

ENSIGN COLLEGE OF PUBLIC HEALTH, KPONG, GHANA.

**THE EFFECT OF ADHERENCE TO ANTIRETROVIRAL THERAPY ON VIRAL
SUPPRESSION AMONG HIV-INFECTED ADOLESCENTS AND YOUNG ADULTS
(AYA) SEEN AT THE KORLE BU TEACHING HOSPITAL (KBTH).**

BY

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A thesis submitted to the Department of Community Health in the Faculty of Public

Health in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH.

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DECLARATION

I hereby declare that except for the references to works by other authors, which have been duly acknowledged, this is my own work and that, it has neither in whole nor in part been presented for a degree in this Institution or elsewhere.

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DEDICATION

This work is dedicated to all health professionals who provide HIV/AIDS care.

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I am grateful to The Almighty God for enduing me with strength and knowledge to undertake this study. My sincerest thanks goes to my Supervisor; Dr. Stephen Manortey of Ensign College of Public Health, Kpong, for his excellent guidance and supervision during the study.

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ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
ARV	Antiretroviral
AYA	Adolescents and Young Adults
CDC	Centers for Disease Control
CD4	Cluster of Differentiation
EDM	Electronic Drug Monitoring
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
KBTH	Korle Bu Teaching Hospital
MAQ	Medication Adherence Questionnaire
MMAS	Morisky Medication Adherence Scale
MMAS-8	Eight-item Morisky Medication Adherence Scale
NACP	National Aids Control Program
PLWHIV	Persons Living With Human Immunodeficiency Virus

RNA	Ribonucleic Acid
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNICEF	The United Nations Children's Fund
USA	Unites States of America
VL	Viral Load
WHO	World Health Organization

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION.....	iii
ACKNOWLEDGEMENT.....	iv
ABBREVIATIONS.....	v
LIST OF TABLES	ix
LIST OF FIGURES.....	x
LIST OF APPENDICES	xi
ABSTRACT.....	xii
CHAPTER ONE.....	1
INTRODUCTION.....	1
1.1 Background	1
1.2 Problem statement.....	4
1.3 Rational of study	4
1.4 Conceptual framework.....	5
1.5 Research question	6
1.6 General objective.....	6
1.7 Specific objectives.....	6
1.8 Profile of study area.....	7
1.9 Scope of study.....	7
1.10 Organization of report	8
CHAPTER TWO	9
LITERATURE REVIEW.....	9
2.1 Assessment of adherence.....	9
2.2 Methods of Measuring Adherence.....	10
2.2.1 Patient self-reports.....	10
2.2.2The Eight-Item Morisky Medication Adherence Scale (MMAS-8).....	11
2.2.3 Pill Count.....	12
2.2.5 Biochemical markers (Viral load monitoring)	13
2.2.6 Electronic Drug Monitoring (EDM).....	13
2.4 Reasons for non-adherence	15

2.6 Measurement of Viral Suppression	17
CHAPTER 3	19
METHODOLOGY.....	19
3.1 Study area and setting.....	19
3.2 Study population.....	19
3.3 Study methods and design.....	20
3.4 Data Collection Techniques and Tools	20
3.5 Study variables.....	21
3.6 Sample size.....	21
3.7 Sampling technique	21
3.8 Pretesting	22
3.9 Data handling.....	22
3.10 Data analysis.....	23
3.11 Ethical Consideration.....	23
3.12 Expected outcomes and policy Implications	23
3.13 Limitations of study.....	24
CHAPTER FOUR.....	25
RESULTS.....	25
4.1 Demographic Characteristics	25
4.2 Prevalence of Adherence to antiretroviral therapy.....	26
4.3 Prevalence of viral suppression.....	30
CHAPTER FIVE	34
5.1 DISCUSSION.....	34
CHAPTER SIX	39
6.1 CONCLUSION.....	39
6.2 RECOMMENDATION.....	39
6.2.1 National Aids Control Programme (NACP)	39
6.2.2 Healthcare providers	40
6.2.3 The AYA population	40
6.2.4 Future Research.....	41
REFERENCES	42
APPENDICES.....	47
Appendix 1	47

Appendix 2: Questionnaire 50

LIST OF TABLES

Table 1 Demographic Characteristics of the study participants.....29

Table 2 Proportions of Adherence (MMAS8) by Categories.....30

Table 3 Individual questions ofMMAS8 and its summary score.....31

Table 4 Bivariate analysis viral load and selected variables.....35

Table 5 Bivariate analysis using MMAS-8 and selected variables.....35

Table 6 Measure of effect on viral suppression from self-reported adherence
(MMAS8).....36

LIST OF FIGURES

Figure 1	Conceptual frame work of adherence factors and viral suppression.....	6
Figure 2	Bar chart showing level of adherence to antiretroviral therapy using MMAS-8.....	30
Figure 3	Pie chart showing Adherence using Pill counts.....	33
Figure 4	Bar chart showing commonest reason for missing antiretroviral therapy.....	34

LIST OF APPENDICES

Appendix 1: Participant information and Assent form

Appendix 2: Questionnaire

ABSTRACT

Background

Adolescents and young adults have gained remarkable attention among PLWHIV because they constitute the only group where HIV-associated mortality is going up despite the introduction of HAART. The aim of the study was to describe level of adherence to ART and its related factors and viral suppression among AYA population at the Fevers Unit of the Korle Bu Teaching Hospital.

Methods

This was a cross-sectional study involving 136 study participants who have been on ARV for 2 or more years at the treatment center. A structured questionnaire was used for data collection. Self – reported adherence was assessed using MMAS-8 and announced pill count done by a trained Pharmacist. Viral load levels were retrieved from latest medical records.

Results

Out of the 136 study participants, prevalence of adherence was 78.7% and 93.8% for self –report (MMAS-8) and by pill count respectively. Prevalence of viral suppression (<400copies/ml) among the 110 who had viral load retrieved from medical records was 68.2%. Self –reported adherence was the only independent predictor of viral suppression. Those with medium adherence score were 5.3 times more likely to be virally suppressed compared to their counterpart with low adherence scores (OR=5.3, p=0.003, 95% CI, 1.74 -16.34). Also those with high adherence scores were 8.4 times more likely to be virally suppressed than those with low adherence scores (OR=8.4, p=0.003, 95% CI, 2.11-33.48). The commonest reason for missing ARV was forgetfulness.

Conclusion

Medication adherence was high among the AYA population; however, viral suppression was low. Efforts must be made by all stakeholders involved in HIV care among this special group of persons to increase viral suppression rates.

CHAPTER ONE

INTRODUCTION

1.1 Background

Despite the fact that AIDS-related death and disease rates have generally and drastically reduced over the years with the advent of the highly active antiretroviral therapy (HAART), the proportion of the disease burden is such that can never be underestimated. In 2014, about 2.0 million adolescents between the ages of 10 and 19 were living with HIV worldwide (UNICEF HIV/AIDS Data 2015). Adolescents account for about 5 per cent of all people living with HIV and about 12 per cent of new adult HIV infections. Interestingly, regions with the highest numbers of HIV-positive adolescents are sub-Saharan Africa and South Asia (UNICEF Data on HIV/AIDS, 2015).

Unfortunately, of the 2.0 million adolescents living with HIV, about 1.6 million (82 per cent) live in sub-Saharan Africa and AIDS is the leading cause of death among adolescents (10-19) in Africa and the second leading cause of death among adolescents globally (UNICEF Data on HIV/AIDS, 2015).

According to the United Nations Children's Fund (UNICEF), AIDS-related deaths among adolescents have tripled since 2000 while decreasing among all other age groups, and this can be largely attributed to a generation of children infected with HIV perinatally who are growing into adolescence without access to life-saving interventions (UNICEF Data on HIV/AIDS, 2015). It is striking to note that, every hour, 26 adolescents (15-19) were newly infected with HIV in 2014 (220,000 total), (UNICEF Data, 2015).

Adolescents and young adults (AYA) HIV/AIDS is a separate epidemic that needs to be handled and managed separately from adult HIV as not only do they face problems in accepting their HIV status, need for life long treatment and other positive family members, but also have sad memories of their lost parent and a big question mark in their future regarding health, education, carrier and marriage. An adolescent HIV patient is an individual in the adolescent age bracket who gets infected with HIV once but stays infected and affected for life. While global and regional efforts have concentrated fully on preventing new infections in newborns and adults, same cannot be said for AYA HIV care programs. Although the need for access to antiretroviral (ARVs) cannot be overemphasized, coverage of antiretroviral therapy (ART) is significantly lower (34%) in adolescents and children than in adults globally according to World Health Organization Global update on HIV Treatment, (2013).

As a result of successful scale-up of screening and treatment of infants infected with HIV, many of the more than 500 000 HIV-infected children who started on ART during infancy are surviving to adolescence, and often these group of persons tend to have complex and challenging treatment needs according to Ferrand *et al.*, (2016).

