining by 51% within the same period worldwide (WHO, 2020a).

HIV transmission has mainly been through sexual contact, mother-to-child infections, exposure to infected blood and blood products, infected organs and tissue transplants and contaminated sharp objects (Normand et al., 1995).

Regional variations among PLWHA indicates that Africa has the highest burden (WHO, 2020b). According to UNAIDS (2020b), PLWHA in the WHO regions in 2019 were as follows: Asia and the Pacific had 5.8 million; Latin America had 2.1 million; The Caribbean had 330000; Middle East and North Africa had 240000; Eastern Europe and Central Asia had 1.7 million; and Western and Central Europe and North America together contributed 2.2 million. The African region had 25.7 million cases, making up two-thirds of the global figure (WHO, 2020a). In the sub-Saharan African (SSA) region, the Eastern and Southern African regions had 20.7 million PLWHA in 2019 and recorded about 300,000 AIDS related deaths (Avert, 2019b; UNAIDS, 2020b). There are currently about 4.9 million people living with HIV in Western and Central Africa, a decline from 6.1 million in 2016 (Osei-Yeboah et al., 2018; Kaiser Family Foundation, 2021). The current Africa data however shows a 35% reduction in new cases (WHO, 2020b). This suggests that, although Africa has the highest burden according to the 2019 statistics, decline has been significant in the region following control efforts (UNAIDS, 2020b).

In Ghana, 92% of the more than 340,000 people living with HIV are classified as adults (Ghana AIDS Commission, 2020). Approximately 36% and 64% of PLWHA in Ghana are, respectively, males and females (Ghana AIDS Commission, 2020). Among the 20,000 new infections in 2019, 85% were adults and 55% women above 15 years old (UNAIDS, 2020a). In Ghana, key population groups such as female sex workers and men who have sex with men are disproportionately affected, with HIV prevalence of 6.9% and 18% respectively (UNAIDS, 2020a). The 2019 HIV Sentinel Survey (HSS) indicates a median prevalence of 2.0% for the country (NACP, 2020b).

From the survey, the Greater Accra region of Ghana had a prevalence of 3.2%, the second highest to the Bono region with a 3.4% prevalence (NACP, 2020a, 2020b). The North East and Northern regions had the least prevalence rate of 0.8% each. The prevalence from sentinel sites in the Greater Accra region were Maamobi (4.2%), Adabraka (3.4%), Tema (2.6%) and Korle-Bu, (2.6%). The need for intensified control efforts to improve viral suppression rates is key in reducing prevalence in regions such as the Greater Accra region.

2.3 Global HIV prevention programmes

The global response to HIV began with behaviour change prevention measures until the mid-2000s when treatment options were prioritized (Avert, 2019a). The initial focus on limiting sexual transmission expanded to include socio-cultural as well as political, legal and other contextual factors leading to the implementation of combination prevention strategies, which commenced in 2003 (Hankins & Zalduondo, 2010). According to Hankins & Zalduondo (2010), combination prevention are community-owned rights- and evidenced-based programmes involving the use of complementary behavioural, biomedical and structural intervention strategies. Behavioural interventions included sex education, stigma and discrimination reduction and counselling (Avert, 2019e). Among the biomedical interventions are condom use, treatment, prevention of mother-to-child transmission, testing and avoiding needle exchanges (UNAIDS, 2014). Avert (2019d) describes interventions to address inequality, promoting the rights of PLWHA and increasing education access for girls as the structural interventions to address the underlying factors to HIV transmission.

Furthermore, the emergence of guiding principles, policies and programmatic actions began in 2005 at the global policy level (Hankins & Zalduondo, 2010). Among these included the second edition of the ‘Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection; recommendations for a public health approach’ in 2016 which was a review to compose the ‘Consolidated guidelines on the use of antiretroviral drugs for

treating and preventing HIV infection: what's new' and the 'Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV: Early Release' released in September 2015 and November 2015 respectively (WHO, 2016b).

The first edition of the consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection were presented in June 2013 by the WHO (2013). Other guidelines released to foster HIV prevention include updated recommendations on first-line and second-line antiretroviral regimens and post-exposure prophylaxis and recommendations on early infant diagnosis of HIV: interim guidelines which were supplementary to the 2016 consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection (WHO, 2018) as well as the guidelines for managing advanced HIV disease and rapid initiation of antiretroviral therapy (WHO, 2017) and the guidelines for diagnosis, treatment and care for key populations (WHO, 2014), which was updated in 2016 (WHO, 2016a).

The strategies to address HIV and AIDS have set targets in order to monitor progress by the global community including the Joint United Nations 90-90-90 target (UNAIDS, 2014). By 2030, the measurable targets include 95% of PLWHA knowing their status with 95% of those who know their status accessing treatment and 95% of PLWHA on treatment achieving viral suppression by 2030 (WHO, 2016c).

Global funding for HIV programmes has also been enormous. For instance, the Global Health Strategy on HIV 2016-2021 indicates an investment into HIV prevention intervention of up to US$ 20 billion in 2020 (WHO, 2016c). According to the Global Health Sector Strategy on HIV 2016-2021 by the WHO (2016c), specific interventions to this funding include condoms, people who inject drugs, behaviour change communication, and prevention of mother-to-child transmission, voluntary medical male circumcision, and post- and pre-exposure prophylaxis as well as antiretroviral therapy. Of all the interventions indicated in the Global Health Sector Strategy, ART required about 47% of the total resources (WHO, 2016c).

Global resources have also been provided by donor agencies, the private sector, and governments. The Global Fund has contributed about 21% of international HIV funding, supporting the fight against HIV with over US$ 21.3 billion for more than hundred countries (The Global Fund, 2020). Also, the Bills and Melinda Gates foundation committed about US$3 billion to various organizations implementing interventions to address the epidemic (Bill & Melinda Gates Foundation, 2021). The US President's Emergency Plan for AIDS Relief (PEPFAR) has since 2003 contributed more than US$85 billion to the Global Fund and UNAIDS as well as through other bilateral funding to combat HIV/AIDS (Avert, 2021; PEPFAR, 2021).

The roll-out of these prevention strategies along with the guidelines and policies have led to tremendous achievements as coverage of services such as testing and treatment have been expanding, contributing to a reduction in new infections by 39% and 51% HIV-related deaths between 2000 and 2019 worldwide (WHO, 2020a). The estimated 1.7 million new infections have been the lowest since 1980s and a 23% reduction from 2010 (UNAIDS, 2020e). Also, the expansion in ART in the world remains a critical component of the global prevention efforts with about 68% and 63% of adults and children respectively receiving treatment (UNAIDS, 2020b). The 2020 Global AIDS Update further reports that, fourteen countries had achieved the 90-90-90 targets by 2019 including Australia, Botswana, Cambodia, Eswatini, Ireland, Namibia, the Netherlands, Rwanda, Spain, Switzerland, Thailand, Uganda, Zambia and Zimbabwe.

According to UNAIDS (2020b), the achievements accruing from the HIV preventive strategies have been too slow to enable the realization of ending the AIDS epidemic, however. This has led to calls for accelerated efforts to achieve the SDG target by 2030 (WHO, 2016c; UNAIDS, 2020b). Among the accelerated efforts included the Global HIV prevention Coalition launched

in 2017 (UNAIDS, 2020e). The Coalition aims to revive combination prevention approaches and rekindle political commitment to addressing HIV (UNAIDS, 2020e).

2.4 HIV prevention programmes in Africa

The African Region has the highest levels of HIV with more than 25 million PLWHA and 70% of all AIDS-related deaths in the world (WHO, 2016d, 2020a). Ensuring that preventive programmes are effective in Africa remains critical to achieving global HIV targets. HIV prevention programmes in Africa have also been directed at behavioural change, as well as addressing contextual and structural issues and scaling-up of biomedical interventions (UNAIDS, 2017).

Behavioural change strategies have been needful in the region for providing information and skills that reduce risk and facilitate primary prevention, including access to prevention commodities like condoms and sterile injection equipment (WHO, 2016c). They also include ensuring blood safety and voluntary male circumcision (Kaiser Family Foundation, 2021). In addressing the structural issues, efforts have been targeted to addressing gender inequality, gender-based and sexual violence and stigmatization and discrimination (WHO, 2016c).

In addition, sub-Saharan African (SSA) countries have continued to adopt and implement provisions in preventive guidelines and frameworks by the WHO. For instance, the Global Health Sector Strategy on HIV (2016 – 2020), which describes accelerated actions to prioritize HIV prevention, expand HIV services and scale-up ART, received commitment for African countries (WHO, 2016d).

The interventions in SSA have had significant impacts although much remains to be achieved. According to UNAIDS (2017), most reductions in HIV infections happened in SSA. There has been a 38% decline in new infections in Eastern and Southern Africa and 25% decline in Western and Central Africa between 2010 and 2019 (Kaiser Family Foundation, 2021).

Programmes to prevent HIV transmission in Africa is not without challenges, however. According to UNAIDS (2020a), the bedrock of the gaps in Africa is inequalities, which continue to disadvantage women and young girls in HIV prevention programmes. Also, many PLWHA in most West and Central African countries have low access to ART (Avert, 2017). In addition, there exist limited access to HIV testing and counselling in Northern African countries such as Tunisia, Egypt and Morocco with below 70% coverage of the first 90 target (Avert, 2019c). Additional emerging challenges relate to the reduction in funding of combination preventive programmes especially to African countries (UNAIDS, 2020b). With SSA's heavy reliance on funding from donors and the international community, progress may be affected with changing donor priorities (WHO, 2016d).

2.5 HIV prevention programmes in Ghana

In Ghana, a number of HIV prevention and control programmes have been implemented since the start of the disease in the 1980s. The national response to HIV/AIDS began with the establishment of the National Advisory Commission on AIDS (NACA) in 1985 to advise government on HIV/AIDS (Ghana AIDS Commission, 2001). The National HIV/AIDS/STI Control Programme (NACP) of the Ghana Health Service was later launched as an arrangement in the Ministry of Health in 1987 for the implementation and coordination of interventions to address the HIV epidemic (Addo et al., 2018).

In addition, the Ghana AIDS Commission (GAC) was established in September 2000 as a supra-ministerial and multi-sectorial body under the Chairmanship of the President of Ghana as the highest policy making body on HIV/AIDS (Ghana AIDS Commission, 2001, 2019a). The GAC has the mandate to work closely with various organizations to manage and co-ordinate activities on HIV/AIDS in Ghana (Ghana AIDS Commission, 2019b).

In order to adequately address the HIV/AIDS epidemic in Ghana, various strategic frameworks have been developed with key intervention areas. One of such is the Ghana HIV/AIDS Strategic framework 2001 – 2005, which identified five intervention areas (Ghana AIDS Commission, 2001). These included the prevention of new transmission of HIV, care and support for PLWHA, creating an enabling environment for national response, decentralizing implementation and institutional arrangements, and research, monitoring and evaluation. Specific provisions to these intervention areas included promoting safer sex among vulnerable groups, reducing mother-to-child transmission, promoting voluntary counselling and testing, minimizing risk of transmission through blood and blood products, providing cost effective institutional and home-based care and mainstreaming HIV/AIDS into ministries, departments and agencies (Addo et al., 2014; Normand et al., 1995; Avert, 2019).

Subsequent to the 2001-2005 National Strategic Framework (NSF) has been the NSF 2016 – 2020 as well as the National HIV/AIDS Strategic Plans 2011-2015 and 2016-2020 (Ghana AIDS Commission, 2019a). The National HIV/AIDS Strategic Plan 2016 -2020 highlights high HIV impact activities broadly to prevent new infections and promote HIV care and treatment. In implementing the prevention strategies, Ghana sought to reduce new adults infection by 80% by 2020 (Ghana AIDS Commission, 2016). This was to be achieved by implementing preventive strategies that target behaviour change, key populations, condom and lubricant promotion and distribution, HIV testing and treatment programme with the 90-90-90 fast tract targets, elimination of mother-to-child transmission (eMTCT), the 'Treat All' policy, management of HIV and TB co-infection, and care and support for patients on ART (Ghana AIDS Commission, 2016).

These intervention areas had strategies in achieving the outcomes. For instance, to achieve the 90-90-90 target, the country estimated to test about 13.5 million people by 2020 by generating demand for testing services, strengthening health systems and increasing facilities and staff as

well as piloting self-testing and peer-led testing for HIV (Ghana AIDS Commission, 2016). The National HIV/AIDS Strategic plan (2016 – 2020) further provided that, to achieve the 'Treat All' policy, there would be a scale-up of ART sites with their accreditation and certification, initiate ART for all patients irrespective of CD4 count and ensure effective viral load monitoring and resistance testing (Ghana AIDS Commission, 2017).

The implementation of programme interventions and policies have contributed to achieving some milestones. HIV prevalence in 2019 reduced to 2% from 2.4% in 2018 amongst pregnant women attending antenatal care (ANC) (NACP, 2020a). According to the 2019 annual report of the NACP (2020a), a cumulative 153,901 clients were on ART with the 90-90-90 currently standing at 58-77-68 for Ghana.

Despite these achievements, there are challenges (Addo et al., 2014). These include huge funding gaps for implementing interventions as well as delayed disbursements of available funds (NACP, 2020a). Other challenges include supply chain bottlenecks, unavailability of adequate storage and transport, challenges with laboratory equipment, staff attrition and human resource challenges and data management challenges, especially poor data on viral load (NACP, (2020).

2.6 Anti-Retroviral Therapy (ART) intervention strategy

Highly active antiretroviral therapy is one of the promoted HIV/AIDS interventions in the last decade. The scale up of ART, since its introduction in 1996, has contributed significantly to the decline in morbidity and AIDS-related deaths globally (Kaiser Family Foundation, 2021). Between 2000 and 2019, the WHO indicates that, ART saved more than 15 million lives (WHO, 2020a). By June 2020, about 26 million PLWHAs were receiving ART in the world (WHO, 2020b). The drugs act as nucleoside reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs) and protease inhibitors (PIs) (Ministry of

Health, 2002). The WHO (2015a) recommends initiation of ART for all adults irrespective of their clinical staging and CD4 cell count.

ART serves as central component to viral suppression as the other factors revolve around the medications (Semvua et al., 2017). To achieve viral suppression, it is important for patients to get the right regimen with adequate support to adhere to ART (Dzansi et al., 2020). The support should reduce bottlenecks to adherence such as forgetfulness, lack of adequate nutrition, stigma and discrimination both at home and at health facility levels (Croome et al., 2017). Croome et al. (2017) further indicate that providing social support, reminders and ensuring friendly relationship with service providers are critical for viral suppression.

Various combination regimen have been provided based on drug toxicity, difficulties in adherence, treatment failures and drug reactions (Ministry of Health, 2002). ART medications include a combination of Tenofovir (TDF), lamivudine (3TC), Efavirenz (EFV), entricitabine (FTC), Zidovudine (AZT), Dolutegavir (DTG) and Nevaripine (NVP) (WHO, 2015a). According to the WHO (2015a), preferred first-line regimen include a combination of TDF, 3TC (or FTC) and EFV. Alternatively, first-line regimen may include AZT + 3TC + EFV (or NVP); TDF + 3TC (or FTC) + DTG; TDF + 3TC (or FTC) + EFV or; TDF + 3TC (or FTC) + NVP. New WHO guidelines contain recommendations regarding preferred first-line regimens to include dolutegravir (WHO, 2018). The combinations of first line regimens available may be changed to second regimen when identified to be ineffective or treatment failure occurs in a patient (Haas et al., 2020).

In Ghana, the preferred first-line ARV combination is TDF, 3TC (or FTC) and DTG (Ghana AIDS Commission, 2019). Ghana's comprehensive current reviewed treatment combinations in the seventh edition of the guidelines are summarized in Table 2.1.

Table 2.1: ART Regimen for Ghana

Regimen	Drugs	Alternative options
First-line	Tenfovir + Lamivudine (or Emtricitabine) + Dolutegravir	Tenofovir + Lamivudine (or Emtricitabine) + Efavirenz Abacavir + Lamivudine (or Emtricitabine) + Efavirenz
Second-line	Zidovudine + Lamivudine (or Emtricitabine) + Lopinavir/r (or Atazanavir/r	Tenofovir + Lamivudine (or Emtricitabine) + Dolutegravir Tenofovir + Lamivudine (or Emtricitabine) + Lopinavir/r (or Atazanavir/r)
Third-line	Darunavir/r + Raltegravir + 1 or 2 NRTI	Darunavir/r + 2NRTIs ± NNRTI

Source: Ghana Health Service & National AIDS/STI Control Programme (2019), Consolidated Guidelines for HIV Care in Ghana.

For effective ART adherence, fixed-dose combinations have been recommended with choices based on convenience, treatment of comorbidities and population dynamics (WHO, 2015b, 2015a). UNAIDS (2014) has indicated the critical contribution of HIV treatment to ending the AIDS epidemic and making viral transmission rare. This should however, be accompanied by programme commitment to ensuring availability and adequate use of drugs among HIV infected patients.

2.7 Viral Suppression among HIV patients on ART

Viral suppression among HIV infected persons are reached when levels of viral load limits transmission of the virus (Ammon et al., 2018; Villa et al., 2020). According to the WHO (2016a), viral suppression occurs when viral load is below 1000 copies per millilitres (ml) of HIV Ribo Nuclei Acid (RNA) among PLWHIV who have been on ART for at least six months. Viral load levels above 1000 copies/ml constitute virological failure or rebound (WHO, 2015a;

Desta et al., 2020; Lokpo et al., 2020). Viral suppression is an important indicator measured by every HIV programme as it reflects the efficacy of ART, medication adherence and lowered risk of transmitting the virus (Mujugira et al., 2016; Nabukeera et al., 2021).

2.7.1 Rate of viral suppression among PLWHA on ART

According to UNAIDS (2020), the global picture of the HIV testing and treatment cascade for 2019 was that 81% PLWHIV knew their status, 67% of those who knew their status were on treatment and 59% of those on treatment were virally suppressed, an indication of 44% increase from 2015 performance of viral suppression. There are regional and country variations in viral load suppression however. The 2020 Global AIDS Update provides performance of viral suppression for the various WHO regions as follows: Western and Central Europe and North America, 67% [53 – 80%]; Asia and the Pacific, 55% [41 - 68%]; Latin America, 53% [35 – 71%]; Caribbean, 50% [41 – 61%]; Eastern Europe and Central Asia, 41% [36 – 46%]; and Middle East and North Africa 32% [22 – 52%] (UNAIDS, 2020b). The African region as at 2019 had 84% of PLWHA knowing their status, 70% of those who knew their status to be receiving ART and 61% of those on ART experiencing viral load suppression (WHO, 2020b).

In SSA, eastern and southern Africa had achieved 65% [57 – 72%] viral suppression and western and central Africa 45% [36 – 58%] by 2019 (UNAIDS, 2020b). Although the target was not achieved in 2020, ample evidence exist to show that, the overall rates of viral suppression in SSA are improving with some countries having achieved the third 90 target (Dharan & Cooper, 2017). These countries include Botswana, Eswatini, Namibia, Rwanda, Uganda, Zambia and Zimbabwe, with Eswatini achieving its 2030 target of 95% of those on ART achieving viral suppression (UNAIDS, 2020b).

Ghana is still below the 90-90-90 target. The Ghana AIDS Commission (2020) indicates that, only 55% of the PLWHA know their status, 77% of those who know their status are receiving

treatment and 68% of those receiving treatment have achieved viral suppression. Similarly, Lokpo et al. (2020) noted from their study on viral suppression in HIV patients in the Ho Municipality of Ghana that 69% of the patients achieved viral suppression. The performance of Ghana on the 90-90-90 by 2020 requires intensified efforts in order to reach its 95-95-95 by 2030.

2.8 Factors associated with viral suppression

The factors that influence viral suppression among HIV positive adults on ART may include socio-demographic, drugs and adherence to medication, follow-up and clinic attendance. These factors are reviewed in detail below.

2.8.1 Socio-demographic factors influencing viral suppression

Socio-demographic characteristics such as age, sex, marital status, education and knowledge level may affect various aspect of a person's life including achieving viral load suppression among PLWHIV. There is limited data on the socio-demographic factors affecting viral load suppression in Ghana due to limited number of studies (Ghana AIDS Commission, 2017). A retrospective data analysis by Lokpo et al. (2020) among HIV patients in the Ho Municipality however showed no association between socio-demographic factors and viral load suppression.

However, according to Desta et al. (2020), the age, sex and level of healthcare facility a patient attended were associated with achieving viral suppression levels in northern Ethiopia. Similar to the findings of Desta et al. (2020), Haas et al. (2020) found that in addition to age and sex, higher education of participants increased the chances of viral suppression in Eswatini, Lesotho, Malawi, Zambia and Zimbabwe. Also, sociodemographic factors including age, sex and employment were significantly associated with viral load suppression among PLWHA in South Carolina (Haider et al., 2021). Also, patients' disease characteristics such as WHO clinical staging of HIV may influence viral suppression or non-suppression. According to

Nabukeera et al. (2021), patients with WHO clinical stage 4 at ART initiation were significantly more likely to experience non-suppression of viral load in Uganda.

2.8.2 Adherence to ART

One of the important ingredients to achieving better medical outcomes is adherence to treatment, which largely refers to the extent to which patients take their drugs (Stirratt et al., 2015). According to the Centre for Disease Control and Prevention (CDC), HIV treatment adherence constitutes starting and keeping all medical appointments as well as taking all medicines accurately every day (CDC, 2020). Thus, adherence is taking medications or interventions according to prescription (Reda & Biadgilign, 2012). This includes the treatment plan, timing, restrictions to food, other medications and substances (Yiltok et al., 2020). Effectively adhering to ART treatment can yield sustained levels of viral suppression up to 95% among HIV infected patients (Mabunda et al., 2019; Dzansi et al., 2020).

Measuring medication adherence among chronic patients can be complex (Unni, 2019), and varying methods exist in measuring antiretroviral therapy adherence (Zhang et al., 2020). The Ghana Health Service (2016) recommends the use of either self-reports, pill counts or pharmacy records to measure adherence. According to Zhang et al. (2020), measuring adherence may also involve electronic drug monitoring, pharmacodynamics and pharmacokinetics metrics as well as the non-invasive self-reported measures, which are widely used because of its cost effectiveness and ease of assessment, although may have inherent biases. Among self-reported adherence measures include standard scales such as the Morisky Medication Adherence Scale (MMAS), the Hill-Bone Compliance to Medication Scale and the Medication Adherence reasons Scale (MAR-Scale) (Al-Hassany et al., 2019; Shima et al., 2015; Unni et al., 2019).

The MMAS provides eight items to be scored to determine patients' adherence to medication by assessing adherence and non-adherence as intentional or unintentional (Oliveira-Filho et al., 2013; Shima et al., 2015). According to Shima et al. (2015), the Hill-Bone Compliance to Medication Scale identifies the barriers and self-efficacy of patients in complying with prescriptions. The MAR-Scale assesses patients' reasons for adherence using a comprehensive scale of about twenty items that reflect non-adherence due to logistics, beliefs, forgetfulness and long term concerns (Unni et al., 2019). In addition to the above, the use of proportion of medication doses taken over time can also inform patients' levels of adherence (Stirratt et al., 2015). Although self-reported measurement scales for adherence have limitations such as biases, their high reliability make them acceptable for assessments (Oliveira-Filho et al., 2013; Unni et al., 2019).