Adolescents are defined as individuals in the 10–19 year age group and young adults (20-24years) according to World Health Organization (WHO, Adolescent health 2016). This phase is characterized by acceleration of physical growth and, psychological and behavioral changes, thus bringing about transformation from childhood to adulthood. Physical growth and development are accompanied by sexual maturation, often leading to intimate relationships. In addition, the adolescent experiences changes in social expectations and perceptions. The individual's capacity for abstract and critical thinking also develops, along with a sense of self-awareness when social expectations require emotional maturity.

Although HIV prevalence rate in Ghana depicts a downward trend from 3.6% in 2003, to 1.5% in 2010 and remaining at 1.3% in 2011 and 2012 (Ghana Aids Commission, 2014), an estimated 220 000 of the population living with HIV and 10 000 deaths per annum makes it a public health problem in Ghana (UNAIDS, 2013; Ghana AIDS Commission, 2014).

The current HIV prevalence among the general population in Ghana stands at 1.62% (NACP Ghana, 2015). However, there were 2,214 new infections among children 0-14 years and prevalence for 15-24 year group was 0.46% and overall 13000 AIDS related deaths in the same year. The Greater Accra Region (one of the ten administrative regions of Ghana), where the study site for this research is located currently has the highest prevalence of 3.2% which is twice the national average (NACP, Ghana 2015).

Chief amongst the interventions taken in Ghana to increase and improve survival among HIV infected individuals is the scaling-up of antiretroviral (ARV) treatment. The number of people living with HIV and receiving ARV treatment has increased from 0.4% in 2003 to 47.4% in 2012 (Ghana AIDS Commission, 2014). Although ARV treatment has been associated with an improved quality of life in people living with HIV/AIDS (Liu *et al.*, 2006), adherence to treatment is a major challenge.

Regrettably, between 2001 and 2013, while trends in global AIDS-related deaths decreased among other age groups, it increased among those aged 10–19 years (WHO Adolescent HIV/AIDS 2013). Factors responsible for these observations may include a lack of knowledge of HIV, inequalities in the availability of health services, infected children growing up without parents, early sexual activity and a generally risky behavior, and non-adherence to antiretroviral therapy (ART) by individuals diagnosed with the virus. The advent of ART has been a major breakthrough for people

infected with HIV, but optimal adherence is needed for best outcomes. The main challenge to ARV treatment is adherence (Bangsberg and Machtinger, 2005; Mini *et al.*, 2012; Panel on Antiretroviral Guidelines for Adults and adolescents, 2014) and non-adherence to ART adversely affects clinical, immunological, and virological outcomes of patients.

1.2 Problem statement

Adolescents habitually find consistent, long-term medication adherence difficult, and HIV treatment is no exception. Despite adherence to antiretroviral being critical in controlling viral replication, maintaining health and preventing HIV associated deaths, studies in Africa have focused on adherence to antiretroviral drugs with little attention to viral suppression. There is limited data on adherence and viral suppression among adolescents and young adults (AYA) in sub Saharan Africa, more especially the West African sub region where the risk of drug resistance from poor adherence is of great concern considering the fact that there are very limited antiretroviral therapy (ART) options available. Furtherance to this, there is limited to virtually no documented study on viral suppression among HIV infected adolescents and young adults (AYA) in Ghana, where this study is done.

1.3 Rational of study

Although there is generally good research on adult living with HIV, same cannot be said for the adolescent and young adult groups in Ghana. Few studies among people living with HIV (PLWHIV) focused on qualitative adherence issues to HAART with no available information on the level of adherence among adolescents and young adults in the Ghanaian context. Currently there is no reported study on viral suppression among adolescents and young adults in Ghana. It

is therefore important to investigate adherence and viral suppression among these groups and their implication on clinical outcome. This will form the grounds for comparison to ascertain any similarities, differences or exceptions to existing knowledge. Findings of this study will help both healthcare providers and policy makers to design context specific ways of improving adherence to HAART and the maintenance of long term adherence to ensure sustained viral suppression and ultimately good clinical outcomes among this special group of persons with HIV. The essence of this study is to report on adherence to ART and viral suppression among adolescents and young adults (AYA) in Ghana thus providing information for future research by scholars in this area.

1.4 Conceptual framework

The conceptual framework as depicted in figure 1 below gives an overview of how socio-demographic factors, medication factors and patient's behavior, healthcare system and healthcare provider factors may impact on adherence to antiretroviral therapy. Adherence to antiretroviral therapy when optimum and sustained leads to HIV viral suppression which in turn results in good clinical outcomes and improved quality of life for PLWHIV. This forms the basis and gives the framework within which the study was conducted.

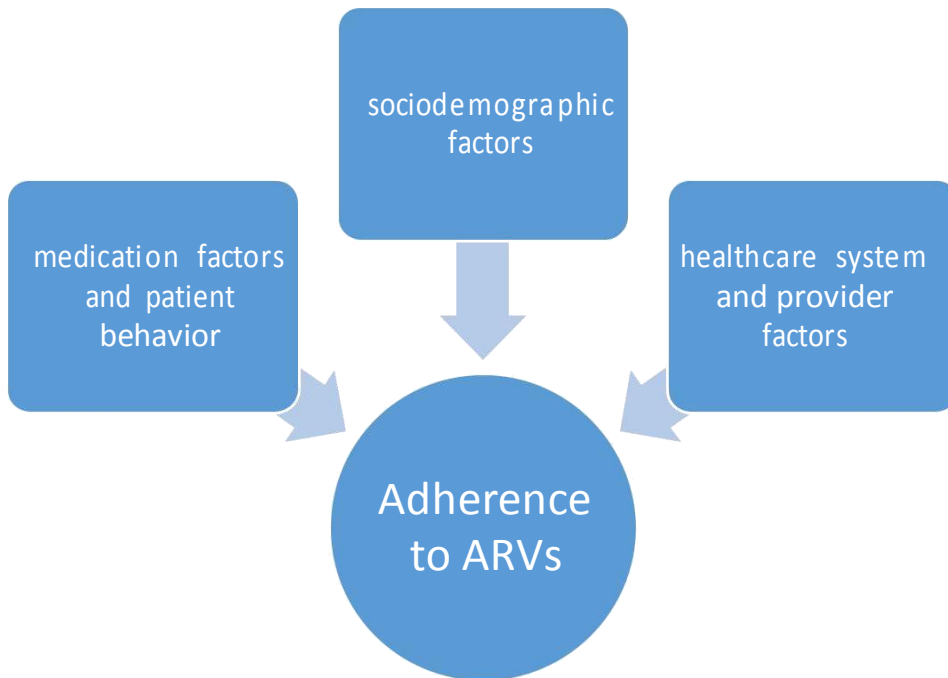


Figure 1: Conceptual frame work of adherence factors and viral suppression
 Source: Author’s own design

1.5 Research question

How does adherence to antiretroviral therapy relate to viral load levels among AYA population who are on treatment for at least 2 years at the Fevers unit of the Korle Bu Teaching Hospital?

1.6 General objective

The general objective of the study was to evaluate treatment adherence among adolescents and young adults based on biomedical (viral suppression) and a behavioral (self-reported medication adherence) outcome, and to explore possible barriers to satisfactory adherence among AYA population at the Fevers Unit of the Korle Bu Teaching Hospital.

1.7 Specific objectives

The specific objectives of the research were as follows:

1. To measure the prevalence of ART adherence among adolescents and young adults at the KBTH.
2. To measure the prevalence of viral suppression after 24 months of initiating antiretroviral drugs.
3. To determine the predictors of adherence to antiretroviral drugs.
4. To assess the relationship between adherence to HAART and viral suppression.

1.8 Profile of study area

The study was conducted at the Korle Bu Teaching Hospital. It is located in the Ablekuma South sub-metro of the Accra Metropolitan Assembly of the Greater Accra Region of Ghana. It was established in 1923 but attained a teaching Hospital status in 1962. It serves as the largest National Specialist referral center in Ghana with a total bed capacity of 2000, a daily average attendance of 1500 patients and about 250 patients' admissions.