Globally, studies have shown positive relationship between adherence and treatment outcomes. According to Craw et al. (2020), adherence to ART was significantly associated with achieving viral suppression among respondents in the United States. An association between good adherence and viral suppression was also found by Haider et al. (2021) among people living with HIV in South Carolina. In Brazil, Oliveira et al. (2018) identified a strong association between viral load suppression and adherence to ART. An association between ART adherence and viral suppression have also been documented in SSA. For instance, in two separate studies conducted in Ethiopia by Sultan et al. (2019) and Desta et al. (2020), good ART adherence was associated with viral load suppression. In Uganda, Kazooba et al. (2018) identified that, a 10% reduction in good adherence parameters, increased virologic failure by over 80%, indicating the influence of poor adherence on viral non-suppression. This is indicative that, viral suppression follows good adherence and efforts to enforce adherence among PLWHA on ART should be strengthened.

2.8.3 Other ART related factors

Other antiretroviral drug related factors may also influence achieving viral suppression among HIV patients on ART. Among those discussed in literature include the ART regimen, the duration of being on ART and adverse side effects of ARVs.

2.8.3.1 ART Regimen

Patients enrolled into HIV care are put on combinations of ARVs by care givers following careful assessment to assist the patient get the benefits of taking the drugs (WHO, 2016b). The combinations of ARVs for the regimen the patient is required to take daily and various combinations have been formulated to make up the first-, second- and third-line regimens as shown in Table 2.1 (Ghana Health Service, 2016). The line of treatment can influence achieving viral suppression among patients, and this explains the change to second- and third-lines when treatment failure occurs (Ghana Health Service, 2016; WHO, 2016b).

In Ghana, Lokpo et al. (2020) did not find any significant association between the different EFV-based and NVP-based first line regimen and viral load suppression in the Volta region. Dharan & Cooper (2017) however found high levels of viral suppression among patients on first-line regimens among UK respondents. Bulage et al. (2017) also identified the second and third-line regimen to influence viral suppression. The differences in the findings from the various groups support a need to further explore the influence of the drug regimen on viral suppression.

2.8.3.2 Duration on ART

HIV/AIDS has no cure and therefore, requires lifelong treatment for improved health outcomes (Siefried et al., 2017). The continuous use of ART is expected to result in lowering viral load levels among HIV patients. However, viral load levels may differ among patients over time when on ART with some experiencing treatment failure even after an initial suppression. Time

is of importance in achieving viral suppression when patients are stable on ART to meet viral load monitoring schedule recommended at 6 and 12 months, then every 12 months (WHO, 2016b). This process is crucial for detecting treatment failure earlier to intervene with treatment options (WHO, 2016b).

In their study in the Volta region, Ghana, Lokpo et al. (2020) identified a duration of three years or more on ART to be associated with viral load suppression. However in Kenya, Maina et al. (2020) found three-year duration on ART to be associated with failing treatment. Babo et al. (2017) and Maru et al. (2020) also found shorter duration on ART to be associated with treatment failure in Ethiopia. Similarly, Haas et al. (2020) indicated from their studies in Eswatini, Lesotho, Malawi, Zambia and Zimbabwe that, being on ART for a short time influenced virologic failure. It is therefore, important to investigate the dynamics of duration of patients on ART and provide evidenced based directions for effective programme implementation in Ghana.

2.8.3.3 ARV adverse side events

ARVs, like many other medications, may have adverse side effects following their use, and this should be part of the initial counselling preceding their administration (WHO, 2016b). The side effects may be of varying degrees and should be managed effectively including substituting ARVs for patients for effective outcomes (Ghana Health Service, 2016). The presence of adverse events following ART administration could influence discontinuation of ARV leading to treatment failure or viral non-suppression among patients (Iacob et al., 2017). HIV treatment with ARVs may be associated with cardiovascular related conditions, glucose intolerance, skin infections, hypertension or even diabetes (Oliveira et al., 2018).

According to Abah et al. (2018) adverse drugs reactions such as anaemia due to ARVs predicted virologic failure among HIV patients. The relationship between the side effects of

ARVs and viral suppression among HIV patients have largely been explained as the side effects being a risk factor for poor adherence (Abah et al., 2018). A systematic review and meta-analysis by Al-Dakkak et al. (2013) revealed that patients with adverse events from taking ARVs were less likely to adhere, resulting in treatment failures. The association between drug toxicities and treatment failures have also been established by Cardosso et al. (2010) in Brazil. Also, patients who had adverse reactions from ARVs were more likely to discontinue treatment, which was a risk for viral non-suppression (Shubber et al., 2013).

2.8.4 Health system factors

Healthcare facilities are essential in the provision of care for HIV patients. The patients' interaction with healthcare providers and the facility can influence treatment outcomes for HIV patients. Healthcare providers should therefore be aware of the contextual barriers to HIV and address them to facilitate achieving programme objectives (Haider et al., 2021). Among the health system factors include accessibility to treatment options, availability of ARVs, role of healthcare workers and clinical follow-up among patients.

Patients should have access to treatment options to enable them achieve viral suppression to break the transmission of HIV. The efforts to ensure universal access to ART is a bedrock to achieving the goal of ending HIV epidemic (Hardon et al., 2006; Lokpo et al., 2020). In Ghana, the use of the decentralized national, regional, district and sub-districts with the component of the community-based services in planning and implementing HIV care has increased access to HIV treatment opportunities (Addo et al., 2018). Decentralizing services is important because it reduces additional cost such as transportation and having to travel for long distances to access treatment and may influence adherence to treatment (Hardon et al., 2006; Kamaingi & Meng'anyi, 2019). Although accessibility and availability of ARVs are not enough, it is important to measure their influence and address bottlenecks inherent in the health system for effective programme implementation (Mabunda et al., 2019).

Healthcare providers of varying expertise are involved in the overall care and treatment of HIV patients including clinicians, pharmacy staff, nurses, laboratory staff, nutritionist, psychosocial support providers and counsellors (Ghana Health Service, 2016). For effective treatment outcomes among HIV patients on ART, the attitude of those providing care should be friendly and supportive, devoid of negative judgement, stigma and discrimination (Kamaingi & Meng'anyi, 2019; WHO, 2019a)

Clinical follow-up is important for patients on ART. Treatment for HIV is chronic and requires repeated clinic visits and routine laboratory investigations (Buscher et al., 2013; Yiltok et al., 2020). The WHO (2016b) recommends that, before initiating ART, detailed discussion should cover follow-ups and monitoring visits required to be made by patients. This cements the need for follow-up among HIV patients on ART. However, one of the fundamental challenges to achieving effective treatment response is loss to follow-up among HIV patients (Assir et al., 2018).

The Ghana Health Service (2016), in the guidelines for ART, asserts the importance of follow-up to achieving viral suppression. During follow-up visits, assessment of adherence, drug tolerance and efficacy of treatment as well as routine laboratory investigations can be conducted for drug toxicities and resistance (WHO, 2016b). It is crucial for all care providers to schedule follow up intervals for clients in a manner that will stimulate compliance (Buscher et al., 2013). As a guide, the Ghana Health Service (2016) recommends clients to be seen within the first two weeks following ART initiation, then monthly within the first three months. Thereafter, follow up visits could be within two to three months and adjusted when necessary, depending on the patients' response to treatment. Ensuring a feasible follow-up interval which can adequately be kept by clients is necessary for achieving lowered levels of viral load (Buscher et al., 2013).

Findings from a study on quality of health and viral suppression by Luna-Mireles et al. (2019) showed that, patients who received a higher quality of care from health facilities had higher probability of achieving viral suppression. A study by Dapaah & Senah (2016) in the Ashanti region of Ghana revealed health system factors including privacy, confidentiality and disclosure of status as important factors in influencing HIV care and outcomes. Also, Lokpo et al. (2020) identified regular clinic attendance to be associated with viral suppression.

Woldesenbet et al. (2020) also identified among a group of pregnant women in South Africa that, inadequate clinic attendance and delayed initiation on ART influenced viral non-suppression. At the health facility, HIV-related stigma by healthcare workers influenced viral non-suppression (Kay et al., 2019). Healthcare practices that may negatively impact care retention among HIV clients should be identified and removed to facilitate long term viral suppression (Colasanti et al., 2016). Similar to the findings of Colasanti et al. (2016), Crawford & Thornton (2017) found that, retaining HIV patients in care increased the odds of achieving viral suppression.

2.8.5 Social Support Systems

Social support has been linked to improved treatment outcomes among HIV patients on ART (Atukunda et al., 2017). The importance of social support to HIV treatment and prevention can be drawn from the social, cultural and developmental underpinnings of HIV especially in low- and middle-income countries like Ghana (Khamarko & Myers, 2013). It is increasingly becoming an important component of HIV treatment due to its influence on uptake of services, acceptance of diagnosis and compliance with treatment (Toth et al., 2018). Positive social support systems remove bottlenecks of stigma, which have negative effects on viral suppression (Rangarajan et al., 2016).

Social support in HIV care and treatment may generally refer to the experience that a person living with HIV is loved and cared for and receives some assistance and responsibility within his or her social network (Khamarko & Myers, 2013). Khamarko & Myers (2013) add that social support broadly cover information support, instrumental support, emotional support and appraisal support, suggesting a construct of different dimensions. By these, social support in care and treatment measures the degree of commitment and support of family members to ensuring positive treatment outcomes (Damulira et al., 2019).

Atukunda et al. (2017) assert that, social support depends on the contextual socio-cultural and socio-economic factors. This means that support systems may vary from place to place. That notwithstanding, the benefits of the family and social support systems such as improving disclosure and quality of service and outcomes leading to viral suppression for PLWHA should be a motivating factor (Khumalo et al., 2020). Although the family and social support have positive influences on HIV health outcomes, Khamarko & Myers (2013) indicate that family and social support may sometimes have negative effects on HIV treatment when unhealthy behaviours like alcohol, smoking and drug use and negative stressors are introduced.

Limited data is available on the direct relationship between social support and viral suppression in Ghana. However, the relationship between social support and medication adherence among HIV patients, which is important for viral suppression has been examined. In a cross-sectional qualitative study by Ankrah et al. (2016), support from health workers was an important ART adherence facilitator and those who had parental support had positive habits to taking antiretrovirals. However, Anakwa et al. (2021) did not find significant association between social support and adherence, which is critical for viral suppression in Ghana. Also, Maragh-Bass et al. (2021) found that higher levels of social support was not statistically significant in influencing viral suppression among participants. There should be targeted approaches to engage social support systems to destigmatized HIV to enhance adherence and subsequent viral

suppression (Maragh-Bass et al., 2021). Also, accounting for these factors is necessary to address negative family and social influences and promote positive behaviours such as reminders, monitoring pill uptake, attending clinics and follow-up.

2.9 Conceptual Framework

Figure 2.1 shows a conceptual framework for understanding factors that may affect viral suppression among HIV positive adults on ART at the 37 Military Hospital. The framework was conceptualized based on the understanding of the factors that influence viral suppression, situated in the review of literature on viral suppression. Although there have been earlier studies on viral suppression and associated factors, this study will include a host of other factors which were not all considered in the earlier works reviewed in Ghana.

The outcome variable is viral suppression among PLWHA, which is measured as when viral load is below 1000 copies of viral RNA/ml of plasma (WHO, 2015a). Several factors may independently or collectively interact to affect viral suppression beginning with enrolment into care and administration of ART (Dixon-Umo & Ikpeme, 2020). ART is central to achieving viral suppression. ART and its adherence as well as other related factors identified to influence viral suppression include the duration on treatment, the regimen of ARVs, experience of adverse reactions or side effects and defaulting on ART (Kalichman et al., 2014; Siefried et al., 2017; James Mburu et al., 2020; Lokpo et al., 2020; Nabukeera et al., 2021).

Patients receive their initial ART as well as subsequent refills from health facilities. Access to the health facility in terms of geographic, financial, service availability and its acceptability can indirectly affect patients reaching viral suppression. This is because ART as a lifelong treatment requires patients to make continuous visits and repeated investigations (Buscher et al., 2013). Where distance and its associated transportation cost is a challenge, clients may default treatment of appointments, which ultimately affects adherence to ART and viral

suppression (Reda & Biadgilign, 2012; UNAIDS, 2014; Kamaingi & Meng'anyi, 2019). Also, missed opportunities due to unavailability of service may contribute to loss to follow-up (Hardon et al., 2006).

Socio-demographic factors are critical in ensuring viral load suppression among HIV positive adults. In addition to influencing the use of ART as indicated by studies such as Nigusso & Mavhandu-Mudzusi (2020) and Kiwanuka et al. (2020) in Ethiopia and Uganda respectively, socio-demographic factors such as age, sex and education can affect viral suppression as shown by Haas et al. (2020) among participants from Eswatini, Lesotho, Zambia, Malawi and Zimbabwe. Considering such factors among adults on ART at the 37 Military hospital is relevant to identifying which factors to target health promotional intervention measures towards so as to improve outcomes. In the provision of ART aimed at achieving viral suppression, patients' clinical characteristics such as HIV type, WHO clinical staging and co-morbidities especially tuberculosis is critical. This is because, the presence of such comorbidities may contribute to viral suppression or otherwise (Bulage et al., 2017; Sunkanmi et al., 2020).

Although there are cross cutting factors influencing viral suppression, it is imperative to determine them contextually in order to improve programme implementation to achieve set targets. With the interaction of factors as shown in the framework, understanding the situation at the 37 Military Hospital is necessary to identify and address programme gaps.

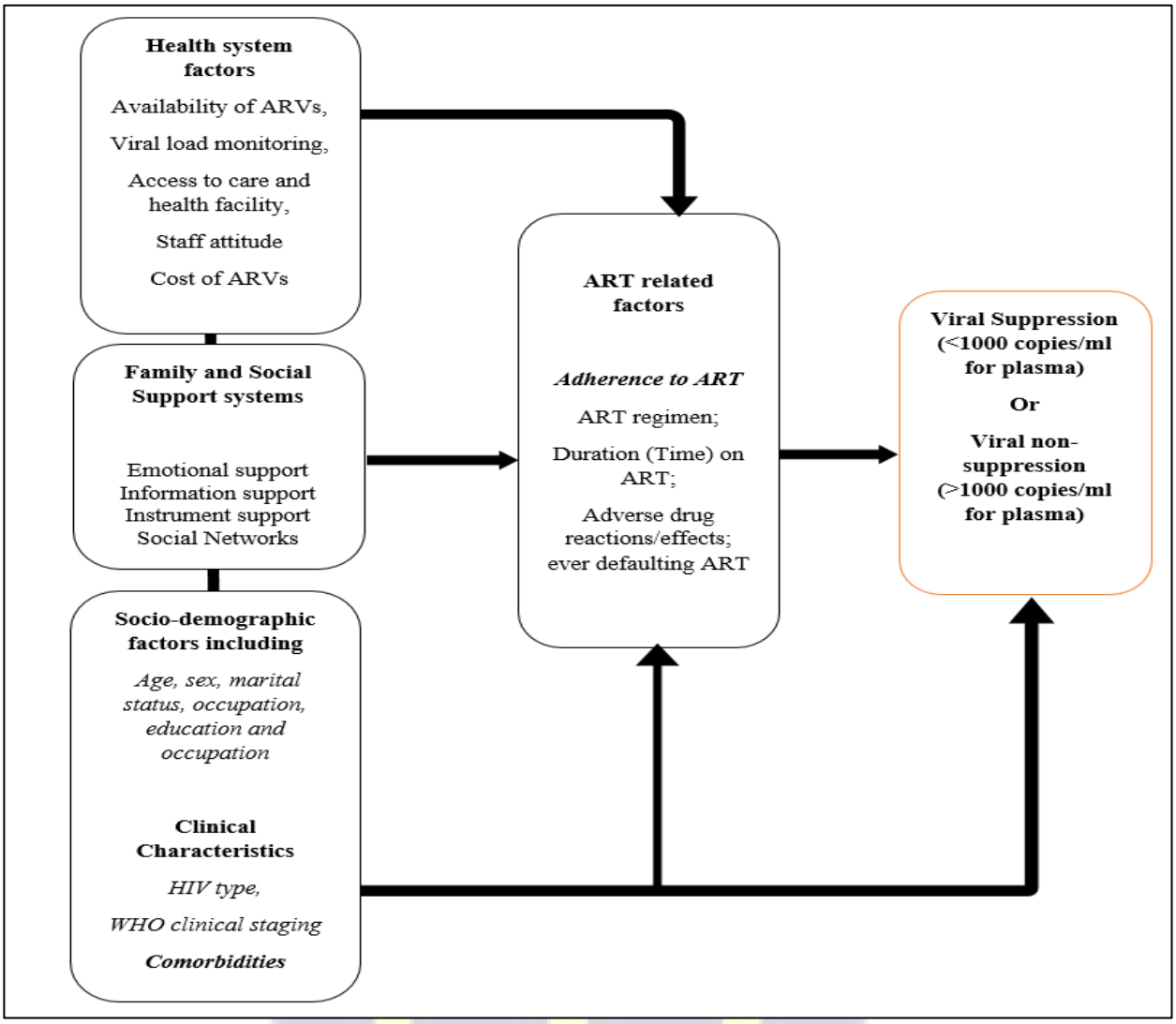

Figure 2.1 Conceptual Framework showing factors affecting viral load suppression

Source: Author's construct

2.10 Chapter summary and outstanding knowledge gaps

The chapter has discussed the HIV programme in Ghana narrowing it to the administration of Highly Active Antiretroviral Therapy (HAART). The factors associated with viral suppression including socio-demographic, economic, drug regimen and adherence to medication, follow-ups and continuous clinic attendance have been discussed. The discussions on the themes in the chapter show gaps in achieving viral suppression especially in SSA. It is evident that

although huge investments have been made into the HIV programme, Ghana could not achieve its 90-90-90 target by the close of 2020.

It is further indicative that, with current performance, the goal of ending HIV epidemic by 2030, where 95% of HIV infected persons on ART should attain viral suppression may not be achieved. The literature review is suggestive that, few empirical studies and systematic analysis have been done in Ghana to estimate the rate of viral load suppression at local levels. Also, studies to identify factors affecting viral suppression contextually are limited. Furthermore, the factors reviewed from earlier studies were limited in scope such as the use of secondary data. Understanding the factors that contribute to achieving viral suppression at all levels of the health system is critical in order to direct scarce resources to address key bottlenecks.

CHAPTER THREE

METHODS

3.0 Introduction

This chapter discusses the methods that were used to answer the research questions. It highlights the study design, the study area and population, data collection techniques and analysis and ethical considerations.

3.1 Study Design

This study was a cross-sectional design involving retrospective analysis of routinely collected data at the 37 Military Hospital ART centre in combination with primary survey data. The hospital runs an ART clinic with capacity to determine viral load for clients. The study focused on determining the factors associated with viral suppression among HIV positive adults on ART.

3.2 Study Context/Area

The study was conducted at the 37 Military Hospital in the Greater Accra Region of Ghana. Operating as one of the largest hospitals, the 37 military hospital was strategically situated to have diverse clients accessing the facility. It was founded in 1941 to provide service to Military personnel and their families but currently provide services for the general public as well. The hospital had a daily turnover of about thousand patients and served as a referral centre for many smaller facilities.

The ART centre at the 37 Military Hospital began operations in December 2006 and commenced viral load monitoring in January 2019. It served about 1,660 adult patients on ART. Located in the public health department, the centre ran ART clinics on Mondays, Wednesdays and Fridays.

3.3 Study population

The study involved HIV positive adults (18+ years) on ART at the 37 Military Hospital.

3.3.1 Inclusion Criteria

The study included all adults accessing ART services at the 37 Military Hospital who initiated ART from 1st March, 2018 to 30th June, 2020.

3.3.2 Exclusion Criteria

HIV positive adults who had been on ART at the hospital for less than six months were excluded from the study. This was in line with the WHO recommendation for viral load monitoring after six months of ART initiation (WHO, 2013, 2016a; UNAIDS, 2016). In addition, a client whose viral load results were absent from the database or folders were excluded from the study. In addition, clients who were too ill to respond to the data collection process as well as those lost to follow up were excluded.

3.4 Sample size estimation

A total of three hundred and thirteen (313) patients were initiated on ART from April 1, 2018 to June 30, 2020. The study used a census of all patients and data collected from those who met the inclusion criteria. However, at the time of the study, 21 had been lost to follow up, 10 were transferred to other facilities and 8 had died. A total of 257 patients out of the remaining 274 retained in care form the base population used for the study.

3.5 Sampling methods

There was no sampling, since a census was conducted on all patients. Patients who fell within the exclusion criteria were dropped. The ART data was stored in the e-tracker database of the NACP, Ghana Health Service. The ART data officers upon request exported the data for the

37 Military hospital into MS Excel format. Upon receiving the data in MS Excel, it was imported into Stata using the *'File>Import>Excel spread sheet'* function. The data available in Stata was then saved as a Stata dataset. Records without viral load data for HIV patients as well as those who had been on treatment less than six months and incomplete records in the database were removed using the '*data > create or change data > drop or keep observations*' function or command in Stata v16.

Patients whose records remained after applying the exclusion criteria were reached through their contact phone numbers and addresses which were available at the ART centre. The details of the study and their selection to participate in it were adequately communicated via phone or their contact addresses. A scheduled visit to the clinic to have the questionnaire administered was planned with all participants.

3.6 Data collection tools and technique

Secondary data were obtained from the Hospital's ART unit for HIV positive adults on ART. A formal request was made to the ART centre of the 37 Military Hospital for the data to be extracted from the e-tracker system used to hold the data. The routinely collected data on HIV positive adults were extracted onto MS Excel sheet. These included the viral load data, drug regimen of client, data on possible switch of regimen, records of follow up and comorbidities available in the database (Appendix 3).

Additional relevant information such as available socio-demographic variables as well as the HIV type which were not in the database were collected from the patient folders. These were put together as a composite database.

Furthermore, a questionnaire was used to collect additional primary data on adherence practices, family and social support systems from respondents. The questionnaire was sub-sectioned into background characteristics of patients, HIV disease characteristics of

respondents, ART related factors, self-reported measurements of adherence, social and family support systems and viral load data. The questionnaire was mainly closed ended questions. The questions were framed under sub-sections to address the research objectives. Data collection was done by trained assistants who approached patients to administer the tool in a serene and comfortable atmosphere during routine clinical follow-up visits.

3.7 Pretesting of questionnaires

The questionnaire was pretested at the ART centre of the Ridge hospital in the Greater Accra region. This was to identify and address all possible gaps in the data collection process. A total of 20 clients accessing ART from the Ridge hospital in the Greater Accra region were used to pre-test the questionnaires. The pretested questionnaires were reviewed and possible updates made to the tool before administering it for the study.

3.8 Data Quality Control

Data were extracted from the ART centre by trained data officers of the Ghana Armed Forces HIV/AIDS Control Programme by primary data handlers at the unit. The census method employed in this study was to allow for total participation of patients. Thus, the method reduced selection biases. In addition, two research assistants with HND or higher with public health, social sciences or related educational background who proved their engagement in previous research activities were recruited to assist in administering the questionnaires to the clients.

The researcher trained the research assistants on the questionnaire for effective administration. This was done in order to foster comprehension and generate the best responses to reduce bias and wrong responses. The collected data were reviewed together with the research assistants daily before data entry. The researcher's choice of using research assistants in collecting the

data from patients was further to reduce biases in data collection, since the researcher has been a direct care provider for patients.