1.9 Scope of study

The scope of this study was limited to self-reported adherence and pill count as a means of measuring adherence to antiretroviral therapy among adolescents and young adults aged 12-24years. Real time viral load sampling wasn't done to measure the exact adherence level accounting for a specific viral load levels due to ethical challenges, instead, viral load levels from medical records that are at most six months old from the test date was used. Only AYA population who have been on treatment for at least two years at the Fevers unit were eligible. It was a cross-

sectional study using questionnaires among 136 participants. Data Analysis consists of descriptive, univariate, test of association, simple and multiple linear regression analysis

1.10 Organization of report

The study has been organized into six chapters. Chapter One comprise the general introduction of the study, consisting of the background, problem statement, rational of the study ,conceptual framework, research question, general and specific objectives, profile of the study area and the scope of the study. Chapter Two consists of literature review on the study topic focusing on ideas of a number of authors whose findings are relevant to the topic of the study. It explains how adherence to HAART is assessed, the various methods for measuring adherence, and the prevalence rate of adherence to HAART globally and within Sub Saharan Africa among the AYA population. Further review of viral suppression and its measurement modalities as well as prevalence within our sub region is explored. Chapter Three describes the study design, sampling technique and explains how the data was collected for the research and the process of data analysis. Chapter Four focuses on the analysis of the data and the presentation of the results in accordance with the objectives of the study and key variables. Chapter Five is made up of the discussion of the findings of the study. Finally, Chapter Six consists of conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Assessment of adherence

Adherence which is the extent to which a patient takes a medication in the way recommended by the healthcare provider (Bangsberg and Machtinger, 2005) has been identified as a major factor associated with achieving therapeutic success of anti-retroviral therapy (Bangsberg and Machtinger, 2005; Mannheimer *et al.*, 2005; Miller *et al.*, 2006). In general, adherence among adolescents to chronic medication has been found to be lower compared with younger children or adults (Wamboldt *et al.* 2002). This is mainly due to the transition process of this subgroup. (Pai *et al.* 2011). Studies all over the world including sub Saharan Africa have identified adolescents with HIV as being at particular risk of poor adherence (WHO, Adolescent HIV/AIDS 2013).

There is no gold standard for measuring or assessing adherence and studies either used a single method or a combination of methods. The most common used methods include;

1. Self-reported tools such as questionnaires,
2. Electronic Drug Monitoring (EDM) devices,
3. Biochemical markers,
4. Pill count and
5. Pharmacy refill records (Nyambura, 2009).

The hierarchy of adherence measures ranks self-assessment report the least, pill count intermediate and EDM the most accurate according to Gill *et al.* (2005). No single measure is however

considered appropriate for all settings and or outcomes. It has been found that the use of more than one adherence measure allows the strength of one to compensate for the weakness of the other and to more accurately capture the information needed to determine adherence levels (Vitolins *et al.* 2000). The current guidelines for antiretroviral therapy in Ghana recommends the use of one of the following methods to measure adherence; self-reports, pill counts and pharmacy records. (NACP 2015, Guidelines for antiretroviral therapy in Ghana, Fifth edition)

2.2 Methods of Measuring Adherence

The various modalities for measuring medication adherence include; patient self-reports, pill count, pharmacy refill records, biochemical markers and electronic drug monitoring system.

2.2.1 Patient self-reports

Self-reports by patients is rapid, cheap, easily carried out in clinical settings and is routinely used in clinical care. It involves asking questions regarding how many times doses of medication were missed to establish adherence. It is important and critical that these questions are asked in a non-threatening and sensitive way as possible. Overestimating adherence is a potential disadvantage of self-reporting, as some adolescents and young adults may want to avoid criticism and disappointment, particularly with healthcare providers with whom they have had a long-standing relationship. Creating a conducive environment and maintaining a patient–healthcare provider relationship that encourages honesty and openness is a critical component of accurate adherence assessment using this method. Self-report has been used by Mannheimer *et al.* (2005) in assessing the adherence rate of 100 HIV infected patients and has described it as reliable.

Although overestimation of adherence is common with self-reports, underestimation can also occur as some adolescents and young adults may simply not know their own adherence rate. It is therefore recommended that self-report must be combined with other methods when assessing adherence, as the former has questionable validity. Studies that compared data from self-report measures to pill counts or EDMs have found differences, suggesting that self-reports provide inflated estimates of adherence behavior (Chesney, 2000).

On the other hand, patient self-reports can provide useful adherence estimates. A review indicated self-reported HAART adherence and HIV-1 RNA VL were consistently associated, even though most of the studies in the review relied on chart-abstracted VL data instead of blood samples drawn at the same time adherence was assessed (Simoni *et al.*, 2006). Another meta-analysis by Nieuwkerk *et al.*, (2005) demonstrated that despite significant study heterogeneity the pooled association between self-reported HAART adherence and viral load (VL) was statistically significant (adjusted *OR* = 2.31; 95% CI, 1.99-2.63)

2.2.2 The Eight-Item Morisky Medication Adherence Scale (MMAS-8)

This is a patient self-reported adherence measure based on the Medication Adherence Questionnaire (MAQ), from which Morisky *et al.* developed the 8-item MMAS (MMAS-8) in 2008. The first seven items are Yes/No responses while the last item is a 5-point Likert response. The additional items focus on medication-taking behaviors, especially related to underuse, such as forgetfulness, so barriers to adherence can be identified more clearly according to Tan *et al.*, (2014).

With regards to the sensitivity and specificity of MMAS, 93% sensitivity and 53% specificity were reported while validating in “very low income minority patients treated for hypertension seeking

routine care in a clinic setting” (Morisky *et al.* , 2008) . MMAS was also validated with outstanding validity and reliability in patients with other chronic diseases as reported by Tan *et al.* (2014). As a result, it is probably considered the most accepted self-report measure for adherence to medication. Gokarn *et al.* (2012), assessed level of adherence among 300 HIV infected adults in a cross sectional observation study using the MMAS (nine question version) in a tertiary care hospital in Auragabad - India and reported adherence level of 78%.

The MMA-8 was used to assess adherence levels in HIV infected adults in a tertiary facility in France by Peyre *et al.* (2016) and a score of 6 and above (6/8 - 8/8) was considered high adherence.

2.2.3 Pill Count

Pill counting is used to compare the actual to the expected consumption of ART since last dispensed by the pharmacy. The effectiveness of pill counting is limited by the fact that adolescents and young adults may discard tablets not taken prior to their routine clinic visit leading to over-estimated adherence. Additionally, the time required by health providers to conduct pill counts may not be available, especially in resource-limited settings.

2.2.4 Pharmacy refill records

Pharmacy refill records can be viewed to ascertain adherence to ART. Such records document if and when an adolescent or young adult has collected their ARVs and irregular collection may indicate adherence challenges. Additionally, computerized pharmacy records assist health managers and planners to assess the overall adherence of an adolescent cohort.

As with other adherence assessment methods, pharmacy refill records may over-estimate adherence, since collecting ARVs does not guarantee that the individuals will take them at all or even take them correctly as prescribed.

2.2.5 Biochemical markers (Viral load monitoring)

Viral load monitoring is the preferred method of assessing adherence and establishing or confirming treatment failure. In settings where this is not available, CD4 count monitoring and clinical assessment should be used according to WHO 2014 Guidelines for Adolescent HIV Care. When initiating ART treatment viral load should be measured at six months and then at least every year thereafter (WHO 2014 Guidelines for Adolescent HIV Care).

A potential disadvantage to viral load monitoring, particularly at 12-month intervals, is that it does not provide real-time assessment of adherence and is often too late to prevent treatment failure. As adherence is often worse during adolescence, more frequent viral load monitoring may assist in avoiding non-adherence and treatment failure during this challenging period. Use of routine viral load monitoring as a measure of adherence may not be available in many settings due to its expensive nature.

2.2.6 Electronic Drug Monitoring (EDM)

Electronic Drug Monitoring is a technology that uses a medicine container with an in-built microchip in the cap of the container. This microchip keeps record of the time and date of each opening as a presumptive dose. Advantages of EDM includes its ability to provide more accurate data by detecting overestimates of adherence, pill dumping and the periods of improved adherence immediately before clinic appointments which is known as the “white coat effect”. EDM also gives

dose timing adherence estimates and is able to describe patterns of adherence over time. This notwithstanding, EDM has several weaknesses, in that, it is expensive, it cannot reveal whether the medication was actually ingested, can be cumbersome to carry and it provides no information about how much of the medication was taken (Bova *et al.* 2005; Deschamps *et al.*, 2004).

More frequently, adherence estimates based on data from EDM are used as a gold standard because they are more highly correlated with viral load than adherence estimates based upon self-report. Results of earlier studies by Deschamps *et al.*, (2004), showed EDM produces higher estimates of non- adherence than self-reports using adherence data obtained either by EDM or self-report. The cost and cumbersome nature of carrying EDM devices makes its application in routine clinical care in resource limited regions such as Sub-Saharan Africa difficult.

2.3 Adherence rates within Sub-Saharan Africa

Although adherence levels as low as 80% have been associated with positive treatment outcome, adherence of around 95% is widely considered desirable for sustained viral suppression and prevention of drug resistance.

In a recent systematic review and meta-analysis by Kim *et al.* (2014), it was found out that adherence (self-reports) among adolescents and young adults (AYA) was poorer in North America (53%) and Europe (62%) than in less-developed regions like Africa (84%) and Asia (84%).

Adherence levels (self-reported) of 90.4% was reported among adolescents with HIV in Uganda while rates of 89% and 67% were recorded in South Africa and Cote d'Ivoire respectively (Kim *et al.*, 2014). Again self-reported adherence among adolescents (12-17years) in Uganda was 99% while adherence using pill count among the same group was 97 %.(Wiens *et al.*, 2012.)