3.9 Data analysis

3.9.1 Study variables

The variables to be studied were categorized into dependent and independent variables.

3.9.1.1 Dependent variables

The study measured viral load of HIV positive adults on ART as the main outcome variable. The value of viral load was a binary categorical outcome, where, '0' defined for viral suppression was for those with <1000 copies/ml post ART initiation for plasma and '1' defined for viral non-suppression for clients with ≥1000 copies/ml post ART initiation according to the WHO guidelines (WHO, 2013, 2016b).

3.9.1.2 Independent Variables

The independent variables considered for this study were described in Table 3.1.

Table 3.1 Independent variables

Variable name	Variable definition	Variable measurement	Measurement scale
Age of client	The age in completed years of the client on ART.	Raw ages of patient	Discrete Categorical
Sex	The biological sex of the clients	0 = Male 1 = Female	Categorical
Locality/Residence	The community or suburb the client stayed	List	Nominal
Marital status	The client's marital status	0 = Never married, 1 = Married (Or as indicated in the database or patient folder)	Categorical
Education	The highest level of completed education indicated in database or patient folders	0 = None, 1 = Primary 2 = Secondary 3= Tertiary or higher	Categorical

Employment status	Indication of whether the client was employed or not	0 = Not employed 1 = employed	Categorical
HIV type	This referred to the type of HIV infection the client has	0 = Type 1 1 = Type 2 2 = Type 1 and 2	Categorical
WHO clinical staging	This referred to the WHO staging classification of the client prior to ART initiation	0 = Stage I 1 = Stage II 2 = Stage III	Categorical
Duration on ART	The length of time client had been on ART	Counts in completed months	Continuous
ART regimen	The regimen of the client	0 = First-line, 1 = Second-line	Categorical
Current ARVs in regimen	The combination of ARVs the client is currently taking	List of drugs	Nominal
Adherence to ART	The client's adherence practices to ART medication. This was measured using the MMAS-8* tool	Raw score from scale computed as a score out of 8. It was later categorized as being non-adherent (0-5) or adherence (6-8) 0 = No 1 = Yes	Continuous Categorical
History of drug reaction	Record of any adverse drug reaction of client	0 = No, 1 = Yes	Categorical
Clinic attendance	Record of client keeping routine/monthly clinic appointment	0 = Never missed clinic 1 = Ever missed clinic	Categorical
Ever defaulting treating	Record of client defaulting treatment. This was based on whether the client has defaulted ART	0 = No, 1 = Yes	Categorical
Treatment failure	Record of failing treatment while on ART. Treatment failure was where two consecutive viral load tests were above 1000 HIV RNA copies/ml.	0 = No, 1 = Yes	Categorical
Any co-morbidity	Record of other presenting diseases with HIV among clients	0 = No, 1 = Yes	Categorical
Name of comorbidities	A list of all comorbidities of client	List of diseases	Nominal
Distance to health facility	Indicated how far the facility was from the patients' residence	Raw	Continuous
Family and social support	Patients' view on family and social support with regards to their care	0= Inadequate support 1 = Adequate support	Categorical

**MMAS-8 tool – The Morisky Medication Adherence Scale which scores respondents out of 8 for responses provided to the standard questions to determine the adherence to medication*

3.9.2 Statistical analysis

The data collected were entered in excel and imported into Stata v16 (Stata Corp, USA) for cleaning and analysis. The data were summarised using descriptive statistics such as frequencies, percentages, means and their standard deviations (SD). Where the data were not normally distributed, the median and interquartile ranges (IQR) were reported. The Pearson's chi-square test of independence was used to determine the association between independent variables and the outcome variable at a significance level of 5% (α=0.05). A penalized binary regression, specifically the exact logistic model was fitted to determine the factors associated with viral load suppression adjusted odds ratios (AOR) at 95% confidence level. A p-value of 5% (where $\alpha = 0.05$) was taken to indicate statistical association. In the determination of the factors associated with viral suppression from the adjusted model, only the significant factors from the univariate analysis conducted using the chi-square test of independence were considered.

3.10 Ethical consideration

Ethical clearance for the study was sought from the 37 Military Institutional Review Board (IRB). An official request was made to the 37 Military Hospital for the data and permission sought to use the data to answer only the research questions. Informed consent was sought from the potential participants of the study before completing the questionnaire. The informed consent form contained names and telephone numbers of the researcher and the administrator of the 37 Military Institutional Review Board.

Before the administration of the questionnaire, informed consent form (Appendix 1) was reviewed with the participant and asked to sign the consent form before the data collection exercise. The potential participants were informed of the rationale of the study, the average time for completing the questionnaire as well as the benefits and risks of the study and how

they were selected to take part in the study. All such information was explained in a language that was understandable to the participant. A copy of the signed consent form was given to the participant and the other one kept by the researcher for future reference.

In addition, the privacy and confidentiality of participants were ensured. The data collection was at venues where participants' utmost privacy was assured. The study only used unique identifiers that cannot be traced to the participant to ensure anonymity of clients. The filled questionnaires were kept under lock and key and all soft copy versions of data were secured with pass codes. Study participants were informed that, there were no direct benefits for participating in the study. However, participants' transportation expenses were reimbursed by the researcher. Their participation however, would contribute to the improvement of services to improve the achievement of viral suppression among HIV clients on ART. The study did not collect any biological samples but used viral load data from patients' records from the ART clinic.

Participation in the study was voluntary and participants could opt to withdraw or not participate in the study. Participants were assured that, such decisions would in no way affect the services being received at the facility.

3.11 Chapter summary

This chapter has outlined the methods to be employed in answering the research questions including the study type, data collection and analysis. The next chapter presents the finding.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the results of the study conducted at the 37 Military Hospital to determine factors associated with viral suppression among HIV positive adults receiving ART. The results include background characteristics of respondents, ART-related characteristics, and adherence measurements, rate of viral suppression and analysis of factors affecting viral suppression.

4.1 Characteristics of study participants

A total of 257 (93.8%) HIV positive adults out of the 274 retained in care participated in the study. Table 4.1 shows the background characteristics of the 257 respondents. The mean age was 40.8 years (±10.7). Female participants were 63% (162) and 37% (95) were males. Some 90.3% (232) of the participants were employed and 65.4% (168) had an average income of below GHC 1000.00 per month.

Table 4.1: Background characteristics of respondents

Background characteristic	Frequency	Percent
Age groups (n=257)		
Mean (SD): 40.8 years (±10.7)		
Below 20 years	3	1.2
20-29 years	34	13.2
30-39 years	81	31.5
40-49 years	82	31.9
50-59 years	41	16.0
60+ years	16	6.2
Sex (n=257)		
Male	95	37
Female	162	63
Level of education (n=257)		
No formal education	16	6.2
Basic	74	28.8
Secondary	93	36.2
Tertiary	74	28.8
Marital Status (n=257)		
Not married	145	56.4
Married	112	43.6
Employment status (n=257)		
Not employed	25	9.7
Employed	232	90.3
Type of employment (n=232)		
Self employed	153	65.9
Public servant	44	19.0
Private institution	35	15.1
Monthly income (n=257)		
Below GHC1000	168	65.4
GHC1000-1999	42	16.3
GHC2000+	47	18.3
Means of transport to Health facility (n=257)		
Private motor/vehicle	41	16
Public transport	216	84

Table 4.2 also shows HIV, co-morbidities and substance use characteristics. Substance use was about 31% (80) and 5.1% (13) of the participants used substance often. In addition, 24.9% (64) had a co-morbidity.

Table 4.2: HIV, co-morbidity and substance use characteristics of respondents

Variable	Frequency	Percent
HIV Type (n=257)		
Type 1	252	98.0
Type 2	2	0.8
Both	3	1.2
Persons aware of your HIV status (n=257)		
No one	5	1.9
My partner/spouse	121	47.1
Children	23	9.0
Friends	17	6.6
Parents/Siblings	91	35.4
Substance use (n=257)		
No	177	68.9
Yes	80	31.1
Frequency of substance use (n=80)		
Occasional	67	83.8
Often	13	16.2
Type of substance (n=80)		
Alcohol	74	92.5
Smoking	6	7.5
Presence of co-morbidity (n=257)		
No	193	75.1
Yes	64	24.9
Number of co-morbidities present (n=64)		
One	60	93.8
Two	4	6.2
Co-morbidity indicated (n=68)		
Hypertension	52	76.5
Diabetes	9	13.2
Hepatitis	4	5.9
Ulcer	2	2.9
Tuberculosis	1	1.5

Table 4.3 shows ART-related characteristics of the respondents. The study showed that, only 21.8% (56) of the respondents had been on ART for less than 2 years. Also, 78.6% (202) had changed their ARV, and they changed their ARVs because of a change in the National guidelines on ARTs. About 99.2% (255) of the respondents were on TDF+3TC+DTG combinations regimen. It was also observed that, 6.6% (17) of the respondents had ever had adverse drug reactions. Furthermore, 26.8% (69) of the respondents had a history of defaulting treatments. On clinic attendance, 43.2% (111) had kept all clinic appointments (Table 4.3).

Table 4.3: ART related characteristics

Drug (ART) Characteristics	Frequency (n=257)	Percent
Duration on ART		
<2 years	56	21.8
2-3 years	101	39.3
>3 years	100	38.9
First ARVs taken		
TDF+3TC+EFV	139	54.1
TDF+3TC+DTG	55	21.4
TDF+FTC+EFV	48	18.7
AZT+3TC+NVP	7	2.7
TDF+3TC+NVP	7	2.7
AZT+3TC+EFV	1	0.4
Ever changed ARVs		
No	55	21.4
Yes	202	78.6
Current ARVs		
TDF+3TC+DTG	255	99.2
TDF+3TC+LPV/r	1	0.4
ABC+3TC+DTG	1	0.4
Ever had adverse side effects		
No	240	93.4
Yes	17	6.6
History of defaulting treatment		
No	188	73.2
Yes	69	26.8
History of Missing pills		
No	242	94.2
Yes	15	5.8
Clinic Attendance		
Never missed an appointment	111	43.2
Ever Missed appointment	146	56.8

TDF – Tenofovir Disoproxil Fumarate; FTC – Entricitabine; EFV – Efavirenz; AZT – Zidovudine; NVP – Nevirapine; 3TC – Lamivudine; ABC – Abacavir; LPV/r – Ritonavir boosted Lopinavir, DTG - Dolutegravir

Adherence to ARTs

In assessing participants self-reporting adherence characteristics using the Morisky scale, 38.9% (100) of participants sometimes forgot to take their medications (Table 4.4). Those who missed their medications for reasons other than forgetfulness were 5.4% (14) and 7% (18) had ever cut back on medication because of feeling worse when they took it. Also 20.6% (53) and 6.2% (16) of the respondents forgot their medication when they travelled and stopped taking medication when their health condition improved respectively. Further, 91.1% (234) took their

medications the day before the interview and 61.1% (157) never had difficulty remembering to take all their medications. Overall, 24.5% (63) of respondents were non-adherent to ART medications (Table 4.3).

Table 4.4: Adherence to ART based on Morisky's self-reporting scale

Morisky Scale Variable	Frequency (n=257)	Percent
Forget sometimes to take medications		
Yes	100	38.9
No	157	61.1
Missed medications for other reasons		
Yes	14	5.4
No	243	94.6
Cut back or stopped medications because you felt worse		
Yes	18	7.0
No	239	93.0
Sometimes forget medications when travelling		
Yes	53	20.6
No	204	79.4
Took medications the day before the interview		
No	23	8.9
Yes	234	91.1
Stopped taking your medications because you felt better		
Yes	16	6.2
No	241	93.8
Taking medications every day is a real inconvenience		
Yes	18	7.0
No	239	93.0
Difficulty remembering to take all your medications		
Yes	100	38.9
No	157	61.1
Overall adherence to ART		
Non-adherent	63	24.5
Adherent	194	75.5

In relation to health service support (see Table 4.5), 98.8% (254) of the respondents said they were satisfied with the attitude of the staff providing ART services at the 37 Military hospital. However, 72.8% (187) perceived their waiting time to be averagely long. About 11.3% (29) had experienced treatment interruptions and 96.5% (248) perceived that being on ART improved their health. It was also observed that, 49.4% (127) of the respondents received financial support from their family and social networks and 7.4% (19) received both financial and informational support. The study showed that 8.2% (21) had previously experienced stigma

and discrimination and 2.3% (6) were experiencing stigma ad discrimination at the time of the study.

Table 4.5: Health and support system characteristics of respondents

Health system and support system variables	Frequency (n=257)	Percent
Have you ever been declined a refill		
No	255	99.2
Yes	2	0.8
Satisfaction with staff attitude towards your care		
Not satisfied	3	1.2
Satisfied	254	98.8
Waiting time at ART		
Short	49	19.0
Average	187	72.8
Long	21	8.2
Treatment interruptions due to health system		
No	228	88.7
Yes	29	11.3
Perceives ART improved your health		
No	9	3.5
Yes	248	96.5
Family support received		
None	22	8.6
Financial	127	49.4
Informational	89	34.6
Informational and financial	19	7.4
Experienced stigmatization and discrimination		
Never experienced	230	89.5
Previously experienced	21	8.2
Currently experiencing	6	2.3
Level of support from your family and social network		
Low	15	5.8
Medium	47	18.3
High	195	75.9

4.2 Viral Suppression rate among adults on ART at the 37 Military Hospital

Table 4.6 shows that overall, 94.5% (243) respondents were virally suppressed, with about 61.1% (158) of the respondents having undetectable levels of viral load. Only 5.4% (14) of respondents were not virally suppressed.

Table 4.6: Viral suppression status among adults on ART at 37 Military Hospital

Viral suppression variables	Frequency (n=257)	Percent
Viral load		
Undetectable levels	157	61.1
20 – 200 copies	80	31.1
201 – 999 copies	6	2.3
1000+ copies	14	5.5
Viral Suppression status		
Virally not suppressed	14	5.5
Virally supressed	243	94.5

4.3 Factors associated with viral suppression among HIV positive adults on ART at the 37 Military hospital

Table 4.7 shows the univariate association analysis of background characteristics and viral suppression of participants. It was observed that, none of the background characteristics were independently associated with viral suppression status of HIV positive adults on ART at the 37 Military hospital (Table 4.7).

Table 4.7: Association between background characteristics and viral load suppression

Variable	Viral Suppression Status			$\chi 2$	P-value
	Non-suppressed (n=14)	Suppressed (n=243)	Total (n=257)		
	n (%)	n (%)	n (%)		
Age groups				3.095	0.758§
<20 years	0 (0.0)	3 (1.3)	3 (1.2)		
20-29 years	1 (5.9)	33 (13.8)	34 (13.2)		
30-39 years	4 (28.6)	77 (31.7)	81 (31.5)		
40-49 years	5 (35.7)	77 (31.7)	82 (31.9)		
50-59 years	4 (35.7)	37 (15.2)	41 (16.0)		
60+ years	0 (0.0)	16 (6.7)	16 (6.2)		
Sex				0.2221	0.639
Male	6 (35.3)	89 (36.6)	95 (37.0)		
Female	8 (57.1))	154 (63.4)	162 (63.0)		
Marital status				2.582	0.108
Not married	5 (35.7)	140 (57.6)	145 (56.7)		
Married	9 (64.3)	103 (42.4)	112 (43.6)		
Educational level				1.531	0.592§
No formal education	1 (7.1)	15 (6.2)	16 (6.2)		
Basic	5 (29.4)	69 (28.7)	74 (28.8)		
Secondary	6 (35.3)	87 (36.3)	93 (36.2)		
Tertiary	2 (14.3)	72 (29.6)	74 (28.8)		
Employment status				0.113	0.596§
Not employed	1 (5.9)	24 (9.9)	25 (9.7)		
Employed	13 (92.9)	219 (90.1)	232 (90.3)		
Substance use				0.650	0.420
No	11 (78.6)	166 (68.3)	177 (68.9)		
Yes	3 (21.4)	77 (31.7)	80 (31.1)		
Average monthly income				3.487	0.211§
<GHC 1000	12 (85.7)	156 (64.2)	168 (65.4)		
GHC 1000-1999	0 (0.0)	42 (17.5)	42 (16.3)		
GHC 2000+	2 (14.3)	45 (18.5)	47 (18.3)		
HIV Type				0.294	1.00§
Type 1	14 (100)	238 (97.9)	252 (98.1)		

Type 2	0 (0.0)	2 (0.8)	2 (0.8)		
Both	0 (0.0)	3 (1.3)	3 (1.3)		
Presence of co-morbidity				2.552	0.110
No	8 (57.1)	185 (76.1)	193 (75.1)		
Yes	6 (42.9)	58 (23.9)	64 (24.9)		

ϕ = Column percentages, χ^2 = Chi Square statistic calculated, § = Fisher's exact P-value, P-value = Significant at 0.05,

The study however showed that patients with history of defaulting treatment ($\chi 2$ = 34.267, p<0.0001), and missing pills ($\chi 2$ = 24.117, p<0.0001) were independently associated with viral suppression. In addition, participants' adherence to ARVs ($\chi 2$ = 17.62, p<0.0001) and experience of stigma and discrimination were associated with viral suppression (Table 4.8).

Table 4.8: Association between ART Characteristics, Health System and Social Support and viral load suppression

Variable	Viral Suppression Status			$\chi 2$	P-value
	Non-suppressed (n=14)	Suppressed (n=243)	Total (n=257)		
	n (%)	n (%)	n (%)		
Ever changed ARVs				0.446	0.741§
No	2 (14.3)	53 (21.8)	55 (21.4)		
Yes	12 (85.7)	190 (78.2)	202 (78.6)		
History of drug reaction				5.26	0.056§
No	11 (78.6)	229 (94.2)	240 (93.4)		
Yes	3 (21.4)	14 (5.8)	17 (6.6)		
Clinic Attendance				7.995	0.002§
Never missed	1 (7.1)	111 (45.7)	112 (43.6)		
Ever missed	13 (92.9)	132 (54.3)	145 (56.4		
Adherence to ARVs				17.612	<0.0001§
Non-adherent	10 (71.4)	53 (21.8)	63 (24.5)		
Adherent	4 (28.6)	190 (78.2)	194 (75.5)		
Declined a refill				0.116	1.00§
No	14 (100.0)	241 (99.2)	255 (99.2)		
Yes	0 (0.0)	2 (0.8)	2 (0.8)		
Means of transport to health facility				0.031	1.00§
Private motor/vehicle	2 (14.3)	39 (16.0)	41 (16.0)		
Public transport	12 (85.7)	204 (84.0)	216 (84.0)		
Perception of health staff attitude				0.175	0.845§
Not satisfied	0 (0.0)	3 (1.2)	3 (1.2)		
Satisfied	14 (100.0)	240 (98.8)	254 (98.8)		
Waiting time at ART clinic				3.725	0.156§
Short	3 (21.4)	46 (18.9)	49 (19.1)		
Average	8 (57.1)	179 (73.7)	187 (72.8)		
Long	3 (21.4)	18 (7.4)	21 (8.2)		
Treatment interruptions due to health system				0.133	0.663§
No	12 (85.7)	216 (88.9)	228 (88.7)		
Yes	2 (14.3)	27 (11.1)	29 (11.3)		

Support from family and social network				4.883	0.160§
None	2 (14.3)	20 (8.2)	22 (8.6)		
Financial	10 (71.4)	117 (48.1)	127 (49.4)		
Informational	2 (14.3)	87 (35.8)	89 (34.6)		
Financial and informational	0 (0.0)	19 (7.8)	19 (7.4)		
Experience of stigma and discrimination				8.427	0.042§
Never suffered	10 (71.4)	220 (90.5)	230 (89.5)		
Previously suffered	4 (28.6)	17 (7.0)	21 (8.2)		
Currently a victim	0 (0.0)	6 (2.5)	6 (2.3)		
Level of family and social support				3.187	0.2166§
Low	1 (7.1)	14 (5.8)	15 (5.8)		
Medium	5 (35.7)	42 (17.3)	47 (18.3)		
High	8 (57.1)	187 (77.0)	195 (75.9)		

% = Column percentages, $\chi 2$ = Chi Square statistic calculated, § = Fisher's exact P-value, P-value = Significant at 0.05,

From Table 4.9, after adjusting for significant factors from the bivariate analysis, adherence to ART remained a major influencing factor of viral suppression among HIV positive adults on ART at the 37 military hospital. Thus, HIV positive adults who were adherent to ART were more than five times likely to achieve viral suppression when compared with those who were non-adherent to ART (AOR: 5.82, 95% CI: 1.56, 27.0, p = 0.006).

Table 4.9 Factors influencing viral suppression among HIV positive adults on ART at the 37 Military hospital

Dependent Variable=Viral Supression	AOR	[95% CI]		Suff.	2*Pr (Suff.)
Experience of stigma and discrimination					
Never experienced	1				
Previously experienced	0.62	0.21	2.38	29	0.515
Adherence to ARTs					
Non-adherent	1				
Adherent	5.82	1.56	27.00	190	0.006
Clinic Attendance					
Never missed appointment	1				
Ever missed appointment	0.14	0.00	1.04	125	0.057

*AOR= Adjusted Odds Ratio; Suff. = Sufficient Statistic; 2*Pr(Suff.) = Probability Value significant at 5%*

4.4 Chapter summary

The chapter has presented the findings of the study conducted at the 37 Military Hospital to determine the factors affecting viral suppression among HIV positive adults. The findings included the estimation of viral suppression to be 94.6% among HIV positive adults. Also, the factors affecting viral suppression were determined to be adherence to ART and regular clinic attendance. The next chapter will provide discussions to the findings of the study

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter discusses the findings of the study. The discussion is focused on the characteristics of HIV adults receiving ART, rate of viral suppression and the factors affecting viral suppression.

5.1 Characteristics of HIV adults receiving ART at the 37 Military hospital

Majority of the HIV positive adults on ART at the 37 Military Hospital who were surveyed were females. This finding is similar to that of Lokpo et al. (2020) where females formed majority of their study participants in the Volta region in Ghana. The relatively higher number of females in this study could be explained by the fact that, a of people living with HIV/AIDS are women (Ghana AIDS Commission, 2020a; UNAIDS, 2020a). It could also be explained by the fact that majority of adult females have been reported to access treatment than males (UNAIDS, 2020d). For instance, according to the Ghana AIDS Commission (2020) and UNAIDS (2020a), ART uptake in 2019 was 33% among men and 54% among women. According to the National AIDS/STI Control Programme (NACP) of the Ghana Health Service, innovative ways such as the strategic community-based interventions to reach men have been initiated to increase uptake of HIV services among men (NACP, 2020a)

The study also showed that, although majority of the respondents had some form of formal education, less than 30% had achieved tertiary education. This is generally consistent with previous studies by Lokpo et al. (2020) and Biney et al. (2021) where less than 5% and about 14% of the respondents had higher tertiary education levels in the Volta region and the Korle Bu Teaching hospital in the Greater Accra region respectively. The finding from this study is

also congruent with previous studies, which indicate a negative relationship between HIV status and attaining higher education (David et al., 2020).

Like other social determinants of health, most PLWHA may drop out of school or fail to continue to higher levels due to financial challenges, frequent indisposition especially when they are not on ARTs and other interventions (Zinyemba et al., 2020). This notwithstanding, ensuring higher educational level attainment among PLWHAs could be essential contribution to the control of HIV especially in low-income countries (Kim, 2006). This is because, higher education can influence knowledge acquisition and positive behaviours to managing and controlling HIV/AIDS such as adhering to medications, condom-use, non-marital sexual relationships and age at first sexual experience (Kim, 2006).