Iroha *et al.*, (2010) reported 100% adherence level among 86.3% of a sample of children and adolescents attending a tertiary facility in Nigeria using either self-reported or caregiver adherence measure. In a cross-sectional study among adolescents in Botswana, adherence using pill count was found to be 76 % by Ndiaye *et al.*, (2013)

According to Adejumo *et al.*, (2015), although higher levels of ART adherence have been reported in sub-Saharan Africa, adolescents in the region may have poorer adherence patterns and there is a need for interventions to improve on adherence among this population.

Sustained high adherence (>95% of daily dosing) to therapy is generally considered the most important determinant of successful treatment and this is often very challenging among HIV-infected adolescents due to reasons such as dependency on caregivers, attitudes of defiance/denial, and also delay in diagnosis disclosure.

2.4 Reasons for non-adherence

Identified reasons for non-adherence according to the literature include forgetfulness, perceived stigmatization due to disclosure, change in daily routine, side effects of antiretroviral, depression or hopelessness, missing appointments, running out of medication, financial barrier and unbelief in antiretroviral therapy (do not think it works). On the other hand, variables found to be significantly associated with non-adherence are age, being comfortable to take ARV in the presence of others and HIV disclosure.

2.5 Viral Suppression

Maintaining sustained high levels of adherence to ART is the key to successful treatment as this ensures sustained viral suppression which prevents disease progression, drug resistance and onward transmission once unprotected sexual activity, which is inevitable in the adolescent and young adult groups occurs. These groups of persons tend to engage in sexual activity out of peer pressure and curiosity. When viral suppression is achieved and maintained, HIV transmission is substantially decreased, as is HIV-associated morbidity and mortality.

The UNAIDS ambitious 90-90-90 targets for the HIV care cascade that was introduced in 2014, has the objective that, by 2020, 90% of all PLHIV will be diagnosed, 90% of those diagnosed will receive sustained antiretroviral therapy (ART) and 90% of those on ART will have undetectable viral loads. To achieve the last 90% target, it is important to not only identify individuals who continue to have detectable viral load despite regular treatment with ART, but also to determine whether viral suppression has failed as a result of poor adherence or other drug related problems (UNAIDS,2014).

Viral load is the most important marker of initial and sustained response to ART and must be measured in all HIV- infected patients at entry into care, at initiation of therapy and on regular basis thereafter according to The Panel on ARV guidelines for adults and adolescents, (2014). The term ‘viral suppression’ is often used clinically to signify a level of plasma HIV RNA virus levels below the level of detection of the commercially available test kit being used.

As a result, the definition of plasma viral suppression has changed over the years with advancement in technology bringing down the lower limit of detection from under 10,000 copies/mL to less

than 20 copies/mL (Hirschhorn *et al.*, 2005). In fact there are tests kits available in research settings that detect plasma viral levels as low as 2 copies/ml.

2.6 Measurement of Viral Suppression

The International AIDS Society (2010) - USA Panel recommends performing baseline HIV-1 RNA measurements and repeat testing within a month of initiating treatment. Effective therapy should result in at least a 10-fold (1.0 log₁₀) decrease in HIV-1 RNA copies/mL in the first month and suppression to less than 50 copies/mL by 24 weeks, depending on pretreatment viral load levels (Hammer *et al.*, 2008)

The 2015 Guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents defines virologic suppression as a confirmed HIV RNA level below the lower limits of detection of available assays (Aidsinfo, 2015)

The guidelines of the World Health Organization (WHO) for the treatment of HIV recommend that, where possible, the viral loads of individuals receiving ART be measured every 6 months to detect viral replication and confirm treatment failure whenever it occurs. (WHO, Geneva 2010)

According to WHO's strategy for the surveillance and monitoring of HIV drug resistance, a viral load of <1000 RNA copies per ml and <50 RNA copies per ml should be taken as evidence of viral suppression in low-middle income and high income countries respectively. (Bennett *et al.*, 2008)

Currently, most clinicians use either standard viral load tests, with thresholds of 400-500 copies/mL, or ultra-sensitive methodology with levels of detection as low as 20-50 copies/mL to confirm viral suppression.

2.7 Viral Suppression rates in Sub-Saharan Africa

In a recent systematic review of literature, the proportion of adolescents with virologic suppression at 12 months ranged from 27% to 89% globally (Ferrand *et al.*, 2016)

Unfortunately few studies in the sub-region have reported on viral suppression among adolescents and young adults living with HIV who are on antiretroviral therapy. Most of the studies were carried out in South Africa and East Africa. Viral suppression (<400 RNA copies/ml) among adolescents in South Africa was found to be 45.7% at 12 months and 43.6% at 24 months (Nachega *et al.*, 2009).

In another study in South Africa by Nglazi *et al.*, (2012), viral suppression (<400 RNA copies/ml) among adolescents (9-19years) and young adults (20-28years) were found to be 27.3% and 63.1% respectively at 48weeks of antiretroviral therapy. However, Evans *et al.*, (2013) reported viral suppression levels of 76% among adolescents in South Africa using same virological suppression cut-off. Bakeera-Kitaka *et al.*, (2008) reported viral suppression (<400 RNA copies/ml) of 89% at 12 months of ART among HIV-1- infected adolescents in Uganda.

CHAPTER 3

METHODOLOGY

3.1 Study area and setting

The study was conducted at the Fevers Unit of the Department of Medicine and Therapeutics of the Korle-Bu Teaching Hospital in Accra, Ghana. The Fevers Unit is a national referral center responsible for the registration and management of all cases of HIV in adults and adolescents older than 12 years. There are three outpatient adult clinic days per week, each with an average attendance of about 120 patients and a total adult population of about 24,000. In addition, there is a special clinic for HIV-infected adolescents and young adults on Thursdays with an average attendance of 20 patients per week and a total adolescents and young adults (AYA) population of about 200 patients.

3.2 Study population

For the purposes of this study, age range for adolescents and young adults was set to 12-24 years. The decision to choose 12 years as the lower limit instead of 10 years is because the adolescent clinic is attended by children aged ≥ 12 years. Children less than 12 years are seen at the Pediatric Unit of the hospital. The study population consisted of adolescents and young adults who were on antiretroviral therapy for at least 2 years at the Fevers Unit.

3.3 Study methods and design

A cross sectional study was carried out with the use of structured questionnaire to gather data on consented patients spanning over their socio-demographic information, adherence assessment using the Eight-item Morisky Medication Adherence Scale (self-reported), pill count at the pharmacy by a pharmacist and retrieval of recent viral load level (VL) from medical records. Viral load reports that were at most 6 months old from the date test was done was used based on the assumption that most of the clients might have been on antiretroviral for a minimum of 2years and thus achieved some viral suppression and also viral load level is requested and performed once in a year as part of the routine clinical care offered at the Fevers Unit. A simple random sampling technique was used to obtain the respondent.

The 8-item Morisky Medication Adherence Scale (MMAS-8) with scores ranging from 1-8 was used to assess self –reported adherence. A score of 6 and above (6/8 to 8/8) was considered optimum adherence in accordance with previous research work in France by Peyre *et al.* (2016). Pill count (as expected) also considered and indicator of high adherence (95%) and viral suppression defined as viral load <400 RNA copies/ml in the latest medical record. The assay being used at the laboratory of the study site has a limit of detection of <20 RNA copies/ml.

3.4 Data Collection Techniques and Tools

The data collection tool used for the study was a Questionnaire which consisted mostly of closed-ended questions. The trained research assistants (HIV counsellors) administered the questionnaire to the study participants through interview. Interviews were conducted at the Fevers Unit after study participants are through with their routine clinic reviews. The interviews were conducted in a designated secluded room which was out of earshot to clinic staff or other patients. The purpose

of the study was explained to the participants and informed consent or assent obtained before questionnaire was administered to those who met the inclusion criteria. Pill count of the participants was carried out at the pharmacy where antiretroviral drugs are supplied by a pharmacist. Viral load levels of participants who were interviewed were retrieved from their medical records by the researcher using their unique coding numbers (KF numbers) given at the Fevers Unit.

3.5 Study variables

The outcome variables were self-reported medication adherence using MMAS8 which was used in the analysis categorized as; 0 for low adherence, 1 for medium adherence and 2 for high adherence, and viral suppression coded as $<400 = 1$, $\geq 400 = 0$ and used for logistic regression analysis. The explanatory variables were Socio-demographic characteristics which included age, sex, religion, ethnicity, education level and duration on antiretroviral therapy.

3.6 Sample size

Sample size was calculated using the CDC Epi Info7 sample size calculator (<https://www.cdc.gov/epiinfo>). Using a population size of 200, a 95% confidence level, 50% expected frequency and a 5% margin of error, a total sample size of 145 participants including 10% non-respondent rate was used for the study.

3.7 Sampling technique

A simple random sampling technique was used to select participants. Adolescents and young adults, both school going and non-school going Ghanaians, who have been on treatment for a

minimum of two years at the study site were eligible for participation . Those who were acutely or terminally ill and co-infected, were excluded from the study.

Selection of study participants was done randomly by a national service personnel at the records section of the same department using random sequence generator software and was not directly involved in providing healthcare. Those who agreed to participate were then sent to the trained research assistants (HIV counsellors) who obtained written consent form either the legal parent/guardian or as assent where applicable before being interviewed.

3.8 Pretesting

Pre testing of questionnaire was done at the HIV clinic of the Ridge Hospital in Accra which is also a referral center. A total of 5 AYA were randomly selected and interviewed by the researcher and two assistants (HIV trained counsellors) after their routine care at the ART center of the Ridge Hospital. This helped to ascertain the average time needed to complete the questionnaire and identified flaws were subsequently corrected. It also provided an opportunity for accurate and uniform interpretation of questions for the study participants.

3.9 Data handling

Three HIV counsellors were trained to assist with the data collection. The completed questionnaires were checked for completeness and all errors found discussed and corrected at the end of each clinic day. Questionnaires were subsequently put in an envelope and sealed. Retrieval of viral load levels and CD4 count from medical records was done using coding numbers (KF numbers) provided at the Fevers Unit.

3.10 Data analysis

Data collected was entered and cleaned by experienced data entry team using Microsoft Office Excel 2007 software. The data was then exported into STATA and analyzed using STATA Statistical software package (Stata Corp. 2007. *Stata Statistical Software: Release 14*. StataCorp LP, College Station, TX, USA). All missing data were dropped in the analysis.

Statistical analyses included; descriptive analysis of sociodemographic characteristic, univariate analysis of outcome and explanatory variables, bivariate analysis where Chi-squared test was used to determine any association between the outcome and explanatory variables and simple logistic regression analysis using self-reported medication adherence on viral load levels. A p-value less than 0.05 at a 95% confidence interval was considered significant.

3.11 Ethical Consideration

Written informed consent was obtained from all legal parents/guardians of participants less than 18years and assent where applicable. All information and data collected was handled with strict confidentiality. Adolescent HIV specially trained healthcare staff were used to avoid any form of stigmatization. Ethical approval was obtained from the Ethics and Protocol Review Committees at the Ensign College of Public Health and Korle Bu Teaching Hospital respectively.

3.12 Expected outcomes and policy Implications

The prevalence of adherence to ART was expected to be high and comparable to earlier studies in the sub region. However prevalence of viral suppression was expected not to be commensurate with the level of adherence since it is a biomedical measure as opposed to self-report in the latter.

The identified predictors of adherence among this special group of persons living with HIV will inform policy makers on effective adolescent friendly strategies to improve adherence to ART.

3.13 Limitations of study

The study was subject to some limitation such as the purely declarative way of self-reported adherence using the MMA-8 with inherent recall bias and self-denial on portions of the questions on adherence. Attempt was made to take care of this weakness in the self-reported adherence by using pill counts as a measure of adherence, but unfortunately pill count done was announced and could be subjected to overestimates as most of the AYA population were used to how pill count was done at the Pharmacy and often come with the expected pill count results. Pill count was not done for all the study participants as a result of unavailability of pill containers from study subjects at the time of the study and tiredness on the part of the Pharmacists. Secondly, the lack of real time viral load testing may not reflect the real current viral suppression levels. Also not all the participants had a recent at most 6months old viral load report in their medical records. Another important limitation is the convenient clinic-based sample size which may not permit the generalization of the findings of this study to the entire AYA population with HIV in Ghana.

CHAPTER FOUR

RESULTS

4.1 Demographic Characteristics

Of the 152 subjects screened for the study, 136 were enrolled generating a study response rate of about 89.5%. The sixteen subjects who screened out were either not eligible or were below eighteen years and had no caregiver present at the clinic or a non-Ghanaian.

The minimum and maximum age of study subjects was 14 and 24 years respectively with a mean age of 18.47 ± 3.26 years. The modal age noted for the study participants was 17 years. Of the total number enrolled, 93(68.3%) were adolescents aged between 14-19 years and 43(31.62%) were young adults within the age range 20-24 years. There were 70 females (51.47%) and 66 males (48.53%). Of the 70 females, 45 were adolescents and 25 were young adults while 48 of the males were adolescents and 18 were young adults. Majority of the study participants were either in Senior High School (42.65%) or Junior High School (34.56%) with a few in tertiary level education (14.71%) and Primary School (5.88%) at the time of the study..

With regards to participant's professed religious faith, Christians constituted 89.71% and Muslims the remaining 10.29%. In terms of ethnic background of the study participants, Akans dominated and accounted for 44.85%, while Ewes and Ga/Dangme constituted 22.06% and 14.71% respectively. All the study participants except one were single and had never been married. The exception was a female young adult who is cohabiting. Majority of them were students constituting 91.18% and thus were not in any form of employment, however a few (8.82%) were non students.

The shortest duration on antiretroviral therapy was 2years whiles the longest duration was 22years with a mean of 7.37years+SD (4.84)

Table 1: *Demographic Characteristics of the study participants*

CHARACTERISTIC (N=136)	CATEGORY	n (%)
Age group	14-19years	93(68.38)
	20-24years	43(31.62)
Gender	Male	66(48.53)
	Female	70(51.47)
Educational level	None	4(2.21)
	Primary	8(5.88)
	JHS	47(34.56)
	SHS	58(42.65)
	Tertiary	20(14.71)
Ethnicity	Akan	61(44.85)
	Ga/Dangme	20(14.71)
	Ewe	30(22.06)
	Other	25(18.38)
Religion	Christian	122(89.71)
	Islamic	14(10.29)
Employment status	Student	124(91.18)
	Non student	12(8.82)

4.2 Prevalence of Adherence to antiretroviral therapy

Using the Eight – item Morisky Medication Adherence Scale (MMAS8) to assess adherence, it was found out that majority of the study subjects had medium adherence scores (6 to less than 8)

constituting 55.88% while 21.32% had low adherence scores (< 6) with only 22.79% scoring high

(8) on the adherence scale. The average score on MMAS8 was $6.27 \pm SD (1.79)$.

Table 2: Proportions of Adherence (MMAS8) by Categories

ADHERENCE SCORE	FREQUENCY	PERCENTAGE
Low	29	21.32
Medium	76	55.88
High	31	22.79
TOTAL	136	

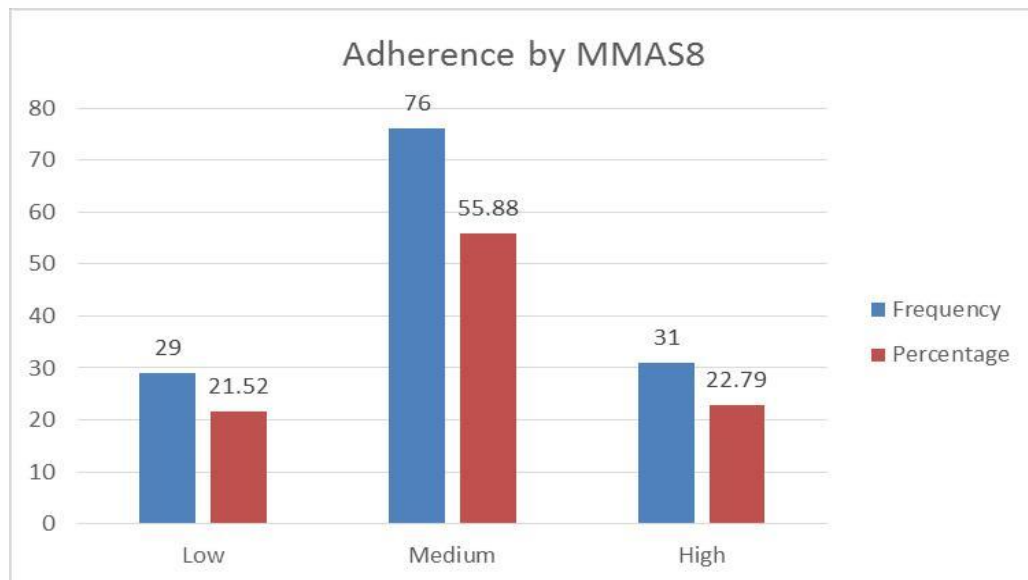


Figure 2: Bar chart showing level of adherence to antiretroviral therapy using MMAS-8

Some featured questioned area used in computing the MMAS-8 as seen in the Table 3 below

revealed very interesting proportions among the respondents who answered either “Yes” or “No”.

Of the total respondents who answered the question on “*Do you sometimes forget to take your medicine?*” 81 representing 59.59% answered in the affirmative. Just a handful of them,

23(16.91%) did confirm they ever stop taking their medications without informing the caregiver. The answer to the question “*Did you take all your medicine yesterday?*” gave a very significant indication that the most respondents, 125(91.91%) were up to the time on taking their medications.