In addition, close to about sixty percent of participants were not married and more than half were self-employed with an average income of less than one thousand Ghana cedis a month. The low levels of higher education as well as income among HIV positive adults from this study further highlight the relationship between low socio-economic status and HIV/AIDS (Ankomah et al., 2016). Furthermore, the higher proportion of PLWHAs being unmarried has also been found by Owusu (2020) in the Eastern region of Ghana. This usually results from divorce or being widowed due to HIV/AIDS (Anglewics & Reniers, 2014; Owusu, 2020).

Almost all respondents had the HIV type 1 infection. The findings is similar to the over ninety-five percent of PLWHA with HIV type 1 infection reported by Lokpo et al. (2020) in the Volta region. The high prevalence of HIV type 1 is due to its aggressive characteristics, which explains why it is common among PLWHA (Esbjörnsson et al., 2019). It is the predominant virus responsible for HIV/AIDS globally (Avert, 2019f) and according to the 2019 HIV sentinel survey in Ghana, HIV type 1 infection formed 98.1% (NACP, 2020b)

In addition, thirty percent of the HIV positive adults were involved in substance use, mainly alcohol, although a few smoked cigarettes. It was observed that, sixty-seven of the eighty respondents, which is approximately 84%, were involved in occasional substance use. HIV patients using these substance during medication need to be counselled to manage the intake of such substances as they have been documented to influence medication adherence and may as well be risk factors to drug toxicity for some of the ARVs (WHO, 2016b, 2018)

Also, about a quarter of the participants had a co-morbidity. The most occurring co-morbidity among respondents was hypertension, followed by diabetes. In a similar study conducted by Ansah et al. (2021) in Kumasi in the Ashanti region, about two-thirds of the HIV patients had a comorbidity with more than half of them having high blood pressure. The relatively high levels of hypertension and diabetes among the study population is not far-fetched, as the WHO has indicated the risk of cardiovascular diseases and metabolic disorders to be related to some of the ARVs (WHO, 2018). The occurrence of conditions especially non-communicable diseases such as hypertension and diabetes from the study should be critically monitored as recommended by the WHO (WHO, 2016b).

The study showed that, close to eighty percent of the respondents had been on ART for more than 24 months. Participants were mainly initiated on treatment with the tenofovir, lamivudine and efavirenz (TDF+3TC+EFV) first line combinations. Other initial combinations included tenofovir with emtricitabine and efavirenz (TDF+FTC+EFV), zidovudine, lamivudine and Nevirapine (AZT+3TC+NVP), tenofovir, lamivudine and nevirapine (TDF+3TC+NV) and zidovudine, lamivudine and efavirenz (AZT+3TC+EFV). However, a change in the national guidelines following the review and adoption of the consolidated guidelines for HIV care in 2019, led to clients having their combinations reviewed to mainly tenofovir, lamivudine and dolutegravir (TDF+3TC+DTG) (Ghana Health Service, 2019). The review of ARTs by the

Ghana Health Service was based on the updated guidelines and recommendations by the WHO (Ghana Health Service, 2019; WHO, 2016b).

The occurrence of adverse effects or reactions to ART was close to seven percent. The possible occurrence of adverse drug reactions have been documented and guidelines to addressing them provided in the consolidated guidelines of the WHO (2016), WHO (2018) and the Ghana Health Service (2019). According to the WHO (2016), adverse events associated with ARVs are temporary and the drugs causing the adverse reactions could be substituted with tolerable options. It is recommended by the WHO and GHS that, patients on ART should be counselled not to break treatment due to the occurring adverse drug reactions but be encouraged to discuss with the care provider for alternatives considerations (Ghana Health Service, 2019; WHO, 2016b).

Additionally, some 43.2% of HIV positive adults at the 37 military had never missed a clinic appointment. This finding was lower than the 79% of respondents found by Lokpo et al. (2020) to attend clinic regularly in the Volta region. It is important to indicate that, clinic attendance is a critical requirement for HIV care in ensuring positive treatment outcomes including viral suppression, as it provides room for medication refill, viral load monitoring, adherence and monitoring of drug toxicities and adverse events (Ghana Health Service, 2019).

It was further observed that, 75.5% of the HIV positive adults were adherent to ART. This finding is higher than the adherence level found by Anokye-Kumatia et al. (2018) among participants at the Komfo Anokye Teaching Hospital in the Ashanti Region. Their finding showed adequate adherence was among less than thirty percent of the study population. However, Biney et al. (2021) found adherence to ART to be 78.7% among PWHA on ART in the Korle Bu Teaching Hospital in the Greater Accra Region. The finding from the current study is thus similar to what was found at the Korle Bu Teaching Hospital.

Key among adherence measurements assessed in this study included forgetfulness, missing medication, and leaving medications when travelling. It remains critical for HIV patients to be sensitized on these practices in order to take medications with strict compliance. As a fundamental determinant of viral suppression, efforts by the health system to foster adherence practices among PLWHAs including always recalling to take medications and taking all medications at the right time as well as keeping to clinic times and schedules remain paramount to the HIV care programme (Biney et al., 2021; WHO, 2016b).

5.2 Viral suppression rate among HIV adults receiving ART at the 37 Military hospital

Findings showed that viral suppression rate was 94.6% among the respondents. Participants with undetectable levels of viral load were about 61.1% whereas 30.7% and 2.3% had viral loads of 20 -200 copies/ml and 201-999 copies/ml respectively. The viral suppression rate observed in this study is higher than the UNAIDS 90-90-90 target set for 2020 and inching closer to the 95-95-95 target for 2030 (UNAIDS, 2014, 2017, 2020b). It is also higher than the 2019 national statistic of 68% reported by the Ghana AIDS Commission, (2020a) as well as current performance of 73% by the Ghana AIDS Commission, (2021). In addition, the rate from this study is higher than the 69% from Ho in the Volta region (Lokpo et al., 2020), 76.4% from Kumasi in the Ashanti region (Ansah et al., 2021), and 68.2% from the Greater Accra region (Biney et al., 2021).

The viral suppression level from the 37 military hospital is also higher than the levels reported from some earlier studies in other SSA countries. For instance, Yiltok et al. (2020) reported a viral suppression rate of 56.6% from Nigeria. From a study conducted by Maina et al. (2020) in Kenya, viral load suppression was 59%. A similar rate of 56.2% was reported by Woldesenbet et al. (2019) in South Africa. Also, Byonanebye et al. (2020) found viral

suppression levels to be 85% among patients receiving care in Uganda. However, Ssemwanga et al. (2020) reported from a national cross-sectional survey in Uganda, a viral load suppression rate of 95% similar to the findings from the study in the 37 military hospital.

The varying levels of viral suppression achieved from different studies and reports suggest the influence of contextual factors and dynamics occurring within the study population. At the current performance, the viral suppression level among HIV adults on treatment from the 37 military hospital is comparable to countries such as Botswana, Eswatini, Namibia, Rwanda, Uganda, Zambia and Zimbabwe which have achieved their targets of viral suppression rates according to the UNAIDS (2020b). The success story of the 37 military hospital in achieving high viral suppression rate may be largely attributed to adherence to ARTs, further studies could be done to investigate and document the lessons to improve Ghana's chances of achieving its target and ultimately the challenge of ending AIDS epidemic by 2030.

5.3 Factors affecting viral suppression among HIV positive adults on ART at the 37 military hospital

The study showed that, after controlling for the significant variables from the univariate analysis as well as participants age and sex, adherence to ART remained statistically significant factors that influenced viral suppression among adults on ART at the 37 military hospital. These results are consistent with Lokpo et al. (2020) who identified medication adherence measured as clinic attendance to be a significant factor in influencing viral suppression among HIV patients in the Volta region of Ghana. Also, Biney et al. (2021) reported from their study in Accra, Ghana, that HIV patients with higher MMAS-8 adherence scores were more than eight times likely to achieve viral suppression.

The identification of ART adherence as an influencing factor to achieving viral suppression has been documented in SSA and other regions. In Nigeria, Yiltok et al. (2020) concluded that,

adherence to medication was significantly related to viral suppression among HIV positive patients. Haas et al. (2020) also found among other factors that, optimal adherence to ART among HIV patients in Eswatini, Lesotho, Malawi, Zambia and Zimbabwe had higher odds of virological suppression. Similarly, Sultan et al. (2019) and Desta et al. (2020) reported the influence of adherence to ART on viral load suppression in Ethiopia.

Viral suppression among HIV adults in the 37 military hospital was not influenced by socio-demographic, economic or cultural factors as were found by Haas et al. (2020) in SSA, Desta et al. (2020) in Ethiopia, Nabukeera et al. (2021) in Uganda, Haider et al. (2021) in South Carolina and Siefried et al. (2017) in Australia. The findings in the current study also agree with Lokpo et al. (2020) in Ghana in which socio-demographic factors were not predictors of viral load suppression.

The findings of this study further supports the assertion that, long-term and sustainable viral suppression among HIV patients largely depend on adhering to modern tolerable and effective ART regimens (Dharan & Cooper, 2017). Thus, it remains imperatively critical for ART care providers to offer adequately the recommended adherence counselling sessions and continuous viral load monitoring for HIV patients when receiving care (FHI, 2013; Ghana Health Service, 2019; Ssemwanga et al., 2020).

The findings underscore the fact that, adherence to ART remains the fundamental predictor of viral suppression as indicated by the World Health Organization (WHO, 2016b). It is critical for health workers, therefore, to regularly assess clients on their adherence behaviours including the tendencies of defaulting, forgetting to take medications, missing pills, cutting back on taking pills, leaving medications behind when travelling and overcoming the inconveniences of taking medications every day.

As used in the Morisky scale of measuring adherence, improvements on these every day behaviours of HIV positive patients as indicated above, will contribute to improvements in adherence behaviours. In the long run, sustained adherence levels will yield durable viral suppression among PLWHA contributing immensely to the fight against HIV and AIDS. This is more so because the goal of ending HIV pandemic by 2030 depends largely of the achievement of higher viral suppression levels. Identifying adherence to ART among HIV positive adults as a factor affecting viral suppression contributes to existing knowledge on how to reach the UNAIDS 95-95-95 target.

The application of this knowledge should drive the campaign of stressing on strict compliance with guidelines given on medications and other protocols necessary for PLWHA to achieve sustained undetectable and untransmissible viral loads levels. This will require PLWHAs to be well orientated to gain adequate understanding on the importance of lifelong adherence and continuous ART treatment to achieve the ultimate treatment success of sustained viral load measurements below 1000 copies/ml and even at undetectable levels (FHI, 2013).

Furthermore, the conceptual framework identified adherence to ARTs as one of the critical factors influencing viral suppression which has been supported by the findings of this study. It is therefore, important for health care providers to promote activities that positively influence medication adherence among HIV positive adults. Underlying factors to medication adherence such as social and family support systems as well as other health system related factors like staff attitudes, access to health facilities and ARTs need to be positively sustained and controlled to enable the facility maintain its high level of viral suppression among HIV adults on ARTs.

In addition, the structuring of HIV continuum of care by the National AIDS/STI Control Programme of the Ghana Health Service to ensure retention in care, adherence to treatment and

viral suppression is an important step in ensuring improvements in the quality of life and reduction in the incidence of AIDS-related deaths (NACP, 2020a). To this end, the national strategic plan 2021-2025 by the Ghana AIDS Commission highlights on the importance of monitoring PLHWAs on treatment and ensuring compliance to guidelines and protocols in order to achieve the third 95 even by 2025 (Ghana AIDS Commission, 2020b).