Table 3: *Individual questions of MMAS8 and its summary score*

MMAS8 Item	N= 136	
	Yes	No
Do you sometimes forget to take your medicine	81(59.56)	55(40.44)
Over the past 2 weeks, where there any days you did not take your medicine.	30(20.06)	106(79.94)
Have you ever stopped your medicine without telling your doctor?	23(16.91)	113(83.09)
When you travel ,do you sometimes forget to bring your medicine	19(13.97)	117(86.03)
Did you take all your medicine yesterday?	125(91.91)	11(8.09)
When you feel your symptoms are under control, do you sometimes stop medicine	24(17.65)	111(82.35)
Taking meds every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	34(25)	102(75)

On the other hand, using pill count as a measure of adherence to antiretroviral therapy showed (Fig.4.2) that most of the study subject (93.81%) had excellent pill count while only a few 2.06% and 4.12% had pill count less than expected and more than expected respectively.

The overall prevalence of adherence to antiretroviral therapy using excellent pill count as expected was 93.81% (n=97).

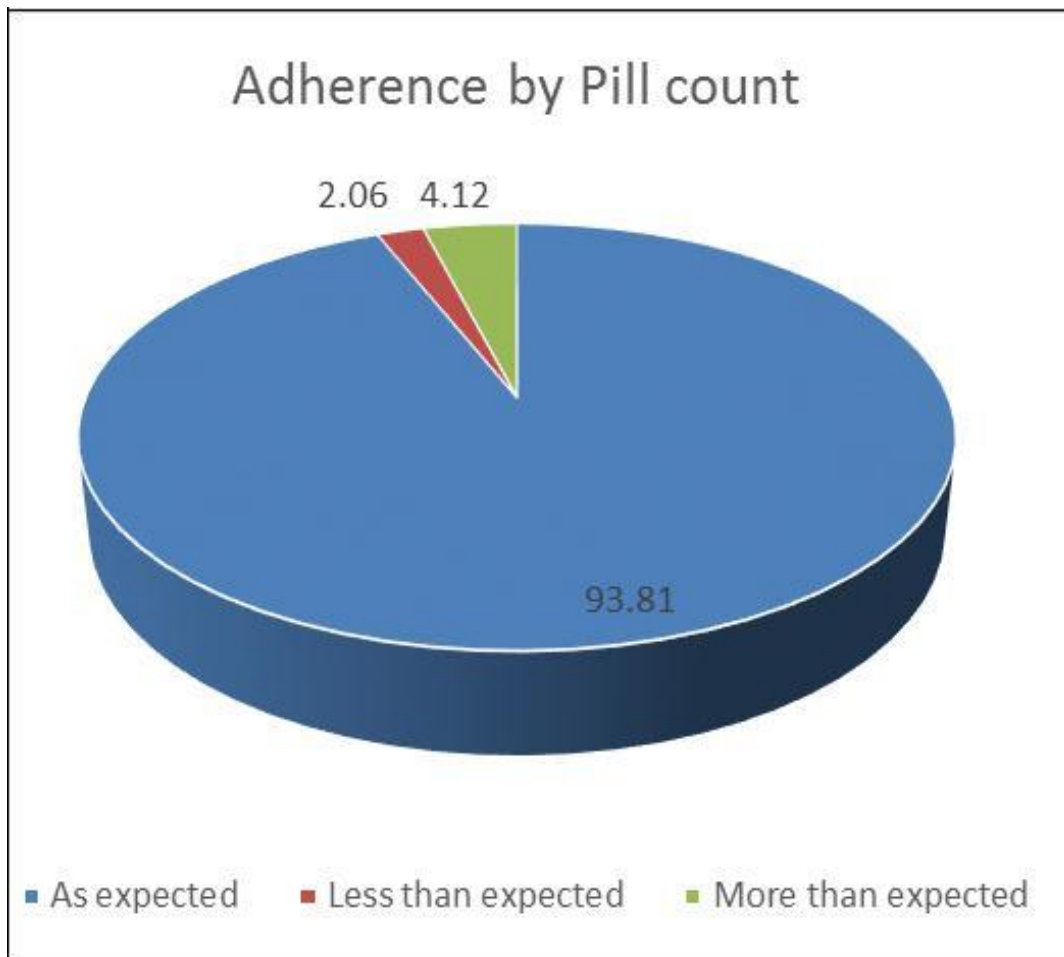


Figure 3: Pie chart showing Adherence using Pill counts

Given the fact that the level of adherence was short of perfection, there was an attempt to tease out some reasons for the failure. The commonest reason for missing antiretroviral therapy as collated in Fig.4.3 below included forgetfulness, which accounted for 50.37%, followed by change in daily routine (7.41%) and side effects of antiretroviral (3.70%). Perceived stigma constituted 2.22% while depression, running out of medication and unbelief in antiretroviral accounted for 1.48% respectively. 6.67% of responders did not answer while 9.63% stated other reasons. The remainder chose more than one answer and these were not included in the analysis.

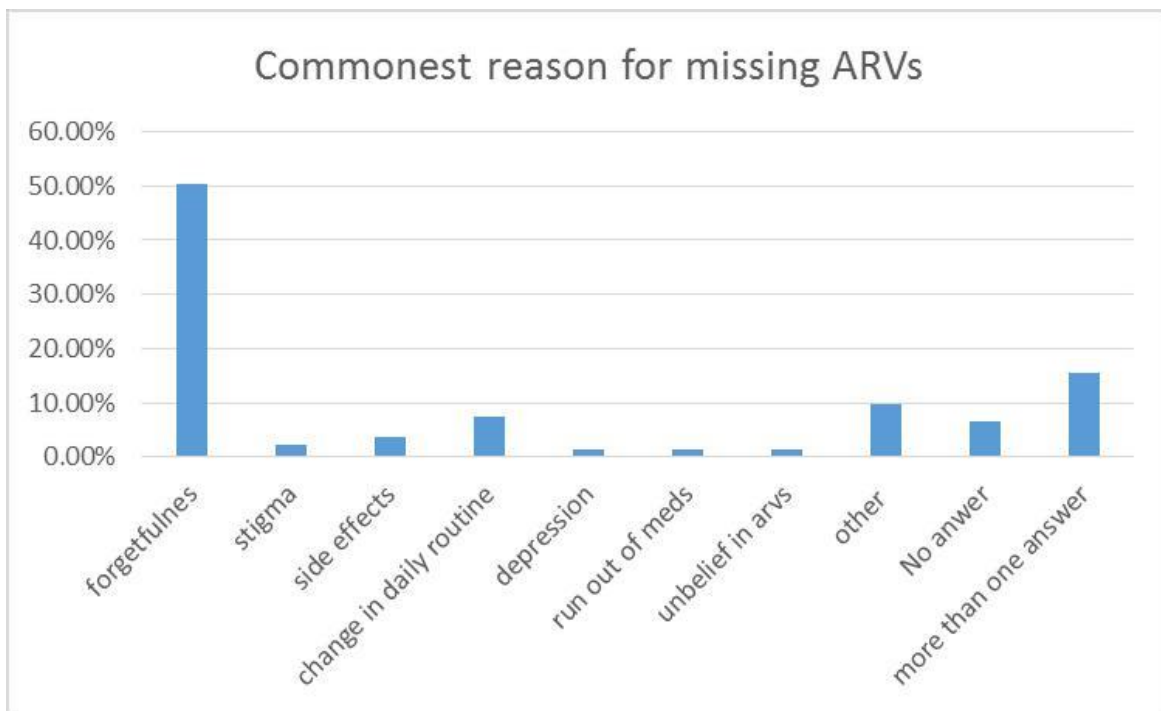


Figure 4: Bar chart showing commonest reason for missing antiretroviral therapy.

4.3 Prevalence of viral suppression

Of the total number of patients recruited, 110 had a recent viral load that was at most 6 months old, 7 had viral load records that was more than one year old (these were not included in the analysis) and the remainder did not have any documented viral load. Majority of the study

participants were virally suppressed (VL<400RNA copies/ml) constituting 68.18% while 31.82% were not virally suppressed. The minimum and maximum viral load levels were <20copies/ml and 335850copies/ml respectively. The overall prevalence of viral suppression (<400copies/ml) was 68.18% (n=110).

To further explore the associations in the data, several bivariate analyses were conducted with observed p-values at 95% confidence interval to test for significance.

Table 4. *Bivariate analysis using viral load and selected variables*

Characteristic	VIRAL LOAD		p-value
	<400	≥400	
MMAS8			0.003
Low	6	12	
Medium	48	18	
High	21	5	
Pill count			0.427
As expected	67	23	
More than expected	2	2	
Less than expected	1	1	
Age Group			0.526
14-19	49	25	
20-24	26	10	
Religious Affiliation			0.111
Christianity	71	30	
Islam	4	5	
Gender			0.910
Male	33	15	
Female	42	20	
Educational Status			0.113
None	1	2	
Primary	5	1	
JHS	20	15	
SHS	34	15	
Tertiary	15	2	
Employment Status			0.306
Student	69	30	
Non student	6	5	

Table 5: Bivariate analysis using MMAS-8 and selected variables

Characteristic	MMAS-8			P-value
	Low	Medium	High	
Age group				0.073
14-19	21	56	16	
20-24	8	20	15	
Gender				0.711
Male	14	35	17	
Female	15	41	14	
Religious Affiliation				0.020
Christian	23	73	26	
Islam	6	3	5	
Educational Status				0.445
None	0	2	0	
Primary	1	4	4	
JHS	10	25	12	
SHS	14	35	9	
Tertiary	4	10	6	
Employment status				0.916
Student	27	69	28	
Non student	2	7	3	

There was no statistically significant association between age groupings, gender, duration on antiretroviral therapy, nor pill count and viral suppression. However, there was a noticeable statistically significant association between self-reported adherence (MMAS8) and viral suppression ($p=0.003$) as shown in Table 4 above. There was also a significant association between one's religious affiliation and self-reported medication adherence ($p=0.020$) as shown in Table 5 above.

A simple Logistic regression analysis to measure the effect of the adherence levels on viral suppression revealed that those with medium adherence score were 5.3 times more likely to be virally suppressed compared to their counterpart with low adherence scores (OR=5.3, $p=0.003$, 95% CI, 1.74 -16.34). Also those with high adherence scores were 8.4 times more likely to be virally suppressed than those with low adherence scores (OR=8.4, $p=0.003$, 95% CI, 2.11-33.48).

Table 6: *Measure of effect on viral suppression from self-reported adherence (MMAS8)*

Viral suppression	OR	P-value	95% CI
Low (Reference)	1	-	-
Medium	5.33	0.003	1.74 - 16.34
High	8.4	0.003	2.11 - 33.48

CHAPTER FIVE

5.1 DISCUSSION

This was a cross-sectional study to assess the adherence to ARV and viral suppression among adolescents and young adults on ART at the KBTH. In reviewing the existing literature, no study has specifically addressed concurrent ARV adherence and viral suppression among any studied population in this age group in Ghana. It is worth mentioning that both the viral load test and the ARVs are provided for free at the Fevers Unit at no cost to the AYA population. The MMAS8 used to assess self-reported adherence measures adherent behavior rather than dose dependent adherence. The decision to choose the MMAS8 is because it is considered superior to other adherence scale due to its less complexity, lesser internal attrition and its relation to viral load levels according to studies carried out by Sodergard *et al.* (2006). The internal consistency reliability as measured by Cronbach's alpha for the MMAS is reported to be 0.89 according to Patterson *et al.* 2000.

The prevalence of self-reported adherence to ARV among the AYA population as measured by MMAS8 was 78.67%. This level of adherence is higher than the global rate of 62% but a little lower than the sub regional (Africa) rate of 84% among AYA population according to a systematic review and meta-analysis by Kim *et al.*, (2014). The difference observed could be as a result of the different adherence measurement scales used in the various studies. Whereas the typical adherence formula used to assess self-reported adherence spans a period of few days (1-3days) to a month or three months and is dose adherence, the MMMAS8 measures behavior adherence since the individual begun ART. Although a high adherence rate (78.7%) was observed among the AYA population in Ghana from this study, rate among Ugandan

adolescents was higher (93%) according to Weins *et al.*, (2012). On the other hand adherence rate observed in the Ghanaian AYA population was higher than the 65% reported among US black AYA population by Chandwani *et al.*, (2012). However almost the same adherence rate as observed in this study was reported in Brazil (79%) among adolescents by Filho *et al.*, (2008). Again different self-reported adherence assessment scales were used in the various studies. For example in the Brazilian setting, > 95% adherence was assessed based on the past 3 day's adherence. Interestingly, Gokart *et al.*, (2012) reported a rate of 78% among adults in India using the MMAS.

Prevalence of adherence using pill count in this study was 93.81% which is higher than the 72% that was reported among Ugandan adolescents (12-18years) by Nabukeera-Barungi *et al.*, (2007) and the 60% reported among Romanian young adults (18-24years) by Dima *et al.*, (2013). The pill count conducted in this study was announced whereas both the Uganda and Romania studies were unannounced. The differences observed may be attributable to the fact that over time patients get used to pill count and often tend to please healthcare staff by presenting required number of pills and or empty pill containers during announced pill counting exercise as oppose to unannounced pill count. Considering the fact that the average duration on antiretroviral therapy was 7.4years, it may support the familiarity of pill counting among the AYA population over time. The pill count of this study was announced because routinely at the treatment center, patients do not carry their pill containers for reviews. Of the 136 study subjects, only 97 had pill count done during the study period due to unavailability of pill containers from participants, tiredness on the part of the pharmacists and delay in routine work at the pharmacy where ARVs are supplied.

The commonest reason for missing ARVs in this study was forgetfulness, followed by change in daily routine and then due to side effects of the drugs. This is consistent with an earlier qualitative study done among adolescents (12-19years) at the study site by Ankrah *et al.*, (2016) where forgetfulness and perceived stigmatization post-disclosure were identified as the commonest barrier to ART adherence. In a systematic review of qualitative studies on adherence to ART, forgetfulness was identified as a major contributor to non-adherence by Vervoort *et al.*, (2007).

From the study, prevalence of viral suppression (<400RNAcopies/ml) among the study participants was 68.2 % (n=110). This is lower than the UNAIDS global 90% target (90-90-90 target) by 2020 for PLWHIV. Although viral load test is free at the treatment center for the AYA population, quite a number of them did not have any recorded viral load reports. This is due to irregular supply and unavailability of reagents and equipment for performing the test which is dependent on provision by the National Aids Control Programme. This makes regular performance of the test unreliable at the treatment center and considering the expensive cost of the viral load test it becomes practically impossible for the patients to bear the cost outside the treatment center for routine care except upon suspicion of ART failure.

The prevalence of viral suppression (<400RNA copies/ml) observed in the Ghanaian AYA population in this study was the same as the 68% observed among black adolescents aged 16-23years with HIV-1 in the USA by Garvie *et al.*, (2009), however the Ghanaian adolescents were more virally suppressed than their counterpart aged (10-19years) in Brazil in a study by Souza *et al.*, (2010) where only 53% were virally suppressed. In comparison with studies in sub-Saharan Africa, the rate observed in this study was lower than the 79% among Ugandan adolescents (10-19years) as reported by Bakeera-kitika *et al.*, (2008) and the 82% in South

Africa among AYA (16-24years) as reported by Mutevedzi *et al.*, (2011) as well as the 94% among adolescents in Botswana according to Ndiaye *et al.*, (2013). There was a statistically significant association between MMAS and viral load levels in this study and is consistent with earlier studies in Sweden by Sodergard *et al.*, (2006).

The 2014 AIDS info Guidelines for the use of Antiretroviral agents in HIV-1-infected Adults and Adolescents suggest that individuals who are adherent to their ARV regimen and do not harbor any resistance mutations to the components of the drugs can generally achieve viral suppression (undetectable levels) 8 to 24 weeks after initiation of ART; rarely, in some individuals patients it may take longer. The average duration of ART among the study subjects was 7.4years and the shortest duration was 48weeks, contrary to expectation of more than 90% viral suppression only 68% were virally suppressed. This could be explained by the sub optimum adherence levels observed in this AYA population since an earlier study by Mannheimer *et al.* (2002) has established that medication adherence is a strong independent predictor of virologic suppression(OR,3.41; 95% CI,2.29-5.06; $p<0.001$).In addition the cut-off for viral suppression ($<400\text{RNAcopies/ml}$) used takes care of isolated blips in viral load levels which are not uncommon in successfully treated patients and are not predictive of virological failure (Havir *et al.*, 2001).

Although this study did not investigate the predictors of viral suppression, viral load level was a predictor of self-reported medication adherence ($p<0.002$). The findings of this study on self-reported medication adherence and viral load levels is consistent with earlier study by Duarte *et al.* (2015) in Latin America among children infected with HIV where it was reported that the probability of having a VL measure $<400\text{copies/ml}$ at 12months was more than 4 times higher among those with perfect adherence than those with less than perfect adherence.

The findings of this study is also consistent with earlier work by Ndiaye *et al.*, (2013) among adolescents in Botswana where it was reported that study participants who self-reported suboptimal ART adherence were more likely to report having ever missed ART doses due to failure to pick up medication at the pharmacy (30.0% versus 9.7%, $p=0.03$) . Findings by Greig *et al.*, (2013) among HIV infected adults in Nigeria showed that a higher self-rated score of recent adherence was associated with lower odds of raised viral loads which is consistent with the findings of this study.