5.4 Strengths and Limitations

The study used a census of all HIV adults on ART at the hospital. This allowed for the control of selection bias and increase in sampling power for the study. However, only the 37 Military Hospital in Accra was used as the study site. The findings may therefore be different from other hospitals in the region and other parts of the country. Also, the use of cross-sectional design does not allow for causal inferences. Furthermore, the use of recall for data collection through questionnaire administration had the tendency of introducing recall bias. This was controlled to some extent by collecting additional secondary patient information from the hospital. Notwithstanding the limitations, the study provides useful findings and information on the factors influencing viral suppression including adherence and regular clinic attendance as fundamental to achieving viral suppression and ending the HIV epidemic.

5.5 Chapter Summary

The chapter has provided a discussion on the findings from the study. The viral suppression rate from the study was observed to be higher than the national statistic as well as reports from previous studies in Ghana. Viral suppression rate at the 37 military hospital was influenced by adherence to ARTs. Based on this, the next chapter makes relevant recommendations.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The chapter presents the summary of the findings, conclusions drawn and suggested recommendation based on the study findings.

6.1 Summary

The study was conducted to examine viral suppression and associated factors among HIV positive adults on ART at the 37 Military Hospital. The study collected data from 257 respondents with a questionnaire. Chi square test and logistic regression analysis were used to examine the factors affecting viral suppression among the respondents. The study showed a viral suppression rate of 94.6% among HIV positive adults receiving antiretroviral treatment at the 37 Military Hospital in the Greater Accra Region of Ghana. It was observed that 61.1% had undetectable levels of viral load and 31.1% and 2.3% had 20-200 copies/ml and 201-999 copies/ml respectively.

The study did not find any statistical relationship between socio-demographic characteristics and viral suppression. However, multivariate analysis revealed that, adherence to ARTs and regular clinic attendance were the main factors affecting viral suppression among HIV positive adults on ART at the hospital.

6.2 Conclusion

Viral suppression rate observed from the 37 Military Hospital was high among HIV positive adults on ART. Adherence to ARTs and related factors including keeping regular clinic appointments are critical to achieving viral suppression. Strengthen efforts to sustain viral

suppression levels among PLWHA accessing treatment at the hospital is therefore important to for reaching the UNAIDS' 95-95-95 target by 2030.

6.3 Recommendations

Based on the findings and discussion in the previous two chapters, the following recommendations are hereby made:

1. Healthcare providers should periodically assess adherence behaviours of PLWHA to sustain viral suppression levels.
2. Healthcare providers should provide adequate information and education to PLWHAs to strictly comply with ART guidelines.
3. Further research is recommended to document the factors and stories that have contributed to the relatively high viral suppression rate at the 37 Military Hospital to be shared with other health facilities especially with lower viral suppression rates

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APPENDICES

APPENDIX A: INFORMED CONSENT FORM

Title: Factors influencing viral suppression among HIV patients on ART in the 37 Military hospital

Principal Investigator: Ms. Edna Aryee

Address: 37 Military Hospital

General Information about Research

The study is aimed at understanding the factors that influence viral suppression among HIV positive adults who receive anti-retroviral treatment from the 37 Military hospital in Accra. The study involves research where participants who voluntarily enrol will respond to a questionnaire relating to the care, they receive at the 37 Military hospital. There will be neither collection of biological samples nor any invasive methods. The participation will take about 15 minutes to complete the questionnaire which are mainly closed ended questions.

Possible Risks and Discomforts

Your participation in this study does not pose any foreseeable risk that may negatively affect your in participation or regarding the care you receive from this facility. You will be required to only respond to a few questions.

Possible Benefits and compensation

Your participation in the study comes with no direct benefits or remuneration. However, your transportation expenses to and from your residence to the site of data collection will be reimbursed by the researcher.

Confidentiality

The data you provide will be treated with utmost confidentiality. Your name and other personal identifiers will not be recorded to keep anonymity of all records. The data will only be available to the researcher and supervisor involved in carrying out this study. Soft copies of records will be secured with passcodes. The filled questionnaires will be kept strictly under lock and key. The data will also not be shared with any third party.

Additional Cost

There is no additional cost to be incurred on your participation in this study,

Voluntary Participation and right to Leave the Research

Participation in this study is voluntary and you can withdraw or refuse to enrol without any penalty or effect on the service(s) rendered to you at the facility.

Termination of Participation by the Researcher

Eligible participants who may be too ill to respond to the questionnaire may not be included in the study.

Contacts for additional Information

In the course of participating in the study, you may contact the principal researcher for additional and further clarification through the details below;

Name: Ms. Edna Aryee

Contact Number: 0244582283

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research on the factors influencing viral suppression among HIV adults on ART at the 37 Military Hospital has been read and explained to me. I have been given the opportunity to ask and questions and received answered to my satisfaction. I agree to participate in the study as a volunteer.

…….. ……

Date Name and Signature or mark of volunteer

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risk and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

…….. ……

Date Name and Signature of witness

I certify that the nature and purpose, the potential benefits and possible risks associated with participating in the research have been explained to the above individual.

…….. ……

Date Name and Signature of Person Who Obtained Consent

APPENDIX B: DATA COLLECTION TOOL

Questionnaire Code……

SN	*Background*	Response	Code
1	Age	……..	age
2	Sex	[0] Male [1] Female	sex
3	Marital Status	[0] Not married [1] Married [2] Others	mstat
4	Level of education	[0] No formal education [1] Basic [2] Secondary [3] Tertiary	educ
5	Employment status	[0] Not employed [1] Employed	estat
6	Type of employment	[0] None [1] Self employed [2] Public servant [3] Private institution	tyem
7	Average monthly income	…….cedis	avin
8	Substance use	[0] No [1] Yes	suse
9	Type of substance	[0] None [1] Alcohol [2] Smoking [3] Others	tsub
10	Frequency of use	[0] None [1] Not often [2] Often [3] Very Often	frus
11	Is there any co-morbidity being managed or treated	[0] No [1] Yes	comr
12	Indicate condition (s)	……	cond
	ART factors		
13	Ever changed ARVs	[0] No [1] Yes	echa
14	Reason for changing ARVs	[0] None [1] Adverse Side effects [2] Treatment failed [3] Other reasons	rcha
15	Line of treatment	[0] First-line [1] Second-line [2] Third-line	ltre

16	Ever defaulted ART	[0] No [1] Yes	edef
	Measuring Adherence		
	Morisky Scale		
17	Do you sometimes forget to take your medications	[0] No [1] Yes	forg
18	People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medications?	[0] No [1] Yes	miss
19	Have you ever cut back or stopped taking your medications without telling your doctor, because you felt worse when you took it?	[0] No [1] Yes	cut
20	When you travel or leave home, do you sometimes forget to bring along your medications?	[0] No [1] Yes	leav
21	Did you take your medications yesterday?	[0] No [1] Yes	yest
22	When you feel your health condition is under control, do you sometimes stop taking your medications?	[0] No [1] Yes	hcon
23	Taking medications every day is a real inconvenience to some people. Do you ever feel hassled about sticking to your treatment plan?	[0] No [1] Yes	inco
24	How often do you have difficulty remembering to take all your medications	[0] All the time [1] Usually [2] Sometimes [3] Once in a while [4] Never/rarely	oftd
	Complete these regarding why you will miss your medication/pills	*Rate the following statement from 1 - 5 where 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*	
25	Personal reasons such as overwhelmed with so much medications	[1] [2] [3] [4] [5]	pere
26	Social reasons such as with friends and family/embarrassment	[1] [2] [3] [4] [5]	sore
27	Difficulty in opening container	[1] [2] [3] [4] [5]	diin
28	Difficulty in swallowing	[1] [2] [3] [4] [5]	diin
29	I ran out of drugs	[1] [2] [3] [4] [5]	ira
30	Transportation issues	[1] [2] [3] [4] [5]	tris

31	I am not sure how to take the medicine/uncertain administration	[1]	[2]	[3]	[4]	[5]	iam
32	Trouble managing all medicines	[1]	[2]	[3]	[4]	[5]	trma
33	Side effects of the medicines	[1]	[2]	[3]	[4]	[5]	sief
34	I don't need the medicine anymore	[1]	[2]	[3]	[4]	[5]	ido
35	Medicine is not working	[1]	[2]	[3]	[4]	[5]	meis
36	I skipped to see if it is still needed	[1]	[2]	[3]	[4]	[5]	isk
37	Simply missed it	[1]	[2]	[3]	[4]	[5]	simi
38	I forgot due to busy schedule	[1]	[2]	[3]	[4]	[5]	ifo
39	Forgot due to cognitive issues	[1]	[2]	[3]	[4]	[5]	fodu
40	Do not consider taking the medicine as a priority	[1]	[2]	[3]	[4]	[5]	dono
41	Cost involved in getting the medicine	[1]	[2]	[3]	[4]	[5]	coin
42	Possible side effects	[1]	[2]	[3]	[4]	[5]	posi
43	Long term effects from the medicine	[1]	[2]	[3]	[4]	[5]	lote
	Health System factors						
44	Have you ever been declined a refill	[0] No [1] Yes					decl
45	How long does it take you to get to the facility	……..					lofa
46	How much do you spend to get to the facility	……..					hmsf
47	Means of transport to Health facility	[0] Walk [1] Private motor/vehicle [2] Public transport					mtra
48	Satisfaction with staff attitude towards your care	[0] Not satisfied [1] Satisfied					sata
49	Waiting time at ART	[0] Short [1] Average [2] Long					wait
50	Treatment interruptions due to health system	[1] No [1] Yes					inte
51	Monthly cost in accessing ART or keeping appointments	…….					mcot
52	Indicate in sum, how you perceive the health system in improving your health	[0] Low [1] Medium [2] High					supe
	Social and Family support systems						
53	Who is aware of your HIV status	[0] None [1] My partner/spouse [2] Child (ren) [3] Friends					awre

		[4] Others specify	
54	What kind of family support do you have	[0] None [1] Financial [2] Informational	fasu
55	Occurrence of stigmatization and discrimination	[0] Have never suffered [1] Previously suffered [2] Currently a victim	stdi
56	How will you regard the kind of support you get from your family and social networks	[0] Non-existent [1] Negative [2] Positive	resu
57	Indicate the level of support from your family and social network	[0] Low [1] Medium [2] High	lesu
	Viral Load data (As available)		
58	Current Viral suppression status of patient	[0] Virally Not suppressed [1] Virally suppressed	vssp

APPENDIXC: DATA EXTRACTION SHEET

Srl No	Q Code	HIV Type	WHO HIV Clinical Stage	CD4 cell at ART initiation	Date of commencing ART	Duration on ART	Initial (ARV) Drug Regimen	Current Drug regimen	Date of switch	History of drug Reaction	Follow-up data	Clinic attendance	History of defaulting treatment	History of Missing pills	Any co-morbidity	Viral load data 1	Date	Viral load data 2	Date	Current Viral load data	Date

Institutional Review Board
37 Military Hospital
Neghelli Barracks
ACCRA

Tel: 059 1759506
Email: irbmilhosp@gmail.com

22 September 2021

ETHICAL CLEARANCE

37MH-IRB/MAS/IPN/540/2021

On 22 September 2021 the 37 Military Hospital (37MH) Institutional Review Board (IRB) approved your protocol.

TITLE OF PROTOCOL: Factors affecting viral suppression among HIV positive adults on ART at the 37 Military Hospital

PRINCIPAL INVESTIGATOR: Edna Aryee

Please note that a final review report must be submitted to the Board at the completion of the study.

Please report all serious adverse events related to this study to 37MH-IRB within seven (7) days verbally and fourteen (14) days in writing.

This certificate is valid till 21 September 2022.

37 MILITARY HOSPITAL
INSTITUTIONAL REVIEW BOARD
DATE: 22-09-2021

DR EDWARD ASUMANU
(37MH-IRB, Vice Chairman)

Cc: Brig Gen NA Obodai
Commander, 37 Military Hospital