CHAPTER SIX

6.1 CONCLUSION

Medication adherence was high among the AYA population at the Fevers Unit of the Korle Bu Teaching Hospital with 79% and 94% for self-report and pill count respectively, however viral suppression was low at 68% which falls short of UNAIDS global target of 90% viral suppression by 2020. Self-reported medication adherence was found to be an independent predictor of being virally suppressed with high medication adherence increasing the odds of viral suppression by 8 folds. The need for sustained optimum adherence among AYA population cannot be overemphasized as this is key in attaining and maintaining viral suppression. Being virally suppressed is a good Public Health outcome as this ensures a reduction in the transmission of the HIV virus, prevention of HIV-related mortality and improvement in the overall clinical outcome. The commonest reason stated for missing daily ARV among this group of PLWHIV was forgetfulness and this demands AYA friendly approach from all stakeholders involved in AYA HIV care so as to improve medication adherence.

6.2 RECOMMENDATION

Based on the review of literature, findings of the study and conclusions of this study, the following recommendations are made to the appropriate stakeholders as follows;

6.2.1 National AIDS Control Programme (NACP)

The NACP must ensure regular and adequate supply of viral load test machine as well as reagents to the Fevers Unit to facilitate at least six monthly viral load test for every AYA. This will help in

the early detection of ART failure and prompt treatment to improve overall quality of life and avoid HIV associated deaths. The NACP must consider multidisciplinary interventions for this special population of adolescents and young adults.

6.2.2 Healthcare providers

Clinicians involved in AYA HIV care must periodically assess adherence to medication and those found to be less adherent, helped on individual basis to improve on their medication adherence. Clinicians must also ensure at least six monthly viral load testing of all their patients.

Clinicians and counsellors must place more emphasis on preparing the patients to start HAART during which lifelong medication adherence is thoroughly discussed and possible barriers to adherence duly addressed. This should be individualized.

Pharmacists must be resourced in terms of personnel to facilitate the organization of regular unannounced pill count for assessment of medication adherence.

The Head of the Fevers Unit can consider instituting an award yearly for the best adherent patient among the adolescents and young adult population. This can be presented at the annual get together program for the healthcare staff and patients to inspire and motivates non-adherent ones to improve on their individual medication adherence.

6.2.3 The AYA population

This special group of persons living with HIV must be encouraged to use reminders such as alarm clocks, cell phone and AYA specific social media group interactive platforms such as WhatsApp group messaging or mobile phone short messaging to facilitate daily intake of medication since

most of them forget to take their medication over time. This will work out for both day and boarding students. Their care providers must be educated and encouraged to monitor closely daily intake of ARV. The need to foster socio-behavioral support among the AYA population to ensure treatment adherence.

6.2.4 Future Research

It is recommended that a multicenter study covering all the 10 regions of Ghana be considered for a bigger sample size and generalization of subsequent findings.

A qualitative study to unravel the reasons behind forgetting to take ARVs is recommended in the future to ascertain possible barriers to medication adherence.

A future research that considers real time viral load testing and adherence factors will be more accurate compared to the review of clinical data.

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APPENDICES

Appendix 1

PARTICIPANT INFORMATION AND ASSENT FORM

VIRAL SUPPRESSION AND ADHERENCE AMONG HIV-INFECTED ADOLESCENTS ON ANTIRETROVIRAL THERAPY AT KORLE BU TEACHING HOSPITAL (KBTH).

NAME AND AFFILIATION OF RESEARCHER (Principal Investigator)

This study will be carried out by Dr. Isaac J.K. Biney (BSc, MBChB) of Department of Internal Medicine, Korle Bu Teaching Hospital, and an **MPH student of ENSIGN COLLEGE OF PUBLIC HEALTH, Kpong.**

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GENERAL INFORMATION AND PURPOSE OF THE STUDY

Regular and consistent use of antiretroviral drugs is key to the general wellbeing of adolescents infected with HIV. This is because the drugs suppress the activities of the HIV virus and prevent their multiplication. When this happens, the body is able to overcome the activities of the viruses and the individual is said to have achieved viral suppression if this state is maintained for a long time. Adolescents generally find long term medication intake (adherence) difficult and in the case of HIV, if the antiretroviral drugs are not adhered to the consequences can be fatal.

The study will evaluate treatment adherence among adolescents on antiretroviral therapy for more than 2 years based on biomedical (viral suppression) and a behavioral (missed doses) outcome, and to explore possible barriers to satisfactory adherence among the adolescent group.

STUDY PROCEEDURE

You will be asked some few questions about yourself (for assent participants) or your adolescent child will answer some few question about him/herself and also concerning how the antiretroviral drugs are taken. This will take place at the Fevers Unit whiles waiting to receive your ARVs after your routine review with your Doctor. Your recent laboratory results of viral load and CD4 count will be retrieved from your folder.

POSSIBLE RISKS AND DISCOMFORT

The interview will not pose any risk to you and the answers you provide will not affect your care at the treatment center (FEVERS UNIT)

COST TO THE STUDY PARTICIPANTS

The study will not cost you any extra funds apart from your usual medical care. You will not be asked to do any test that is not necessary for your care.

BENEFITS

No cash benefit is available for being part of the study, however the knowledge gained from the study will help doctors improve the care of adolescents with HIV.

CONFIDENTIALITY

Information gathered from the study will be coded and your name will not be recorded. The collected data will not be linked to you and anything that will identify you will not be used in any publication.

VOLUNTARINESS

Participation in this study is voluntary with no consequences. You can ask as many questions as you like. You can leave the study at any time without giving any reason and this will not affect your medical care or treatment provided at the Fevers Unit.

CONFLICT OF INTEREST

No grant or sponsorship was received for this research

Statement of researcher obtaining informed consent

I have fully explained this research to
and have given sufficient information including risks and benefits to make an informed decision.

.....

Signature of researcher

.....

Date

Statement of study participant giving consent:

I have read the description of the study or it has been explained to me in a language I understand. I understand that my participation is voluntary. I know enough about the purpose, benefits and risk of the study to decide whether to participate or not. I understand that I may stop being part of the study at any time I want with no consequences to my care at the Fevers Unit. I have received a copy of the consent form to keep for myself.

.....
Signature/thumbprint of parent (guardian)

.....
Date

.....
Signature/ thumbprint of patient (Assent)

Appendix 2: Questionnaire

QUESTIONNAIRE

VIRAL SUPPRESSION AND ADHERENCE AMONG HIV-INFECTED ADOLESCENTS ON ANTIRETROVIRAL THERAPY AT KORLE BU TEACHING HOSPITAL (KBTH)

INSTRUCTIONS: Tick or circle your choice(s) from the options given. Also supply answers where options are not provided

(REMEMBER ELIGIBILITY: ON ANTIRETROVIRAL FOR TWO OR MORE YEARS, NO CO-INFECTION)

Participant ID number:

Date of Interview:

Name of Interviewer:

SECTION A: DEMOGRAPHIC INFORMATION

No	Question	Response	Code
1	Age	[] years	D1
2	Sex	Male 1 Female 2	D2
3	Educational level	Primary 1 JSS 2 SSS 3 Tertiary 4 Never been to School 5	D3
4	Religion	Christian 1 Islamic 2 Traditional 3 Other () 4	D4
5	Ethnicity	Akan 1 Mole-Dagbani 5 Ga/ Dangme 2 Grusi 6 Ewe 3 Mande 7 Guan 4 Other 8	D5
6	What is your marital status	Never married 1 Currently married 2 Divorced 3 Separated 4 Widowed 5 Cohabiting 6	D6
7	Occupation	Student 1 Other () 2	D7

8	How long have you been on antiretroviral treatment?	[] years	D8
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SECTION B: ADHERENCE TO ANTIRETROVIRAL THERAPY

9	Do you sometimes forget to take your medicines (ARVS)	Yes 0 No 1	A
10	People sometimes miss their medication for reason other than forgetting. Over the past 2 weeks, were there any days you did not take your medicine (ARVS)?	Yes 0 No 1	A
11	Have you ever cut back or stopped taking your medicine (ARVS) without telling your doctor because you felt worse when you took it?	Yes 0 No 1	A
12	When you travel or leave home, do you sometimes forget to bring your medicine (ARVS)?	Yes 0 No 1	A
13	Did you take all your medicines (ARVS) yesterday?	Yes 1 No 0	A
14	When you feel your symptoms are under control, do you sometimes stop taking your medicine (ARVS)?	Yes 0 No 1	A
15	Taking medicine (ARVS) every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	Yes 0 No 1	A
16	How often do you have difficulty remembering to take all your medicines (ARVS)?	All of the time 0 Usually 1 Sometimes 2 Once in a while 3 Never/rarely 4	LA MA HA
17	Pill count	As expected 1 Less than expected 2 More than expected 3	PCE PLC PCM
18	What is the commonest reason for missing your antiretroviral therapy?	Forgetfulness 1 Perceived stigmatization due to disclosure 2 Side effects 3 Change in daily routine 4 Depression or hopelessness 5 Running out of medication 6	NA

		Financial barrier	7	
		Unbelief in ARVs (do not think it works)	8	
		Other	
			9	

SECTION C: VIRAL SUPPRESSION (Retrieve from folder please and record in the blank space below)

19	Recent Viral load report (at most 6 months old)	VL	Date done
20	Current CD4 count report	CD4	Date done

